☐ Telephone	☒ Meeting	Time: 10:00 am	Date: 10.04.07

Individuals Attending Teleconference or Meeting:

Jennifer Montoya (GWQB), John Young (HWB), Robert George (GWQB), Steve Pullen (HWB), Rebecca Kay (HWB), Dave Cobrain (HWB), Gerald Knutson (GWQB, George Schumann (GWQB),

_met with: Bob Beers (LANL), Mike Saladen (LANL), Marty Price (LANL), Steve Hanson (LANL)

_DP-_1132 and DP 857_____

Subject: _Update on status of Permits for RLWTF and SWSH_____

Discussion: _Began with Introductions and discussion on later involving surface water. The NOI for 1132 (TA-50) was received and reviewed by GWQB. George brought up two points of discussion

1. submission of LANL's legal analysis re: exemption from DP has not been received. Beers stated this has not been completed yet.

2. Determination on whether Haz-Waste or GWQB will be regulating.

Price spoke briefly on the project schedule. Currently it is approximately 50% designed and once they are farther along they will submit detailed a detailed letter. Currently a draft letter has been prepared but not completed. The ZLD is part of the RLWTF upgrade project and was held up due to continuing resolution for funds last FY. This year the funding will be available and the project is moving forward. A contract for design detail should be awarded by May 31, 2008 and building around March 2009. The facility will not be operational until November 2011. Most of the methods will remain the same as the old facility. The new facility will only be used for processing and will have no offices, storage or laboratory space.

Pullen stated that the exemptions listed by LANL are not clear.

George stated that there were essentially two options for permitting at TA-50.

1. would be to include the Zero Liquid Discharge (ZLD) under the current DP-1132
2. would be to separate the ZLD as it's own DP (this one is more favorable)

Pullen inquired about required sampling locations at the headworks for RCRA. Price explained that the location where samples are currently taken will be different once the new plant comes online. The wastewater will be stored in fiberglass tanks prior and will be tested just before coming into the facility. Pullen inquired about who from LANL will be involved with the RCRA exemptions. Saladen said he would be involved along with others from LANL.

George informed LANL that a proposal for closure of the existing facility will need to be submitted. This should clearly define timelines, specs and activities planned for closure. This would be a separate closure under the new permit. For the new permit it should include flow schematic, site map, volumes, mass-balance and the 50% design specs would be adequate at this point. This would be considered a revision to the current application and would be required to undergo a new PN-1.

Knutson gave a brief overview of the status of DP-857. The draft has been written but needs revisions. George said a revised draft should be out in the next few weeks and should be out for PN by the end of the year. The revised draft will be circulated to Haz-Waste and LANL for review and then to interested parties. The revisions are going to include all holding tanks and Septic Tanks that are in operation. Currently the holding tanks are mentioned but not individually identified. Beers requested that NMED submit a request for this to LANL. An application for the septic tank/leach fields was submitted as a separate DP however this can be added to DP-857 at a later date.

Beers asked if Schuman had received the e-mail regarding the decision tree and if it was found acceptable. Schuman stated that it looks alright and that NMED does not need an NOI for all activities.

All spill reports should be submitted to Bill Olson however Knutson will be handling domestic spills and Montoya will be handling all other spill reports.

GWQB would like to tour the sites (TA-50, SWSH and SURF). Tour has been set up for November 20th, 2007 at 10:00 am (TA-50 and 1:00 (SWSH).

Conclusions:

LANL will submit their legal analysis to GWQB

GWQB will submit a letter requesting the identification of holding tanks for DP-857

GWQB will circulate the revised draft within the next few weeks pending the submission of holding tank identification from LANL

A revision for DP-1132 application will be submitted with specs for the new facility. Application process will commence once GWQB receives the revisions.

GWQB and Haz-Waste will visit the site on November 20, 2007. Meeting location will be decided upon prior to site visit

Spill reports will be submitted to Bill Olson (Knutson will handle domestic and Montoya will handle all others)

Initialed [ ]

Distributions: __George Schuman, Robert George, Gerald Knutson___

Fullam Docs 030714 / Caseloads / LANL / DP1132 TA-50 RLWTF / DP 1132 emails

Fullam, Jennifer, NMENV

From: Robert Beers <bbeers@lanl.gov>
Sent: Friday, October 26, 2007 3:03 PM
To: George, Robert, NMENV; Montoya, Jennifer, NMENV
Cc: saladen_michael_t@lanl.gov; hanson@lanl.gov; artiglia@lanl.gov; vpw@lanl.gov; Margaret A. Powers; wardwell@lanl.gov
Subject: DP-1132 Application Amendment

Hi Robert and Jennifer,

At our October 4th meeting we discussed the Laboratory's project (RLWTF Upgrade Project) to construct a new Radioactive Liquid Treatment Facility at TA-50. Based on your recommendations at that meeting, the Laboratory intends to amend the existing Ground Water Discharge Permit Application (DP-1132) for the TA-50 RLWTF by submitting substantive plans & specifications for the new facility, and a closure plan for closing down the existing facility. The acting project manager for the RLWTF Upgrade Project is currently projecting that the 60% design package will not be completed until June 2008. I will be contacting you as that date approaches for more guidance in preparing the amendment.

Please let me know if you have any questions concerning this matter.

Sincerely,

Bob

0-047-05

GROUND WATER

BUREAU

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Stewardship Division (ENV-DO)
Water Quality & Hydrology Group (ENV-WQH)
P.O. Box 1663, Mail Stop K497
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: October 18, 2005
Refer To: ENV-WQH: 05-195
LA-UR: 05-7932

Mr. Christopher F. Vick
Ground Water Pollution Prevention Section
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, New Mexico 87502-6110

SUBJECT: TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, GROUND WATER DISCHARGE PLAN (DP-1132) QUARTERLY REPORT, THIRD QUARTER 2005

Dear Mr. Vick:

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the third quarter (July, August, and September) of 2005. Since the first quarter of 1999, Los Alamos National Laboratory has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Mortandad Canyon Alluvial Ground Water Monitoring Results

Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial monitoring wells during the third quarter of 2005. All of the analytical results from MCO-3, MCO-4B, MCO-6, and MCO-7 were below New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

In the last quarterly discharge plan report (ENV-WQH: 05-131, July 26, 2005), the Laboratory reported a nitrate+nitrite (as N) result for MCO-3 of 530 mg/L. This result was believed to be an erroneous value due to analytical or sampling error. Attachment I is a July 29, 2005, e-mail from General Engineering Laboratories, Inc., regarding abnormally high nitrate results in three Laboratory samples, including the sample from MCO-3 (GF05060G3CM90). The conclusion reached by GEL's Quality Assurance Officer is that the samples were preserved with nitric acid and incorrectly labeled as preserved with sulfuric acid.

93689

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from weekly composite sampling of the RLWTF's effluent. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. None of the sample results from the third quarter exceeded the NM WQCC Regulation 3103 standards for NO3-N, F, or TDS.

Table 3.0 presents the final monthly composite (FMC) sample results for nitrate-N and perchlorate for the third quarter of 2005. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. None of the sample results from the third quarter exceeded the NM WQCC Regulation 3103 standard for NO_3-N.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

for Bob Beers
Water Quality & Hydrology Group

BB/lm

Attachments: a/s

Cy: M. Leavitt, NMED/SWQB, Santa Fe, NM, w/att.
R. Ford-Schmid, NMED/DOE/OB, Santa Fe, NM, w/att.
M. Johansen, NNSA/LASO, w/att., MS A316
G. Turner, NNSA/LASO, w/att., MS A316
K. Hargis, ENV-DO, w/att., MS J591
D. Stavert, ENV-DO, w/att., MS J591
T. George, ENV-DO, w/att., MS J591
J. Dewart, ENV-ERS, w/att., MS M992
S. Rae, ENV-WQH, w/att., MS K497
M. Saladen, ENV-WQH, w/att., MS K497
J. Ball, NWIS-DO, w/att., MS J910
R. Alexander, NWIS-TA-50, w/att., MS E518
D. Moss, NWIS-TA-50, w/att., MS E518
P. Worland, NWIS-TA-50, w/att., MS E518
B. McClenahan, NWIS-TA-50, w/att., MS E518
ENV-WQH File, w/att., MS K497
IM-9, w/att., MS A150

Table 1.0. Mortandad Canyon Alluvial Monitoring Well Sampling, Analytical Results, 3rd Quarter, 2005.

Sampling Location	Sample Date	Perchlorate by LC/MS/MS[2] (ug/L)	Perchlorate by IC[3] (ug/L)	NO3+NO2-N (mg/L)	TKN (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	8/10/2005	2.48	<4.00	2.96	0.481	<0.010	277	0.41
MCO-4B	8/8/2005	29.5	27.3	1.60	0.338	<0.010	329	0.93
MCO-4B field duplicate	8/8/2005	29.4	27.9	1.59	0.311	<0.010	324	0.93
MCO-6	8/10/2005	31.0	32.4	1.65	0.456	<0.010	318	1.08
MCO-6 GEL QC duplicate	8/10/2005			1.56		<0.010	294	
MCO-7	8/8/2005	35.5	34.5	2.58	0.332	<0.010	307	1.40
NM WQCC 3103 Ground Water Standards (mg/L)				*10*[1]			*1000*	*1.6*

Notes:

[1]The NMWQCC Regulation 3103 Ground Water Standard is for NO_3-N.

[2]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[3] IC means the EPA Method 314, perchlorate analysis by Ion Chromatography.

NS means that no sample was collected due to insufficient water in the well.

J indicates an estimated value. The result was less than the reporting limit, but greater than the detection limit.

All analyses by General Engineering Laboratories, Charleston, SC.

All samples filtered.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, Analytical Results, 3rd Quarter, 2005.

Monitoring Period	Sample Composite Date	RLWTF Final Weekly Composite Results (mg/L)		
		NO3+NO2-N[1] (mg/L)	Fluoride[1] (mg/L)	TDS[1] (mg/L)
June, 2005	6/20/2005	1.23	<0.10	85
	6/27/2005	1.94	0.11	94
July, 2005	7/5/2005	3.08	0.12	110
	7/12/2005	1.80	<0.10	146
	7/18/2005	4.05	0.14	437
	No discharges 7/24-7/29			
	7/30/2005	4.51	0.43	455
August, 2005	8/8/2005	3.77	0.30	299
	8/15/2005	<1.70	0.18	188H
	8/15/05-dupe	0.189	0.189	186H
	8/22/2005	0.92	0.21	201
	8/29/2005	1.53	0.31	262
September, 2005	9/6/2005	1.48	0.29	280
	pending			
	pending			
	pending			
3rd Quarter 2005 Averages (mg/L)[3]		**2.4**	**0.21**	**232**
NM WQCC 3103. Ground Water Standards (mg/L)		*10[2]*	*1.6*	*1000*

Notes:

[1]Analysis by General Engineering Laboratories, Inc., Charleston, SC

[2]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[3]2nd quarter averages include results from June 2005.

H means that the hold-time was exceeded.

J means the reported value is greater than the Method Detectio Limit (MDL) but less than the Reporting Limit (RL).

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, Analytical Results, 3rd Quarter, 2005.

	RLWTF FMC Results[1]	
Monitoring Period	**NO3-N (mg/L)**	**Perchlorate by IC (ug/L)**
July, 2005	1.7	0 +/-1
August, 2005	1.2	0 +/-1
September, 2005	1.0	0 +/-1
NM WQCC 3103. Ground Water Standards (mg/L)	*10*	*NA*

Notes:
[1]Analyses by the Laboratory's TA-50 RLWTF analytical laboratory.

Attachment I

X-Sieve: CMU Sieve 2.2
To: bart Vanden Plas <bartvan@lanl.gov>
Cc: slug@lanl.gov, Valerie Davis <vsd@gel.com>, Harris Frampton <harris.frampton@gel.com>, bbeers@lanl.gov
Subject: Fwd: [Fwd: Re: Fwd: Re: Fwd: Re: Fwd: Nitrate-nitrite > TDS]
From: Lonnie Morris <ldm@mail.gel.com>
Date: Fri, 29 Jul 2005 16:58:49 -0400
X-Mailer: Apple Mail (2.622)
X-Proofpoint-Spam: 0
X-PMX-Version: 4.7.1.128075

Bart,

Here is a summary from our teleconference today about the unexpectedly high nitrate results.

GEL was requested to investigate abnormally high nitrate results in samples GF05060GMA501, GF05050GSPD01, and GF05060G3CM90. During a previous conference call we determined to analyze the three samples by Ion Chromatography. The results are as follows:

GF05060GMA501 preserved with H2SO4 = 105000 ppm, analyzed at 1000X dilution
GF05050GSPD01 unpreserved = ND, but sample was analyzed at 1000x dilution
GF05060G3CM90 unpreserved = 137 ppm, but also analyzed at 1000X dilution.

All three samples with H2SO4 preservation were tested with Nitrate Strips. Results were off scale high (> 500 ppm).

Two of the samples GF05050GSPD01 and GF05060G3CM90 were available unpreserved. They were tested with the Nitrate Strips. Results were negative. ND of Nitrate.

My conclusion based on this information is that the samples were preserved with HNO3 and incorrectly labeled as preserved with H2SO4. I would suspect that if the samples were properly preserved there would be very low concentrations of Nitrates in the samples or even ND of Nitrates.

Please let me or Valerie know if you require any additional information.

Best Regards,
Lonnie

Lonnie Morris
Quality Assurance Officer
General Engineering Laboratories, LLC.
2040 Savage Road
Charleston, SC 29407
(843) 556-8171

Pullen, Steve, NMENV

From: Bearzi, James, NMENV
Sent: Tuesday, November 6, 2007 2:18 PM
To: Lindsay Lovejoy
Cc: Cobrain, Dave, NMENV; Hughes, Tracy, NMENV; De Saillan, Charles, NMENV; Pullen, Steve, NMENV; Kieling, John, NMENV; Leavitt, Marcy, NMENV; Saums, Glenn, NMENV; Schuman, George, NMENV; George, Robert, NMENV
Subject: RE: LANL RLWTF exemptions

Lindsay -- I agree that this is an important issue, but it really is a policy position, and one that we have taken some time ago. We don't agree that it would be extremely difficult to argue that an NPDES permit is necessary for discharges into Mortandad Canyon in light of the Rapanos decision. Sure, had Justice Scalia gotten a fifth vote in his concurring opinion in Rapanos, intermittent streams would be out of the Clean Water Act. But he did not get that fifth vote, so it's still a question of whether there is a hydraulic connection to a navigable water, such as the Rio Grande. I think we can easily make that showing, and so can EPA.

NMED's position will continue to be that articulated in its amicus brief in the Rapanos case. We're not interested in challenging or questioning the agency's position here. What HWB is interested in is, given NMED's position that the RLWTF is subject to a CWA permit, and given that the exemption in RCRA for CWA permitted treatment units has broad applicability, is there still a RCRA hook, particularly if LANL goes to a zero-discharge (and consequently no sampling) system with evaporation tanks? Does this circumstance, as LANL proposes it and we understand it, still satisfy the exemption?

All this is something to just think about right now, as we're still waiting for LANL's response to our October 26 information request. So there's not really much point in pursuing this too far until then.

-----Original Message-----
From: Lindsay Lovejoy [mailto:lindsay@lindsaylovejoy.com]
Sent: Thursday, November 01, 2007 9:42 AM
To: De Saillan, Charles, NMENV; Bearzi, James, NMENV; Kieling, John, NMENV; Pullen, Steve, NMENV
Cc: Cobrain, Dave, NMENV; 'Lindsay Lovejoy'
Subject: RE: LANL RLWTF exemptions

Folks--
I suggest that we get together and discuss this before we become fixed in our positions. The question here is not one of the policy position that the Department likes or prefers to take. It is a legal question which the agency raised, involving LANL's claim for an exemption from HWA regulation. Because LANL claims an exemption based on Clean Water Act jurisdiction, that question concerns the limits under current decisions of Clean Water Act jurisdiction.

The recent Supreme Court decisions have made it, I would say, at the very least extremely difficult to argue that an outfall into a tributary of Mortandad Canyon requires a permit under the Clean Water Act. This situation suggests that there is no HWA exemption here and that the RLWTF outfall is subject to regulation under the HWA.

I originally asked Steve for a contact at NMED with whom I could discuss NMED's rationale supporting the NPDES permit. It would be helpful to have that discussion and look at the permit file for any data that may be

relevant.

I realize that this question is sensitive and involves a lot of agency history. Agency management will need to weigh those factors. I'm just looking at the legal basis for the exemption claimed by LANL. That's what I was asked to do. So far, it's very hard to support LANL's position.
Regards,
--Lindsay

-----Original Message-----
From: De Saillan, Charles, NMENV [mailto:charles.desaillan@state.nm.us]
Sent: Wednesday, October 31, 2007 6:11 PM
To: Bearzi, James, NMENV; Kieling, John, NMENV; Pullen, Steve, NMENV
Cc: Cobrain, Dave, NMENV; Lindsay Lovejoy
Subject: RE: LANL RLWTF exemptions

James,

The Department's position has, for a long time, been that LANL is required to have an NPDES permit for discharges into the canyons at the facility. I emphatically agree with that position. The Department has supported a broad interpretation of "waters of the United States" under the Clean Water Act, and that an NPDES permit is therefore required for discharges into perennial and intermittent streams that are hydraulically connected to navigable waters. Last year, we joined a U.S. Supreme Court brief in the Rapanos case urging such a broad interpretation. Although the Rapanos decision makes that showing somewhat more difficult, I cannot imagine the Department changing its position, and I see no need to. I think the Department's position is wholly consistent with the Court's decision in Rapanos.

I recognize that the Clean Water Act exemption in RCRA makes it more difficult for us to regulate LANL discharges under RCRA, and I see that as a problem. But I think the more prudent, and environmentally protective, approach to that problem is to try to narrow the RCRA exemption.

- Charlie

-----Original Message-----
From: Bearzi, James, NMENV
Sent: Wednesday, October 31, 2007 12:26 PM
To: Kieling, John, NMENV; Pullen, Steve, NMENV
Cc: Cobrain, Dave, NMENV; De Saillan, Charles, NMENV
Subject: RE: LANL RLWTF exemptions

This is an important issue for the agency, and I believe this very issue is the subject of current litigation. Charlie?

-----Original Message-----
From: Kieling, John, NMENV
Sent: Wednesday, October 31, 2007 12:23 PM
To: Pullen, Steve, NMENV
Cc: Cobrain, Dave, NMENV; Bearzi, James, NMENV
Subject: RE: LANL RLWTF exemptions

Steve,
We should talk...

John E. Kieling, Program Manager
New Mexico Environment Department- Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
john.kieling@state.nm.us

Phone: (505) 476-6035
HWB Main Phone: 476-6000
Fax: (505) 476-6030

Websites:
New Mexico Environment Department
Hazardous Waste Bureau

-----Original Message-----
From: Pullen, Steve, NMENV
Sent: Wednesday, October 31, 2007 8:46 AM
To: Kieling, John, NMENV; Bearzi, James, NMENV
Subject: FW: LANL RLWTF exemptions

Guys,

Lindsay is asking to discuss the legality of the NPDES permit at TA-50. (See below) Previous communication with Lindsay suggests he questions whether the canyon drainage constitutes "navigable waters of the U.S." He cites recent court decisions and recognizes this could have significant ramifications to the department.

Any suggestion as to how I should reply to Lindsay's request for a contact person?

SP

-----Original Message-----
From: Lindsay Lovejoy [mailto:lindsay@lindsaylovejoy.com]
Sent: Tuesday, October 30, 2007 2:11 PM
To: Pullen, Steve, NMENV
Subject: RE: LANL RLWTF exemptions

Steve--
Is there anyone at NMED that I could speak with who is familiar with the legal rationale for issuing a NPDES permit for the TA-50 RLWTF outfall? I
realize that this may have been done largely by EPA.
Thanks,
--Lindsay

Lindsay A. Lovejoy, Jr.
1807 Second St. #65
Santa Fe, NM 87505
505-983-1800
fax: 505-983-4508
-----Original Message-----
From: Pullen, Steve, NMENV [mailto:steve.pullen@state.nm.us]
Sent: Monday, October 29, 2007 9:53 AM
To: Lindsay Lovejoy
Subject: RE: LANL RLWTF exemptions

Thank you

SP

-----Original Message-----
From: Lindsay Lovejoy [mailto:lindsay@lindsaylovejoy.com]
Sent: Monday, October 29, 2007 9:38 AM
To: Pullen, Steve, NMENV
Subject: RE: LANL RLWTF exemptions

Steve--
Here is that Nov. 17 1981 Fed Reg issuance.
Thanks,
--Lindsay

Lindsay A. Lovejoy, Jr.
1807 Second St. #65
Santa Fe, NM 87505
505-983-1800
fax: 505-983-4508
-----Original Message-----
From: Pullen, Steve, NMENV [mailto:steve.pullen@state.nm.us]
Sent: Wednesday, October 24, 2007 8:39 AM
To: lindsayl@cybermesa.com
Subject: RE: LANL RLWTF exemptions

Lindsay,

Next week will be fine.

Thanks,

Steve

-----Original Message-----
From: lindsayl@cybermesa.com [mailto:lindsayl@cybermesa.com]
Sent: Tuesday, October 23, 2007 6:06 PM
To: Pullen, Steve, NMENV
Subject: RE: LANL RLWTF exemptions

Hi Steve--
I'm out of town and away from Westlaw. Can I send them next week after
I
get back? If important, I can try to get onto Westlaw here.
Thanks,
--Lindsay

---------- Original Message ----------
From: "Pullen, Steve, NMENV" <steve.pullen@state.nm.us>
To: "Lindsay Lovejoy" <lindsay@lindsaylovejoy.com>
Cc: "Kieling, John, NMENV" <john.kieling@state.nm.us>, "Cobrain, Dave,
NMENV" <dave.cobrain@state.nm.us>
Sent: Tue, 23 Oct 2007 14:33:37 -0600
Subject: RE: LANL RLWTF exemptions

> Lindsay,
>
>
>
> Could you please provide a copy of the Nov. 17, 1981 Federal Register
> (or just the relevant pages) referenced in your attached memo?
>
>
>
> Thanks,
>

>
>
> Steve
>
>
>
> _____
>
> From: Lindsay Lovejoy [mailto:lindsay@lindsaylovejoy.com]
> Sent: Thursday, October 11, 2007 7:38 PM
> To: Pullen, Steve, NMENV; Young, John, NMENV; Kieling, John, NMENV;
> Cobrain, Dave, NMENV
> Subject: LANL RLWTF exemptions
>
>
>
> Folks-
>
> Here is an initial memo on the RLWTF. I will continue to look into
> whether the NPDES exemption could possibly be lost somehow. The
> other exemptions do not, on the basis of my present limited
> information, seem to apply. Therefore, the RLWTF seems to be a tank
> system subject to RCRA regulation.
>
>
>
> I don't know whether you have requested LANL to present its showing
> in support of exemptions. I would like to see whether they maintain
> that all waste input to the RLWTF is "lab waste" and whether they
> claim that all wastewater entering the RLWTF is treated and released
> via the outfall.
>
>
>
> Let me know your questions and please advise if you get more
information
> on these exemptions.
>
> Regards and thanks,
>
> --Lindsay
>
>
>
> Lindsay A. Lovejoy, Jr.
>
> 1807 Second St. #65
>
> Santa Fe, NM 87505
>
> 505-983-1800
>
> fax: 505-983-4508
>
>
>
> _____

_____
>

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GW_00185

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: November 1, 2007
Refer To: ENV-RCRA: 07-184
LA-UR: 07-4794

Mr. William C. Olson
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502-6110

Mr. James Bearzi
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, NM 87505-6313

SUBJECT: NOTICE OF INTENT TO DISCHARGE, EVAPORATION TANKS, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY

Dear Mr. Olson and Mr. Bearzi:

This letter and enclosures constitute a Notice of Intent (NOI) to discharge pursuant to 20.6.2.1201 NMAC regarding Los Alamos National Laboratory's (Laboratory) plan to construct three evaporation tanks. The above-ground tanks would receive part or all of the treated effluent from the Laboratory's TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF). The evaporation of treated effluent at these tanks would significantly reduce or, at times, eliminate discharges at NPDES Outfall 051. The RLWTF discharge is into Mortandad Canyon, pursuant to NPDES Permit NM0028355. It is the Laboratory's view that a groundwater discharge permit will not be required for this project because there is no reasonable probability or likelihood that liquid contained in the evaporation tanks will move into groundwater, either through a leak or by overflow. Additional information is presented below and in the following enclosures:

- Enclosure 1.0 is a completed NMED-Ground Water Quality Bureau NOI form.
- Enclosure 2.0 is a preliminary location map.
- Enclosure 3.0, per your agency's request, is the Laboratory's analysis of the applicability of the Wastewater Treatment Unit (WWTU) exemption under the federal RCRA regulations for those facilities regulated under the federal CWA.
- Enclosure 4.0 is EPA FAXBACK #13526, January 16, 1992.
- Enclosure 5.0 is Federal Register Vol. 61, No. 68, *Land Disposal Restrictions Phase III—Decharacterization Wastewaters, Carbamate Wastes, and Spent Potliners* (40 CFR Parts 148, 268, 271, and 403); specifically relevant to this NOI are pages 15569 to 15574 containing land disposal restrictions applicable to zero dischargers.

Enclosure 4.0 states that the primary reason of the wastewater treatment exemption is to avoid imposing duplicative requirements pursuant to both a NPDES permit and a RCRA permit for the same unit. The FAXBACK also defines the requirements that must be met for the WWTU exemption to apply.

Enclosure 5.0 is an EPA preamble dealing with Land Disposal Restrictions, which we are providing in response to questions from Steve Pullen. Any material removed from the evaporation tanks during cleaning will be characterized and managed appropriately. Further, Section III.A. of the Federal Register in Enclosure 5.0 states that land disposal treatment standards apply only to the following types of facilities:

"(1) facilities treating formerly characteristic wastes in surface impoundments whose ultimate discharge is subject to regulation under either section 402 or 307 of the CWA." The ZLD evaporation tanks at LANL will meet the definition of a tank or tank system in 40 CFR §260.10, they are not surface impoundments; thus, the tanks are not within the first type of facility to which land disposal requirements apply.

"(2) permitted and unpermitted zero dischargers engaging in treatment that is equivalent to that of the CWA-regulated facilities (see 40 CFR 268.37(a) defining CWA-equivalent treatment), including facilities treating formerly characteristic waste in tanks prior to release on the land for such purposes as irrigation or land treatment." The proposed ZLD tanks will not release effluent on the land for such purposes as irrigation or land treatment. In addition, the proposed ZLD tanks will not conduct treatment that meets the description of CWA-equivalent treatment[1], therefore, land disposal regulations do not apply to the evaporation tanks under these criteria either. This Federal Register further clarifies that the treatment standards do not apply to facilities that discharge to navigable water or POTWs or that manage decharacterized waste in treatment systems without surface impoundments.

Conceptual Tank Design

Each of the three evaporation tanks will have an area of approximately 0.7 to 1.0 acres providing a total evaporation area of 2.1 to 3.0 acres. The total depth of each basin will be approximately 4 ft. Multiple modeling scenarios using conservative input parameters show that the actual operating depth will range from approximately 1.4 to 2.2 ft depending upon the volume of effluent discharged to the tanks, precipitation, and the final tank sizes selected; these operating depths will provide a minimum freeboard of approximately 1.8 ft. The tanks will be constructed with reinforced-concrete walls and floors, and with the water surface open to the atmosphere. The concrete tanks will be sealed with a curing compound and all joints will be watertight. A liner system will be installed in each concrete tank consisting of primary and secondary geomembrane liners separated by a geosynthetic drainage material for leak detection. The wall of the tanks will be self-supporting. Depth to regional groundwater at the project site is approximately 1260 ft.

[1] CWA-equivalent treatment means biological treatment for organics, alkaline chlorination or ferrous sulfate precipitation of cyanide, precipitation/sedimentation for metals, reduction of hexavalent chromium, or other treatment technology that can be demonstrated to perform equally or greater than these technologies.

Quality of Effluent

All effluent discharged to the evaporation tanks will be fully treated by RLWTF treatment operations and will comply with all applicable NPDES permit limits and all of the listed numerical standards of 20.6.2.3103 NMAC. Effluent discharged to the evaporation tanks will receive the same level of treatment and will be of equal quality to that effluent discharged to Mortandad Canyon at NPDES Outfall 051. The quality of the RLWTF's effluent is routinely reported to the NMED through the following documents:

1. NPDES Monthly Discharge Monitoring Reports (DMRs) submitted to NMED, Surface Water Quality Bureau;
2. RLWTF Annual Operating Reports submitted to the NMED, Ground Water Quality Bureau (the 2006 RLWTF Annual Report was submitted on June 11, 2007; ENV-RCRA: 07-0135, LA-UR-07-3447); and
3. DP-1132 quarterly monitoring reports submitted to the NMED, Ground Water Quality Bureau.

For the reasons indicated above, no groundwater permit is required. As explained above, there is no reasonable probability that liquid in the evaporation tanks will move directly or indirectly into groundwater [*See* Amended Final Order, In the Matter of: No Discharge Plan Required McKinley Paper Co. (July 13, 1993) (determining no discharge permit required for discharges to closed-loop, zero discharge system comprised of U-drains, lift stations and piping)]. Further, even if the discharges to the tanks were considered a discharge subject to the permitting requirements of 20.6.2.3104 NMAC, as discussed above, the effluent meets all of the listed numerical standards of 20.6.2.3103 NMAC, has a total nitrogen concentration of 10 mg/L or less, does not contain any toxic pollutant, and is therefore exempt from the permitting requirements under 20.2.3105.A NMAC.

We are sending this NOI well in advance of beginning construction as we want to complete all regulatory requirements in a timely fashion. Detailed plans and specifications will be submitted to your agency once they become available.

This letter is not intended to fully answer to the information requested in the October 26, 2007, letter from James Bearzi to Donald L. Winchell and Richard S. Watkins regarding the exemption status of the TA-50 RLWTF. The response to that letter will be forthcoming under separate cover.

We look forward to receiving your response to this NOI and position paper. Please contact Bob Beers (505-667-7969) if you have any questions or need any additional information.

Sincerely,

A. R. Grieggs

Anthony R. Grieggs
Group Leader
Water Quality & RCRA (ENV-RCRA) Group
ARG:BB/lm

ARG:BB/lm

Enclosures: a/s

Cy: Tracy Hughes, NMED OGC, Santa Fe, NM
Marcy Leavitt, NMED SWQB, Santa Fe, NM
George Schuman, NMED GWQB, Santa Fe, NM
Robert George, NMED GWQB, Santa Fe, NM
Jake Knutson, NMED GWQB, Santa Fe, NM
John Young, NMED HWB, Santa Fe, NM
Steve Pullen, NMED HWB, Santa Fe, NM
Dave Cobrain, NMED HWB, Santa Fe, NM
Lisa Cummings, NNSA/LASO, MS A316
George Rael, LASO/EO, MS A316
Gene Turner, LASO/EO, MS A316
Michael B. Mallory, PADOPS, MS A102
Richard S. Watkins, ADESHQ, MS K491
Tori George, ENV-DO, MS J978
Mike Saladen, ENV-RCRA, MS K490
Bob Beers, ENV-RCRA, MS K490
Holly Wheeler-Benson, ENV-RCRA, MS K490
Marc Bailey, ENV-RCRA, MS K490
Pete Worland, EWMO-RLW, MS E518
Ed Artiglia, PE-DO, MS E554
Craig Douglas, RLW, MS E0518
Phil Wardwell, LC-LESH, MS A187
ADESHQ Files, MS K491
LC Fileroom, MS A187
LC/LESH File, MS A187
ENV-RCRA File, MS K490
IRM-RMMSO, MS A150

ENCLOSURE 1.0

New Mexico Environment Department
Ground Water Quality Bureau

Ground Water Quality Bureau – Pollution Prevention Section Notice of Intent

1. Name and Address of person making discharge:

Los Alamos National Laboratory
Attn: Bob Beers
P.O. Box 1663, Mail Stop K490
Los Alamos, NM 87545

Phone: 505-667-7969 (office)
505-665-9344 (fax)

2. Location of discharge (give township, range, section, ¼ section, miles from closest town and street address, if applicable):

Los Alamos National Laboratory
Technical Area (TA)-52. See Enclosure 2.0.
35° 51' 37"N, 106° 16' 57"W (NAD27), USGS Frijoles (NM) Quadrangle

GROUND WATER

NOV 0 8 2007

BUREAU

3. Type of operation generating the discharge:

Treated effluent evaporation tanks (3)

4. Description of the source of the discharge:

Treated effluent from TA-50 RLWTF treatment unit operations

5. Estimated concentration of contaminants in the discharge:

Effluent quality is documented in the following reports submitted to the NMED in 2006-07:

- NPDES Monthly Discharge Monitoring Reports (DMRs) submitted to NMED, Surface Water Quality Bureau,
- RLWTF Annual Operating Reports submitted to the NMED, Ground Water Quality Bureau (the 2006 RLWTF Annual Report was submitted on June 11, 2007; ENV-RCRA: 07-0135, LA-UR-07-3447), and
- DP-1132 quarterly monitoring reports submitted to the NMED, Ground Water Quality Bureau.

6. Means of the discharge (to a lagoon, watercourse, septic tank/leachfield, etc.):

Treated effluent will be transferred from the TA-50 RLWTF to the evaporation tanks via a pipeline.

7. Estimated daily flow rate of the discharge:

Evaporation Tanks Design Basis: 13.6 million liters per year (3.6 million gallons per year).

8. Estimated depth to ground water:

Approximately 1260 ft to regional ground water.

Signature: A R Grieggs **Title:** Group Leader

Printed name: Anthony R. Grieggs **Date:** 11/2/07

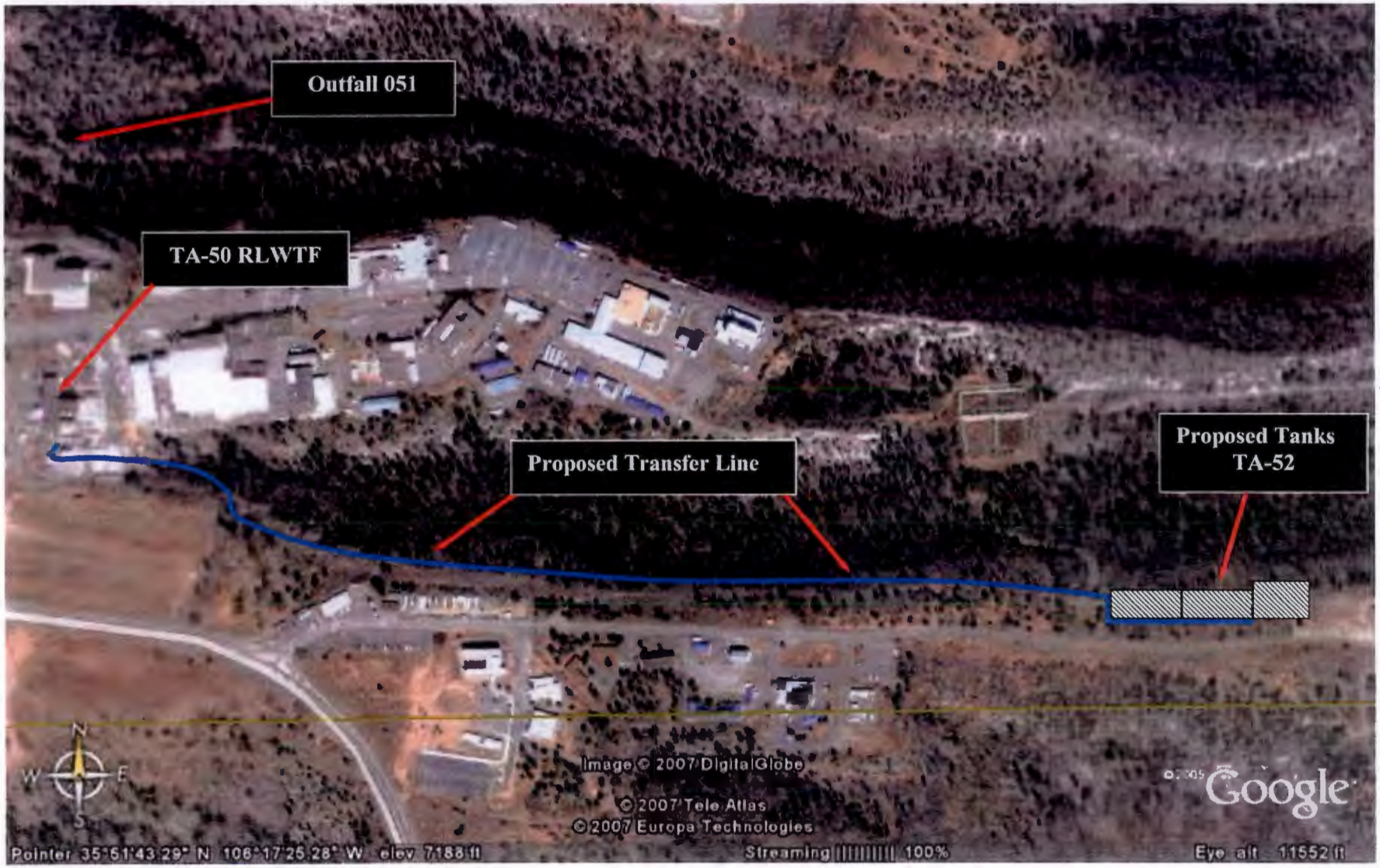
Providing additional information such as maps, plans and specifications, laboratory analyses, and/or a detailed description of the discharge will help NMED to process this NOI in a more timely manner. Please return this form to:

NMED Ground Water Quality Bureau
P.O. Box 26110
Santa Fe, New Mexico 87502

Telephone: 505-827-2900
Fax: 505-827-2965

ENCLOSURE 2.0

NPDES PERMIT NO. NM0028355
Proposed RLWTF Effluent Evaporation Tanks
LA-UR-07-4794



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ENCLOSURE 3.0

Position Paper

TA-50 RLWTF Zero Liquid Discharge Evaporation Tanks

Under Los Alamos National Laboratory's NPDES Permit No. NM0028355, the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) discharges treated effluent from Outfall 051 to Mortandad Canyon. Permit conditions, including effluent limitations and monitoring requirements, for Outfall 051 can be viewed online at http://www.lanl.gov/environment/h2o/docs/NM0028355_LANL_NPDES2007.pdf. The proposed change to the RLWTF includes the addition of three concrete evaporation tanks to receive treated effluent, so that the discharge from Outfall 051 is significantly reduced or eliminated. Reducing or eliminating the amount of water discharge from Outfall 051 will, in turn, reduce the potential for the migration of legacy contaminants in Mortandad Canyon by reducing surface flow.

The evaporation tanks will be an integral part of the RLWTF which is a wastewater treatment facility regulated under the Clean Water Act (CWA). Therefore, a RCRA permit is not required for this project. The Environmental Protection Agency (EPA) provided some discussion in 53 FR 34080 (September 2, 1988) which states that: "the wastewater treatment unit exemption is intended to cover only tank systems that are part of a wastewater treatment facility that (1) produces a treated wastewater effluent which is discharged into surface waters or into a POTW sewer system and therefore is subject to the NPDES or pretreatment requirements of the Clean Water Act, or (2) produces no treated wastewater effluent as a direct result of such requirements."

Further guidance relative to zero discharge facilities is provided in Enclosure 4.0, EPA FAXBACK # 13526, January 16, 1992.

Federal RCRA regulations, adopted by reference by the EIB (20.4.1 NMAC), provide that a RCRA permit is not required for wastewater treatment units (WWTUs). Further, 40 CFR 270.1(c)(2), states that "The following persons are among those not required to obtain a RCRA permit: . . . (v) Owners and operators of . . wastewater treatment units as defined in 40 CFR 260.10." The definition of a WWTU in 40 CFR 260.10 contains three requirements. The RLWTF meets these three requirements as follows:

First, RLWTF and its associated evaporation tanks (once constructed) are "part of a wastewater facility that is subject to regulation under . . . Section 402 . . . of the Clean Water Act." The RLWTF is currently subject to regulation under Section 402 of the federal Clean Water Act, as Outfall 51 of NPDES Permit No. NM0028355.

Second, the RLWTF receives and treats or stores influent that is a hazardous waste, in that it may contain corrosive characteristic (D002) mixed wastewater. This influent will be treated before it is discharged to the evaporation tanks.

Third, the structure containing the wastewater must meet the definition of a "tank" or "tank system" in 40 CFR 260.10. A "tank" is defined as "a stationary device, designed to contain an accumulation of hazardous waste which is constructed primarily of non-earthen materials (e.g., wood, concrete, steel, plastic) which provide structural support." As noted above, the evaporation tanks will be constructed of concrete; the concrete walls will provide structural support to contain the liquid inside. A "tank system" includes the associated ancillary equipment of a tank; for example, the sump.

ENCLOSURE 4.0

FAXBACK #13526

EXEMPTION FROM PERMITTING REQUIREMENTS FOR WASTE WATER TREATMENT UNITS
PPC 9522.1992(01)

United States Environmental Protection Agency
Washington, D.C. 20460
Office of Solid Waste and Emergency Response

January 16, 1992

Mr. Thomas W. Cervino, P.E.
Colonial Pipeline Company
Lenox Towers
3390 Peachtree Road, N.E.
Atlanta, Georgia 30326

Dear Mr. Cervino:

This letter is in response to your August 9, 1991 correspondence requesting a clarification of the conditions under which waste water treatment units qualify for an exemption from RCRA permitting requirements. In your letter you explained that Colonial Pipeline Company has several locations that generate waste waters that are hazardous under the toxicity characteristic, and you asked whether a RCRA permit would be required for a new treatment unit that you are considering.

The primary reason for the waste water treatment exemption is to avoid imposing duplicative requirements pursuant to both a NPDES permit and a RCRA permit for the same unit. As you are aware, in order for a unit to qualify for this exemption contained in 40 CFR_264.1(g)(6), it must:

(1) Be part of a waste water treatment facility that is subject to regulation under either Section 402 or 307(b) of the Clean Water Act;

(2) Receive, treat, or store influent waste water; or generate, accumulate, treat, or store a waste water treatment sludge; and,

(3) Meet the definition of tank or tank system in 40 CFR _260.10.

The main question that you raised concerns the first criteria: i.e., which units are considered subject to the Clean Water Act. As you are aware, the Agency provided some discussion of this requirement in 53 FR 34080 (September 2, 1988) which states that:

"the wastewater treatment unit exemption is intended to cover only tank systems that are part of a wastewater treatment facility that (1) produces a treated wastewater effluent which is discharged into surface waters or into a POTW sewer system and therefore is subject to the NPDES or pretreatment requirements of the Clean Water Act, or (2) produces no treated wastewater effluent as a direct result of such requirements."

It is important to note that it is not necessary that the Clean Water Act permits actually be issued for the units to be eligible for the RCRA exemption; it is sufficient that the facility be subject to the requirements of the Clean Water Act.

Based on a review of the information provided, EPA has determined that any of the treatment systems (including the proposed treatment unit) at the Colonial Pipeline facilities which are currently permitted, were ever permitted, or should have been permitted under NPDES, all meet the first test of the Section 264.1(g)(6) exemption. The key issue is whether the treatment system ever had a discharge to surface water, and thus was ever permitted (or should have been permitted) under NPDES. If there was never a discharge to surface waters, then the exemption criteria is not satisfied. You also mentioned that some of your facilities employ wastewater treatment systems which are regulated in accordance with other applicable state laws, rules, and regulations. Without more specific information regarding these state requirements and permits, EPA cannot address whether these facilities would qualify for the exemption. However, as discussed above, the exemption in the federal regulations would only be available if the state requirements stem from the identified sections of the Clean Water Act.

With regard to the question of a "zero discharge" facility, EPA would like to clarify the difference between a facility that produces no treated wastewater as a direct result of Clean Water Act requirements and units that are not required to obtain an NPDES permit because they do not discharge treated effluent. In the first case, the facility would have had a surface water discharge at one time, but has since eliminated the discharge as a result of, or by exceeding, NPDES or pretreatment requirements. Such facility would qualify for the waste water treatment unit exemption under RCRA. In the second case, the facility never had a surface water discharge, and therefore was never subject to NPDES permitting or Clean Water Act requirements (53 FR 34080). The RCRA exemption is not available in these cases. (We should point out that the language you referred to on page 2 of the May 22, 1984 memo on zero discharge has been further refined and clarified by recent program policies and interpretations.)

There is another management option that my staff has discussed with you on the phone. That approach would be to treat your waste water in tank units pursuant to the generator accumulation exemption of 40 CFR _262.34. This provision allows generators of hazardous wastes to treat or store such wastes in tanks or containers for short periods of time (i.e., 90 days) without obtaining a RCRA permit, provided that all the conditions of _262.34 are met, including compliance with specified tank or container standards in 40 CFR Part 265. In many cases air strippers may be considered tank units under RCRA and might be eligible for this exemption. Of course, as long as the treated waste water meets a hazardous waste listing description or exhibits a hazardous waste characteristic it must

continue to be managed as a hazardous waste.

If you have facility-specific questions, please contact individual in the appropriate EPA Regional Offices. For Region III (Philadelphia), contact Ms. Susan Sciarratia at (215) 597-7259 and for Region IV (Atlanta), contact Ms. Beth Antley at (404) 347-3433. Should you have further questions about this letter, please contact Glenn Strahs of my staff at (202) 260-4782.

Sincerely,
Sylvia K. Lowrance, Director
Office of Solid Waste

cc: Kathy Nam, OGC; EPA RCRA Branch Chiefs, Regions I-X; Barbara Simcoe, ASTSWMO

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: November 1, 2007
Refer To: ENV-RCRA: 07-184
LA-UR: 07-4794

Mr. William C. Olson
Ground Water Quality Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502-6110

Mr. James Bearzi
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, NM 87505-6313

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We look forward to receiving your response to this NOI and position paper. Please contact Bob Beers (505-667-7969) if you have any questions or need any additional information.

Sincerely,

A. R. Grieggs

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Enclosures: a/s

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IRM-RMMSO, MS A150

Enclosure 5.0

Monday
April 8, 1996

federal register

Part II

Environmental Protection Agency

40 CFR Part 148, et al.
Land Disposal Restrictions Phase III; Final Rule and Partial Withdrawal and Amendment of Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 148, 268, 271, and 403

RIN 2050–AD38

[EPA # 530–Z–96–002; FRL–5438–3]

Land Disposal Restrictions Phase III—Decharacterized Wastewaters, Carbamate Wastes, and Spent Potliners

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: EPA is promulgating treatment standards for hazardous wastes from the production of carbamate pesticides and from primary aluminum production under its Land Disposal Restrictions (LDR) program. The purpose of the LDR program, authorized by the Resource Conservation and Recovery Act (RCRA), is to minimize short- and long-term threats to human health and the environment due to land disposal of hazardous wastes.

The Agency is also amending the treatment standards for hazardous wastes that exhibit the characteristic of reactivity. The rule also begins the process of amending existing treatment standards for wastewaters which are hazardous because they display the characteristic of ignitability, corrosivity, reactivity, or toxicity. These wastes are sometimes treated in lagoons whose ultimate discharge is regulated under the Clean Water Act, and sometimes injected into deepwells which are regulated under the Safe Drinking Water Act. Prior to today's rule, the treatment standard for these wastes required only removal of the characteristic property. Today's revised treatment standards require treatment, not only to remove the characteristic, but also to treat any underlying hazardous constituents which may be present in the wastes. Therefore, these revised treatment standards will minimize threats from exposure to hazardous constituents which may potentially migrate from these lagoons or wells.

Finally, EPA is codifying as a rule its existing Enforcement Policy that combustion of inorganic wastes is an impermissible form of treatment because hazardous constituents are being diluted rather than effectively treated.

EFFECTIVE DATE: This final rule is effective on April 8, 1996, except:

Sections 148.18(a), 268.39(a), (b), and (f), which are effective on July 1, 1996; and

Sections 148.18(b) and 268.39(c), which are effective on January 8, 1997; and

Sections 148.1 (a), (b), and (d), 148.3, 148.4, 148.18 (c) and (d), 148.20(a), 268.1(e), 268.2 (k) and (l), 268.3 (a) and (b), 268.9 (d), (e), (f), and (g), 268.39 (d) and (e), 268.44(a), and 403.5 (c) and (d), which are effective on April 8, 1998.

ADDRESSES: Supporting materials are available for viewing in the RCRA information Center (RIC), located at Crystal Gateway One, 1235 Jefferson Davis Highway, First Floor, Arlington, VA. The Docket Identification Number is F–96–PH3F–FFFFF. The RCRA Docket is open from 9 a.m. to 4 p.m. Monday through Friday, except for Federal holidays. The public must make an appointment to review docket materials by calling (703) 603–9230. The public may copy a maximum of 100 pages from any regulatory document at no cost. Additional copies cost $0.15 per page.

FOR FURTHER INFORMATION CONTACT: For general information on the LDR program, contact the RCRA Hotline at 800–424–9346 (toll-free) or 703–412–9810 locally. For general information on today's rule, contact Peggy Vyas in the Office of Solid Waste, phone 703–308–8594.

SUPPLEMENTARY INFORMATION:

Glossary of Acronyms

BAT—Best Available Technology
BDAT—Best Demonstrated Available Technology
BIFs—Boilers and Industrial Furnaces
CAA—Clean Air Act
CWA—Clean Water Act
EP—Extraction Procedure
HON—Hazardous Organic NESHAPs
HSWA—Hazardous and Solid Waste Amendments
HWIR—Hazardous Waste Identification Rule
ICR—ignitable, corrosive, and reactive wastes, or, Information Collection Request (in section IX.D.)
ICRT—ignitable, corrosive, reactive, and TC wastes
LDR—Land Disposal Restrictions
NESHAPs—National Emission Standards for Hazardous Air Pollutants
NPDES—National Pollutant Discharge Elimination System
POTW—Publicly-Owned Treatment Works
PSES—Pretreatment Standards for Existing Sources
PSNS—Pretreatment Standards for New Sources
RCRA—Resource Conservation and Recovery Act
RIA—Regulatory Impact Analysis
SDWA—Safe Drinking Water Act
TC—toxicity characteristic
TCLP—Toxicity Characteristic Leaching Procedure
TRI—Toxic Release Inventory
UIC—Underground Injection Control
UTS—Universal Treatment Standards

Outline

I. Background

A. Summary of the Statutory Requirements of the 1984 Hazardous and Solid Waste Amendments, and Requirements of the 1993 Consent Decree With the Environmental Defense Fund

The Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA), enacted on November 8, 1984, largely prohibit the land disposal of untreated hazardous wastes that do not meet treatment standards established by EPA under section 3004(m). Once a hazardous waste is prohibited, the statute provides only two options for legal land disposal: meet the treatment standard for the waste prior to land disposal, or dispose of the waste in a land disposal unit that has been found to satisfy the statutory no migration test. A no migration unit is one from which there will be no migration of hazardous constituents for as long as the waste remains hazardous. RCRA sections 3004 (d), (e), (f), (g)(5).

The amendments also require the Agency to set levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short term and long term threats to human health and the environment are minimized. RCRA section 3004(m)(1). To date, the Agency has implemented this provision by establishing treatment standards for chemical constituents in hazardous wastes based on the performance of the best demonstrated available technology (BDAT) to treat the waste. EPA may establish treatment standards as specified technologies, as constituent concentration levels in treatment residuals, or both. When treatment standards are set as levels, the regulated community may use any technology not otherwise prohibited (such as impermissible dilution) to treat the waste.

It should be noted that the Agency has proposed risk-based exit levels—levels at which wastes are no longer considered hazardous for purposes of RCRA subtitle C—for the majority of hazardous constituents found in listed hazardous wastes in the Hazardous Waste Identification Rule (HWIR) (60 FR 66344, December 21, 1995). Wastes meeting these levels either before or after treatment consequently could be disposed in units not subject to RCRA hazardous waste management requirements (e.g., landfills without subtitle C permits). A consent decree approved by the U.S. District Court for the District of Columbia requires EPA to finalize the HWIR exit levels by December 15, 1996. In the same notice, the Agency proposed to allow the exit levels for some constituents to serve as alternative, risk-based LDR treatment standards satisfying the "minimize threat" standard of section 3004(m). Where these risk-based levels are higher (less restrictive) than current BDAT treatment standards, they will effectively supersede the BDAT requirements. See *Hazardous Waste Treatment Council* v. *EPA*, 886 F.2d 355, 362–63 (D.C. Cir. 1989).

EPA was required to promulgate land disposal prohibitions and treatment standards by May 8, 1990 for all wastes that were either listed or identified as hazardous at the time of the 1984 amendments (RCRA sections 3004 (d), (e), and (g)(5)), a task EPA completed within the statutory timeframe. EPA was also required to promulgate prohibitions and treatment standards for wastes identified or listed as hazardous after the date of the 1984 amendments within six months after the listing or identification takes effect (RCRA section 3004(g)(4)).

The Agency did not meet this latter statutory deadline for all of the wastes identified or listed after the 1984 amendments. As a result, a suit was filed by the Environmental Defense Fund (EDF). EPA and EDF signed a consent decree that establishes a schedule for adopting prohibitions and treatment standards for newly identified and listed wastes. (*EDF* v. *Reilly*, Cir. No. 89–0598, D.D.C.). EPA also entered into a settlement agreement with the environmental petitioners in *Chemical Waste Management* v. *EPA*, 976 F.2d 2 (D.C. Cir. 1992), cert. denied 113 S. Ct. 1961 (1993) regarding the procedural effect of the mandate entered in that case. This settlement calls for EPA to take action to implement the portions of the opinion dealing with centralized management of wastewaters that initially exhibit a hazardous waste characteristic within specified timeframes.

Today's rule fulfills several provisions of the settlement agreement and proposed consent decree. First, the rule amends the treatment standards for initially characteristic wastewaters managed in centralized wastewater management systems containing land disposal units. Three specific fact patterns are covered by the rule: (1) Where the wastewaters are ultimately discharged and are subject to limitations or standards established under the Clean Water Act (CWA) and the treatment system preceding discharge includes a surface impoundment; (2) where a facility with initially characteristic wastes treats those wastes with CWA-equivalent treatment but ultimately uses a form of land disposal (such as spray irrigation) that is not regulated under the CWA as the final means of disposing of the treated wastewaters; and (3) the initially characteristic wastes are injected into Class 1 non-hazardous deep wells subject to regulation under the Safe Drinking Water Act (SDWA). In all cases, the wastewaters no longer exhibit a characteristic at the point of land disposal. The amended treatment standards require treatment that destroys, immobilizes, or removes the hazardous constituents present in the initially characteristic wastewaters (referred to as "underlying hazardous

constituents" because these constituents are not typically the reason the waste is classified as hazardous). Treatment of the underlying hazardous constituents is nevertheless required in order to minimize the long-term threats land disposal of these wastes can cause. 976 F.2d at 16–17.

EPA is fulfilling provisions of the consent decree by promulgating prohibitions and treatment standards for two "newly listed wastes" wastes from production of carbamate pesticides, and spent aluminum potliners from primary aluminum production.

That being said, the risks addressed by the portion of the rule dealing with centralized wastewater management, particularly UIC wells, are very small relative to the risks presented by other environmental conditions or situations. In a time of limited resources, common sense dictates that we deal with higher risk activities first, a principle on which EPA, members of the regulated community, and the public can all agree. For this reason, the Administration is supporting HR 2036, legislation which passed the House of Representatives, that would remove the mandate to automatically apply LDR treatment standards to decharacterized wastes managed in centralized wastewater management situations regulated by the CWA or the SDWA. If this legislation passes in its current form, it would affect the regulations discussed in sections III., IV., and VI.B. of the preamble. It would not affect the other sections of the preamble and rule. The sections of preamble and rule that are affected by the legislation have been granted 2-year national capacity variance (see §§ 148.18 (c) and (d) and 268.39 (c) and (d)). The sections of preamble and rule not affected by the legislation have more immediate effective dates. If the legislation does pass into law, the Agency could issue an immediately effective final rule remanding the affected portions.

Nevertheless, the Agency is presently required to set treatment standards for these relatively low risk wastes and disposal practices, although there are other actions and projects with which the Agency could provide greater protection of human health and the environment. At the same time, however, EPA has sought to exercise the full extent of its authority under current law to implement these mandates with significantly lower cost while ensuring protectiveness, such as giving credit for up-stream reductions in hazardous constituents, and crafting limited exemptions for wastewaters containing de minimis amounts of hazardous constituents.

B. Treatment Standards for Hazardous Wastes That Exhibit a Characteristic—The D.C. Circuit's Opinion in Chemical Waste Management v. EPA

In *Chemical Waste Management* v. *EPA*, 976 F.2d 2 (D.C. Cir. 1992) cert. denied 113 S. Ct. 1961 (1993), the court made a number of far-reaching rulings pertaining to treatment standards for hazardous wastes that are hazardous because they exhibit a characteristic. First, the court held that land disposal restriction requirements can continue to apply to characteristic hazardous wastes even after they no longer exhibit a characteristic. 976 F.2d at 12–14. Second, to satisfy the requirement in RCRA section 3004(m) that treatment address both short-term and long-term threats posed by a waste's land disposal, it is not enough that characteristic hazardous wastes be treated to remove the short-term property (viz. ignitability, corrosivity, or reactivity) that makes them hazardous. Long-term threats, in the form of toxic underlying hazardous constituents, also must be addressed. 976 F.2d at 16–17. Third (as EPA reads the opinion), the court held that dilution was ordinarily not a permissible means of treating hazardous constituents. Such constituents generally must be destroyed, immobilized, or removed from the waste to satisfy the requirements of section 3004(m), specifically, the requirement that long-term threats be minimized. 976 F.2d at 23, 25 and n. 8; 60 FR at 11706–11708 (March 2, 1995). Fourth, centralized wastewater management systems whose discharge is ultimately regulated under the Clean Water Act, and which dilute characteristic hazardous wastes before treatment in surface impoundments, may continue to do so provided the wastewater treatment system destroys, immobilizes, or removes the same volume of hazardous constituents as would be removed, immobilized, or destroyed if the wastes were treated separately. 976 F.2d at 22–24. In other words, notwithstanding that these wastes are disposed in impoundments without being fully treated, the practice is permissible provided equivalent treatment occurs before the waste is ultimately discharged. Fifth, this option of demonstrating equivalent treatment across a treatment system is not available for Class I nonhazardous deep well injection systems because such units are permanent disposal rather than treatment units. 976 F.2d at 24–6.

These portions of the opinion are addressed in various sections of today's rule.

The Agency is also addressing the issue of equivalent treatment by Clean Water Act treatment systems managing de-characterized wastes in impoundments by promulgating treatment standards and related requirements that would be used to measure this so-called end-of-pipe equivalence. Finally, EPA is implementing the court's mandate with respect to Class I nonhazardous injection wells by requiring treatment of underlying hazardous constituents in ignitable, and corrosive characteristic wastes being injected into such wells, and prohibiting dilution as a means of achieving those standards.

Responses to the comments on EPA's reading of the court's opinion are found in the Response to Comment Background Document which is part of the administrative record for this rule. In general, however, the Agency adheres to the reading set out in the proposed rule's preamble at 60 FR 11706–11708.

EPA is also amending the treatment standards for reactive wastes (other than reactive sulfide and cyanide reactive wastes) so that treatment addresses both the property of reactivity and the threat posed by disposal of underlying hazardous constituents in these wastes (with an exception for ordnance and other explosives which are the subject of an emergency response, as explained in the next paragraph). The Agency is taking this action despite the fact that the court found reactive wastes did not contain sufficient concentrations of hazardous constituents to require any treatment beyond that of removing the characteristic. The Agency believes that it is as likely that reactive wastes contain underlying hazardous constituents at levels that may create a threat as do ignitable and corrosive wastes, and consequently, proposed to regulate reactive wastes in the Phase III proposal. Commenters submitted no data suggesting that reactive wastes do not contain the same types and concentrations of underlying hazardous constituents. Therefore, EPA is promulgating treatment standards for reactive wastes (other than reactive sulfides and cyanides) in this rule that require treatment of all underlying hazardous constituents reasonably expected to be present in the reactive wastes at the point of generation.

EPA is, however, temporarily deferring application of these amended LDR treatment standards for reactive wastes with respect to unexploded ordnance and other explosive devices which are the subject of an emergency response. An emergency response is an action taken to prevent imminent risk of explosion. (See 40 CFR 264.1(g)(8)

setting out circumstances where such responses are exempt from RCRA permitting requirements.) During the development of the proposed Military Munitions Rule: Hazardous Waste Identification and Management; Explosives Emergencies; Redefinition of On-site proposed rule (60 FR 56468, November 8, 1995), the Department of Defense, the military services, and other Federal agencies raised concerns that LDR requirements requiring treatment of underlying hazardous constituents might impede the most effective emergency responses involving these materials. If a responding team had to determine LDR applicability before deactivating an explosive subject to an emergency response, the response could be significantly delayed or complicated. Furthermore, concern about LDR applicability might discourage the team from responding at all. This discussion serves as EPA's initial response to these comments.

EPA agrees that the primary goal in emergency responses to explosives is the safe and prompt elimination of immediate threats to human life and property, and the Agency would be concerned if LDR or other regulatory requirements complicated these responses. The issue is too important and potentially complicated to resolve in today's rule. Therefore, EPA is temporarily deferring final action while it considers this issue further.

In deferring action for this limited class of reactive wastes, EPA notes that emergency responses present issues different from routine management of reactive wastes, where there is no competing consideration of need for immediate action to prevent an imminent threat. In non-emergency response management situations, as discussed earlier, the Agency believes these wastes can be fully treated to minimize both short and long-term threats posed by land disposal of wastes.[1] EPA also is amending the treatment standards for wastes exhibiting the toxicity characteristic to include standards for underlying hazardous constituents.

Toxic wastes can also contain underlying hazardous constituents in the same potentially harmful concentrations as ICR wastes. 60 FR at 11706. Today's final rule consequently conforms standards for toxic characteristic hazardous wastes to assure treatment of underlying hazardous constituents as well, when such constituents are present at levels exceeding the minimize threat level (as established either by the current technology-based standards or, if risk-based levels are established, exceeding a risk-based level.) Thus, the prohibitions and standards in today's rule will apply to ignitable, corrosive, reactive and toxic characteristic wastes, as just discussed.

II. Miscellaneous Issues for Which EPA Is Not Finalizing an Approach in This Final Rule

A. Treatment Standards for Organobromine Wastes

Organobromine wastes are not yet listed as hazardous. EPA anticipates making a final listing determination in a future rulemaking.

Although EPA proposed treatment standards for organobromine wastes, it clearly would be putting the cart before the horse to promulgate treatment standards in advance of a determination of whether the wastes are hazardous. The Agency intends to establish treatment standards for organobromine wastes should these wastes are listed in the future.

B. Potential Prohibition of Nonamenable Wastes From Land-Based Biological Treatment Systems

The proposed rule contained an extensive discussion of whether certain wastes should be prohibited from placement in biological treatment surface impoundments because they are not amenable to biological treatment. To allow more time to gather comments, the Agency has decided to address this issue in the LDR Phase IV rule, which was proposed on August 22, 1995 (60 FR 43654) and is scheduled to be finalized in June of 1996.

C. Certain Sections of Completing Universal Treatment Standards

The LDR Phase III proposed rule included a section on the completion of universal treatment standards (60 FR at 11727, March 2, 1995). Possible nonwastewater universal treatment standards (UTS) for eleven constituents were discussed in the proposal, and comments and data were solicited. In general, commenters felt more data should be gathered before EPA proposes nonwastewater standards for these constituents, and EPA agrees. EPA had also solicited comment and data on extending certain universal treatment standards to fill gaps in the § 268.40 table of universal treatment standards where "NA" appeared for either the wastewater or nonwastewater form of a regulated hazardous constituent. Commenters were opposed to this, stating that it would be arbitrary to add a standard to a waste code where before there was none without supporting data. The Agency again agrees. Therefore, EPA is not taking final action at this time.

D. Prohibition of Hazardous Waste as Fill Material

EPA proposed to prohibit use of hazardous waste as fill material. 60 FR at 11732. Because issues raised in the proposal are related to those in a number of other pending rulemakings, including the Hazardous Waste Identification Rule, and the proposed rule relating to land-based uses of hazardous waste K061 (59 FR 67256 (Dec. 29, 1994)), EPA is not taking final action on the proposal at this time.

E. Point of Generation

The Agency discussed possible changes that could be made to the "point of generation"—or point at which LDR requirements attach to a hazardous waste (see 60 FR 11717, March 2, 1995). The Agency is still considering the options discussed in the proposal and potentially other options not discussed. The Agency will reopen the point of generation issue for further comment, and is intending to finalize an option in a future rulemaking.

F. Prohibition on Using Iron Filings to Stabilize Spent Foundry Sand

The Agency proposed designating the practice of adding iron dust/filings to spent foundry sand as impermissible dilution (60 FR 11731, March 2, 1995). The Agency is gathering data on the stability of the chemical bond formed between the iron and lead in the spent foundry sand. After the Agency analyzes these data, as well as further studies the public comments on this issue, it may take final action on the proposal.

III. End-of-Pipe Equivalence: Treatment Standards for Clean Water Act (CWA) and CWA-Equivalent Wastewater Treatment Systems

A. Types of Facilities to Which Treatment Standards Apply

As explained above, the D.C. Circuit established a standard of so-called end-of-pipe equivalence, allowing CWA treatment systems with surface impoundments to dilute characteristic wastes before land disposal in those impoundments without violating LDR requirements, provided the treatment system destroys, immobilizes, or removes an equivalent amount of hazardous constituent as if the characteristic waste were treated separately to meet RCRA standards. EPA

[1] EPA also notes that it is not reopening the issue of open burning/open detonation of reactive wastes. In 1986, EPA determined that such activities are not a form of land disposal. See 51 FR at 40580 (Nov. 7, 1986).

is establishing in this rule the treatment standards that must be satisfied in order to demonstrate that equivalent treatment is occurring.

These treatment standards apply to the following types of facilities: (1) facilities treating formerly characteristic wastes in surface impoundments whose ultimate discharge is subject to regulation under either section 402 or 307 of the CWA. The rule thus encompasses both direct dischargers (facilities discharging to navigable waters) and indirect dischargers (those discharging to POTWs); and, (2) permitted and unpermitted zero dischargers engaging in treatment that is equivalent to that of the CWA-regulated facilities (see 40 CFR 268.37(a) defining CWA-equivalent treatment), including facilities treating formerly characteristic wastes in tanks prior to release on the land for such purposes as irrigation or land treatment.

EPA also wishes to make clear the types of wastewater management situations to which these standards do not apply. First, the standards do not apply to facilities that discharge to navigable waters or POTWs and that manage decharacterized wastes in treatment systems without surface impoundments. Consequently, if a facility generates a characteristic waste, dilutes it so that it no longer exhibits a characteristic, and then treats the waste in tanks before ultimate discharge to a navigable water or a POTW, this rule does not apply. There is no land disposal of a prohibited waste occurring and consequently no RCRA requirement that the characteristic waste be pretreated. Applicable CWA limitations and standards would, of course, continue to apply (as would a one-time recordkeeping requirement under RCRA (see § 268.9).

Second, the standards do not apply in situations where RCRA hazardous waste (subtitle C) impoundments are used. The statute already sets out the requirements for subtitle C impoundments receiving wastes which may not yet have met a treatment standard. RCRA section 3005(j)(11). These requirements are not altered by the Third Third opinion. 976 F. 2d at 24 n. 10.

Finally, in response to comment, EPA has determined that the end-of-pipe treatment standards should not apply to stormwater impoundments. Stormwater impoundments are used by treatment facilities to catch stormwater during rain events, because their biological treatment systems cannot adequately handle such sudden, large volumes of water. At some treatment facilities, however, because they have a combined wastewater system, stormwater impoundments also receive process water containing decharacterized wastes.

The Agency agrees with commenters who stated that stormwater impoundments are necessary to maintain the efficacy of biological treatment units. In addition, such impoundments are empty most of the time because they are designed for emergency rain events. In the Third Third opinion, the court focused on wastewater treatment surface impoundments. It seems likely that stormwater impoundments were outside the court's consideration. Furthermore, imposing treatment standards on such impoundments could require treatment of the stormwater/decharacterized waste before it could permissibly go into the impoundment, not a practical alternative during a major storm event. Alternatively, imposing LDR treatment standards might require the facility to replace its combined wastewater system, which would be a major disruption to most of these facilities and hardly seems justified when stormwater impoundments are used only on an emergency basis. These are the very types of disruptions that the integration clause in RCRA 1006(b) is intended to prevent. Consequently, EPA is indicating that today's rule does not apply to stormwater impoundments.

B. End-of-Pipe Treatment Standards

The treatment standards that EPA is promulgating for characteristic wastewaters are found in the table of LDR treatment standards at 40 CFR 268.40 and 268.48. As explained more fully in the following section, these treatment standards generally adopt the limitations or standards that apply to the facility's discharge as the RCRA treatment standards. The reason EPA is taking this approach is that the CWA industry category or case-by-case industrial POTW limitations and standards represent specific determinations of what Best Available Treatment (BAT) technology is capable of achieving for that plant's wastewater, or, in the case of Water Quality Criteria-based limitations, what an appropriate limit is based on BAT treatment plus risk-based considerations. In the event a hazardous constituent present in the wastewater at point of generation of the original characteristic hazardous waste is not already regulated pursuant to a CWA limitation or standard, the RCRA Universal Treatment Standard for that constituent would apply.

These treatment standards may be met at the CWA point of compliance, typically the point the wastewater is discharged to a navigable water or a POTW. For CWA-equivalent facilities, the treatment standards must be met at the point where the wastewater is sprayed onto the land in irrigation (or similar) activities, or injected into a non-Class I injection well. This accords with the equivalence standard established by the court: "hazardous constituents are [to be] removed from the waste before it enters the environment." 976 F. 2d at 24; see also id. at 23 and n. 8. Most commenters likewise agreed with an end-of-pipe measuring point. Indeed, requiring full treatment before ultimate discharge could destroy the very accommodation with the CWA regime that the court thought critical. See 60 FR at 13677 (Aug. 22, 1995).

However, EPA also agrees with commenters that there is no reason to impede individual facilities from choosing an alternative point of compliance (i.e. other than end-of-pipe) provided the facility can demonstrate that the prohibited waste (the decharacterized portion of the combined effluent) has been treated by means other than dilution to remove an equivalent mass of hazardous constituents. This is specifically consistent with the principle announced in the Administration's report on "Reinventing Environmental Regulation" to "provid[e] maximum flexibility in the means of achieving our environmental goals, but requiring accountability for the results". Consequently, the Agency is allowing a facility to designate any compliance point downstream of treatment that destroys, immobilizes, or removes hazardous constituents as the point for demonstrating that equivalent treatment occurs. This point can, but need not be, the NPDES or pretreatment point of compliance. Examples of alternative points of compliance that would be permissible (assuming the treatment standard is being satisfied) would be prior to initial placement in an impoundment, or after treatment in an impoundment but before final discharge.

The Agency also agrees with commenters that there can be alternative points of compliance for different underlying hazardous constituents. Again, the reason is to allow flexibility of compliance alternatives when a facility can demonstrate that it is destroying, immobilizing, or removing an equivalent mass of hazardous constituents through wastewater treatment as would be achieved by segregating the characteristic wastestream for separate RCRA treatment. Thus, if a facility generated a

characteristic waste containing metal and organic underlying hazardous constituents and the waste was treated sequentially by means not involving impermissible dilution, there could be different compliance points for the metal and organic hazardous constituents.

EPA notes, however, that if alternative points of compliance are utilized, enforcement would normally be pursuant to RCRA, not the Clean Water Act. This is by necessity, since CWA permits (or, for indirect dischargers, control mechanisms) would not normally apply to effluent quality before final discharge. See further discussion on means of implementing today's standards below in this preamble.

C. Why CWA Limitations and Standards Can Also Be RCRA Treatment Standards

As explained above, when a hazardous constituent is already subject to a CWA industry category or Water Quality Criteria-based limitation, or a case-by-case industrial POTW limitation or standard, the Agency believes (and the final rule provides) that the CWA limitations and standards satisfy RCRA section 3004(m) requirements and consequently become the RCRA treatment standard for purposes of demonstrating equivalent treatment. EPA believes that this is an obvious and effective means of integrating CWA and RCRA requirements, in accord with the court's objective. 976 F. 2d at 22; RCRA section 1006(b). This approach was generally supported by commenters as a reasonable means of satisfying the court's mandate and the underlying policy of integration of the two statutes.

Several commenters, however, argued that CWA limitations and standards could not be equivalent to RCRA because such standards can reflect (among other things) "the cost of achieving such effluent reduction", and "the age of equipment and facilities involved". CWA section 304(b)(2)(B) (factors to be considered in determining Best Available Technology). EPA disagrees. While it is true that technology-based standards developed to address toxic pollutants from various industrial categories are developed after consideration of levels that can be achieved through application of the best available technology economically achievable, the CWA limitations and standards nevertheless represent the best evaluation of what technically advanced wastewater treatment is capable of achieving for a particular industry's (or, in some cases, particular plant's) wastewater. Although there is no requirement that a particular treatment technology must be used to achieve the facility's limits, it is expected that plants utilizing BAT will have treated their effluent so that there are substantial reductions in concentration and mass of hazardous constituents. As the Agency has stated many times, EPA believes that section 3004(m) is satisfied by treatment that substantially destroys, immobilizes, and removes the hazardous constituents that are present in the waste, notwithstanding that minor amounts of hazardous constituents remain after treatment. Put another way, the statute does not require that every conceivable threat posed by land disposal be eliminated by treatment. 55 FR at 6641 and n. 1 (Feb. 26, 1990); 56 FR at 12355 (March 25, 1991); 57 FR 37259 (August 18, 1992); 55 FR at 22596 (June 1, 1990). In fact, the legislative history states explicitly that the treatment standards are not to be technology forcing, but rather are to utilize the available effective treatment technologies. 130 Cong. Rec. S. 1978 (daily ed. July 25, 1984) (statement of Sen. Chaffee); 56 FR at 12355. That is precisely what EPA has done here.

Second, with specific regard to use of CWA limitations, EPA notes that virtually all of the current LDR treatment standards for wastewaters are already drawn from CWA limitations and standards. See 55 FR at 22601 (wastewater standards for U and P wastes and F039, which essentially became the universal treatment standards, were transferred from treatment data from CWA programs), and see also the Final BDAT Background Document for U and P Wastes and Multi-Source Leachate (F039) Volume C (documenting that most of existing RCRA wastewater standards were transferred from CWA limitations and standards). Moreover, the technologies that are often used to achieve CWA limitations and standards are, in most cases, the same technologies upon which the RCRA Universal Treatment Standards are based. As EPA has already stated, "because most treatment technologies cannot be so precisely calibrated as to achieve, for example, 3.5 ppm rather than 2.7 ppm, the likely result is that the same amount of treatment will occur." 59 FR at 47989 (Sept. 19, 1994). Since frequently the same technologies are used to treat wastewaters, EPA expects the degree of treatment to be comparable.

EPA also emphasizes that RCRA section 1006(b) requires EPA (among other things) to integrate provisions of RCRA and the CWA when implementing RCRA, and to avoid duplication to the maximum extent possible with CWA requirements. The Agency feels it is accomplishing this requirement by allowing a constituent-specific, CWA treatment standard to satisfy RCRA 3004(m). The Agency reiterates that a technology-based CWA limitation or standard for a hazardous constituent satisfies RCRA because such a limitation or standard directly reflects the capability of BAT technologies to treat a specific industry's or facility's wastewater, whereas the RCRA UTS for wastewaters were developed by transferring performance data from various industries, and thus EPA need not make that same transfer when industry-specific (or plant-specific) wastewater treatment data is available.

A water-quality based limitation would also satisfy RCRA section 3004(m). A CWA water quality-based limitation must be at least as stringent as the limitations required to implement an existing technology-based standard. (See CWA section 301(b)(1)(c).) Even where there is no existing BAT limitation for a toxic or nonconventional pollutant, a permit writer must determine whether BAT would be more stringent than the applicable water quality-based limitation, and again, must apply the more stringent of the two potential limitations. (40 CFR 125.3(c)(2).)

If a facility has received a Fundamentally Different Factors (FDF) variance, the limitations established by that variance also satisfy RCRA requirements. Limitations established by the FDF variance process are technology-based standards reflecting facility-specific circumstances, and hence can appropriately be viewed as BDAT as well, just as with RCRA treatability variance standards. See 51 FR at 40605 (Nov. 7, 1986).

EPA also believes that there are adequate constraints in the CWA implementing rules to prevent these end-of-pipe standards from being achieved by means of simple dilution. First, many of the effluent limitation guidelines and standards regulate the mass of pollutants discharged, and thus directly regulate not only the concentration of pollutant discharged but the degree of wastewater flow as well. Even where rules are concentration-based, NPDES permit writers can set requirements which preclude excessive water use, and EPA has so instructed permit writers. (See 58 FR 66151, December 17, 1993, encouraging permit writers to estimate reasonable rate of flow per facility and factor that flow limit into the permit.) These permit conditions can take the form of best management practices,

explicit mass limitations, and conditions on internal waste streams. 40 CFR 122.44(k); 122.45 (f), (g) and (h).

Indirect dischargers are also subject to specific CWA dilution rules in both the general pretreatment rules and the Combined Wastestream Formula (as well as through many of the categorical standards). 40 CFR 403.6 (d) and (e). Many of the guidelines and standards also preclude addition of stormwater runoff to process wastewater to preclude achieving treatment requirements by means of dilution. The Agency is accordingly of the view that end-of-pipe equivalence would be achieved by treatment that removes, immobilizes, or destroys hazardous constituents, and therefore we have determined the treatment satisfies the requirements of RCRA section 3004(m).

EPA emphasizes, however, that it is not addressing the issue of whether cross-media transfers of hazardous constituents become so extensive as to invalidate the wastewater treatment function of a land-based unit. This is the subject of the pending Phase IV proposed rule (60 FR at 43654 (August 22, 1995)), and will be addressed as part of that proceeding.

D. When CWA Limitations and Standards Become the RCRA Standards

Today's rule establishes the following principles:

1. Direct Dischargers

A CWA limitation becomes the RCRA treatment standard as well in the following situations: (a) where there is a categorical BAT or NSPS limitation for the underlying hazardous constituent; (b) where there is a facility-specific limitation for the underlying hazardous constituent pursuant to 40 CFR 125.3 (c)(2) and (d)(3); (c) where there is a Water Quality-based limitation established pursuant to 40 CFR 122.44(d); or (d) where the facility has received a Fundamentally Different Factors variance establishing an alternative limitation pursuant to 40 CFR Part 125 subpart D.

2. Indirect Dischargers

A Clean Water Act pretreatment standard becomes the RCRA treatment standard as well in the following circumstances: (a) where there is a categorical PSES or PSNS for a particular hazardous constituent; and, (b) where POTWs have developed local limits, in addition to categorical standards, to prevent pass through and interference and apply them to indirect dischargers.

EPA proposed that if pretreatment standards reflected a finding that a particular hazardous constituent will not pass through to navigable waters because of efficacious treatment by the POTW, that standard would also satisfy RCRA. The reason is that there will be full-scale treatment of the hazardous constituent before its final release into the environment. Such full-scale treatment satisfies the court's equivalency test. 60 FR at 11711. EPA is adopting this provision in today's rule for these reasons.

The Agency also proposed that pretreatment standards based on interference with POTW operations would not be considered to satisfy RCRA. *Id.* EPA is adopting this position in the final rule. The reason is that interference findings reflect the effect the pollutant may have on overall POTW treatment, not necessarily treatment of the particular constituent. Because the relationship of an interference-based standard with treatment of a particular hazardous constituent is tenuous, EPA does not believe that such a standard can be said to be equivalent to RCRA treatment. Several commenters disagreed with this reasoning, but provided no empirical information calling the Agency's conclusion into question. EPA is consequently adopting this provision as proposed.

3. Zero Dischargers Performing CWA-Equivalent Treatment

In the May 24, 1993 emergency rule, EPA established the principle that zero discharge facilities performing CWA-equivalent treatment on decharacterized wastewaters would be subject to the rules for direct dischargers, and thus would retain the ability to use surface impoundments as part of the treatment process for decharacterized wastes provided equivalent treatment occurs. 58 FR at 29863–29864. The reason is that these facilities can be performing wastewater treatment identical to, or more stringent than, that required of direct dischargers, and thus the same policy of integrating RCRA and the CWA should apply to such facilities. *Id.*

EPA is consequently also applying today's rules on equivalency to zero dischargers performing CWA-equivalent treatment, including tank-based systems that ultimately land dispose rather than discharge treated effluent. "CWA-equivalent treatment" is defined in 268.37(a) to mean "biological treatment for organics, alkaline chlorination or ferrous sulfate precipitation/sedimentation for metals, reduction of hexavalent chromium, or other treatment technology that can be demonstrated to perform equally or greater than these technologies".

E. Implementation

1. Where Permits Contain Standards for Hazardous Constituents

If a direct discharger subject to the rule (i.e. generating a characteristic waste containing underlying hazardous constituents at concentrations exceeding the treatment standard at the point the waste is generated, and is treating those decharacterized wastes in surface impoundments) has an NPDES permit containing a limitation for that hazardous constituent based on BAT, NSPS, BPJ, or a water quality standard, then there are no independent RCRA requirements beyond documenting in the facility's records that this is the facility's mode of compliance.

EPA notes further that if the Agency (or authorized State), as part of the CWA decisionmaking process for setting the limitations, affirmatively decided that such hazardous constituents need not be regulated due to low toxicity, low bioavailability or other environmental factors and that fact is reflected in the rulemaking record, permit or permit record, no additional RCRA standards would apply. If the rulemaking or permit and permit record do not contain such a finding, the permitting authority should reexamine the NPDES permit upon reissuance in order to clarify whether such hazardous constituents need not be regulated. During the time between the date this rule becomes effective and the date the permit is reissued, however, the RCRA Universal Treatment Standards for those constituents must be met.

In addition, if EPA (or an authorized State) affirmatively decided either in the rulemaking or in the permitting process that a particular hazardous constituent is controlled through controls on an indicator pollutant, then again, no additional RCRA standards would apply. For this purpose, however, the Agency would only accept as a valid indicator situations where a toxic pollutant parameter is used as an indicator for another toxic pollutant. The Agency does not believe that use of conventional pollutants (such as BOD or COD) as indicators for toxic constituents guarantees the type of equivalent treatment of hazardous constituents, which EPA feels is necessary to implement the equivalence requirement. 976 F. 2d at 23 n. 8.[2]

[2] In making this statement, EPA is of course not calling into question the use of conventional pollutants as valid indicators to satisfy Clean Water Act requirements. The language in the text is directed solely at implementing the court's mandate for purposes of RCRA.

2. Where Permits Do Not Contain a Limitation for a Hazardous Constituent

If the CWA permit either does not contain a limitation for the pollutant or does not regulate the pollutant through an indicator, or in cases when this rule becomes effective before the reissuance of a facility's permit, the RCRA universal treatment standards would apply as they do for any other RCRA hazardous wastestream. In this situation, the owner or operator of a facility has several choices. The owner/operator could do nothing, in which case the hazardous constituent would be subject to the UTS. These standards would be implemented by rule, and thus would not be embodied in a CWA permit. Enforcement consequently would be solely under RCRA. As noted earlier, the point of compliance could, but need not be, at the end-of-pipe point of discharge.

In the alternative, a facility could seek amendment of its NPDES permit pursuant to § 122.62(a)(3), requesting that the applicable permitting authority modify the permit at reissuance, or sooner, to add limits for the underlying hazardous constituents reflecting BAT for that pollutant at the facility.[3] Assuming proper design and operation of the wastewater treatment technology, a permit writer in such a case could modify the permit to add a limitation for the pollutant based on Best Professional Judgement reflecting actual BAT treatment (40 CFR 125.3(c)). Modification requests would be processed pursuant to the procedures found at § 124.5. The modified permit limitation would be a CWA requirement and enforceable solely under that statute, but would be deemed by the Agency to satisfy RCRA 3004(m), so that meeting UTS per se would not be required.

A final alternative is for the facility to seek a RCRA treatability variance. EPA is amending the grounds for granting such a variance to include situations where a facility is treating decharacterized wastes by treatment identified as BAT or NSPS (New Source Performance Standards), the technology is designed and operated properly, but is not achieving the UTS (see § 268.44(a)).

3. Indirect Dischargers

The same alternatives exist for indirect dischargers. If an underlying hazardous constituent is regulated by a categorical PSES, PSNS, or by a local limit in a control mechanism reflecting PSES or PSNS—level treatment, then that standard satisfies both RCRA and the CWA. In addition, if there is no pretreatment standard (i.e., PSES/PSNS) for an underlying hazardous constituent, because the Agency determined that there was no pass through, then section 3004(m) is satisfied and the RCRA standard for that underlying hazardous constituents does not apply.

If an underlying hazardous constituent is not regulated nationally by a PSES or PSNS, or by a local limit, it becomes subject to the UTS for that constituent. That UTS would be enforced as a RCRA standard. However, in cases where an underlying hazardous constituent is not already subject to categorical PSES, categorical PSNS, or to a local limit in a control mechanism reflecting PSES or PSNS-level treatment, water quality, or pass through, the control mechanism between the indirect discharger and the applicable control authority would have to be modified in order to avoid application of the UTS by rule. EPA is amending § 403.5(c)(1) and § 403.5(c)(2) of the pretreatment rules to specifically authorize control authorities to make such determinations.

The final option is for a facility to obtain a RCRA treatability variance. Thus, the amendment to the treatability variance rules also applies to indirect dischargers properly operating technology identified as the basis for their PSES or their PSNS standard.

4. Zero Dischargers Performing CWA-Equivalent Treatment

The implementation options for zero dischargers performing CWA-equivalent treatment are similar. Some of these facilities may have CWA permits authorizing specified levels of discharge. If these permit limitations apply to underlying hazardous constituents present in the RCRA-prohibited portion of the discharge, the CWA permit limit satisfies RCRA as well. The facility also could seek to amend the CWA permit to add limitations for the hazardous constituent. Enforcement then would be exclusively pursuant to the CWA.

If the zero discharger has no CWA permit, or the permit does not contain limitations for underlying hazardous constituents and is not amended to do so, then the facility would have to meet the RCRA UTS or an alternative standard established by treatability variance either at the point of discharge[4] or at an earlier point of its choosing (assuming, of course, that a valid demonstration of bona fide treatment can be made at an earlier point).

5. Implementation When CWA Standards and Limitations Will Not Be the Exclusive Standard

If the facility treats to UTS and does not modify its CWA permit or control mechanism to include a CWA standard/limitation for an underlying hazardous constituent, EPA is finalizing minimal recordkeeping requirements, under RCRA authority. Generators can use their knowledge to identify the underlying hazardous constituents reasonably expected to be present at the point of generation of the lCRT wastes which are not covered by a CWA limitation or standard and hence must be treated to meet UTS (assuming no permit modification). EPA is requiring that this information be kept on-site in files at the facility. The facility will then monitor compliance with the UTS standard for each of these constituents at the point of ultimate discharge or alternative compliance point, on a quarterly basis, and results of this monitoring must be kept in the facility's on-site files. An exceedence of the RCRA UTS standard must be documented in the facility's on site records.

These same requirements apply to facilities without NPDES permits documenting compliance as zero dischargers with CWA-equivalent treatment who are affected by this rule. The absence of a permit necessitates some alternative means of documenting compliance, and the scheme outlined above seems to be the least burdensome scheme which would still provide a reasonable means of enforcing this rule.

6. RCRA Controls Over Point Source Discharges and Domestic Sewage

Both RCRA and the implementing regulations provide that point source discharges and domestic sewage (including mixtures of domestic sewage with other wastes) are not subject to

[3] EPA is interpreting the language in § 122.62(a)(2) to indicate that the D.C. Circuit's opinion in the Third Third case is new information warranting reopening a permit.

[4] The point of compliance for a zero discharger choosing the point of discharge as a compliance point would be at the point of ultimate disposal. For those zero dischargers who discharge to a dry river bed (common in the western U.S.) not considered a "water of the U.S." under the CWA, the point of compliance would be at the end-of-pipe. For those zero dischargers who spray irrigate, or otherwise place the wastewaters on the land after treatment in the surface impoundment, the point of compliance would be at the point just prior to the land placement. Furthermore, zero dischargers treating wastewaters in a tank system followed by spray irrigation or another form of land placement are also subject to this rule. For those zero dischargers who use evaporation ponds, the point of compliance is before the wastewater enters the surface impoundment, as this is the ultimate disposal point.

RCRA subtitle C jurisdiction. RCRA section 1004(27) and § 261.4(a) (1) and (2). Some commenters questioned whether by allowing CWA limitations and standards to satisfy the RCRA treatment standard requirement, EPA were somehow imposing RCRA controls where it lacks authority to do so.

This is not the case. EPA is creating here a mechanism for evaluating whether RCRA-equivalent treatment has occurred for purposes of determining whether surface impoundments (i.e. RCRA land disposal units) can permissibly be used as part of that treatment process. 976 F. 2d at 22–24. The effect, for RCRA purposes, of failing to satisfy the limitations or standards is that the facility has engaged in illegal land disposal by virtue of not performing equivalent treatment. Id. Thus, the effect of the rule is on activity upstream of the discharge point, and these activities are within RCRA's jurisdictional purview.

7. Applicability to the Pulp and Paper Industry

The concerns about integration of CWA and RCRA standards are particularly acute with respect to the pulp and paper industry. EPA is at a critical stage in developing comprehensive multi-media rules for this industry (to control both hazardous air emissions and wastewater discharges). These rules were proposed at 58 FR 66078 (Dec. 17, 1993) and are slated for promulgation by mid-1996. The rules should fundamentally affect (for the better) the types of wastewaters managed at pulp and paper facilities and the potential releases of hazardous constituents from such wastes. The Agency believes that it would be putting the cart before the horse, and would fail to properly integrating RCRA with the CWA (and potentially CAA in this case) by proceeding with implementation of the court's decision for this industry in advance of completion of this rulemaking. Cf. *Edison Electric Inst.* v. *EPA*, 2 F. 3d 438, 453 (D.C. Cir. 1993) noting when temporary deferrals of action to allow better integration of overlapping statutes is permissible. The Agency will revisit the question of how to implement the court's decision for the pulp and paper industry upon completion of the existing multi-media rulemaking.

IV. Treatment Standards for Class I Nonhazardous Injection Wells and Response to Comments

A. Introduction

Generally, Class I nonhazardous injection well owners/operators injecting decharacterized ICRT wastes do not substantially treat their waste beyond removing the characteristic by aggregating and diluting wastestreams, plus filtering of solids in order to facilitate injection. There are as many as 100 such nonhazardous facilities in addition to the approximately 54 hazardous facilities injecting ICRT wastes. As discussed in the Phase III proposed rule, EPA estimates that the average flow of a "typical" Class I nonhazardous well is 107,000 gallons/day. Typically, the volume of hazardous wastes comprises 25% or less of the aggregated injected wastestream.

In the Third rule, EPA proposed that characteristic wastes were not prohibited from injection into these deep wells provided they no longer exhibited a characteristic at the point they are injected.e. land disposed. 60 JR at 11704–11705. The D.C. Circuit rejected this portion of the rule, holding, in EPA's reading of the opinion, that the statutory requirements could not be satisfied absent treatment that addressed both short term and long term threats posed by land disposal of the waste, and hence that hazardous constituents in the waste had to be destroyed, removed or immobilized before injection, not merely diluted. 60 JR at 11706–11708. EPA is implementing that mandate in this rule. (However, EPA reiterates, as it did at proposal, that EPA is taking this action to implement the court's mandate, not because it is an environmental priority, or prudent use of the Agency's or the regulated community's resources. The Administration is in fact pursuing a legislative change which would restore EPA's original policy determination reflected in the 1990 Third rule.)

The effect of today's final rule is to prohibit the land disposal of characteristic waste streams at the point they are generated. If those wastes contain underlying hazardous constituents at levels exceeding the Universal Treatment Standards and (as explained further below) at levels and volumes greater than designated *de minims* amounts, those constituents would have to be destroyed, removed, or immobilized before the waste is injected. This could be accomplished either by segregating the characteristic portion of the injectate for treatment, or by treating the commingled injectate before disposal (i.e. before injection). The rule further provides that if a facility removes an equivalent mass of the hazardous constituent through source reduction, or waste treatment, that the treatment standard is satisfied. The final, alternative means of compliance is for the unit to have received a no-migration determination.

A number of commenters believed that aggregation or dilution of wastes to remove the hazardous characteristic of the waste stream prior to injection was sufficient and that the requirement to treat underlying constituents was legally unnecessary and onerous. EPA's reading of the Third Third opinion and section 3004(m) is that treatment that destroys, immobilizes, or removes hazardous constituents is required, and that this requirement is not satisfied merely by dilution. The statutory findings of the inherent uncertainty of land disposal of hazardous wastes, the propensity to bioaccumulate these same constituents, the statutory goals of waste minimization and proper waste management, plus the legislative history documenting Congressional intent not to permit treatment by dilution supports the Agency in rejecting these comments. 60 FR at 11706–708. Therefore, the Agency has decided not to allow Class I nonhazardous wells to dilute or aggregate their waste streams in order to fulfill, substitute, or avoid treatment levels or methods established in the LDRs. See the dilution prohibition added in § 148.3 of today's final rule.

Furthermore, the Agency, as proposed, is expanding the applicability of 40 CFR Part 148 to now require owners/operators of Class I nonhazardous wells to determine whether LDRs apply to their facilities.

Commenters likewise sharply questioned the Agency's determinations as to when land disposal prohibitions should attach, and state, correctly in the Agency's view, that the opinion did not compel a determination that prohibitions must attach at the initial point of waste generation or when underlying hazardous constituents are present at that point in concentrations exceeding the UTS. EPA is in fact pursuing alternatives on both of these fronts. The Agency proposed alternatives to the strictest point of generation approach, 60 FR at 11715–716, and expects to take final action on this proposal well before the effective date of the Phase III prohibitions for Class I non-hazardous UIC wells. The source reduction compliance option in this rule is a related means of dealing with this issue, since it can be conceptualized as allowing the requisite hazardous constituent reductions to be achieved by means other than downstream treatment notwithstanding presence of hazardous constituents above UTS at what is technically point of waste generation.

With regard to whether presence of hazardous constituents above UTS

would be the trigger level for the LDR prohibition, EPA has recently proposed risk-based hazardous constituent concentration levels which would implement the "minimize threat" requirement in section 3004(m), and would cap the technology-based treatment standards whenever the technology-based standards are lower (60 FR 66344, December 21, 1995). The *de minimis* feature of today's rule further addresses situations where EPA believes that prohibitions need not apply due to the low concentrations and volumes of hazardous constituents in the decharacterized portion of the injectate.

B. Compliance Options for Class I Nonhazardous Wells

In the proposed rule, the Agency indicated that facilities could segregate their hazardous wastes, and treat just that volume of the total waste stream to UTS levels in order to conform to the treatment requirement. A number of commenters maintained that the Agency oversimplified this approach and that such segregation was impractical from both a technical and economic standpoint. EPA acknowledges that many facilities may not practically be able to segregate streams. These facilities may utilize of other LDR compliance options as discussed below.

One option would be to apply for an exemption from treatment standards via the no-migration petition variance. EPA is promulgating a clarifying revision to 40 CFR 148.20 which allows facilities to seek a no-migration variance for their Class I nonhazardous wells, and has long indicated that this compliance option is available (see pp. 25–27, Supplemental Information Report prepared for the Notice of Data Availability, January 19, 1993, 58 FR 4972). If these facilities demonstrate to EPA that their formerly characteristic wastes (including any hazardous constituents) will not migrate out of the injection zone for 10,000 years, or no longer pose a threat to human health and the environment because the wastes are attenuated, transformed, or immobilized by natural processes, then they may continue to inject without further treatment.

A significant number of commenters responded to the proposed rule's discussion on the Agency's position on granting no-migration petitions. Comments included that petitions were a too costly option, took too much time to be processed, generic petitions for Class I non-hazardous wells should be granted, and existing no-migration exemptions should not require modification to include Phase III wastes. These comments, among others, will be discussed in detail in the "Response to Comments" background document for this rule, but basically many had partial merit.

First, although the Agency has estimated earlier that the average petition costs an operator $343,000, several individual petition reviews have far exceeded that amount. The Agency will examine the possibility of revising petition cost data in future LDR rules. Second, although a petition may take up to 3 years to process, the Agency (as noted above) indicated as early as 1992 (after the Third Third opinion) that it would begin review of Class I nonhazardous injection well no-migration petitions if submitted (58 FR 4972, January 19, 1993). Although time and resource restraints on the Agency are real, the Agency will continue to work with affected Class I operators in order to facilitate the no-migration petition review process. Third, although EPA has established a reasonable knowledge base on the review process for Class I hazardous facilities, it cannot automatically infer that all Class I nonhazardous facilities will successfully make a no-migration demonstration. Well site geology, hydrogeology, abandoned well area of review, and the specific characteristics of the injectate and receiving formation are site specific factors which, as a factual matter, must be evaluated individually in order to demonstrate "to a reasonable degree of certainty" (RCRA section 3004(g)(5)) that the no-migration standard has been satisfied. See Supplemental Report to Notice of Data Availability, January 19, 1993, at 25–26 9. It must be remembered that not every Class I injection well applying for the variance has been able to make the demonstration, and that one salutary effect of the no migration process has been to identify certain (albeit a limited number of) wells that would not be capable of adequately containing injectate over the long term.

EPA agrees completely with commenters, however, that wells that already have approved no migration exemptions are not affected by the Third Third opinion and thus are not affected by land disposal restrictions affecting decharacterized wastes. (In fact, EPA does not read the proposal to suggest otherwise.) Absent a change in the waste being injected, there is no reason to reopen no migration determinations that have already evaluated the entire injected waste stream. 57 FR at 31963 (July 20, 1992).

EPA is also promulgating additional means for Class I nonhazardous facilities to comply with the LDR requirements. Revisions to 40 CFR 148.1(c)(1) and 148.4 will allow Class I nonhazardous owners and operators to apply for a case-by-case extension of the capacity variance for up to one year (renewable for up to an additional year) in order to acquire or construct alternative treatment capacity. Based on experience, EPA believes that the availability of the case-by-case extension coupled with national capacity variance(s) should allow operators more than adequate time to acquire alternative treatment or complete the no-migration petition process. Two other options include the pollution prevention option and the de minimis volume exclusion.

C. Pollution Prevention Compliance Option

The final rule provides an alternative means of obtaining the reductions in mass loadings of hazardous constituents mandated by the Third Third opinion. Under this alternative, mass reductions can be achieved by removing hazardous constituents from any of the wastestreams that are going to be injected, and these reductions in mass loadings can be accomplished by means of source reduction (i.e. equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control), recycling, or conventional treatment. As an example, if a facility can make process changes that reduce the mass of cadmium by the same amount that would be removed if the prohibited wastestream was treated to satisfy UTS, the facility would satisfy LDR requirements. The facility could also remove cadmium from any of the streams (prohibited or non-prohibited) which are going to be injected, or could find a means of recycling some portion of the injectate to reduce injected mass loadings of cadmium. In all cases, the result would be that the mass loading of hazardous constituents into the injection unit would be reduced by the same amount as it would be reduced by treatment of the prohibited, characteristic portion of the injectate. 976 F. 2d at 23 n. 8; see also *Specialty Steel Inst.* v. *EPA*, 27 F. 3d 642, 649 (D.C. Cir. 1994) (treatment standards that result in lower volume of waste to be disposed—precisely what the alternative standard here can achieve—are a permissible means of complying with RCRA section 3004 (m)).

Commenters further requested that this alternative be available on a hazardous constituent by hazardous constituent basis. EPA agrees that this is

reasonable since it still results in the requisite reduction of hazardous constituent mass loading and provides desirable compliance flexibility. Of course, if the pollution prevention alternative is used partially, there must still be compliance by some alternative means for the remaining hazardous constituents subject to the prohibition.

The Agency is not, however, adopting any type of hazardous constituent trading provision as part of this rule. It first is not clear that such a provision would satisfy the equivalency test enunciated by the court. In addition, given the narrow time frame available to the Agency to develop this rule, the Agency lacks the time and resources to properly evaluate the ramifications of the idea in this proceeding.

As a means of implementing this alternative, EPA is adopting the method proposed. The mass/day reduction of a particular underlying hazardous constituents is to be calculated by comparing the injected baseline with the allowance. The injected baseline is determined by multiplying the volume/day of prohibited hazardous waste generated and subsequently injected times the concentration of hazardous constituents before the pollution prevention measure. The allowance is determined by multiplying the volume/day of a hazardous constituent generated/injected times the UTS for that constituent. The difference between the injected baseline and the allowance is the required mass/day reduction.

EPA proposed, and is adopting the requirement that after successful employment of a pollution prevention measure, the facility must demonstrate that the injected mass achieves the required mass/day reduction. Because the amount of an underlying hazardous constituent in the injectate is dependent upon the level of production, a correction factor for production is needed. In the example given in the proposal (60 FR 11714), the calculation for the injected baseline was corrected by a production variability factor based on volume. The Agency had solicited comment on whether there are production parameters other than volume (e.g., mass, square footage, etc.). One commenter gave a specific example where square footage would be a more appropriate parameter. Therefore, the Agency is promulgating today that any appropriate parameter may be used to calculate the production variability factor. Another commenter was concerned that in the example the baseline used after pollution prevention seemed to be based on the production rate, whereas the baseline before pollution prevention was not. The commenter misunderstood the purpose of the production variability factor. In the example the post-pollution prevention injectate was adjusted by the production variability factor; however, the example could have been reorganized such that the initial baseline was adjusted for production variability. It was not necessary to adjust both the pre- and post-pollution prevention baselines for production variabilty; in fact, doing so would cause the variability factor to cancel out.

Several commenters were concerned that there are other factors besides rate of production which could cause variability in the level of an underlying hazardous constituent. One commenter mentioned variations in operation of specific source unit operations such as distillation and/or stripping trains feeding the injection unit. Another commenter stated that since they do not actually produce anything, they have no production rates to use, and suggested basing production on man-hours worked or total water consumed by a facility. The Agency agrees with all these suggestions. The mass/day of an underlying hazardous constituent after pollution prevention is based on the flowrate multiplied by the concentration of the constituent, and must be less than or equal to the calculated mass/day allowance for that underlying hazardous constituent. Beyond this basic formula, the facility can adjust for any factors which would cause a variation in the concentration of the underlying hazardous constituent, provided the variation(s) are part of a normal operating procedure.

Under this approach, a facility would make a one-time change in operating practice. Because the mass loading reductions resulting from the practice are obtained from the time of the change forward, it obviously is not necessary (and neither practical or likely feasible) for the facility to make on-going (potentially daily) changes to qualify under the provision.

A number of commenters, although supporting the Agency's proposal, argued that it should apply to facilities that already have implemented source reduction or other pollution prevention practices before the effective date of the rule, not just those making the change prospectively (as EPA proposed). Their point is that facilities that have already implemented source reduction, and as a result may now have fewer opportunities to do so, should not be on a worse footing than facilities who have been laxer and thus now have a wider range of possible means of reduction. This argument certainly has equitable force. At the same time, however, there has to be some objectively defined baseline period for the rule to be enforceable, and for there to be some nexus between the pollution prevention measure and the reduced mass loadings in current injectate. Balancing these considerations, the Agency is establishing 1990 as the base year for establishing a baseline. This was the year EPA adopted (per Congressional schedule) the prohibitions for characteristic hazardous waste and (coincidentally) the year of the Pollution Prevention Act.

EPA is sensitive to other comments regarding the need for this alternative to be objectively verifiable. The Agency is therefore requiring that facilities must monitor the underlying hazardous constituent concentration and the volume of the prohibited hazardous waste stream (i.e. all characteristic streams subject to LDR treatment standard requirements that will be decharacterized before injection), both on the day before and the day after successful implementation of pollution prevention. Results of this monitoring must be reported to the EPA Region or authorized State on a one-time basis. The Agency had solicited comment on whether more than one day is needed for monitoring. Several commenters were concerned that certain pollution prevention methods would take several weeks, not one day, to show results. It should be noted that the Agency did not intend for the pollution prevention method to show results in one day. Results should be achieved by the effective date of the rule for the facility to be in compliance, and the pollution prevention method should have been employed no earlier than 1990. The facility must also include a description of the pollution prevention method used (including any recycling alternative). In addition, the facility will monitor and keep on-site records of the results on a quarterly basis (this time period is selected to match the quarterly monitoring already required under SDWA regulations at 40 CFR 146.13 (b)). If the facility changes its means of complying with this alternative, it must renotify the EPA Region or authorized State, and again document the basis for its compliance by monitoring.

D. De Minimis Volume Exemption

EPA is finalizing the *de minimis* exemption proposed. 60 FR at 11714–11715. The terms of the exemption are that if decharacterized wastewaters comprise no more than 1% of the total injectate, if the total volume of the characteristic streams do not exceed 10,000 gallons per day, and if underlying hazardous constituents are

present in the characteristic wastes at concentrations less than 10 times UTS at the point of generation, then the wastes are not prohibited from injection in a Class I non-hazardous deepwell (assuming the injectate is not hazardous at the point of injection). The Agency continues to believe that under these circumstances, the relatively small decharacterized hazardous waste streams would not appreciably alter the risks posed by the injection practice.

Generally, the proposed approach was well received. Some commenters stated, however, that the *de minimis* volume exemption, as proposed, would allow excessively large volumes of routinely generated characteristic wastes to go untreated to disposal in deep wells, while others believe that the specific quantifying parameters are overly restrictive. The Agency analyzed potential risks associated with concentrations of 5 contaminants detected in Class I facility waste streams at 10, 20, and 50 times UTS. (This analysis was conducted in conjunction with revising the Regulatory Impact Analysis For Underground Injected Wastes for this rule. See 60 FR 11715.) In brief, risk estimates for 4 geologic settings and 2 well malfunction scenarios were found to be below levels of regulatory concern at 10 and 20 times UTS. However, at 50 times UTS, risk estimates for cancer and hazard index were above regulatory concern for a waste stream containing carbon tetrachloride, assuming an abandoned borehole failure within 500 feet of the injection well. Taking into account the statutorily enumerated "long-term uncertainties associated with land disposal" (RCRA section 3004(d)(1)(A)), EPA believes the 10 × UTS level to be well within the zone of reasonable values it could select as *de minimis*. The one percent volumetric requirement is consistent with other longstanding *de minimis* exemptions for wastewater management systems in the subtitle C rules (see § 261.3(a)(2)(iv) (A) and (E)), and would normally cap the total volume of characteristic injectate at approximately 1100 gallons per day, given average Class I UIC non-hazardous injection rates.

At a rate of 1100 gallons per day, 10×UTS for carbon tetrachloride would mean a mass loading of approximately 165 mg of the constituents being injected each day. Mass loadings for the other hazardous constituents would similarly be modest. EPA again believes that these small mass loadings would have *de minimis* effect on the risk potential posed by the injection practice and consequently should be exempted from the prohibition.

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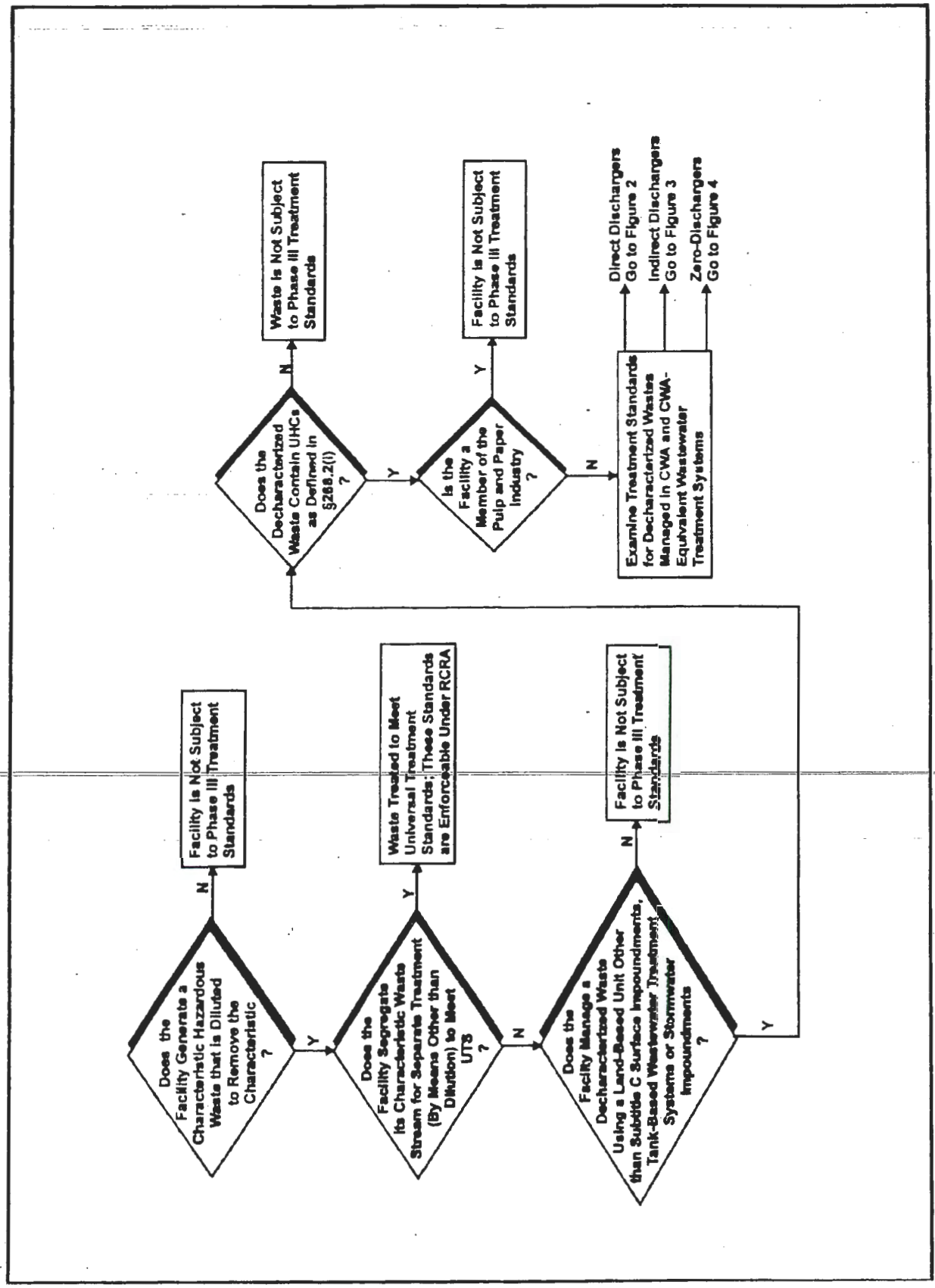

Figure 1. General Applicability Criteria for Treatment Standards for Clean Water Act (CWA) and CWA-Equivalent Wastewater Treatment Systems

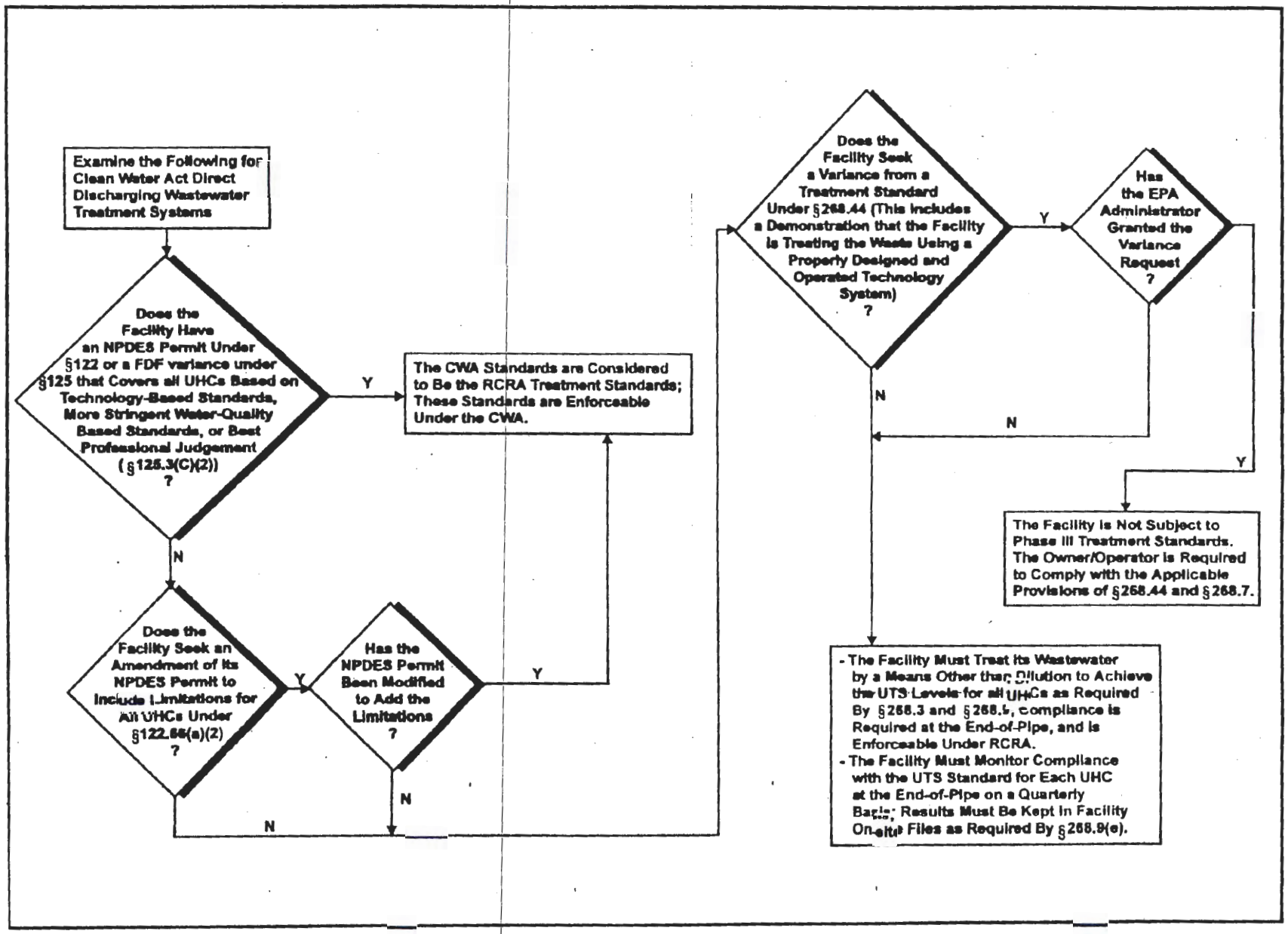

Figure 2. Applicability Criteria and Treatment Standards for Decharacterized Wastes Managed in Clean Water Act Direct Discharging Wastewater Treatment Systems

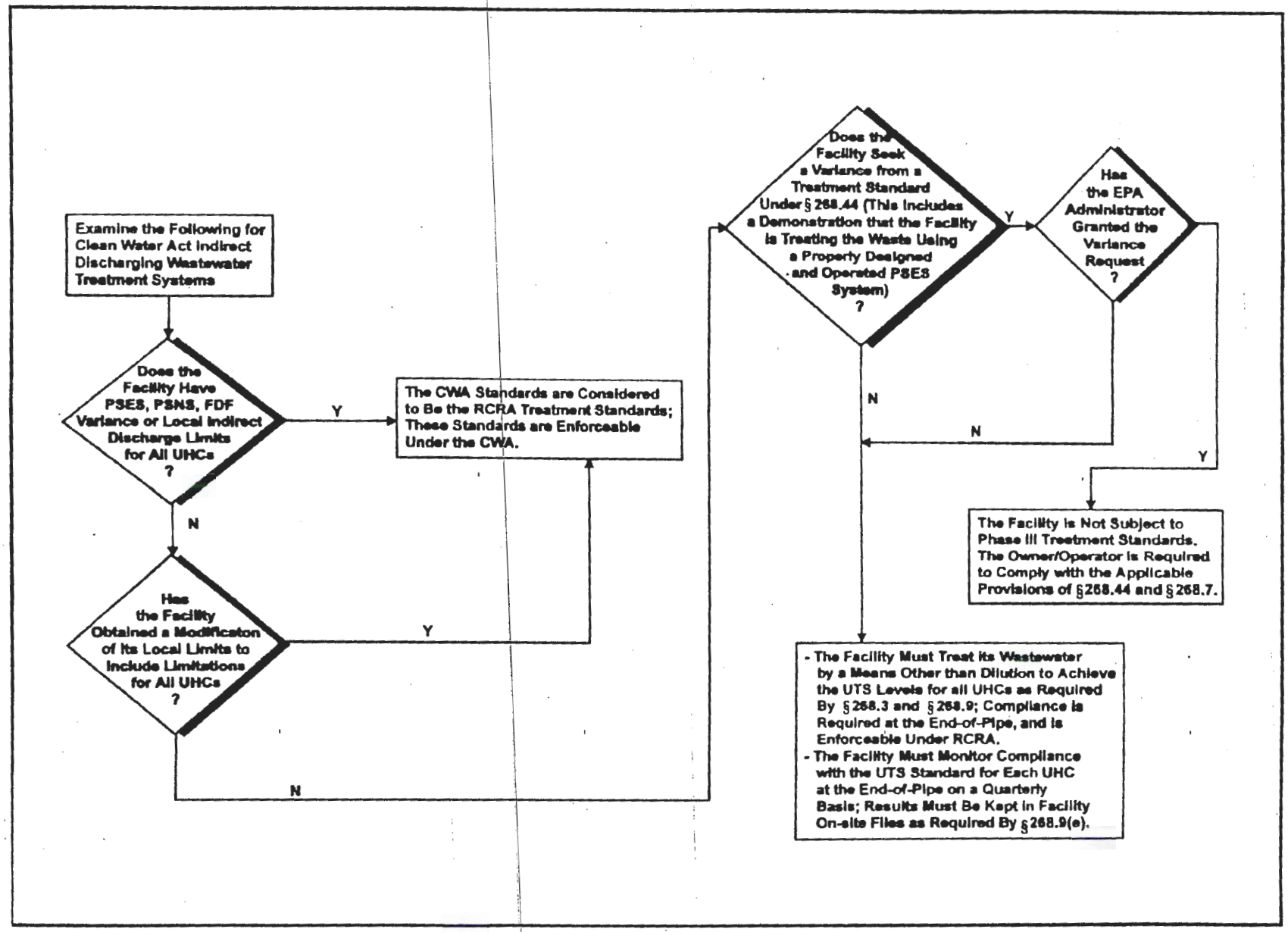

Figure 3. Applicability Criteria and Treatment Standards for Decharacterized Wastes Managed in Clean Water Act Indirect Discharging Wastewater Treatment Systems

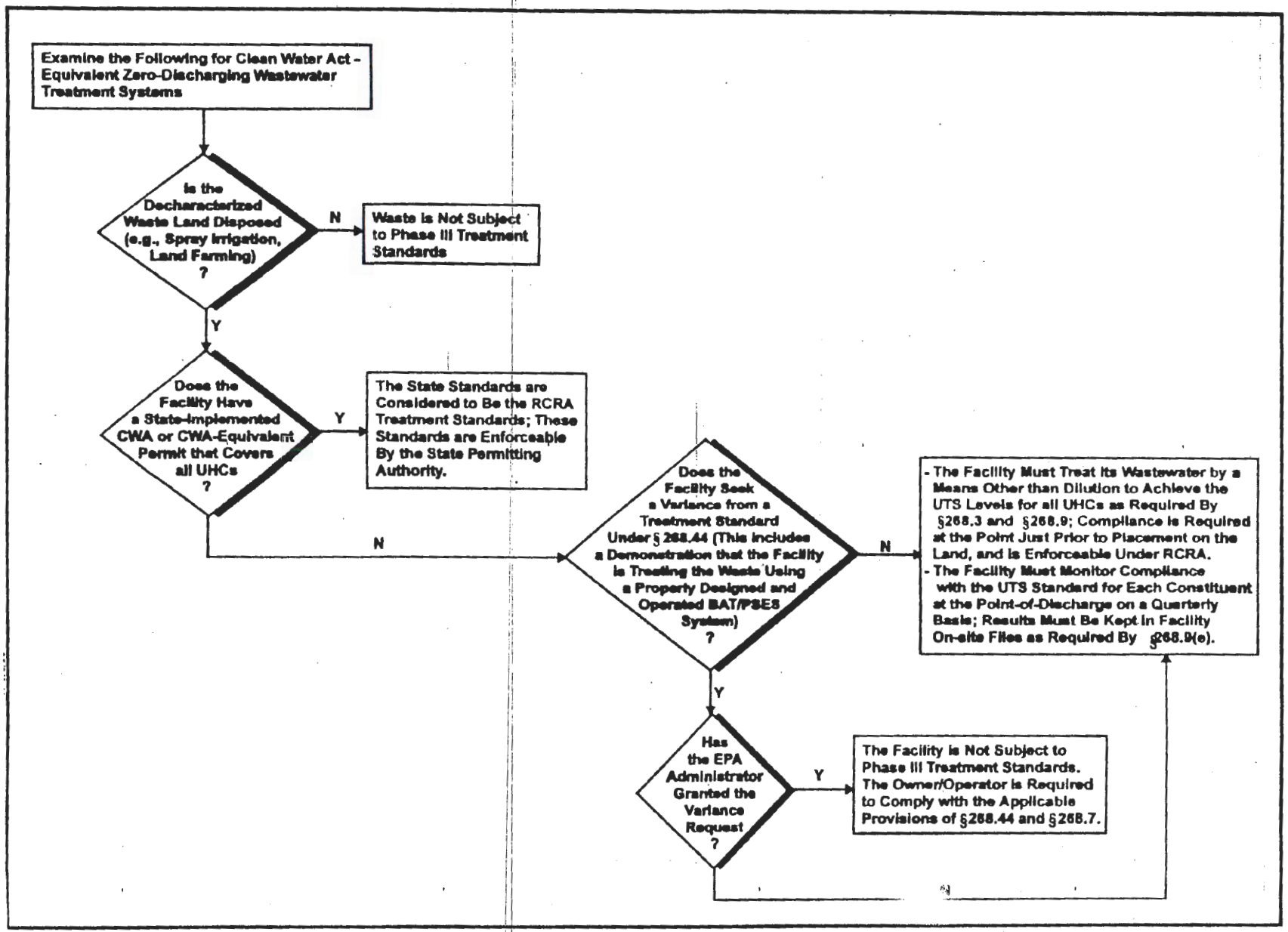

Figure 4. Applicability Criteria and Treatment Standards for Decharacterized Wastes Managed in Clean Water Act - Equivalent Zero-Discharging Wastewater Treatment Systems

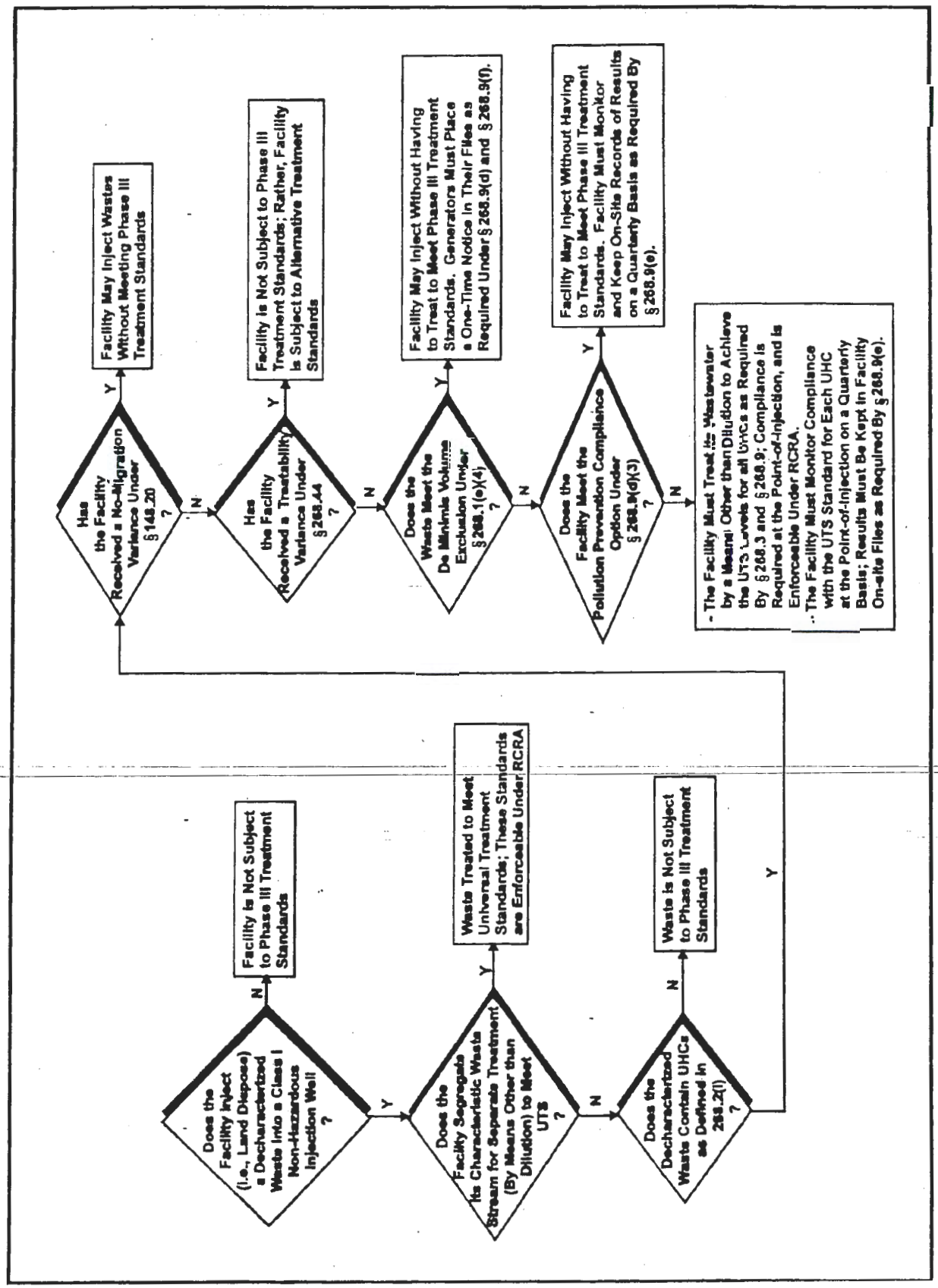

Figure 5. General Applicability Criteria and Treatment Standards for SDWA-Regulated Facilities Discharging Decharacterized Waste Into Class I Non-Hazardous Injection Wells

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V. Treatment Standards for Newly Listed Wastes

A. Carbamates

Hazardous Wastes From Specific Sources (K Waste Codes)

K156—Organic waste (including heavy ends, still bottoms, light ends, spent solvents, filtrates, and decantates) from the production of carbamates and carbamoyl oximes.
K157—Wastewaters (including scrubber waters, condenser waters, washwaters, and separation waters) from the production of carbamates and carbamoyl oximes.
K158—Bag house dust, and filter/separation solids from the production of carbamates and carbamoyl oximes.
K159—Organics from the treatment of thiocarbamate wastes.
K160—Solids (including filter wastes, separation solids, and spent catalysts) from the production of thiocarbamates and solids from the treatment of thiocarbamate wastes.
K161—Purification solids (including filtration, evaporation, and centrifugation solids), baghouse dust, and floor sweepings from the production of dithiocarbamate acids and their salts. (This listing does not include K125 or K126.)

Acute Hazardous Wastes (P Waste Codes)

P203 Aldicarb sulfone
P127 Carbofuran
P189 Carbosulfan
P202 m-Cumenyl methylcarbamate
P191 Dimetilan
P198 Formetanate hydrochloride
P197 Formparanate
P192 Isolan
P196 Manganese dimethyldithiocarbamate
P199 Methiocarb
P190 Metolcarb
P128 Mexacarbate
P194 Oxamyl
P204 Physostigmine
P188 Physostigmine salicylate
P201 Promecarb
P185 Tirpate
P205 Ziram

Toxic Hazardous Wastes

U394 A2213
U280 Barban
U278 Bendiocarb
U364 Bendiocarb phenol
U271 Benomyl
U400 Bis(pentamethylene)thiuram tetrasulfide
U392 Butylate
U279 Carbaryl
U372 Carbendazim
U367 Carbofuran phenol
U393 Copper dimethyldithiocarbamate
U386 Cycloate
U366 Dazomet
U395 Diethylene glycol, dicarbamate
U403 Disulfiram
U390 EPTC
U407 Ethyl Ziram
U396 Ferbam
U375 3-Iodo-2-propynyl n-butylcarbamate
U384 Metam Sodium
U365 Molinate
U391 Pebulate
U383 Potassium dimethyl dithiocarbamate
U378 Potassium n-hydroxymethyl-n-methyldithiocarbamate
U377 Potassium n-methyldithiocarbamate
U373 Propham
U411 Propoxur
U387 Prosulfocarb
U376 Selenium, tetrakis (dimethyldithiocarbamate)
U379 Sodium dibutyldithiocarbamate
U381 Sodium diethyldithiocarbamate
U382 Sodium dimethyldithiocarbamate
U277 Sulfallate
U402 Tetrabutylthiuram disulfide
U401 Tetramethylthiuram monosulfide
U410 Thiodicarb
U409 Thiophanate-methyl
U389 Triallate
U404 Triethylamine
U385 Vernolate

EPA is promulgating the treatment standards that were proposed for wastes from the carbamate industry specified above.

The preamble of the proposed rule described the basis for these treatment standards in greater detail (60 FR 11720). For background information on waste characterization data, data gathering efforts, and applicable technologies, see the Best Demonstrated Available Technology (BDAT) Background Document for Newly Listed or Identified Wastes from the Production of Carbamates.

The concentration-based treatment standards being promulgated today for carbamate wastewaters and nonwastewaters are at UTS levels for certain constituents, and at newly-established levels for other constituents that are today being added to the UTS list. The UTS standards have already been promulgated for 21 of the constituents of concern (16 organic constituents and 5 metals). The Agency is promulgating new UTS for 42 constituents associated with carbamate wastes. Forty of these constituents are chemicals produced by the carbamate industry which may be grouped into the following categories: carbamates and carbamate intermediates, carbamoyl oximes, thiocarbamates, and dithiocarbamates. Please refer to the Background Document for definitions of these chemical groups and the categorization of these 40 chemicals. The other 2 constituents for which new UTS are being promulgated (triethylamine, and o-phenylene diamine) are not carbamate products, but are hazardous constituents present at levels of regulatory concern in carbamate wastes.

One commenter requested clarification on the applicability of the carbamate treatment standards, stating that the summary section of the proposed treatment standards said that treatment standards were being proposed for certain hazardous wastes "including those from the production of carbamate pesticides", whereas the section of the rule that directly addressed carbamate wastes referred to carbamates without the pesticide limitation. EPA points out in response that the final listing rule which defined the new waste codes does not limit the definition to pesticides only. The treatment standards being promulgated apply to all wastes which fit the definitions of the waste codes established in the final listing rule.

One commenter stated that EPA exceeded its authority under RCRA section 3004 and violated the Administrative Procedure Act by preparing the proposed treatment standards and sending this rule to OMB well before the final listing had been promulgated. EPA points out that the proposed treatment standards were actually published after publication of the final listing rule. The proposed treatment standards were modified to conform with the changes that appeared in the final listing; thus, treatment standards were only proposed for those carbamate wastes whose listing had been promulgated in final form. Proposed standards for wastes whose listings were not finalized were eliminated from the proposed treatment standards rule. Given the statutory requirement described above (i.e., the requirement to finalize LDR treatment standards six months after the listing is finalized), Congress must have envisioned that the two rulemaking activities would occur in close proximity.

One commenter had several objections to the proposed standards for thiocarbamate wastes, stating that 1) nonwastewater standards should not have been based on detection limits compiled from sampling and analysis performed as part of the listing process

because the Agency made errors in the sampling and analysis; 2) that EPA has no data to support the assertion that the proposed UTS limits can be met by thermal destruction technologies and that the source of the detection limit used to develop the nonwastewater standard was not clearly identified; and, 3) that no document was found in the record to support the proposed wastewater limit of 0.003 mg/l for thiocarbamate constituents (A2213, Butylate, Cycloate, EPTC, Molinate, Pebulate, Prosulfocarb, Triallate, Vernolate), based on granular activated carbon absorption, giving the commenter no basis to evaluate the achievability of this treatment standard.

To respond, the nonwastewater limit for thiocarbamate wastes was actually based on a detection limit of 0.5 mg/kg by GC/NPD, identified in a general characterization report addressing the newly regulated constituents, rather than on the limit of 0.125 mg/kg by SW-846 8270B, identified in the sampling and analysis reports. The commenter has not yet provided any data to indicate that the proposed treatment standards for nonwastewaters cannot be met.

The Agency has decided to promulgate a treatment standard of 0.042 mg/l in wastewaters for the thiocarbamate constituents identified above. This standard is based on an analytical detection limit of 0.015 mg/l for Butylate, identified in an activated carbon isotherm test performed by the Office of Water to support development of effluent guideline limitations. The Agency had proposed a wastewater limit of 0.003 mg/l, based on data taken from the PEST (Pesticide Treatability Database) database containing treatability data for pesticides, prepared and maintained by RREL (Risk Reduction Engineering Laboratory) in Cincinnati, Ohio. However, upon review of the available data, the Agency has decided that the Office of Water data is more accurately representative of available wastewater treatment than the pilot-scale data from the PEST database, and has decided to change the final treatment standard accordingly.

EPA is today clarifying that the LDRs do not apply to waste streams which were specifically exempted from the definition of hazardous waste in the final listing rule for carbamates. These waste streams include sludges from the biological treatment of K156 and K157 and streams which satisfy the concentration-based exemption from the definition of K156 and K157 codified at § 261.3(a)(2)(iv)(G).

The promulgation of treatment standards for carbamate wastes has greatly expanded the number of constituents covered by the Universal Treatment Standards at Section 268.48. The Agency wishes to clarify that only a very limited number of generators or treaters, such as manufacturers or users of carbamate products, are expected to have these new constituents present in their wastes. Therefore, affected parties may rely on process knowledge to determine if it is necessary to analyze for these constituents.

The commenter has not yet provided any data to indicate that the proposed treatment standards cannot be met. The commenter did indicate an intention to submit biological treatment data for thiocarbamate wastes. This commenter was instructed to submit this data quickly (by the end of August) to allow the Agency time to give consideration to this data prior to issuing the final rule.

B. Spent Aluminum Potliners (K088)

K088—Spent potliners from primary aluminum reduction.

EPA proposed to establish treatment standards for K088 expressed as numerical concentration limits (see 60 FR 11722) for the following constituents: acenapthene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)-anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, cyanide and fluoride. Today, EPA is promulgating these treatment standards as proposed. The nonwastewater treatment standards for cyanide, and the organic constituents, are based on a total composition concentration analysis. The nonwastewater treatment standards for fluoride, and the metal constituents, are based on analysis using the TCLP. All wastewater treatment standards are based on total composition concentration analysis.

1. Comments Received on the "Inherently Waste-Like" Determination

The majority of the comments received on the issue of declaring K088 "inherently waste-like" opposed such a determination. As discussed in the proposal, declaring K088 inherently waste-like would require that all K088 treaters/recyclers obtain a RCRA Part B permit regardless of whether the K088 is recycled, reused, used as a feedstock in a process, or conventionally treated. The commenters asserted that this designation would discourage recycling/reuse and development of innovative technologies, and would be overly burdensome for many of the small companies pursuing recycling technologies.

The Agency was persuaded by commenters that a determination of "inherently waste-like" is unnecessary at this time. Instead, any determination of whether a particular K088 processing technology is a type of excluded recycling activity would need to be made on a case-by-case basis by EPA Regions or authorized states. EPA was persuaded by commenters that allowing individual flexibility in making such a determination is desirable here.

Criteria that are typically relevant in making any such determinations are set out (among other places) at 50 FR at 638 (Jan. 4, 1985); 53 FR at 522 (Jan. 8, 1988); and 56 FR at 7159 and 7185 (Feb. 21, 1991). EPA also repeats the concerns voiced in the proposed rule that spent aluminum potliners contain high concentrations of cyanides and polyaromatic hydrocarbons which may be conventionally treated by thermal recovery processes, and that these and other hazardous constituents are present in the potliners in concentrations well exceeding those found in the raw materials or products for which the spent potliners would be substituting. 60 FR at 11723 n. 11. Other concerns are that the thermal recovery processes appear to pose the same potential risks of harmful air emissions as processing hazardous wastes in industrial furnaces, that the residues of recovery processes may not be adequately treated, and that storage of spent potliners can (and indeed has) posed significant risk. Id. at 11723-24. EPA also repeats that many of these units may already be subject to the rules for industrial furnaces burning hazardous wastes, since those rules apply to industrial furnaces that burn hazardous wastes for energy recovery, material recovery, or destruction. Id. at 11722 and n. 10; 56 FR at 7142; 50 FR at 49171-49174 (Nov. 29, 1985); 40 CFR 266.100.

A consequence of EPA's decision to allow for individualized determinations is that it is also unnecessary (and indeed, not factually justified) to make a general determination of "substantial confusion" pursuant to 270.10(e)(2) which could establish an opportunity for interim status eligibility. That finding would have been premised on the generic inherently waste-like determination (see 60 FR at 11723), which the Agency is not making. EPA is also not pursuing in this proceeding the idea of toxic air emission standards under section 112(d)(1) of the Clean Air Act for these sources. These sources could be subject to these standards if they are major (or, in some cases, area)

sources under section 112, but that determination need not be part of the present rulemaking.

2. Comments Received on Regulated Constituents

EPA requested comment on regulating the phthalates: bis (2-ethylhexyl) phthalate, di-n-butyl phthalate and di-n-octyl phthalate. These constituents have seemingly been detected in the untreated potliner and the treated residue; however, EPA believes that their presence may simply be due to lab contamination. Commenters overwhelmingly requested that these phthalates not be regulated. The Agency agrees and is not including any phthalates in the list of regulated constituents for K088.

A number of commenters requested that benzo(a)pyrene be used as a surrogate for analyzing organics. The commenters were concerned that analytical costs for other PAHs would be excessive. EPA is not convinced that analyzing benzo(a)pyrene would be sufficient for determining proper treatment of all organics. The concentration of one constituent does not always reflect the concentration of similar constituents in a waste. Surrogate analyses assume that all PAHs are present at similar concentrations which may or may not be true. Because of the variability of concentrations found in K088 wastes, benzo(a)pyrene may not be present while other PAHs may be present. Analyzing only for benzo(a)pyrene or any other potential surrogate does not ensure the treatment to UTS concentrations of other PAHs. In addition, the Agency believes that since all of the PAHs are analyzed by a single method the cost increase for additional PAHs should not be significant. Therefore, the Agency does not believe the organic constituents monitored in K088 wastes should be limited to a surrogate indicator. EPA is allowing, however, flexibility in the waste analysis plans developed by the companies with their permit writers to analyze only for those constituents expected to be present in the generated K088.

The Agency proposed to regulate fluoride in K088. While fluoride is not a "hazardous constituent", i.e., listed in Appendix VIII of part 261, it is present in very high concentrations in K088 and is capable of causing substantial harm in the form of groundwater degradation, adverse ecological effects and potential adverse human health effects. The Agency's view thus is that, unless fluoride in this waste is treated, the legal standard in section 3004(m) would not be satisfied. That is, treatment would not "substantially diminish the toxicity of the waste * * * so that short-term and long-term threats to human health and the environment are minimized." RCRA section 3004(m)(1). In addition, as discussed in the proposed rule, EPA reads the language in section 3004 (d)(1), (e)(1), and (g)(5) to require that land disposal may still be prohibited after treatment of hazardous constituents if the waste might still pose substantial hazards due to presence of other constituents or properties. 56 FR at 41168 (August 19, 1991); *NRDC* v. *EPA*, 907 F. 2d 1146, 1171-72 (D.C. Cir. 1990) (dissenting opinion). These hazards could be posed due to lack of treatment of other constituents in the waste, in this case, fluoride.

The Agency requested comment on whether fluoride should be added to Appendix VIII, as well. The overwhelming response of the commenters is that fluoride should not be added to Appendix VIII. The Agency agrees that fluoride does not pose the same risks in other wastes because it does not occur in such high concentrations. Furthermore, adding fluoride to Appendix VIII has associated potential analytical costs which would be unwarranted. Therefore, even though the Agency is regulating fluoride in K088, it is not adding it to Appendix VIII at this time.

3. Comments Received on Data

Several comments were received regarding EPA's use of data on K088. One comment in particular suggested that EPA ignored relevant data gathered by the Aluminum Association. The Agency did not ignore these data. They were submitted after the proposal and are currently in the docket for this final rule. The Agency has reviewed these data and found that they do not support any changes to the proposed treatment standards that are being finalized in this rule. This issue is discussed in greater detail in the Response to Comments background document.

4. Comments Received on Technical Basis for BDAT

There were a number of comments submitted on the technical basis for the numerical treatment standards. As described in the preamble to the proposed rule, most of the treatment standards are taken from the universal treatment standards (UTS) (59 FR 47988, September 19, 1994) which were developed for each constituent by evaluating all existing Agency data from various technologies. The exception to the UTS for K088 constituents is the fluoride treatment standard, which was taken from the Reynolds delisting petition. While K088 is a unique waste, available data indicate that these UTS levels can be routinely achieved.

There seemed to be some confusion in that some commenters believed that EPA was proposing a required technology for the treatment of K088. This is not the case. The longstanding position of the Agency is when numerical treatment levels are established under the LDR program, any treatment technology (other than impermissible dilution) can be used to achieve those levels.

Additional K088 comments along with EPA's responses are provided in the Response to Comments Background Document located in the docket for this rule.

VI. Improvements to the Existing Land Disposal Restrictions Program

A. Completion of Universal Treatment Standards

1. Addition of Constituents to Table 268.48

As discussed in the section on carbamate wastes, EPA is today adding 42 new constituents to the table of universal treatment standards (Table 268.48), for which treatment standards are being promulgated today.

2. Wastewater Standard for 1,4-Dioxane

EPA proposed on March 2, 1995 (60 FR 11702), to establish a wastewater treatment standard for 1,4-dioxane. 1,4-Dioxane was the only UTS constituent for which EPA had promulgated a nonwastewater treatment standard but not a wastewater standard. At that time, the Agency proposed a wastewater UTS for 1,4-dioxane of 0.22 mg/l. This proposed standard was based on the maximum daily limit for 1,4-dioxane that had been developed as part of the proposed effluent guidelines for the pharmaceutical industry (60 FR 21592, May 2, 1995). This standard was based on a transfer of distillation performance data from methanol to 1,4-dioxane.

Today, the Agency is promulgating a revised treatment standard for wastewater forms of 1,4-dioxane based on 5 data points. This data was submitted by one of the commenters and represents actual treatment of wastewaters containing 1,4-dioxane. The Agency prefers to use actual treatment data in lieu of a data transfer whenever possible. These data show that wastewaters containing between 2265-7365 mg/l of 1,4-dioxane can be treated by distillation to levels between 3-7 mg/l, representing a 99.9% removal rate for the dioxane. As a result of this data submittal, the Agency is today promulgating a UTS of 12.0 mg/l for 1,4-

dioxane wastewaters based on the performance of distillation. The standard was calculated following the standard methodology employed by EPA in developing all BDAT treatment standards.

Comments received on the wastewater treatment standard for 1,4-dioxane focused on three major points: (1) The unavailability, at the time of proposal, of data from the effluent guidelines proposed rule for the pharmaceutical industry, from which the proposed standard had been derived; (2) the inappropriateness of transferring distillation data from methanol to 1,4-dioxane (based on the effluent guidelines data); and (3) analytical difficulties inherent in analyzing for 1,4 dioxane in wastewater.

In the proposed rule, EPA referenced effluent guidelines data that would be made available to support the proposed wastewater treatment standard for 1,4-dioxane (60 FR 11727, footnote 13). Although the Agency believed that these data would be available for public inspection shortly after signature of the proposed rule, this was not the case. The data were available one day following the close of the comment period on the Phase III proposed rule. As a result, many comments were received that criticized the Agency for not providing appropriate pubic review of data that was used to develop a treatment standard.

In light of the delayed release of the effluent guidelines data, the Agency decided to accept comments on these data and the proposed 1,4-dioxane treatment standard for 30 additional days. In addition, the Agency provided notice of this extension to all commenters of the proposed rule. Several comments were received in response to this memo. Most of the commenters who had raised issue with the proposed standard commented on the EPA memo.

In response to the second concern raised by commenters, the Agency has received actual wastewater treatment data on 1,4-dioxane and as such has developed a UTS based on that data. As stated earlier, the Agency prefers to use actual constituency data from available treatment technology in lieu of transferred data from other constituents whenever feasible.

Finally, several commenters raised concerns regarding the analytical difficulties of reliably detecting and quantifying 1,4-dioxane in wastewater. CMA, in particular, stated that any UTS under 20 mg/l for 1,4-dioxane would be impractical. Other commenters noted extreme variability and difficulty in testing for the presence of 1,4-dioxane in wastewaters. While the analytical results provided by one of the commenters did show some irregularities, a comprehensive analytical protocol was not provided by the any of the comments which would be needed to fully assess their concerns regarding 1,4-dioxane. As such, the Agency believes that there should be no difficulty in analyzing for 1,4-dioxane in wastewater. Analysis can be accomplished by either direct injection into a GCFID (SW 846, Method 8015B) or a more sensitive analysis involving the injection of an azeotropic distillate preparation into a GCFID (SW-846, Method 5031).

3. Revision to the Acetonitrile Standard

EPA proposed to raise the UTS for the nonwastewater form of acetonitrile from 1.8 mg/kg to 38 mg/kg. Commenters generally supported this revision for the reasons given in the proposed rule. Therefore the Agency is promulgating this revised treatment standard in this rule for the reasons stated at 60 FR 11729.

Related to this, EPA also proposed revoking the special wastewater/nonwastewater definition for acrylonitrile wastes (K011/13/14), recognizing that these nonwastewaters could consist of over 90% water, and that wastewater treatment is an appropriate means of treating these wastes. Commenters agreed with this, and the Agency is finalizing this today.

B. Aggressive Biological Treatment as BDAT for Petroleum Refinery Wastes

EPA had solicited comment on whether to specify aggressive biological treatment (ABT) as the treatment standard for decharacterized petroleum refining wastewaters. The Agency is not establishing such a treatment standard in this final rule, but is instead promulgating a reduction in the frequency of monitoring required for those facilities using ABT to treat their wastes. The reasons for this are discussed below.

This issue was raised by the American Petroleum Institute (API), which had submitted data to the Agency on ten of its facilities that used aggressive biological treatment. Along with the data, API requested that EPA specify aggressive biological treatment as the treatment standard for their wastes. Such a standard, which would operate in lieu of UTS, would, in API's view, provide adequate treatment and could reduce their monitoring burden. In a similar vein, CMA commented that EPA should specify an optional treatment method (biological treatment) as an alternative to meeting UTS for underlying hazardous constituents reasonably expected to be present in characteristic wastes.

The Environmental Technology Council (ETC) opposed setting ABT as a new technology-specific treatment standard. They argued that biological treatment only partially destroys underlying hazardous constituents. They also felt that reducing the monitoring burden is inadequate justification for creating a new technology-specific standard.

As discussed in the preamble to the proposed rule (60 FR at 11719), biotreatment systems vary in performance both in general and as to specific constituents; the Agency is therefore reluctant to designate ABT as BDAT based on data from only ten facilities. The main reason given by both API and CMA for having a treatment method as the treatment standard was the elimination of the compliance monitoring burden. Although we agree with ETC that reducing monitoring burden is not an adequate justification for creating a new technology-specific treatment standard, EPA is certainly willing to consider more efficient means of ensuring compliance with LDR requirements.

Therefore, EPA is not designating ABT as BDAT, but is, however, requiring that decharacterized wastes affected by today's rule, which are managed in a wastewater treatment system involving ABT, must be monitored annually to ensure compliance with the treatment standards for underlying hazardous constituents. Other decharacterized wastes affected by today's rule must be monitored quarterly. EPA has been reviewing the paperwork burden posed by the LDR program; this was discussed in the supplemental notice to the LDR Phase IV proposed rule (61 FR 2338, January 25, 1996). As part of this paperwork burden reduction effort, the Agency is considering reducing the monitoring burden for all facilities complying with LDRs. The Agency considers reducing the monitoring burden for facilities treating wastewater with ABT to be a positive step towards this goal, and therefore believes it is justified. Reductions of this type for other types of treatment will be explored in future rulemakings.

C. Dilution Prohibition

Under the existing LDR dilution prohibition (40 CFR 268.3), burning inorganic metal-bearing hazardous wastes can be a form of impermissible dilution. On May 27, 1994, the Assistant Administrator for the Office of Solid Waste and Emergency Response issued

a Statement of Policy which clarified this point (59 FR 27546–27547). Today the Agency is codifying and quantifying these principles.

As discussed in the proposed rule, impermissible dilution may occur when wastes not amenable to treatment by a certain method (i.e., treated very ineffectively by that treatment method) are nevertheless 'treated' by that method (55 FR 22666, June 1, 1990; 52 FR at 25778–25779, July 8, 1987). Today's rule provides a general distinction between "adequate treatment" and potential violations of the dilution prohibition.

1. Inorganic Metal-Bearing Wastes

The Agency has evaluated the hazardous wastes and has determined that 43 of the RCRA listed wastes (as set forth in 40 CFR part 261) typically appear to be inorganic hazardous wastes that do not contain organics, or contain only insignificant amounts of organics, and are not regulated for organics. BDAT for these inorganic, metal-bearing listed wastes is metal recovery or stabilization. Thus, impermissible dilution may result when these wastes are combusted. When an inorganic metal-bearing hazardous waste with insignificant concentrations of organics is placed in a combustion unit, legitimate treatment for purposes of LDR ordinarily is not occurring. No treatment of the inorganic component occurs during combustion, and therefore, metals are not destroyed, removed, or immobilized. Since there are no significant concentrations of organic compounds in inorganic metal-bearing hazardous wastes, it cannot be maintained that the waste is being properly or effectively treated via combustion (i.e., thermally treated or otherwise destroyed, removed, or immobilized). For this reason, combustion of inorganic wastes is not a "metho[d] of treatment * * * which substantially diminish[es] the toxicity of the waste or substantially reduce[s] the likelihood of migration of hazardous constituents from the waste * * *" (RCRA § 3004(m)) and so is not a permissible method of treatment under that provision.

In terms of the dilution prohibition, if combustion is allowed as a method to achieve a treatment standard for these wastes, metals in these wastes will be dispersed to the ambient air and will be diluted by being mixed in with combustion ash from other waste streams. Adequate treatment (stabilization or metal recovery to meet LDR treatment standards) has not been performed and dilution has occurred. It is also inappropriate to regard eventual stabilizing of such combustion ash as providing adequate treatment for purposes of the LDRs. Simply meeting the numerical BDAT standards for the ash fails to account for metals in the original waste stream that were emitted to the air and for reductions achieved by dilution with other materials in the ash. (In most cases, of course, the metal-bearing wastes will have been mixed with other wastes before combustion, which mixing itself could be viewed as impermissible dilution).

These inorganic, metal-bearing hazardous wastes should be—and are usually—treated by metal recovery or stabilization technologies. These technologies remove hazardous constituents through recovery in products, or through immobilization, and are therefore permissible BDAT treatment methods.

There are eight characteristic metal wastes; however, only wastes that exhibit the TC as measured by both the TCLP and the EP for D004–D011 are presently prohibited (see 55 FR 22660–22662, June 1, 1990). EPA recently proposed prohibition and treatment standards for wastes identified as hazardous solely because they exhibit the TC (60 FR at 43682, August, 22, 1995). Characteristic wastes, of course, cannot be generically characterized as easily as listed wastes because they can be generated from many different types of processes. For example, although some characteristic metal wastes do not contain organics or cyanide or contain only insignificant amounts, others may have organics or cyanide present which justify combustion, such as a used oil exhibiting the TC characteristic for a metal. Thus, it is difficult to say which D004–D011 wastes would be impermissibly diluted when combusted, beyond stating that as a general matter, impermissible dilution would occur if the D004–D011 waste does not have significant organic or cyanide content but is nevertheless combusted.

An "inorganic metal-bearing waste" is one for which EPA has established treatment standards for metal hazardous constituents, and which does not otherwise contain significant organic or cyanide content. The table being promulgated in 40 CFR part 268, Appendix XI is the list of waste codes for which EPA regulates only metals that are affected by this rule.

2. Inorganic Metal-Bearing Wastes Not Prohibited Under the LDR Dilution Prohibition

Combustion of the following inorganic metal-bearing wastes is not prohibited under the LDR dilution prohibition: (1) wastes that, at the point of generation, or after any bona fide treatment such as cyanide destruction prior to combustion, contain hazardous organic constituents or cyanide at levels exceeding the constituent-specific treatment standard for UTS; (2) organic, debris-like materials (e.g., wood, paper, plastic, or cloth) contaminated with an inorganic metal-bearing hazardous waste; (3) wastes that, at point of generation, have reasonable heating value such as greater than or equal to 5000 Btu/lb (see 48 FR 11157, March 16, 1983); (4) wastes co-generated with wastes that specify combustion as a required method of treatment; (5) wastes, including soil, subject to Federal and/or State requirements necessitating reduction of organics (including biological agents); and (6) wastes with greater than 1% Total Organic Carbon (TOC).

Several commenters want EPA to add additional criteria. One commenter recommended adding a seventh criterion, i.e., combustion that results in a significant reduction in volume. Several commenters recommended adding a seventh criterion to allow combustion of lab packs. The Agency is not persuaded that a seventh criterion is necessary. It has determined that volume reduction is not a sufficient reason to allow the combustion of inorganic metal-bearing wastes because metals are neither destroyed nor immobilized, and it is possible that a significant amount of metal is being transferred to another media. As for lab packs, in the Phase II final rule (59 FR 47982, September 19, 1994), the Agency specifically addressed lab pack issues when it revised 268 Appendix IV to specify those wastes that are prohibited from inclusion in lab packs destined for combustion. Today's dilution prohibition does not supersede the streamlined treatment standards promulgated in the Phase II final rule. Therefore, metal-bearing inorganic wastes may be included in a lab pack unless it is prohibited under the list of wastes in 268 Appendix IV.

3. Cyanide-Bearing Wastes

A commenter questioned why EPA allows the presence of cyanide to justify combustion when there are adequate alternative treatment methods for that waste constituent. This approach was adopted because cyanide is destroyed—i.e., effectively treated and not diluted—by combustion. Existing LDR rules, in many cases, identify combustion as an appropriate BDAT for destruction of cyanide-bearing wastes. See, e.g., treatment standards for F009, F010, and F011. The LDR Phase III proposal solicited comments on whether the

cyanide criterion should be dropped. Several commenters strongly supported the continued use of combustion as a treatment method for cyanide-bearing wastes, stating that combustion is the most efficient and effective method for treating cyanide wastes. One commenter, ETC, supported dropping the cyanide criterion because of the existence of alternative non-combustion technologies to treat inorganic cyanide-bearing wastes without dispersing metals. The Agency disagrees; combustion, when properly conducted, can effectively destroy all the cyanide in a waste. In the Agency's view, this indicates that cyanide wastes which are treated by combustion are not being diluted impermissibly. This issue of whether metals are being dispersed would be addressed through substantive controls on the combustion unit.

4. Table of Inorganic Metal Bearing Wastes

The table being promulgated in 40 CFR part 268, Appendix XI today indicates the list of waste codes for which EPA regulates only metals and/or cyanides that would be affected by this proposed rule. Except for P122, this list is identical to the list originally published in the aforementioned Policy Statement on this subject. The Agency is removing P122 (Zinc Phosphide greater than 10%) from the list of restricted inorganic metal-bearing wastes, because the Agency has previously promulgated a treatment standard of INCIN for the nonwastewater forms of this waste. See 40 CFR 268.40. The policy memo was in error on this point. EPA wishes to clarify that this dilution prohibition is limited to the 51 waste codes in this table. In addition, if an Appendix IX waste meets any of the six criteria discussed above, it would be permissible to combust the waste despite the fact that it is an Appendix IX waste.

D. Expansion of Treatment Options That Will Meet the LDR Treatment Standard "CMBST"

EPA is modifying the treatment standard expressed as INCIN, which specifies hazardous waste incineration, to CMBST, which allows combustion in incinerators, boilers and industrial furnaces. EPA also solicited comment on whether the Catalytic Extraction Process, for which Molten Metal Technology received a determination of equivalent treatment under § 268.42(b), should also be allowed for all wastes which have a treatment standard of CMBST, and whether there are other technologies which are equivalent to CMBST. Commenters supported the inclusion of the Catalytic Extraction Process (CEP), and since the Agency has determined that (properly operated) it performs in a manner equivalent to other combustion technologies, is adding it to the CMBST standard. Molten Metal Technology commented that the CEP is not in fact a combustion technology, and the Agency has attempted to reflect this in the definition. One commenter, Exide Corporation, requested that their plasma arc process for the recovery of lead also be added to the definition of CMBST. The Exide plasma arc process is in fact an industrial furnace under § 260.10, and is therefore already considered part of the definition of CMBST.

EPA also notes that the new CMBST standard requires that wastes be thermally treated in units that either are subject to subtitle C standards, or, in cases where non-hazardous but prohibited wastes are being thermally treated, in accordance with applicable technical operating requirements. This situation could arise, for example, if a decharacterized waste were then being thermally treated. Such a waste need not be managed in a hazardous waste combustion unit. The regulatory language makes clear that non-hazardous waste combustion units can be utilized. In fact, the predecessor to the CMBST standard—INCIN—allowed nonhazardous incinerators to be an eligible type of unit because the INCIN standard allowed burning in units subject to applicable emissions standards, which standards did not necessarily have to include subtitle C standards (59 FR 48002, Sept. 19, 1994, and 60 FR 242, June 3, 1995). This language was omitted inadvertently from the CMBST standard, and is being restored in today's rule.

E. Clean Up of 40 CFR Part 268

EPA is finalizing changes to the LDR program to achieve the goal of simplified regulations.

1. Section 268.8

Because treatment standards for all scheduled wastes were promulgated in the Third Third rule in 1990, the § 268.8 "soft hammer" requirements are no longer necessary. Therefore, § 268.8 is removed from part 268.

2. Sections 268.10–268.12

The purpose of Subpart B of 268 was to set out a schedule for hazardous wastes by the date when treatment standards were to be established. Deadlines in all three of these sections were met on time, and the wastes are subject to treatment standards. Therefore, these three sections are no longer necessary, and are removed.

3. Section 268.2(f)

With the promulgation of UTS in the LDR Phase II final rule (59 FR 47982, September 19, 1994), distinctions in the definitions of wastewaters are unnecessary. The Agency is therefore removing paragraphs (1)–(3) from § 268.2(f).

4. Corrections to Proposed Rule Language

A number of commenters pointed out properly that EPA had proposed an amendment to § 268.9 of the rules which would have the effect of subjecting all listed wastes which also exhibit a characteristic of hazardous waste to evaluate whether the waste contains underlying hazardous constituents not covered by the treatment standard for the listed waste, and if so, to treat for them. See 60 FR at 11741. EPA agrees with the commenters that this provision is unnecessary and is not adopting it. (In fact, the Agency did not intend any far-reaching change in proposing the revised language.) The provision is unnecessary because EPA already evaluated which hazardous constituents are present in listed wastes at the time of developing the treatment standards (any of the Background Documents supporting the treatment standards indicates the sampling done, and that the sampling encompassed the whole range of hazardous constituents potentially present). There is no need to duplicate this effort. Consequently, the Agency is not amending § 268.9(b).

Other commenters pointed out that the proposed changes to the de mimmis exemption in § 268.1(e)(4)(i) (see 60 FR 11740) inadvertently omitted the language which states that de minimis losses are not prohibited. That language has been put back into the final rule language.

VII. Capacity Determinations

A. Introduction

This section summarizes the results of the capacity analysis for the wastes covered by this rule. For background information on data sources, methodology, and a summary of each analysis, see the Background Document for Capacity Analysis for Land Disposal Restrictions, Phase III—Decharacterized Wastewaters, Carbamate Wastes, and Spent Potliners, found in the docket for today's rule. For EPA's responses to capacity-related comments, see the Response to Capacity-Related Comments Received on the Phase III

Land Disposal Restrictions Rulemaking, also found in the docket for today's rule.

In general, EPA's capacity analysis methodologies focus on the amount of waste to be restricted from land disposal that is currently managed in land-based units and that will require alternative treatment as a result of the LDRs. The quantity of wastes that are not managed in land-based units (e.g., wastewaters managed only in RCRA exempt tanks, with direct discharge to a POTW) is not included in the quantities requiring alternative treatment as a result of the LDRs. Also, wastes that do not require alternative treatment (e.g., those that are currently treated using an appropriate treatment technology) are not included in these quantity estimates.

EPA's decisions on whether to grant a national capacity variance are based on the availability of alternative treatment or recovery technologies. Consequently, the methodology focuses on deriving estimates of the quantities of waste that will require either commercial treatment or the construction of new on-site treatment systems as a result of the LDRs—quantities of waste that will be treated adequately either on site in existing systems or off site by facilities owned by the same company as the generator (i.e., captive facilities) are omitted from the required capacity estimates.

B. Capacity Analysis Results Summary

For the decharacterized ICR and TC wastes managed in CWA, CWA-equivalent, and Class I injection well systems, EPA estimates that between 85 and 500 million tons per year (estimated at end-of-pipe) will be affected as a result of today's rule. EPA believes that many affected facilities need time to build treatment capacity for these wastes, as wastewater volumes generally make off-site treatment impractical. Thus, EPA has determined that sufficient alternative treatment capacity is not available, and today is granting a two-year national capacity variance for decharacterized wastewaters.

Commenters to the rule generally supported EPA's decision to grant a national capacity variance for decharacterized wastes managed in CWA, CWA-equivalent, and Class I injection well systems. Numerous other comments were received on issues such as those associated with the definition of point of generation for ICR and TC wastewaters and the applicability of today's rule to wastewater management units other than surface impoundments, such as stormwater impoundments, sumps, sewers, and trenches. The Response to Capacity-Related Comments Received on the Phase III Land Disposal Restrictions Rulemaking background document provides a detailed discussion of the capacity-related comments on decharacterized wastewaters and EPA's response to them.

To assess the quantity of D003 wastes that could be affected by the rule other than those wastes managed in CWA and CWA-equivalent systems, EPA extracted information from the 1993 Biennial Reporting System (BRS) on the generation and management of D003 wastes. According to the BRS, approximately 2.2 million tons of D003 wastewaters are currently deepwell injected, 650 tons of D003 nonwastewaters are managed through land application, and 17,600 tons of D003 nonwastewaters are managed in "other" disposal units (not specified in the BRS). These wastes may require additional treatment in order to meet the LDRs. In addition, some D003 waste that may be affected by the rule may not be reported in the BRS, because these wastes may not be considered hazardous by the generator once they have been decharacterized. Although EPA believes that in general there is adequate treatment capacity for these wastes, such capacity may not be immediately available. Therefore, EPA is granting a 90-day capacity variance for D003 wastes that are impacted by the rule and are not managed in CWA and CWA-equivalent systems in order to allow facilities time to determine whether their wastes are affected by this rule, and identify and locate alternative treatment capacity if necessary.

EPA estimates that approximately 105,000—130,000 tons of newly listed wastes included in today's rule will require alternative treatment. In particular, approximately 4,500 tons of carbamate wastes (K156–K161, P127, P128, P185, P188–P192, P194, P196–P199, P201–P205, U271, U277–U280, U364–U367, U372, U373, U375–U379, U381–U387, U389–U396, U400–U404, U407, U409–U411) will require alternative treatment. In addition, 100,000—125,000 tons (not including contaminated media) of spent aluminum potliners (K088) will require alternative treatment capacity.

EPA received a number of comments on its capacity analysis for K088 wastes. Most commenters disagreed with EPA's proposal not to grant a capacity variance for K088 wastes. Specifically, these commenters believe that EPA overestimated the quantity of available capacity and underestimated the quantity of required capacity. In performing the capacity analysis for the final rule, EPA considered all of the issues raised by the commenters and reexamined its estimates of both available and required capacity. EPA found that adequate treatment capacity does exist for K088 wastes, although the amount of treatment capacity appears to be just adequate to accommodate demand. However, some of the facilities capable of treating these wastes may require pretreatment such as grinding or crushing prior to accepting the waste. In order to allow facilities generating K088 adequate time to work out logistics such as transportation, pretreatment capacity, and contracting for treatment capacity, EPA has decided to grant a nine-month national capacity variance for these wastes—the time at which EPA estimates existing treatment capacity will be available as a practical matter. A detailed discussion of the final capacity analysis is provided in the Background Document for Capacity Analysis for Land Disposal Restrictions, Phase III—Decharacterized Wastewaters, Carbamate Wastes, and Spent Potliners and EPA's responses to the individual comments on the K088 capacity analysis are provided in the Response to Capacity-Related Comments Received on the Phase III Land Disposal Restrictions Rulemaking, both of which are in the docket for today's rule.

EPA has determined that there is adequate alternative treatment capacity available for the 4,500 tons of carbamate wastes generated each year and is therefore not granting a national capacity variance for these wastes.

The quantities of radioactive wastes mixed with wastes included in today's rule are generated primarily by the U.S. Department of Energy (DOE). EPA estimates that 820 tons of high-level waste and 360 tons of mixed low-level waste that may be affected by this proposal will be generated annually by DOE. In addition, there are currently 7,000 tons of high-level waste, 10 tons of mixed transuranic waste, and 2,700 tons of mixed low-level waste in storage that may be affected by this rule. DOE currently faces treatment capacity shortfalls for high-level wastes and mixed transuranic wastes. Although DOE does have some available treatment capacity for mixed low-level wastes, most of this capacity is limited to treatment of wastewaters with less than one percent total suspended solids and is not readily adaptable for other waste forms. DOE has indicated that it will generally give treatment priority to mixed wastes that are already restricted under previous LDR rules. Therefore, EPA is granting a two-year national capacity variance to radioactive wastes mixed with the hazardous wastes affected by today's rule. Commenters to the proposed rule supported EPA's

decision to grant a national capacity variance for these wastes.

Table 1 lists each RCRA hazardous waste code for which EPA is today promulgating LDR standards. For each code, this table indicates whether EPA is granting a national capacity variance for land-disposed wastes. Also, EPA is granting a three-month national capacity variance for all wastes in this rule to handle logistical problems associated with complying with the new standards.

TABLE 1.—VARIANCES FOR NEWLY LISTED AND IDENTIFIED WASTES

Waste description[1]	Surface-disposed wastes	Deepwell-injected wastes
Ignitable and corrosive wastes managed in CWA or CWA-equivalent systems, or SDWA (D001 and D002)	2 Years	2 Years.
Reactive wastes managed in CWA or CWA-equivalent systems, or SDWA (D003)	2 Years	2 Years.
Reactive wastes not managed in CWA or CWA-equivalent systems, or SDWA (D003)	3 Months	3 Months.
Newly identified pesticide wastes managed in CWA or CWA-equivalent systems, or SDWA (D012–D017)	2 Years	2 Years.
Newly identified TC organic wastewaters managed in CWA or CWA-equivalent systems, or SDWA (D018–D043)	2 Years	2 Years.
Spent aluminum potliners (K088)	9 Months	3 Months.
Carbamate production wastes (K156–K161, P127, P128, P185, P188–P192, P194, P196–P199, P201–P205, U271, U277–U280, U364–U367, U372, U373, U375–U379, U381–U387, U389–U396, U400–U404, U407, U409–U411) mixed radioactive wastes[2].	3 Months	3 Months.

[1] Includes soil and debris contaminated with each waste.
[2] The variance determinations listed apply only to radioactive wastes mixed with decharacterized D001–D003 or newly identified D012–D017 wastes managed in CWA and CWA-equivalent systems; to radioactive wastes mixed with newly identified TC organic wastewaters; and to radioactive wastes mixed with spent aluminum potliners, or carbamate production wastes.

VIII. State Authority

A. Applicability of Rules in Authorized States

Under section 3006 of RCRA, EPA may authorize qualified States to administer and enforce the RCRA program within the State. Following authorization, EPA retains enforcement authority under sections 3008, 3013, and 7003 of RCRA, although authorized States have primary enforcement responsibility. The standards and requirements for authorization are found in 40 CFR Part 271.

Prior to HSWA, a State with final authorization administered its hazardous waste program in lieu of EPA administering the Federal program in that State. The Federal requirements no longer applied in the authorized State, and EPA could not issue permits for any facilities that the State was authorized to permit. When new, more stringent Federal requirements were promulgated or enacted, the State was obliged to enact equivalent authority within specified time frames. New Federal requirements did not take effect in an authorized State until the State adopted the requirements as State law.

In contrast, under RCRA section 3006(g) (42 U.S.C. 6926(g)), new requirements and prohibitions imposed by HSWA take effect in authorized States at the same time that they take effect in unauthorized States. EPA is directed to carry out these requirements and prohibitions in authorized States, including the issuance of permits, until the State is granted authorization to do so.

Today's rule is being promulgated pursuant to sections 3004(d) through (k), and 3004(m), of RCRA (42 U.S.C. 6924(d) through (k), and 6924(m)). Therefore, the Agency is adding today's rule to Table 1 in 40 CFR 271.1(j), which identifies the Federal program requirements that are promulgated pursuant to HSWA. States may apply for final authorization for the HSWA provisions in Table 1, as discussed in the following section of this preamble. Table 2 in 40 CFR 271.1(j) is also modified to indicate that this rule is a self-implementing provision of HSWA.

B. Abbreviated Authorization Procedures for Specified Portions of Today's Rule

On August 22, 1995, EPA proposed in the Phase IV LDR notice an abbreviated authorization procedure that would also be used for certain parts of the Phase III LDR rule that are minor in nature (EPA also proposed to use this procedure for the Universal Treatment Standards (UTS) in the Phase II rule). This procedure is designed to expedite the authorization process by reducing the scope of a State's submittal, for authorization to a State certification and copies of applicable regulations and statutes. EPA would then conduct a short review of the State's request, primarily consisting of a completeness check (see 60 FR 43686 for a full description of the proposed procedures). The parts of the Phase III rule to which the streamlined authorization procedures would be applicable are: (1) treatment standards for newly listed wastes, (2) improvements to the existing land disposal restrictions program, and (3) revisions and corrections to the treatment standards in §§ 268.40 and 268.48. (Further discussion of this issue also is found in the supplemental proposal to the LDR Phase IV rule (61 FR 2358, 2365, January 25, 1996)).

Although EPA is firmly committed to streamlining the RCRA State authorization procedures, the Agency has decided not to finalize the proposed Category 1 authorization procedures for parts of the Phase III rule today's notice. EPA believes that public comments from both the August 22 proposal and comments submitted for the recent HWIR-contaminated media proposal should be considered before finalizing new procedures for authorization. This full consideration will enable EPA to make the best decision regarding how the authorization process should work. EPA intends to finalize both the Category 1 and Category 2 procedures at the same time.

C. Effect on State Authorization

Because today's Phase III LDR rule is being promulgated under HSWA authority, those sections of today's rule that expand the coverage of the LDR program (e.g., to newly identified wastes) would be implemented by EPA on the effective date of today's rule in authorized States until their programs are modified to adopt these rules and the modification is approved by EPA.

However, some of today's regulatory amendments are neither more or less stringent than the existing Federal requirements. EPA clarified in a December 19, 1994, memorandum (which is in the docket for today's rule) that EPA would not implement the Universal Treatment Standards (promulgated under HSWA authority in the Phase II LDR rule) separately for those States for which the State has received LDR authorization. EPA views any changes from the existing limits to

be neither more or less stringent since the technology basis of the standards has not changed. Accordingly, EPA will not implement the amendments to the UTS in today's LDR Phase III rule for those states with LDR authorization.

Because today's rule is promulgated pursuant to HSWA, a State submitting a program modification may apply to receive interim or final authorization under RCRA section 3006(g)(2) or 3006(b), respectively, on the basis of requirements that are substantially equivalent or equivalent to EPA's. The procedures and schedule for State program modifications for final authorization are described in 40 CFR 271.21. It should be noted that all HSWA interim authorizations will expire January 1, 2003. (See § 271.24 and 57 FR 60132, December 18, 1992.)

Section 271.21(e)(2) requires that States with final authorization must modify their programs to reflect Federal program changes and to subsequently submit the modification to EPA for approval. The deadline by which the State would have to modify its program to adopt these regulations is specified in § 271.21(e). This deadline can be extended in certain cases (see § 271.21(e)(3)). Once EPA approves the modification, the State requirements become Subtitle C RCRA requirements.

States with authorized RCRA programs may already have requirements similar to those in today's rule. These State regulations have not been assessed against the Federal regulations being proposed today to determine whether they meet the tests for authorization. Thus, a State is not authorized to implement these requirements in lieu of EPA until the State program modifications are approved. Of course, states with existing standards could continue to administer and enforce their standards as a matter of State law. In implementing the Federal program, EPA will work with States under agreements to minimize duplication of efforts. In most cases, EPA expects that it will be able to defer to the States in their efforts to implement their programs rather than take separate actions under Federal authority.

States that submit official applications for final authorization less than 12 months after the effective date of these regulations are not required to include standards equivalent to these regulations in their application. However, the State must modify its program by the deadline set forth in § 271.21(e). States that submit official applications for final authorization 12 months after the effective date of these regulations must include standards equivalent to these regulations in their application. The requirements a State must meet when submitting its final authorization application are set forth in 40 CFR 271.3.

IX. Regulatory Requirements

A. Regulatory Impact Analysis Pursuant to Executive Order 12866

Executive Order No. 12866 requires agencies to determine whether a regulatory action is "significant." The Order defines a "significant" regulatory action as one that "is likely to result in a rule that may: (1) have an annual effect on the economy of $100 million or more or adversely affect, in a material way, the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order."

The Agency estimated the costs of today's rule to determine if it is a significant regulation as defined by the Executive Order. The analysis considers compliance cost and economic impacts for both characteristic wastes and newly listed wastes affected by this rule. For characteristic wastes, the potential cost impacts of this rule depend on whether facilities' current wastewater treatment systems will meet the UTS levels or if additional treatment will be required. If current treatments are adequate, facilities will only incur administrative costs to have their permits revised as well as on-going monitoring costs. In general, the Agency expects that facilities will seek permit modifications, treatability variances, or certification of adequate POTW treatment because these compliance options can be implemented at much lower cost than the option requiring treatment to UTS levels. EPA estimates the total annualized costs of the rule for these wastes would range from approximately $197,000 to $598,000, of which $154,000 to $425,000 would be incurred at the 28 to 73 potentially affected facilities in the organic chemical industry, and approximately $43,000 to $173,000 would be incurred at the 8 to 30 potentially affected facilities in the petroleum refining industry. However, at the high end, if current wastewater treatment systems need to be augmented with additional treatment steps, the incremental compliance costs for today's rule could be as high as $1 million per affected facility. The Agency does not have adequate data to estimate how many, if any, facilities may require modification to their treatment facilities. The Agency did conduct a sensitivity analysis, considering the costs of the rule under two scenarios: (1) Assuming that 80 percent of the facilities comply with the rule by obtaining permit modifications and 20 percent comply by treating their wastes, and, (2) assuming that 60 percent comply by obtaining permit modifications and 40 percent comply by treating their wastes. Based on the first scenario, the estimated annualized costs of the rule would range from $6.6 million to $18.2 million. Based on the second scenario, the estimated annualized costs would range from $12.9 million to $35.7 million. For newly listed wastes, the costs are substantially higher and will be incurred each year. These costs range from approximately $11.9 million to $47.3 million and are attributable to thermal treatment of aluminum potliner wastes (K088). Therefore, today's rule may be considered an economically significant rule. Because today's rule is significant, the Agency analyzed the costs, economic impacts, and benefits.

This section of the preamble for today's rule provides a discussion of the methodology used for estimating the costs, economic impacts and the benefits attributable to today's rule, followed by a presentation of the cost, economic impact and benefit results. More detailed discussions of the methodology and results may be found in the background document, "Regulatory Impact Analysis of the Land Disposal Restrictions Final Rule for the LDR Phase III Newly Listed and Identified Wastes," which has been placed in the docket for today's rule.

1. Methodology Section

In today's rule, the Agency is establishing treatment standards for the following wastes: end-of-pipe standards for ignitable, corrosive, and reactive (ICR) wastewaters managed in CWA, CWA-equivalent systems, and UIC wells; Toxicity Characteristic pesticide (D012–17) and organic (D018–43) wastewaters managed in CWA, CWA-equivalent systems, and UIC wells; and newly listed wastes from two industries—spent aluminum potliners and carbamates.

a. Methodology for Estimating the Affected Universe. In determining the costs, economic impacts, and benefits associated with today's rule, the Agency

estimated the volumes of waste affected by today's rule. The procedure for estimating the volumes of ICR waste and TC organic and pesticide waste, and newly listed wastes affected by today's rule is summarized below.

First, the Agency examined all industries which might be likely to produce wastes covered under today's standards. Through reviewing comments to the Supplemental Notice of Data Availability published by the Agency in 1993, reviewing runs from the Biennial Reporting System (BRS) of volumes generated from particular industry sectors, as well as discussions with industry, and discussions with the Office of Water at EPA HQ, the Agency narrowed it down to 16 industries which would potentially have significant volumes of wastewater affected by today's rule.

Using a host of databases and/or sources, the Agency collected data on the quantities, constituents, and concentrations of the volumes affected from each of the 16 industries. In addition, the Agency gathered any data on current management practices, plant design, etc. The following sources were used: Toxic Release Inventory (TRI), Section 308 data from the Office of Water, Industrial Studies Database (ISDB), 1991 Biennial Reporting System (BRS), primary summary and development documents data from effluent guidelines, TCRIA documents, data gathered in the capacity analysis performed for today's rule, as well as comments from potentially affected industries.

The Agency obtained volume information for the newly listed wastes—spent aluminum potliners (K088) and carbamate wastes (K156–161)—from the listing documents prepared for these wastes during the listing procedure.

b. Cost Methodology. The cost analysis estimates the national level incremental costs which will be incurred as a result of today's rule. The cost estimates for both the baseline and post-regulatory scenarios are calculated employing: (i) the facility wastestream volume, (ii) the management practice (baseline or post-regulatory) assigned to that wastestream, and (iii) the unit cost associated with that practice. Summing the costs for all facilities produces the total costs for the given waste and scenario. Subtracting the baseline cost from the post-regulatory cost produces the national incremental cost associated with today's rule for the given waste.

The cost methodology section includes three sub-sections: (i) ICR and TC Pesticide and Organic Wastes Managed in CWA and CWA-Equivalent Systems, (ii) Newly Listed Wastes, (iii) Testing and Recordkeeping Costs.

i. ICR and TC Pesticide and Organic Wastes Managed in CWA and CWA-Equivalent Systems. The Agency employed the following approach to estimate the incremental costs for the ICR and TC wastes. First, using information available on the affected industries, the Agency created average-sized model facilities for each industry. Second, for a given model facility in an affected industry, the Agency used available unit cost data to develop costs for the baseline management practices (usually treatment in surface impoundments followed by discharge into receiving waters through a NPDES permit). Third, the Agency used data on the constituents and waste quantities for each industry, where applicable, to determine the necessary treatment required to reduce to UTS levels the constituents present. Fourth, the Agency used unit costs to develop costs for the post-regulatory management practices for the treatment requirements determined in the third step. Fifth, subtracting the baseline from the post-regulatory costs for an average facility in an industry sector and using the data available on the number of facilities affected within each industry, the Agency was able calculate the incremental cost for a given industry. Sixth, summing costs across affected industries, the Agency determined the incremental cost for the rule for the end-of-pipe treatment standards.

ii. Newly Listed Wastes. The costs for treatment of spent aluminum potliners (K088) and carbamate wastes (K156–161) will be determined using data from the listings on baseline management practices, judgment on the technology(s) required to meet the UTS standards for these wastes, and available unit cost data.

iii. Testing and Recordkeeping Costs. Testing and recordkeeping costs, including costs that facilities will incur for ensuring that hazardous constituents in characteristic waste are meeting new treatment standards and costs associated with permit modifications will be based upon an average, one-time testing cost, on-going monitoring costs, and an Information Collection Request, respectively.

c. Economic Impact Methodology. The economic effects of today's rule are defined as the difference between the industrial activity under post-regulatory conditions and the industrial activity in the absence of regulation (i.e., baseline conditions).

The Agency used (1) historic average capital expenditures for each industry, (2) historic average operating expenditures for each industry, (3) historic revenues, and (4) historic average pollution abatement and control expenditures (PACE) to determine the economic impacts. However, the Agency was unable to examine the impacts on a facility-specific basis due to lack of data. Therefore, the impacts are assessed on an industry-specific basis.

d. Benefits Methodology. The approach for estimating benefits associated with today's rule involves three components: (i) estimation of pollutant loadings reductions, (ii) estimation of reductions in exceedances of health-based levels, and, (iii) qualitative description of the potential benefits. The benefits assessment is based upon the waste quantity and concentration data collected for the cost analysis. This incremental assessment focuses upon reductions in toxic concentrations at the point of discharge and does not consider any potential benefits resulting from reductions in air emissions or impacts on impoundment leaks and sludges which may occur as part of treating wastes to comply with the LDRs. It is expected that additional treatment to comply with the LDRs may result in risk reductions from air emissions, leaks, and sludges.

EPA has conducted an assessment of the benefits related to the effects of the rule on newly listed spent aluminum potliners. These benefits depend on the incremental risk reductions that may result from treatment of the wastes. In conducting the risk assessment for spent aluminum potliners, EPA improved upon the fate and transport modeling approach used in the RIA. Specifically, in the RIA, EPA applied generic dilution/attenuation factors (DAFs) (which did not reflect constituent-specific fate and transport processes, site-specific hydrogeological conditions, or waste characterization data) to relate the concentration of contaminants in the leachate to their concentration in a down-gradient well. Instead, EPA used its Composite Model for Leachate Migration and Transformation Products (EPACMTP) to perform constituent-specific fate and transport modeling. A summary of the analysis can be found in the Addendum to the RIA placed in the docket for this rule. EPA data indicate that approximately 120,000 metric tons of spent aluminum potliners are generated annually. EPA has not conducted an assessment of the benefits related to the effects of the rule on newly listed carbamate wastes. Because the Agency expects facilities to comply with LDRs through permit modifications, and because the quantity of waste is very small, benefits for

newly listed carbamate wastes are expected to be minimal.

i. Estimation of Pollutant Loadings Reductions. An incremental approach was used to estimate reductions in pollutant loadings. For the baseline scenario, contaminant concentrations were based upon data or estimates of current effluent discharge concentration levels. For the post-regulatory scenario, concentration levels were assumed to equal UTS levels.

ii. Estimation of Reductions in Exceedances of Health-Based Levels. The methods used for evaluating the benefits associated with cancer and noncancer risk reductions resulting from the rule entail comparing constituent concentration levels to health-based standards to evaluate whether implementation of the rule reduces concentration levels below levels that pose risk to human health.

To estimate benefits from cancer risk reductions resulting from the rule, a simple screening analysis was performed. This analysis compared contaminant concentrations for the baseline and post-regulatory scenario to health-based levels for carcinogens. Further analysis may be undertaken to quantify benefits associated with facility/ wastestream combinations identified in the contaminant concentration comparisons.

Benefits associated with reductions in non-cancer exceedances are estimated based upon comparisons of contaminant concentration levels in effluent discharges of the affected wastestreams to the reference health levels. These benefits are expressed in terms of the number of exceedances of health-based levels under the baseline scenario compared to the number of exceedances under the rule.

iii. Qualitative Description of the Potential Benefits. A qualitative assessment of potential benefits likely to result from the rule is used where data are limited. The Agency acknowledges limited data availability in developing waste volumes affected, constituents, concentrations, cost estimates, economic impacts, and benefits estimates for the LDR Phase III rulemaking. The Agency continues to request comment from industry regarding constituents, concentrations, waste volumes, and current management practices.

2. Results

a. Volume Results. The Agency has estimated the volumes of formerly characteristic wastes potentially affected by today's rule to total in the range of 33.5 to 500 million metric tons. The Agency requests comment on waste volumes affected by the LDR Phase III rule. For newly listed wastes, the analyses supporting the listing determination showed about 4,500 metric tons of carbamate wastes and 118,000 metric tons of spent aluminum potliners are potentially affected by this rule.

b. Cost Results. For characteristic wastes, the potential cost impacts of this rule depend on whether facilities' current wastewater treatment systems will meet the UTS levels or if additional treatment will be required. If current treatments are adequate, facilities will only incur administrative costs to have their permits revised. EPA estimates the total annualized costs of the rule for these wastes would range from approximately $197,000 to $598,000, of which $154,000 to $425,000 would be incurred at the 28 to 73 potentially affected facilities in the organic chemical industry, and approximately $43,000 to $173,000 would be incurred at the 8 to 30 potentially affected facilities in the petroleum refining industry. However, at the high end, if current wastewater treatment systems need to be augmented with additional treatment steps, the incremental compliance costs could be as high as $1 million per affected facility. The Agency does not have adequate data to estimate how many, if any, facilities may require modification to their treatment facilities. The Agency continues to request comment and data on how often additional treatment may be required.

For newly listed wastes, the costs are substantially higher and will be incurred each year. These costs range from approximately $11.9 million to $47.3 million and are attributable to thermal treatment of aluminum potliner wastes (K088). The Agency requests comment on where industry falls within this range.

c. Economic Impact Results. The Agency has estimated the economic impacts of today's rule to represent less than one percent of historic pollution control and operating costs for the organic chemical and petroleum refining industries. However, for those facilities that may need to treat to UTS to comply with today's rule, costs could be more significant. The estimated compliance costs for treating newly listed spent aluminum potliners represents 40 percent of pollution control operating costs for aluminum reducers; however, treatment costs represent only one percent of total historic operating costs.

d. Benefit Estimate Results. The Agency expects facilities to comply with the LDRs through permit modifications. As a result, the Agency has estimated the benefits associated with today's rule to be small. Assuming facilities comply with the rule by treating their affected wastestreams, loadings reductions estimates range between 1,527 to 21,322 metric tons per year at 129 to 291 facilities (direct and indirect dischargers) involving 175 to 647 constituent/wastestream combinations. Ninety-eight percent of the reductions occur at organic chemicals facilities, with the remainder occurring at petroleum refiners. Estimated loadings reductions for direct dischargers range between 36 and 267 tons per year, representing between 0.03 and 0.2 percent of total Toxic Release Inventory (TRI) chemical loadings to surface waters. For indirect dischargers, estimated loadings reductions range between 1,491 and 21,055 metric tons per year, representing between 0.8 and 11.0 percent of total TRI chemical loadings transferred to POTWs. Based upon the results of the screening and more detailed risk assessments, the estimated baseline risks associated with nine to twenty wastestreams (out of the 155 to 404 constituent/wastestream combinations potentially affected by the rule) exceed 10^{-6} under baseline conditions and three to six wastestreams with noncancer risk levels exceeding reference doses. These 12 to 26 wastestreams contain one of five constituents: aniline (9 to 19 wastestreams), acrylamide (0 to 1 wastestream), pyridine (2 waststreams), barium compounds (1 wastestream), and acetonitrile (0 to 2 wastestreams). For these 12 to 26 wastestreams, EPA conducted a more detailed risk assessment, using site-specific data. Results of the more detailed risk assessment indicate that the benefits from the rule are small. EPA identified four wastestreams potentially posing cancer risk exceeding the threshold risk levels. Three wastestreams pose baseline cancer risk ranging from 1×10^{-5} to 1×10^{-4} (due to exposure to aniline) which potentially would be reduced to between 8×10^{-8} and 3×10^{-6} under the LDR Phase III rule. A fourth wastestream containing acrylamide poses baseline cancer risk at a level of 2×10^{-3}. The rule is estimated to reduce this risk to between 2×10^{-4} and 4×10^{-36}. All four of these wastestreams are discharged to POTWs; if POTW treatment removes these constituents from the wastewater prior to discharge to surface water and/or if no drinking water intake is located downstream from the POTW's outfall, baseline risks will be lower. The Agency expects facilities to comply with the LDRs through permit modifications;

however, additional treatment may result in potentially significant risk reduction.

EPA performed constituent-specific fate and transport modeling using its EPACMTP to further assess cancer and noncancer risks of spent aluminum potliners. Using these additional data, EPA assessment of baseline risks indicates that individual lifetime cancer risks increase to about 10^{-6} under central tendency assumptions and 10^{-3} under high-end assumptions. In addition, the new estimates suggest that under high-end assumptions, baseline concentrations in drinking water may be high enough to present noncancer risks; previously, noncancer risks were estimated to be negligible. Consequently, the benefits of regulating spent aluminum potliners are higher than previously estimated. Under central tendency assumptions, individual lifetime cancer risks resulting from current waste management practices are slightly higher than post-regulatory risks (10^{-6} versus less than 10^{-6}); some incremental benefits may therefore be realized as a result of the LDRs. Under high-end assumptions, however, the regulation could reduce cancer risks by one or two order of magnitude, while noncancer risks could be eliminated. Although population risks would also be reduced correspondingly, EPA is unable to specify the magnitude of the exposed population.

B. Regulatory Impact Analysis for Underground Injected Wastes

The Agency has completed a separate regulatory impact analysis for underground injected wastes affected by the LDR Phase III final rule. This analysis describes the regulatory impacts only to the Class I injection well universe. The new Phase III LDRs cover decharacterized ICR and TC organic wastes, and other newly-identified hazardous wastes that are distinctly industrial wastes injected by owners and operators of only Class I hazardous and non-hazardous injection wells.

According to the available data outlined in the RIA, our best estimate indicates that of the 223 Class I injection facilities in the nation, up to 154 facilities will be affected by the new Phase III LDRs. Of these facilities, 100 inject nonhazardous waste and 54 inject hazardous waste. Combined, these facilities inject approximately 18 billion gallons of waste annually into Class I wells. These Class I injection wells will now be required to either treat wastes onsite, segregate and ship affected wastes offsite for treatment and disposal, or file no migration petitions as outlined in the UIC regulations in 40 CFR Part 148 (See 53 FR 28118, July 26, 1988, preamble for a mote thorough discussion of the no migration petition review process). Additional options for compliance with the final Phase III LDRs, including a *de minimis* exemption and a pollution prevention option discussed in detail elsewhere in this rule and in the final UIC RIA.

Of the newly affected Class I facilities, 38 already have no migration exemptions approved by EPA, but they may be required to submit a petition modification to EPA due to the Phase III rule unless their original petition already addressed affected Phase III wastes, including underlying hazardous constituents in decharacterized wastes. In the cases where the petition already covers all hazardous wastes and underlying hazardous constituents in the injected waste stream (i.e., the injectate that was evaluated during the no migration petition process has not changed), no further Agency review of these petitions is necessary. For the facilities which do not have approved no migration exemptions, the rule will add compliance costs to those incurred as a result of previous rulemakings. The Agency analyzed costs and benefits for the final Phase III rule using the same approach and methodology developed in the Regulatory Impact Analysis of the Underground Injection Control Program: Proposed Hazardous Waste Disposal Injection Restriction (53 FR 28118) and subsequent LDR rulemaking. An analysis was performed to assess the economic effect of associated compliance costs for the additional volumes of injected wastes attributable to this rule.

In general, Class I injection facilities affected by the LDR Phase III rule have several options. As previously outlined, some facilities will modify existing no migration petitions already approved by the Agency, others may submit entirely new petitions, and still others may accept the prohibitions and either continue to inject treated wastes or cease injection operations altogether. And some facilities with approved petitions already addressing Phase III wastes will have no or little additional compliance costs. EPA assessed compliance costs for Class I facilities submitting no migration petitions, employing alternative treatment, and/or implementing pollution prevention measures. Although facilities using pollution prevention/waste minimization to comply with the Phase III LDRs will likely lower overall regulatory compliance costs, these situations are site-specific and, therefore, EPA cannot estimate these costs savings at this time.

For Class I facilities opting to use alternative treatment, the Agency derived costs for both treating wastes on-site, and/or shipping wastes and treating them off-site at a commercial facility. However, EPA believes that the segregation and transportation of large volumes of liquid wastes off-site is not very practical or cost-effective. This makes the off-site treatment scenario, at best, a highly conservative analysis and in actuality, a least likely and therefore discountable scenario. EPA expects that all injection facilities will opt for the most cost-effective approach in complying with the Phase III final rule and they will either submit a no migration petition or treat their wastes on-site. EPA also assumes that non-commercial facilities will segregate wastes for treatment on-site, whereas commercial facilities will find it more cost effective to not segregate LDR Phase III wastes. For the final rule, EPA estimates that the total annual compliance cost for petitions and alternative on-site treatment to industry affected by the new LDR Phase III prohibitions will range between $32.91 million to $34.08 million per year. The average annual compliance costs per affected facility employing on-site alternative treatment were $217,500. The range of costs for alternative treatment is the result of applying a sensitivity analysis. Only the incremental treatment costs for the new waste listings are calculated in this RIA. All of these costs will be incurred by Class I injection well owners and operators. The average annual compliance costs per affected facility employing on-site alternative treatment were $217,500. The total annual compliance costs for the 154 potentially affected facilities would therefore be $33.4 million. These figures were derived by applying the probability of certain outcomes occurring, via the decision tree methodology described in the RIA, to the costs associated with those outcomes for each affected facility.

Additionally, as part of the RIA analysis, the costs associated with three differing scenarios also were derived. These scenarios are represented by (1) a minimum case, where all facilities incur only petition costs, (2) a mid-line case, where all facilities incur treatment costs (commercial facilities treat on-site with no waste segregation while non-commercial facilities chose the least cost treatment option), and a maximum case, where all facilities incur both petition and treatment costs. Costs associated with these scenarios range

from $3.67 million per year for all facilities incurring only petition costs to $132.62 million per year for all facilities incurring both petition and treatment costs. Based on past EPA experience, there is little probability that all facilities will arrive at each of these possible outcomes. However, this indicated range provides an extreme lower and upper bound estimate for national compliance costs purposes.

The benefits to human health and the environment in the RIA are generally defined as reduced human health risk resulting from fewer instances of ground water contamination. In general, potential health risks from Class I injection wells are extremely low.

EPA conducted a quantitative assessment of the potential human health risks associated with two well malfunction scenarios. EPA developed a methodology described in the RIA to measure health risks of five Phase III contaminants: benzene, carbon tetrachloride, chloroform, phenol, and toluene. The results of these analyses show that most of the cancer risks calculated are below the 1×10^{-4} to 1×10^{-6} risk range generally used by EPA to regulate exposure to carcinogens. Virtually all of the non-cancer risks are below a hazard index (HI) of 1, which represents a ratio used to compare the relative health risks posed by contaminants. Therefore, these cancer and non-cancer risks calculated are below any levels of regulatory concern. Only two cancer risk estimates in the high end scenarios, those calculated for benzene and carbon tetrachloride, slightly exceeded the risk range to regulate exposure to carcinogens. Only one hazard index calculated for carbon tetrachloride exceeded EPA's level of concern of a ratio greater than 1. However, these results were derived from a scenario where an abandoned borehole (i.e. the "failure pathway") was in very close proximity to the injection well, substantial pumping of a drinking water well was occurring, and the local geology was typical of the highly transmissive East Gulf Coast Region. The assumptions used in deriving these results were based on conservative, upper-bound estimates, therefore the cancer and non-cancer risks represent worst-case estimates. Considering the limitations imposed by the failure scenarios, and the documented low probability of Class I failures, the overall risks from failure of Class I injection wells would be below regulatory concern.

There also is a potential qualitative benefit to the no-migration process for Class I nonhazardous wells. It is possible that the process would uncover certain wells that cannot satisfy the no-migration standard and indeed may not be suitable for Class I injection in any case. This proved to be true for Class I hazardous wells. However, notwithstanding this potential benefit, as noted in the early part of this preamble, the Agency does not regard this regulatory effort as deserving of the priority afforded it, due to the litigation-driven schedule and the D.C. Circuit's mandate, and would not be undertaking the effort at this time were it not for that mandate and schedule.

The economic analysis of LDR Phase III compliance costs suggests that publicly traded companies probably will not be significantly affected. The limited data available for privately-held companies suggests, however, that they may face significant costs due to the proportionally larger expenses they may face due to the LDR Phase III rule.

C. Regulatory Flexibility Analysis

Pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. 601 et seq., when an agency publishes a notice of rulemaking, for a rule that will have a significant effect on a substantial number of small entities, the agency must prepare and make available for public comment a regulatory flexibility analysis that considers the effect of the rule on small entities (i.e.: small businesses, small organizations, and small governmental jurisdictions). Under the Agency's Revised Guidelines for Implementing The Regulatory Flexibility Act, dated May 4, 1992, the Agency committed to considering regulatory alternatives in rulemakings when there were any economic impacts estimated on any small entities. (See RCRA sections 3004 (d), (e), and (g)(5), which apply uniformly to all hazardous wastes.) Previous guidance required regulatory alternatives to be examined only when significant economic effects were estimated on a substantial number of small entities.

In assessing the regulatory approach for dealing with small entities in today's rule, for both surface disposal of wastes, the Agency considered two factors. First, data on potentially affected small entities are unavailable. Second, due to the statutory requirements of the RCRA LDR program, no legal avenues exist for the Agency to provide relief from the LDR's for small entities. The only relief available for small entities is the existing small quantity generator provisions and conditionally exempt small quantity generator exemptions found in 40 CFR 262.11–12, and 261.5, respectively. These exemptions basically prescribe 100 kilograms (kg) per calendar month generation of hazardous waste as the limit below which one is exempted from complying with the RCRA standards.

Given these two factors, the Agency was unable to frame a series of small entity options from which to select the lowest cost approach; rather, the Agency was legally bound to regulate the land disposal of the hazardous wastes covered in today's rule without regard to the size of the entity being regulated.

The Agency has, however, included an exemption covering injection facilities where the decharacterized portion of the injectate is minimal in absolute terms, as a percentage of the total injectate, and in hazardous constituent mass loadings. This *de minimis* exemption provides a measure of relief to both small and larger entities satisfying its terms.

D. Paperwork Reduction Act

The information collection requirements in this rule have been submitted for approval to the Office of Management and Budget (OMB) under the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* Four Information Collection Request (ICR) documents have been prepared by EPA, as follows. OSWER ICR No. 1442.12 would amend the existing ICR approved under OMB Control No. 2050–0085. The additional information requirements for the Underground Injection Control (UIC) Program were submitted to OMB under ICR No. 0370.14; this will amend the existing UIC approval under OMB Control No. 2040–0042. OSWER ICR No. 1442.12 and UIC ICR No. 0370.14 have not been approved by OMB and the information collection requirements in those ICRs are not enforceable until OMB approves them. EPA will publish a document in the Federal Register when OMB approves the information collection requirements. Until EPA publishes a document displaying the valid OMB control number, persons are not required to respond to collections of information in these two ICRs. Two amendments to National Pollutant Discharge Elimination System (NPDES) ICRs were approved at proposal. These are ICR 0229.10 for the Discharge Monitoring Report, approved under OMB Control No. 2040–0004, and ICR 0226.11 for NPDES Applications, approved under OMB Control No. 2040–0086.

Copies of these ICRs may be obtained from Sandy Farmer, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2136); 401 M St., S.W.; Washington, D.C. 20460 or by calling (202) 260–2740. Include the ICR numbers in any request. The information requirements for the

OSWER ICR and the UIC ICR are not effective until OMB approves them.

The additional burden associated with the OSWER ICR 1442.12 is as follows. The overall annual burden for the recordkeeping and reporting requirements is 4,202 hours. It is expected that approximately 125 respondents will be affected, therefore, the annual recordkeeping and reporting burden averages 33 hours per respondent. This time is necessary to collect data, submit notifications and certifications to waste treaters and disposers, and to maintain records of this information. The annual cost burden for this rule is approximately $177,045. Of this amount, it is estimated that facilities will incur annual operation and maintainence capital costs of approximately $8,375.

The additional burden associated with the UIC Program, explained in ICR 0370.14, is as follows. The estimated annual reporting burden averages 3845 hours per respondent (i.e., inclusive of incremental reporting burdens associated with all affected Class I facilities and Primacy States). The average incremental annual reporting and recordkeeping burdens are about 4,442 hours per each affected Class I nonhazardous facility and about 2,700 hours per each affected Class I hazardous facility. For efforts associated with implementing the rule amendments, the annual incremental State burden equals about 22 hours for each Class I respondent.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number.

Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection of techniques to the Director, OPPE Regulatory Information Division; U.S. Environmental Protection Agency (2136); 401 M St., S.W.; Washington, DC 20460; and to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th St., N.W., Washington, D.C. 20503, marked "Attention: Desk Officer for EPA." Include the ICR numbers in any correspondence.

X. Unfunded Mandates Reform Act

Under Section 202 of the Unfunded Mandates Reform Act of 1995, signed into law on March 22, 1995, EPA must prepare a statement to accompany any rule where the estimated costs to State, local, or tribal governments in the aggregate, or to the private sector, will be $100 million or more in any one year. Under Section 205, EPA must select the most cost-effective and least burdensome alternative that achieves the objective of the rule and is consistent with statutory requirements. Section 203 requires EPA to establish a plan for informing and advising any small governments that may be significantly impacted by the rule.

EPA has completed an analysis of the costs and benefits from the LDR Phase III rule and has determined that this rule does not include a Federal mandate that may result in estimated costs of $100 million or more to either State, local or tribal governments in the aggregate. As stated above, the private sector may incur costs exceeding $100 million per year depending upon the option chosen in the final rulemaking. EPA has fulfilled the requirement for analysis under the Unfunded Mandates Reform Act, and results of this analysis have been included in the background document "Regulatory Impact Analysis of the Final Phase III Land Disposal Restrictions Rule," which was placed in the docket for today's rule.

List of Subjects

40 CFR Part 148

Environmental protection, Administrative practice and procedure, Hazardous waste, Reporting and recordkeeping requirements, Water supply.

40 CFR Part 268

Hazardous waste, Reporting and recordkeeping requirements.

40 CFR Part 271

Administrative practice and procedure, Hazardous materials transportation, Hazardous waste, Penalties, Reporting and recordkeeping requirements.

40 CFR Part 403

Reporting and recordkeeping requirements, Waste treatment and disposal, Water pollution control.

Dated: February 16, 1996.

Carol M. Browner,

Administrator.

For the reasons set out in the preamble, title 40, chapter I of the Code of Federal Regulations is amended as follows:

PART 148—HAZARDOUS WASTE INJECTION RESTRICTIONS

1. The authority citation for part 148 continues to read as follows:

Authority: Secs. 3004, Resource Conservation and Recovery Act, 42 U.S.C. 6901 *et seq.*

2. Section 148.1 is amended by revising paragraphs (a), (b) and (d) to read as follows:

§ 148.1 Purpose, scope and applicability.

(a) This part identifies wastes that are restricted from disposal into Class I wells and defines those circumstances under which a waste, otherwise prohibited from injection, may be injected.

(b) The requirements of this part apply to owners or operators of Class I hazardous waste injection wells used to inject hazardous waste; and, owners or operators of Class I injection wells used to inject wastes which once exhibited a prohibited characteristic of hazardous waste identified in 40 CFR part 261, subpart C, at the point of generation, and no longer exhibit the characteristic at the point of injection.

* * * * *

(d) Wastes that are only hazardous because they display a characteristic of ignitability, corrosivity, reactivity, or toxicity that are otherwise prohibited, are not prohibited:

(1) If the wastes are disposed into a nonhazardous waste injection well defined under 40 CFR 144.6(a); and

(2) Do not exhibit any prohibited characteristic of hazardous waste identified in 40 CFR part 261, subpart C, and either:

(i) Do not contain any hazardous constituents identified in 40 CFR 268.48 at levels greater than the 40 CFR 268.48 Universal Treatment Standard levels at the point of generation;

(ii) Are de minimis in volume and hazardous constituent concentration levels, as defined in 40 CFR 268.1(e)(4)(ii). (Recordkeeping requirements for this alternative are found at 40 CFR 268.9(d)(4).); or

(iii)(A) The facility removes an equivalent mass of hazardous

constituents as would be removed by treating the characteristic hazardous wastestream pursuant to the treatment standards in 40 CFR 268.48. This mass reduction can come from:

(*1*) Treating nonhazardous portions of the injectate;

(*2*) Recycling before ultimate injection; or

(*3*) Engaging in pollution prevention practices (such as equipment or technology modifications, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control).

(B) The compliance alternative in paragraph (d)(2)(iii)(A) of this section is demonstrated by comparing the injected baseline (determined by multiplying the volume/day of characteristically hazardous waste generated and injected) times the concentration of hazardous constituents before the treatment/recycling/pollution prevention measure, with the mass allowance obtained by multiplying the volume/day of a hazardous constituent generated and injected times the universal treatment standard for that constituent. The baseline cannot include practices initiated before the year 1990. (Recordkeeping requirements for this alternative are found at 40 CFR 268.9(d)(3).)

3. Section 148.3 is revised to read as follows:

§ 148.3 Dilution prohibited as a substitute for treatment.

(a) The provisions of 40 CFR 268.3 shall apply to owners or operators of Class I wells used to inject a waste which is hazardous at the point of generation whether or not the waste is hazardous at the point of injection.

(b) Owners or operators of Class I nonhazardous waste injection wells which inject waste formerly exhibiting a hazardous characteristic which has been removed by dilution, may address underlying hazardous constituents by treating the hazardous waste, obtaining an exemption pursuant to a petition filed under § 148.20, or complying with the provisions set forth in 40 CFR 268.9.

4. Section 148.4 is revised to read as follows:

§ 148.4 Procedures for case-by-case extensions to an effective date.

The owner or operator of a Class I hazardous or nonhazardous waste injection well may submit an application to the Administrator for an extension of the effective date of any applicable prohibition established under subpart B of this part according to the procedures of 40 CFR 268.5.

5. Section 148.18 is added to subpart B to read as follows:

§ 148.18 Waste specific prohibitions—Newly Identified Wastes.

(a) On July 8, 1996, the wastes specified in 40 CFR 261.32 as EPA Hazardous waste numbers K156–K161, P127, P128, P185, P188–P192, P194, P196–P199, P201–P205, U271, U277–U280, U364–U367, U372, U373, U375–U379, U381–387, U389–U396, U400–U404, U407, and U409–U411 are prohibited from underground injection.

(b) On January 8, 1997, the wastes specified in 40 CFR 261.32 as EPA Hazardous waste number K088 is prohibited from underground injection.

(c) On April 8, 1998, the wastes specified in 40 CFR part 261 as EPA Hazardous waste numbers D018–043, and Mixed TC/Radioactive wastes, are prohibited from underground injection.

(d) On April 8, 1998, the wastes specified in 40 CFR part 261 as EPA Hazardous waste numbers D001–D003 are prohibited from underground injection.

6. Section 148.20 is amended by revising paragraph (a) introductory text to read as follows:

§ 148.20 Petitions to allow injection of a waste prohibited under subpart B.

(a) Any person seeking an exemption from a prohibition under subpart B of this part for the injection of a restricted hazardous waste, including a hazardous waste exhibiting a characteristic and containing underlying hazardous constituents at the point of generation, but no longer exhibiting a characteristic when injected into a Class I injection well or wells, shall submit a petition to the Director demonstrating that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. This demonstration requires a showing that:

* * * * *

PART 268—LAND DISPOSAL RESTRICTIONS

7. The authority citation for part 268 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, and 6924.

Subpart A—General

8. Section 268.1 is amended in paragraph (e)(3) by removing the period at the end of the paragraph and adding "; or" in its place, by revising paragraph (e)(4) and by removing paragraph (e)(5) to read as follows:

§ 268.1 Purpose, scope and applicability.

* * * * *

(e) * * *

(4) *De minimis* losses of characteristic wastes to wastewaters are not considered to be prohibited wastes and are defined as:

(i) Losses from normal material handling operations (e.g. spills from the unloading or transfer of materials from bins or other containers, leaks from pipes, valves or other devices used to transfer materials); minor leaks of process equipment, storage tanks or containers; leaks from well-maintained pump packings and seals; sample purgings; and relief device discharges; discharges from safety showers and rinsing and cleaning of personal safety equipment; rinsate from empty containers or from containers that are rendered empty by that rinsing; and laboratory wastes not exceeding one per cent of the total flow of wastewater into the facility's headworks on an annual basis, or with a combined annualized average concentration not exceeding one part per million in the headworks of the facility's wastewater treatment or pretreatment facility; or

(ii) Decharacterized wastes which are injected into Class I nonhazardous wells which wastes combined volume is less than one per cent of the total flow at the wellhead on an annualized basis, is no greater than 10,000 gallons per day, and in which any underlying hazardous constituents in the characteristic wastes are present at the point of generation at levels less than ten times the treatment standards found at § 268.48.

* * * * *

9. Section 268.2 is amended by revising paragraphs (f) and (i), and by adding paragraphs (j), (k), and (l) to read as follows:

§ 268.2 Definitions applicable in this part.

* * * * *

(f) *Wastewaters* are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS).

* * * * *

(i) *Underlying hazardous constituent* means any constituent listed in § 268.48, Table UTS—Universal Treatment Standards, except fluoride, vanadium, and zinc, which can reasonably be expected to be present at the point of generation of the hazardous waste, at a concentration above the constituent-specific UTS treatment standards.

(j) *Inorganic metal-bearing waste* is one for which EPA has established treatment standards for metal hazardous constituents, and which does not otherwise contain significant organic or cyanide content as described in § 268.3(b)(1), and is specifically listed in appendix XI of this part.

(k) *End-of-pipe* refers to the point where effluent is discharged to the environment.

(l) *Stormwater impoundments* are surface impoundments which receive wet weather flow, and only receive process waste during wet weather events.

10. Section 268.3 is revised to read as follows:

§ 268.3 Dilution prohibited as a substitute for treatment.

(a) No generator, transporter, handler, or owner or operator of a treatment, storage, or disposal facility shall in any way dilute a restricted waste or the residual from treatment of a restricted waste as a substitute for adequate treatment to achieve compliance with subpart D of this part, to circumvent the effective date of a prohibition in subpart C of this part, to otherwise avoid a prohibition in subpart C of this part, or to circumvent a land disposal prohibition imposed by RCRA section 3004.

(b) Dilution of wastes that are hazardous only because they exhibit a hazardous characteristic in a treatment system which treats wastes subsequently discharged to a water of the United States pursuant to a permit issued under section 402 of the Clean Water Act (CWA), or which treats wastes for the purposes of pretreatment requirements under section 307 of the CWA, or zero discharge systems with wastewater treatment equivalent to these systems, is not impermissible dilution, so long as the § 268.48 universal treatment standards are met at the point of discharge, or at a prior point of compliance specified under a CWA permit, for all underlying hazardous constituents reasonably expected to be present at the point of generation of the hazardous waste.

(c) Combustion of the hazardous waste codes listed in Appendix XI of this part is prohibited, unless the waste, at the point of generation, or after any bona fide treatment such as cyanide destruction prior to combustion, can be demonstrated to comply with one or more of the following criteria (unless otherwise specifically prohibited from combustion):

(1) the waste contains hazardous organic constituents or cyanide at levels exceeding the constituent-specific treatment standard found in § 268.48;

(2) The waste consists of organic, debris-like materials (e.g., wood, paper, plastic, or cloth) contaminated with an inorganic metal-bearing hazardous waste;

(3) The waste, at point of generation, has reasonable heating value such as greater than or equal to 5000 BTU per pound;

(4) The waste is co-generated with wastes for which combustion is a required method of treatment;

(5) The waste is subject to Federal and/or State requirements necessitating reduction of organics (including biological agents); or

(6) The waste contains greater than 1% Total Organic Carbon (TOC).

11. Section 268.7 is amended by revising the last sentence of paragraph (a) introductory text, paragraphs (a)(1)(ii), (a)(2)(i)(B), (a)(3)(ii), (b)(4)(ii), (b)(5)(iv), by removing "268.45';" at the end of paragraph (a)(1)(iv) and adding "268.45'; and" in its place, by removing "; and," at the end of paragraph (a)(1)(v) and adding a period in its place, by removing paragraph (a)(1)(vi), and by adding paragraph (b)(5)(v) to read as follows:

§ 268.7 Waste analysis and recordkeeping.

(a) * * * If the generator determines that his waste exhibits the characteristic of ignitability (D001) (and is not in the High TOC Ignitable Liquids Subcategory or is not treated by CMBST or RORGS of § 268.42, Table 1), and/or the characteristic of corrosivity (D002), and/or reactivity (D003), and/or the characteristic of organic toxicity (D012–D043), and is prohibited under § 268.37, § 268.38, and § 268.39, the generator must determine the underlying hazardous constituents (as defined in § 268.2, in the D001, D002, D003, or D012–D043 wastes.

(1) * * *

(ii) The waste constituents that the treater will monitor, if monitoring will not include all regulated constituents, for wastes F001–F005, F039, D001, D002, D003, and D012–D043. Generators must also include whether the waste is a nonwastewater or wastewater (as defined in § 268.2 (d) and (f), and indicate the subcategory of the waste (such as "D003 reactive cyanide"), if applicable;

* * * * *

(2) * * *

(i) * * *

(B) The waste constituents that the treater will monitor, if monitoring will not include all regulated constituents, for wastes F001–F005, F039, D001, D002, D003, and D012–D043. Generators must also include whether the waste is a nonwastewater or wastewater (as defined in § 268.2(d) and (f)) and indicate the subcategory of the waste (such as "D003 reactive cyanide"), if applicable;

* * * * *

(3) * * *

(ii) The waste constituents that the treater will monitor, if monitoring will not include all regulated constituents, for wastes F001–F005, F039, D001, D002, D003, and D012–D043. Generators must also include whether the waste is a nonwastewater or wastewater (as defined in § 268.2(d) and (f)), and indicate the subcategory of the waste (such as "D003 reactive cyanide"), if applicable;

* * * * *

(b) * * *

(4) * * *

(ii) The waste constituents to be monitored, if monitoring will not include all regulated constituents, for wastes F001–F005, F039, D001, D002, D003, and D012–D043. Generators must also include whether the waste is a nonwastewater or wastewater (as defined in § 268.2(d) and (f), and indicate the subcategory of the waste (such as D003 reactive cyanide), if applicable;

* * * * *

(5) * * *

(iv) For characteristic wastes D001, D002, D003, and D012–D043 that are: subject to the treatment standards in § 268.40 (other than those expressed as a required method of treatment); that are reasonably expected to contain underlying hazardous constituents as defined in § 268.2(i); are treated on-site to remove the hazardous characteristic; and are then sent off-site for treatment of underlying hazardous constituents, the certification must state the following:

I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic. This decharacterized waste contains underlying hazardous constituents that require further treatment to meet universal treatment standards. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

(v) For characteristic wastes D001, D002, D003 and D012–D043 that contain underlying hazardous constituents as defined in § 268.2(i) that are treated on-site to remove the hazardous characteristic and to treat underlying hazardous constituents to levels in § 268.48 Universal Treatment Standards, the certification must state the following:

I certify under penalty of law that the waste has been treated in accordance with the requirements of 40 CFR 268.40 to remove the hazardous characteristic, and that underlying hazardous constituents, as defined in § 268.2, have been treated on-site to meet the § 268.48 Universal Treatment Standards. I am aware that there are

significant penalties for submitting a false certification, including the possibility of fine and imprisonment.

* * * * *

§ 268.8 [Removed and reserved]

12. Section 268.8 is removed and reserved.

13. Section 268.9 is amended by revising paragraphs (a), (d) introductory text, (d)(1)(i), and (d)(1)(ii), and by adding paragraphs (d)(3), (e), (f), and (g) to read as follows:

§ 268.9 Special rules regarding wastes that exhibit a characteristic.

(a) The initial generator of a solid waste must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under subpart D of this part. For purposes of this part 268, the waste will carry the waste code for any applicable listing under 40 CFR part 261, subpart D. In addition, the waste will carry one or more of the waste codes under 40 CFR part 261, subpart C, where the waste exhibits a characteristic, except in the case when the treatment standard for the waste code listed in 40 CFR part 261, subpart D operates in lieu of the standard for the waste code under 40 CFR part 261, subpart C, as specified in paragraph (b) of this section. If the generator determines that his waste displays a hazardous characteristic (and the waste is not a D004—D011 waste, a High TOC D001, or is not treated by CMBST, or RORGS of § 268.42, Table 1), the generator must determine what underlying hazardous constituents (as defined in § 268.2), are reasonably expected to be present above the universal treatment standards found in § 268.48.

* * * * *

(d) Wastes that exhibit a characteristic are also subject to § 268.7 requirements, except that once the waste is no longer hazardous, a one-time notification and certification must be placed in the generators or treaters files and sent to the EPA region or authorized state, except for those facilities discussed in paragraph (f) of this section. The notification and certification that is placed in the generators or treaters files must be updated if the process or operation generating the waste changes and/or if the Subtitle D facility receiving the waste changes. However, the generator or treater need only notify the EPA region or an authorized state on an annual basis if such changes occur. Such notification and certification should be sent to the EPA region or authorized state by the end of the calendar year, but no later than December 31.

(1) * * *

(i) For characteristic wastes other than those managed on site in a wastewater treatment system subject to the Clean Water Act (CWA), zero-dischargers engaged in CWA-equivalent treatment, or Class I nonhazardous injection wells, the name and address of the Subtitle D facility receiving the waste shipment; and

(ii) For all characteristic wastes, a description of the waste as initially generated, including the applicable EPA Hazardous Waste Number(s), treatability group(s), and underlying hazardous constituents.

* * * * *

(3) For characteristic wastes whose ultimate disposal will be into a Class I nonhazardous injection well, and compliance with the treatment standards found in § 268.48 for underlying hazardous constituents is achieved through pollution prevention that meets the criteria set out at 40 CFR 148.1(d), the following information must also be included:

(i) A description of the pollution prevention mechanism and when it was implemented if already complete;

(ii) The mass of each underlying hazardous constituent before pollution prevention;

(iii) The mass of each underlying hazardous constituent that must be removed, adjusted to reflect variations in mass due to normal operating conditions; and

(iv) The mass reduction of each underlying hazardous constituent that is achieved.

(e) For decharacterized wastes managed on-site in a wastewater treatment system subject to the Clean Water Act (CWA) or zero-dischargers engaged in CWA-equivalent treatment, compliance with the treatment standards found at § 268.48 must be monitored quarterly, unless the treatment is aggressive biological treatment, in which case compliance must be monitored annually. Monitoring results must be kept in on-site files for 5 years.

(f) For decharacterized wastes managed on-site in a wastewater treatment system subject to the Clean Water Act (CWA) for which all underlying hazardous constituents (as defined in § 268.2), are addressed by a CWA permit, this compliance must be documented and this documentation must be kept in on-site files.

(g) For characteristic wastes whose ultimate disposal will be into a Class I nonhazardous injection well which qualifies for the *de minimis* exclusion described in § 268.1, information supporting that qualification must be kept in on-site files.

§§ 268.10–268.12 [Removed and Reserved]

14. Sections 268.10 through 268.12 are removed and reserved.

15. Section 268.39 is added to subpart C to read as follows:

§ 268.39 Waste specific prohibitions—End-of-pipe CWA, CWA-equivalent, and Class I nonhazardous injection well treatment standards; spent aluminum potliners; and carbamate wastes.

(a) On July 8, 1996, the wastes specified in 40 CFR 261.32 as EPA Hazardous Waste numbers K156–K161; and in 40 CFR 261.33 as EPA Hazardous Waste numbers P127, P128, P185, P188–P192, P194, P196–P199, P201–P205, U271, U277–U280, U364–U367, U372, U373, U375–U379, U381–U387, U389–U396, U400–U404, U407, and U409–U411 are prohibited from land disposal. In addition, soil and debris contaminated with these wastes are prohibited from land disposal.

(b) On July 8, 1996 the wastes identified in 40 CFR 261.23 as D003 that are managed in systems other than those whose discharge is regulated under the Clean Water Act (CWA), or that inject in Class I deep wells regulated under the Safe Drinking Water Act (SDWA), or that are zero dischargers that engage in CWA-equivalent treatment before ultimate land disposal, are prohibited from land disposal. This prohibition does not apply to unexploded ordnance and other explosive devices which have been the subject of an emergency response (such D003 wastes are prohibited unless they meet the treatment standard of DEACT before land disposal (see § 268.40)).

(c) On July 8, 1996, the wastes specified in 40 CFR 261.32 as EPA Hazardous Waste number K088 are prohibited from land disposal. In addition, soil and debris contaminated with these wastes are prohibited from land disposal.

(d) On April 8, 1998, decharacterized wastes managed in surface impoundments whose discharge is regulated under the Clean Water Act (CWA), or decharacterized wastes managed by zero dischargers in surface impoundments or tanks that engage in CWA-equivalent treatment before ultimate land disposal are prohibited from land disposal. The following are exceptions to this requirement:

(1) Surface impoundments which are permitted under subtitle C of RCRA;

(2) Storm water impoundments as defined in § 268.2;

(3) Surface impoundments which are part of facilities in the pulp, paper, and paperboard industrial category.

(e) On April 8, 1998, Radioactive wastes mixed with K088, K156–K161, P127, P128, P185, P188–P192, P194, P196–P199, P201–P205, U271, U277–U280, U364–U367, U372, U373, U375–U379, U381–U387, U389–U396, U400–U404, and U407, U409–U411 are also prohibited from land disposal. In addition, soil and debris contaminated with these radioactive mixed wastes are prohibited from land disposal.

(f) Between July 8, 1996 and April 8, 1998, the wastes included in paragraphs (a), (b), (c), and (e) of this section may be disposed in a landfill or surface impoundment, only if such unit is in compliance with the requirements specified in § 268.5(h)(2).

(g) The requirements of paragraphs (a), (b), (c), (d), and (e) of this section do not apply if:

(1) The wastes meet the applicable treatment standards specified in Subpart D of this part;

(2) Persons have been granted an exemption from a prohibition pursuant to a petition under § 268.6, with respect to those wastes and units covered by the petition;

(3) The wastes meet the applicable alternate treatment standards established pursuant to a petition granted under § 268.44;

(4) Persons have been granted an extension to the effective date of a prohibition pursuant to § 268.5, with respect to these wastes covered by the extension.

(h) To determine whether a hazardous waste identified in this section exceeds the applicable treatment standards specified in § 268.40, the initial generator must test a sample of the waste extract or the entire waste, depending on whether the treatment standards are expressed as concentrations in the waste extract or the waste, or the generator may use knowledge of the waste. If the waste contains constituents in excess of the applicable Subpart D levels, the waste is prohibited from land disposal, and all requirements of this part 268 are applicable, except as otherwise specified.

16. Section 268.40 is amended by revising paragraph (e) and the table at the end of § 268.40 to read as follows:

§ 268.40 Applicability of treatment standards.

* * * * *

(e) For characteristic wastes (D001–D043) that are subject to treatment standards in the following table "Treatment Standards for Hazardous Wastes," all underlying hazardous constituents (as defined in § 268.2(i)) must meet Universal Treatment Standards, found in § 268.48, "Table UTS," prior to land disposal.

(1) When these wastes are managed in wastewater treatment systems regulated by the Clean Water Act (CWA), compliance with the treatment standards must be achieved no later than "end-of-pipe" as defined in § 268.2(k); or

(2) When these wastes are managed in CWA-equivalent treatment systems and tank-based systems that discharge onto the land, compliance with the treatment standards must be achieved no later than the point the wastewater is released to the land (e.g., spray irrigation, discharge to dry river beds, placed into evaporation ponds); or

(3) When these wastes are managed in Class I nonhazardous injection wells, compliance with the treatment standards must be achieved no later than the well head; or

(4) For all other, compliance with the treatment standard must be met prior to land disposal as defined in § 268.2(c).

* * * * *

Treatment Standards for Hazardous Wastes

* * * * *

TREATMENT STANDARDS FOR HAZARDOUS WASTES

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
D001	Ignitable Characteristic Wastes, except for the § 261.21(a)(1) High TOC Subcategory.	NA	NA	DEACT and meet § 268.48 standards; or RORGS; or CMBST[6]	DEACT and meet § 268.48 standards; or RORGS; or CMBST[6]
	High TOC Ignitable Characteristic Liquids Subcategory based on 40 CFR 261.21(a)(1)—*Greater* than or equal to 10% total organic carbon. (Note: This subcategory consists of nonwastewaters only).	NA	NA	NA	RORGS; or CMBST
D002	Corrosive Characteristic Wastes.	NA	NA	DEACT and meet § 268.48 standards[6]	DEACT and meet § 268.48 standards[6]
D002, D004, D005, D006, D007, D008, D009, D010, D011.	Radioactive high level wastes generated during the reprocessing of fuel rods. (Note: This subcategory consists of nonwastewaters only).	Corrosivity (pH)	NA	NA	HLVIT
		Arsenic	7440–38–2	NA	HLVIT
		Barium	7440–39–3	NA	HLVIT
		Cadmium	7440–43–9	NA	HLVIT
		Chromium (Total)	7440–47–3	NA	HLVIT
		Lead	7439–92–1	NA	HLVIT
		Mercury	7439–97–6	NA	HLVIT
		Selenium	7782–49–2	NA	HLVIT
		Silver	7440–22–4	NA	HLVIT
D003	Reactive Sulfides Subcategory based on 261.23(a)(5).	NA	NA	DEACT and meet § 268.48 standards[6]	DEACT and meet § 268.48 standards[6]
	Explosives Subcategory based on 261.23(a) (6), (7) and (8).	NA	NA	DEACT and meet § 268.48 standards[6]	DEACT and meet § 268.48 standards[6]
	Unexploded ordnance and other explosive devices which have been the subject of an emergency response.	NA	NA	DEACT	DEACT
	Other Reactives Subcategory based on 261.23(a)(1).	NA	NA	DEACT and meet § 268.48 standards[6]	DEACT and meet § 268.48 standards[6]
	Water Reactive Subcategory based on 261.23(a) (2), (3), and (4). (Note: This subcategory consists of nonwastewaters only).	NA	NA	NA	DEACT and meet § 268.48 standards[6]
	Reactive Cyanides Subcategory based on 261.23(a)(5).	Cyanides (Total)[7]	57–12–5	Reserved	590
		Cyanides (Amendable)[7]	57–12–5	0.86	30
D004	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for arsenic based on the extraction procedure (EP) in SW846 Methods 1310.	Arsenic	7440–38–2	5.0	5.0 mg/l EP

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
		Arsenic; alternate[6] standard for nonwastewaters only.	7440–38–2	NA	5.0 mg/l TCLP
D005	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for barium based on the extraction procedure (EP) in SW846 Method 1310.	Barium	7440–39–3	100	100 mg/l TCLP
D006	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for cadmium based on the extraction procedure (EP) in SW846 Method 1310.	Cadmium	7440–43–9	1.0	1.0 mg/l TCLP
	Cadmium Containing Batteries Subcategory. (Note: This subcategory consists of nonwastewaters only).	Cadmium	7440–43–9	NA	RTHRM
D007	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for chromium based on the extraction procedure (EP) in SW846 Method 1310.	Chromium (Total)	7440–47–3	5.0	5.0 mg/l TCLP
D008	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for lead based on the extraction procedure (EP) in SW846 Method 1310.	Lead	7439–92–1	5.0	5.0 mg/l EP
		Lead; alternate[6] standard for nonwastewaters only.	7439–92–1	NA	5.0 mg/l TCLP
	Lead Acid Batteries Subcategory (Note: This standard only applies to lead acid batteries that are identified as RCRA hazardous wastes and that are not excluded elsewhere from regulation under the land disposal restrictions of 40 CFR 268 or exempted under other EPA regulations (see 40 CFR 266.80). This subcategory consists of nonwastewaters only.).	Lead	7439–92–1	NA	RLEAD
	Radioactive Lead Solids Subcategory (Note: these lead solids include, but are not limited to, all forms of lead shielding and other elemental forms of lead. These lead solids do not include treatment residuals such as hydroxide sludges, other wastewater treatment residuals, or incinerator ashes that can undergo conventional pozzolanic stabilization, nor do they include organo-lead materials that can be incinerated and stabilized as ash. This subcategory consists of nonwastewaters only).	Lead	7439–92–1	NA	MACRO

D009	Nonwastewaters that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the extraction procedure (EP) in SW846 Method 1310; and contain greater than or equal to 260 mg/kg total mercury that also contain organics and are not incinerator residues. (High Mercury-Organic Subcategory.).	Mercury	7439–97–6	NA	IMERC; OR RMERC
	Nonwastewaters that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the extraction procedure (EP) in SW846 Method 1310; and contain greater than or equal to 260 mg/kg total mercury that are inorganic, including incinerator residues and residues from RMERC. (High Mercury-Inorganic Subcategory.).	Mercury	7439–97–6	NA	RMERC
	Nonwastewaters that exhibit, or are expected to exhibit, the characteristic of toxicity for mercury based on the extraction procedure (EP) in SW846 Method 1310; and contain less than 260 mg/kg total mercury. (Low Mercury Subcategory.).	Mercury	7439–97–6	NA	0.20 mg/l TCLP
	All D009 wastewaters	Mercury	7439–97–6	0.20	NA
	Elemental mercury contaminated with radioactive materials. (Note: This subcategory consists of nonwastewaters only.).	Mercury	7439–97–6	NA	AMLGM
	Hydraulic oil contaminated with Mercury Radioactive Materials Subcategory. (Note: This subcategory consists of nonwastewaters only.).	Mercury	7439–97–6	NA	IMERC
D010	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for selenium based on the extraction procedure (EP) in SW846 Method 1310.	Selenium	7782–49–2	1.0	5.7 mg/l TCLP
D011	Wastes that exhibit, or are expected to exhibit, the characteristic of toxicity for silver based on the extraction procedure (EP) in SW846 Method 1310.	Silver	7440–22–4	5.0	5.0 mg/l TCLP
D012	Wastes that are TC for Endrin based on the TCLP in SW846 Method 1311.	Endrin	72–20–8	BIODG; or CMBST[a]	0.13 and meet § 268.48 standards[a]
		Endrin aldehyde	7421–93–4	BIODG; or CMBST[a]	0.13 and meet § 268.48 standards[a]
D013	Wastes that are TC for Lindane based on the TCLP in SW846 Method 1311.).	alpha-BHC	319–84–6	CARBN; or CMBST[a]	0.066 and meet § 268.48 standards[a]
		beta–BHC	319–85–7	CARBN; or CMBST[a]	0.066 and meet § 268.48 standards[a]
		delta-BHC	319–86–8	CARBN; or CMBST[a]	0.066 and meet § 268.48 standards[a]
		gamma-BHC (Lindane)	58–89–9	CARBN; or CMBST[a]	0.066 and meet § 268.48 standards[a]
D014	Wastes that are TC for Methoxychlor based on the TCLP in SW846 Method 1311.	Methoxychlor	72–43–5	WETOX or CMBST[a]	0.18 and meet § 268.48 standards[a]

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
D015	Wastes that are TC for Toxaphene based on the TCLP in SW846 Method 1311.	Toxaphene	8001–35–2	BIODG or CMBST[6]	2.6 and meet § 268.48 standards[6]
D016	Wastes that are TC for 2,4-D (2,4-Dichlorophenoxyacetic acid) based on the TCLP in SW846 Method 1311.	2,4-D (2,4-Dichlorophenoxyacetic acid).	94–75–7	CHOXD, BIODG, or CMBST[6]	10 and meet § 268.48 standards[6]
D017	Wastes that are TC for 2,4,5-TP (Silvex) based on the TCLP in SW846 Method 1311.	2,4,5-TP (Silvex)	93–72–1	CHOXD or CMBST[6]	7.9 and meet § 268.48 standards[6]
D018	Wastes that are TC for Benzene based on the TCLP in SW846 Method 1311.	Benzene	71–43–2	0.14 and meet § 268.48 standards[6]	10 and meet § 268.48 standards[6]
D019	Wastes that are TC for Carbon tetrachloride based on the TCLP in SW846 Method 1311.	Carbon tetrachloride	56–23–5	0.057 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]
D020	Wastes that are TC for Chlordane based on the TCLP in SW846 Method 1311.	Chlordane (alpha and gamma isomers).	57–74–9	0.0033 and meet § 268.48 standards[6]	0.26 and meet § 268.48 standards[6]
D021	Wastes that are TC for Chlorobenzene based on the TCLP in SW846 Method 1311.	Chlorobenzene	108–90–7	0.057 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]
D022	Wastes that are TC for Chloroform based on the TCLP in SW846 Method 1311.	Chloroform	67–66–3	0.046 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]
D023	Wastes that are TC for o-Cresol based on the TCLP in SW846 Method 1311.	o-Cresol	95–48–7	0.11 and meet § 268.48 standards[6]	5.6 and meet § 268.48 standards[6]
D024	Wastes that are TC for m-Cresol based on the TCLP in SW846 Method 1311.	m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77 and meet § 268.48 standards[6]	5.6 and meet § 268.48 standards[6]
D025	Wastes that are TC for p-Cresol based on the TCLP in SW846 Method 1311.	p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77 and meet § 268.48 standards[6]	5.6 and meet § 268.48 standards[6]
D026	Wastes that are TC for Cresols (Total) based on the TCLP in SW846 Method 1311.	Cresol-mixed isomers (Cresylic acid)(sum of o-, m-, and p-cresol concentrations).	1319–77–3	0.88 and meet § 268.48 standards[6]	11.2 and meet § 268.48 standards[6]
D027	Wastes that are TC for p-Dichlorobenzene based on the TCLP in SW846 Method 1311.	p-Dichlorobenzene (1,4-Dichlorobenzene).	106–46–7	0.090 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]
D028	Wastes that are TC for 1,2-Dichloroethane based on the TCLP in SW846 Method 1311.	1,2-Dichloroethane	107–06–2	0.21 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]
D029	Wastes that are TC for 1,1-Dichloroethylene based on the TCLP in SW846 Method 1311.	1,1-Dichloroethylene	75–35–4	0.025 and meet § 268.48 standards[6]	6.0 and meet § 268.48 standards[6]

D030	Wastes that are TC for 2,4-Dinitrotoluene based on the TCLP in SW846 Method 1311.	2,4-Dinitrotoluene	121–14–2	0.32 and meet § 268.48 standards [8]	140 and meet § 268.48 standards [8]
D031	Wastes that are TC for Heptachlor based on the TCLP in SW846 Method 1311.	Heptachlor	76–44–8	0.0012 and meet § 268.48 standards [8]	0.066 and meet § 268.48 standards [8]
		Heptachlor epoxide	1024–57–3	0.016 and meet § 268.48 standards [8]	0.066 and meet § 268.48 standards [8]
D032	Wastes that are TC for Hexachlorobenzene based on the TCLP in SW846 Method 1311.	Hexachlorobenzene	118–74–1	0.055 and meet § 268.48 standards [8]	10 and meet § 268.48 standards [8]
D033	Wastes that are TC for Hexachlorobutadiene based on the TCLP in SW846 Method 1311.	Hexachlorobutadiene	87–68–3	0.055 and meet § 268.48 standards [8]	5.6 and meet § 268.48 standards [8]
D034	Wastes that are TC for Hexachloroethane based on the TCLP in SW846 Method 1311.	Hexachloroethane	67–72–1	0.055 and meet § 268.48 standards [8]	30 and meet § 268.48 standards [8]
D035	Wastes that are TC for Methyl ethyl ketone based on the TCLP in SW846 Method 1311.	Methyl ethyl ketone	78–93–3	0.28 and meet § 268.48 standards [8]	36 and meet § 268.48 standards [8]
D036	Wastes that are TC for Nitrobenzene based on the TCLP in SW846 Method 1311.	Nitrobenzene	98–95–3	0.068 and meet § 268.48 standards [8]	14 and meet § 268.48 standards [8]
D037	Wastes that are TC for Pentachlorophenol based on the TCLP in SW846 Method 1311.	Pentachlorophenol	87–86–5	0.089 and meet § 268.48 standards [8]	7.4 and meet § 268.48 standards [8]
D038	Wastes that are TC for Pyridine based on the TCLP in SW846 Method 1311.	Pyridine	110–86–1	0.014 and meet § 268.48 standards [8]	16 and meet § 268.48 standards [8]
D039	Wastes that are TC for Tetrachloroethylene based on the TCLP in SW846 Method 1311.	Tetrachloroethylene	127–18–4	0.056 and meet § 268.48 standards [8]	6.0 and meet § 268.48 standards [8]
D040	Wastes that are TC for Trichloroethylene based on the TCLP in SW846 Method 1311.	Trichloroethylene	79–01–6	0.054 and meet § 268.48 standards [8]	6.0 and meet § 268.48 standards [8]
D041	Wastes that are TC for 2,4,5-Trichlorophenol based on the TCLP in SW846 Method 1311.	2,4,5-Trichlorophenol	95–95–4	0.18 and meet § 268.48 standards [8]	7.4 and meet § 268.48 standards [8]
D042	Wastes that are TC for 2,4,6-Trichlorophenol based on the TCLP in SW846 Method 1311.	2,4,6-Trichlorophenol	88–06–2	0.035 and meet § 268.48 standards [8]	7.4 and meet § 268.48 standards [8]
D043	Wastes that are TC for Vinyl chloride based on the TCLP in SW846 Method 1311.	Vinyl chloride	75–01–4	0.27 and meet § 268.48 standards [8]	6.0 and meet § 268.48 standards [8]

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
F001, F002, F003, F004, & F005	F001, F002, F003, F004, and/or F005 solvent wastes that contain any combination of one or more of the following spent solvents: acetone, benzene, n-butyl alcohol, carbon disulfide, carbon tetrachloride, chlorinated fluorocarbons, chlorobenzene, o-cresol, m-cresol, p-cresol, cyclohexanone, o-dichlorobenzene, 2-ethoxyethanol, ethyl acetate, ethyl benzene, ethyl ether, isobutyl alcohol, methanol, methylene chloride, methyl ethyl ketone, methyl isobutyl ketone, nitrobenzene, 2-nitropropane, pyridine, tetrachloroethylene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, 1,1,2-trichloro-1,2,2-trifluorethane, trichloroethane, trichloromonofluouromethane, and/or xylenes [except as specifically noted in other subcategories]. See further details of these listings in § 261.31.	Acetone	67–64–1	0.28	160
		Benzene	71–42–2	0.14	10
		n-Butyl alcohol	71–36–3	5.6	2.6
		Carbon disulfide	75–15–0	3.8	NA
		Carbon tetrachloride	56–23–5	0.057	6.0
		Chlorobenzene	108–90–7	0.057	6.0
		o-Cresol	95–48–7	0.11	5.6
		m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77	5.6
		p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77	5.6
		Cresol-mixed isomers (Cresylic acid) (sum of o-, m-, and p-cresol concentrations.	1319–77–3	0.88	11.2
		Cyclohexanone	108–94–1	0.36	NA
		o-Dichlorobenzene	95–50–1	0.088	6.0
		Ethyl acetate	141–78–6	0.34	33
		Ethyl benzene	100–41–4	0.057	10
		Ethyl ether	60–29–7	0.12	160
		Isobutyl alcohol	78–83–1	5.6	170
		Methanol	67–56–1	5.6	NA
		Methylene chloride	75–9–2	0.089	30
		Methyl ethyl ketone	78–93–3	0.28	36
		Methyl isobutyl ketone	108–10–1	0.14	33
		Nitrobenzene	98–95–3	0.068	14
		Pyridine	110–86–1	0.014	16
		Tetrachloroethylene	127–18–4	0.056	6.0
		Toluene	108–88–3	0.080	10
		1,1,1-Trichlorethane	71–55–6	0.054	6.0
		1,1,2-Trichloroethane	79–00–5	0.054	6.0

		1,1,2-Trichloro-1,2,2-trifluoroethane.	76–13–1	0.057	30
		Trichloroethylene	79–01–6	0.054	6.0
		Trichloromonofluoromethane	75–69–4	0.020	30
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations.	1330–20–7	0.32	30
	F003 and/or F005 solvent wastes that contain any combination of one or more of the following three solvents as the only listed F001–5 solvents: carbon disulfide, cyclohexanone, and/or methanol. (formerly 268.41(c)).	Carbon disulfide	75–15–0	3.8	4.8 mg/1 TCLP
		Cyclohexanone	108–94–1	0.36	0.75 mg/l TCLP
		Methanol	67–56–1	5.6	0.75 mg/l TCLP
	F005 solvent waste containing 2-Nitropropane as the only listed F001–5 solvent..	2-Nitropropane	79–46–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
	F005 solvent waste containing 2—Ethoxyethanol as the only listed F001–5 solvent..	2-Ethoxyethanol	110–80–5	BIODG; or CMBST	CMBST
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) Sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum..	Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amendable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	0.43	0.30 mg/l TCLP
F007	Spent cyanide plating bath solutions from electroplating operations.	Cadmium	7440–43–9	0.69	0.19 mg/1 TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP
F008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.	Cadmium	7440–43–9	NA	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.	Cadmium	7440–43–9	NA	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
F010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.	Cadmium	7440–43–9	NA	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP
F012	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process.	Cadmium	7440–43–9	NA	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process.	Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30

F020, F021, F022, F023, F026	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of: (1) tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives, excluding wastes from the production of Hexachlorophene from highly purified 2,4,5-trichlorophenol (F020); (2) pentachlorophenol, or of intermediates used to produce its derivatives (i.e., F021); (3) tetra-, penta-, or hexachlorobenzenes under alkaline conditions (i.e., F022); and from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of: (1) tri- or tetrachlorophenols, excluding wastes from equipment used only for the production of Hexachlorophene from highly purified 2,4,5-trichlorophenol (F023); (2) tetra-, penta-, or hexachlorobenzenes under alkaline conditions (i.e., F026).	HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		HxCDFs (All Hexachlorodibenzofurans).	NA	0.000063	0.001
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.000035	0.001
		Pentachlorophenol	87–86–5	0.089	7.4
		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		TCDFs (All Tetrachlorodibenzofurans).	NA	0.000063	0.001
		2,4,5-Trichlorophenol	95–95–4	0.18	7.4
		2,4,6-Trichlorophenol	88–06–2	0.035	7.4
		2,3,4,6-Tetrachlorophenol	58–90–2	0.030	7.4
F024	Process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes, from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. (This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and wastes listed in §261.31 or §261.32.).	All F024 wastes	NA	CMBST	CMBST
		2-Chloro-1,3-butadiene	126–99–8	0.057	0.28
		3-Chloropropylene	107–05–1	0.036	30
		1,1-Dichloroethane	75–34–3	0.059	6.0
		1,2-Dichloroethane	107–06–2	0.21	6.0
		1,2-Dichloropropane	78–87–5	0.85	18
		cis-1,3-Dichloropropylene	10061–01–5	0.036	18
		trans-1,3-Dichloropropylene	10061–02–6	0.036	18
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Hexachloroethane	67–72–1	0.055	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
F025	Condensed light ends from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution.	Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		1,2-Dichloroethane	107–06–2	0.21	6.0
		1,1-Dichloroethylene	75–35–4	0.025	6.0
		Methylene chloride	75–9–2	0.089	30
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
		Vinyl chloride	75–01–4	0.27	6.0
	Spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. F025—Spent Filters/Aids and Desiccants Subcategory.	Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Hexachlorobutadiene	87–68–3	0.055	5.6
		Hexachloroethane	67–72–1	0.055	30
		Methylene chloride	75–9–2	0.089	30
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
		Vinyl chloride	75–01–4	0.27	6.0
F027	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. (This listing does not include formulations containing hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component).	HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.059	NA
		HxCDFs (All Hexachlorodibenzofurans).	NA	0.059	3.4
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.14	10
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.059	3.4
		Pentachlorophenol	87–86–5	0.061	3.4

		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.28	28
		TCDFs (All Tetracholorodibenzofurans).	NA	0.059	3.4
		2,4,5-Trichlorophenol	95–95–4	0.057	28
		2,4,6-Trichlorophenol	88–06–2	0.057	10
		2,3,4,6-Tetrachlorophenol	58–90–2	0.059	NA
F028	Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Wastes Nos. F020, F021, F023, F026, and F027.	HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.059	5.6
		HxCDFs (All Hexachlorodibenzofurans).	NA	0.059	5.6
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.039	6.2
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.067	8.2
		Pentachlorophenol	87–86–5	0.080	10
		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.32	30
		TCDFs (All Tetrachlorodibenzofurans).	NA	2.77	0.86 mg/l TCLP
		2,4,5-Trichlorophenol	95–95–4	1.2	590
		2,4,6-Trichlorophenol	88–06–2	0.69	NA
		2,3,4,6-Tetrachlorophenol	58–90–2	3.98	5.0 mg/l TCLP
F037	Petroleum refinery primary oil/water/solids separation sludge—Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow. Sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oil cooling waters, sludges generated in aggressive biological treatment units as defined in §261.31(b)(2) (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing.	Acenaphthene	83–32–9	0.059	NA
		Anthracene	120–12–7	0.059	3.4
		Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Chrysene	218–01–9	0.059	3.4
		Di-n-butyl phthalate	84–74–2	0.057	28
		Ethylbenzene	100–41–4	0.057	10
		Fluorene	86–73–7	0.059	NA
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
F038	Petroleum refinery secondary (emulsified) oil/water/solids separation sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Such wastes include, but are not limited to, all sludges and floats generated in: induced air floatation (IAF) units, tanks and impoundments, and all sludges generated in DAF units. Sludges generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges and floats generated in aggressive biological treatment units as defined in § 261.31(b)(2) (including sludges and floats generated in one or more additional units after wastewaters have been treated in aggressive biological units) and F037, K048, and K051 are not included in this listing.	Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Chrysene	218–01–9	0.059	3.4
		Di-n-butyl phthalate	84–74–2	0.057	28
		Ethylbenzene	100–41–4	0.057	10
		Fluorene	86–73–7	0.059	NA
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP

F039	Leachate (liquids that have percolated through land disposed wastes) resulting from the disposal of more than one restricted waste classified as hazardous under subpart D of this part. (Leachate resulting from the disposal of one or more of the following EPA Hazardous Wastes and no other Hazardous Wastes retains its EPA Hazardous Waste Number(s): F020, F021, F022, F026, F027, and/or F028.).	Acenaphthylene	208–96–8	0.059	3.4
		Acenaphthene	83–32–9	0.059	3.4
		Acetone	67–64–1	0.28	160
		Acetonitrile	75–05–8	5.6	38
		Acetophenone	96–86–2	0.010	9.7
		2-Acetylaminofluorene	53–96–3	0.059	140
		Acrolein	107–02–8	0.29	NA
		Acrylonitrile	107–13–1	0.24	84
		Aldrin	309–00–2	0.021	0.066
		4-Aminobiphenyl	92–67–1	0.13	NA
		Aniline	62–53–3	0.81	14
		Anthracene	120–12–7	0.059	3.4
		Aramite	140–57–8	0.36	NA
		alpha-BHC	319–84–6	0.00014	0.066
		beta-BHC	319–85–7	0.00014	0.066
		delta-BHC	319–86–8	0.023	0.066
		gamma-BHC	58–89–9	0.0017	0.066
		Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene.	205–99–2	0.11	6.8
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene.	207–08–9	0.11	6.8
		Benzo(g,h,i)perylene	191–24–2	0.0055	1.8
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Bromodichloromethane	75–27–4	0.35	15
		Methyl bromide (Bromomethane)	74–83–9	0.11	15
		4-Bromophenyl phenyl ether	101–55–3	0.055	15
		n-Butyl alcohol	71–36–3	5.6	2.6
		Butyl benzyl phthalate	85–68–7	0.017	28
		2-sec-Butyl-4,6-dinitrophenol (Dinoseb).	88–85–7	0.066	2.5
		Carbon disulfide	75–15–0	3.8	4.8 mg/l TCLP
		Carbon tetrachloride	56–23–5	0.057	6.0
		Chlordane (alpha and gamma isomers).	57–74–9	0.0033	0.26
		p-Chloroaniline	106–47–8	0.46	16
		Chlorobenzene	108–90–7	0.057	6.0
		Chlorobenzilate	510–15–6	0.10	NA
		2-Chloro-1,3-butadiene	126–99–8	0.057	0.28
		Chlorodibromomethane	124–48–1	0.057	15
		Chloroethane	75–00–3	0.27	6.0
		bis(2-Chloroethoxy)methane	111–91–1	0.036	7.2
		bis(2-Chloroethyl)ether	111–44–4	0.033	6.0
		Chloroform	67–66–3	0.046	6.0
		bis(2-Chloroisopropyl)ether	39638–32–9	0.055	7.2
		p-Chloro-m-cresol	59–50–7	0.018	14
		Chloromethane (Methyl chlorida)	74–87–3	0.19	30
		2-Chloronaphthalene	91–58–7	0.055	5.6

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
		2-Chlorophenol	95–57–8	0.044	5.7
		3-Chloropropylene	107–05–1	0.036	30
		Chrysene	218–01–9	0.059	3.4
		o-Cresol	95–48–7	0.11	5.6
		m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77	5.6
		p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77	5.6
		Cyclohexanone	108–94–1	0.36	0.75 mg/l TCLP
		1,2-Dibromo-e-chloropropane	96–12–8	0.11	15
		Ethylene dibromide (1,2-Dibromoethane).	106–93–4	0.028	15
		Dibromomethane	74–95–3	0.11	15
		2,4-D (2,4-Dichlorophenoxyacetic acid).	94–75–7	0.72	10
		o,p'-DDD	53–19–0	0.023	0.87
		p,p'-DDD	72–54–8	0.023	0.087
		o,p'-DDE	3424–82–6	0.031	0.087
		p,p'-DDE	72–55–9	0.031	0.087
		o,p'-DDT	789–02–6	0.0039	0.087
		p,p'-DDT	50–29–3	0.0039	0.087
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Dibenz(a,e)pyrene	192–65–4	0.061	NA
		m-Dichlorobenzene	541–73–1	0.036	6.0
		o-Dichlorobenzene	95–50–1	0.088	6.0
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Dichlorodifluoromethane	75–71–8	0.23	7.2
		1,1-Dichloroethane	75–34–3	0.059	6.0
		1,2-Dichloroethane	107–06–2	0.21	6.0
		1,1-Dichloroethylene	75–35–4	0.025	6.0
		trans-1,2-Dichloroethylene	156–60–5	0.054	30
		2,4-Dichlorophenol	120–83–2	0.044	14
		2,6-Dichlorophenol	87–65–0	0.044	14
		1,2-Dichloropropane	78–87–5	0.85	18
		cis-1,3-Dichloropropylene	10061–01–5	0.036	18
		trans-1,3-Dichloropropylene	10061–02–6	0.036	18
		Dieldrin	60–57–1	0.017	0.13
		Diethyl phthalate	84–66–2	0.20	28
		2-4-Dimethyl phenol	105–67–9	0.036	14
		Dimethyl phthalate	131–11–3	0.047	28
		Di-n-butyl phthalate	84–74–2	0.057	28
		1,4-Dinitrobenzene	100–25–4	0.32	2.3
		4,6-Dinitro-o-cresol	534–52–1	0.28	160
		2,4-Dinitrophenol	51–28–5	0.12	160
		2,4-Dinitrotoluene	121–14–2	0.32	140
		2,6-Dinitrotoluene	606–20–2	0.55	28
		Di-n-octyl phthalate	117–84–0	0.017	28
		Di-n-propylnitrosamine	621–64–7	0.40	14

1,4-Dioxane	123–91–1	0.22	170
Diphenylamine (difficult to distinguish from diphenylnitrosamine).	122–39–4	0.92	13
Diphenylnitrosamine (difficult to distinguish from diphenylamine).	86–30–6	0.92	13
1,2-Diphenylhydrazine	122–66–7	0.087	1.5
Disulfoton	298–04–4	0.017	6.2
Endosulfan I	939–98–8	0.023	0.066
Endosulfan II	33213–6–5	0.029	0.13
Endosulfan sulfate	1–31–07–8	0.029	0.13
Endrin	72–20–8	0.0028	0.13
Endrin aldehyde	7421–93–4	0.025	0.13
Ethyl acetate	141–78–6	0.34	33
Ethyl cyanide (Propanenitrile)	107–12–0	0.24	360
Ethyl benzene	100–41–4	0.057	10
Ethyl ether	60–29–7	0.12	160
bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
Ethyl methacrylate	97–63–2	0.14	160
Ethylene oxide	75–21–8	0.12	NA
Famphur	52–85–7	0.017	15
Fluoranthene	206–44–0	0.068	3.4
Fluorene	86–73–7	0.059	3.4
Heptachlor	76–44–8	0.0012	0.066
Heptachlor epoxide	1024–57–3	0.016	0.066
Hexachlorobenzene	118–74–1	0.055	10
Hexachlorobutadiene	87–68–3	0.055	5.6
Hexachlorocyclopentadiene	77–47–4	0.057	2.4
HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.000063	0.001
HxCDFs (All Hexachlorodibenzofurans).	NA	0.000063	0.001
Hexachloroethane	67–72–1	0.055	30
Hexachloropropylene	1888–71–7	0.035	30
Indeno (1,2,3-c,d) pyrene	193–39–5	0.0055	3.4
Iodomethane	74–88–4	0.19	65
Isobutyl alcohol	78–83–1	5.6	170
Isodrin	465–73–6	0.021	0.066
Isosafrole	120–58–1	0.081	2.6
Kepone	143–50–8	0.0011	0.13
Methacrylonitrile	126–98–7	0.24	84
Methanol	67–56–1	5.6	0.75 mg/l TCLP
Methapyrilene	91–80–5	0.081	1.5
Methoxychlor	72–43–5	0.25	0.18
3-Methylcholanthrene	56–49–5	0.0055	15
4,4-Methylene bis(2-chloroaniline)	101–14–4	0.50	30
Methylene chloride	75–09–2	0.089	30
Methyl ethyl ketone	78–93–3	0.28	36
Methyl isobutyl ketone	108–10–1	0.14	33
Methyl methacrylate	80–62–6	0.14	160
Methyl methansulfonate	66–27–3	0.018	NA
Methyl parathion	298–00–0	0.014	4.6
Naphthalene	91–20–3	0.059	5.6
2-Naphthylamine	91–59–8	0.52	NA
p-Nitroaniline	100–01–6	0.028	28
Nitrobenzene	98–95–3	0.068	14
5-Nitro-o-toluidine	99–55–8	0.32	28
p-Nitrophenol	100–02–7	0.12	29
N-Nitrosodiethylamine	55–18–5	0.40	28
N–Nitrosodimethylamine	62–75–9	0.40	2.3

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
		N-Nitroso-di-n-butylamine	924–16–3	0.40	17
		N-Nitrosomethylethylamine	10595–95–6	0.40	2.3
		N-Nitrosomorpholine	59–89–2	0.40	2.3
		N-Nitrosopiperidine	100–75–4	0.013	35
		N-Nitrosophyrrolidine	930–55–2	0.013	35
		Parathion	56–38–2	0.014	4.6
		Total PCBs (sum of all PCB isomer, or all Aroclors).	1336–36–3	0.10	10
		Pentachlorobenzene	608–93–5	0.055	10
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.000035	0.001
		Pentachloronitrobenzene	82–68–8	0.055	4.8
		Pentachlorophenol	87–86–5	0.089	7.4
		Phenacetin	62–44–2	0.081	16
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Phorate	298–02–2	0.021	4.6
		Phthalic anhydride	85–44–9	0.055	28
		Pronamide	23950–58–5	0.093	1.5
		Pyrene	129–00–0	0.067	8.2
		Pyridine	110–86–1	0.014	16
		Safrole	94–59–7	0.081	22
		Silvex (2,4,5-TP)	93–72–1	0.72	7.9
		2,4,5-T	93–76–5	0.72	7.9
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		TCDFs (All Tetrachlorodibenzofurans).	NA	0.000063	0.001
		1,1,1,2-Tetrachloroethane	630–20–6	0.057	6.0
		1,1,1,2-Tetrachloroethane	79–34–6	0.057	6.0
		Tetrachloroethylene	127–18–4	0.056	6.0
		2,3,4,6-Tetrachlorophenol	58–90–2	0.030	7.4
		Toluene	108–88–3	0.080	10
		Toxaphene	8001–35–2	0.0095	2.6
		Bromoform (Tribromomethane)	75–25–2	0.63	15
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
		Trichloromonofluoromethane	75–69–4	0.020	30
		2,4,5-Trichlorophenol	95–95–4	0.18	7.4
		2,4,6-Trichlorophenol	88–06–2	0.035	7.4
		1,2,3-Trichloropropane	96–18–4	0.85	30
		1,1,2-Trichloro-1,2,2-trifluoroethane.	76–13–1	0.057	30

		tris(2,3-Dibromopropyl) phosphate	126–72–7	0.11	0.10
		Vinyl chloride	75–01–4	0.27	6.0
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Antimony	7440–36–0	1.9	2.1 mg/l TCLP
		Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
		Barium	7440–39–3	1.2	7.6 mg/l TCLP
		Beryllium	7440–41–7	0.82	0.014 mg/l TCLP
		Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Fluoride	16964–48–8	35	48
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Mercury	7439–97–6	0.15	0.025 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Selenium	7782–49–2	0.82	0.16 mg/l TCLP
		Silver	7440–22–4	0.43	0.30 mg/l TCLP
		Sulfide	8496–25–8	14	NA
		Thallium	7440–28–0	1.4	0.078 mg/l TCLP
		Vanadium	7440–62–2	4.3	0.23
K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol..	Naphthalene	91–20–3	0.059	5.6
		Pentachlorophenol	87–86–5	0.089	7.4
		Phenanthrene	85–01–8	0.059	5.6
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K003	Wastewater treatment sludge from the production of molybdate orange pigments.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K004	Wastewater treatment sludge from the production of zinc yellow pigments.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K005	Wastewater treatment sludge from the production of chrome green pigments.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous).	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
	Wastewater treatment sludge from the production of chrome oxide green pigments (hydrated).	Lead	7439–92–1	0.69	NA
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K007	Wastewater treatment sludge from the production of iron blue pigments.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
K008	Oven residue from the production of chrome oxide green.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l
		Lead	7439–92–1	0.69	0.37 mg/l TCLP

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K009	Distillation bottoms from the production of acetaldehyde from ethylene.	Chloroform	67–66–3	0.046	6.0
K010	Distillation side cuts from the procduction of acetaldehyde from ethylene.	Chloroform	67–66–3	0.046	6.0
K011	Bottom stream from the wastewater stripper in the production of acrylonitrile.	Acetonitrile	75–05–8	5.6	38
		Acrylonitrile	107–13–1	0.24	84
		Acrylamide	79–06–1	19	23
		Benzene	71–43–2	0.14	10
		Cyanide (Total)	57–12–5	1.2	590
K013	Bottom stream from the acetonitrile column in the production of acrylonitrile..	Acetonitrile	75–05–8	5.6	38
		Acrylonitrile	107–13–1	0.24	84
		Acrylamide	79–06–1	19	23
		Benzene	71–43–2	0.14	10
		Cyanide (Total)	57–12–5	1.2	590
K014	Bottoms from the acetonitrile purification column in the production of acrylonitrile.	Acetonitrile	75–05–8	5.6	38
		Acrylonitrile	107–13–1	0.24	84
		Acrylamide	79–06–1	19	23
		Benzene	71–43–2	0.14	10
		Cyanide (Total)	57–12–5	1.2	590
K015	Still bottoms from the distillation of benzyle chloride..	Anthracene	120–12–7	0.059	3.4
		Benzal chloride	98–87–3	0.055	6.0
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene.	205–99–2	0.11	6.8
		Benzo(k)fluroanthene (difficult to distinguish from benzo(b) fluoranthene.	207–08–9	0.11	6.8
		Phenanthrene	85–01–8	0.059	5.6
		Toluene	108–88–3	0.080	10
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
K016	Heavy ends or distillation residues from the production of carbon tetrachloride.	Hexachlorobenzene	118–74–1	0.055	10
		Hexachlorobutadiene	87–68–3	0.055	5.6
		Hexachlorocyclopentadiene	77–47–4	0.057	2.4
		Hexachloroethane	67–72–1	0.055	30
		Tetrachloroethylene	127–18–4	0.056	6.0
K017	Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.	bis(2-Chloroethyl)ether	111–44–4	0.033	6.0
		1,2-Dichloropropane	78–87–5	0.85	18
		1,2,3-Trichloropropane	96–18–4	0.85	30
K018	Heavy ends from the fractionation column in ethyl chloride production.	Chloroethane	75–00–3	0.27	6.0
		Chloromethane	74–87–3	0.19	NA

		1,1-Dichloroethane	75–34–3	0.059	6.0
		1,2-Dichloroethane	107–06–2	0.21	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Hexachlorobutadiene	87–68–3	0.055	5.6
		Hexachloroethane	67–72–1	0.055	30
		Pentachloroethane	76–01–7	NA	6.0
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production..	bis(2-Chloroethyl)ether	111–44–4	0.033	6.0
		Chlorobenzene	108–90–7	0.057	6.0
		Chloroform	68–66–3	0.046	6.0
		p-Dichlorobenzene	106–46–7	0.090	NA
		1,2-Dichloroethane	107–06–2	0.21	6.0
		Fluorene	86–73–7	0.059	NA
		Hexachloroethane	67–72–1	0.055	30
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	NA
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production.	1,2-Dichloroethane	107–06–2	0.21	6.0
		1,1,2,2-Tetrachloroethane	79–34–6	0.057	6.0
		Tetrachloroethylene	127–18–4	0.056	6.0
K021	Aqueous spent antimony catalyst waste from fluoromethanes production.	Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Antimony	7440–36–0	1.9	2.1 mg/l TCLP
K022	Distillation bottom tars from the production of phenol/acetone from cumene.	Toluene	108–88–3	0.080	10
		Acetophenone	96–86–2	0.010	9.7
		Diphenylamine (difficult to distinguish from diphenylnitrosamine).	122–39–4	0.92	13
		Diphenylnitrosamine (difficult to distinguish from diphenylamine).	86–30–6	0.92	13
		Phenol	108–95–2	0.039	6.2
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
K023	Distillation light ends from the production of phthalic anhydride from naphthalene.	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	100–21–0	0.055	28
		Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	85–44–9	0.055	28
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene.	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	100–21–0	0.055	28
		Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	85–44–9	0.055	28
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene.	NA	NA	LLEXT fb SSTRP fb CARBN; or CMBST	CMBST
K026	Stripping still tails from the production of methyl ethyl pyridines.	NA	NA	CMBST	CMBST
K027	Centrifuge and distillation residues from toluene diisocyanate production.	NA	NA	CARBN; or CMBST	CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.	1,1-Dichloroethane	75–34–3	0.059	6.0
		trans-1,2-Dichloroethylene	156–60–5	0.054	30
		Hexachlorobutadiene	87–68–3	0.055	5.6
		Hexachloroethane	67–72–1	0.055	30
		Pentachloroethane	76–01–7	NA	6.0
		1,1,1,2-Tetrachloroethane	630–20–6	0.057	6.0
		1,1,2,2-Tetrachloroethane	79–34–6	0.057	6.0
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Cadmium	7440–43–9	0.69	NA
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane.	Chloroform	67–66–3	0.046	6.0
		1,2-Dichloroethane	107–06–2	0.21	6.0
		1,1-Dichloroethylene	75–35–4	0.025	6.0
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
		Vinyl chloride	75–01–4	0.27	6.0
K030	Column bodies or heavy ends from the combined production of trichloroethylene and perchloroethylene.	o-Dichlorobenzene	95–50–1	0.088	NA
		p-Dichlorobenzene	106–46–7	0.090	NA
		Hexachlorobutadiene	87–68–3	0.055	5.6
		Hexachloroethane	67–72–1	0.055	30
		Hexachloropropylene	1888–71–7	NA	30
		Pentachlorobenzene	608–93–5	NA	10
		Pentachloroethane	76–01–7	NA	6.0
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
K031	By-product salts generated in the production of MSMA and cacodylic acid.	Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
K032	Wastewater treatment sludge from the production of chlordane.	Hexachlorocyclopentadiene	77–47–4	0.057	2.4
		Chlordane (alpha and gamma isomers).	57–74–9	0.0033	0.26
		Heptachlor	76–44–8	0.0012	0.066
		Heptachlor epoxide	1024–57–3	0.016	0.066
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.	Hexachlorocyclopentadiene	77–47–4	0.057	2.4
K034	Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane.	Hexachlorocyclpentadiene	77–47–4	0.057	2.4

K035	Wastewater treatment sludges generated in the production of creosote.	Acenaphthene	83–32–9	NA	3.4
		Anthracene	120–12–7	NA	3.4
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Chrysene	218–01–9	0.059	3.4
		o-Cresol	95–48–7	0.11	5.6
		m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77	5.6
		p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77	5.6
		Dibenz(a,h)anthracene	53–70–3	NA	8.2
		Fluoranthene	206–44–0	0.068	3.4
		Fluorene	86–73–7	NA	3.4
		Indeno(1,2,3-cd)pyrene	193–39–5	NA	3.4
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2
K036	Still bottoms from toluene reclamation distillation in the production of disulfoton.	Disulfoton	298–04–4	0.017	6.2
K037	Wastewater treatment sludges from the production of disulfoton.	Disulfoton	298–04–4	0.017	6.2
		Toluene	108–88–3	0.080	10
K038	Wastewater from the washing and stripping of phorate production.	Phorate	298–02–2	0.021	4.6
K039	Filter cake from the filtration of diethylphosphorodithioc acid in the production of phorate.	NA	NA	CARBN, or CMBST	CMBST
K040	Wastewater treatment sludge from the production of phorate.	Phorate	298–02–2	0.021	4.6
K041	Wastewater treatment sludge from the production of toxaphene.	Toxaphene	8001–35–2	0.0095	2.6
K042	Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T.	o-Dichlorobenzene	95–50–1	0.088	6.0
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Pentachlorobenzene	608–93–5	0.055	10
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
K043	2,6-Dichlorophenol waste from the production of 2,4-D.	2,4-Dichlorophenol	120–83–2	0.044	14
		2,6-Dichlorophenol	187–65–0	0.044	14
		2,4,5-Trichlorophenol	95–95–4	0.18	7.4
		2,4,6-Trichlorophenol	88–06–2	0.035	7.4
		2,3,4,6-Tetrachlorophenol	58–90–2	0.030	7.4
		Pentachlorophenol	87–86–5	0.089	7.4
		Tetrachloroethylene	127–18–4	0.056	6.0
		HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		HxCDFs (All Hexachlorodibenzofurans).	NA	0.000063	0.001
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.000035	0.001
		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.000063	0.001

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
		TCDFs (All Tetrachlorodibenzofurans).	NA	0.000063	0.001
K044	Wastewater treatment sludges from the manufacturing and processing of explosives.	NA	NA	DEACT	DEACT
K045	Spent carbon from the treatment of wastewater containing explosives.	NA	NA	DEACT	DEACT
K046	Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds.	Lead	7439–92–1	0.69	0.37 mg/l TCLP
K047	Pink/red water from TNT operations	NA	NA	DEACT	DEACT
K048	Dissolved air flotation (DAF) float from the petroleum refining industry.	Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Chrysene	218–01–9	0.059	3.4
		Di-n-butyl phthalate	84–74–2	0.057	28
		Ethylbenzene	100–41–4	0.057	10
		Fluorene	86–73–7	0.059	NA
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–33	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP
K049	Slop oil emulsion solids from the petroleum refining industry.	Anthracene	120–12–7	0.059	3.4
		Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Carbon disulfide	75–15–0	3.8	NA
		Chrysene	2218–01–9	0.059	3.4
		2,4-Dimethylphenol	105–67–9	0.036	NA
		Ethylbenzene	100–41–4	0.057	10
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30

		Cyanides (Total)[7]	57–12–5	1.2	590
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry.	Benzo(a)pyrene	50–32–8	0.061	3.4
		Phenol	108–95–2	0.039	6.2
		Cyanides (Total)[7]	57–12–5	1.2	590
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP
K051	API separator sludge from the petroleum refining industry.	Acenaphthene	83–32–9	0.059	NA
		Anthracene	120–12–7	0.059	3.4
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
		Chrysene	2218–01–9	0.059	3.4
		Di-n-butyl phthalate	105–67–9	0.057	28
		Ethylbenzene	100–41–4	0.057	10
		Fluorene	86–73–7	0.059	NA
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–3	0.08	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1330–20–7	0.32	30
		Cyanides (Total)[7]	57–12–5	1.2	590
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP
K052	Tank bottoms (leaded) from the petroleum refining industry.	Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		o-Cresol	95–48–7	0.11	5.6
		m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77	5.6
		p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77	5.6
		2,4-Dimethylphenol	105–67–9	0.036	NA
		Ethylbenzene	100–41–4	0.057	10
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Toluene	108–88–3	0.08	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1330–20–7	0.32	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Lead	7439–92–1	0.69	NA
		Nickel	7440–02–0	NA	5.0 mg/l TCLP
K060	Ammonia still lime sludge from coking operations ...	Benzene	71–43–2	0.14	10
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Naphthalene	91–20–3	0.059	5.6
		Phenol	108–95–2	0.039	6.2

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K061	Emission control dust/sludge from the primary production of steel in electric furnaces.	Cyanides (Total)[7]	57–12–5	1.2	590
		Antimony	7440–36–0	NA	2.1 mg/l TCLP
		Arsenic	7440–38–2	NA	5.0 mg/l TCLP
		Barium	7440–39–3	NA	7.6 mg/l TCLP
		Beryllium	7440–41–7	NA	0.014 mg/l TCLP
		Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Mercury	7439–97–6	NA	0.025 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Selenium	7782–49–2	NA	0.16 mg/l TCLP
		Silver	7440–22–4	NA	0.30 mg/l TCLP
		Thallium	7440–28–0	NA	0.078 mg/l TCLP
		Zinc	7440–66–6	NA	5.3 mg/l TCLP
K062	Spent pickle liquor generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332).	Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
K069	Emission control dust/sludge from secondary lead smelting.—Calcium Sulfate (Low Lead) Subcategory.	Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
	Emission control dust/sludge from secondary lead smelting—Non-Calcium Sulfate (High Lead) Subcategory.	NA	NA	NA	RLEAD
K071	K071 (Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used) nonwastewaters that are residues from RMERC.	Mercury	7439–97–6	NA	0.02 mg/l TCLP
	K071 (Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used) nonwastewaters that are not residues from RMERC.	Mercury	7439–97–6	NA	0.025 mg/l TCLP
	All K071 wastewaters	Mercury	7439–97–6	0.15	NA
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.	Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Hexachloroethane	67–72–1	0.055	30
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
K083	Distillation bottoms from aniline production	Aniline	62–53–3	0.81	14
		Benzene	71–43–2	0.14	10
		Cyclohexanone	108–94–1	0.36	NA

		Diphenylamine (difficult to distinguish from diphenylnitrosamine).	122–39–4	0.92	13
		Diphenylnitrosamine (difficult to distinguish from diphenylamine).	86–30–6	0.92	13
		Nitrobenzene	98–95–3	0.068	14
		Phenol	108–95–2	0.039	6.2
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
K085	Distillation or fractionation column bottoms from the production of chlorobenzenes.	Benzene	71–43–2	0.14	10
		Chlorobenzene	108–90–7	0.057	6.0
		m-Dichlorobenzene	541–73–1	0.036	6.0
		o-Dichlorobenzene	95–50–1	0.088	6.0
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Total PCBs (sum of all PCB isomers, or all Aroclors).	1336–36–3	0.10	10
		Pentachlorobenzene	608–93–5	0.055	10
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
K086	Solvent wastes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead.	Acetone	67–64–1	0.28	160
		Acetophenone	96–86–2	0.010	9.7
		bis(2-Ethylhexyl phthalate	117–81–7	0.28	28
		n-Butyl alcohol	71–36–3	5.6	2.6
		Butylbenzyl phthalate	85–68–7	0.017	28
		Cyclohexanone	108–94–1	0.36	NA
		o-Dichlorobenzene	95–50–1	0.088	6.0
		Diethyl phthalate	84–66–2	0.20	28
		Dimethyl phthalate	131–11–3	0.047	28
		Di-n-butyl phthalate	84–74–2	0.057	28
		Di-n-octyl phthalate	117–84–0	0.017	28
		Ethyl acetate	141–78–6	0.34	33
		Ethylbenzene	100–41–4	0.057	10
		Menthanol	67–56–1	5.6	NA
		Methyl ethyl ketone	78–93–3	0.28	36
		Methyl isobutyl ketone	108–10–1	0.14	33
		Methylene chloride	75–09–2	0.089	30
		Naphthalene	91–20–3	0.059	5.6
		Nitrobenzene	98–95–3	0.068	14
		Toluene	108–88–3	0.080	10
		1,1,1-Trichloroethane	71–55–6	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
		Xylenes-mixed isomers (sum of o-,m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
K087	Decanter tank tar sludge from coking operations	Acenaphthylene	208–96–8	0.059	3.4
		Benzene	71–43–2	0.14	10
		Chrysene	218–01–9	0.059	3.4
		Fluoranthene	206–44–0	0.068	3.4
		Indeno(1,2,3-cd)pyrene	193–39–5	0.0055	3.4

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
		Naphthalene	91–20–3	0.059	5.6
		Phenanthrene	85–01–8	0.059	5.6
		Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations)	1330–20–7	0.32	30
K088	Spent potliners from primary aluminum reduction	Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Acenaphthene	83–32–9	0.059	3.4
		Anthracene	120–12–7	0.059	3.4
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene	205–99–2	0.11	6.8
		Benzo(k)fluoranthene	207–08–9	0.11	6.8
		Benzo(g,h,i)perylene	191–24–2	0.0055	1.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Fluoranthene	206–44–0	0.068	3.4
		Indeno(1,2,3-c,d)pyrene	193–39–5	0.0055	3.4
		Phenanthrene	85–01–8	0.059	5.6
		Pyrene	129–00–0	0.067	8.2
		Antimony	7440–36–0	1.9	2.1 mg/l TCLP
		Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
		Barium	7440–39–3	1.2	7.6 mg/l TCLP
		Beryllium	7440–41–7	0.82	0.014 mg/l TCLP
		Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Mercury	7439–97–6	0.15	0.025 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Selenium	7782–49–2	0.82	0.16 mg/l TCLP
		Silver	7440–22–4	0.43	0.30 mg/l TCLP
		Cyanide (Total)	57–12–5	1.2	590
		Cyanide (Amenable)	57–12–5	0.86	30
		Fluoride	16984–48–8	35	48 mg/l TCLP
K093	Distillation light ends from the production of phthalic anhydride from ortho-xylene.	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	100–21–0	0.055	28
		Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	85–44–9	0.055	28
K094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene.	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	100–21–0	0.055	28
		Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	85–44–9	0.055	28

K095	Distillation bottoms from the production of 1,1,1-trichloroethane.	Hexachloroethane	67–72–1	0.055	30
		Pentachloroethane	76–01–7	0.055	6.0
		1,1,1,2-Tetrachloroethane	630–20–6	0.057	6.0
		1,1,2,2-Tetrachloroethane	79–34–6	0.057	6 0
		Tetrachloroethylene	127–18–4	0.056	6 0
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.	m-Dichlorobenzene	541–73–1	0.036	6.0
		Pentachloroethane	76–01–7	0.055	6.0
		1,1,1,2-Tetrachloroethane	630–20–6	0.057	6.0
		1,1,2,2-Tetrachloroethane	79–34–6	0.057	6.0
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
		1,1,2-Trichloroethane	79–00–5	0.054	6.0
		Trichloroethylene	79–01–6	0.054	6.0
K097	Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane.	Chlordane (alpha and gamma isomers).	57–74–9	0.0033	0.26
		Heptachlor	76–44–8	0.0012	0.066
		Heptachlor epoxide	1024–57–3	0.016	0.066
		Hexachlorocyclopentadiene	77–47–4	0.057	2.4
K098	Untreated process wastewater from the production of toxaphene.	Toxaphene	8001–35–2	0.0095	2.6
K099	Untreated wastewater from the production of 2,4-D	2,4-Dichlorophenoxyacetic acid	94–75–7	0.72	10
		HxCDDs (All Hexachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		HxCDFs (All Hexachlorodibenzofurans).	NA	0.000063	0.001
		PeCDDs (All Pentachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		PeCDFs (All Pentachlorodibenzofurans).	NA	0.000035	0.001
		TCDDs (All Tetrachlorodibenzo-p-dioxins).	NA	0.000063	0.001
		TCDFs (All Tetrachlorodibenzofurans).	NA	0.000063	0.001
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting.	Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
		Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	o-Nitroaniline	88–74–4	0.27	14
		Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
		Cadmium	7440–43–9	0.69	NA
		Lead	7439–92–1	0.69	NA
		Mercury	7439–97–6	0.15	NA
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	o-Nitrophenol	88–75–5	0.028	13
		Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
		Cadmium	7440–43–9	0.69	NA
		Lead	7439–92–1	0.69	NA
		Mercury	7439–97–6	0.15	NA

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K103	Process residues from aniline extraction from the production of aniline.	Aniline	62–53–3	0.81	14
		Benzene	71–43–2	0.14	10
		2,4-Dinitrophenol	51–28–5	0.12	160
		Nitrobenzene	98–95–3	0.068	14
		Phenol	108–95–2	0.039	6.2
K104	Combined wastewater streams generated from nitrobenzene/aniline production.	Aniline	62–53–3	0.81	14
		Benzene	71–43–2	0.14	10
		2,4-Dinitrophenol	51–28–5	0.12	160
		Nitrobenzene	98–95–3	0.068	14
		Phenol	108–95–2	0.039	6.2
		Cyanides (Total)[7]	57–12–5	1.2	590
K105	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.	Benzene	71–43–2	0.14	10
		Chlorobenzene	108–90–7	0.057	6.0
		2-Chlorophenol	95–57–8	0.044	5.7
		o-Dichlorobenzene	95–50–1	0.088	6.0
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Phenol	108–95–2	0.039	6.2
		2,4,5-Trichlorophenol	95–95–4	0.18	7.4
		2,4,6-Trichlorophenol	88–06–2	0.035	7.4
K106	K106 (wastewater treatment sludge from the mercury cell process in chlorine production) nonwastewaters that contain greater than or equal to 260 mg/kg total mercury.	Mercury	7439–97–6	NA	RMERC
	K106 (wastewater treatment sludge from the mercury cell process in chlorine production) nonwastewaters that contain less than 260 mg/kg total mercury that are residues from RMERC.	Mercury	7439–97–6	NA	0.20 mg/l TCLP
	Other K106 nonwastewaters that contain less than 260 mg/kg total mercury and are not residues from RMERC.	Mercury	7439–97–6	NA	0.025 mg/l TCLP
	All K106 wastewaters	Mercury	7439–97–6	0.15	NA
K107	Column bottoms from product separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.	NA	NA	CMBST; or CHOXD fb CARBN; or BIODG fb CARBN	CMBST
K108	Condensed column overheads from product separation and condensed reactor vent gases from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazines.	NA	NA	CMBST; or CHOXD fb CARBN; or BIODG fb CARBN	CMBST
K109	Spent filter cartridges from product purification from the production of 1,1-dimethyhydrazine (UDMH) from carboxylic acid hydrazides.	NA	NA	CMBST; or CHOXD fb CARBN; or BIODG fb CARBN	CMBST

K110	Condensed column overheads from intermediate separation from the production of 1,1-dimethyhydrazine (UDMH) from carboxylic acid hydrazides.	NA	NA	CMBST; or CHOXD fb CARBN; or BIODG fb CARBN	CMBST
K111	Product washwaters from the production of dinitrotoluene via nitration of toluene.	2,4-Dinitrotoluene	121–1–2	0.32	140
		2,6-Dinitrotoluene	606–20–2	0.55	28
K112	Reaction by-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.	NA	NA	CMBST; or CHOXD fb CARBN; or BIODG fb CARBN	CMBST
K113	Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	NA	NA	CARBN; or CMBST	CMBST
K114	Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	NA	NA	CARBN; or CMBST	CMBST
K115	Heavy ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		NA	NA	CARBN; or CMBST	CMBST
K116	Organic condensate from the solvent recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine.	NA	NA	CARBN; or CMBST	CMBST
K117	Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene.	Methyl bromide (Bromomethane)	74–83–9	0.11	15
		Chloroform	67–66–3	0.046	6.0
		Ethylene dibromide (1,2-Dibromoethane).	106–93–4	0.028	15
K118	Spent absorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	Methyl bromide (Bromomethane)	74–83–9	0.11	15
		Chloroform	67–66–3	0.046	6.0
		Ethylene dibromide (1,2-Dibromoethane).	106–93–4	0.028	15
K123	Process wastewater (including supernates, filtrates, and washwaters) from the production of ethylenebisdithiocarbamic acid and its salts.	NA	NA	CMBST; or CHOXD fb (BIODG or CARBN)	CMBST
K124	Reactor vent scrubber water from the production of ethylenebisdithiocarbamic acid and its salts.	NA	NA	CMBST; or CHOXD fb (BIODG or CARBN)	CMBST
K125	Filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts.	NA	NA	CMBST; or CHOXD fb (BIODG or CARBN)	CMBST
K126	Baghouse dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts.	NA	NA	CMBST; or CHOXD fb (BIODG or CARBN)	CMBST
K131	Wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide.	Methyl bromide (Bromomethane)	74–83–9	0.11	15

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K132	Spent absorbent and wastewater separator solids from the production of methyl bromide.	Methyl bromide (Bromomethane)	74–83–9	0.11	15
K136	Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	Methyl bromide (Bromomethane)	74–83–9	0.11	15
		Chloroform	67–66–3	0.046	6.0
		Ethylene dibromide (1,2-Dibromoethane).	106–93–4	0.028	15
K140	Waste solids and filter cartridges from the production of 2,4,6-tribromophenol.	2,4,6-Tribromophenol	118–79–6	0.035	7.4
K141	Process residues from the recovery of coal tar, including, but not limited to, collecting sump residues from the production of coke or the recovery of coke by-products produced from coal. This listing does not include K087 (decanter tank tar sludge from coking operations).	Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–2–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Indeno(1,2,3–cd)pyrene	193–39–5	0.0055	3.4
K142	Tar storage tank residues from the production of coke from coal or from the recovery of coke by-products produced from coal.	Benzene	71–43–2	0.14	10
		Benz(a)anthracene	50–32–8	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Indeno(1,2,3–cd)pyrene	193–39–5	0.0055	3.4
K143	Process residues from the recovery of light oil, including, but not limited to, those generated in stills, decanters, and wash oil recovery units from the recovery of coke by-products produced from coal.	Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4

		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k) fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Benzene	71–43–2	0.14	10
		Chrysene	218–01–9	0.059	3.4
K144	Wastewater sump residues from light oil refining, including, but not limited to, intercepting or contamination sump sludges from the recovery of coke by-products produced from coal.	Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
K145	Residues from naphthalene collection and recovery operations from the recovery of coke by-products produced from coal.	Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Naphthalene	91–20–3	0.059	5.6
K147	Tar storage tank residues from coal tar refining	Benzene	71–43–2	0.14	10
		Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Indeno(1,2,3-cd)pyrene	193–39–5	0.0055	3.4
K148	Residues from coal tar distillation, including, but not limited to, still bottoms.	Benz(a)anthracene	56–55–3	0.059	3.4
		Benzo(a)pyrene	50–32–8	0.061	3.4
		Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene).	205–99–2	0.11	6.8
		Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene).	207–08–9	0.11	6.8
		Chrysene	218–01–9	0.059	3.4
		Dibenz(a,h)anthracene	53–70–3	0.055	8.2
		Indeno(1,2,3-cd)pyrene	193–39–5	0.0055	3.4

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
K149	Distillation bottoms from the production of alpha- (or methyl-) chlorinated toluenes, ring-chlorinated toluenes, benzoyl chlorides, and compounds with mixtures of these functional groups. (This waste does not include still bottoms from the distillations of benzyl chloride.).	Chlorobenzene	108–90–7	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Chloromethane	74–87–3	0.19	30
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Pentachlorobenzene	608–93–5	0.055	10
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		Toluene	108–88–3	0.080	10
K150	Organic residuals, excluding spent carbon adsorbent, from the spent chlorine gas and hydrochloric acid recovery processes associated with the production of alpha- (or methyl-) chlorinated toluenes, ring-chlorinated toluenes, benzoyl chlorides, and compounds with mixtures of these functional groups.	Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Chloromethane	74–87–3	0.19	30
		p-Dichlorobenzene	106–46–7	0.090	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Pentachlorobenzene	608–93–5	0.055	10
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		1,1,2,2-Tetrachlorotehane	79–34–5	0.057	6.0
		Tetrachloroethylene	127–18–4	0.056	6.0
		1,2,4-Trichlorobenzene	120–82–1	0.055	19
K151	Wastewater treatment sludges, excluding neutralization and biological sludges, generated during the treatment of wastewaters from the production of alpha- (or methyl-) chlorinated toluenes, ring-chlorinated toluenes, benzoyl chlorides, and compounds with mixtures of these functional groups.	Benzene	71–43–2	0.14	10
		Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Hexachlorobenzene	118–74–1	0.055	10
		Pentachlorobenzene	608–93–5	0.055	10
		1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
		Tetrachloroethylene	127–18–4	0.056	6.0
		Toluene	108–88–3	0.080	10
K156	Organic waste (including heavy ends, still bottoms, light ends, spent solvents, filtrates, and decantates) from the production of carbamates and carbamoyl oximes.	Acetone	67–64–1	0.28	160
		Acetonitrile	75–05–8	5.6	1.8
		Acetophenone	96–86–2	0.010	9.7
		Aniline	62–53–3	0.81	14
		Benomyl	17804–35–2	0.056	1.4
		Benzene	71–43–2	0.14	10
		Carbaryl	63–25–21	0.006	0.14
		Carbenzadim	10605–21–7	0.056	1.4
		Carbofuran	1563–66–2	0.006	0.14
		Carbosulfan	55285–14–8	0.028	1.4
		Chlorobenzene	108–90–7	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		o-Dichlorobenzene	95–50–1	0.088	6.0
		Hexane	110–54–3	0.611	10
		Methomyl	16752–77–5	0.028	0.14
		Methylene chloride	75–09–2	0.089	30
		Methyl ethyl ketone	78–93–3	0.28	36
		Methyl isobutyl ketone	108–10–1	0.14	33
		Naphthalene	91–20–3	0.059	5.6
		Phenol	108–95–2	0.039	6.2
		Pyridine	110–86–1	0.014	16

		Toluene	108–88–3	0.080	10
		Triethylamine	121–44–8	0.081	1.5
		Xylenes (total)	1330–20–7	0.32	30
K157..	Wastewaters (including scrubber waters, condenser waters, washwaters, and separation waters) from the production of carbamates and carbamoyl oximes.	Acetone	67–64–1	0.28	160
		Carbon tetrachloride	56–23–5	0.057	6.0
		Chloroform	67–66–3	0.046	6.0
		Chloromethane	74–87–3	0.19	30
		Methanol	67–56–1	5.6	0.75 mg/l TCLP
		Methomyl	16752–77–5	0.028	0.14
		Methylene chloride	75–09–2	0.089	30
		Methyl ethyl ketone	78–93–3	0.28	36
		Methyl isobutyl ketone	108–10–1	0.14	33
		o-Phenylenediamine	95–54–5	0.056	5.6
		Pyridine	110–86–1	0.014	16
		Triethylamine	121–44–8	0.081	1.5
K158..	Bag house dusts and filter/separation solids from the production of carbamates and carbamoyl oximes.	Benomyl	17804–35–2	0.056	1.4
		Benzene	71–43–2	0.14	10
		Carbenzadim	10605–21–7	0.056	1.4
		Carbofuran	1563–66–2	0.006	0.14
		Carbosulfan	55285–14–8	0.028	1.4
		Chloroform	67–66–3	0.046	6.0
		Hexane	110–54–3	0.611	10
		Methanol	67–56–1	5.6	0.75 mg/l TCLP
		Methylene chloride	75–09–2	0.089	30
		Phenol	108–95–2	0.039	6.2
		Xylenes (total)	1330–20–7	0.32	30
K159..	Organics from the treatment of thiocarbamate wastes.	Benzene	71–43–2	0.14	10
		Butylate	2008–41–5	0.003	1.5
		EPTC (Eptam)	759–94–4	0.003	1.4
		Molinate	2212–67–1	0.003	1.4
		Pebulate	1114–71–2	0.003	1.4
		Thiocarbamate, N.O.S.	NA	0.003	1.4
		Vernolate	1929–77–7	0.003	1.4
K160..	Solids (including filter wastes, separation solids, and spent catalysts) from the production of thiocarbamates and solids from the treatment of thiocarbamate wastes.	Butylate	2008–41–5	0.003	1.5
		EPTC (Eptam)	759–94–4	0.003	1.4
		Molinate	2212–67–1	0.003	1.4
		Pebulate	1114–71–2	0.003	1.4
		Thiocarbamate, N.O.S.	NA	0.003	1.4
		Toluene	108–88–3	0.080	10
		Vernolate	1929–77–7	0.003	1.4
		Xylenes (total)	1330–20–7	0.32	30
K161..	Purification solids (including filtration, evaporation, and centrifugation solids), baghouse dust and floor sweepings from the production of dithiocarbamate acids and their salts.	Antimony	7440–36–0	1.9	2.1 mg/l TCLP
		Carbon disulfide	75–15–0	3.8	4.8 mg/l TCLP
		Dithiocarbamates, total	NA	0.028	28
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
		Selenium	7782–49–2	0.82	016 mg/l TCLP
		Xylenes (total)	1330–20–7	0.32	30
P001	Warfarin, & salts, when present at concentrations greater than 0.3%.	Warfarin	81–81–2	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
P002	1-Acetyl-2-thiourea	1-Acetyl-2-thiourea	591–08–2	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P003	Acrolein	Acrolein	107–02–8	0.29	CMBST
P004	Aldrin	Aldrin	309–00–2	0.021	0.066
P005	Allyl alcohol	Allyl alcohol	107–18–6	(WETOX or CHOXD) fb CARBN. or CBMST	CMBST
P006	Aluminum phosphide	Aluminum phosphide	20859–73–8	CHOXD; CHRED; or CMBST	CHOXD; CHRED; or CMBST
P007	5-Aminomethyl e-isoxazoloe	5-Aminomethyl e-isoxazoloe	2763–96–4	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P008	4-Aminopyridine	4-Aminopyridine	504–24–5	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P009	Ammonium picrate	Ammonium picrate	131–74–8	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
P010	Arsenic acid	Arsenic	7440–38–2	1.4	50 mg/l TCLP
P011	Arsenic pentoxide	Arsenic	7440–38–2	1.4	50 mg/l TCLP
P012	Arsenic trioxide	Arsenic	7440–38–2	1.4	50 mg/l TCLP
P013	Barium cyanide	Barium	7440–39–3	NA	7.6 mg/l TCLP
		Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
P014	Thiophenol (Benzene thiol)	Thiophenol (Benzene thiol)	108–98–5	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P015	Beryllium dust	Beryllium	7440–41–7	RMETL, or RTHRM	RMETL; or RTHRM
P016	Dichloromethyl ether (Bis(chloromethyl)ether)	Dichloromethyl ether	542–88–1	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P017	Bromoacetone	Bromoacetone	598–31–2	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P018	Brucine	Brucine	357–57–3	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST

P020	2-sec-Butyl-4,6-dinitrophenol (Dinoseb)	2-sec-Butyl-4,6-dinitrophenol (Dinoseb).	88–85–7	0.066	2.5
P021	Calcium cyanide	Cyanides (Total) [7]	57–12–5	1.2	590
		Cyanides (Amenable) [7]	57–12–5	0.86	30
P022	Carbon disulfide	Carbon disulfide	75–15–0	3.8	CMBST
		Carbon disulfide; alternate [6] standard for nonwastewaters only.	75–15–0	NA	4.8 mg/l TCLP
P023	Choloracetaldehyde	Choloracetaldehyde	107–20–0	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P024	p-Chloroaniline	p-Chloroaniline	106–47–8	0.46	16
P026	1-(o-Cholorphenyl)thiourea	1-(o-Cholorphenyl)thiourea	5344–82–1	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P027	3-Chloropropionitrile	3-Chloropropionitrile	542–76–7	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P028	Benzyl chloride	Benzyl chloride	100–44–7	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P029	Copper cyanide	Cyanides (Total) [7]	57–12–5	1.2	590
		Cyanides (Amenable) [7]	57–12–5	0.86	30
P030	Cyanides (soluble salts and complexes)	Cyanides (Total) [7]	57–12–5	1.2	590
		Cyanides (Amenable) [7]	57–12–5	0.86	30
P031	Cyanogen	Cyanogen	460–19–5	CHOXD; WETOX; or CMBST	CHOXD; WETOX; or CMBST
P033	Cyanogen chloride	Cyanogen chloride	506–77–4	CHOXD; WETOX; or CMBST	CHOXD; WETOX; or CMBST
P034	2-Cyclohexly-4,6-dinitrophenol	2-Cyclohexly-4,6-dinitrophenol	131–89–5	(WETOX or CHOXD) fb CARBN; or CBMST	CMBST
P036	Dichlorophenylarsine	Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
P037	Dieldrin	Dieldrin	60–57–1	0.017	0.13
P038	Diethylarsine	Arsenic	7440–38–2	1.4	50 mg/l TCLP
P039	Disulfoton	Disulfoton	298–04–4	0.017	6.2
P040	0,0-Diethyl O-pyrazinyl phosphorothioate	0,0-Diethyl O-pyrazinyl phosphorothioate.	297–97–2	CARBN; or CMBST	CMBST
P041	Diethyl-p-nitrophenyl phosphate	Diethyl-p-nitrophenyl phosphate	311–45–5	CARBN; or CMBST	CMBST
P042	Epinephrine	Epinephrine	51–43–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P043	Diisopropylfluorophosphate (DFP)	Diisopropylfluorophosphate (DFP)	55–91–4	CARBN; or CMBST	CMBST
P044	Dimethoate	Dimethoate	60–51–5	CARBN; or CMBST	CMBST
P045	Thiofanox	Thiofanox	39196–18–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
P046	alpha, alpha-Dimethylphenethylamine	alpha, alpha-Dimethylphenethylamine.	122–09–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P047	4,6-Dinitro-o-cresol	4,6-Dinitro-o-cresol	543–52–1	0.28	160
	4,6-Dinitro-o-cresol salts	NA	NA	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P048	2,4-Dinitrophenol	2,4-Dinitrophenol	51–28–5	0.12	160
P049	Dithiobiuret	Dithiobiuret	541–53–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P050	Endosulfan	Endosulfan I	939–98–8	0.023	0.066
		Endosulfan II	33213–6–5	0.029	0.13
		Endosulfan sulfate	1031–07–8	0.029	0.13
P051	Endrin	Endrin	72–20–8	0.0028	0.13
		Endrin aldehyde	7421–93–4	0.025	0.13
P054	Aziridine	Aziridine	151–56–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P056	Fluorine	Fluorine (measured in wastewaters only).	16964–48–8	35	ADGAS fb NEUTR
P057	Fluoroacetamide	Fluoroacetamide	640–19–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P058	Fluoroacetic acid, sodium salt	Fluoroacetic acid, sodium salt	62–74–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P059	Heptachlor	Heptachlor	76–44–8	0.0012	0.066
		Heptachlor epoxide	1024–57–3	0.016	0.066
P060	Isodrin	Isodrin	465–73–6	0.021	0.066
P062	Hexaethyl tetraphosphate	Hexaethyl tetraphosphate	757–58–4	CARBN; or CMBST	CMBST
P063	Hydrogen cyanide	Cyandies (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
P064	Isocyanic acid, ethyl ester	Isocyanic acid, ethyl ester	624–83–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P065	Mercury fulminate nonwastewaters, regardless of their total mercury content, that are not incinerator residues or are not residues from RMERC.	Mercury	7439–97–6	NA	IMERC

	Mercury fulminate nonwastewaters that are either incinerator residues or are residues from RMERC; and contain greater than or equal to 260 mg/kg total mercury.	Mercury	7339–97–6	NA	RMERC
	Mercury fulminate nonwastewaters that are residues from RMERC and contain less than 260 mg/kg total mercury.	Mercury	7439–97–6	NA	0.20 mg/l TCLP
	Mercury fulminate nonwastewaters that are incinerator residues and contain less than 260 mg/kg total mercury.	Mercury	7439–97–6	NA	0.025 mg/l TCLP
	All mercury fulminate wastewaters	Mercury	7439–97–6	0.15	NA
P066	Methomyl	Methomyl	16752–77–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P067	2-Methyl-aziridine	2-Methyl-aziridine	75–55–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P068	Methyl hydrazine	Methyl hydrazine	60–34–4	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
P069	2-Methyllactonitrile	2-Methyllactonitrile	75–86–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P070	Aldicarb	Aldicarb	116–06–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P071	Methyl parathion	Methyl parathion	298–00–0	0.014	4.6
P072	1-Naphthyl–2–thiourea	1-Naphthyl–2–thiourea	86–88–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P073	Nickel carbonyl	Nickel	7440–02–0	3.98	5.0 mg/l TCLP
P074	Nickel-cyanide	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Total)[7]	57–12–5	0.86	30
		Nickel	7440–02–0	3.98	5.0 mg/l TCLP
P075	Nicotine and salts	Nicotine and salts	54–11–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P076	Nitric oxide	Nitric oxide	10102–43–9	ADGAS	ADGAS
P077	p-Nitroaniline	p-Nitroaniline	100–01–6	0.028	28
P078	Nitrogen dioxide	Nitrogen dioxide	10102–44–0	ADGAS	ADGAS
P081	Nitroglycerin	Nitroglycerin	55–63–0	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
P082	N-Nitrosodimethylamine	N-Nitrosodimethylamine	62–75–9	0.40	2.3
P084	N-Nitrosomethylvinylamine	N-Nitrosomethylvinylamine	4549–40–0	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P085	Octamethylpyrophosphoramide	Octamethylpyrophosphoramide	152–16–9	CARBN; OR CMBST	CMBST
P087	Osmium tectroxide	Osmium tectroxide	20816–12–0	RMETL; or RTHRM	RMETL; or RTHRM

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
P088	Endothall	Endothall	145–73–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P089	Parathion	Parathion	56–38–2	0.014	4.6
P092	Phenyl mercuric acetate nonwastewaters, regardless of their total mercury content, that are not incinerator residues or are not residues from RMERC.	Mercury	7439–97–6	NA	IMERC; or RMERC
	Phenyl mercuric acetate nonwastewaters that are either incinerator residues or are residues from RMERC; and still contain greater than or equal to 260 mg/kg total mercury.	Mercury	7439–97–6	NA	RMERC
	Phenyl mercuric acetate nonwastewaters that are residues from RMERC and contain less than 160 mg/kg total mercury.	Mercury	7439–97–6	NA	0.20 mg/l TCLP
	Phenyl mercuric acetate nonwastewaters that are incinerator residues and contain less then 260 mg/kg total mercury.	Mercury	7439–97–6	NA	0.025 mg/l TCLP
	All phenyl mercuric acetate wastewaters.	Mercury	7439–97–6	0.15	NA
P093	Phenythiouea	Phenythiouea	103–85–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P094	Phorate	Phorate	298–02–2	0.021	4.6
P095	Phosgene	Phosgene	75–44–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P096	Phosphine	Phosphine	7803–51–2	CHOXD; CHRED; or CMBST	CHOXD; CHRED; or CMBST
P097	Famphur	Famphur	52–85–7	0.017	15
P098	Potassium cyanide.	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	.086	30
P099	Potasslum silver cyanide	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Silver	7440–22–4	.043	0.30 mg/l TCLP
P0101	Ethyl cyanide (Propanenitrile)	Ethyl cyanide (Propanenitrile)	107–12–0	0.24	360
P0102	Propargyl alcohol	Propargyl alcohol	107–19–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P0103	Selenourea	Selenium	7782–49–2	0.82	0.16 mg/l TCLP
P0104	Silver cyanide	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
		Silver	7440–22–4	0.43	0.30 mg/l TCLP

P0105	Sodium azide	Sodium azide	26628–22–8	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
P0106	Sodium cyanide	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
P0108	Strychnine and salts	Strychnine and salts	57–24–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P109	Tetraethyldithiopyrophosphate	Tetraethyldithiopyrophosphate	3689–24–5	CARBN; or CMBST	CMBST
P110	Tetraethyl lead	Lead	7439–92–1	0.69	0.37 mg/l TCLP
P111	Tetraethylpyrophosphate	Tetraethylpyrophosphate	107–49–3	CARBN; or CMBST	CMBST
P112	Tetranitromethane	Tetranitromethane	509–14–8	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
P113	Thallic oxide	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
P114	Thallium selenite	Selenium	7782–49–2	0.82	0.16 mg/l TCLP
P115	Thallium (I) sulfate	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
P116	Thiosemicarbazide	Thiosemicarbazide	79–19–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P118	Trichloromethanethiol	Trichloromethanethiol	75–70–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
P119	Ammonium vanadate	Vanadium (measured in wastewaters only).	7440–62–2	4.3	STABL
P120	Vandium pentoxide	Vanadium (measured in wastewaters only).	7440–62–2	4.3	STABL
P121	Zinc cyanide	Cyanides (Total)[7]	57–12–5	1.2	590
		Cyanides (Amenable)[7]	57–12–5	0.86	30
P122	Zinc phosphide Zn_3P_2, when present at concentrations greater than 10%.	Zinc Phosphide	1314–84–7	CHOXD; CHRED; or CMBST	CHOXD; CHRED; or CMBST
P123	Toxaphene	Toxaphene	8001–35–2	0.0095	2.6
P127	Carbofuran	Carbofuran	1563–66–2	0.006	0.14
P128	Mexacarbate	Mexacarbate	315–18–4	0.056	1.4
P185	Tirpate	Tirpate	26419–73–8	0.056	0.28
P187	Bendiocarb	Bendiocarb	22781–23–3	0.056	1.4
P188	Physostigimine salicylate	Physostigmine salicylate	57–64–7	0.056	1.4
P189	Carbosulfan	Carbosulfan	55285–14–8	0.028	1.4
P190	Metolcarb	Metolcarb	1129–41–5	0.056	1.4
P191	Dimetilan	Dimetilan	644–64–4	0.056	1.4
P192	Isolan	Isolan	119–38–0	0.056	1.4
P193	Thiophanate-methyl	Thiophanate-methyl	23564–05–8	0.056	1.4
P194	Oxamyl	Oxamyl	23135–22–0	0.056	0.28
P195	Thiodicarb	Thiodicarb	59669–26–0	0.019	1.4
P196	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
P197	Formparanate	Formparanate	17702–57–7	0.056	1.4
P198	Formetanate hydrochloride	Formetanate hydrochloride	23422–53–9	0.056	1.4
P199	Methiocarb.	Methiocarb	2032–65–7	0.056	1.4
P200	Propoxur	Propoxur	114–26–1	0.056	1.4
P201	Promecarb	Promecarb	2631–37–0	0.056	1.4
P202	Hercules AC–5727	Hercules AC–5727	64–00–6	0.056	1.4

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
P203	Aldicarb sulfone	Aldicarb sulfone	1646–88–4	0.056	0.28
P204	Physostigmine	Physostigmine	57–47–6	0.056	1.4
P205	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U001	Acetaldehyde	Acetaldehyde	75–07–0	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U002	Acetone	Acetone	67–64–1	0.28	160
U003	Acetonitrile	Acetonitrile	75–05–8	5.6	CMBST
		Acetonitrile; alternate[6] standard for nonwastewaters only.	75–05–8	NA	1.8
U004	Acetophenone	Acetophenone	98–86–2	0.010	9.7
U005	2-Acetylaminofluorene	2-Acetylaminofluorene	53–96–3	0.059	140
U006	Acetyl chloride	Acetyl Chloride	75–36–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U007	Acrylamide	Acrylamide	79–06–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U008	Acrylic acid	Acrylic acid	79–10–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U009	Acrylonitrile	Acrylonitrile	107–13–1	0.24	84
U010	Mitomycin C	Mitomycin C	50–07–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U011	Amitrole	Amitrole	61–82–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U012	Aniline	Aniline	62–53–3	0.81	14
U014	Auramine	Auramine	492–80–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U015	Azaserine	Azaserine	115–02–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U016	Benz(c)acridine	Benz(c)acridine	225–51–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST

U017	Benzal chloride	Benzal chloride	98–87–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U018	Benz(a)anthracene	Benz(a)anthracene	56–55–3	0.059	3.4
U019	Benzene	Benzene	71–43–2	0.14	10
U020	Benzenesulfonyl chloride	Benzenesulfonyl chloride	98–09–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U021	Benzidine	Benzidine	92–87–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U022	Benzo(a)pyrene	Benzo(a)pyrene	50–32–8	0.061	3.4
U023	Benzotrichloride	Benzotrichloride	98–07–7	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
U024	bis(2-Chloroethoxy)methane	bis(2-Chloroethoxy)methane	111–91–1	0.036	7.2
U025	bis(2-Chloroethyl)ether	bis(2-Chloroethyl)ether	111–44–4	0.033	6.0
U026	Chlornaphazine	Chlornaphazine	494–03–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U027	bis(2-Chloroisopropyl)ether	bis(2-Chloroisopropyl)ether	39638–32–9	(WETOX or CHOXD) fb CARBN; or CMBST	7.2
U028	bis(2-Ethylhexyl) phthalate	bis(2-Ethylhexyl) phthalate	117–81–7	0.28	28
U029	Methyl bromide (Bromomethane)	Methyl bromide (Bromomethane)	74–83–9	0.11	15
U030	4-Bromophenyl phenyl ether	4-Bromophenyl phenyl ether	101–55–3	0.055	15
U031	n-Butyl alcohol	n-Butyl alcohol	71–36–3	5.6	2.6
U032	Calcium chromate	Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
U033	Carbon oxyfluoride	Carbon oxyfluoride	353–50–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U034	Trichloroacetaldehyde (Chloral)	Trichloroacetaldehyde (Chloral)	75–87–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U035	Chlorambucil	Chlorambucil	305–03–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U036	Chlordane	Chlordane (alpha and gamma isomers).	57–74–9	0.0033	0.26
U037	Chlorobenzene	Chlorobenzene	108–90–7	0.057	6.0
U038	Chlorobenzilate	Chlorobenzilate	510–15–6	0.10	CMBEST
U039	p-Chloro-m-cresol	p-Chloro-m-cresol	59–50–7	0.018	14
U041	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	Epichlorohydrin (1-Chloro-2,3-epoxypropane).	106–89–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U042	2-Chloroethyl vinyl ether	2-Chloroethyl vinyl ether	110–75–8	0.062	CMBST
U043	Vinyl chloride	Vinyl chloride	75–01–4	0.27	6.0
U044	Chloroform	Chloroform	67–66–3	0.046	6.0
U045	Chloromethane (Methyl chloride)	Chloromethane (Methyl chloride)	74–87–3	0.19	30

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U046	Chloromethyl methyl ether	Chloromethyl methyl ether	107–30–2	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U047	2-Chloronaphthalene	2-Chloronaphthalene	91–58–7	0.055	5.6
U048	2-Chlorophenol	2-Chlorophenol	95–57–8	0.044	5.7
U049	4-Chloro-o-toluidine hydrochloride	4-Chloro-o-toluidine hydrochloride	3165–93–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U050	Chrysene	Chrysene	218–01–9	0.059	3.4
U051	Creosote	Naphthalene	91–20–3	0.059	5.6
		Pentachlorophenol	87–86–5	0.089	7.4
		Phenanthrene	85–01–8	0.059	5.6
		Pyrene	129–00–0	0.067	8.2
		Toluene	108–88–3	0.080	10
		Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
		Lead	7439–92–1	0.69	0.37 mg/l TCLP
U052	Cresols (Cresylic acid)	o-Cresol	95–48–7	0.11	5.6
		m-Cresol (difficult to distinguish from p-cresol).	108–39–4	0.77	5.6
		p-Cresol (difficult to distinguish from m-cresol).	106–44–5	0.77	5.6
		Cresol-mixed isomers (Cresylic acid) (sum of o-, m-, and p-cresol concentrations).	1319–77–3	0.88	11.2
U053	Crotonaldehyde	Crotonaldehyde	4170–30–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U055	Cumene	Cumene	98–82–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U056	Cyclohexane	Cyclohexane	110–82–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U057	Cyclohexanone	Cyclohexanone	108–94–1	0.36	CMBST
		Cyclohexanone; alternate[6] standard for nonwastewaters only.	108–94–1	NA	0.75 mg/l TCLP
U058	Cyclophosphamide	Cyclophosphamide	50–18–0	CARBN; or CMBST	CMBST

U059	Daunomycin	Daunomycin	20830–81–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U060	DDD	o,p'-DDD	53–19–0	0.023	0.087
		p,p'-DDD	72–54–8	0.023	0.087
U061	DDT	o,p'-DDT	789–02–6	0.0039	0.087
		p,p'-DDT	50–29–3	0.0039	0.087
		o,p'-DDD	53–19–0	0.023	0.087
		p,p'-DDD	72–54–8	0.023	0.087
		o,p'-DDE	3424–82–6	0.031	0.087
		p,p'-DDE	72–55–9	0.031	0.087
U062	Diallate	Diallate	2303–16–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U063	Dibenz(a,h)anthracene	Dibenz(a,h)anthracene	53–70–3	0.055	8.2
U064	Dibenz(a,i)pyrene	Dibenz(a,i)pyrene	189–55–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U066	1,2-Dibromo-3-chloropropane	1,2-Dibromo-3-chloropropane	96–12–8	0.11	15
U067	Ethylene dibromide (1,2-Dibromoethane)	Ethylene dibromide (1,2-Dibromoethane).	106–93–4	0.028	15
U068	Dibromomethane	Dibromomethane	74–95–3	0.11	15
U069	Di-n-butyl phthalate	Di-n-butyl phthalate	84–74–2	0.057	28
U070	o-Dichlorobenzene	o-Dichlorobenzene	95–50–1	0.088	6.0
U071	m-Dichlorobenzene	m-Dichlorobenzene	541–73–1	0.036	6.0
U072	p-Dichlorobenzene	p-Dichlorobenzene	106–46–7	0.090	6.0
U073	3,3'-Dichlorobenzidine	3,3'-Dichlorobenzidine	91–94–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U074	1,4-Dichloro-2-butene	cis-1,4-Dichloro-2-butene	1476–11–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
		trans-1,4-Dichloro-2-butene	764–41–0	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U075	Dichlorodifluoromethane	Dichlorodifluoromethane	75–71–8	0.23	7.2
U076	1,1-Dichloroethane	1,1-Dichloroethane	75–34–3	0.059	6.0
U077	1,2-Dichloroethane	1,2-Dichloroethane	107–06–2	0.21	6.0
U078	1,1-Dichloroethylene	1,1-Dichloroethylene	75–35–4	0.025	6.0
U079	1,2-Dichloroethylene	trans-1,2-Dichloroethylene	156–60–5	0.054	30
U080	Methylene chloride	Methylene chloride	75–09–2	0.089	30
U081	2,4-Dichlorophenol	2,4-Dichlorophenol	120–83–2	0.044	14
U082	2,6-Dichlorophenol	2,6-Dichlorophenol	87–65–0	0.044	14
U083	1,2-Dichloropropane	1,2-Dichloropropane	78–87–5	0.85	18
U084	1,3-Dichloropropylene	cis-1,3-Dichloropropylene	10061–01–5	0.036	18
		trans-1,3-Dichloropropylene	10061–02–6	0.036	18
U085	1,2:3,4-Diepoxybutane	1,2:3,4-Diepoxybutane	1464–53–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U086	N,N'-Diethylhydrazine	N,N'-Diethylhydrazine	1615–80–1	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
U087	O,O-Diethyl S-methyldithiophosphate	O,O-Diethyl S-methyldithiophosphate.	3288–58–2	CARBN; CMBST	CMBST
U088	Diethyl phthalate	Diethyl phthalate	84–66–2	0.20	28
U089	Diethyl stilbestrol	Diethyl stilbestrol	56–53–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U090	Dihydrosafrole	Dihydrosafrole	94–58–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U091	3,3'-Dimethoxybenzidine	3,3'-Dimethoxybenzidine	119–90–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U092	Dimethylamine	Dimethylamine	124–40–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U093	p-Dimethylaminoazobenzene	p-Dimethylaminoazobenzene	60–11–7	0.13	CMBST
U094	7,12-Dimethylibenz(a)anthracene	7,12-Dimethylbenz(a)anthracene	57–97–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST CMBST
U095	3,3'-Dimethylbenzidine	3,3'-Dimethylbenzidine	119–93–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U096	alpha, alpha-Dimethyl benzyl hydroperoxide	alpha, alpha-Dimethyl benzyl hydroperoxide.	80–15–9	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
U097	Dimethylcarbamoyl chloride	Dimethylcarbamoyl chloride	79–44–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U098	1,1-Dimethylhydrazine	1,1-Dimethylhydrazine	57–14–7	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST

U099	1,2-Dimethylhydrazine	1,2-Dimethylhydrazine	540–73–8	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
U101	2,4-Dimethylphenol	2,4-Dimethylphenol	105–67–9	0.036	14
U102	Dimethyl phthalate	Dimethyl phthalate	131–11–3	0.047	28
U103	Dimethyl sulfate	Dimethyl sulfate	77–78–1	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
U105	2,4-Dinitrotoluene	2,4-Dinitrotoluene	121–14–2	0.32	140
U106	2,6-Dinitrotoluene	2,6-Dinitrotoluene	606–20–2	0.55	28
U108	1,4-Dioxane	1,4-Dioxane	123–91–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
		1,4-Dioxane; alternate[6] standard for nonwastewaters only.	123–91–1	NA	170
U109	1,2-Diphenylhydrazine	1,2-Diphenylhydrazine	122–66–7	CHOXD; CHRED; CARBN; BIODG; or CMBST	CHOXD; CHRED; or CMBST
		1,2-Diphenylhydrazine; alternate[6] standard for wastewaters only.	122–66–7	0.087	NA
U110	Dipropylamine	Dipropylamine	142–84–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U111	Di-n-propylnitrosamine	Di-n-propylnitrosamine	621–64–7	0.40	14
U112	Ethyl acetate	Ethyl acetate	141–78–6	0.34	33
U113	Ethyl acrylate	Ethyl acrylate	140–88–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U114	Ethylenebisdithiocarbamic acid salts and esters	Ethylenebisdithiocarbamic acid	111–54–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U115	Ethylene oxide	Ethylene oxide	75–21–8	(WETOX or CHOXD) fb CARBN; or CMBST	CHOXD; or CMBST
		Ethylene oxide; alternate[6] standard for wastewaters only.	75–21–8	0.12	NA
U116	Ethylene thiourea	Ethylene thiourea	96–45–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U117	Ethyl ether	Ethyl ether	60–29–7	0.12	160
U118	Ethyl methacrylate	Ethyl methacrylate	97–63–2	0.14	160
U119	Ethyl methane sulfonate	Ethyl methane sulfonate	62–50–0	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U120	Fluoranthene	Fluoranthene	206–44–0	0.068	3.4
U121	Trichloromonofluoromethane	Trichloromonofluoromethane	75–69–4	0.020	30

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U122	Formaldehyde	Formaldehyde	50–00–0	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U123	Formic acid	Formic acid	64–18–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U124	Furan	Furan	110–00–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U125	Furfural	Furfural	98–01–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U126	Glycidylaldehyde	Glycidylaldehyde	765–34–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U127	Hexachlorobenzene	Hexachlorobenzene	118–74–1	0.055	10
U128	Hexachlorobutadiene	Hexachlorobutadiene	87–68–3	0.055	5.6
U129	Lindane	alpha-BHC	319–84–6	0.00014	0.066
		beta-BHC	319–85–7	0.00014	0.066
		delta-BHC	319–86–8	0.023	0.066
		gamma-BHC (Lindane)	58–89–9	0.0017	0.066
U130	Hexachlorocyclopentadiene	Hexachlorocyclopentadiene	77–47–4	0.057	2.4
U131	Hexachloroethane	Hexachloroethane	67–72–1	0.055	30
U132	Hexachlorophene	Hexachlorophene	70–30–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U133	Hydrazine	Hydrazine	302–01–2	CHOXD; CHRED; CARBN; DIODG; or CMBST	CHOXD; CHRED; or CMBST
U134	Hydrogen fluoride	Fluoride (measured in wastewaters only).	16964–48–8	35	ADGAS fb NEUTR; or NEUTR
U135	Hydrogen Sulfide	Hydrogen Sulfide	7783–06–4	CHOXD; CHRED; or CMBST	CHOXD; CHRED; or CMBST
U136	Cacodylic acid	Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
U137	Indeno(1,2,3-c,d)pyrene	Indeno(1,2,3-c,d)pyrene	193–39–5	0.0055	3.4
U138	Iodomethane	Iodomethane	74–88–4	0.19	65
U140	Isobutyl alcohol	Isobutyl alcohol	78–83–1	5.6	170
U141	Isosafrole	Isosafrole	120–58–1	0.081	2.6
U142	Kepone	Kepone	143–50–8	0.0011	0.13

U143	Lasiocarpine	Lasiocarpine	303–34–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U144	Lead acetate	Lead	7439–92–1	0.69	0.37 mg/l TCLP
U145	Lead phosphate	Lead	7439–92–1	0.69	0.37 mg/l TCLP
U146	Lead subacetate	Lead	7439–92–1	0.69	0.37 mg/l TCLP
U147	Maleic anhydride	Maleic anhydride	108–31–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U148	Maleic hydrazide	Maleic hydrazide	123–33–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U149	Malononitrile	Malononitrile	109–77–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U150	Melphalan	Melphalan	148–82–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U151	U151 (mercury) nonwastewaters that contain greater than or equal to 260 mg/kg total mercury.	Mercury	7439–97–6	NA	RMERC
	U151 (mercury) nonwastewaters that contain less than 260 mg/kg total mercury and that are residues from RMERC only.	Mercury	7439–97–6	NA	0.20 mg/l TCLP
	U151 (mercury) nonwastewaters that contain less than 260 mg/kg total mercury and that are not residues from RMERC.	Mercury	7439–97–6	NA	0.025 mg/l TCLP
	All U151 (mercury) wastewaters	Mercury	7439–97–6	0.15	NA
	Elemental Mercury Contaminated with Radioactive materials.	Mercury	7439–97–6	NA	AMLGM
U152	Methacrylonitrile	Methacrylonitrile	126–98–7	0.24	84
U153	Methanethiol	Methanethiol	74–93–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U154	Methanol	Methanol	67–56–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
		Methanol, alternate[e] set of standards for both wastewaters and nonwastewaters.	67–56–1	5.6	0.75 mg/l TCLP
U155	Methapyrilene	Methapyrilene	91–80–5	0.081	1.5
U156	Methyl chlorocarbonate	Methyl chlorocarbonate	79–22–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U157	3-Methylcholanthrene	3-Methylcholanthrene	56–49–5	0.0055	15
U158	4,4'-Methylene bis(2-chloroaniline)	4,4'-Methylene bis(2-chloroaniline)	101–14–4	0.50	30
U159	Methyl ethyl ketone	Methyl ethyl ketone	78–93–3	0.28	36
U160	Methyl ethyl ketone peroxide	Methyl ethyl ketone peroxide	1338–23–4	CHOXD; CHRED; CARBN; BIODG; OR CMBST	CHOXD; CHRED; OR CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U161	Methyl isobutyl ketone	Methyl isobutyl ketone	108–10–1	0.14	33
U162	Methyl methacrylate	Methyl methacrylate	80–62–6	0.14	160
U163	N-Methyl N'-nitro N-nitrosoguanidine	N-Methyl N'-nitro N-nitrosoguanidine.	70–25–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U164	Methylthiouracil	Methylthiouracil	56–04–2	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U165	Naphthalene	Naphthalene	91–20–3	0.059	5.6
U166	1,4-Naphthoquinone	1,4-Naphthoquinone	130–15–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U167	1-Naphthlyamine	1-Naphthlyamine	134–32–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U168	2-Naphthlyamine	2-Naphthlyamine	91–59–8	0.52	CMBST
U169	Nitrobenzene	Nitrobenzene	98–95–3	0.068	14
U170	p-Nitrophenol	p-Nitrophenol	100–02–7	0.12	29
U171	2-Nitropropane	2-Nitropropane	79–46–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U172	N-Nitrosodi-n-butylamine	N-Nitrosodi-n-butylamine	924–16–3	0.40	17
U173	N-Nitrosodiethylamine	N-Nitrosodiethanolamine	1116–54–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U174	N-Nitrosodiethanolamine	N-Nitrosodiethylamine	55–18–5	0.40	28
U176	N-Nitroso-N-ethylurea	N-Nitroso-N-ethylurea	759–73–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U177	N-Nitroso-N-methylurea	N-Nitroso-N-methylurea	684–93–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U178	N-Nitroso-N-methylurethane	N-Nitroso-N-methylurethane	615–53–2	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U179	N-Nitrosopiperidine	N-Nitrosopiperidine	100–75–4	0.013	35
U180	N-Nitrosopyrrolidine	N-Nitrosopyrrolidine	930–55–2	0.013	35
U181	5-Nitro-o-toluidine	5-Nitro-o-toluidine	99–55–8	0.32	28

U182	Paraldehyde	Paraldehyde	123–63–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U183	Pentachlorobenzene	Pentachlorobenzene	608–93–5	0.055	10
U184	Pentachloroethane	Pentachloroethane	76–01–7	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
		Pentachloroethane; alternate[6] standards for both wastewaters and nonwastewaters.	76–01–7	0.055	6.0
U185	Pentachloronitrobenzene	Pentachloronitrobenzene	82–68–8	0.055	4.8
U186	1,3-Pentadiene	1,3-Pentadiene	504–60–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U187	Phenacetin	Phenacetin	62–44–2	0.081	16
U188	Phenol	Phenol	108–95–2	0.039	6.2
U189	Phosphorus sulfide	Phosphorus sulfide	1314–80–3	CHOXD, CHRED, or CMBST	CHOXD, CHRED, or CMBST
U190	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	Phthalic anhydride (measured as Phthalic acid or Terephthalic acid).	100–21–0	0.055	28
		Phthalic anhydride	85–44–9	0.055	28
U191	2-Picoline	2-Picoline	109–06–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U192	Pronamide	Pronamide	23950–58–5	0.093	1.5
U193	1,3-Propane sultone	1,3-Propane sultone	1120–71–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U194	n-Propylamine	n-Propylamine	107–10–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U196	Pyridine	Pyridine	110–86–1	0.014	16
U197	p-Benzoquinone	p-Benzoquinone	106–51–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U200	Reserpine	Reserpine	50–55–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U201	Resorcinol	Resorcinol	108–46–3	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U202	Saccharin and salts	Saccharin	81–07–2	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U203	Safrole	Safrole	94–59–7	0.081	22
U204	Selenium dioxide	Selenium	7782–49–2	0.82	0.16 mg/l TCLP
U205	Selenium sulfide	Selenium	7782–49–2	0.82	0.16 mg/l TCLP

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U206	Streptozotocin	Streptozotocin	18883–66–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U207	1,2,4,5-Tetrachlorobenzene	1,2,4,5-Tetrachlorobenzene	95–94–3	0.055	14
U208	1,1,1,2-Tetrachloroethane	1,1,1,2-Tetrachloroethane	630–20–6	0.057	6.0
U209	1,1,2,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	79–34–5	0.057	6.0
U210	Tetrachloroethylene	Tetrachloroethylene	127–18–4	0.056	6.0
U211	Carbon tetrachloride	Carbon tetrachloride	56–23–5	0.057	6.0
U213	Tetrahydrofuran	Tetrahydrofuran	109–99–9	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U214	Thallium (I) acetate	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
U215	Thallium (I) carbonate	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
U216	Thallium (I) chloride	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
U217	Thallium (I) nitrate	Thallium (measured in wastewaters only).	7440–28–0	1.4	RTHRM; or STABL
U218	Thioacetamide	Thioacetamide	62–55–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U219	Thiourea	Thiourea	62–56–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U220	Toluene	Toluene	108–83–3	0.080	10
U221	Toluenediamine	Toluenediamine	25376–45–8	CARBN; or CMBST	CMBST
U222	o-Toluidine hydrochloride	o-Toluidine hydrochloride	636–21–5	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U223	Toluene diisocyanate	Toluene diisocyanate	26471–62–5	CARBN; or CMBST	CMBST
U225	Bromoform (Tribromomethane)	Bromoform (Tribromomethane)	75–25–2	0.63	15
U226	1,1,1-Trichloroethane	1,1,1-Trichloroethane	71–55–6	0.054	6.0
U227	1,1,2-Trichloroethane	1,1,2-Trichloroethane	79–00–5	0.054	6.0
U228	Trichloroethylene	Trichloroethylene	79–01–6	0.054	6.0
U234	1,3,5-Trinitrobenzene	1,3,5-Trinitrobenzene	99–35–4	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST

U235	tris-(2,3-Dibromoprophyl)-phosphate	tris-(2,3-Dibromoprophyl)-phosphate.	126–72–7	0.11	0.10
U236	Trypan Blue	Trypan Blue	72–57–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U237	Uracil mustard	Uracil mustard	66–75–1	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U238	Urethane (Ethyl carbamate)	Urethane (Ethyl carbamate)	51–79–6	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U239	Xylenes	Xylenes-mixed isomers (sum of o-, m-, and p-xylene concentrations).	1330–20–7	0.32	30
U240	2,4-D (2,4-Dichlorophenoxyacetic acid)	2,4–D (2,4-Dichlorophenoxyacetic acid).	94–75–7	0.72	10
	2,4-D (2,4-Dichlorophenoxyacetic acid) salts and esters.		NA	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U243	Hexachloropropylene	Hexachloropropylene	1888–71–7	0.035	30
U244	Thiram	Thiram	137–26–8	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U246	Cyanogen bromide	Cyanogen bromide	506–68–3	CHOXD; WETOX; or CMBST	CHOXD, WETOX; or CMBST
U247	Methoxychlor	Methoxychlor	72–43–5	0.25	0.18
U248	Warfarin, & salts, when present at concentrations of 0.3% or less.	Warfarin	81–81–2	(WETOX or CHOXD) fb CARBN; or CMBST	CMBST
U249	Zinc phosphide, Zn_3P_2, when present at concentrations of 10% or less.	Zinc Phosphide	1314–84–7	CHOXD; CHRED; or CMBST	CHOXD; CHRED; or CMBST
U271	Benomyl	Benomyl	17804–35–2	0.056	1.4
U277	Sulfallate	Sulfallate	95–06–7	0.056	1.4
U279	Carbaryl	Carbaryl	63–25–2	0.006	0.14
U280	Barban	Barban	101–27–9	0.056	1.4
U328	o-Toluidine	o-Toluidine	95–53–4	CMBST; or CHOXD fb (BIODG or CARBN); or BIODG fb CARBN.	CMBST
U353	p-Toluidine	p-Toluidine	106–49–0	CMBST; or CHOXD fb (BIODG or CARBN); or BIODG fb CARBN.	CMBST
U359	2-Ethoxyethanol	2-Ethoxyethanol	110–80–5	CMBST; or CHOXD fb (BIODG or CARBN); or BIODG fb CARBN	CMBST

TREATMENT STANDARDS FOR HAZARDOUS WASTES—Continued

(Note: NA means not applicable.)

Waste code	Waste description and treatment/regulatory subcategory[1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS[2] No.	Concentration in mg/l[3]; or technology code[4]	Concentration in mg/kg[5] unless noted as "mg/l TCLP"; or technology code
U360	Carbamates, N.O.S	Carbamates, N.O.S	NA	0.056	1.4
U361	Carbamoyl Oximes, N.O.S	Carbamoyl Oximes, N.O.S	NA	0.056	0.28
U362	Thiocarbamates, N.O.S	Thiocarbamates, N.O.S	NA	0.003	1.4
U363	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Antimony	Antimony	7440–36–0	1.9	2.1 mg/l TCLP
	Lead	Lead	7439–92–1	0.69	0.37 mg/l TCLP
	Nickel	Nickel	7440–02–0	3.98	5.0 mg/l TCLP
	Selenium	Selenium	7782–49–2	0.82	0.16 mg/l TCLP
U364	Bendiocarb phenol	Bendiocarb phenol	22961–82–6	0.056	1.4
U365	Molinate	Molinate	2212–67–1	0.003	1.4
U366	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U367	Carbofuran phenol	Carbofuran phenol	1563–38–8	0.056	1.4
U368	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Antimony	Antimony	7440–36–0	1.9	2.1 mg/l TCLP
U369	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Antimony	Antimony	7440–36–0	1.9	2.1 mg/l TCLP
U370	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U371	Hexazinone intermediate	Hexazinone intermediate	65086–85–3	0.056	1.4
U372	Carbendazim	Carbendazim	10605–21–7	0.056	1.4
U373	Propham	Propham	122–42–9	0.056	1.4
U374	U9069	U9069	112006–94–7	0.056	1.4
U375	Troysan Polyphase	Troysan Polyphase	55406–53–6	0.056	1.4
U376	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Selenium	Selenium	7782–49–2	0.82	0.16 mg/l TCLP
U377	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U378	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U379	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U380	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U381	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U382	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U383	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U384	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U385	Vernolate	Vernolate	1929–77–7	0.003	1.4
U386	Cycloate	Cycloate	1134–23–2	0.003	1.4
U387	Prosulfocarb	Prosulfocarb	52888–80–9	0.003	1.4
U388	Esprocarb	Esprocarb	85785–20–2	0.003	1.4
U389	Triallate	Triallate	2303–17–5	0.003	1.4
U390	Eptam	Eptam	759–94–4	0.003	1.4
U391	Pebulate	Pebulate	1114–71–2	0.003	1.4
U392	Butylate	Butylate	2008–41–5	0.003	1.4
U393	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U394	A2213	A2213	30558–43–1	0.003	1.4
U395	Reactacrease 4–DEG	Reactacrease 4–DEG	5952–26–1	0.056	1.4
U396	Ferbam	Ferbam	14484–64–1	0.056	1.4
U397	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Lead	Lead	7439–92–1	0.69	0.37 mg/l TCLP
U398	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28

J399	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
	Nickel	Nickel	7440–02–0	3.98	5.0 mg/l TCLP
U400	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U401	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U402	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U403	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U404	Triethylamine	Triethylamine	121–44–8	0.081	1.5
U405	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U406	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U407	Dithiocarbamates (total)	Dithiocarbamates (total)	NA	0.028	28
U408	2,4,6-Tribromophenol	2,4,6-Tribromophenol	118–79–6	0.035	7.4

Notes to Table:

[1] The waste descriptions provided in this table do not replace waste descriptions in 40 CFR part 261. Descriptions of Treatment/Regulatory Subcategories are provided, as needed, to distinguish betweenapplicability of different standards.

[2] CAS means Chemical Abstract Services. When the waste code and/or regulated constituents are described as a combination of a chemical with it's salts and/or esters, the CAS number is given for the parent compound only.

[3] Concentration standards for wastewaters are expressed in mg/l and are based on analysis of composite samples.

[4] All treatment standards expressed as a Technology Code or combination of Technology Codes are explained in detail in 40 CFR 268.42 Table 1—Technology Codes and Descriptions of Technology-Based Standards.

[5] Except for Metals (EP or TCLP) and Cyanides (Total and Amenable) the nonwastewater treatment standards expressed as a concentration were established, in part, based upon incineration in units operated in accordance with the technical requirements of 40 CFR Part 264, Subpart O, or Part 265, Subpart O, or based upon combustion in fuel substitution units operating in accordance with applicable technical requirements. A facility may comply with these treatment standards according to provisions in 40 CFR 268.40(d). All concentration standards for nonwastewaters are based on analysis of grab samples.

[6] Where an alternate treatment standard or set of alternate standards has been indicated, a facility may comply with this alternate standard, but only for the Treatment/Regulatory Subcategory or physical form (i.e., wastewater and/or nonwastewater) specified for that alternate standard.

[7] Both Cyanides (Total) and Cyanides (Amenable) for nonwastewaters are to be analyzed using Method 9010 or 9012, found in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW–846, as incorporated by reference in 40 CFR 260.11, with a sample size of 10 grams and a distillation time of one hour and 15 minutes.

[8] As an alternative to these standards, the underlying hazardous constituents in the waste must meet a CWA limitation, which can include a toxic pollutant indicator for the constituent; Pretreatment Standards for Existing Sources; Pretreatment Standards for New Sources; local limitations based upon a pass-through determination; or a Fundamentally Different Factors variance under 40 CFR 125.30–125.32.

17. In § 268.42 Table 1. is amended by revising the entry "CMBST" to read as follows:

§ 268.42 Treatment standards expressed as specified technologies.

* * * * *

TABLE 1.—TECHNOLOGY CODES AND DESCRIPTION OF TECHNOLOGY-BASED STANDARDS

Technology code	Description of technology-based standards
* * * * * * *	
CMBST:	High temperature organic destruction technologies, such as combustion in incinerators, boilers, or industrial furnaces operated in accordance with the applicable requirements of 40 CFR part 264, subpart O, or 40 CFR part 265, subpart O, or 40 CFR part 266, subpart H, and in other units operated in accordance with applicable technical operating requirements; and certain non-combustive technologies, such as the Catalytic Extraction Process.
* * * * * * *	

* * * * *

18. Section 268.44 is amended by revising paragraph (a) to read as follows:

§ 268.44 Variance from a treatment standard.

(a) Where the treatment standard is expressed as a concentration in a waste or waste extract and a waste cannot be treated to the specified level, or where the treatment technology is not appropriate to the waste, the generator or treatment facility may petition the Administrator for a variance from the treatment standard. The petitioner must demonstrate that because the physical or chemical properties of the waste differs significantly from wastes analyzed in developing the treatment standard, the waste cannot be treated to specified levels or by the specified methods. The petitioner may also demonstrate that it is treating underlying hazardous constituents in characteristically hazardous wastewaters by sending the waste to a properly designed and operated BAT/PSES system, which may not be achieving the treatment standards found in § 268.48.

* * * * *

19. In § 268.48 the table in paragraph (a) is revised to read as follows:

§ 268.48 Universal treatment standards.

(a) * * *

UNIVERSAL TREATMENT STANDARDS

[Note: NA means not applicable.]

Regulated constituent/common name	CAS[1] number	Wastewater standard: Concentration in mg/l[2]	Nonwastewater standard: Concentration in mg/kg[3] unless noted as "mg/l TCLP"
I. Organic constituents:			
A2213	30558–43–1	0.003	1.4
Acenaphthene	83–32–9	0.059	3.4
Acenaphthylene	208–96–8	0.059	3.4
Acetone	67–64–1	0.28	160
Acetonitrile	75–05–8	5.6	38
Acetophenone	96–86–2	0.010	9.7
2-Acetylaminofluorene	53–96–3	0.059	140
Acrolein	107–02–8	0.29	NA
Acrylamide	79–06–1	19	23
Acrylonitrile	107–13–1	0.24	84
Aldicarb sulfone	1646–88–4	0.056	0.28
Aldrin	309–00–2	0.021	0.066
4-Aminobiphenyl	92–67–1	0.13	NA
Aniline	62–53–3	0.81	14
Anthracene	120–12–7	0.059	3.4
Aramite	140–57–8	0.36	NA
Barban	101–27–9	0.056	1.4
Bendiocarb	22781–23–3	0.056	1.4
Bendiocarb phenol	22961–82–6	0.056	1.4
Benomyl	17804–35–2	0.056	1.4
Benz(a)anthracene	56–55–3	0.059	3.4
Benzal chloride	98–87–3	0.055	6.0
Benzene	71–43–2	0.14	10
Benzo(b)fluoranthene (difficult to distinguish from benzo(k)fluoranthene)	205–99–2	0.11	6.8
Benzo(k)fluoranthene (difficult to distinguish from benzo(b)fluoranthene)	207–08–9	0.11	6.8
Benzo(g,h,i)perylene	191–24–2	0.0055	1.8
Benzo(a)pyrene	50–32–8	0.061	3.4

UNIVERSAL TREATMENT STANDARDS—Continued

[Note: NA means not applicable.]

Regulated constituent/common name	CAS[1] number	Wastewater standard	Nonwastewater standard
		Concentration in mg/l[2]	Concentration in mg/kg[3] unless noted as "mg/l TCLP"
alpha-BHC	319–84–6	0.00014	0.066
beta-BHC	319–85–7	0.00014	0.066
delta-BHC	319–86–8	0.023	0.066
gamma-BHC	58–89–9	0.0017	0.066
Bromodichloromethane	75–27–4	0.35	15
Bromomethane/Methyl bromide	74–83–9	0.11	15
4-Bromophenyl phenyl ether	101–55–3	0.055	15
n-Butyl alcohol	71–36–3	5.6	2.6
Butyl benzyl phthalate	85–68–7	0.017	28
Butylate	2008–41–5	0.003	1.4
2-sec-Butyl-4,6-dinitrophenol/Dinoseb	88–85–7	0.066	2.5
Carbaryl	63–25–2	0.006	0.14
Carbenzadim	10605–21–7	0.056	1.4
Carbofuran	1563–66–2	0.006	0.14
Carbofuran phenol	1563–38–8	0.056	1.4
Carbon disulfide	75–15–0	3.8	4.8 mg/l TCLP
Carbon tetrachloride	56–23–5	0.057	6.0
Carbosulfan	55285–14–8	0.028	1.4
Chlordane (alpha and gamma isomers)	57–74–9	0.0033	0.26
p-Chloroaniline	106–47–8	0.46	16
Chlorobenzene	108–90–7	0.057	6.0
Chlorobenzilate	510–15–6	0.10	NA
2-Chloro-1,3-butadiene	126–99–8	0.057	0.28
Chlorodibromomethane	124–48–1	0.057	15
Chloroethane	75–00–3	0.27	6.0
bis(2-Chloroethoxy)methane	111–91–1	0.036	7.2
bis(2-Chloroethyl)ether	111–44–4	0.033	6.0
2-Chloroethyl vinyl ether	110–75–8	0.062	NA
Chloroform	67–66–3	0.046	6.0
bis(2-Chloroisopropyl)ether	39638–32–9	0.055	7.2
p-Chloro-m-cresol	59–50–7	0.018	14
Chloromethane/Methyl chloride	74–87–3	0.19	30
2-Chloronaphthalene	91–58–7	0.055	5.6
2-Chlorophenol	95–57–8	0.044	5.7
3-Chloropropylene	107–05–1	0.036	30
Chrysene	218–01–9	0.059	3.4
o-Cresol	95–48–7	0.11	5.6
m-Cresol (difficult to distinguish from p-cresol)	108–39–4	0.77	5.6
p-Cresol (difficult to distinguish from m-cresol)	106–44–5	0.77	5.6
m-Cumenyl methylcarbamate	64–00–6	0.056	1.4
Cycloate	1134–23–2	0.003	1.4
Cyclohexanone	108–94–1	0.36	0.75 mg/l TCLP
o,p'-DDD	53–19–0	0.023	0.087
p,p'-DDD	72–54–8	0.023	0.087
o,p'-DDE	3424–82–6	0.031	0.087
p,p'-DDE	72–55–9	0.031	0.087
o,p'-DDT	789–02–6	0.0039	0.087
p,p'-DDT	50–29–3	0.0039	0.087
Dibenz(a,h)anthracene	53–70–3	0.055	8.2
Dibenz(a,e)pyrene	192–65–4	0.061	NA
1,2-Dibromo-3-chloropropane	96–12–8	0.11	15
1,2-Dibromoethane/Ethylene dibromide	106–93–4	0.028	15
Dibromomethane	74–95–3	0.11	15
m-Dichlorobenzene	541–73–1	0.036	6.0
o-Dichlorobenzene	95–50–1	0.088	6.0
p-Dichlorobenzene	106–46–7	0.090	6.0
Dichlorodifluoromethane	75–71–8	0.23	7.2
1,1-Dichloroethane	75–34–3	0.059	6.0
1,2-Dichloroethane	107–06–2	0.21	6.0
1,1-Dichloroethylene	75–35–4	0.025	6.0
trans-1,2-Dichloroethylene	156–60–5	0.054	30
2,4-Dichlorophenol	120–83–2	0.044	14
2,6-Dichlorophenol	87–65–0	0.044	14
2,4-Dichlorophenoxyacetic acid/2,4-D	94–75–7	0.72	10
1,2-Dichloropropane	78–87–5	0.85	18

UNIVERSAL TREATMENT STANDARDS—Continued

[Note: NA means not applicable.]

Regulated constituent/common name	CAS[1] number	Wastewater standard	Nonwastewater standard
		Concentration in mg/l[2]	Concentration in mg/kg[3] unless noted as "mg/l TCLP"
cis-1,3-Dichloropropylene	10061-01-5	0.036	18
trans-1,3-Dichloropropylene	10061-02-6	0.036	18
Dieldrin	60-57-1	0.017	0.13
Diethyl phthalate	84-66-2	0.20	28
Diethylene glycol, dicarbamate	5952-26-1	0.056	1.4
p-Dimethylaminoazobenzene	60-11-7	0.13	NA
2-4-Dimethyl phenol	105-67-9	0.036	14
Dimethyl phthalate	131-11-3	0.047	28
Dimetilan	644-64-4	0.056	1.4
Di-n-butyl phthalate	84-74-2	0.057	28
1,4-Dinitrobenzene	100-25-4	0.32	2.3
4,6-Dinitro-o-cresol	534-52.1	0.28	160
2,4-Dinitrophenol	51-28-5	0.12	160
2,4-Dinitrotoluene	121-14-2	0.32	140
2,6-Dinitrotoluene	606-20-2	0.55	28
Di-n-octyl phthalate	117-84-0	0.017	28
Di-n-propylnitrosamine	621-64-7	0.40	14
1,4-Dioxane	123-91-1	12.0	170
Diphenylamine (difficult to distinguish from diphenylitrosamine)	122-39-4	0.92	13
Diphenylnitrosamine (difficult to distinguish from diphenylamine)	86-30-6	0.92	13
1,2-Diphenylhydrazine	122-66-7	0.087	NA
Disulfoton	298-04-3	0.017	6.2
Dithiocarbamates (total)	137-30-4	0.028	28
Endosulfan I	959-98-8	0.023	0.066
Endosulfan II	33213-65-9	0.029	0.13
Endosulfan sulfate	1031-07-8	0.029	0.13
Endrin	72-20-8	0.0028	0.13
Endrin aldehyde	7421-93-4	0.025	0.13
EPTC	759-94-4	0.003	1.4
Ethyl acetate	141-78-6	0.34	33
Ethyl benzene	100-41-4	0.057	10
Ethyl cyanide/Propanenitrile	107-12-0	0.24	360
Ethyl ether	60-29-7	0.12	160
Ethyl methacrylate	97-63-2	0.14	160
Ethylene oxide	75-21-8	0.12	NA
bis(2-Ethylhexyl) phthalate	117-81-7	0.28	28
Famphur	52-85-7	0.017	15
Fluoranthene	206-44-0	0.068	3.4
Fluorene	86-73-7	0.059	3.4
Formetanate hydrochloride	23422-53-9	0.056	1.4
Formparanate	17702-57-7	0.056	1.4
Heptachlor	76-44-8	0.0012	0.066
Heptachlor epoxide	1024-57-3	0.016	0.066
Hexachlorobenzene	118-74-1	0.055	10
Hexachlorobutadiene	87-68-3	0.055	5.6
Hexachlorocyclopentadiene	77-47-4	0.057	2.4
Hexachloroethane	67-72-1	0.055	30
Hexachloropropylene	1888-71-7	0.035	30
HxCDDs (All Hexachlorodibenzo-p-dioxins)	NA	0.000063	0.001
HxCDFs (All Hexachlorodibenzofurans)	NA	0.000063	0.001
Indeno (1,2,3-c,d) pyrene	193-39-5	0.0055	3.4
Iodomethane	74-88-4	0.19	65
3-Iodo-2-propynyl n-butylcarbamate	55406-53-6	0.056	1.4
Isobutyl alcohol	78-83-1	5.6	170
Isodrin	465-73-6	0.021	0.066
Isolan	119-38-0	0.056	1.4
Isosafrole	120-58-1	0.081	2.6
Kepone	143-50-0	0.0011	0.13
Methacrylonitrile	126-98-7	0.24	84
Methanol	67-56-1	5.6	0.75 mg/l TCLP
Methapyrilene	91-80-5	0.081	1.5
Methiocarb	2032-65-7	0.056	1.4
Methomyl	16752-77-5	0.028	0.14
Methoxychlor	72-43-5	0.25	0.18
Methyl ethyl ketone	78-93-3	0.28	36

UNIVERSAL TREATMENT STANDARDS—Continued

[Note: NA means not applicable.]

Regulated constituent/common name	CAS[1] number	Wastewater standard	Nonwastewater standard
		Concentration in mg/l[2]	Concentration in mg/kg[3] unless noted as "mg/l TCLP"
Methyl isobutyl ketone	108-10-1	0.14	33
Methyl methacrylate	80-62-6	0.14	160
Methyl methansulfonate	66-27-3	0.018	NA
Methyl parathion	298-00-0	0.014	4.6
3-Methylcholanthrene	56-49-5	0.0055	15
4,4-Methylene bis(2-chloroaniline	101-14-4	0.50	30
Methylene chloride	75-09-2	0.089	30
Metolcarb	1129-41-5	0.056	1.4
Mexacarbate	315-18-4	0.056	1.4
Molinate	2212-67-1	0.003	1.4
Naphthalene	91-20-3	0.059	5.6
2-Naphthylamine	91-59-8	0.52	NA
o-Nitroaniline	88-74-4	0.27	14
p-Nitroaniline	100-01-6	0.028	28
Nitrobenzene	98-95-3	0.068	14
5-Nitro-o-toluidine	99-55-8	0.32	28
o-Nitrophenol	88-75-5	0.028	13
p-Nitrophenol	100-02-7	0.12	29
N-Nitrosodiethylamine	55-18-5	0.40	28
N-Nitrosodimethylamine	62-75-9	0.40	2.3
N-Nitroso-di-n-butylamine	924-16-3	0.40	17
N-Nitrosomethylethylamine	10595-95-6	0.40	2.3
N-Nitrosomorpholine	59-89-2	0.40	2.3
N-Nitrosopiperidine	100-75-4	0.013	35
N-Nitrosopyrrolidine	930-55-2	0.013	35
Oxamyl	23135-22-0	0.056	0.28
Parathion	56-38-2	0.014	4.6
Total PCBs (sum of all PCB isomers, or all Aroclors)	1336-36-3	0.10	10
Pebulate	1114-71-2	0.003	1.4
Pentachlorobenzene	608-93-5	0.055	10
PeCDDs (All Pentachlorodibenzo-p-dioxins)	NA	0.000063	0.001
PeCDFs (All Pentachlorodibenzofurans)	NA	0.000035	0.001
Pentachloroethane	76-01-7	0.055	6.0
Pentachloronitrobenzene	82-68-8	0.055	4.8
Pentachlorophenol	87-86-5	0.089	7.4
Phenacetin	62-44-2	0.081	16
Phenanthrene	85-01-8	0.059	5.6
Phenol	108-95-2	0.039	6.2
o-Phenylenediamine	95-54-5	0.056	5.6
Phorate	298-02-2	0.021	4.6
Phthalic acid	100-21-0	0.055	28
Phthalic anhydride	85-44-9	0.055	28
Physostigmine	57-47-6	0.056	1.4
Physostigmine salicylate	57-64-7	0.056	1.4
Promecarb	2631-37-0	0.056	1.4
Pronamide	23950-58-5	0.093	1.5
Propham	122-42-9	0.056	1.4
Propoxur	114-26-1	0.056	1.4
Prosulfocarb	52888-80-9	0.003	1.4
Pyrene	129-00-0	0.067	8.2
Pyridine	110-86-1	0.014	16
Safrole	94-59-7	0.081	22
Silvex/2,4,5-TP	93-72-1	0.72	7.9
1,2,4,5-Tetrachlorobenzene	95-94-3	0.055	14
TCDDs (All Tetrachlorodibenzo-p-dioxins)	NA	0.000063	0.001
TCDFs (All Tetrachlorodibenzofurans)	NA	0.000063	0.001
1,1,1,2-Tetrachloroethane	630-20-6	0.057	6.0
1,1,2,2-Tetrachloroethane	79-34-5	0.057	6.0
Tetrachloroethylene	127-18-4	0.056	6.0
2,3,4,6-Tetrachlorophenol	58-90-2	0.030	7.4
Thiodicarb	59669-26-0	0.019	1.4
Thiophanate-methyl	23564-05-8	0.056	1.4
Tirpate	26419-73-8	0.056	0.28
Toluene	108-88-3	0.080	10
Toxaphene	8001-35-2	0.0095	2.6

UNIVERSAL TREATMENT STANDARDS—Continued

[Note: NA means not applicable.]

Regulated constituent/common name	CAS[1] number	Wastewater standard	Nonwastewater standard
		Concentration in mg/l[2]	Concentration in mg/kg[3] unless noted as "mg/l TCLP"
Triallate	2303–17–5	0.003	1.4
Tribromomethane/Bromoform	75–25–2	0.63	15
1, 2, 4-Trichlorobenzene	120–82–1	0.055	19
1,1,1-Trichlorethane	71–55–6	0.054	6.0
1,1,2-Trichlorethane	79–00–5	0.054	6.0
Trichloroethylene	79–01–6	0.054	6.0
Trichloromonofluoromethane	75–69–4	0.020	30
2,4,5-Trichlorophenol	95–95–4	0.18	7.4
2,4,6-Trichlorophenol	88–06–2	0.035	7.4
2,4,5-Trichlorophenoxyacetic acid/2,4,5-T	93–.76–5	0.72	7.9
1,2,3-Trichloropropane	96–18–4	0.85	30
1,1,2-Trichloro-2,2,2-trifluoroethane	76–13–1	0.057	30
Triethylamine	101–44–8	0.081	1.5
tris-(2,3-Dibromopropyl) phosphate	126–72–7	0.11	0.10
Vernolate	1929–77–7	0.003	1.4
Vinyl chloride	75–01–4	0.27	6.0
Xylenes-mixed isomers (sum of o-,m-, and p-xylene concentrations)	1330–20–7	0.32	30
II. Inorganic Constituents:			
Antimony	7440–36–0	1.9	2.1 mg/l TCLP
Arsenic	7440–38–2	1.4	5.0 mg/l TCLP
Barium	7440–39–3	1.2	7.6 mg/l TCLP
Beryllium	7440–41–7	0.82	0.014 mg/l TCLP
Cadmium	7440–43–9	0.69	0.19 mg/l TCLP
Chromium (Total)	7440–47–3	2.77	0.86 mg/l TCLP
Cyanides (Total)[4]	57–12–5	1.2	590
Cyanides (Amenable)[4]	57–12–5	0.86	30
Fluoride[5]	16984–48–8	35	NA
Lead	7439–92–1	0.69	0.37 mg/l TCLP
Mercury—Nonwastewater from Retort	7439–97–6	NA	0.20 mg/l TCLP
Mercury—All Others	7439–97–6	0.15	0.25 mg/l TCLP
Nickel	7440–02–0	3.98	5.0 mg/l TCLP
Selenium	7782–49–2	0.82	0.16 mg/l TCLP
Silver	7440–22–4	0.43	0.30 mg/l TCLP
Sulfide	18496–25–8	14	NA
Thallium	7440–28–0	1.4	0.78 mg/l TCLP
Vanadium[4]	7440–62–2	4.3	0.23 mg/l TCLP
Zinc[5]	7440–66–6	2.61	5.3 mg/l TCLP

Notes to table:

[1] CAS means Chemical Abstract Services. When the waste code and/or regulated constituents are described as a combination of a chemical with it's salts and/or esters, the CAS number is given for the parent compound only.

[2] Concentration standards for wastewaters are expressed in mg/l and are based on analysis of composite samples.

[3] Except for Metals (EP or TCLP) and Cyanides (Total and Amenable) the nonwastewater treatment standards expressed as a concentration were established, in part, based upon incineration in units operated in accordance with the technical requirements of 40 CFR part 264, subpart O, or 40 CFR part 265, subpart O, or based upon combustion in fuel substitution units operating in accordance with applicable technical requirements. A facility may comply with these treatment standards according to provisions in 40 CFR 268.40(d). All concentration standards for nonwastewaters are based on analysis of grab samples.

[4] Both Cyanides (Total) and Cyanides (Amenable) for nonwastewaters are to be analyzed using Method 9010 or 9012, found in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", EPA Publication SW–846, as incorporated by reference in 40 CFR 260.11, with a sample size of 10 grams and a distillation time of one hour and 15 minutes.

[5] These constituents are not "underlying hazardous constituents" in characteristic wastes, according to the definition at § 268.2(i).

20. Appendix XI is added to part 268 to read as follows:

APPENDIX XI TO PART 268—METAL BEARING WASTES PROHIBITED FROM DILUTION IN A COMBUSTION UNIT ACCORDING TO 40 CFR 268.3(C)[1]

Waste code	Waste description
D004	Toxicity Characteristic for Arsenic.
D005	Toxicity Characteristic for Barium.
D006	Toxicity Characteristic for Cadmium.
D007	Toxicity Characteristic for Chromium.
D008	Toxicity Characteristic for Lead.
D009	Toxicity Characteristic for Mercury.
D010	Toxicity Characteristic for Selenium.
D011	Toxicity Characteristic for Silver.

APPENDIX XI TO PART 268—METAL BEARING WASTES PROHIBITED FROM DILUTION IN A COMBUSTION UNIT ACCORDING TO 40 CFR 268.3(C) [1]—Continued

Waste code	Waste description
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.
F007	Spent cyanide plating bath solutions from electroplating operations.
F008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.
F010	Quenching bath residues from oil baths from metal treating operations where cyanides are used in the process.
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.
F012	Quenching waste water treatment sludges from metal heat treating operations where cyanides are used in the process.
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in aluminum car washing when such phosphating is an exclusive conversion coating process.
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.
K003	Wastewater treatment sludge from the production of molybdate orange pigments.
K004	Wastewater treatment sludge from the production of zinc yellow pigments.
K005	Wastewater treatment sludge from the production of chrome green pigments.
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).
K007	Wastewater treatment sludge from the production of iron blue pigments.
K008	Oven residue from the production of chrome oxide green pigments.
K061	Emission control dust/sludge from the primary production of steel in electric furnaces.
K069	Emission control dust/sludge from secondary lead smelting.
K071	Brine purification muds from the mercury cell processes in chlorine production, where separately prepurified brine is not used.
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting.
K106	Sludges from the mercury cell processes for making chlorine.
P010	Arsenic acid H_3AsO_4
P011	Arsenic oxide As_2O_5
P012	Arsenic trioxide
P013	Barium cyanide
P015	Beryllium
P029	Copper cyanide Cu(CN)
P074	Nickel cyanide $Ni(CN)_2$
P087	Osmium tetroxide
P099	Potassium silver cyanide
P104	Silver cyanide
P113	Thallic oxide
P114	Thallium (I) selenite
P115	Thallium (I) sulfate
P119	Ammonium vanadate
P120	Vanadium oxide V_2O_5
P121	Zinc cyanide.
U032	Calcium chromate.
U145	Lead phosphate.
U151	Mercury.
U204	Selenious acid.
U205	Selenium disulfide.
U216	Thallium (I) chloride.
U217	Thallium (I) nitrate.

[1] A combustion unit is defined as any thermal technology subject to 40 CFR part 264, subpart O; Part 265, subpart O; and/or 266, subpart H.

PART 271—REQUIREMENTS FOR AUTHORIZATION OF STATE HAZARDOUS WASTE PROGRAMS

21. The authority citation for part 271 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a) and 6926.

Subpart A—Requirements for Final Authorization

22. Section 271.1(j) is amended by adding the following entries to Table 1 in chronological order by date of publication in the Federal Register, and by adding the following entries to Table 2 in chronological order by effective date in the Federal Register to read as follows:

§ 271.1 Purpose and scope.

* * * * *

(j) * * *

TABLE 1.—REGULATIONS IMPLEMENTING THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

Promulgation date	Title of regulation	Federal Register reference	Effective date
* *	* * *	*	*
April 8, 1996	Land Disposal Restrictions Phase III—Decharacterized Wastewaters, Carbamate Wastes, and Spent Aluminum Potliners in § 268.39..	61 FR [Insert page numbers].	July 8, 1996.
* *	* * *	*	*

TABLE 2—SELF-IMPLEMENTING PROVISIONS OF THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

Effective date	Self-implementing provision	RCRA citation	Federal Register reference
* *	* *	*	* *
July 8, 1996	Prohibition on land disposal of carbamate wastes..	3004(m).	April 8, 1996, 61 FR [Insert page numbers].
* *	* *	*	* *
October 8, 1996	Prohibition on land disposal of K088 wastes. .	3004(m).	April 8, 1998, 61 FR [Insert page numbers].
April 8, 1996		3004(m)	April 8, 1996, 61 FR [Insert page numbers].
* *	* *	*	* *

PART 403—GENERAL PRETREATMENT REGULATIONS FOR EXISTING AND NEW SOURCES OF POLLUTION

23. The authority citation for part 403 continues to read as follows:

Authority: Sec. 54(c)(2) of the Clean Water Act of 1977, (Pub. L. 95–217) sections 204(b)(1)(C), 208(b)(2)(C)(iii), 301(b)(1)(A)(ii), 301(b)(2)(A)(ii), 301(b)(2)(C), 301(h)(5), 301(i)(2), 304(e), 304(g), 307, 308, 309, 402(b), 405 and 501(a) of the Federal Water Pollution Control Act (Pub. L. 92–500) as amended by the Clean Water Act of 1977 and the Water Quality Act of 1987 (Pub. L. 100–4).

24. In § 403.5, paragraphs (c) heading, (c)(1) and (d) are revised to read as follows:

§ 403.5 National pretreatment standards: Prohibited discharges.

* * * * *

(c) *Development of specific limits by POTW.* (1) Each POTW developing a POTW Pretreatment Program pursuant to § 403.8 shall develop and enforce specific limits to implement the prohibitions listed in paragraphs (a)(1) and (b) of this section. Each POTW with an approved pretreatment program shall continue to develop these limits as necessary and effectively enforce such limits. In addition, the POTW may establish such limits as necessary to address the land disposal restrictions at 40 CFR 268.40.

* * * * *

(d) *Local limits.* Where specific prohibitions or limits on pollutants or pollutant parameters are developed by a POTW in accordance with paragraph (c) of this section, including those standards established to address land disposal restrictions at 40 CFR 268.40, such limits shall be deemed Pretreatment Standards for the purposes of section 307(d) of the Act.

* * * * *

[FR Doc. 96–7597 Filed 4–5–96; 8:45 am]

BILLING CODE 6560–50–P

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40 CFR Parts 148, 268 and 403

[EPA # 530–Z–96–002; FRL–5452–7]

RIN 2050–AD38

Land Disposal Restrictions Phase III—Decharacterized Wastewaters, Carbamate Wastes, and Spent Potliners

AGENCY: Environmental Protection Agency (EPA).

ACTION: Partial withdrawal and amendment of final rule.

SUMMARY: Elsewhere in this Federal Register, EPA is promulgating a final rule which, among other things, revises treatment standards for hazardous wastewaters that exhibit the characteristic of ignitability, corrosivity, reactivity, or toxicity. The revised treatment standards were promulgated to implement the mandate of the opinion of the Circuit Court of Appeals for the District of Columbia Circuit in *Chemical Waste Management (CWM)* v. *EPA*, 976 F. 2d 2 (D.C. Cir. 1992) cert. denied 507 U.S. 1057 (1993). On March 26, 1996, President Clinton signed into law the Land Disposal Program Flexibility Act of 1996 which, among other things, provides that the wastes in question are no longer prohibited from land disposal so long as they are not hazardous wastes at the point they are land disposed. By operation of the statute, this provision is made effective immediately and therefore essentially overrules this portion of the CWM opinion. EPA accordingly is incorporating the statutory provision into the regulations by amending and/or withdrawing the portions of the regulations that are superseded by the new legislation. The amendment/withdrawal of these standards does not affect any other part of the final rule; and the effective dates of the other actions in the final rule likewise will not change. Furthermore, EPA is amending parts of the LDR Phase II final rule, published on September 19, 1994 (59 FR 47982) which are also overruled by the legislation.

EFFECTIVE DATE: April 5, 1996.

FOR FURTHER INFORMATION CONTACT: For general information contact the RCRA Hotline at 800–424–9346 (toll-free) or 703–412–9810 locally. For specific information on the LDR Phase III rule

Inspection Report
Ground Water Quality Bureau

Start Date: 11/20/2007 10:30 AM **End Date:** 11/20/2007 12:30 PM

Facility Information

Facility Name: Los Alamos National Laboratory, DP-1132 Type of Operation: Federal Agency
Contact: Pete Worland (LANL), Bob Beers (LANL) Location: Los Alamos

Inspector(s): Jennifer Montoya, Gerald Knutson, Robert George

Inspection Summary

Purpose: Facility Inspection (GWB)

Activities

Samples Taken: No

Observations and Information Obtained

Site visit and discussion for the TA-50 RLWTF, SWSH, SERF, lagoons and proposed ZLD site for TA-50. NMED Hazardous waste was present for the site visit through TA-50.

Site history:

1963 Start-up of RLWTF
1981 CWA
1986 RCRA

Process: There are three main processes based on waste type:

Low-level radioactive waste (and hazardous waste)- process includes swee flocculation for rads (removing up to 95%) sludge is removed through clarifiers and filter 2-3% more. Wastewater then undergoes tubular ultrafiltration and ion exchange (for perchlorate removal), reverse osmosis (reject water is run through electrodialysis reversal which is not operational right now) and into an effluent tank which is sampled prior to discharging to Mortandad canyon under a NPDES permit. The tank farm evaporates out and leaves a liquid with high TDS which is shipped to TN for de-watering and then shipped back to LANL (TA-54) for processing

High-level radioactive waste (acidic)- Are treated in Room 60 prior to being sent to the low level treatment. Sludge is cemented in 55 gallon drums and goes to WIPP. See field notebook for process.

High- level radioactive waste (caustic)-Are treated in Room 60 prior to being sent to the low level treatment. Sludge is cemented in 55 gallon drums and goes to WIPP. See field notebook for process.

Discharge volumes are approximately 2- 20,000 gallon batches in a week (or approximately 6,000 gpd or 5 million L/year). Discharge volumes have decreased over time due to stricter guidelines on what is sent down to TA-50.

Upgrade on facility will include drying of sludge on site to reduce costs, incorporation of new membrane techniques in place of clarifiers which are being used at SERF, new concrete tank, replacement of room 60 to be simpler and more efficient. The clarifiers at the current facility are built into the structure and will not be removed once closed. The building is planned to remain standing and operational as office space.

Sources for waste being received at TA-50 are derived from TA-48, TA-3, TA-55, TA-35, TA-50 TA-49 and occasionally trucked in from TA-21. All waste must meet the waste acceptance criteria. Flow meters are at each site although LANL admitted they are not always functional. Some sites have their own holding tanks and discharge at one time. Facilitiies which discharge to TA-50 must complete waste profiles for influent. HWB questioned the ability to bypass the treatment facility. LANL clarified that the treatment facility can not be bypassed. All waste must be processed. Floor drains are sent through the process and profiles for chemicals used for cleaning are kept on file.

HWB questioned the Quality Assurance for staff to dispose of haz-waste appropriately. LANL stated that there are trainings and signage at the sinks which indicate what is accepted. A profile has to be filled out in order to procure haz-waste materials which outlines the final destination of the chemical.

Annual report is being sent to Haz-waste electronically.

Room 60 is currently undergoing maintenance of equipment and was not available to tour at the time of the site visit. Handouts outlining the current process will be sent to attendees once it has been cleared through LANL.

Toured the TA-50 Low-level area: viewed clarifiers/pH neutralization (oxidation) rad waste storage area, composite samplers (for influent waste taken daily). Perchlorate processing tanks, ultratubular filters and the reverse osmosis treatment. As this was an initial visit to obtain more knowledge on the process there was nothing to report which appeared abnormal.

Toured SWSH, SERF and lagoons. Worland showed NMED the proposed location for the TA-50 ZLD ponds.

Action Required

None at this time.

Water Quality Inspection & Sampling Checklist

Reference: Regulation No. HED 86 – 14 (NMED)

Entry Conference:

❑ Was facility representative informed of NMED's right of entry and authority: (To access records, inspect monitoring equipment or methods and sample effluents under Sections 74-6-9.E of the New Mexico Water Quality Act NMSA 1978)?

☒ Was NMED identification presented?

❑ Were other potential or suspected violations which prompted inspections listed?

❑ During the inspection, was the facility representative immediately advised or addition potential violations?

Exit Conference:

☒Were the preliminary inspection results summarized?

❑ Was the facility representative advised if violations discussed during the entry conference remain under investigation?

❑ Were other potential violations discovered during the inspection discussed?

❑ Was a date provided as to when NMED expects to complete consideration of potential violation?

Water Quality Sampling:

❑ Was the facility representative offered a reasonable opportunity to obtain split/replicate samples, perform simultaneous tests, measurements or photographs?

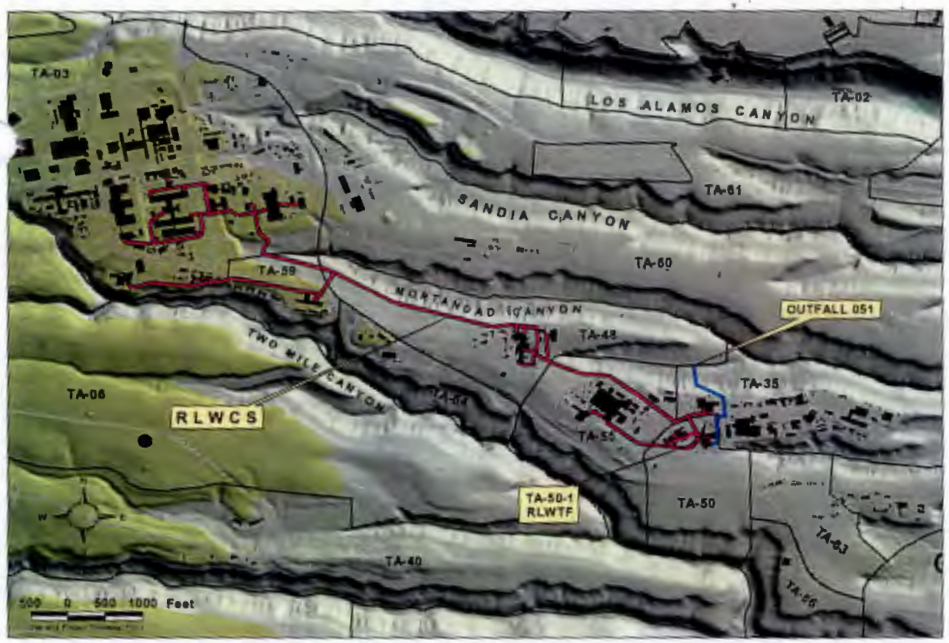
❑ Were copies of NMED's results (sampling, testing, photos) requested? If yes, copies must be provided within ten working days after such results are in NMED's possession.

Radioactive Liquid Waste Treatment Facility
Los Alamos National Laboratory
TA-50

Environment and Waste Management Operations
Radioactive Liquid Waste Group
LA-UR-04-8540
November, 2007

The radioactive liquid waste treatment facility **(RLWTF)** at Technical Area 50 (TA-50) at Los Alamos National Laboratory (LANL) began operation in the summer of **1963**. **Low level radioactive liquid waste (LLW)** is conveyed to the facility via a buried, four mile long double contained pipeline made of high density polyethylene. Additionally, a small volume of LLW is trucked to the RLWTF. Figure 1 shows the location of the RLWTF and of the pipeline that is known as the radioactive liquid waste collection system **(RLWCS)**. The point where treated effluent is discharged to **Mortandad Canyon** is also shown in Figure 1.

Figure 1



During **Calendar Year 2003** the RLWTF received and treated about **twelve million liters of LLW**. Generators of liquid waste are required to profile their waste and receive approval from the RLWTF prior to discharge of the waste to the RLWTF.

Transuranic (TRU) liquid waste is also treated at the RLWTF. This material is more radioactive than the LLW and is generated at the **TA-55 Facility**. The volume of this waste is minimal compared to the LLW, but due to its unique characteristics it is treated by a separate treatment process within the RLWTF. Figure 2 is an aerial photo of the RLWTF in 2003 as viewed from the south.

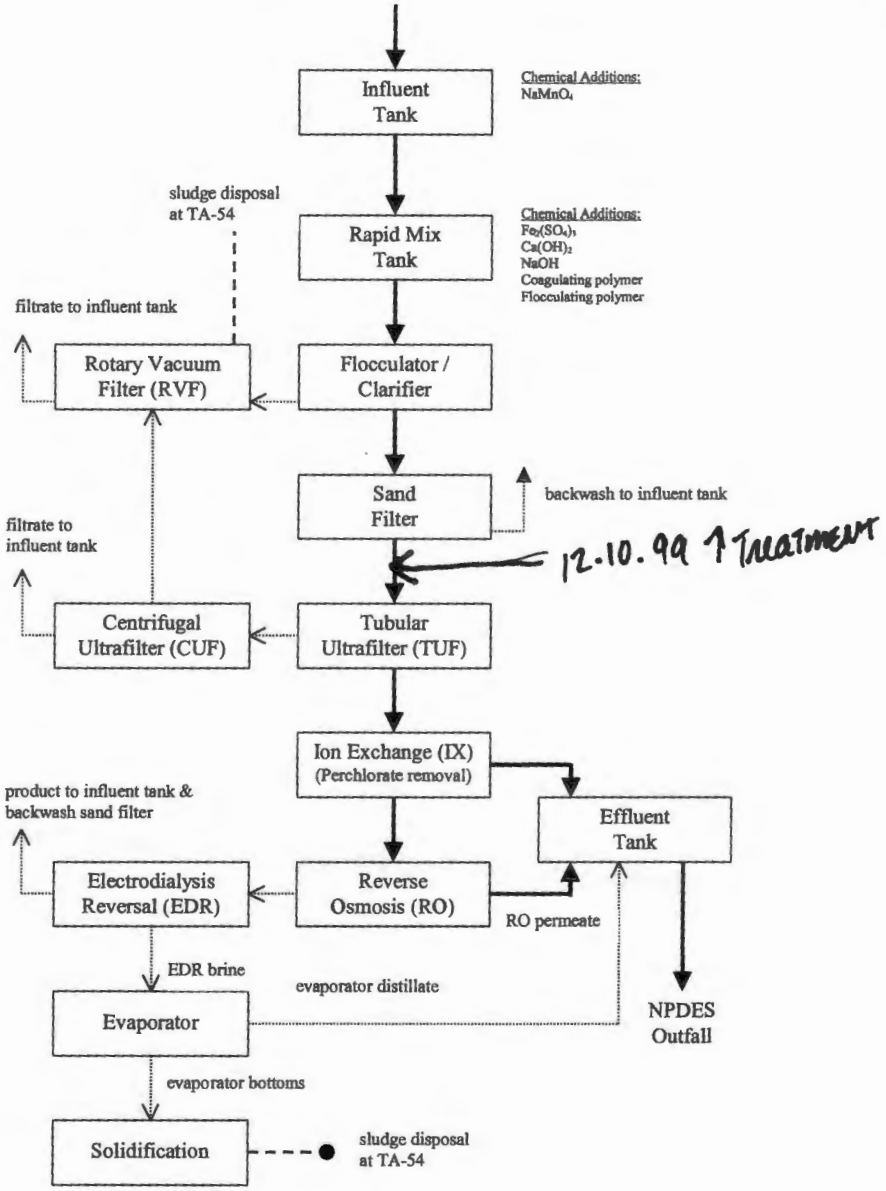
Figure 2

The **LLW treatment process**, shown in Figure 3, consists of oxidation and pH adjustment of the influent followed by chemical addition, coagulation, flocculation and sedimentation in the clarifier followed by rapid sand filtration. This water is then treated by ultrafiltration, ion exchange and reverse osmosis and analyzed for eleven parameters prior to discharge to the environment.

Secondary wastewaters and sludge are generated in this LLW process. The clarifier sludge and secondary wastewaters are

dewatered, volume reduced and drummed. These drums are disposed at the TA-54 radioactive solid waste disposal facility. Prior to **upgrades beginning in 1999**, LLW treatment consisted only of the first five processes shown in Figure 3.

Figure 3



The quality of the effluent waters from the **RLWTF is regulated** by the U.S. Environmental Protection Agency **(EPA)** National Pollutant Discharge Elimination System (NPDES) [21 parameters], the New Mexico Environment Department **(NMED)** [3 parmeters] and by U.S. Department of Energy **(DOE)** guidelines [radionuclides].

Future Plans at the RLWTF include the following:

1. Construction is underway on the 300,000 gallon influent tank farm at TA-50.
2. Critical Decision One (CD-1) DOE approval has been granted to perform preliminary design of an upgraded/new RLWTF capability.
3. Room 60 Remediated Operations Project to provide reliable treatment capability for Plutonium Facility missions.

Los Alamos

NNSA

The SERF is....

designed to treat sanitary effluent from the Los Alamos National Laboratory 's (LANL) domestic wastewater treatment facility at TA-46, producing a higher quality effluent that may be reclaimed for industrial use. The process allows the treated water to be used as cooling tower makeup water for the LANL Super Computing Center (SCC), saving as much as 20 million gallons of fresh water per year.

The SERF uses membrane technology to remove silica, which is naturally high in New Mexico due to volcanic activity. The dissolved silica must be removed to maximize water usage efficiency in the cooling towers. This allows the cooling tower to operate at 4 cycles of concentration.

Of the water treated at SERF, only 2% of it evaporates or ends up as sludge, so the treatment process has a very impressive and high water recovery rate. The silica that is removed is disposed of as a sludge and goes to a landfill.

The SERF itself is very compact and requires only 2 people to operate. LANL personnel have worked hard to assure the SERF's viability and operability. We are proud to have a state of the art water reclamation application at LANL.

Los Alamos
NATIONAL LABORATORY
EST. 1943

Los Alamos National Laboratory
P.O. Box 1663 MS E518
Los Alamos, NM 87545

Sanitary Effluent Reclamation Facility (SERF)

LA-UR-05-3188

Los Alamos
NATIONAL LABORATORY
EST. 1943

938

Los Alamos National Laboratory Recycled Wastewater Flow Path

Sanitary from LANL

Wastewater is transported from Laboratory facilities through the collection system to the SWWS facility located at TA-46.

Sanitary Wastewater System (SWWS) TA-46

Approx. 0.25 MGD of treated effluent is sent to the 500 Kgal storage tank at TA-3 through the return line installed in the 90's.

Cross Canyon Feed To Recycle Tank

Booster Pump Station (TA-3-285)

Sanitary Effluent Reclamation Facility TA-3-1398 (SERF)

SWWS Recycle Tank (TA-3-336)

Unused sanitary effluent discharges through Outfall 001

Power Plant Outfall 001

Effluent from the sanitary wastewater facility is treated in the Recycle Facility located at TA-3. The process takes the wastewater and passes it through microfiltration, followed by reverse osmosis, at a maximum rate of 0.14 MGD. The product water from the RO is blended with sanitary effluent at roughly a 2:1 ratio and sent to the cooling towers at the Supercomputing Complex at TA-3. This will allow the towers to operate at 4 cycles of concentration or greater (limited by chlorides).

Process Area

Secondary waste from the microfilter is retreated through the system. Solids are concentrated and filtered with a filter press. RO reject, ~ 0.0084 MGD, is sent to the solar evap basin located approx. 1.75 miles east of the treatment facility. The basin is in two sections, double lined w/ leak detection. The two sections are connected by an overflow pipe. The basin has a 4' usable depth.

SCC Cooling Towers

Cooling tower blowdown is sent to a current NPDES permitted outfall (03A027).

Discharge from SCC into Sandia Canyon

Downstream from Discharge

Solar Evap Basin

LA-UR-05-3188

Los Alamos NATIONAL LABORATORY EST. 1943

03821

NMED VISIT/TOUR @ RLWTF 11-20-07

Name	Org	Phone	email
Pete Worland	ENMD-RLW	665-7167	vpw@lanl.gov
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Los Alamos
NATIONAL LABORATORY
EST. 1943

Environment, Safety, Health & Quality
P.O. Box 1663, Mail Stop K491
Los Alamos, New Mexico 87545
(505) 667-4218/FAX: (505) 665-3811

Date: November 28, 2007
Refer To: ESH&Q-07-077

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Bearzi:

SUBJECT: RESPONSE TO INFORMATION REQUEST REGARDING THE EXEMPTION STATUS OF THE TECHNICAL AREA 50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, LOS ALAMOS NATIONAL LABORATORY (LANL), EPA ID# NM0890010515

The purpose of this letter is to provide the Los Alamos National Security, LLC and the National Nuclear Security Administration response to the Information Request (IR) issued by the Hazardous Waste Bureau of the New Mexico Environment Department (NMED) on October 26, 2007. The IR required that LANL provide information regarding the Resource Conservation and Recovery Act (RCRA) hazardous waste and hazardous waste permitting exemptions for the Technical Area (TA) Radioactive Liquid Waste Treatment Facility (RLWTF) and the planned zero-discharge upgrade.

Enclosure 1 to this letter provides responses to each of the twelve requested information items and identifies specific appendices that contain information requested in the IR. The twenty one append are provided in electronic format due to the size of the submittal and are listed on page 3 of this le

The IR stated that a response was due within 30 days of receipt of the letter. The letter was receiv November 2, 2007, making the scheduled submittal date December 3, 2007 (the first office day a December 1). This document transmittal contains Official Use Only (OUO) information.

If you have any questions related to this request for information, please contact Jack Ellvinger, Environmental Protection Division, ENV-RCRA Group at (505) 667-0633.

Sincerely,

Cindy Dutro

Richard S. Watkins
Associate Director
Environment, Safety, Health and Quality
Los Alamos National Security, LLC

Sincerely,

Gene Turner

Gene Turner
Environmental Permitting Manager
Los Alamos Site Office

RSW:GT:HWB/lm

Enclosures: a/s

Cy: Steve Pullen, NMED/HWB, Santa Fe, NM, w/enc.
John Kieling, NMED/HWB, Santa Fe, NM, w/o enc.
Robert George, NMED/GWQB, Santa Fe, NM, w/o enc.
Laura King, USEPA, Region 6, Dallas, TX, w/enc.
Michael B. Mallory, PADOPS, w/o enc., A102
Tori George, ENV-DO, w/o enc., J978
Jack Ellvinger, ENV-RCRA, w/o enc., K490
Holly Wheeler-Benson, ENV-RCRA, w/o enc., K490
Mike Saladen, ENV-RCRA, w/o enc., K490
Bob Beers, ENV-RCRA, w/o enc., K490
Pete Worland, EWMO-RLW, w/o enc., E518
Edward Artiglia, PE-DO, w/o enc., P137
Keith Orr, PP-WEP, w/o enc., P137
Craig Douglas, RLW, w/o enc., E518
Alison Dorries, WES-DO, w/o enc., M992
Gerry O'Leary, WDP-DO, w/o enc., J591
Ellen Louderbough, LC-LESH, w/o enc., A187
Phil Wardwell, LC-LESH, w/o enc., A187
ENV-RCRA File (07-266), w/enc., K490
IRM-RMMSO, (U0703504), w/enc., A150

List of Appendices

Appendix A - Information Request Regarding the Exemption Status of the Technical Area 50 Radioactive Liquid Waste Treatment Facility, Los Alamos National Laboratory (LANL), EPA ID # NM0890010515 (electronic copy)

Appendix B - State Certification of National Pollution Discharge Elimination System Permit, Los Alamos National Laboratory (electronic copy)

Appendix C - Amendment of New Mexico's State Certification of National Pollution Discharge Elimination System Permit, Los Alamos National Laboratory (electronic copy)

Appendix D – Los Alamos National Laboratory NPDES Permit Re-Application and Supplement 1, Permit No NM0028355, LA-UR-04-4957 and LA-UR-05-6509 (electronic copy)

Appendix E – Waste Profile Forms for Wastes Transferred to the Radioactive Liquid Waste Treatment Facility, LA-UR-07-7774 (electronic copy)

Appendix F – TA-55 Liquid Waste Transferred to TA-50, LA-UR-07-7774 (electronic copy)

Appendix G – Radioactive Liquid Waste Treatment Facility Waste Acceptance Criteria, LA-UR-07-7774 (electronic copy)

Appendix H – Waste Acceptance Criteria for Transuranic Radioactive Liquid Waste, LA-UR-07-7774 (electronic copy)

Appendix I – Managing of Radioactive Liquid Waste Disposal from TA-55 to TA-50, LA-UR-07-7774 (electronic copy)

Appendix J – Identification of Certain RCRA Wastes – the F-Spent Solvent, P, and U Listings (EI 231-0058/1291) (electronic copy)

Appendix K – Fact Sheet, Waste Acceptance Criteria for Wastewater Discharged to the Radioact Liquid Waste Treatment Facility, LA-UR-07-7774 (electronic copy)

Appendix L – 2002 Annual Report for the Radioactive Liquid Waste Treatment Facility, LA-UR-03-2728 (electronic copy)

Appendix M – 2003 Annual Report for the Radioactive Liquid Waste Treatment Facility, LA-CP-07-04-0314 [this document has been provided under a separate cover to the New Mexic Environment Department as Official Use Only]. This document transmittal contains OUO infor Further dissemination is authorized to the Department of Energy and DOE contractors only; oth requests shall be approved by the originating facility or higher DOE programmatic authority (electronic copy)

Appendix N – 2004 Annual Report for the Radioactive Liquid Waste Treatment Facility LA-UR-05-4395 (electronic copy)

Appendix O – 2005 Annual Report for the Radioactive Liquid Waste Treatment Facility LA-UR-06-3887 (electronic copy)

Appendix P – 2006 Annual Report for the Radioactive Liquid Waste Treatment Facility LA-UR-07-3447 (electronic copy)

Appendix Q – Waste Profile Forms for Wastes Generated at TA-50, Building 1, LA-UR-07-7774 (electronic copy)

Appendix R – Disposition of Waste Generated at TA-50, Building 1, LA-UR-07-7774 (electronic copy)

Appendix S – Monthly, Quarterly, and Annual Discharge Monitoring Reports Previously Submitted to EPA and NMED, LA-UR-07-7774 (electronic copy)

Appendix T – Derived Concentration Guidelines Reports Previously Submitted to DOE and NMED, LA-UR-07-7774 (electronic copy)

Appendix U – Quarterly Ground Water Discharge Plan Reports Previously Submitted to NMED, LA-UR-07-7774 (electronic copy)

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: January 25, 2008
Refer To: ENV-RCRA-08-015
LA-UR: 08-0328

Mr. William Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

GROUND WATER
JAN 3 0 2008
BUREAU

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, FOURTH QUARTER 2007, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the fourth quarter (October, November, December) of 2007. Since the first quarter of 1999, Los Alamos National Laboratory has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the fourth quarter of 2007 (Please note that data missing from the third quarter 2007 report, the analytical results for MCO-4B, are also included in Table 1.0). Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Laboratory's Water Quality Database (http://wqdbworld.lanl.gov/).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the period October through December, 2007. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. All of the FWC results for the fourth quarter of 2007 were below the NM WQCC ground water standards for nitrate-nitrogen, fluoride, and total dissolved solids.

Table 3.0 presents the final monthly composite (FMC) sample results for nitrate-nitrogen, perchlorate (ClO_4, by Method 314.0, Ion Chromatography), fluoride, and total dissolved solids for the third quarter of 2007. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results were below the NM WQCC Regulation 3103 standards for nitrate-nitrogen, fluoride, and total dissolved solids.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Marcy Leavitt, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Matthew Johansen, LASO/EO, A316
Gene Turner, LASO/EO, A316
Michael Mallory, PADOPS, A102
Richard S. Watkins, ADESHQ, K491
Tori George, ENV-DO, J978
Mike Saladen, ENV-RCRA, K490
Bob Beers, ENV-RCRA, K490
Daniel Cox, EWMO-DO, J910
Craig Douglass, RLW, E518
Pete Worland, EWMO-RLW, E518
Chris Del Signore, EWMO-RLW, E518
ENV-RCRA, File, w/enc., K490
IRM-RMMSO, w/enc., A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 4th Quarter, 2007.

Sampling Location	Sample Field Prep (F/UF)[3]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F[3]	12/10/2007	3.95	0.67	0.20	<0.05	217	0.33
MCO-4B	F	8/13/2007	13.3	1.78H	0.28H	<0.03H	378	0.72
MCO-4B	F	12/14/2007	11.1	5.57	0.53	0.41	248	0.88
MCO-6	F	12/14/2007	19.0	1.89	0.08J	<0.05	308	0.98
MCO-7	F	12/14/2007	23.9	10.0	0.06J	<0.05	300	1.23
MCO-7 field duplicate[2]	F	12/14/2007	24.2	9.77	0.07J	<0.05	296	1.23
NM WQCC 3103 Ground Water Standards			*NA*[4]	*10 mg/L*[5]	*NA*[4]	*NA*[4]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]LANL collects duplicate samples as part of its QC program.

[3]F means the sample was filtered, UF means the sample was not filtered.

[4]NA means that there is no NM WQCC 3103 standard for this analyte.

[5]The NMWQCC Regulation 3103 Ground Water Standard is for NO_3-N.

J means that the analyte is classified as detected but the reported value is expected to be more uncertain than usual.

H means that the analytical holding time was exceeded.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 4th Quarter, 2007.

Monitoring Period	Sample Composite Date	Sample ID#	RLWTF Final Weekly Composite Results[1]			
			NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
Sept, 2007	9/24/2007	GU070900OTHE04	2.34	0.24	<0.033	70
Oct, 2007	10/1/2007	GU071000OTHE01	0.86	0.33	<0.033	51
	10/8/2007	GU071000OTHE02	0.03J	<0.05	<0.033	103H
	10/15/2007	GU071000OTHE03	<0.01	<0.05	0.18	53
	10/22/2007	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]
	10/29/2007	GU071000OTHE04	<0.08J	0.17	0.18	50
Nov, 2007	11/5/2007	GU071000OTHE05	<0.05	<0.05	0.12	68H
	11/12/2007	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]
	11/19/2007	GU071000OTHE06	<0.05	<0.05	0.11	68
	11/26/2007	GU071100OTHE01	<0.25	<0.05	0.07J	85
Dec, 2007	12/3/2007	GU071200OTHE01	<0.5	0.06J	0.06J	76
	12/10/2007	GU071200OTHE02	<0.5	0.06J	0.07J	91
	12/17/2007	GU071200OTHE03	<0.05	0.07J	0.09J	75
	12/24/2007	GU080100OTHE01	pending	pending	pending	pending
	12/31/2007	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]	No Discharge[2]
4th Quarter 2007 Averages[3] (mg/L)			**0.41**	**0.11**	**0.09**	**72**
NM WQCC 3103 Ground Water Standards			*10 mg/L*[4]	*NA*[5]	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]All analyses by General Engineering Laboratories, Inc. unless otherwise noted.

[2]No Discharges means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]4th quarter 2007 averages include the results from September 2007.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).
H means that the analytical holding time was exceeded.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 4th Quarter, 2007.

	RLWTF FMC Results[1]			
Monitoring Period	**NO_3-N (mg/L)**	**Perchlorate by IC[2] (ug/L)**	**TDS (mg/L)**	**F (mg/L)**
October, 2007	0.08	<1	78	0.17
November, 2007	0.07	<1	66	0.17
December, 2007	<0.02	<1	90	<0.01
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA[3]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analyses by the Laboratory's TA-50 RLWTF analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

Fullam Docs /caseloads / LANL /LANL emails

Fullam, Jennifer, NMENV

From: Schuman, George, NMENV
Sent: Wednesday, March 5, 2008 1:55 PM
To: Fullam, Jennifer, NMENV; Knutson, Gerald, NMENV
Subject: FW:
Attachments: Letter to Messrs.Gregory and McInroy; Letter to Messrs. Winchell and Watkins; Letter to David Gregory and David McInroy; Letter to Messers.Gregory and McInroy

FYI.

From: Olson, Bill, NMENV
Sent: Wednesday, March 05, 2008 10:08 AM
To: Schuman, George, NMENV
Subject:

These are old LANL letters from HWB.

Bill Olson
Ground Water Quality Bureau Chief
New Mexico Environment Department
1190 St. Francis Dr.
Santa Fe NM 87502-6110
(505) 827-2919

Fullam, Jennifer, NMENV

From: Martinez, Cynthia, NMENV
Sent: Thursday, January 17, 2008 1:34 PM
To: Kieling, John, NMENV; Cobrain, Dave, NMENV; Pullen, Steve, NMENV; Kay, Rebecca, NMENV; Young, John, NMENV
Cc: Olson, Bill, NMENV; Leavitt, Marcy, NMENV
Subject: Letter to Messrs. Winchell and Watkins
Attachments: Requirement to submit a RCRA permit app. for TA 50 01-17-08.pdf

Please see attached.

Cynthia Martinez
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Bldg.1
Santa Fe, New Mexico 87505
Phone: 505-476-6000
Fax: 505-476-6030

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

JON GOLDSTEIN
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

January 17, 2008

Donald L. Winchell, Jr., Manager
Los Alamos Site Office
Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

Richard S. Watkins, Associate Director
Environment, Safety, Health, & Quality
Los Alamos National Security, LLC
Los Alamos Research Park
4200 Jemez Road, Suite 400
Los Alamos, NM 87545

RE: REQUIREMENT TO SUBMIT A RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) PERMIT APPLICATION FOR THE TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY LOS ALAMOS NATIONAL LABORATORY (LANL) EPA ID NO. NM 890010515 LANL-07-020

Dear Messrs. Winchell and Watkins:

The New Mexico Environment Department (NMED) has reviewed the response provided by the Los Alamos National Security, LLC and the National Nuclear Security Administration (collectively the Permittees) dated November 28, 2007 (Response) to NMED's information request regarding the Resource Conservation and Recovery Act (RCRA) exemption status of the Technical Area (TA) 50 Radioactive Liquid Waste Treatment Facility (RLWTF). NMED has determined that the RLWTF is a hazardous waste management unit subject to New Mexico's Hazardous Waste Management regulations at 20 .4.1 NMAC. The Permittees must therefore submit a permit application for the unit in accordance with 20.4.1.900 NMAC (incorporating the federal regulations at 40 CFR part 270).

The Permittees claim the Wastewater Treatment Unit (WWTU) permitting exemption at 20.4.1.900 NMAC (incorporating 40 CFR § 270.1(c)(2)(V)) applies to the RLWTF and therefore

the unit is not subject to RCRA permitting. This exemption in part requires a unit be a WWTU subject to the regulations under Section 402 (National Pollution Discharge Elimination System (NPDES)) of the Clean Water Act (CWA). The RLWTF is a "dual use" unit because effluent from the unit both discharges to a National Pollution Discharge Elimination System (NPDES) permitted outfall (Outfall 51) and is transported to a non-NPDES permitted evaporation lagoon at TA-53. The WWTU exemption is not applicable to units where wastewater is managed by means other than, or in addition to, discharge through a NPDES permitted outfall.

The U.S. Environmental Protection Agency (EPA) elaborates on the WWTU exemption in an April 19, 1988 correspondence to Ms. Susan Pendleton (RCRA On-line (RO) # 14262). In that correspondence EPA states "EPA did not intend the WWTU exemption to apply in situations involving 'dual use' of a tank (where a tank is concurrently used for wastewater treatment and for another purpose). Nor did EPA intend for the exemption to apply in situations, such as the one your letter describes, involving 'alternating use' of a tank. Since the purpose of this exemption is to avoid dual regulation under the Clean Water Act and the Resource Conservation and Recovery Act (RCRA), EPA believes that a tank must be used only for wastewater treatment purposes at all times in connection with an on-site wastewater treatment facility in order to qualify for the exemption. EPA did not intend for the exemption to apply in either the 'dual use' or the 'alternating use' scenario. Accordingly, a tank that operates on a 'alternating use basis, as you describe above, does not satisfy the WWTU exemption and is subject to all relevant RCRA regulations."

Furthermore, the WWTU exemption requires wastes entering the unit be classified as "wastewater." The Response provides numerous waste profile forms (WPF) of waste entering the RLWTF that either are identified as non-wastewaters or do not qualify as wastewater as defined by EPA in an August 2000 memorandum. WPF #s 32733, 35269, 35576, 36237, and 36404 identify hazardous or mixed wastes going to the RLWTF as non-wastewaters. EPA's memorandum dated August 4, 2000 (RO # 14472) states "[t]he Agency has not formally defined "wastewater" in the context of the wastewater treatment unit exclusion. However, in a July 31, 1981 letter from John P. Lehman to Richard C. Boyton ..., the Agency described wastewater by stating that wastewaters are 'not concentrated chemicals or non aqueous wastes. While we have not promulgated a formal definition, we are interpreting the term (wastewaters) to refer to wastes which are substantially water with contaminants amounting to a few percent at most.'" The Response includes greater than thirty WPFs that identify wastes which at times contain less than 95 % water and concentrations of contaminants exceeding two percent. The unit is therefore disqualified from the WWTU exemption.

NMED hereby requires the Permittees to submit a RCRA permit application for the RLWTF. The Permittees must submit this application by April 30, 2008.

Please contact Steve Pullen at (505) 476-6044 if you have any questions.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED-HWB
D. Cobrain, NMED-HWB
S. Pullen, NMED-HWB
R. Kay, NMED-HWB
J. Young, NMED-HWB
B. Olsen, NMED-GWQB
M. Leavitt, NMED-SWQB
T. Grieggs, ENV-RCRA, LANL-LASO, MS K490
T. George, ENV-RCRA, LANL-LASO, MS J978
J. Ellvinger, ENV-RCRA, LANL-LASO, MS K490
G. Turner, DOE-LANS, MS A316
G. Rael, EO, LANL-LASO

file: Reading and LANL Permit 2008

Oct. 13. 08

DP 1132
Blue File MRs.

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: April 30, 2008
Refer To: ENV-RCRA-08-081
LA-UR: 08-2393

Mr. William Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

GROUND WATER
APR 2 9 2008
BUREAU

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, FIRST QUARTER 2008, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the first quarter (January, February, March) of 2008. Since the first quarter of 1999, Los Alamos National Laboratory has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the first quarter of 2008. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Laboratory's Water Quality Database (http://wqdbworld.lanl.gov/).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the period January through March 2008. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. All of the FWC results for the first quarter of 2008 were below the NM WQCC ground water standards for nitrate-nitrogen, fluoride, and total dissolved solids.

Table 3.0 presents the final monthly composite (FMC) sample results for nitrate-nitrogen, perchlorate (ClO_4, by Method 314.0, Ion Chromatography), fluoride, and total dissolved solids for the first quarter of 2008. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results were below the NM WQCC Regulation 3103 standards for nitrate-nitrogen, fluoride, and total dissolved solids.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Marcy Leavitt, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, J993
Matthew Johansen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Michael Mallory, PADOPS, A102
Richard S. Watkins, ADESHQ, K491
Tori George, ENV-DO, J978
Mike Saladen, ENV-RCRA, K490
Craig Douglass, RLW, E518
Pete Worland, EWMO-RLW, E518
Chris Del Signore, EWMO-RLW, E518
Jeffery R. Theesfeld, OS-BSI, P901
ENV-RCRA, File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 1st Quarter, 2008.

Sampling Location	Sample Field Prep (F/UF)[3]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F[3]	3/5/2008	2.3	0.29	0.25J	0.14J-	243	0.29
MCO-4B	F	2/7/2008	16.9	1.18	0.92J	<0.05	249J	0.93
MCO-4B duplicate sample[2]	F	2/7/2008	16.2	1.13	0.34J	<0.05	248J	0.92
MCO-6	F	2/21/2008	16.7	1.38	0.24	<0.05	265	1.05
MCO-7	F	2/25/2008	30.5	2.6	<0.21	<0.5	305	1.24
NM WQCC 3103 Ground Water Standards			*NA[4]*	*10 mg/L[5]*	*NA[4]*	*NA[4]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]LANL collects duplicate samples as part of its QC program.

[3]F means the sample was filtered, UF means the sample was not filtered.

[4]NA means that there is no NM WQCC 3103 standard for this analyte.

[5]The NMWQCC Regulation 3103 Ground Water Standard is for NO_3-N.

J means that the analyte is classified as detected but the reported value is expected to be more uncertain than usual.

J- means that the analyte is classified as detected but the reported value is expected to be more uncertain than usual with a negative bias.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 1st Quarter, 2008.

Monitoring Period	Sample Composite Date	Sample ID#	RLWTF Final Weekly Composite Results[1]			
			NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
Dec-07	12/24/2007	GU080100OTHE01	0.15J	0.24	0.23	321
Jan-08	1/7/2008	No Discharge[2]				
	1/14/2008	GU080100OTHE02	<0.05	0.19J	0.08J	137
	1/21/2008	No Discharge				
	1/28/2008	No Discharge				
Feb-08	2/4/2008	GU080200OTHE01	<0.05	0.43	0.52	713
	2/14/2008	GU080200OTHE02	<0.05	2.38	0.42	501
	2/11/2008	GU080200OTHE03	<0.05	2.27	0.45	550
	2/25/2008	No Discharge				
Mar-08	3/3/2008	GU080200OTHE04	0.22J	3.53	0.27	320
	3/11/2008	GU080300OTHE01	0.13J	0.98	0.20	199
	3/19/2008	GU080300OTHE02	0.16J	1.32	0.15	120
	3/24/2008	GU080300OTHE03	pending	pending	pending	pending
	3/31/2008	GU080300OTHE04	pending	pending	pending	pending
1st Quarter 2008 Averages[3] (mg/L)			**0.08**	**1.42**	**0.29**	**358**
NM WQCC 3103 Ground Water Standards			*10 mg/L*[4]	*NA*[5]	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]All analyses by General Engineering Laboratories, Inc. unless otherwise noted.

[2]No Discharges means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]1st quarter 2008 averages include the results from December 2007.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 1st Quarter, 2008.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
January 2008	0.13	<1	318	0.26
February 2008	0.16	<1	556	0.50
March 2008	0.10	<1	235	0.31
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analyses by the Laboratory's TA-50 RLWTF analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

Inspection Report
Ground Water Quality Bureau

Start Date: 06/02/2008 10:00 AM **End Date:** 06/02/2008 11:00 AM

Facility Information
Facility Name: Los Alamos National Laboratory, DP-1132 Type of Operation: Federal Agency
Contact: Beers, Bob (LANL) Location: Los Alamos

Inspector(s): Jennifer Fullam, Gerald Knutson, Robert George

Inspection Summary
Purpose: Facility Inspection

Activities
Samples Taken: No

Observations and Information Obtained
Facility update
Site Visit:
The site visit began with a facility update meeting at Technical Area 50 (TA-50). TA-52 is the location of the proposed Zero Liquid Discharge (ZLD) tanks but will keep the current piping to the NPDES in case of emergency discharge. Went out to the location of the proposed ZLD tanks on Puye Rd. The tanks would be on left side of road. The lines will run on the south side of the current water lines that go out on the mesa. Approximately ½ way of where "septic tank-3" sign is will have to move the current road to the south in order to get the tanks properly placed away from the edge of the mesa.

At TA-50 the collection system operates via gravity flow and has a leak detection system. The system consists of an influent pipe and a secondary pipe which would collect leaking water and deliver it to a sump with leak detection. The only leaks that have occurred were results from infiltration. LANL is beginning to fix the leaking manholes where infiltration water is getting into the system. There are currently 65 manholes. In 1993 there was a Site Characterization Project which took inventory of all the infrastructure around the laboratory. This project resulted in repairs to wastewater lines and reduction in the number of outfalls within the laboratory.

Discussed the sources of waste coming into the RLWTF. High level waste (transuranics) comes from TA-55 into two tanks outside TA-50. The tanks are subsurface. There is 2" HDPE which was put in around 1980 and replaced in 1994 with newer lines tied in around 2006. The grassy area between the road and the facility is a Material Disposal Area. Some of the pipes which were replaced in the 1980's were outside unprotected.

The low-level wastewater comes into a 75,000 gallon subsurface concrete influent tank which was constructed into the tuft in July 1963. To Beers' knowledge, the tank has never been inspected or maintained since it's construction. There are four 20,000 gallon tanks which were supposed to replace the 75,000 gallon tank but they are now being used for the RO wastewater. This water is evaporated and the liquid portion is retreated with the ultrapurification.

Beers took us to see the effluent tanks with ion exchange. These treat at 15 gallons/minute. The new plant design will be for 9,000,000 L/year whereas the current facility is only designed for 5,000,000 L/year. Volumes could increase because of the reduction in NPDES outfalls throughout the Laboratory. This reduction in outfalls is primarily due to the reduction in the metals criteria for NPDES. This wastewater would have to come through the RLWTF or to SERF.

Tour of the "Tank Farm" which is currently being constructed. There are 6-50,000 gallon fiberglass tanks which are housed in a subsurface 3' concrete facility. The purpose was to replace the 75,000 gallon tank which was originally designed for handling emergency discharge events. This project has been placed on hold based on funding and conclusive evidence that the wastewater would not react with the fiberglass tanks. At the time of inspection, all 6 tanks were in place within the structure. Electrical and infrastructural plumbing was still required.

NPDES Outfall site. The water from the RLWTF currently discharges out to "effluent canyon" which is a tributary to the larger "mortandad canyon". There are outfalls just above the RLWTF outfall and most of the time water goes subsurface. Monitoring Well MW-MC-03 is approximately ¼ mile from the discharge location and depth to the alluvial aquifer is approximately 15'. Sampling occurs at the facility and not at the actual outfall due to safety hazards accessing the outfall location.

Action Required

Conclusions:

NMED will:

1. Set up another update meeting in six months to determine the status of the ZLD design.

Permittee will:

1. Set up another update meeting in six months to determine the status of the ZLD design.

06.02.08
Time: 10:00 am- 11:30 am
DP-810
Location: Los Alamos National Laboratory RLWTF (TA-50)
Attendees: Gerald Knutson, NMED GWQB
Robert George, NMED GWQB
Jennifer Fullam, NMED GWQB
Bob Beers, Facility Contact

Site Visit:
The site visit began with a facility update meeting at Technical Area 50 (TA-50). TA-52 is the location of the proposed Zero Liquid Discharge (ZLD) tanks but will keep the current piping to the NPDES in case of emergency discharge. Went out to the location of the proposed ZLD tanks on Puye Rd. The tanks would be on left side of road. The lines will run on the south side of the current water lines that go out on the mesa. Approximately ½ way of where "septic tank-3" sign is will have to move the current road to the south in order to get the tanks properly placed away from the edge of the mesa.

At TA-50 the collection system operates via gravity flow and has a leak detection system. The system consists of an influent pipe and a secondary pipe which would collect leaking water and deliver it to a sump with leak detection. The only leaks that have occurred were results from infiltration. LANL is beginning to fix the leaking manholes where infiltration water is getting into the system. There are currently 65 manholes. In 1993 there was a Site Characterization Project which took inventory of all the infrastructure around the laboratory. This project resulted in repairs to wastewater lines and reduction in the number of outfalls within the laboratory.

Discussed the sources of waste coming into the RLWTF. High level waste (transuranics) comes from TA-55 into two tanks outside TA-50. The tanks are subsurface. There is 2" HDPE which was put in around 1980 and replaced in 1994 with newer lines tied in around 2006. The grassy area between the road and the facility is a Material Disposal Area. Some of the pipes which were replaced in the 1980's were outside unprotected.

The low-level wastewater comes into a 75,000 gallon subsurface concrete influent tank which was constructed into the tuft in July 1963. To Beers' knowledge, the tank has never been inspected or maintained since it's construction. There are four 20,000 gallon tanks which were supposed to replace the 75,000 gallon tank but they are now being used for the RO wastewater. This water is evaporated and the liquid portion is retreated with the ultrapurification.

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Permittee will:

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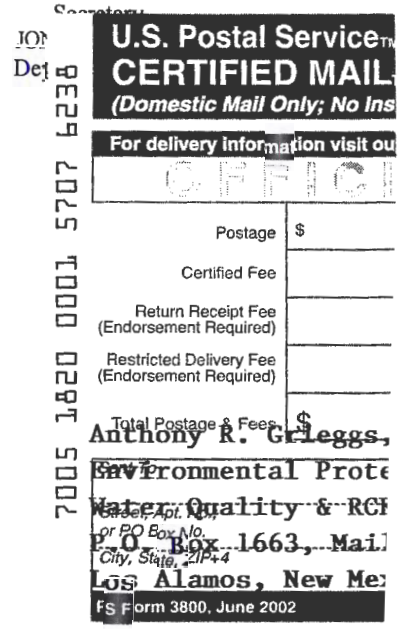
NEW MEXICO
ENVIRONMENT DEPARTMENT

Ground Water Quality Bureau

1190 St. Francis Drive
P.O. Box 26110, Santa Fe, NM 87502
Phone (505) 827-2918 Fax (505) 827-2965
www.nmenv.state.nm.us

BILL RICHARDSON
Governor
DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary
JON
Dep



CERTIFIED MAIL – RETURN RECEIPT REQUESTED

June 11, 2008

Anthony R. Grieggs, Group Leader
Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, NM 87545

RE: Request for Additional Information, DP-1132, Radioactive Liquid Waste Treatment Facility

Dear Mr. Grieggs:

The New Mexico Environment Department (NMED) received a ground water Discharge Permit application from you on April 16, 1996 for the above referenced facility and a Notice of Intent for the discharge of effluent water to evaporative tanks (zero liquid discharge facility) on November 8, 2007. The application proposes the discharge of up to 3.6 million gallons per year of industrial wastewater.

NMED has reviewed the Notice of Intent in accordance with the New Mexico Water Quality Control Commission Regulations (20.6.2 NMAC). The following additional information is necessary in order for NMED to determine if the zero liquid discharge facility will require a New Mexico Environment Department Ground Water Discharge Permit:

1. Submit 60% complete plans and specifications of the facility. Include detailed information regarding the construction of the evaporation tanks.

2. Submit information regarding ground water near the facility that is most likely to be impacted should a release occur. This should include the most shallow aquifers located down gradient of the facility prior to the Rio Grande.

3. Submit procedures for the operation and maintenance of the evaporation tanks. Please include estimated cleaning timelines and methodologies.

4. Submit information on the concentration of waste in the tanks due to evaporation.

5. Submit seismic studies conducted in accordance to 40 CFR § 264.18 (a)

Following submission of the requested additional information, NMED will act upon your Notice of Intent to discharge. Your cooperation is appreciated. If you have any questions, you may reach me at (505) 827-2909.

Sincerely,

Jennifer Fullam
Environmental Scientist
Ground Water Pollution Prevention Section

cc: James Bearzi, NMED Hazardous Waste Bureau
John Young, NMED Hazardous Waste Bureau
Marcy Leavitt, NMED SWQB
Ralph Ford-Schmidt, NMED-DOE Oversight Bureau
Bob Beers, Environmental Protection Division, Water Quality & RCRA Ground , P.O. Box 1663, Mail Stop K490, Los Alamos, New Mexico 87545
Mike Saladen, ENV-RCRA, Los Alamos National Laboratory, K490, Los Alamos, NM 87545 (W/O enclosure)

Fullam Docs 030714 / Casloads / LANL / LANL emails

Fullam, Jennifer, NMENV

From: Fullam, Jennifer, NMENV
Sent: Tuesday, July 1, 2008 11:28 AM
To: Schuman, George, NMENV
Subject: RE: Call from Bob Beers

Thanks. I will make a note in the file. That is strange to hear because we were up there on June 2nd and they did not mention any problems with it.

Jennifer Fullam
Environmental Scientist
Ground Water Quality Bureau
New Mexico Environment Department
505.827.2909
jennifer.fullam@state.nm.us

From: Schuman, George, NMENV
Sent: Tuesday, July 01, 2008 10:11 AM
To: Fullam, Jennifer, NMENV; Knutson, Gerald, NMENV; George, Robert, NMENV
Subject: Call from Bob Beers

Jen, Jake, and Robert:

I received a call from Bob Beers on June 30 regarding TA-50. He called to give us a heads up on a perchlorate issue with the TA-50 effluent. They remove perchlorate from the effluent using ion exchange. In May 2008 they observed perchlorate concentrations in the effluent of 15 ppb, up from 0.4 to 1 ppb. On May 7, 2008 they installed some temporary ion exchange units; perchlorate concentrations are now at 1 ppb. The permanent ion exchange columns have been serviced and will be reinstalled some time this month.

George

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: July 1, 2008
Refer To: ENV-RCRA-08-139

Mr. Robert George, Domestic Team Leader
Ground Water Pollution Prevention Section
Ground Water Quality Bureau
New Mexico Environment Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, New Mexico 87502-6110

Dear Mr. George:

SUBJECT: TA-50 RLWTF ANNUAL REPORT FOR 2007

Please find enclosed the following Los Alamos National Laboratory report: *Radioactive Liquid Waste Treatment Facility Annual Report for 2007* (LA-UR-08-03779, June 2008). This report is being provided to your agency as supporting documentation for the Laboratory's Ground Water Discharge Plan Application (DP-1132) for the Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area (TA)-50.

The *RLWTF Annual Report for 2007* contains summary information about flows, concentrations, and quantities received and discharged at the three LANL radioactive liquid waste treatment facilities (TA-50, TA-21, and TA-53). The facility at TA-50 contains two different treatment processes, each treating a different radioactive liquid waste stream. The two processes are discussed separately throughout the report as though they were each a facility.

Please contact me at 505-667-7969 if you have any questions regarding this report.

Sincerely,

Bob Beers
Water Quality and RCRA Group

BB/lm

Enclosure: a/s

Cy: William Olson, NMED/GWQB, Santa Fe, NM, w/o enc.
Marcy Leavitt, NMED/SWQB, Santa Fe, NM, w/enc.
James Bearzi, NMED/HWB, Santa Fe, NM, w/enc.
Steve Yanicak, NMED/DOE/OB, w/enc., J993
Gene Turner, LASO-EO, w/o enc., A316
Hai Shen, LASO-EO, w/o enc., A316
Michael B. Mallory, PADOPS, w/o enc., A102
Richard S. Watkins, ADESHQ, w/o enc., K491
Tori George, ENV-DO, w/o enc., J978
Craig Douglass, RLW, w/o enc., E518
Peter Rice,., STO-DO, w/o enc E518
Pete Worland, EWMO-RLW, w/o enc., E518
Chris Del Signore, EWMO-RLW, w/o enc., E518
Mike Saladen, ENV-RCRA, w/o enc., K490
ENV-RCRA, File, w/enc., K490
IRM-RMMSO, w/enc., A150

Los Alamos
NATIONAL LABORATORY
EST.1943

JUL 11 2008

BY:----------

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: July 1, 2008
Refer To: ENV-RCRA-08-139

Mr. Robert George, Domestic Team Leader
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Sincerely,

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Water Quality and RCRA Group

BB/lm

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Mike Saladen, ENV-RCRA, w/o enc., K490
ENV-RCRA, File, w/enc., K490
IRM-RMMSO, w/enc., A150

LA-UR-08-03779

Approved for public release; distribution is unlimited.

Title:	Radioactive Liquid Waste Treatment Facility Annual Report for 2007
Author(s):	J.C. Del Signore R.L. Watkins
Intended for:	Environmental & Waste Management Facility Operations June 2008

Los Alamos
NATIONAL LABORATORY
EST. 1943

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Acronyms and Abbreviations

AE-Ci	americium-241-equivalent curie
Ci	curie (3.7×10^{10} disintegrations per second)
COD	chemical oxygen demand
CY	calendar year
DCG	derived concentration guidelines
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
Final50	composite sample of effluent from the RLWTF
IX	ion exchange
Kg	kilogram
L	liter
LANL	Los Alamos National Laboratory
MDL	method detection limit
meq/L	milliequivalents per liter
mg/L	milligram per liter
mrem	millirem (10^{-3} rem)
nCi/L	nanocuries per liter (10^{-9} curies per liter)
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
pCi/L	picocuries per liter (10^{-12} curies per liter)
Pu-239	plutonium isotope with atomic weight of 239
Raw50	composite sample of daily influent to RLWTF via the RLWCS
RLW	radioactive liquid waste(s)
RLWCS	radioactive liquid waste collection system
RLWTF	radioactive liquid waste treatment facility
RO	reverse osmosis
SVOC	semi-volatile organic chemical(s)
TA	technical area
TDS	total dissolved solids
TSS	total suspended solids
TUF	tubular ultrafilter
VOC	volatile organic chemical(s)
µS/cm	microSiemens per centimeter
µg/L	microgram per liter

1. Overview of Facilities and Operations

There are three Radioactive Liquid Waste Treatment Facilities (RLWTF) at the Los Alamos National Laboratory, one each at TA21, TA53, and TA50. The RLW facility at TA50, however, contains two different treatment processes, each treating a different radioactive liquid waste (RLW) stream. These two processes are discussed separately throughout this report as though they were each a facility.

1.1 TA50 RLWTF for Low-Level RLW

The low-level RLW facility at TA50 receives and treats low-level RLW from more than 1000 generating points. RLW are sent from generator facilities to TA50 via truck or by underground pipe. The underground collection system that has about four miles of double-walled pipes that are tied to 25 buildings at six Technical Areas at LANL.

The low-level RLW facility is the only facility that discharges water to the environment. Treated waters are discharged through an outfall in Mortandad Canyon. One state and two federal agencies monitor the quality of these treated waters.

Primary structures at the TA50 RLWTF for the treatment of low-level RLW are Building 50-01, 50-02, 50-90, 50-248, and a trailer-based evaporator. These structures, with a combined area of approximately 55,000 square feet, house process equipment, operations support areas, analytical laboratories, and offices (Del Signore, 07/19/01). The facility has a main treatment process (MTP) with five unit operations, and a secondary treatment process consisting of two unit operations for the treatment of wastes generated by the MTP. The facility has been designated a Hazard Category 3 nuclear facility, and primarily has Management Level 3 quality assurance requirements.

The TA50 RLWTF was constructed in 1963. Because of its age, and because of changing regulations, the facility has undergone significant modifications. The infusion of capital into the TA50 facility for repairs and upgrades has exceeded $20 million since 1997, including projects for stack consolidation, repair of tanks and equipment, and the installation of new processes in 1999 and 2002 to address more stringent discharge standards.

1.2 TA50 RLWTF for Transuranic RLW

The transuranic facility receives and treats an acid waste stream and a caustic waste stream from the plutonium facility at TA55. These two streams are transferred to TA50 via two underground double-walled collection pipes. Treated transuranic waters are sent to the low-level evaporator for further treatment.

The transuranic RLW process was designed and installed in 1982, and brought online in 1983. Structures consist of a valve station at Building 50-201, two influent storage tanks in Building 50-66, and the treatment process within Room 60 of Building 50-01. This facility is part of the Hazard Category 3 nuclear facility at TA50, but primarily has Management Level 2 quality assurance requirements.

Current and recent facility modifications include the replacement of transfer lines between TA55 and TA50, replacement of the caustic waste tank in Building 50-66, and replacement of piping and treatment equipment in Room 60 itself.

1.3 TA53 Facility

The facility at TA53 treats RLW from accelerator research at the Los Alamos Neutron Science Center through water storage, to allow radioisotope decay, and solar evaporation. The TA53 facility started operation in December 1999, and is categorized as a radiological facility.

Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan center. The RLW is pumped from these lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945 at the east end of TA53. The tanks allow decay of radioisotopes created by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one of two evaporator basins, each with a capacity of 125,000 gallons.

1.4 TA21 Facility

The facility at TA21 pre-treats RLW from tritium research at TA21 using a clarifier and a gravity filter. Effluent from the facility is transferred to either the TA50 low-level RLWTF or the TA53 Facility for additional treatment.

The facility is small (4200 ft^2) and old, having been constructed in 1966 (LANL, 09/30/03, p.B-3). Process equipment is smaller than that at the TA50 RLWTF because volumes are smaller. For example, the TA21 clarifier has a capacity of 4,000 gallons, while that at TA50 can hold 18,000 gallons. Associated with the facility are an office trailer and a number of above-ground and below-grade storage tanks. The TA21 RLWTF is categorized as a radiological facility.

2. Operations Summary for 2007

2.1 Flows

Low-level RLW: As shown in Table 2-1, the TA50 RLWTF received 4,448,500 liters of influent during 2007, and discharged 4,585,100 liters to Mortandad Canyon. Influent included 119,820 liters of water transported from six generators via truck; no influent was received during 2007 from the TA21 facility. Water flows were the lowest in the 44-year history of the RLWTF. Influent and effluent volumes are detailed by month in Table 2-2.

Table 2-1
Radioactive Liquid Waste Flows During 2007

Facility	Influent (liters)	Effluent (liters)
Low-level RLW	4,448,500	4,585,100
Transuranic RLW	16,920	1,590
TA-53	176,830	95,730
TA-21	0	0

The influent brought with it 0.76 curie of alpha radioactivity and 0.02 curie of beta activity in 0.79 kilogram of radioactive materials. Uranium-238 accounted for nearly all of the radioactive mass, while plutonium and americium accounted for nearly all of the radioactivity. Effluent contained just 0.02 curie in six grams of radioactive materials. Approximately 99% of the radioactivity in the effluent was due to tritium, which cannot be removed by RLWTF processes.

Nearly 2,400 kilograms of impurities entered the plant in the form of suspended solids (44 kilograms) and dissolved solids (2,350 kilograms). A total of 459 kilograms of solids were discharged with effluent into Mortandad Canyon, of which 40% was sodium.

Transuranic RLW: Influent for the year consisted of 12,290 liters of acid waste plus 4,620 liters of caustic waste. Acid waste influent would have been larger but for the fact that the acid waste influent tank had filled up by mid-October. Transuranic effluent consisted of a single transfer on May 8th to the tanks in Building 50-248. These waters were generated by rinsing and flushing Room 60 piping and equipment.

TA53 RLWTF: All influent was from the TA53 lift stations; no waters were trucked to TA53 in 2007. At the end of the year, storage tanks were filled to 70% capacity (which explains why effluent was so much smaller than influent volume).

Table 2-2
Low-level RLW Flow Summary During 2007

Date	Influent (Liters)	No. of Discharges	Discharged (Liters)
Jan-07	343,036	6	451,200
Feb-07	374,507	5	364,600
Mar-07	418,018	7	518,000
Apr-07	375,281	4	297,500
May-07	413,123	8	593,900
Jun-07	309,752	4	297,500
Jul-07	343,053	3	222,700
Aug-07	433,850	4	293,900
Sep-07	364,786	6	444,400
Oct-07	384,881	6	432,700
Nov-07	372,600	4	295,700
Dec-07	315,612	5	373,000
Total	4,448,499	62	4,585,100

2.2 Effluent Quality: Low-level RLW

Three agencies monitor the quality of treated waters discharged from the TA50 RLWTF into Mortandad Canyon. The United States Department of Energy (DOE) regulates discharges of radioactive materials via Order 5400.5, "Radiation Protection of the Public and the Environment". (DOE, 01/17/93) The United States Environmental Protection Agency (USEPA) regulates 18 parameters via NPDES permit number NM0028355. (EPA, 06/08/07) LANL also has voluntary commitments (a) to the New Mexico Environment Department (NMED) to meet groundwater standards for fluoride, nitrate-nitrogen and total dissolved solids (TDS), (b) to the NMED to meet a proposed discharge standard for perchlorates, and (c) to the DOE to limit tritium to 1% of its published discharge standard.

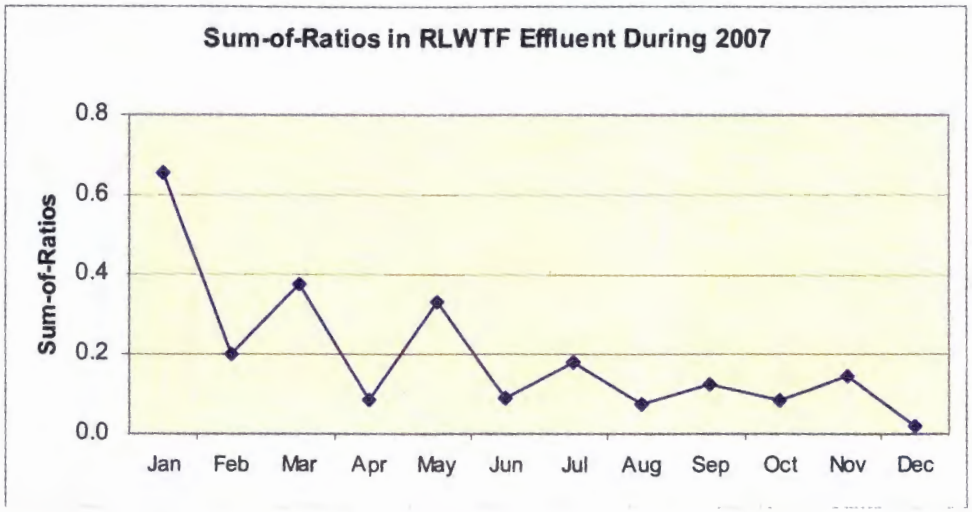
During calendar year 2007, TA50 RLWTF effluent:

- met all DOE standards set forth in Order 5400.5 for radiological discharges;
- was in compliance with all NPDES water quality parameters; and
- met all five voluntary standards.

DOE: Effluent radiological quality during 2007 is illustrated in Figure 2-1, a plot of sum-of-ratios for each month. The average sum-of-ratios for all of 2007 was 0.22, or less than one-fourth of the DOE discharge standard. RLWTF effluent has been compliant with the standard for 94 of the past 96 consecutive months[1].

[1] The monthly sum-of-ratios for discharge of radionuclides was 1.28 in January 2002 and 1.19 in February 2002, versus the DOE Guideline of 1.0.

Figure 2-1



EPA: Table 2-4 summarizes effluent quality versus NPDES discharge limits. The table lists regulated parameters, their discharge standards, and the maximum and average concentration of each parameter in monthly composite samples of effluent during 2007. Annual average discharge concentrations were less than 20% of the discharge standard for all regulated parameters; maximum monthly concentrations were less than half of discharge standards. RLWTF effluent has been compliant with NPDES discharge standards for the past 96 months.

Voluntary: Table 2-3 summarizes effluent quality versus voluntary discharge standards. The table lists the voluntary discharge standards, and the maximum and average concentration of each parameter in weekly composite samples of effluent during 2007. Annual average discharge concentrations were less than 30% of the voluntary standards; maximum weekly concentrations were less than half of the standards. RLWTF effluent has now been compliant with NMED voluntary standards for 441 of the last 443 weekly samples[2]; compliant with the tritium standard for the last 82 months; and compliant with the perchlorate standard for the last 69 months.

Table 2-3
TA50 RLWTF Effluent During 2007 Compared To Voluntary Standards

	Agency	Units	Standard	Max.	Avg.
Dissolved Solids	NMED	mg/L	1,000	480	185
Fluoride	NMED	mg/L	1.6	0.45	0.10
Nitrate-Nitrogen	NMED	mg/L	10	6.5	1.3
Perchlorate	EPA	µg/L	4	0	0
Tritium	DOE	nCi/L	20	12	5.6

Data is from 41 weekly composite samples.

[2] Two weekly composite samples of RLWTF effluent slightly exceeded the groundwater standard for fluoride during 2003. Sample values were 2.07 mg/L (week of Jan 3rd) and 1.64 mg/L (week of Mar 3rd), versus the groundwater standard of 1.6 mg/L. (Watkins and Worland, March 2004, p. 30.)

Table 2-4
TA50 RLWTF Effluent During 2007 Compared To NPDES Standards

Regulated Parameter	Units	Standard (Jan-Jul)	Standard (Aug-Dec)	Max.	Avg.
Aluminum	µg/L	5,000	N.R.	54	11
Arsenic	µg/L	368	N.R.	30	4
Boron	µg/L	5,000	N.R.	170	107
Cadmium	µg/L	50	Report	*	*
Chromium	µg/L	1,340	1,340	*	*
Cobalt	µg/L	1,000	N.R.	*	*
COD	mg/L	125	125	62	14
Copper	µg/L	1,393	Report	23	9.5
Iron	µg/L	Report	N.R.	80	18
Lead	µg/L	423	423	10	1
Mercury	µg/L	0.77	Report	.11	.02
Nickel	µg/L	Report	Report	30	5
PCBs	µg/L	N.R.	Report	*	*
Perchlorate	µg/L	Report	Report	*	*
pH	s.u.	6 - 9	6 - 9	8.2	7
Radium	pCi/L	30	30	*	*
Residual Chlorine	µg/L	N.R.	11	*	*
Selenium	µg/L	5	Report	2	1
Suspended Solids	mg/L	30	30	12	2
Toxic Organics	µg/L	1,000	1,000	55	9
Tritium	nCi/L	20	N.R.	8.2	4.1
Vanadium	µg/L	100	N.R.	8	1
WET	%	N.R.	Report	100%	56%
Zinc	µg/L	4,370	Report	10	2

Data is from 12 monthly composite samples.
N.R. = Not Regulated WET = whole effluent toxicity * Less than detection limit.

2.3 Wastes and Secondary Liquids

RLW treatment processes generate both liquid streams that require further processing and solid wastes that must be disposed. The total volume of liquid wastes generated during 2007 probabl approached three million liters, or 60% of the raw influent volume. More than half of this volume was generated via operation of the tubular ultrafilter, primarily from daily purging of influent tanks and recycle of spongeball waters.

Solid wastes totaled 7260 kilograms of low-level radioactive wastes, 4030 kilograms of chem wastes, and 348 kilograms of mixed low-level wastes. No transuranic wastes, were generate during the year. All of the chemical wastes and mixed low-level wastes, and most of the radioactive wastes, were from construction projects.

2.4 Process and Facility Modifications

Process: The NPDES permit for the TA50 RKWTF was renewed effective August 2007; former permit had been in effect since February 2001. The renewed permit changed NPI sampling and analytical protocols by reducing the number of regulated parameters with

discharge standards from 18 to eight (Table 2-5), and by decreasing the frequency of sampling by two-thirds, from 533 to 173 samples per year (Table 2-6). The number of parameters with a discharge standard will increase to 11 in August 2010 when whole effluent toxicity testing, copper, and zinc cease to be "report only" parameters.

Table 2-5
Comparison of NPDES Regulated Parameters

	Effective Date		
	Feb-01	Aug-07	Aug-10
Discharge Std.	18	8	11
Report Only	3	9	6
Totals	**21**	**17**	**17**

Flow, a regulated (report only) parameter, is not included in the above table.

Table 2-6
Comparison of NPDES Sampling Frequency

	NUMBER OF ANALYSES				
	Weekly	Monthly	Quarterly	Annually	Totals
Feb-01:					
#Analytes	10	2	0	9	21
#Analyses/ yr	500	24	0	9	533
Aug-07:					
#Analytes	2	5	1	9	17
#Analyses/ yr	100	60	4	9	173
Aug-10:					
#Analytes	2	5	1	9	17
#Analyses/ yr	100	60	4	9	173

Facility: The capability of the TA50 RLWTF to receive acid and caustic liquid wastes from TA55 was restored 02/21/07. This achievement followed the activation of new underground influent lines, and installation of a new caustic waste tank, to replace a tank that had developed a leak in September 2003. These two construction projects required 11 months, 3500 labor hours, and 123 confined-space entries into WM66 and WM201 (Worland, 02/22/07). Contamination levels within WM66 were reduced by four orders of magnitude, from 10 million to 100 dpm/100 square centimeters. No contamination of personnel occurred; no CAMs reached alarm levels; and no injuries were suffered.

Also during 2007, work continued on two other TA50 facility modifications – Room 60 repairs, and installation of a new pump house and influent storage facility.

3. Radiological Nature of Low-level RLW

The influent wastewater to the TA50 RLWTF is radioactive due to the presence of radionuclides that emit alpha and beta particles, gamma rays and neutrons. RLWTF influent and effluent samples are analyzed for thirty-seven (37) such radionuclides which, from past experience, are possible in LANL radioactive liquid wastes.

Alpha-emitting radionuclides are of most concern because of quantities (both mass and radioactivity) and safety basis impacts. Specifically, whereas three-fourths of a kilogram and 0.76 curie of alpha-emitting radionuclides were received in RLWTF influent during 2007, less than one gram and just 0.02 curie of beta-emitting radionuclides were received. In the area of safety basis, alpha radionuclides have americium-241 weights ranging from 0.2-1.0, whereas beta radionuclides have weights that are four or more orders of magnitude smaller.

3.1 Influent Characteristics

As shown in Table 3-1, twelve radionuclides were detected in the RLWTF influent: seven alpha-emitting isotopes and five beta-emitting isotopes.

Alpha-emitting radionuclides had an average concentration of 171 nCi/L, or 157 americium-241-equivalent curies (AE-Ci) per liter. This concentration is about three times historical average concentrations (Del Signore, December 2006, p.25), and equates to an influent total of 0.76 curie. Am-241, Pu-238, and Pu-239 comprised all but 0.4% of the alpha radioactivity.

Beta-emitting radionuclides had an average concentration of 4.3 nCi/L, which equates to 0.02 curie. More than 97% of beta radioactivity was from tritium.

3.2 Effluent Characteristics

Also as shown in Table 3-1, thirteen radionuclides were detected in the RLWTF effluent: seven alpha-emitting isotopes and six beta-emitting isotopes. Alpha-emitting radionuclides had an average effluent concentration of 13.5 pCi/L, and beta-emitting radionuclides an average concentration of 4.1 nCi/L.

3.3 Radionuclide Removal

Table 3-2 summarizes radioactivity (curies) into and out of the RLWTF for 2007 for all radioisotopes. In the table, "alpha gross" indicates direct analytical measurement of alpha

activity by liquid scintillation counting, and "alpha sum" is the arithmetic sum of the concentrations of the nine alpha-emitting radionuclides by alpha spectroscopy. This double analysis of water samples provides an accuracy check for analytical results, and can indicate when re-analysis may be warranted.

Table 3-1
Radionuclide Analyses of RLWTF Influent and Effluent in CY 2007

Radionuclides Analyzed for in the RLWTF Influent and Effluent	Radionuclides Present in RLWTF Influent	Radionuclides Detected in RLWTF Effluent
Alpha Particle Emitters (9)		
Am-241	X	X
Np-237		
Ra-226		
Pu-238	X	X
Pu-239	X	X
Th-232	X	X
U-234	X	X
U-235	X	X
U-238	X	X
Beta Particle Emitters (28)		
As-74		X
Be-7		
Ce-141	X	
Co-56 and Co-57		
Co-58 and Co-60		
Cs-134		
Cs-137	X	X
Eu-152		
H-3	X	X
I-133		
Mn-52 and Mn-54		
Na-22		
Ra-228		
Rb-83		X
Rb-84		X
Sc-46 and Sc-48		
Se-75		X
Sn-113		
Sr-85	X	
Sr-89		
Sr-90	X	
V-48		
Y-88		
Zn-65		
37 Total	**12 Total**	**13 Total**

Table 3-2
TA50 RLWTF Radionuclide Summary For 2007

	RAW Avg (nCi/L)	Maxi-mum (nCi/L)	Mini-mum (nCi/L)	Total (Ci)	FINAL Avg (pCi/L)	Maxi-mum (pCi/L)	Mini mum (pCi/L)	TOTAL (Ci)
Alpha Gross	155.2 E0	730. E0	35. E0	690.5 E-3	13. E0	63. E0	2.5 E0	59.7 E-6
Alpha Sum	171.2 E0	740.3 E0	39. E0	761.8 E-3	13.5 E0	68.4 E0	460. E-3	62.1 E-6
Am-241	74.5 E0	210. E0	12. E0	331.3 E-3	3.6 E0	8.1 E0	460. E-3	16.6 E-6
As-74	*	*	*	*	1.5 E0	15. E0	*	6.8 E-6
Be-7	*	*	*	*	*	*	*	*
Ce-141	4.3 E-3	44. E-3	*	19.1 E-6	*	*	*	*
Co-56	*	*	*	*	*	*	*	*
Co-57	*	*	*	*	*	*	*	*
Co-58	*	*	*	*	*	*	*	*
Co-60	*	*	*	*	*	*	*	*
Cs-134	*	*	*	*	*	*	*	*
Cs-137	13.7 E-3	140. E-3	*	60.7 E-6	1.8 E0	9.9 E0	*	8.4 E-6
Eu-152	*	*	*	*	*	*	*	*
H-3	*	*	*	*	4.1 E3	8.2 E3	1.6 E3	19. E-3
I-133	*	*	*	*	*	*	*	*
Mn-52	*	*	*	*	*	*	*	*
Mn-54	*	*	*	*	*	*	*	*
Na-22	*	*	*	*	*	*	*	*
Np-237	*	*	*	*	*	*	*	*
Pu-238	62.6 E0	380. E0	17. E0	278.6 E-3	1.3 E0	4.9 E0	*	6. E-6
Pu-239	33.5 E0	150. E0	9.9 E0	149.2 E-3	1.5 E0	4.9 E0	*	6.8 E-6
Ra-226	*	*	*	*	*	*	*	*
Ra-228	*	*	*	*	*	*	*	*
Rb-83	*	*	*	*	20.4 E0	130. E0	*	93.4 E-6
Rb-84	*	*	*	*	610.1 E-	6.2 E0	*	2.8 E-6
Sc-46	*	*	*	*	*	*	*	*
Sc-48	*	*	*	*	*	*	*	*
Se-75	*	*	*	*	954.5 E-	9.7 E0	*	4.4 E-6
Sn-113	*	*	*	*	*	*	*	*
Sr-85	11.4 E-3	160. E-3	*	50.5 E-6	*	*	*	*
Sr-89	*	*	*	*	*	*	*	*
Sr-90	86.8 E-3	440. E-3	*	386.1 E-6	*	*	*	*
Th-232	183.3 E-6	790. E-6	*	815.4 E-9	3.6 E-3	38. E-3	*	16.4 E-9
U-234	548. E-3	3. E0	*	2.4 E-3	6.7 E0	48. E0	*	30.6 E-6
U-235	2.5 E-3	6.9 E-3	*	11.2 E-6	46.4 E-3	310. E-3	*	212.9 E-9
U-238	58.2 E-3	160. E-3	*	258.9 E-6	412.4 E-	2.7 E0	*	1.9 E-6
V-48	*	*	*	*	*	*	*	*
Y-88	*	*	*	*	*	*	*	*
Zn-65	*	*	*	*	*	*	*	*

Twelve influent samples and 12 effluent samples for each isotope.
* Less than Detection Limit

Table 3-3 shows the *mass* of the nine alpha-emitting radionuclides analyzed for in the RLWTF influent and effluent from the RLWTF in 2007. The table shows that 786 grams of alpha emitters were received in influent, and that treatment removed 99.25% of the mass of these alpha emitters from the wastewater stream (5.9 grams out). The table also shows that uranium-238 comprised nearly all of the mass of these radionuclides in both influent and effluent.

A similar perspective is obtained by examining removal of alpha *radioactivity* during 2007 (Table 3-4). The RLWTF performed even better from this perspective, removing 99.99% of the radioactivity of the alpha emitters from the wastewater stream (0.76 curie in, 62 microcuries out) during 2007.

Table 3-3
Mass of Alpha Radionuclides During 2007

Radionuclide	Influent (grams)	Effluent (grams)
Am-241	0.1	<0.001
Np-237	*	*
Ra-226	*	*
Pu-238	<0.1	<0.001
Pu-239	2.4	<0.001
Th-232	7.4	0.149
U-234	0.4	0.005
U-235	5.1	0.098
U-238	770.3	5.640
Totals	**785.8**	**5.900**

* Less than Detection Limit

Removal of beta-emitting radioisotopes is also depicted in Table 3-4. Approximately three-fourths of non-tritium beta activity was removed during 2007 (0.52 millicurie in; 0.12 millicurie out). Tritium quantities entering and leaving the plant were the same (18.8 millicuries). This is because tritium is present *as* water, and the RLWTF is not equipped to treat or remove tritium. Although treatment for and removal of beta-emitting radioisotopes was not as effective as for alpha-emitting radioisotopes, the quantities encountered were smaller. Influent contained just 18.8 millicuries of beta activity, versus 762 millicuries of alpha activity.

Table 3-4
Removal of Radioactivity From RLWTF Influent During 2007

Month	Raw (Ci)	Final (Ci)	%Removed
Alpha radioactivity	7.62 E-01	6.21 E-05	99.99
Beta radioactivity*	5.17 E-04	1.16 E-04	77.6
Tritium (beta)	1.88 E-02	1.88 E-02	0

* Non-tritium beta

3.4 Regulatory Performance

In 1990 DOE issued Order 5400.5, "Radiation Protection of the Public and the Environment," which revised Derived Concentration Guidelines (DCGs) for all radionuclides discharged from DOE facilities. The concentration of each radionuclide divided by its particular DCG value results in a ratio. For waters containing more than one radionuclide, a ratio is to be found for each radionuclide, and these ratios are to be summed. To be in compliance with Order 5400.5, the sum of the ratios cannot exceed 1.0.

Table 3-5 provides flow-weighted sum-of-the-ratios for individual isotopes, and shows that the average for all of 2007 was 0.22. Americium accounted for 55% of the sum of the ratios in the RLWTF effluent during 2007, and another three isotopes (^{234}U, ^{238}Pu, and ^{239}Pu) accounted for nearly all the rest.

Table 3-5
TA-50 RLWTF Effluent During 2007 Compared With DOE Order 5400.5

Radioactive Isotopes *	Average Concentration (picoCi/L)	DCG 5400.5 (picoCi/L)	Percent Of DCG
Am-241	3.6 E0	30	12.1
As-74	1.5 E0	40,000	< 0.1
Cs-137	1.8 E0	3,000	< 0.1
H-3	4.1 E3	2,000,000	0.21
Pu-238	1.3 E0	40	3.26
Pu-239	1.5 E0	30	4.94
Rb-83	20.4 E0	20,000	0.10
Rb-84	6.1 E-1	10,000	< 0.1
Se-75	9.545 E-1	20,000	< 0.1
Th-232	3.6 E-3	50	< 0.1
U-234	6.7 E0	500	1.33
U-235	4.64 E-2	600	< 0.1
U-238	4.124 E-1	600	< 0.1
Sum of Ratios = 0.221			

* Other isotopes were not detected in RLWTF effluent.

3.5 Graphs of Radiological Data

Figures 3-1 and 3-2 chart concentrations in RLWTF influent and effluent for each month of 2007 for alpha-emitting isotopes (i.e., sum of the concentration of the nine alpha radionuclides listed in Table 3-1). Note that the ordinate of Figure 3-1 is scaled in nanocuries per liter while Figure 3-2 is scaled in picocuries per liter, a factor of one thousand. Examination of these graphs shows the following:

- The decontamination factor for alpha radioisotopes was four orders of magnitude (i.e., 10,000) or more. This was also indicated in Table 3-4.

- Effluent concentrations averaged less than 25 pCi/L for 11 months, and less than 10 pCi/L for nine months.

- January discharges were unusually high (average of 68 pCi/L) due to the presence of ^{234}U at an average concentration of 48 pCi/L. Uranium-234 had been sloughed from the ion exchange unit operation as resins neared end-of-life during the final three months of 2006. (Del Signore and Watkins, May 2007, p.17). Although the January effluent concentration was unusually high, January discharges had a sum-of ratios value of 0.65, and were thus below DOE's discharge standard.

- There was no pattern for influent concentrations for the alpha-emitting isotopes. The December average concentration of 740 nCi/L, however, was a jump to more than four times the average influent concentration for all of 2007. No particular isotope was the cause, as ^{238}Pu, ^{239}Pu, and ^{241}Am concentration each increased by factors of 3-5 times the annual average. No generator was identified as the source of the spike. (Influent concentrations returned to a more typical concentration of 100 nCi/L in January 2008.)

Figure 3-3 shows effluent concentrations for U-234, and demonstrates that it was the chief constituent of the higher effluent concentration in January 2007. Figure 3-4 charts average concentrations, in picocuries per liter, of tritium by month in RLWTF effluent. Tritium was the only significant beta-emitting radionuclide in RLWTF effluent, accounting for 98% of the total beta activity discharged during 2007.

Figure 3-1
Alpha-Emitting Isotopes in RLWTF Influent During 2007

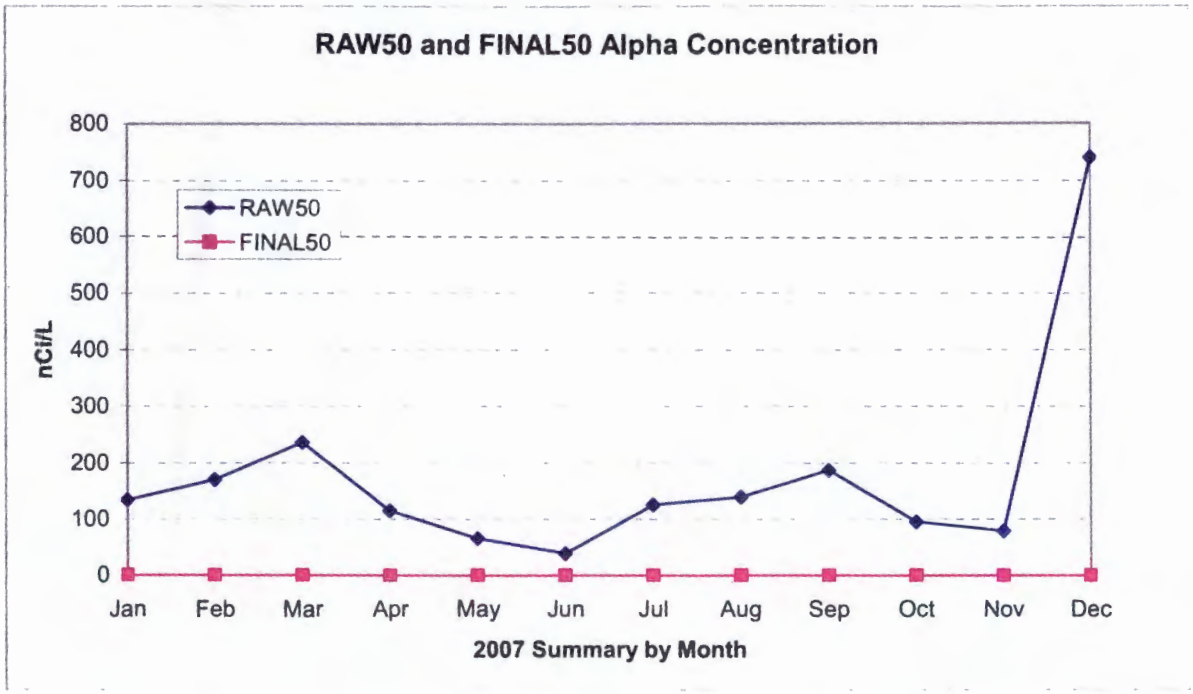


Figure 3-2
Alpha-Emitting Isotopes in RLWTF Effluent During 2007

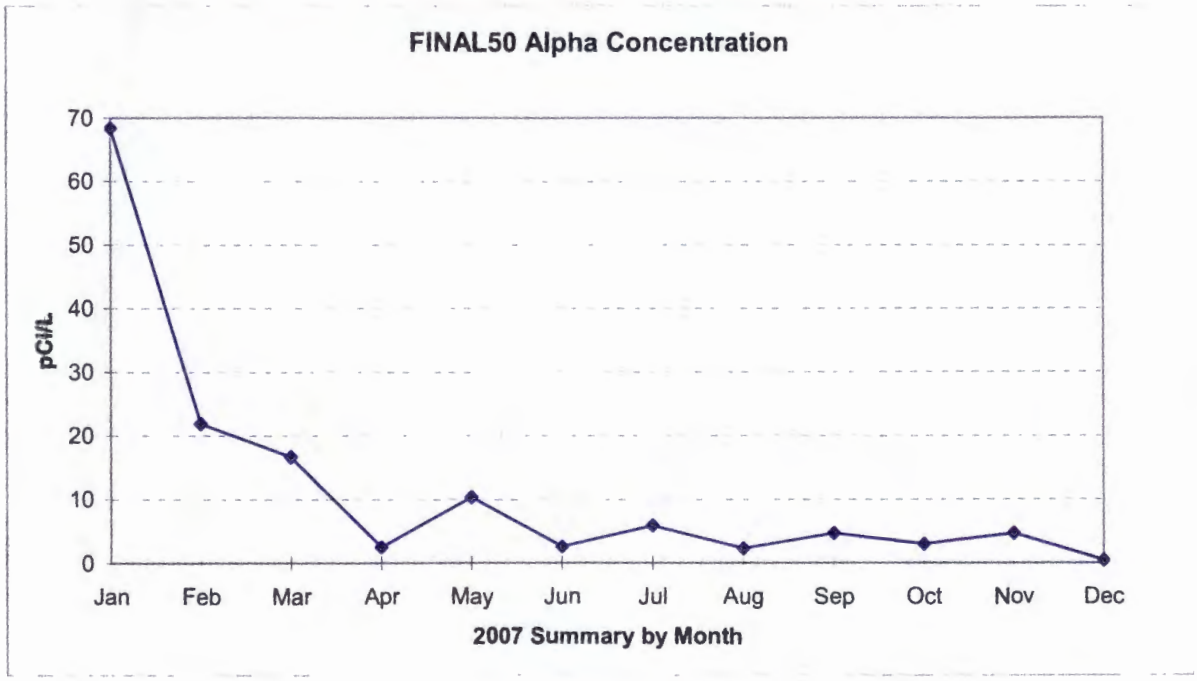


Figure 3-3
U-234 in RLWTF Effluent During 2007

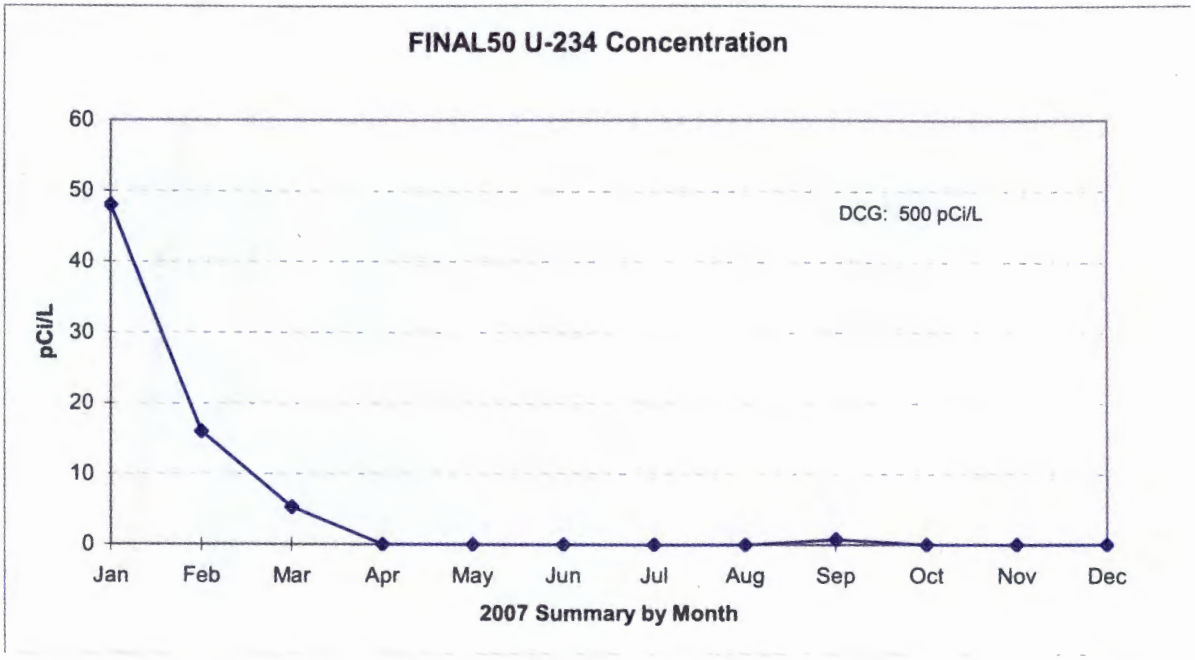
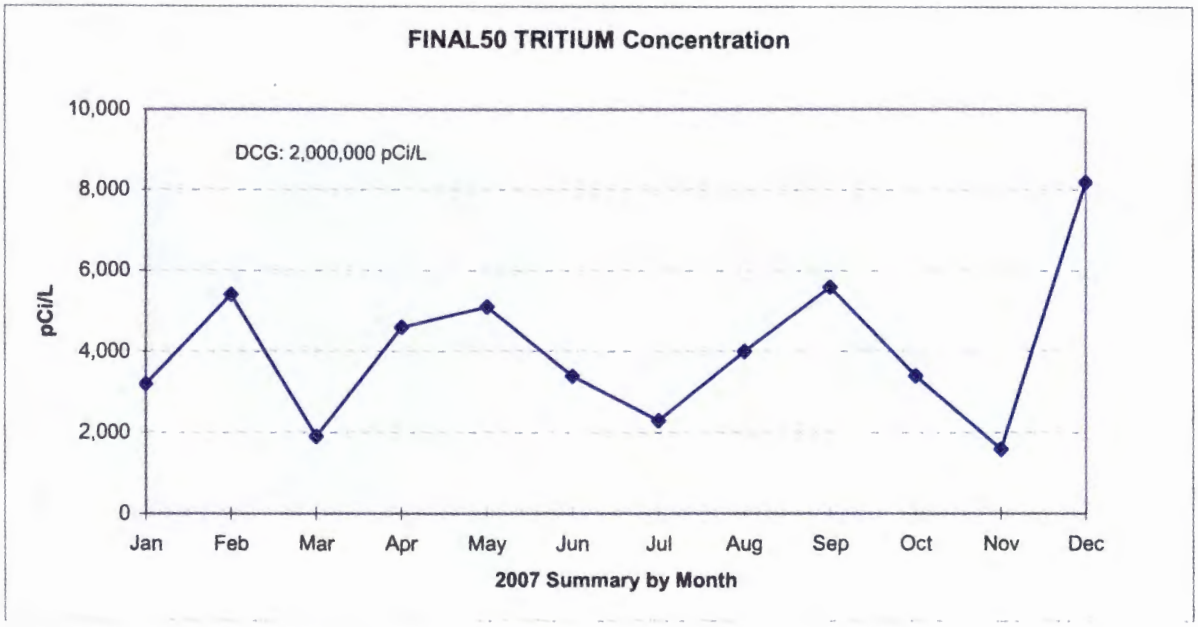


Figure 3-4
Tritium in RLWTF Effluent During 2007



4. Non-Radiological Nature of Low-level RLW

Wastewater received at the TA50 RLWTF also contains nonradioactive constituents, most of which are present in tap water. RLWTF influent samples are analyzed for 42 non-radioactive, inorganic water quality parameters, and for volatile and semi-volatile organic compounds. Effluent samples are analyzed for the same 42 inorganic parameters, and for total toxic organics.

Inorganic parameters can be aggregated as follows:

(a) eight conventional water quality measures – chemical oxygen demand, conductivity, hardness, pH, total dissolved solids, total suspended solids, and two measurements for alkalinity.
(b) a total of 25 cation (metals) measurements, including total cations.
(c) five anions: chloride, fluoride, cyanide, sulfate, and perchlorate.
(d) four nitrogen measurements – nitrogen as nitrates, nitrogen as ammonia, nitrogen as nitrites, and total Kjedahl nitrogen.

Effluent is analyzed for 90 toxic organic compounds. Influent is analyzed for these 90 toxic organic compounds plus 40 other volatile and semi-volatile organic compounds.

4.1 Influent Characteristics

As shown in Table 4-1, all 42 inorganic parameters were detected in the RLWTF influent in 2007. Table 4-1 also shows, however, that sixteen of these were reported at less than the analytic detection limit for at least one month during the year. On average, in fact, five minerals were reported each month at less than the analytic detection limit. Average influent concentration of all minerals for the entire year was 540 mg/L.

As shown in Table 4-2, the total mass of minerals entering the RLWTF was nearly 2400 kilograms. This was quite different from radioactive contaminants, which had a combined influent mass of less than one kilogram. Table 4-2 indicates significant quantities of sodium and chloride, which could pose long-term corrosion concerns. Table 4-2 also shows appreciable quantities of nitrogen compounds in RLWTF influent.

Influent was also analyzed for volatile and semi-volatile organic compounds. A total of 29 samples were collected during 2007, and each were analyzed for ~130 organic compounds. Of these analyses, 206 (5%) were found to exceed minimum detection level. Annual average influent concentration was 0.8 mg/L organic compounds.

Table 4-1
TA50 RLWTF Mineral Summary For 2007

	RAW Average	Maxi-mum	Mini-mum	Total In (Kg)	FINAL Average	Maxi-mum	Mini-mum	Total Out (Kg)
ALKALINITY-MO**	2.44E+02	9.35E+02	*	1.09E+03	2.23E+02	1.38E+03	2.60E+01	1.02E+03
ALKALINITY-P**	4.16E+00	5.40E+01	*	1.85E+01	8.51E+01	8.65E+02	*	3.90E+02
ALUMINUM	1.14E+00	8.30E+00	1.40E-01	5.08E+00	1.14E-02	5.40E-02	*	5.25E-02
AMMONIA-N	1.17E+01	1.85E+01	7.87E+00	5.18E+01	6.49E+00	1.01E+01	*	2.97E+01
ARSENIC	2.46E-03	3.00E-02	*	1.09E-02	4.24E-03	3.00E-02	*	1.95E-02
BARIUM	4.17E-02	1.00E-01	2.00E-02	1.85E-01	3.20E-04	3.00E-03	*	1.47E-03
BERYLLIUM	7.99E-03	3.00E-02	*	3.55E-02	4.52E-04	4.00E-03	*	2.07E-03
BORON	9.28E-02	2.00E-01	*	4.13E-01	1.07E-01	1.70E-01	7.00E-02	4.90E-01
CADMIUM	2.05E-03	1.00E-02	*	9.14E-03	*	*	*	*
CALCIUM	1.09E+01	1.90E+01	3.00E+00	4.86E+01	9.59E-01	3.95E+00	*	4.40E+00
CHLORIDE	1.37E+02	7.60E+02	1.92E+01	6.12E+02	7.52E+00	1.80E+01	3.20E+00	3.45E+01
COBALT	1.09E-02	7.00E-02	*	4.84E-02	*	*	*	*
COD	2.50E+02	5.54E+02	5.50E+01	1.11E+03	1.40E+01	6.20E+01	*	6.40E+01
CONDUCTIVITY**	1.44E+03	6.60E+03	2.90E+02	6.40E+03	2.65E+02	5.90E+02	1.20E+02	1.22E+03
COPPER	7.27E-01	2.50E+00	2.20E-01	3.23E+00	9.51E-03	2.30E-02	2.60E-03	4.36E-02
CYANIDE	8.21E-04	7.00E-03	*	3.65E-03	4.54E-04	3.00E-03	*	2.08E-03
FLUORIDE	8.55E-01	1.70E+00	4.00E-01	3.81E+00	1.33E-01	3.40E-01	*	6.09E-01
HARDNESS**	3.92E+01	7.22E+01	1.86E+01	1.75E+02	2.65E+00	9.86E+00	*	1.21E+01
IRON	3.66E+00	3.60E+01	4.90E-01	1.63E+01	1.82E-02	8.00E-02	*	8.36E-02
LEAD	1.99E-01	1.00E+00	6.00E-02	8.84E-01	1.13E-03	1.00E-02	*	5.18E-03
MAGNESIUM	2.90E+00	6.00E+00	1.40E+00	1.29E+01	6.12E-02	7.80E-01	*	2.81E-01
MERCURY	2.25E-03	4.60E-03	8.50E-04	1.00E-02	1.82E-05	1.10E-04	*	8.36E-05
NICKEL	6.11E+00	5.90E+01	5.00E-03	2.72E+01	5.16E-03	3.00E-02	*	2.37E-02
NITRATE-N	1.17E+01	2.40E+01	6.00E+00	5.22E+01	1.50E+00	6.50E+00	*	6.90E+00
NITRITE-N	1.10E+00	2.48E+00	*	4.91E+00	1.05E+00	2.44E+00	*	4.83E+00
PERCHLORATE	2.43E-01	5.00E-01	*	1.08E+00	*	*	*	*
pH	6.59E+00	1.19E+01	2.20E+00	--	7.47E+00	8.21E+00	6.72E+00	--
PHOSPHORUS	2.35E+00	3.40E+00	5.10E-01	1.05E+01	3.63E-02	1.50E-01	*	1.66E-01
POTASSIUM	2.07E+00	6.50E+00	2.00E-01	9.20E+00	7.19E-01	4.00E+00	5.00E-02	3.30E+00
SELENIUM	1.67E-03	5.20E-03	*	7.41E-03	1.04E-03	2.20E-03	4.20E-04	4.78E-03
SILICON	2.96E+01	4.10E+01	1.95E+01	1.32E+02	1.15E+00	3.39E+00	3.20E-01	5.29E+00
SILVER	3.04E-03	1.40E-02	*	1.35E-02	8.43E-04	4.00E-03	*	3.86E-03
SODIUM	1.48E+02	5.67E+02	1.40E+01	6.57E+02	4.17E+01	1.28E+02	1.00E+01	1.91E+02
SULFATE	2.96E+01	9.00E+01	1.13E+01	1.32E+02	5.81E+00	2.45E+01	2.60E-01	2.67E+01
TDS	5.28E+02	1.46E+03	1.96E+02	2.35E+03	9.84E+01	2.49E+02	2.20E+01	4.51E+02
TKN	1.61E+01	3.60E+01	*	7.16E+01	6.15E+00	8.80E+00	3.71E+00	2.82E+01
TOTAL CATIONS**	8.51E+00	2.70E+01	2.76E+00	3.78E+01	5.45E+00	2.96E+01	1.02E+00	2.50E+01
TOTAL CHROMIUM	2.19E-01	1.30E+00	1.00E-02	9.73E-01	*	*	*	*
TOXIC ORGANICS	n.m.	n.m.	n.m.	n.m.	9.07E-03	5.46E-02	*	4.16E-02
TSS	9.83E+00	5.60E+01	*	4.37E+01	1.82E+00	1.20E+01	*	8.36E+00
URANIUM	1.50E-01	3.30E-01	*	6.68E-01	1.23E-03	8.00E-03	*	5.62E-03
VANADIUM	2.13E-02	9.00E-02	*	9.49E-02	8.43E-04	8.00E-03	*	3.86E-03
ZINC	1.80E-01	9.00E-01	1.00E-03	8.02E-01	2.25E-03	1.00E-02	*	1.03E-02

Twelve influent samples and 12 effluent samples for each mineral.
* Less than Detection Limit n.m.: Not measured
**Units: All figures in mg/L except:
Alkalinities and hardness as mg CaCO3/L; Conductivity as uS/cm; Total Cations as meq/L.

4.2 Effluent Characteristics

As shown in Table 4-1, 38 of the 42 inorganic constituents were detected in the RLWTF effluent; cadmium, chromium, cobalt, perchlorate were not detected in any of the 12 monthly composite samples. Table 4-1 also shows, that 28 of these were reported at less than the analytic detection limit for at least one month during the year. On average, in fact, 17 minerals were reported each month at less than the analytic detection limit. Average effluent concentration of all minerals for the entire year was 100 mg/L.

As shown in Table 4-2, the total mass of minerals leaving the RLWTF was 459 kilograms, a reduction of nearly two metric tonnes from influent waters. This, too, was quite different from radioactive contaminants, which had a combined effluent mass of just six grams.

Effluent is also analyzed for toxic organic compounds. A total of 12 samples were collected during 2007, and each were analyzed for ~90 organic compounds. Of these analyses, just five (0.5%) were found to exceed minimum detection level. Annual average influent concentration was 0.009 mg/L organic compounds.

Table 4-2
Removal of Major Inorganic Minerals From RLWTF Influent During 2007

Mineral	Mass in Influent (Kgs)	Mass in Effluent (Kgs)	Percent Removed
Sodium	657	191	71
Chloride	612	34	94
Silicon	132	5	96
Sulfate	132	27	80
Kjedahl Nitrogen	72	28	61
Nitrate-Nitrogen	52	7	87
Ammonia-Nitrogen	52	30	43
Calcium	49	4	91
Nickel	27	0	100
Subtotal, Major Minerals	1784	326	82
Total Solids *	2392	459	81

* Total Dissolved Solids + Total Suspended Solids

4.3 Removal of Minerals

Table 4-1 provides a summary of mineral concentrations and quantities received by (influent) and discharged from (effluent) the RLWTF during 2007. The information shows that 2,392 kilograms of contaminants entered the facility in the form of suspended solids (44 kilograms) and dissolved solids (2350 kilograms). This quantity is similar to the 2890 kilograms received

during 2004, but twice the amounts received in 2005 and 2006 (1460 and 1300 kilograms, respectively).

In treating the influent, RLWTF personnel added lime at the clarifier to soften the water, ferric sulfate at the clarifier to precipitate radionuclides, and potassium permanganate and sodium hydroxide at the neutralization chamber to adjust pH. Other chemicals, including sodium hydroxide and hydrochloric acid were used to clean the TUF and RO membranes. Data does not exist for the quantities of these additional chemicals required for water treatment, so that the total quantity of chemicals seen in RTLWTF waters in 2007 is not known. As a rule of thumb, however, the sum of chemicals added during treatment approximates the quantity of inorganic chemicals that enter the RLWTF with the influent.

As can be derived from the final column of Table 4-1, the total amount of chemicals leaving the facility with the effluent was 459 kilograms, the sum of total dissolved solids and total suspended solids. This was 19% of the total quantity entering as influent, and an estimated 11% of the total of influent chemicals plus chemicals required for water treatment.

Nine inorganic chemicals comprised the majority (~71%) of these chemicals in effluent; they are summarized in Table 4-2, along with percent removed from the RLWTF influent. With respect to influent, nickel was received in surprising concentrations, and three nitrogen compounds were among the major minerals.

4.4 Regulatory Performance

From January through July, 22 parameters in the effluent from the RLWTF were regulated by the National Pollutant Discharge Elimination System in compliance with the Federal Clean Water Act (EPA, 12/29/00). The NPDES Permit was revised effective August 1st, after which the number of regulated parameters was reduced to 18, of which only eight have discharge standards. LANL also has a voluntary commitment with the New Mexico Environment Department to discharge effluent from the TA-50 RLWTF below groundwater standards set by the New Mexico Water Quality Control Commission (NMED, 04/20/08) for three water quality parameters: fluoride, nitrogen-as-nitrate, and total dissolved solids.

Table 4-3 identifies these parameters regulated from January through July, and Table 4-4 identifies parameters regulated beginning August 1, 2007. The tables also show sampling frequency required for each, and their regulatory limits.

During calendar year 2007, TA50 RLWTF effluent, for the eighth consecutive year, was in compliance with all NPDES water quality parameters. TA50 effluent also met NMED ground water standards for fluoride, nitrate, and TDS every week of the year, and has now met these voluntary standards for all but two weeks over the last eight years [3].

[3] Two weekly composite samples of RLWTF effluent slightly exceeded the groundwater standard for fluoride during 2003. Sample values of 2.07 mg/L (January 3rd) and 1.64 mg/L (March 25th) were obtained, versus the groundwater standard of 1.6 mg/L. (Watkins and Worland, March 2004, p. 30.)

Table 4-3
NPDES and NMED Regulated Parameters
January 2007 through July 2007

Parameter	Sampling Frequency	Units	Monthly Average	Daily Max
NPDES Parameters (22)				
Chemical Oxygen Demand	1	mg/L	125	125
Flow	4	Liters	Report	Report
Perchlorate	3	µg/L	Report	Report
pH	1	s.u.	6 – 9	6 – 9
Radium 226 + Radium 228	3	pCi/L	30	30
Tritium (accelerator produced)	3	pCi/L	20,000	20,000
Total Aluminum	3	µg/L	5,000	5,000
Total Arsenic	3	µg/L	368	368
Total Boron	3	µg/L	5,000	5,000
Total Cadmium	1	µg/L	50	50
Total Chromium	1	µg/L	1,340	2,680
Total Cobalt	3	µg/L	1,000	1,000
Total Copper	1	µg/L	1,393	1,393
Total Iron	1	mg/L	Report	Report
Total Lead	1	µg/L	423	524
Total Mercury	1	µg/L	0.77	0.77
Total Nickel	2	smg/L	Report	Report
Total Selenium	3	µg/L	5	5
Total Suspended Solids	1	mg/L	30	45
Total Toxic Organics	2	µg/L	1,000	1,000
Total Vanadium	3	µg/L	100	100
Total Zinc	1	µg/L	4,370	8,750
NMED Parameters (3)				
Fluoride	5	mg/L	1.6	
Nitrogen-as-Nitrate	5	mg/L	10	
Total Dissolved Solids	5	mg/L	1,000	

Sampling frequencies:

[1] weekly grab sample
[2] monthly grab sample
[3] yearly grab sample
[4] continuous record
[5] weekly composite sample

Table 4-4
NPDES and NMED Regulated Parameters
August 2007 through December 2007

Parameter	Sampling Frequency	Units	Monthly Average	Daily Max
NPDES Parameters (18)				
Chemical Oxygen Demand	2	mg/L	125	125
Flow	5	----	Report	Report
Perchlorate	4		Report	Report
pH	1	s.u.	6 – 9	6 – 9
Radium 226 + Radium 228	4	pCi/L	30	30
Total Cadmium	4	µg/L	Report	Report
Total Chromium	4	µg/L	Report	Report
Total Copper	2	µg/L	Report	Report
Total Lead	4	µg/L	423	524
Total Mercury	4	µg/L	Report	Report
Total Nickel	4	µg/L	Report	Report
Total PCBs	4	µg/L	Report	Report
Total Residual Chlorine	1	µg/L	----	11
Total Selenium	4	µg/L	Report	Report
Total Suspended Solids	2	mg/L	30	45
Total Toxic Organics	2	µg/L	1,000	1,000
Total Zinc	2	µg/L	Report	Report
Whole Effluent Toxicity	3	%	Report	Report
NMED Parameters (3)				
Fluoride	6	mg/L	1.6	
Nitrogen-as-Nitrate	6	mg/L	10	
Total Dissolved Solids	6	mg/L	1,000	

Sampling frequencies:
1 weekly grab sample
2 monthly grab sample
3 quarterly grab sample
4 yearly grab sample
5 continuous record
6 weekly composite sample

4.5 Graphs of Non-Radiological Data

The following series of graphs highlight important information about non-radiological components of the TA50 RLWTF influent and effluent. Although influent and effluent are analyzed for 42 non-radioactive parameters, just seven have been chosen for display in this report. Each figure plots mineral concentration in RLWTF influent and effluent by month during 2007.

Figures 4-1 and 4-2 show total dissolved solids and total suspended solids in RLWTF influent and effluent during 2007. These two parameters provide general information about water purity since they represent the sum of all contaminants present. Both parameters also have regulatory

Figure 4-1
Dissolved Solids in RLWTF Waters During 2007

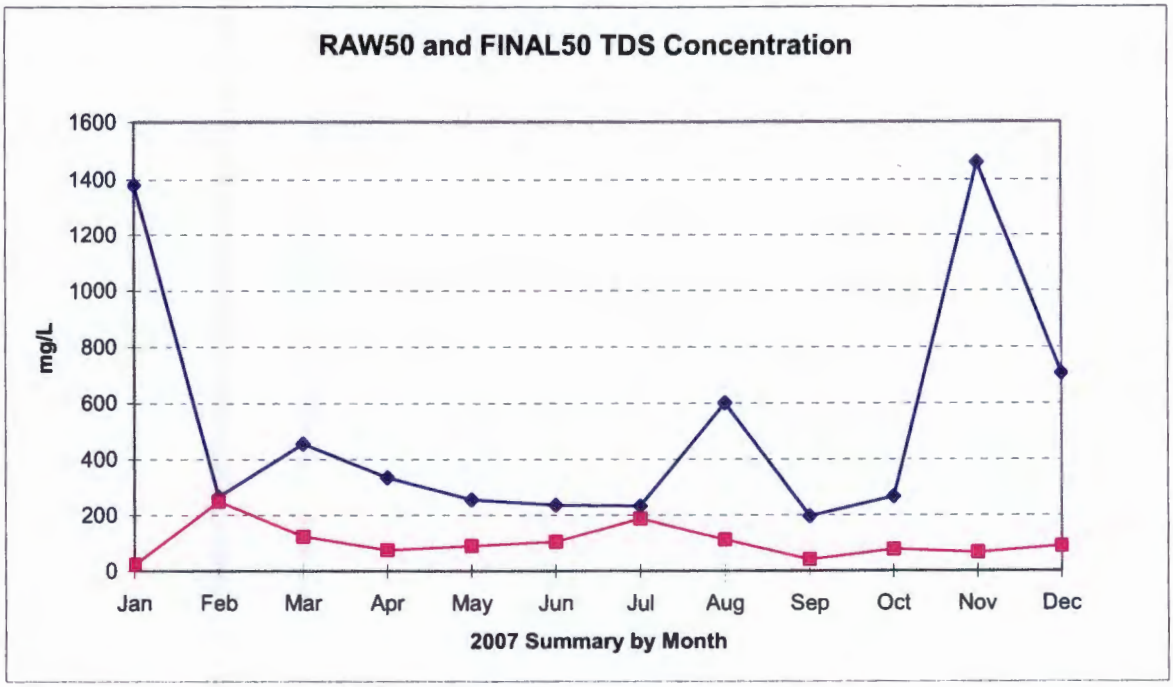
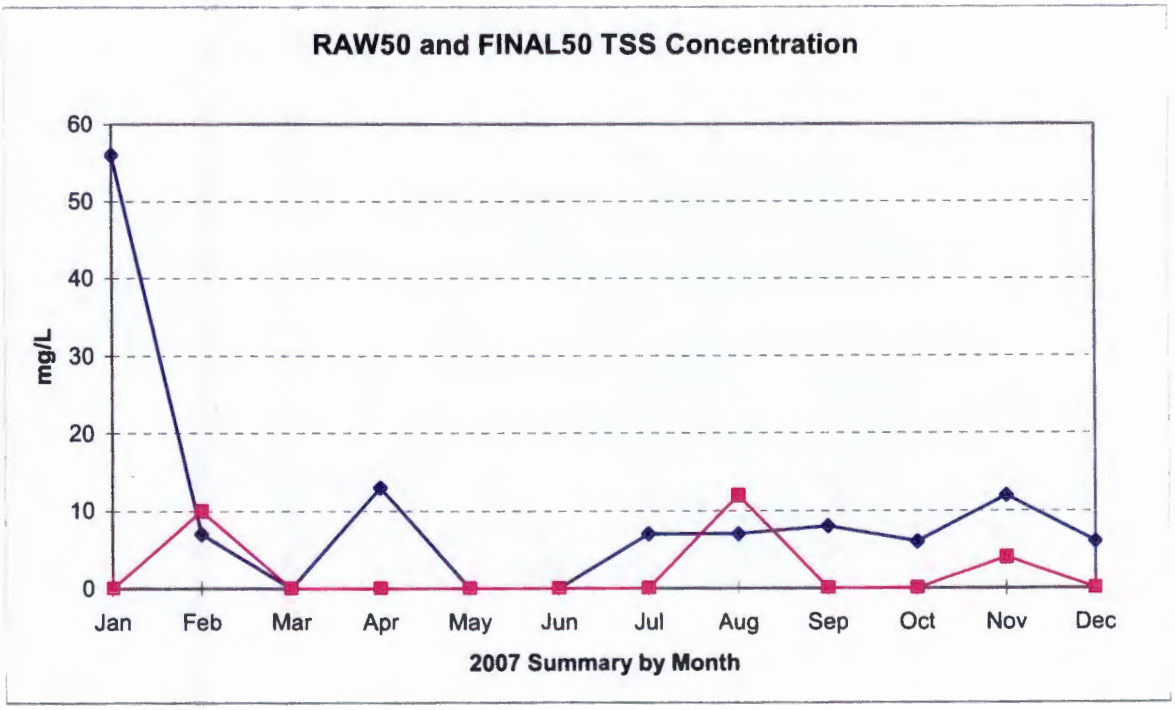


Figure 4-2
Suspended Solids in RLWTF Waters During 2007



discharge limits – 1000 mg/L for TDS and 30 mg/L for TSS. In the RLWTF treatment process, the gravity filter and ultrafilter remove essentially all suspended solids. Reverse osmosis removes varying percentages of dissolved solids, depending upon particle mass and size.

- The TDS graph shows spikes in influent concentrations in January and December. These spikes created process upsets due to the practice of recycling reverse osmosis concentrate. The January spike contributed to membrane damge, which led to a change of membranes on February 27th. The December spike required the purge of 15,000 gallons of RO concentrate in order to meet discharge standards, and to avoid a repeat of membrane damage.

- The TSS graph shows a spike in influent concentrations in January, but with typical influent concentrations of less than 20 mg/L for the remainder of the year. This spike was one of just six months in the last eight years where influent TSS concentrations exceeded 50 mg/L. Effluent concentrations show three non-zero months (February, August, and November), which is very unusual. These were the *only* three months in the past five years with non-zero TSS concentrations in the effluent.

Figure 4-3 shows concentrations of nitrate-as-nitrogen in RLWTF influent and effluent during 2007. Nitrate is not a regulated parameter, but LANL has volunteered to discharge at concentrations less than 10 mg/L. At the RLWTF, waste acceptance criteria limit influent nitrate concentrations, and reverse osmosis removes 80% - 90% of nitrates that are received with the influent. Figure 4-3 shows that influent concentrations ranged from 6-24 mg/L, and exceeded the waste acceptance criterion of 10 mg/L. Despite this, effluent concentrations were consistently below the voluntary discharge standard.

Figure 4-3
Nitrogen-as-Nitrate in RLWTF Waters During 2007

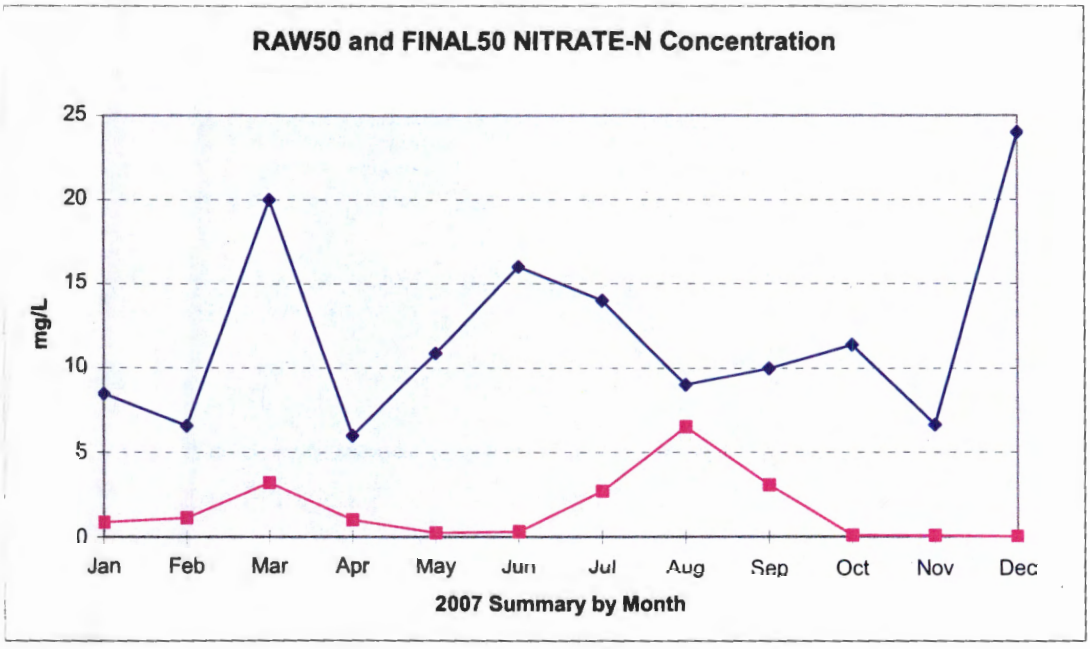


Table 4-5 presents average concentrations for nitrogen compounds for the year. Influent concentrations were higher than historical averages, and continued a trend that started in 2002 of increasing influent nitrogen concentrations. Effluent concentrations were consistent with those since 2002.

Table 4-5
Nitrogen Compounds in RLWTF Waters During 2007

	Influent*	Effluent*
Total Kjedahl Nitrogen	16.1	6.2
Nitrogen-as-Ammonia	11.7	6.5
Nitrogen-as-Nitrate	11.7	1.5
Nitrogen-as-Nitrite	1.1	1.1
All Nitrogen	40.5	15.3

* Average concentration for 2007, in mg/L.

Figures 4-4 and 4-5 show copper and zinc concentrations in RLWTF influent and effluent during 2007. Both parameters are of regulatory concern because reduced discharge standards become effective August 2010. The discharge standard for zinc will decrease by a factor of 2,000 to 2.2 µg/L, and that for copper will decrease by a factor of 9,950 to 0.14 µg/L

- The zinc graph reveals little about the ability of RLWTF to meet the 2010 discharge standard. Nine months had concentrations below the method detection limit, and hence were reported at zero. The method detection limit, nearly four times greater than the 2010 discharge standard, will be lowered during 2008 so that more meaningful data can be obtained.

- The copper graph shows, quite clearly, that the 2010 discharge standard cannot be met without additional treatment. A Plant Test conducted during 2005 (Del Signore and McClenahan, March 2006, p.33) showed that copper is one of several metals that exist in both the soluble and insoluble states. Enough of the soluble fraction survives the Main Treatment Process to appear in plant effluent in concentrations greater than the proposed discharge standard. A cation exchange treatment step has been proposed.

Finally, Figures 4-6 and 4-7 shows influent and effluent concentrations for sodium and chloride. As shown in Table 4-2, these two chemicals accounted for more than half of all contaminants in both the influent and effluent to the RLWTF during 2007. The figures show dramatic increases of influent concentrations by factors of 10-15 for both sodium and chloride during November and/or December. The causes of these jumps were not determined, but they were conclusively the source of TDS increase, the reason that processing difficulties were encountered, and the reason that 15,000 gallons of RO concentrate had to be purged in December.

Figure 4-4
Zinc in RLWTF Effluent During 2007

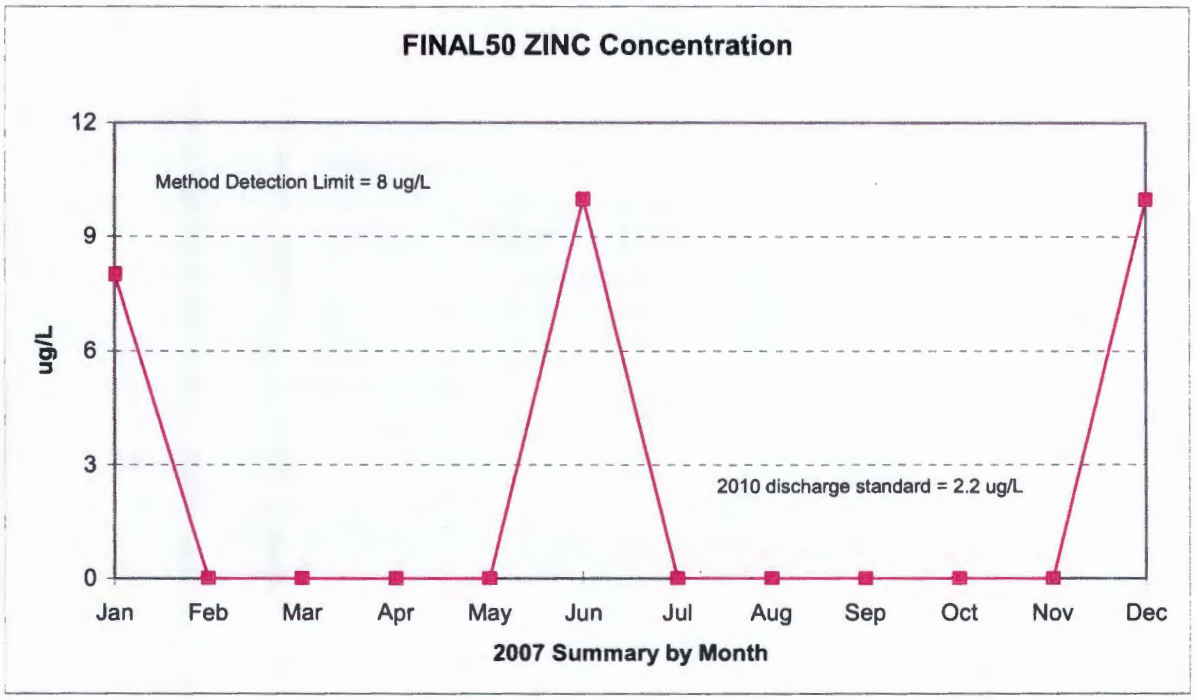


Figure 4-5
Copper in RLWTF Effluent During 2007

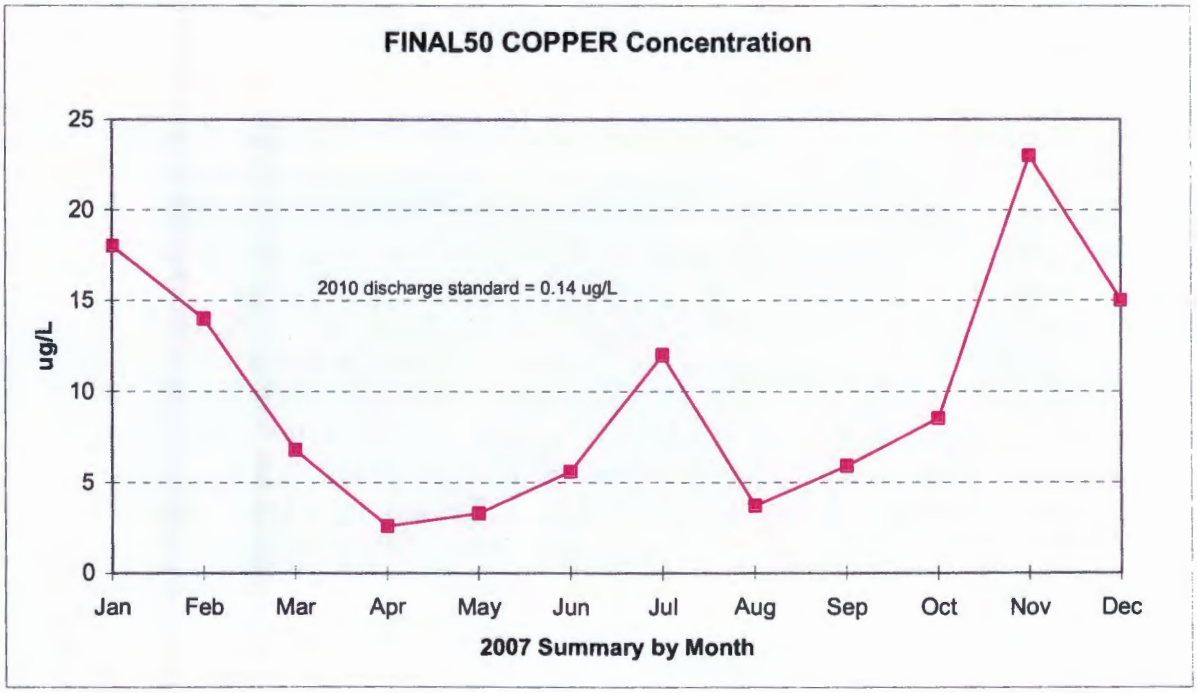


Figure 4-6
Sodium in RLWTF Waters During 2007

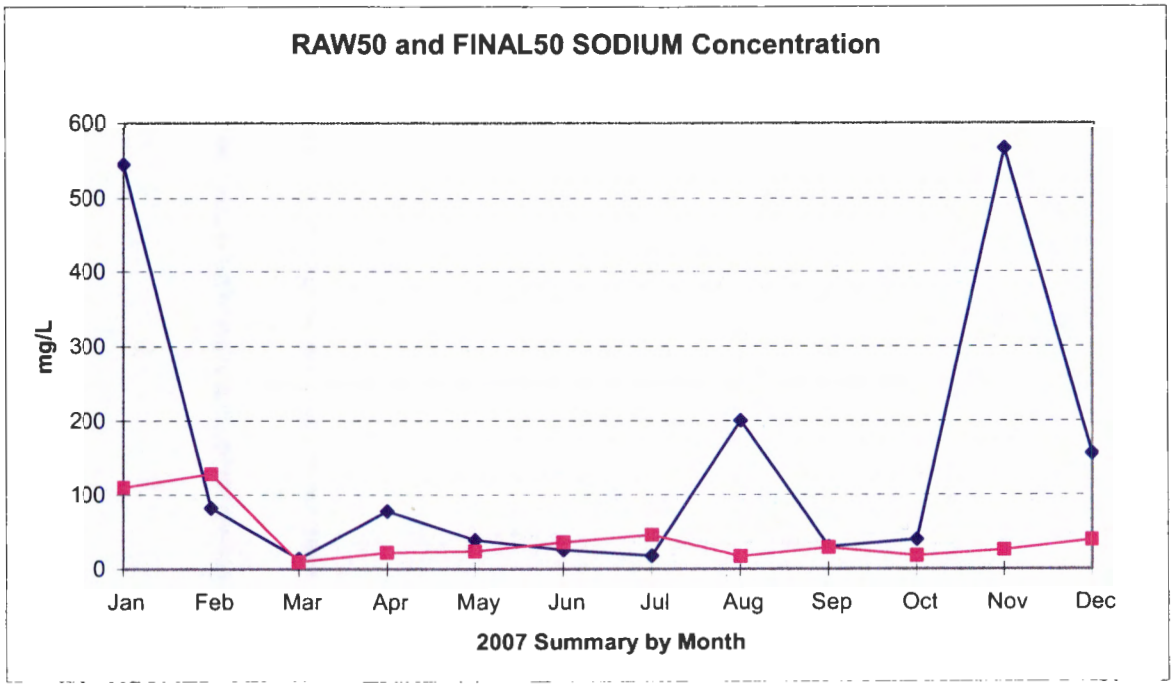
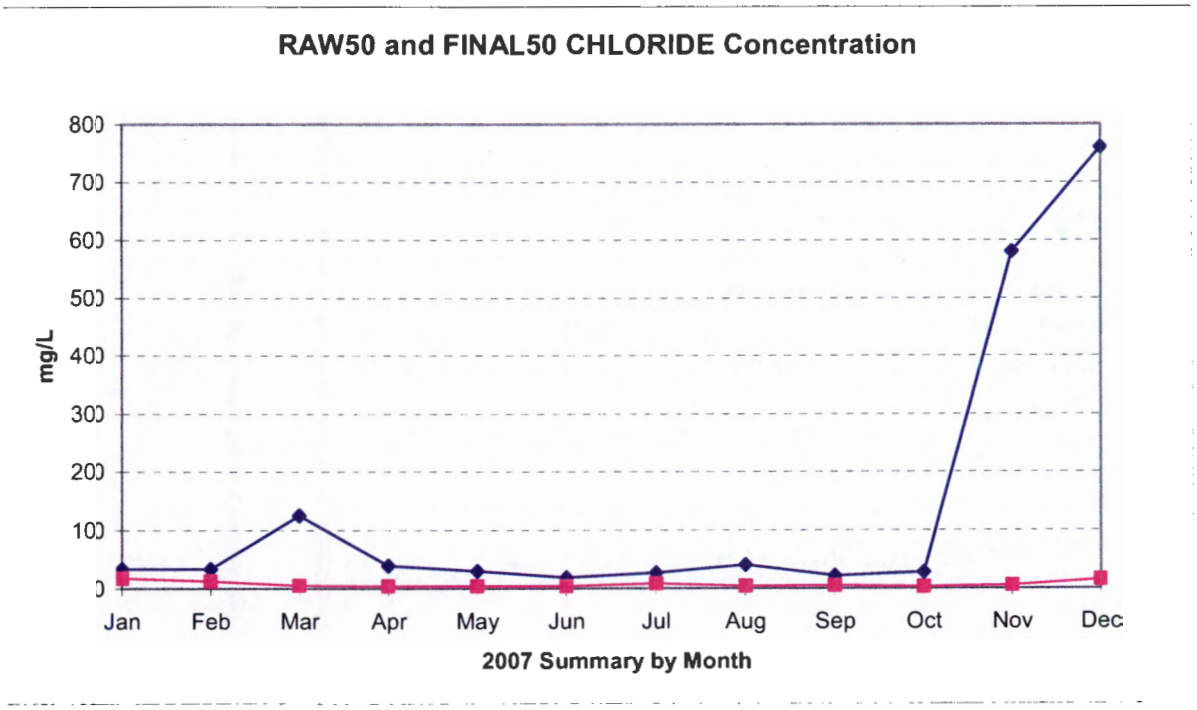


Figure 4-7
Chloride in RLWTF Waters During 2007



4.6 Organic Chemicals

Monthly grab samples of influent, monthly grab samples of effluent, and individual batches of sludge are analyzed for volatile organic chemicals (VOC) and semi-volatile organic chemicals (SVOC). Analyses are performed by an external EPA-certified laboratory according to EPA approved methods 624 for VOC, and 625A and 625B for SVOC.

4.6.1 Influent

Tables 4-6 and 4-7 summarize the VOC and SVOC detected in the RLWTF influent during 2007 and the concentration range of these chemicals. The "No. of Detects" column in these tables indicates the number of samples in which a particular chemical was detected. This influent sampling had the following results:

- A total of 29 influent samples were collected during the year, and each were analyzed for ~130 organic compounds. Samples were collected once per week at first; frequency was reduced to once per month in the middle of the year.

- Of these ~3800 analyses, a total of 206 (5%) were found to exceed minimum detection level. This is an average of seven detects per sample.

- While 16 volatile organic and 17 semi-volatile organic compounds were detected in RLWTF influent, just three compounds accounted for one-third of the "detects": 2-nitrophenol (22 detects), acetone (25 detects), and bis(2-ethylhexyl)phthalate (26 detects).

- Maximum concentration was 3.4 mg/L (acetone); the second-highest analyzed concentration was just 0.17 mg/L. Annual average influent concentration was 0.8 mg/L organic compounds. These concentrations are far below the waste acceptance ceiling of 25 mg/L for total organics.

4.6.2 Effluent

Table 4-8 summarizes the VOC and SVOC detected in the RLWTF effluent during 2007. The "No. of Detects" column in these tables indicates the number of samples in which a particular chemical was detected. Effluent sampling had the following results:

- A total of 12 effluent samples were collected during the year, and each were analyzed for ~90 organic compounds.

- Of these ~1080 analyses, just five (0.5%) were found to exceed minimum detection level.

- Maximum concentration was 55 µg/L (chloroform). Annual average effluent concentration was 8.3 µg/L organic compounds. These concentrations are far below the NPDES discharge standard of 1,000 µg/L for total toxic organics.

Table 4-6
VOC Detected in RLWTF Influent During 2007

VOC (EPA Method 624)	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
1,2,4-TRIMETHYLBENZENE	2	3.3	4.1
2-BUTANONE	2	4.5	21.0
4-METHYL-2-PENTANONE	15	4.0	72.0
ACETONE	25	61.0	3400
BROMODICHLOROMETHANE	1	1.5	1.5
BROMOMETHANE	2	1.1	12.0
CARBON DISULFIDE	1	1.1	1.1
CHLOROETHANE	1	1.4	1.4
CHLOROFORM	4	8.5	44.7
CHLOROMETHANE	3	1.7	2.4
IODOMETHANE	2	2.2	4.9
M,P-XYLENES	1	0.5	0.5
METHYLENE CHLORIDE	17	6.6	37.0
O-XYLENE	1	0.6	0.6
TOLUENE	8	1.2	7.7
TRICHLOROETHENE	1	1.7	1.7

Table 4-7
SVOC Detected in RLWTF Influent During 2007

SVOC (EPA Methods 625A and 625B)	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
2,4-DINITROPHENOL	1	15.0	15.0
2-NITROPHENOL	22	1.2	36.0
4,6-DINITRO-2-METHYLPHENOL	1	8.8	8.8
4-NITROPHENOL	5	5.4	20.0
AZOBENZENE	1	3.1	3.1
BENZOIC ACID	11	9.2	140.
BENZYL ALCOHOL	4	1.7	8.4
BIS(2-ETHYLHEXYL)PHTHALATE	26	3.6	150.
BUTYLBENZYLPHTHALATE	2	1.5	1.8
DI-N-BUTYLPHTHALATE	2	1.3	3.3
DI-N-OCTYL PHTHALATE	1	17.4	17.4
DIETHYLPHTHALATE	4	1.4	2.4
N-NITROSO-DI-N-PROPYLAMINE	11	1.3	170.
N-NITROSODIMETHYLAMINE	1	4.7	4.7
NITROBENZENE	2	1.3	1.8
PHENOL	14	4.5	49.0
PYRIDINE	12	6.5	15.0

Table 4-8
Organics Detected in RLWTF Effluent During 2007

Organic Compound	Type	No. of Detects	Minimum (ug/L)	Maximum (ug/L)
Chloroform	VOC	4	4.8	54.6
Phenol	SVOC	1	17.7	17.7

4.6.3 Sludge

Sludge samples are also analyzed for organic compounds. However, since sampling is not performed on all sludge drums, and since sludge operations were limited during 2007, no samples were collected.

5. Wastes and Secondary Liquids

RLW treatment processes generate both liquid streams that require further processing and solid wastes that must be disposed. The disposition of both requires resources that include materials, labor, and dollars (e.g., disposal fees).

5.1 Secondary Liquids to Process

Secondary liquids include a wide variety of process streams from each of the treatment operations. For example, clarifier and gravity filter operations produce backwash waters and a liquid, solids-containing slurry. The reverse osmosis unit creates a concentrate stream and membrane cleaning solutions.

More than 20 such secondary streams are generated by the seven unit operations at the TA50 RLWTF; all but evaporator bottoms are treated at TA50 RLWTF [4]. Clarifier sludge, for example, is processed through the rotary vacuum filter in Room 116; gravity filter backwash waters are returned to the influent tanks to be re-processed through the clarifier; and RO concentrate is processed through an evaporator.

Table 5-1
RLWTF Secondary Liquid Streams During 2007

Secondary Stream	Volume (liters)	From	Additional Processing
01. UF Feed tank purge waters	n.e.	Ultrafilter	Process through MTP
02. Spongeball waters	n.e.	Ultrafilter	Process through MTP
03. UF concentrate	n.e.	Ultrafilter	Process through MTP
04. UF Cleaning solutions	n.e.	Ultrafilter	Process through MTP
05. RO Cleaning solutions	n.e.	Reverse osmosis	Process through MTP
06. GF Backwash waters	100,980	Gravity filter	Process through MTP
07. Off-spec effluent	83,210	Reverse osmosis	Process through MTP
08. Evap. Overheads	0	Evaporator	Process through MTP
09. C-T bleed and Boiler Blowdown	0	Evaporator	Process through MTP
10. TK8 Decant	24,820	TK8	Process through MTP
11. RVF filtrate	9,540	Vacuum filter	Process through MTP
12. RO concentrate	226,270	Reverse osmosis	Evaporate
13. Evap. Bottoms	0	Evaporator	Dry (off-site)
14. R60 filtrate & decant	1,590	Room 60	Evaporate
15. Transuranic sludge	0	Room 60	Solidify with cement

n.e.: No estimate

[4] Evaporator bottoms are shipped to an off-site subcontractor for drying.

A listing of the more important of these secondary liquid streams appears in Table 5-1, along with volumes generated during 2007. The total volume of these streams during the year probably approached three million liters, or 60% of the raw influent volume. More than half of this volume was generated via operation of the tubular ultrafilter, primarily from daily purging of influent tanks and recycle of spongeball waters.

5.2 Solid Wastes

Influent to the TA50 RLWTF contained 2,390 kilograms of dissolved and suspended solids. Treatment of this influent to achieve compliance with DOE, EPA, and NMED discharge standards resulted in the generation of 11,640 kilograms of solid wastes, as summarized in Table 5-2. These solid wastes can be broadly grouped as wastes stemming from major construction projects, and wastes from treatment operations.

Construction Wastes: Solid wastes were generated (a) during the construction of the new pump house and influent storage tank building that is part of the Cerro Grande Rehabilitation Project and (b) during the replacement of equipment and piping in Room 60. Such wastes take the form of used protective equipment and clothing, dismantled equipment, and project-related debris and soils. During 2007, six cubic meters and 4,916 kilograms of this non-routine waste was shipped. The majority was petroleum-contaminated soil (3.2 cubic meters, 4031 kilograms).

Table 5-2
Solid Wastes Shipped From the TA50 RLWTF During 2007

	Chem-ical	LLW	MLLW	TRU	Totals
No. Items:					
Construction wastes	16	2	2	0	20
Operations	0	12	0	0	12
Salts from Bear Creek	0	0	0	0	0
Sludge	0	16	0	0	16
Totals	16	30	2	0	48
Volume (m^3):					
Construction wastes	3.2	2.7	0.1	0	6.0
Operations	0	30.3	0	0	30.3
Salts from Bear Creek	0	0	0	0	0.0
Sludge	0	3.3	0	0	3.3
Totals	3.2	36.4	0.1	0	39.7
Weight (Kg):					
Construction wastes	4,031	537	348	0	4,916
Operations	0	4,062	0	0	4,062
Salts from Bear Creek	0	0	0	0	0
Sludge	0	2,664	0	0	2,664
Totals	4,031	7,263	348	0	11,643

Operations Wastes: Operations wastes result from both day-to-day water treatment activities and from facility and equipment repairs and modifications. A total of 30 cubic meters weighing 4,062 kilograms of operations wastes were generated at the TA50 RLWTF during 2007. Operations wastes consisted broadly of compactible and other trash generated in radiation control areas at the RLWTF. Compactible trash includes paper, discarded plastic sample vials and bottles, protective gloves, and similar materials needed for day-to-day activities. Other trash included empty containers, process consumables such as spent filter cartridges, and waste from repairs and modifications such as piping and worn pumps and motors.

Salts From Bear Creek: Salts form a special category of operations wastes. Bottoms from the interim evaporator are shipped to a subcontractor in Bear Creek, TN, where the bottoms are dried. The resultant dried salts are returned for disposal at Area G as LLW. During 2007, no shipments of evaporator bottoms were made to Bear Creek, and no drums of dried salts were returned to LANL.

Process Sludge: Process sludge is another special category of operations wastes. MTP clarifier sludge, after being processed through the rotary vacuum filter, is drummed and then shipped to Area G for disposal as LLW. During 2007, 16 drums containing 2,664 kilograms of process sludge were shipped for disposal as LLW at Area G in a single shipment on 13 December. A second sludge waste stream, Room 60 sludge, is drummed, then solidified, prior to disposal as transuranic waste at the Waste Isolation Pilot Plant. No drums of solidified transuranic sludge were shipped from TA50 during 2007.

6. Operations in 2007 at the Other RLW Facilities

Chapters 2 through 5 of this annual report discussed the treatment of low-level radioactive liquid wastes at the TA50 RLWTF. This chapter discusses the other RLW treatment processes.

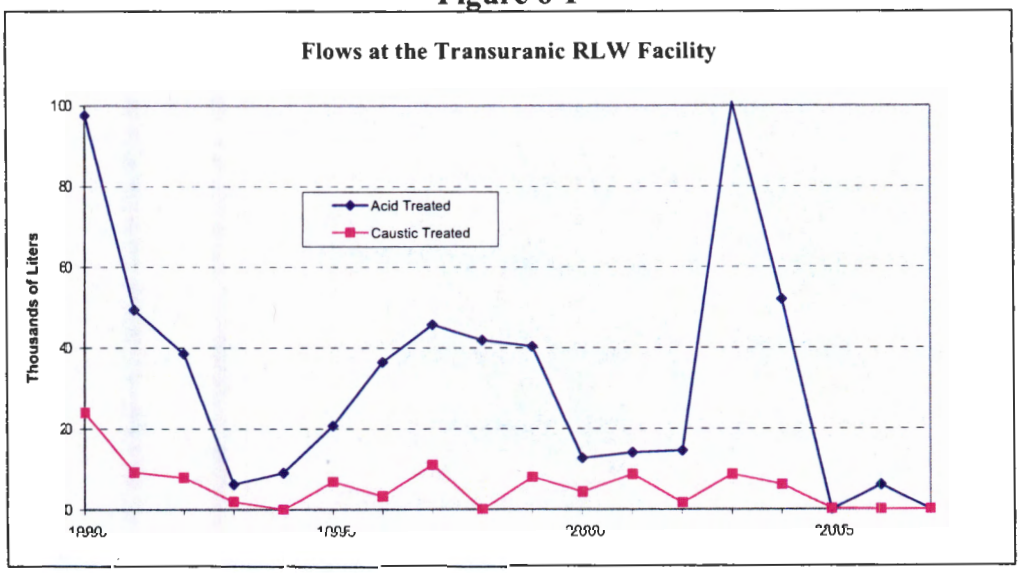
6.1 Transuranic RLW Process

Two events limited transuranic RLW operations during 2007: the discovery in September 2003 that the influent storage tank for caustic wastes was leaking, and the shutdown of Room 60 in July 2004 due to deteriorating equipment and vessels. Maintenance efforts to repair these items have been underway ever since.

Installation of the new caustic waste tank was completed in February 2007, and the receipt of acid and caustic wastes resumed shortly thereafter. Totals of 12,290 liters of acid waste (33 transfers) and 4,260 liters of caustic waste (18 transfers) were received during the year. Acid waste transfers were suspended in mid-October 2007 because the acid waste tank had been filled; caustic waste transfers were not impeded.

Room 60 repairs proceeded throughout the year, and Room 60 was operated sparingly during 2007 as a result. No transuranic RLW were treated during the year, but 1590 liters of effluent were generated by the rinsing and draining of Room 60 piping and equipment. These effluent waters were transferred to the low-level evaporator feed tanks in Building 50-248. Figure 6-1 provides an historical perspective for volumes of transuranic RLW treated in Room 60.

Figure 6-1



6.2 TA53 RLW Facility

The TA53 RLWTF treats radioactive liquid waste from accelerator research at the Los Alamos Neutron Science Center. The treatment process includes wastewater storage to allow short-lived radioisotope decay, followed by solar evaporation. Three flows are of importance.

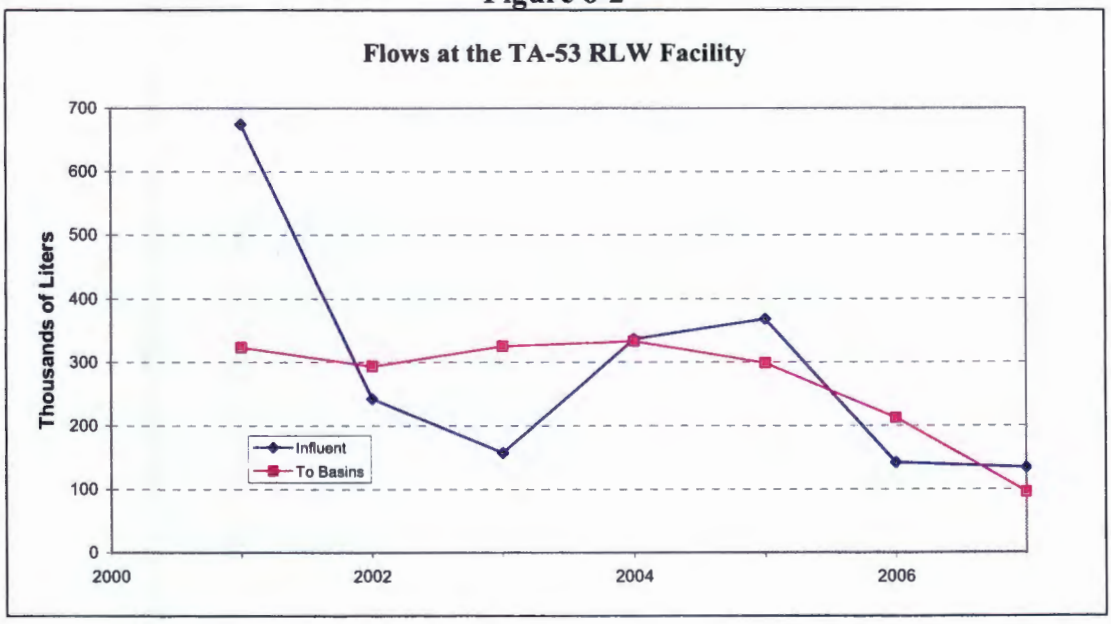
- Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan Center. The RLW is pumped from the lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945. A total of 122,160 liters of RLW were transferred from the lift stations to the RLWTF during 2007.

- Tritiated waters are occasionally trucked to the TA53 influent tanks. During 2007, 11,820 liters were trucked to the basins from TA16. These trucked wastewaters met the waste acceptance criteria for the TA53 RLWTF. This additional trucked quantity raised total influent volume for the year to 133,980 liters.

- After aging in the influent tanks, the RLW is pumped to the evaporator basins. During 2007, a single pump-out occurred (TK1), totaling 95,730 liters.

Figure 6-2 provides an historical perspective for RLW flows at the TA53 facility. The graph shows that flows in 2007 were the lowest since the facility went into operation in December 1999. There is no conclusive trend to the flows, however, and they remain well below the evaporative capacity (1.4 million liters per year) of the basins.

Figure 6-2



6.3 TA21 RLW Facility

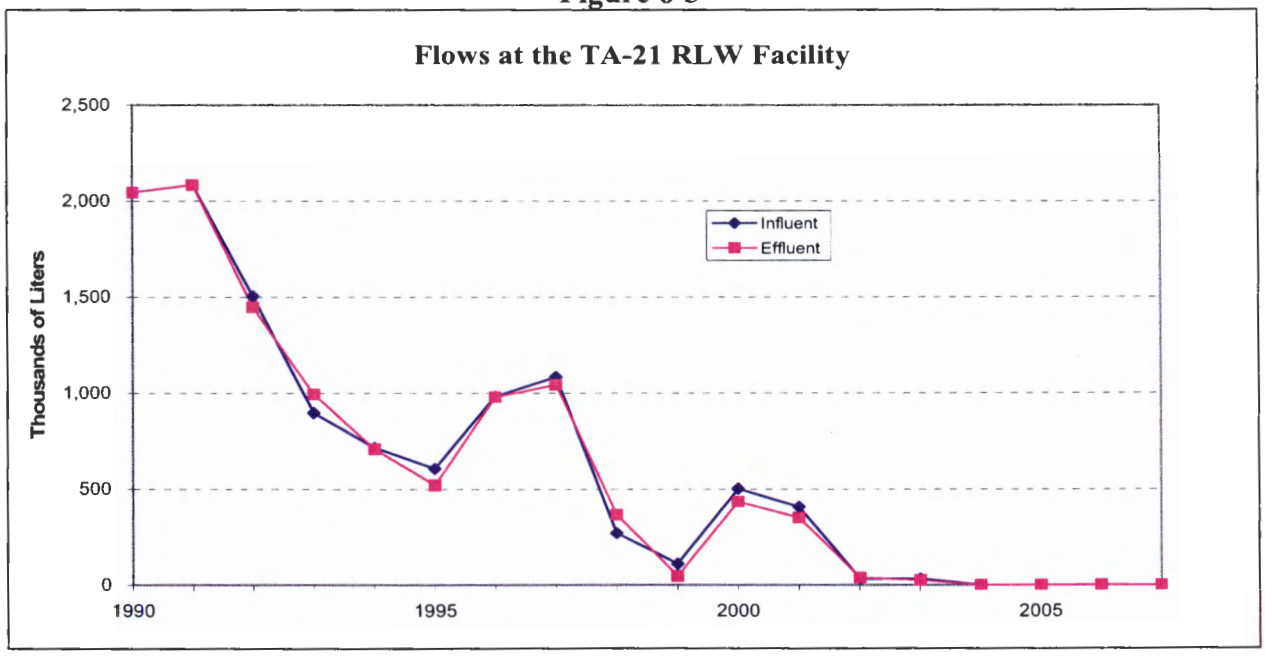
The facility at TA21 treats RLW from tritium research at TA21 using a clarifier and a gravity filter. From 1966 through 2000, effluent from this facility was transferred via underground piping to TA50. Beginning in 2001, treated TA21 waters have been transferred to TA50 by truck. Effluent from the TA21 Facility may also be trucked to the TA53 Facility.

Volumes and concentrations of tritiated RLW have declined as tritium activities have been scaled back at TA21. Although influent volumes historically exceeded one million liters, they declined to just 30,000 liters in 2002, 32,000 liters in 2003, and nearly zero since. The TA21 RLWTF was last operated in 2003. During 2007, influent approximated zero, and the facility was again not operated. The facility had no effluent.

The TA21 facility has an inventory of waters in tanks and process equipment, estimated to be about 250,000 liters. Condition of the equipment for the processing of this inventory is of concern, however, due to age and intermittent use. A return to operation will require major efforts, including procedure reviews and walkdowns, equipment checks and tests, processing trials using non-radioactive waters, a Management Self Assessment, and perhaps a LANL Readiness Assessment. After the existing inventory of waters have been processed, the TA21 facility will be placed in cold shutdown status to await decommissioning.

Figure 6-3 provides an historical perspective for RLW flows at the TA21 facility. It clearly shows the closure of TA21 tritium operations beginning in 2002.

Figure 6-3



7. References

Much of the information presented in this Annual Report come from the RLWTF process control system, RS View, which automatically records temperatures, flow rates, flow totals, pressures, tank levels, and similar readings of process conditions. Another large segment of the information presented in graphs and tables in this Annual Report comes from analytical data results for process control samples. The below list of references points to the third major data source used in compiling the Annual Report – published reports that are cited within the text of the Annual Report.

Del Signore, J.C., 07/19/01. "Facility Floor Space", memo to File, Los Alamos, NM.

Del Signore, J.C., December 2006. "Material-at-Risk Calculations for the Radioactive Liquid Waste Treatment Facility", LA-UR-06-8731.

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Del Signore, J.C., 02/11/08. "Low-level RLW Influent During 2007", memo to File, Los Alamos, NM.

Del Singore, J.C. and McClenahan, R.L., Jr., March 2006. "RLWTF Plant Test Conducted August and September 2005", LA-UR-06-2082.

Del Singore, J.C. and Watkins, R.L., May 2007. "RLWTF Annual Report for 2006", LA-UR-07-3447.

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Environmental Protection Agency, 06/08/07. "Authorization to Discharge Under the National Pollution Discharge Elimination System", NPDES Permit No. NM0028355, Dallas, TX.

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http://www.nmenv.state.nm.us/wqcc/regulations.htm

Watkins, R.L. and Worland, V.P., March 2004. "RLWTF Annual Report for 2003", LA-CP-04-0314, Los Alamos, NM.

Worland, V.P., 10/01/01. "Rapid Deployment of Ion Exchange Technology to Remove Perchlorate from the RLWTF Effluent".

Worland, V.P., 02/22/07, 16:20. "Condition 1 Achieved at TA50 RLWTF", email to wide distribution.

07.27.08
Jennifer

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: July 30, 2008
Refer To: ENV-RCRA-08-149
LA-UR: 08-04521

Mr. William Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, SECOND QUARTER 2008, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the second quarter (April, May, June) of 2008. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the second quarter of 2008. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Laboratory's Water Quality Database (http://wqdbworld.lanl.gov/).

RLWTF Effluent Monitoring Results

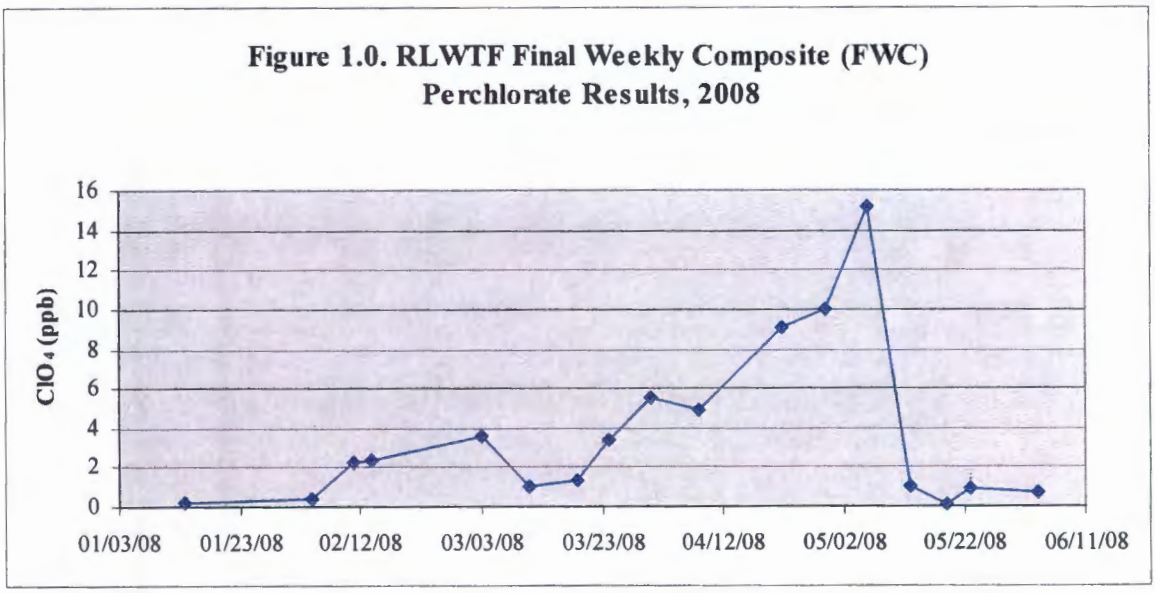
Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for second quarter of 2008. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF's analytical laboratory analyzes duplicate FWC samples as part of their operational monitoring program.

All of the FWC results for the second quarter of 2008 were below the NM WQCC ground water standards for nitrate (NO_3-N), fluoride, and total dissolved solids. The combined NO_3+NO_2-N concentration in the June 3, 2008, FWC sample was 10.6 mg/L. The NM WQCC ground water standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the analytical laboratory at the TA-50 RLWTF performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples as part of their operational monitoring program.

Duplicate sample results from the TA-50 RLWTF analytical laboratory for June 3, 2008, show a NO_3-N concentration of 7.25 mg/L and a NO_2-N concentration of 2.57 mg/L. The sum of these, 9.82 mg/L, is consistent with (within 10% analytical uncertainty) GEL's combined NO_3+NO_2-N result of 10.6 mg/L. Based upon these data, NO_3-N concentrations for the second quarter of 2008 were below the NM WQCC ground water standard of 10 mg/L.

On June 30, 2008, Laboratory staff informed the NMED, Ground Water Quality Bureau, that perchlorate concentrations in the TA-50 RLWTF's effluent increased from approximately 1 ppb to over 15 ppb during a two-month period (personal communication, R. Beers and M. Saladen, ENV-RCRA, with G. Schuman, NMED). Figure 1.0 presents the FWC results for perchlorate during the first two quarters of 2008.

Figure 1.0. RLWTF Final Weekly Composite (FWC) Perchlorate Results, 2008



On May 7, 2008, after identifying the source of the elevated perchlorate, the Laboratory installed temporary ion-exchange (IX) columns until the permanent IX columns could be replaced. Immediately following their installation perchlorate concentrations in the RLWTF's effluent dropped back to about 1 ppb. Installation of the permanent IX columns is scheduled for July 2008. As you are aware, neither the federal government nor the State of New Mexico has established a standard for perchlorate in ground water or drinking water.

The final monthly composite (FMC) sample results from the TA-50 RLWTF's analytical laboratory for nitrate-nitrogen, fluoride, and total dissolved solids for the second quarter of 2008 were not available at the time this report was prepared. These results will be reported to your agency in the 3rd quarter 2008 discharge permit report for DP-1132.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Marcy Leavitt, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Michael Mallory, PADOPS, A102
Richard S. Watkins, ADESHQ, K491
Susan G. Stiger, ADEP, M991
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Craig Douglass, RLW, E518
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Chris Del Signore, EWMO-RLW, E518
Steve Hanson, EWMO-RLW, E518
Jeffery R. Theesfeld, OS-BSI, MS P901
ENV-RCRA, File, w/enc., K490
IRM-RMMSO, w/enc., A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 2nd Quarter, 2008.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	5/20/2008	2.3	2.39	0.34	<0.05	334	0.28
MCO-4B	F	5/21/2008	12.9	0.84	0.32	<0.05	281	0.76
MCO-6	F	5/21/2008	10.2	0.89	0.23	<0.05	276	1.00
MCO-7	F	5/21/2008	10.6	1.45	0.20	<0.05	220	1.48
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NMWQCC Regulation 3103 Ground Water Standard is for NO_3-N.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 2nd Quarter, 2008.

Monitoring Period	Sample Composite Date	Sample ID#	RLWTF Final Weekly Composite Results[1]			
			NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
Mar-08	3/24/2008	GU080300OTHE03	0.43	3.33J	0.40	281
	3/31/2008	GU080300OTHE04	0.38	5.88J	0.51	361
Apr-08	4/8/2008	GU080400OTHE01	3.95	4.88J	0.47	351
	4/15/2008	No Discharge[2]	NA	NA	NA	NA
	4/22/2008	GU080400OTHE02	3.60	9.05J	0.70	509
	4/22/08-Field Dupe	GU080400OTHE20	3.61	9.05J	0.70	525
	4/29/2008	GU080400OTHE03	0.92	10.00	0.81	659
May-08	5/6/2008	GU080500OTHE01	7.95	15.20	0.86	609
	5/13/2008	GU080500OTHE02	5.95	1.02	1.27	561
	5/19/2008	GU080500OTHE03	7.03	0.101J	1.22	523
	5/23/2008	GU080500OTHE04	0.93	0.96	0.83	473
Jun-08	6/3/2008	GU080600OTHE01	10.6	0.67	0.99	645
	6/10/2008	GU080600OTHE02	Results Pending	Results Pending	Results Pending	Results Pending
	6/16/2008	GU080600OTHE03	Results Pending	Results Pending	Results Pending	Results Pending
	6/24/2008	No Discharge[2]	NA	NA	NA	NA
2nd Quarter 2008 Averages[3] (mg/L)			**4.17**	**5.11**	**0.81**	**499**
NM WQCC 3103 Ground Water Standards			*10 mg/L*[4]	*NA*[5]	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]All analyses by General Engineering Laboratories, Inc. unless otherwise noted.

[2]No Discharges means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]2nd quarter 2008 averages include the results from March 2008.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Fullam, Jennifer, NMENV

From: Olson, Bill, NMENV
Sent: Friday, September 19, 2008 10:30 AM
To: George, Robert, NMENV; Fullam, Jennifer, NMENV
Cc: Schuman, George, NMENV
Subject: FW: Listening Session Press release and flier
Attachments: ESP LA FlyerREV_09_18_2008.pub; LA & Esp. Listening Session Press Release.doc

Next weeks session at Los Alamos was moved. I will be on leave for these. Can you please attend these if possible or find someone that can represent GWQB. I doubt the public will ask about our DP's, but the bureaus are supposed to be represented. Thanks.

Bill Olson
Ground Water Quality Bureau Chief
New Mexico Environment Department
1190 St. Francis Dr.
Santa Fe NM 87502-6110
(505) 827-2919

From: Kay, Rebecca, NMENV
Sent: Friday, September 19, 2008 10:06 AM
To: Stone, Marissa, NMENV
Cc: Leavitt, Marcy, NMENV; Bearzi, James, NMENV; Kieling, John, NMENV; Bluehouse, Milton, NMENV; Smutz, Glen, NMENV; George, Robert, NMENV; Turner, Jill, NMENV; Goldstein, Jon, NMENV; Uhl, Mary, NMENV; Skibitski, Thomas, NMENV; Olson, Bill, NMENV; Ashley-Marx, Auralie, NMENV; Denise Gonzales
Subject: Listening Session Press release and flier

Good morning Marissa-

Attached is the PR (and the flier) for the next couple of Listening Sessions (Espanola and Los Alamos). Could you please send the PR out on Monday, September 22nd? And another on Monday, September 29th? Thanks so much.

I hope you had a great summer! Fall is a coming!

Rebecca

Rebecca Kay
NMED- Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505

Phone: 505.476.6040
Fax: 505.476.6030

September 22, 2008
Director
For Immediate Release

Contact: Marissa Stone, NMED Communications
(505) 827-0314 or (505) 231-0475

NMED and NMCF Convene Community Listening Sessions about Los Alamos National Laboratory Issues

WHAT: The New Mexico Environment Department and the New Mexico Community Foundation are hosting two "Listening Sessions" to better understand issues and perceptions residents of northern New Mexico have regarding Los Alamos National Laboratory. The intent of the Sessions is to provide a forum for the public to express those perceptions, and for the Department and the Foundation to listen. The conveners expect the conversation to focus on environmental issues pertaining to the Lab. Better understanding of the environmental issues and priorities important to northern New Mexicans and their communities will allow the Department to incorporate these concerns in its decisions about how to handle potential environmental risks posed by LANL. The next two sessions will be held in Española and Los Alamos. Future sessions will be held in Pojoaque, Albuquerque, Taos, and Santa Fe.

ESPAÑOLA LISTENING SESSION

WHERE: Northern New Mexico College, located on the Main Campus, Española, NM

WHEN: Tuesday, September 30, 2008 from 5:30 p.m. to 7:30 p.m.

WHO: New Mexico Environment Department and New Mexico Community Foundation.

LOS ALAMOS LISTENING SESSION

WHERE: Best Western Hilltop House Hotel, 3rd floor, located at 400 Trinity Ave, Los Alamos, NM

WHEN: Tuesday, October 7, 2008 from 5:30 p.m. to 7:30 p.m.

WHO: New Mexico Environment Department and New Mexico Community Foundation.

For more information, contact Rebecca Kay, NMED Hazardous Waste Bureau, at (505) 476-6040 or rebecca.kay@state.nm.us, or Marissa Stone, NMED Communication Director, at (505) 827-0314

DP 1132
Blue Folder mls

GROUND WATER

OCT 3 0 2008

BUREAU

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: October 30, 2008
Refer To: ENV-RCRA-08-218
LA-UR: 08-06697

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, THIRD QUARTER 2008, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the third quarter (July, August, and September) of 2008. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the third quarter of 2008. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Water Quality Database (http://wqdbworld.lanl.gov/) and the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the second quarter and third quarters of 2008 (Note: late-second quarter results are included in this report because the analytical results were pending when the second quarter report was prepared). The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC ground water standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentrations in four FWC samples—6/10/08, 6/16/08, 8/18/08, and 8/26/08—were greater than 10 mg/L. The NM WQCC ground water standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC ground water standard of 10 mg/L.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, perchlorate (ClO_4), F, and TDS for the second and third quarters of 2008. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results were below the NM WQCC Regulation 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Hai Shen, LASO/EO, A316
Gene Turner, LASO/EO, A316
Michael Mallory, PADOPS, A102
Richard S. Watkins, ADESHQ, K491

Cy (continued):
Susan G. Stiger, ADEP, M991
Mike Saladen, ENV-RCRA, K490
Craig Douglass, RLW, E518
Peter J. Rice, FMO-STO, E518
Pete Worland, EWMO-RLW, E518
Chris Del Signore, EWMO-RLW, E518
Steve Hanson, EWMO-RLW, E518
Jeffery R. Theesfeld, OS-BSI, MS P901
ENV-DO, File, J978
ENV-RCRA, File, w/enc., K490
IRM-RMMSO, w/enc., A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 3rd Quarter, 2008.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	8/15/2008	4.15	3.08	0.13	<0.05	330	0.39J-
MCO-4B	F	8/18/2008	6.97	0.82	<0.10	<0.05	341	0.63
MCO-6	F	8/19/2008	7.39	0.75	0.08J	<0.05	351	0.89
MCO-7	F	8/19/2008	10.1J	1.13	0.09J	<0.05	262	1.39
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NMWQCC Regulation 3103 Ground Water Standard is for NO_3-N.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).
J- means that the analyte is classified as detected but the reported concentration value is expected to be more uncertain than usual with a potential negative bias.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 3rd Quarter, 2008.

Monitoring Period	Sample Composite Date	Sample ID#	Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
			NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
Jun-08	06/10/08	GU080600OTHE02	7.77	2.37	10.5	0.185J	0.95	721
	06/16/08	GU080600OTHE03	8.30	3.10	14.9	3.07J	1.06	795H,J
	06/24/08	No Discharge[2]	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge
Jul-08	07/01/08	GU080600OTHE04	6.85	1.75	6.08	0.13J	0.94	568
	07/09/08	GU080700OTHE01	4.70	<0.01	5.9	0.0825J	0.69	489
	07/14/08	GU080700OTHE02	3.59	3.34	7.4	0.157J	0.67	507
	07/21/08	GU080700OTHE03	6.70	1.46	8.15	0.229J-	0.72	414
	07/27/08	GU080700OTHE04	5.10	2.65	6.78	1.12J	0.83	457H,J
Aug-08	08/04/08	GU080800OTHE01	0.66	4.50	3.46	0.34	0.75	262
	08/11/08	GU080800OTHE02	2.30	6.98	6.75	<0.05	0.79	361
	08/18/08	GU080800OTHE03	7.80	14.0	15.4	<0.05	0.90	460
	08/26/08	GU080800OTHE04	9.20	6.30	14.2	<0.05	1.03	462
Sep-08	09/02/08	GU080900OTHE01	4.60	2.60	7.25	<0.05	0.24	147
	09/09/08	GU080900OTHE02	1.69	0.48	2.21	<0.05	0.046J	46H
	09/15/08	GU080900OTHE03	2.73	0.16	3.32	<0.05	0.054J	45
	09/22/08	GU080900OTHE04	2.29	0.50	2.95	<0.05	0.089J	53H
	09/29/08	No Discharge[2]	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge	No Discharge
3rd Quarter 2008 Averages[3] (mg/L)			**5.0**	**3.3**	**7.7**	**0.38**	**0.65**	**386**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharges means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]3rd quarter 2008 averages include the results from June 2008.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

J- means that the analyte is classified as detected but the reported concentration value is expected to be more uncertain than usual with a potential negative bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 2nd & 3rd Quarters, 2008.

	RLWTF FMC Results[1]			
2008 Monitoring Period	**NO_3-N (mg/L)**	**Perchlorate by IC[2] (ug/L)**	**TDS (mg/L)**	**F (mg/L)**
April	0.30	<1	470	0.87
May	2.50	<1	474	1.2
June	6.90	<1	765	1.1
July	4.95	<1	450	0.83
August	3.80	<1	308	0.60
September	2.20	<1	27	<0.01
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA[3]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analyses by the Laboratory's TA-50 RLWTF analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

1.28.09 Jennifer

DP 1132 Blue File

GROUND WATER

JAN 27 2009

BUREAU

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: January 30, 2009
Refer To: ENV-RCRA-09-009
LA-UR: 09-00270

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, FOURTH QUARTER 2008, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132) ✓

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the fourth quarter (October, November, and December) of 2008. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells

Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the fourth quarter of 2008. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Water Quality Database (http://wqdbworld.lanl.gov/) and the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

MK In 01.28.09 Entered 02 11.09 Misc. - 0 Signed-GW-P : 03924

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the fourth quarter of 2008. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC ground water standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentrations in two FWC samples—10/6/08, and 11/10/08—were greater than 10 mg/L. The NM WQCC ground water standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC ground water standard of 10 mg/L.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, perchlorate (ClO_4), F, and TDS for the fourth quarter of 2008. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NM WQCC Regulation 3103 standards for NO_3-N, F, and TDS. The November FMC perchlorate result and all of the December FMC results were not available at the time this report was prepared. These data will be reported to your agency in the next quarterly discharge plan report (April 30, 2009).

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Hai Shen, LASO/EO, A316
Gene Turner, LASO/EO, A316
Michael Mallory, PADOPS, A102

Cy (continued):
Richard S. Watkins, ADESHQ, K491
Michael J. Graham, ADEP, M991
Mike Saladen, ENV-RCRA, K490
Craig Douglass, RLW, E518
Peter J. Rice, FMO-STO, E518
Pete Worland, EWMO-RLW, E518
Chris Del Signore, EWMO-RLW, E518
Steve Hanson, EWMO-RLW, E518
ENV-DO, File, J978
ENV-RCRA, File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 4th Quarter, 2008.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	11/6/2008	0.971	2.8	3.65	<0.05	256	0.35
MCO-4B	F	11/10/2008	10.6	0.99	0.049J	<0.05	278	0.75
MCO-6	F	11/11/2008	9.51	1.0	<0.10	<0.05	313	0.87
MCO-7	F	11/11/2008	10.3	1.1	0.074J	<0.05	252	1.3
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 4th Quarter, 2008.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	Sample Composite Date	Sample ID#	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
October	10/06/08	GU080900OTHE05	7.2	4.1	11.2	<0.05	0.27	296
	10/14/08	GU081000OTHE01	3.7	2.5	8.1J	<0.05	0.21	220
	10/20/08	GU081000OTHE02	4.1	4.4	8.48	<0.05	0.32	352
	10/27/08	GU081000OTHE03	8.5	0.37	8.33	<0.05	0.28	303HJ
November	11/03/08	No Discharge[2]						
	11/10/08	GU081100OTHE01	4.6	6.3	11.5	<0.05	0.31	255
	11/17/08	GU081100OTHE02	7.9	<0.01	7.63	<0.05	0.21	193
	11/24/08	GU081100OTHE03	4.4	<0.01	4.53	<0.05	0.22	136
December	12/01/08	GU081200OTHE01	8.0	<0.01	8.33	<0.05	0.24	224
	12/08/08	No Discharge						
	12/15/08	GU081200OTHE02	pending[6]	pending	pending	pending	pending	pending
	12/22/08	GU081200OTHE03	pending	pending	pending	pending	pending	pending
	12/29/08	No Discharge						
4th Quarter 2008 Averages[3] (mg/L)			**6.1**	**2.2**	**8.51**	**0.05**	**0.26**	**247**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]4th quarter 2008 averages include the results from September 2008, if applicable.

[4]The NM WQCC 3103 standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were not available at the time this report was prepared.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 4th Quarter, 2008.

	RLWTF FMC Results[1]			
Monitoring Period	**NO_3-N (mg/L)**	**Perchlorate by IC[2] (ug/L)**	**TDS (mg/L)**	**F (mg/L)**
October	6.2	<1	277	0.16
November	7.7	pending[4]	167	0.18
December	pending	pending	pending	pending
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA[3]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]Pending means that the analytical results were not available at the time this report was prepared.

Memorandum of Meeting or Phone Conversation

☐ Telephone ☐ Meeting	**Time:** 10:00-12:30 pm	**Date:** 02.11.09

Individuals Involved

	☐ called	Mike Saladen, LANL
Robert George, NMED-GWQB Team Leader	☐ returned call to	Mark Haagenstad, LANL
Jennifer Fullam, NMED-GWQB Environmental Scientist	☐ received call from	Tim, LANL Ground Water Monitoring Program
Gerald Knutson, NMED-GWQB Environmental Scientist	☐ other: **Meeting**	

Subject: See Below

Discussion:

I. NOI Decision Tree for Purge Water Discharges

Issues with the excel tool developed to determine purge water requirements. The tool only authorizes discharge if the purge water is sampled for the entire list of analytes within the past 12 months as required under the purge water decision tree. Many of the wells are not analyzed for all constituents on an annual basis but are monitored based on the criteria in the Annual Monitoring Plan submitted by LANL and approved by the Haz-Waste Bureau. Once a well is developed it is tested for all constituents but based on a series on non–detects, historical activities with specific contaminants within a specific watershed and consensus with the Haz-Waste Bureau many analytes are not required to be monitored and only historical data shows the full suite. Even though the decision tree states all contaminants will be analyzed, Haz-waste is in agreement with not requiring the full suite in analysis to allow discharges of the purge water. LANL is requesting an evaluation and amendment to the current Decision Tree to allow a variance in the required analytes. The GWB will evaluate the Annual Monitoring Report and determine if LANL can scale down analysis in order to discharge purge water.

LANL has been submitting a periodic monitoring reports (PMRs) to NMED-HWB which summarize discharges of the purge water based on the requirements of the decision tree. GWB has not been receiving these reports and would like a copy. The report does not have the level of detail which would be of value to the GWB and requested additional information be submitted. Once LANL submits their request for variance, GWB will evaluate additional changes and reporting requirements in the Purge Water Decision Tree.

II. Test Well #8 in Mortandad Canyon

R-8 is a regional monitoring well which approximately 40 years old. Upon HWB's request LANL replaced the well with another regional well within proximity to R-8. The new well is identified as R-1. LANL is in the process of plugging and abandoning R-8 however the HWB has requested a 24-hour pump test be performed prior to P & A. The pump test is estimated to yield over 30,000 gallons of purge water which is subject to qualifying for discharge under the Purge Water Decision Tree. LANL does not have a full analysis on this well which is less than one-year (2006 data includes the full suite however it is older than one year and not eligible under the current decision tree). LANL does have a full suite of data on the new R-1 well however Beers was not certain on the proximity to R-8. LANL is

requesting a single variance for this discharge. GWB requested LANL submit a written request which should include historical data, proximity of wells, details of how the pump test will be performed and details of how the purge water will be discharged.

III. Unpermitted sanitary holding tank at T-16

LANL has recently obtained information that there is a sanitary holding tank at T-16 which has never been permitted. It is believed that this tank serves one restroom at the facility and when pumped the wastewater is taken to SWISH for processing. The tank was installed in '96-'97 and was pumped in 2004. GWB requested LANL submit a letter amending the current application to include this tank. GW informed LANL that requirements on such holding tanks will probably include hydrostatic testing to ensure they are not leaking. LANL had conducted a study in the early 90's on the infrastructure in which a report was written. It is called the "Wastestream Characterization Report" 1995. The SWQB has a copy of the 73 volume report.

IV. Composting at SWISH

LANL has begun discussing composting of sludge at the SWISH plant. LANL was requesting information on the permitting process for such activities. GWB would require specific conditions which could be included as part of the WWTP permit or an independent permit just for composting. Generally ground water monitoring is included as one of the required conditions but this would have to be evaluated once an application was submitted.

V. Land application of PRB waste

Discussion of this topic will be discussed at another time

VI. Outfall Reduction

Ongoing discussions regarding points of compliance and outfall reduction. This topic will need to be discussed at further length at another time.

Conclusions:

LANL will:

1. Submit a request for variance from the current purge water decision tree based on the annual monitoring report approved by HWB.
2. Submit a request for variance from the current purge water decision tree for the planned 24-hour pump test on R-8 prior to P&A.
3. Submit a letter to include the holding tank at TA-16 on the application for a Discharge Permit

GWB will:

1. Respond to the request for Purge Decision Tree variance with additional language to specify reporting requirements.
2. respond to LANLs request for variance on Purge Decision Tree data for R-8

Distribution:

Initialed

1132 NM Blvd 5/11 SF

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: April 30, 2009
Refer To: ENV-RCRA-09-074
LA-UR: 09-02389

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, FIRST QUARTER 2009, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the first quarter (January, February, and March) of 2009. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the first quarter of 2009. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the first quarter of 2009. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC ground water standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentrations in two FWC samples—12/15/08, and 12/29/08—were greater than 10 mg/L. The NM WQCC ground water standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC ground water standard of 10 mg/L.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, perchlorate (ClO_4), F, and TDS for the first quarter of 2009. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NM WQCC Regulation 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Hai Shen, LASO/EO, A316
Gene Turner, LASO/EO, A316
Michael Mallory, PADOPS, A102
J. Chris Cantwell, ADESHQ, K491
Michael J. Graham, ADEP, M991

Cy (continued):
Mike Saladen, ENV-RCRA, K490
Craig Douglass, RLW, E518
Peter J. Rice, TA-55-RLW, E518
Pete Worland, PMT-2, E518
Chris Del Signore, ES-SE, E518
Steve Hanson, PMT-2, E518
ENV-DO, File, J978
ENV-RCRA, File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 1st Quarter, 2009.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	2/11/2009	2.14J	4.62	0.53J	<0.05	404	0.27
MCO-4B	F	2/4/2009	5.68	1.49	0.45J+	<0.05	281	0.68
MCO-6	F	2/4/2009	7.82	1.16	<0.11	<0.05	286	0.90
MCO-7	F	2/3/2009	10.4	1.13	0.06J	<0.05	269	1.1
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 1st Quarter, 2009.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	Sample Composite Date	Sample ID#	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
December	12/15/08	GU081200OTHE02	7.6	Invalid	14.9	0.11J	0.27	261
	12/22/08	GU081200OTHE03	9.0	Invalid	9.35	<0.05	0.23	223
	12/29/08	50FWC-09-2798	9.9	Invalid	10.5	<0.05	0.27	313
January	01/05/09	No Discharge						
	01/12/09	No Discharge						
	01/19/09	No Discharge						
	01/26/09	50FWC-09-2799	5.3	0.82	5.39	<0.05	0.23	283
February	02/02/09	50FWC-09-2800	5.7	0.09	6.00	<0.05	0.16	141
	02/09/09	50FWC-09-2801	5.4	3.8	8.15	<0.05	0.25	271
	02/17/09	50FWC-09-2802	4.0	1.8	4.35	0.06J	0.16	138
	02/23/09	No Discharge						
March	03/02/09	50FWC-09-2803	4.7	6.1	7.78	1.95	0.17	370H
	03/09/09	50FWC-09-2804	4.2	7.2	6.58	<0.05	0.09J	514H
	03/16/09	50FWC-09-2805	5.7	6.0	7.98	<0.05	0.07J	365
	03/23/09	50FWC-09-2806	5.6	1.1	Pending	Pending	Pending	Pending
	03/30/09	50FWC-09-2807	5.9	4.4	Pending	Pending	Pending	Pending
1st Quarter 2009 Averages[3] (mg/L)			**6.1**	**2.6**	**8.1**	**0.25**	**0.19**	**288**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]1st quarter 2009 averages include the results from December 2008, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pendidng at the time this report was prepared.

Invalid means that no analytical results are available due to quality control issues.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 1st Quarter, 2009.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
January	5.3	<1	246	1.5
February	6.6	<1	186	1.1
March	5.2	<1	325	0.1
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

DP-1132 MRS

GROUND WATER

JUL 30 2009

BUREAU

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: July 30, 2009
Refer To: ENV-RCRA-09-135
LA-UR: 09-04399

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2261
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUND WATER DISCHARGE PLAN QUARTERLY REPORT, SECOND QUARTER 2009, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Ground Water Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the second quarter (April, May, and June) of 2009. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and ground water monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Ground Water Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the second quarter of 2009. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) Regulation 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the second quarter of 2009. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC ground water standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentrations in five FWC samples—4/20/09, 4/27/09, 5/4/09, 6/1/09, and 6/15/09—were greater than 10 mg/L. The NM WQCC ground water standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC ground water standard of 10 mg/L.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, perchlorate (ClO_4), F, and TDS for the second quarter of 2009. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NM WQCC Regulation 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, NMED/OB/LASO, J993
Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Michael Mallory, PADOPS, A102
Chris Cantwell, ADESHQ, K491

Cy (continued):
Robert C. Mason, TA55-DO, E583
Pete Worland, PMT-2, E518
Chris Del Signore, PMT-2, E518
Steve Hanson, PMT-2, E518
Mike Saladen, ENV-RCRA, K490
Harvey Decker, ENV-EAQ, E500
ENV-DO File, J978
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 2nd Quarter, 2009.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	4/30/2009	0.79	3.5	<0.16	<0.02	387	0.34
MCO-4B	F	5/4/2009	4.7	1.9	0.37J-	0.12J-	266	0.76
MCO-6	F	5/5/2009	6.3	1.4	0.19	0.03J-	282	0.99
MCO-7	F	5/4/2009	10.0	1.2	0.14J-	0.02J-	278	1.2
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 2nd Quarter, 2009.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	**Sample Composite Date**	**Sample ID#**	**NO_3-N (mg/L)**	**NO_2-N (mg/L)**	**NO_3+NO_2-N (mg/L)**	**Perchlorate by LC/MS/MS (ug/L)**	**Fluoride (mg/L)**	**TDS (mg/L)**
March	3/24/09	50FWC-09-2806	5.64	1.10	7.03	<0.2	0.06J	119
	3/30/09	50FWC-09-2807	5.90	4.40	8.33	<0.2	0.07J	111HJ-
April	4/7/09	50FWC-09-2808	5.99	2.50	9.65	<0.2	0.10J	189
	4/15/09	50FWC-09-2809	5.15	1.94	6.20	<0.2	0.10	169
	4/20/09	50FWC-09-2810	9.27	<0.01	12.3	<0.2	0.14	278J-
	4/27/09	50FWC-09-2811	8.87	4.50	11.4	<0.2	0.22	312J-
May	5/4/09	50FWC-09-2812	7.00	5.83	10.7	<0.2	0.21	278HJ-
	5/12/09	50FWC-09-2813	6.80	1.50	7.90	<0.2	<0.13	227
	5/18/09	50FWC-09-2814	4.90	2.95	8.50	<0.2	0.05J	141J
	5/26/09	50FWC-09-2815	5.05	2.25	7.63	<0.2	0.06J	219J
June	6/1/09	50FWC-09-2816	5.20	7.60	12.9	<0.2	0.13	214
	6/9/09	50FWC-09-2817	5.60	6.50	9.95	<0.2	0.19	309
	6/15/09	50FWC-09-2818	7.70	5.40	12.4	<0.2	0.27J-	388
	6/22/09	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]
	6/29/09	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]	pending[6]
2nd Quarter 2009 Averages[3] (mg/L)			**6.4**	**3.6**	**9.6**	**<0.2**	**0.13**	**227**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period preceding the composite date.

[3]2nd quarter 2009 averages include the results from March 2009, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 2nd Quarter, 2009.

	RLWTF FMC Results[1]			
Monitoring Period	**NO_3-N (mg/L)**	**Perchlorate by IC[2] (ug/L)**	**TDS (mg/L)**	**F (mg/L)**
April	6.5	<1	215	0.06
May	7.1	<1	230	0.06
June	7.0	<1	363	0.14
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA[3]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

LANL / LANI Emails

Fullam, Jennifer, NMENV

From: marissa stone bardino <marissa.bardino@state.nm.us>
Sent: Thursday, July 9, 2009 4:59 PM
To: Fullam, Jennifer, NMENV
Subject: ABQjournal message from marissa stone bardino

ABQ JOURNAL link to story: http://www.abqjournal.com/news/state/092338167878newsstate07-09-09.htm

marissa stone bardino thought this article would be of interest.

Comments: ***Jennifer, here's the article you requested***

Recommended by marissa stone bardino at marissa.bardino@state.nm.us (Note: name and e-mail address have not been verified.)

Thursday, July 09, 2009

Radioactive Waste Plant at LANL Has Spill

By John Fleck
Journal Staff Writer

A 40-year-old plant at Los Alamos National Laboratory that treats liquid radioactive waste had another leak last month as some members of Congress balk at the rising costs of the plant's replacement.

The leak happened when a plastic connector cracked, spilling 500 gallons of contaminated water onto the floor inside one of the plant's buildings, according to a report from federal nuclear safety officials. The water flowed into a sump inside the building, and none of it escaped, according to the report.

The incident highlights the increasingly fragile nature of the aging plant. In a report to Congress earlier this year, the National Nuclear Security Administration said portions of the plant's waste treatment systems "are over 40 years old and their reliability is significantly diminishing."

But a key House committee this week eliminated funding for major upgrades, complaining about "significant cost overruns" for the project.

The June incident is the second time in the last year that a similar plastic part cracked and caused a leak, according to a report from the Defense Nuclear Facilities Safety Board, a federal body that provides independent oversight at Los Alamos and other nuclear weapon sites.

The Radioactive Liquid Waste Treatment Facility, located in the lab's Technical Area 50, came online in 1963.

The plant, connected by a network of piping to 63 buildings at Los Alamos, treats water contaminated with radioactive materials as a result of work on nuclear weapons and other projects at Los Alamos.

Los Alamos spokesman Kevin Roark acknowledged that the plant "does not comply with current codes and standards," including seismic, building and electrical codes.

The Safety Board has argued that problems at the waste treatment plant threaten the lab's ability to carry out work with radioactive plutonium to maintain U.S. nuclear weapons, because continued breakdowns would leave no way to deal with the radioactive waste the work creates.

Roark said the spill was cleaned up within days and did not interrupt operations at the plant.

In 2006, the National Nuclear Security Administration estimated the cost for waste management upgrades at $80 million to $100 million, but a budget report sent to Congress this year said it was likely to rise.

Fullam, Jennifer, NMENV

From: Fullam, Jennifer, NMENV
Sent: Monday, August 24, 2009 2:57 PM
To: 'Robert S. Beers'
Subject: RE: Map Request

Bob,

Due to the extensive range of activities and locations NMED handles at LANL, it would be highly beneficial if the Ground Water Quality Bureau could obtain a reference map with the following coverages:

- *General topography (aerial imagery of facility and adjacent lands)*
- *All monitoring and supply wells including those that are not within LANL's boundaries but are associated with LANL related monitoring/activities (ID and depth/aquifer)*
- *Canyons (labeled)*
- *Technical Areas*
- *The extents of alluvial/intermediate and regional aquifers as determined through modeling*
- *Roads (labels for major roadways)*
- *Wastewater infrastructure (domestic/industrial/haz-waste- lines, septic tanks and treatment facilities). Please do not include potable water supply lines if at all possible.*

Please let me know if you have any questions regarding this request. Thanks.

Jennifer Fullam
Environmental Scientist
Ground Water Quality Bureau
New Mexico Environment Department
505.827.2909
jennifer.fullam@state.nm.us

From: Robert S. Beers [mailto:bbeers@lanl.gov]
Sent: Monday, August 17, 2009 8:45 AM
To: Fullam, Jennifer, NMENV
Cc: saladen@lanl.gov; mph@lanl.gov
Subject: Map Request

Hi Jennifer,

The last time we spoke on the telephone you mentioned to me that it would be helpful to you in your evaluation of LANL activities if you had a new map.

I would be happy to have our GIS folks build one for you. However, could you please formalize your request in an email and also give me some specifics on the types of coverages you would like to see on the map.

Bob

11.05.09 J.F.

DP 1132 Blue File MR

Los Alamos
NATIONAL LABORATORY
EST.1943

GROUND WATER

OCT 30 2009

BUREAU

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: October 28, 2009
Refer To: ENV-RCRA-09-190
LA-UR: 09-06578

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN QUARTERLY REPORT, THIRD QUARTER 2009, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Groundwater Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the third quarter (July, August, and September) of 2009. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells

Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the third quarter of 2009. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the third quarter of 2009. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC 3103 standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentrations in four FWC samples—6/23/09, 6/29/09, 9/8/09, and 9/15/09—were greater than 10 mg/L. The NM WQCC 3103 standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC 3103 standard of 10 mg/L. No sample results were available for perchlorate(ClO_4), F, and TDS from the 9/15/09 FWC sample; the sample was incorrectly preserved in the field and these analyses were cancelled by GEL.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for the third quarter of 2009. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NM WQCC 3103 standards for NO_3-N, F, and TDS. No sample result was available for NO_3-N from the September FMC sample; the results were rejected following a determination that the sample was contaminated in the RLWTF laboratory.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Bob Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, M894
Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316

Cy (continued):
Michael Mallory, PADOPS, A102
Chris Cantwell, ADESHQ, K491
Robert C. Mason, TA55-DO, E583
Pete Worland, PMT-2, E518
Chris Del Signore, PMT-2, E518
Steve Hanson, PMT-2, E518
Mike Saladen, ENV-RCRA, K490
Harvey Decker, ENV-EAQ, E500
ENV-DO File, J978
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 3rd Quarter, 2009.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	08/12/09	0.421	1.07	0.90J-	<0.034	212	0.47
MCO-4B	F	08/18/09	9.23	1.51	0.77J-	0.098J-	290J	0.72
MCO-6	F	08/12/09	7.26	2.06	<0.14	<0.022	274	0.88
MCO-7	F	08/13/09	12.0	1.30J	<0.22	0.016J	269	1.1
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 3rd Quarter, 2009.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	Sample Composite Date	Sample ID#	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
June	06/23/09	50FWC-09-2819	9.0	4.8	13.9J	<0.2	0.41J-	558
	06/29/09	50FWC-09-2820	7.3	4.0	11.8J	<0.2	0.21	427
July	07/07/09	50FWC-09-2821	4.0	1.7	5.9	<0.2	0.08J	154
	07/15/09	50FWC-09-2822	4.4	1.9	7.6J	0.07J	0.26	342
	07/20/09	50FWC-09-2823	6.7	2.9	9.8	<0.2	0.27	327
	07/27/09	50FWC-09-2824	3.8	1.7	<6.3	<0.2	0.01J-	157
August	08/03/09	50FWC-09-2825	3.7	9.1	6.3J	<0.2	0.28J-	558
	08/10/09	50FWC-09-2826	5.7	3.9	9.9	<0.2	0.15	188HJ
	08/18/09	50FWC-09-2827	1.6	1.3	3.1	<0.2	0.06J	67HJ
	08/24/09	50FWC-09-2828	2.5	1.7	3.6	<0.2	0.13	147J
September	09/01/09	50FWC-09-2829	2.4	8.5	8.9	<0.2	0.20J-	257
	09/08/09	50FWC-09-2830	5.7	6.0	10.1J	<0.2	0.29	215HJ-
	09/15/09	50FWC-09-2831	4.2	3.6	14.5J	No Result[7]	No Result[7]	No Result[7]
	09/21/09	50FWC-09-2832	9.3	0.3	7.55J	<0.2	0.32	180
	09/28/09	50FWC-09-2833	9.3	0.1	9.2	<0.2	0.55J-	406
3rd Quarter 2009 Averages[3] (mg/L)			**5.3**	**3.4**	**8.6**	**0.19**	**0.24**	**285**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]3rd quarter 2009 averages include the results from June 2009, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

[7]No Result means that no result was available for this analyte. The F+ClO4+TDS container received by GEL was incorrectly preserved and the analyses were canceled.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 3rd Quarter, 2009.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
July	5.2	<1	244	0.13
August	2.7	<1	225	0.10
September	No Result[4]	<1	278	0.30
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]No result is available, the FMC sample was contaminated in the RLWTF laboratory.

DP 1132 Blue File
MRS

Los Alamos
NATIONAL LABORATORY
EST. 1943

JAN 28 2010

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: January 28, 2010
Refer To: ENV-RCRA-10-027
LAUR: 10-00256

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN QUARTERLY REPORT, FOURTH QUARTER 2009, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Groundwater Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the fourth quarter (October, November, and December) of 2009. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells

Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the fourth quarter of 2009. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS). Please note that the TDS result from alluvial well MCO-3 is a reanalysis result; the initial result reported by GEL of 1290 mg/L was not supported by the specific conductance measurement collected in the field. Reanalysis confirmed that the initial result was invalid.

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racermm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the fourth quarter of 2009. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC 3103 standards for NO_3-N, F, and TDS with the exception of two NO_3-N results from 10/5/09 and 11/24/09. Data collected by the RLWTF prior to discharge confirmed that the effluent was compliant with NM WQCC 3103 standards. Data available post-discharge is contradictory suggesting that NO_3-N concentrations may have exceeded 10 mg/L. These results are discussed below.

- The final weekly composite (FWC) sample for 10/5/09 (ID# 50FWC-09-2834) was composited from two effluent tanks discharged during the previous week. Individual and composite analytical results from these two tanks are summarized below:

Sample Type	Sample Date	Analytical Laboratory	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)
Effluent tank	9/23/09	RLWTF	9.4	4.4	
Effluent tank	9/30/09	RWLTF	7.8	2.3	
FWC	10/5/09	GEL			11.8
FWC	10/5/09	RLWTF	12.9	<0.1	

The samples collected from the effluent tanks on 9/23/09 and 9/30/09 were pre-discharge screening samples. In accordance with the RLWTF's standard operating procedure, the NO_3-N concentration is measured in each effluent tank prior to discharge to ensure compliance with the NM WQCC 3103 standard of 10 mg/L. The NO_3-N screening results—9.4 and 7.8 mg/L—confirmed that both effluent tanks met the standard for discharge. The average of these two NO_3-N results—a theoretical composite of the two tanks—is 8.6 mg/L.

In addition to pre-discharge screening analyses, a final weekly composite sample is also prepared from each effluent tank for analysis by both GEL and the RLWTF analytical laboratory. GEL reported a combined NO_3+NO_2-N concentration of 11.8 mg/L; this result is consistent with the calculated NO_3+NO_2-N concentration for the 9/23/09 and 9/30/09 effluent tanks of 11.95 mg/L.

In contrast, the RLWTF analytical laboratory's reported NO_3-N and NO_2-N results of 12.9 mg/L and <0.1 mg/L, respectively, in the FWC sample of 10/5/09 are not consistent with the individual effluent tank NO_3-N and NO_2-N measurements from 9/23/09 and 9/30/09. The absence of NO_2-N in the FWC sample—<0.1 mg/L—and the elevated concentration of NO_3-N—12.9 mg/L—indicate that all of the NO_2-N in the sample was oxidized to NO_3-N prior to analysis. As such, the FWC sample does not accurately represent the concentrations of NO_3-N in the two effluent tanks at the time of discharge.

- The final weekly composite (FWC) sample for 11/17/09 (ID# 50FWC-09-2839) was composited from a single effluent tank discharged during the previous week. Analytical results from this tank are summarized below:

Sample Type	Sample Date	Analytical Laboratory	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)
Effluent tank	11/17/09	RLWTF	9.9	0.28	
FWC	11/24/09	GEL			11.2
FWC	11/24/09	RLWTF	12.8	<0.1	

A screening sample was collected on 11/17/09 from the effluent tank prior to discharge; the NO_3-N screening result—9.9 mg/L—confirmed that the effluent tank met the standard for discharge of 10 mg/L, albeit with little margin for analytical error.

The FWC result reported by GEL—11.2 mg/L—for NO_3+NO_2-N is consistent, within analytical error, with the calculated NO_3+NO_2-N concentration in the 11/17/09 screening sample of 10.2 mg/L.

In contrast, the RLWTF analytical laboratory's reported NO_3-N and NO_2-N results of 12.8 mg/L and <0.1 mg/L, respectively, are not consistent with the individual effluent tank measurement. These data suggest that NO_3-N concentration in the 11/17/09 effluent tank may have been near, or possibly greater, than the discharge limit of 10 mg/L. The following corrective action will be initiated by the RLWTF to ensure that effluent of marginal quality is not approved for discharge.

  - The RLWTF's operators, following a standard operating procedure (SOP), use an effluent screening sheet for each effluent tank to record and compare pre-discharge screening data to the discharge limits, and then confirm that the effluent in a tank is suitable for discharge. Currently, the effluent screening sheet's discharge limit for NO_3-N is 10 mg/L, a threshold without allowance for analytical uncertainty. Under this corrective action, the RLWTF will review discharge limits on the effluent screening sheet and adjust each limit downward, as necessary, to account for method-specific analytical uncertainties.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for the fourth quarter of 2009. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NM WQCC 3103 standards for NO_3-N, F, and TDS with the exception of the October 2009 result for NO_3-N of 10.7 mg/L. This value is consistent with the higher NO_3-N concentrations in the October discharges.

In closing, monitoring data indicate that NO_3-N concentrations were possibly greater than 10 mg/L in one of the eleven effluent tanks discharged during the fourth quarter of 2009. In response, the RLWTF will initiate the following corrective measure: Discharge limits listed on the pre-discharge effluent screening sheet will be evaluated and adjusted downward, as

appropriate, to reflect method-specific analytical uncertainties. This correction will provide for a more conservative screening of effluent prior to discharge.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, M894
Hai Shen, LASO-EO, A316
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Pete Worland, PMT-3, E518
Chris Del Signore, PMT-3, E518
Steve Hanson, PMT-3, E518
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 4th Quarter, 2009.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	11/05/09	0.808	1.74J	0.592J-	<0.05	296H[5]	0.40
MCO-4B	F	11/09/09	6.05	1.05J	0.074J	0.142J	281	0.63
MCO-6	F	11/10/09	7.82	1.07	0.045J-	<0.05	266	0.77
MCO-7	F	11/10/09	11.7	1.49	<0.10	<0.05	273	0.93
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

[5]Reanalysis result. See discussion.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the required extraction or holding time was exceeded.

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 4th Quarter, 2009.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	Sample Composite Date	Sample ID#	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate by LC/MS/MS (ug/L)	Fluoride (mg/L)	TDS (mg/L)
October	10/5/09	50FWC-09-2834	12.9[7]	<0.1	11.8	<0.2	0.342	308
	10/13/09	50FWC-09-2835	4.0	2.7	7.03	<0.2	0.072J	67
	10/19/09	50FWC-09-2836	8.5	0.1	9.20	<0.2	0.062J	102
	10/29/09	50FWC-09-2837	9.4	<0.1	8.38	<0.2	0.082J	108
November	11/9/09	50FWC-09-2838	7.9	<0.1	7.55J	<0.2	0.088J	94HJ-
	11/24/09	50FWC-09-2839	12.8[8]	<0.1	11.2J	<0.2	0.125J-	143
	11/30/09	50FWC-09-2840	7.4	0.7	7.38	<0.2	0.093J	118
December	12/7/09	50FWC-09-2841	7.5	<0.1	6.73	0.062J	0.105	131
	12/16/09	50FWC-09-2842	3.4	0.5	3.90	<0.2	0.068J	46
	12/22/09	50FWC-09-2843	3.7	0.3	3.85	<0.2	0.067J	72
4th Quarter 2009 Averages[3] (mg/L)			**7.8**	**0.5**	**7.7**	**0.19**	**0.11**	**119**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]4th quarter 2009 averages include the results from September 2009, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

[7]Individual effluent tank measurements taken by the RLWTF laboratory prior to discharge were 9.4 and 7.8 mg/L.

[8]Individual effluent tank measurement taken by the RLWTF laboratory prior to discharge was 9.9 mg/L.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 4th Quarter, 2009.

	RLWTF FMC Results[1]			
Monitoring Period	**NO_3-N (mg/L)**	**Perchlorate by IC[2] (ug/L)**	**TDS (mg/L)**	**F (mg/L)**
October	10.7	<1	164	0.15
November	9.7	<1	150	0.06
December	4.7	<1	128	0.05
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA[3]*	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

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GROUND WATER

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BUREAU

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: April 28, 2010
Refer To: ENV-RCRA-10-078
LAUR: 10-02559

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Typo in Subject, should be 2010

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN QUARTERLY REPORT, FIRST QUARTER 2009, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Groundwater Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the first quarter (January, February, and March) of 2010. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells

Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the first quarter of 2010. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

: 03969

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the first quarter of 2010. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are equal to or less than the NMWQCC 3103 standards for NO_3-N, F, and TDS, with the exception of a March 15, 2010, NO_3-N result reported by the TA-50 RLWTF analytical laboratory of 10.1 mg/L. A duplicate sample result from GEL showed a concentration of nitrate-nitrogen plus nitrite-nitrogen (NO_3+NO_2-N) of 10.0 mg/L.

As required by procedure, the RLWTF collects a screening sample from each effluent tank prior to discharge to verify compliance with water quality parameters. Only one effluent tank was discharged during the 7-day composite period preceding March 15, 2010; an effluent screening sample from this tank showed NO_3-N and NO_2-N concentrations of 7.4 mg/L and 3.4 mg/L, respectively. All analytical results associated with effluent discharged during the March 15, 2010, composite period are presented in the table below.

Sample Type	Sample Date	Analytical Laboratory	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)
FWC	3/15/10	GEL	NA	NA	10.0
FWC	3/15/10	TA-50 RLWTF	10.1	<0.01	10.1[a]
Screening Sample[b]	2/25/10	TA-50 RLWTF	7.4	3.4	10.8[a]

[a] Calculated value, sum of NO3-N and NO2-N.
[b] Collected prior to discharge.

The NO_3+NO_2-N result reported by GEL—10.0 mg/L—is consistent with the calculated NO_3+NO_2-N results—10.1 mg/L and 10.8 mg/L—reported by the TA-50 RLWTF analytical laboratory, considering analytical error. The increase in the NO_3-N concentration from the screening sample (7.4 mg/L) and the RLWTF's FWC sample (10.1 mg/L) can be attributed to oxidation of NO_2-N.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for the first quarter of 2010. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NMWQCC 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Enclosures: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, M894
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Steve Hanson, TA-55-RLW, E518
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 1st Quarter, 2010.

Sampling Location	Sample Field Prep (F/UF)[2]	Sample Date	Perchlorate by LC/MS/MS[1] (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	02/02/10	0.977	2.67	<0.10	<0.029	369	0.21
MCO-4B	F	02/03/10	3.30J	1.08	<0.10	<0.062	265	0.73
MCO-6	F	01/27/10	6.04	1.04J+	0.06J-	0.046J-	293	0.94
MCO-7	F	01/28/10	7.26J	1.26	<0.10	0.031J-	292	0.96J-
NM WQCC 3103 Ground Water Standards			*NA*[3]	*10 mg/L*[4]	*NA*[3]	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]LC/MS/MS means perchlorate analysis by Liquid Chromatography/Mass Spectrometry/Mass Spectrometry.

[2]All samples filtered with the exception of TKN.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

[4]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 1st Quarter, 2010.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	**Sample Composite Date**	**Sample ID#**	**NO_3-N (mg/L)**	**NO_2-N (mg/L)**	**NO_3+NO_2-N (mg/L)**	**Perchlorate by LC/MS/MS (ug/L)**	**Fluoride (mg/L)**	**TDS (mg/L)**
December	12/28/09	50FWC-09-2844	3.9	<0.01	3.84	<0.05	0.046J	70
January	1/4/10	No discharge[2]						
	1/11/10	50FWC-10-9939	3.5	0.28	3.44	0.068J	<0.033	74
	1/19/10	50FWC-10-9940	1.5	0.64	2.22	<0.05	<0.033	61
	1/25/10	No discharge[2]						
February	2/1/10	50FWC-10-9941	1.0	0.32	1.56	<0.05	0.089J	128
	2/8/10	50FWC-10-9942	1.9	0.07	1.84	<0.05	<0.33	56
	2/16/10	50FWC-10-9943	1.6	0.21	<0.10	<0.05	<0.033	137
	2/22/10	No discharge[2]						
March	3/1/10	50FWC-10-9944	2.3	0.70	3.17	0.054J	0.22	134J-
	3/8/10	No discharge[2]						
	3/15/10	50FWC-10-9945	10.1	<0.01	10.0H	<0.05H	0.418H	341H
	3/22/10	No discharge[2]						
	3/29/10	50FWC-10-9946	2.20	0.05	3.14	0.182J	0.055J	63H
1st Quarter 2010 Averages[3]			**3.0**	**0.3**	**3.26**	**0.07**	**0.14**	**118**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]4th quarter 2009 averages include the results from September 2009, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

H means that the analytical hold time was exceeded.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 1st Quarter, 2010.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
January	2.2	<1	80	0.02
February	1.9	<1	159	0.06
March	6.5	<1	185	0.20
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: March 8, 2010
Refer To: ENV-RCRA-10-052
LAUR: 10-01288

Mr. William Olson, Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, GROUND WATER DISCHARGE PLAN (DP-1132), UPGRADE PROJECT 60% DESIGN

In accordance with 20.6.2.3107.C of the New Mexico Water Quality Control Commission Regulations, Los Alamos National Laboratory (Laboratory) is providing you with a copy of the 60% design package—plans and specifications—for the construction of a new Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area (TA)-50. This letter and the enclosed CDs (2) are supporting documents to the Laboratory's August 16, 1996, Ground Water Discharge Plan Application (DP-1132) for the TA-50 RLWTF. The Laboratory will provide you with a copy of the 90% design package once it becomes available. The tentative project schedule is as follows:

2010
Final design and Request For Proposals (RFP) for installation of lay-down areas and fire suppression water tower only

2011-2012
Construction of lay-down areas and fire suppression water tower

2012 – 2017
Construction of nuclear treatment facility, central utility building, and zero liquid discharge

2017
Start-up, cold (potable water) operations and operational readiness review

2018
Place into service, commence hot (radioactive liquid waste) operations

Please contact me at (505) 667-7969 if you have questions regarding this matter.

Sincerely,

Robert Beers
Water Quality & RCRA Group

Enclosures: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM, w/o enc.
James Bearzi, NMED/HWB, Santa Fe, NM, w/o enc.
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Robert C. Mason, TA55-DO, w/o enc., E583
Hugh McGovern, TA-55 RLW, w/o enc., E518
Pete Worland, TA-55-RLW, w/o enc., E518
Keith Orr, PMF-DO, w/o enc., P137
Ed Artiglia, ES-PE, w/o enc., P137
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., A150

Radioactive Liquid Waste Treatment Facility (RLWTF) Upgrade Project
Definitive Design

Deliverable No. 1B - 60% Submission
September 28, 2009

Contents:
Volume 1 - Reports/Studies
Volume 2 - Drawings
Volume 3 - Calculations
Volume 4 - Specifications

100761-09-000260

Prepared for:
Los Alamos
NATIONAL LABORATORY

Contract 66355-001-08
LANL Project ID 100761

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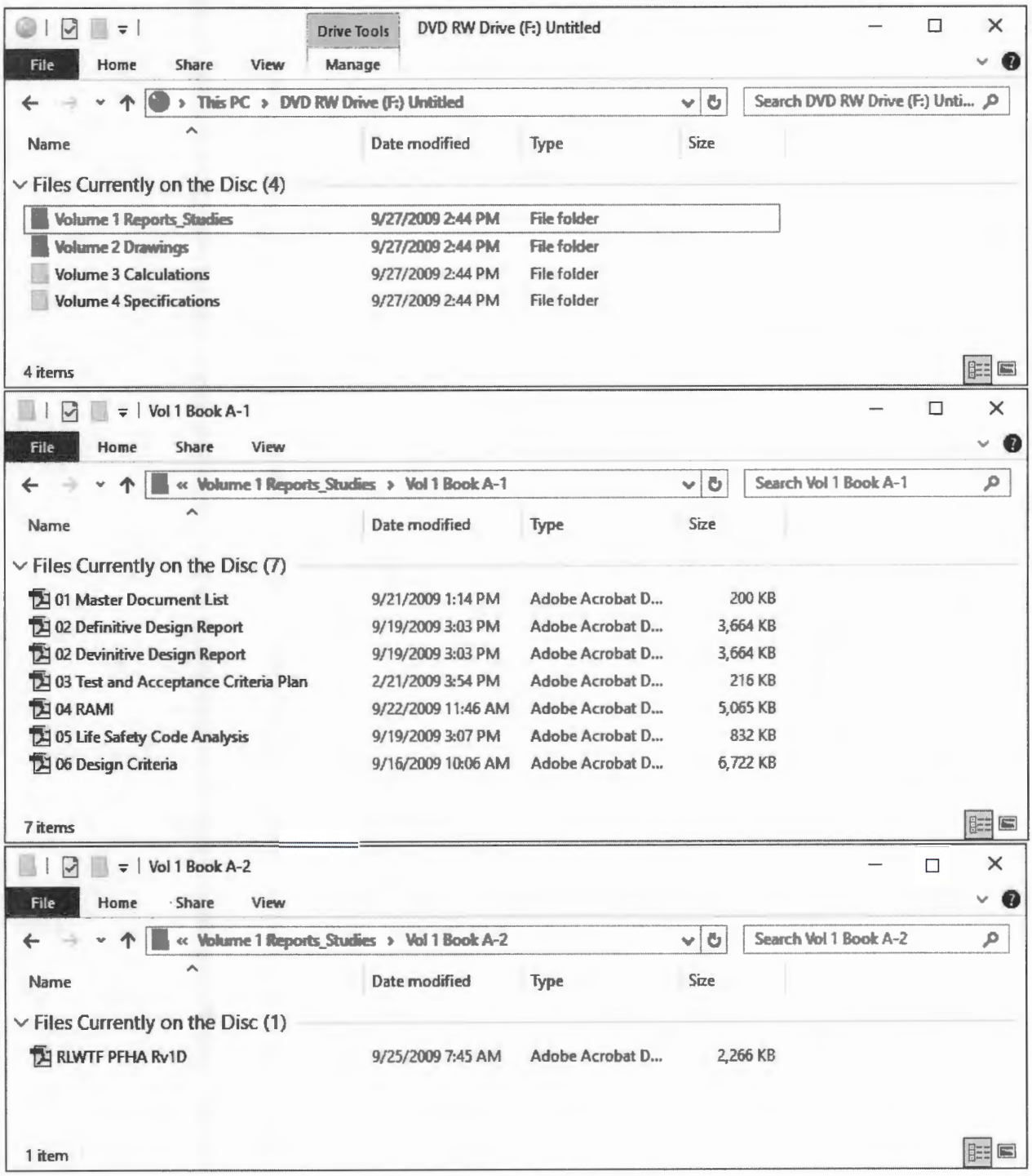
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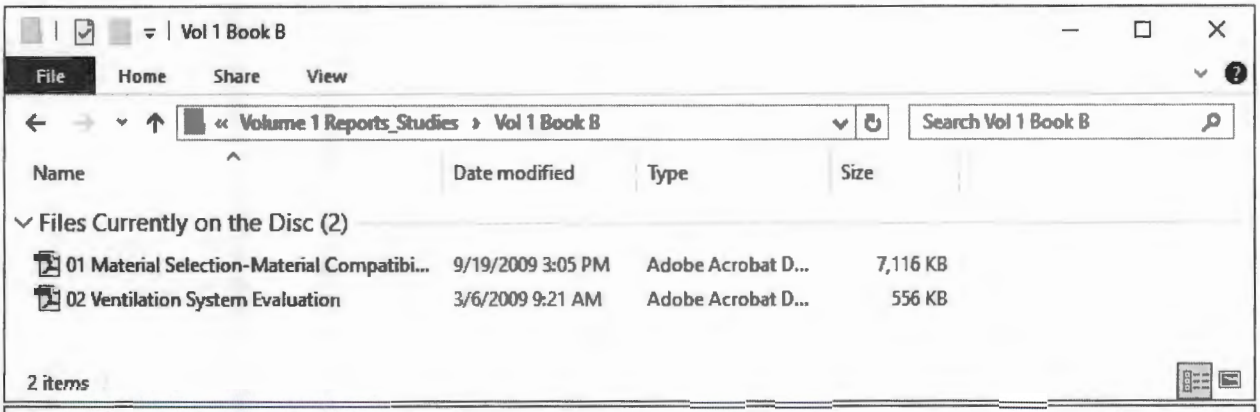
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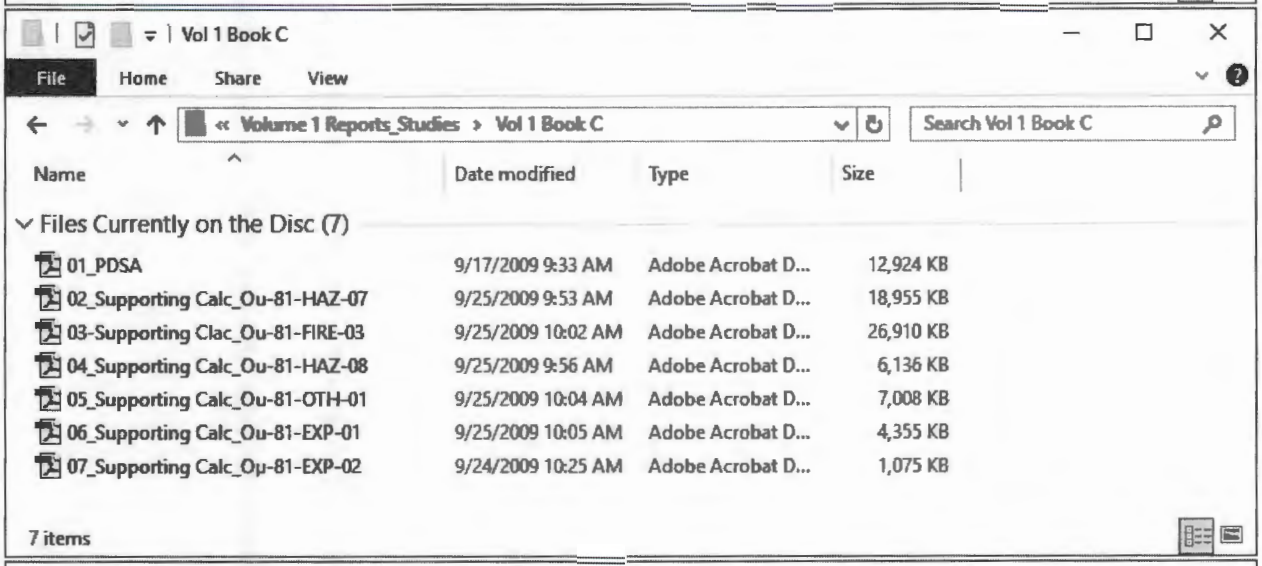
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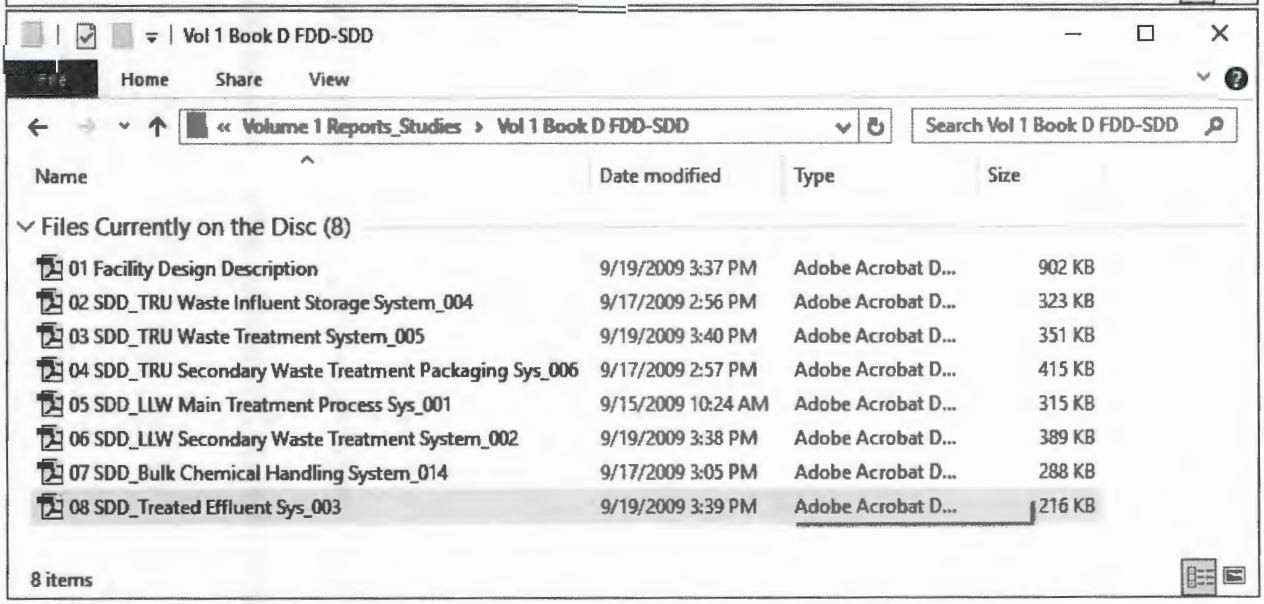
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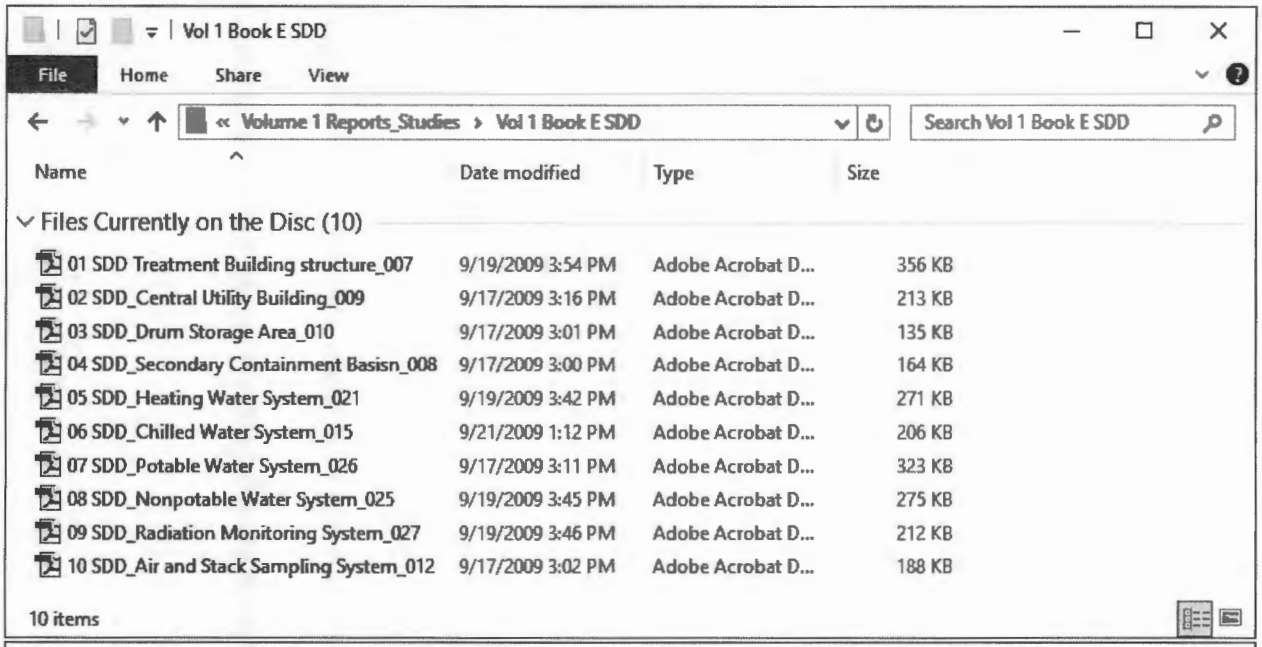
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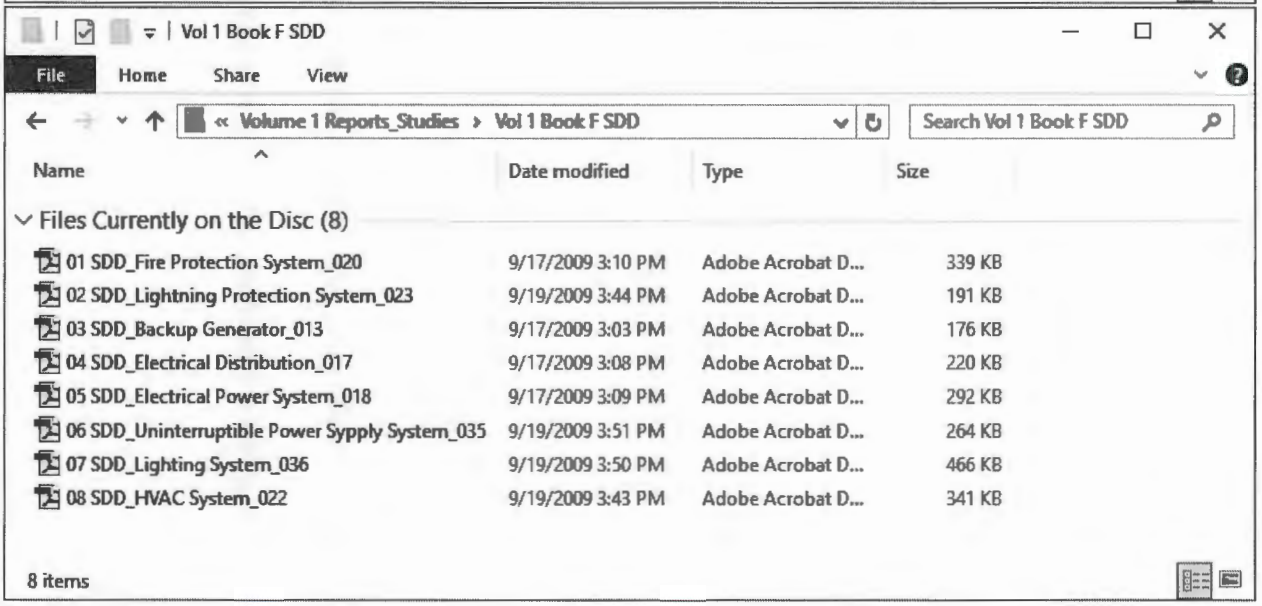
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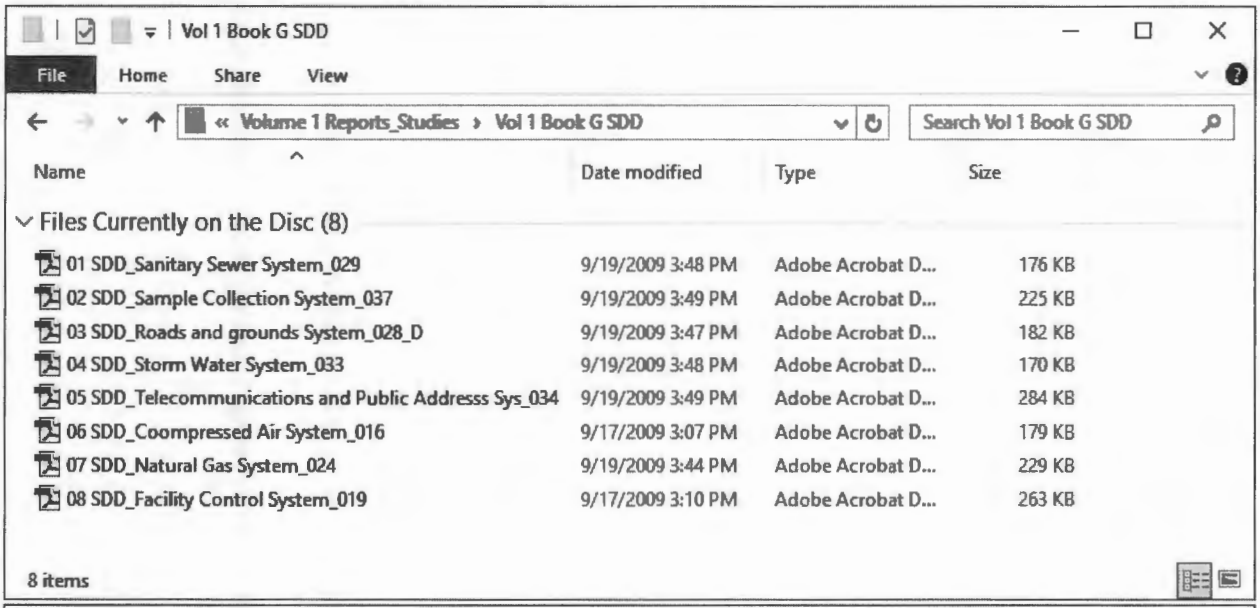
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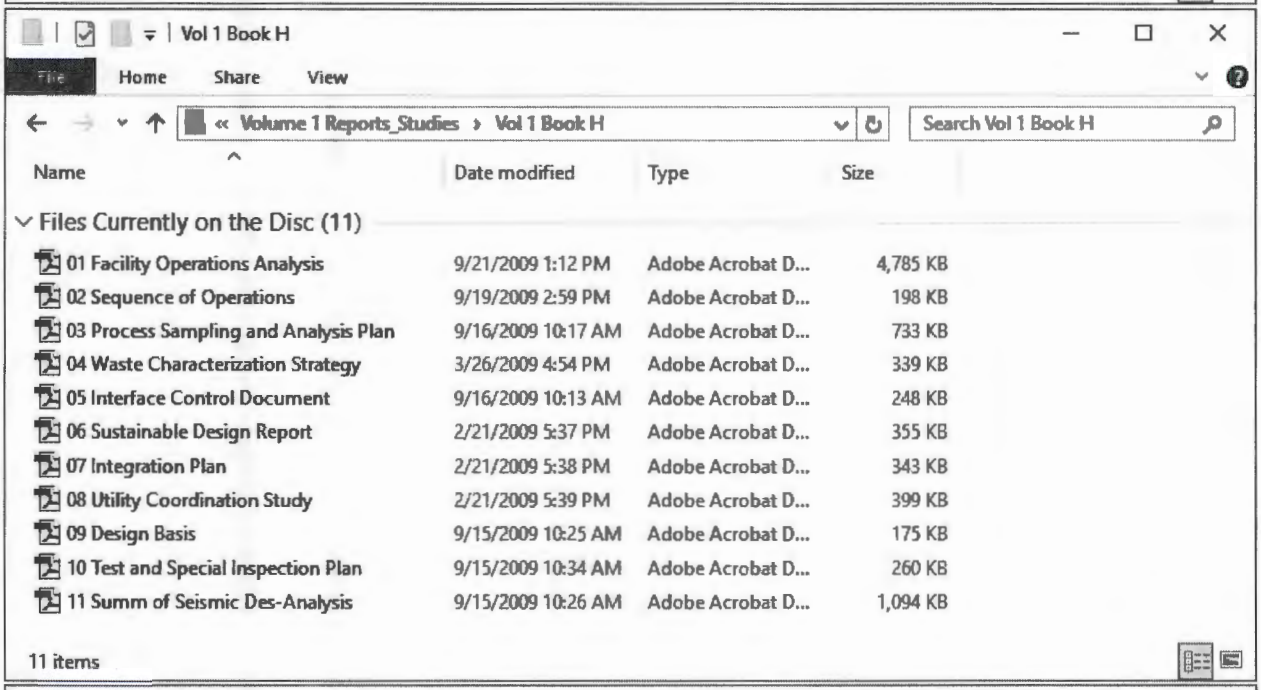
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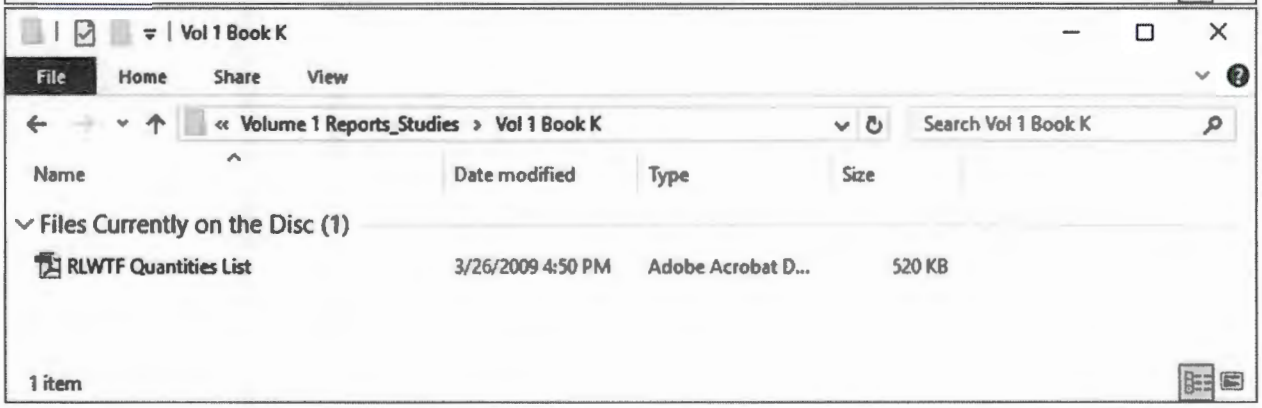
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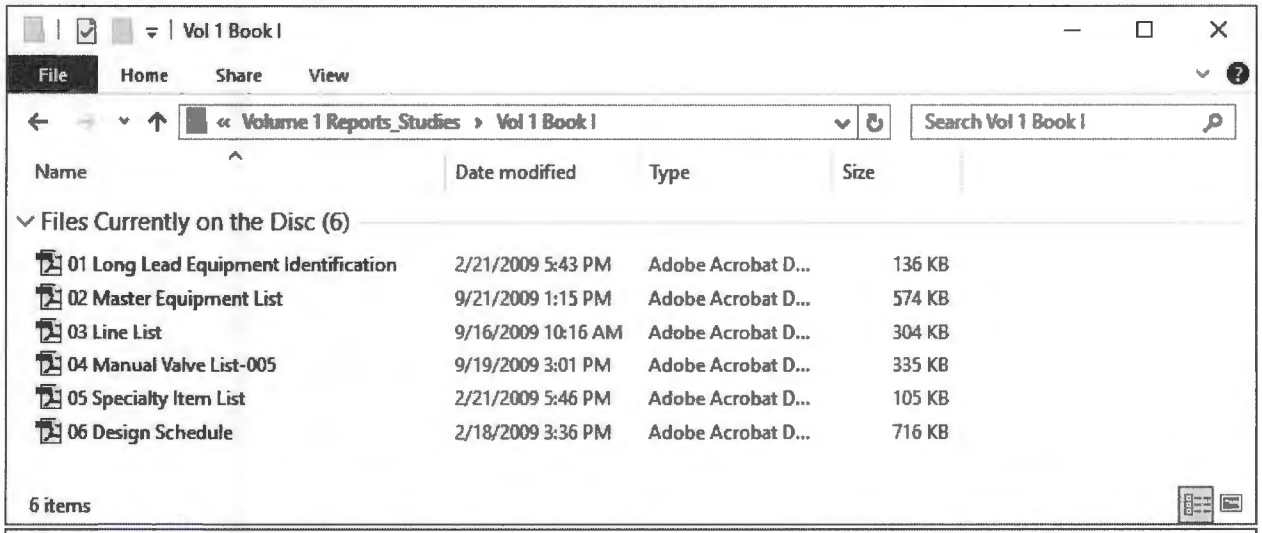
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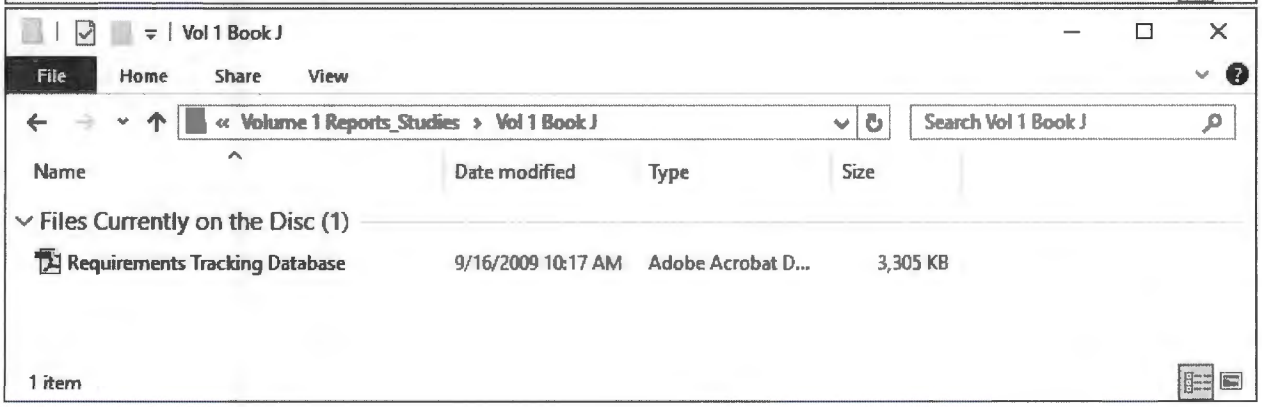
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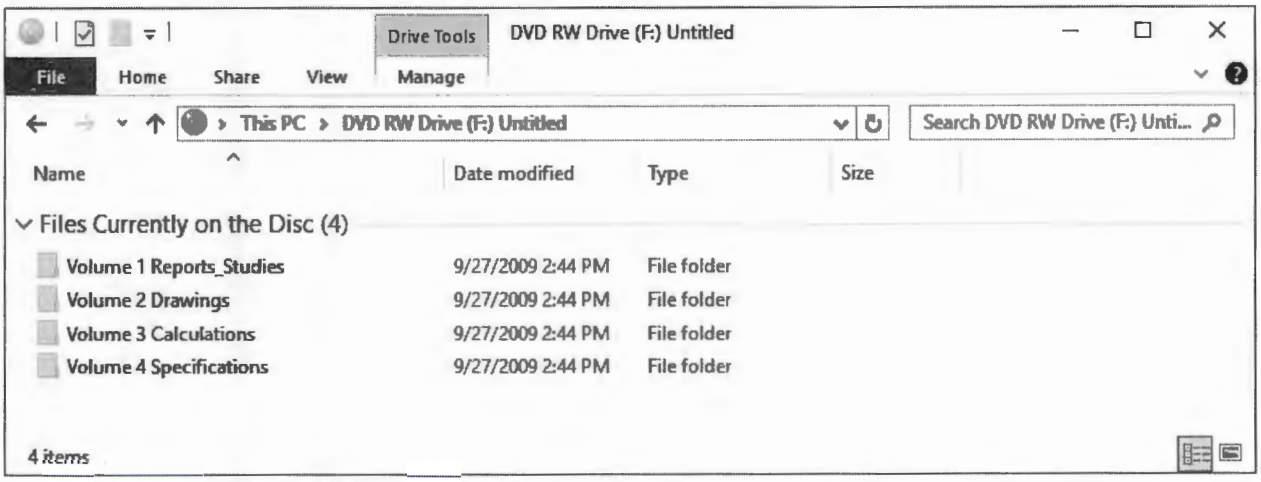
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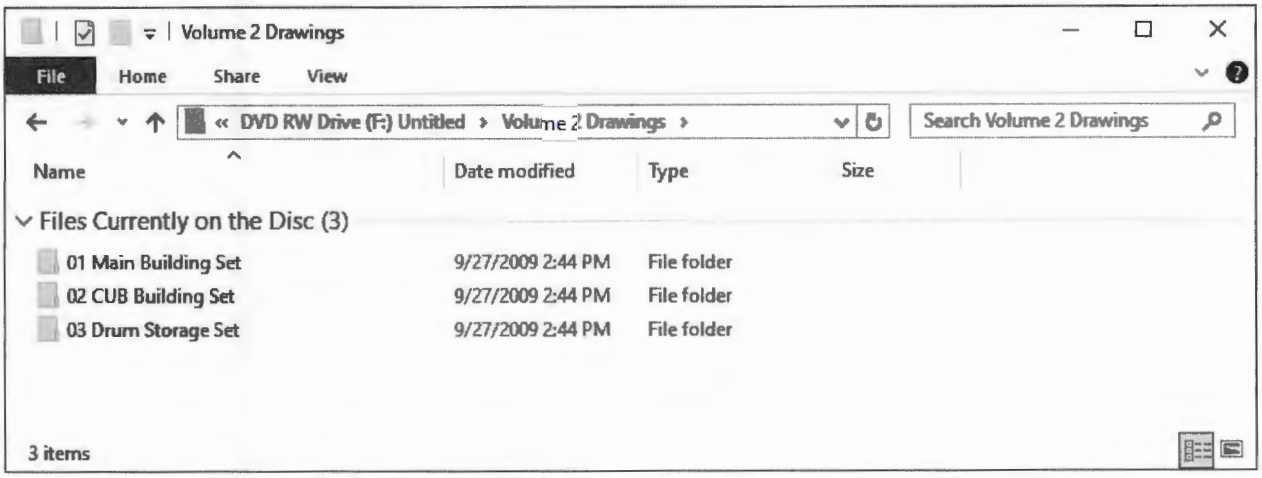
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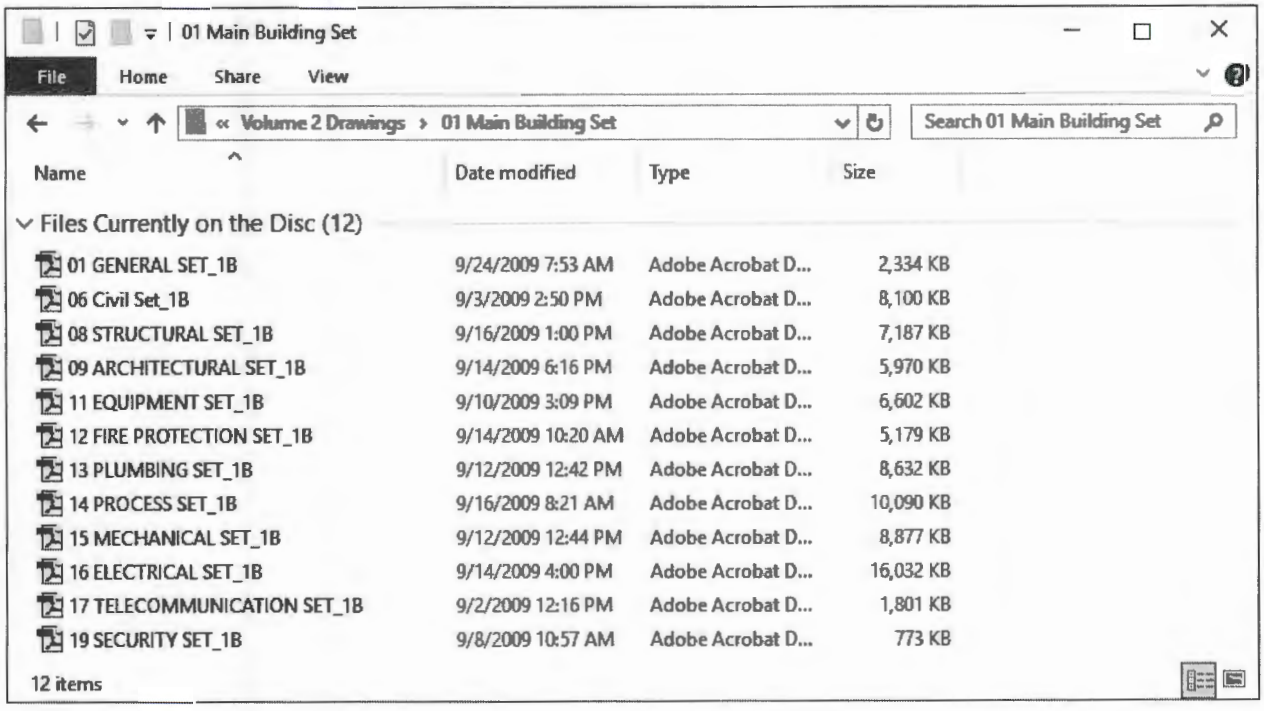
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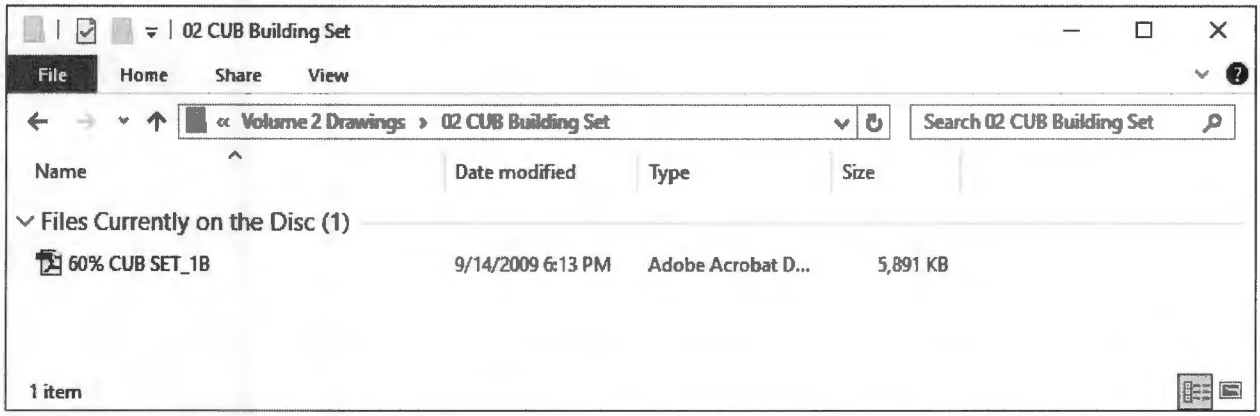
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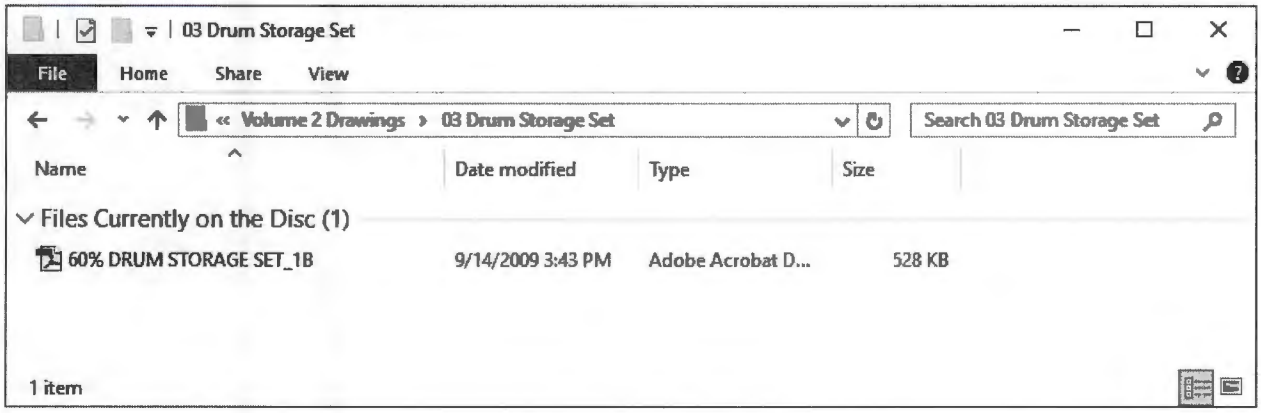
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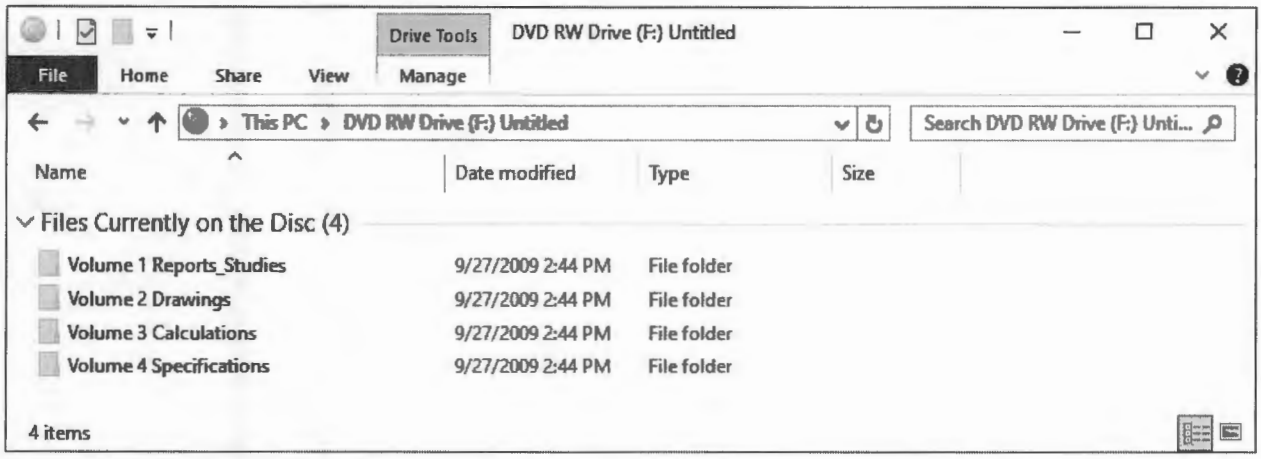
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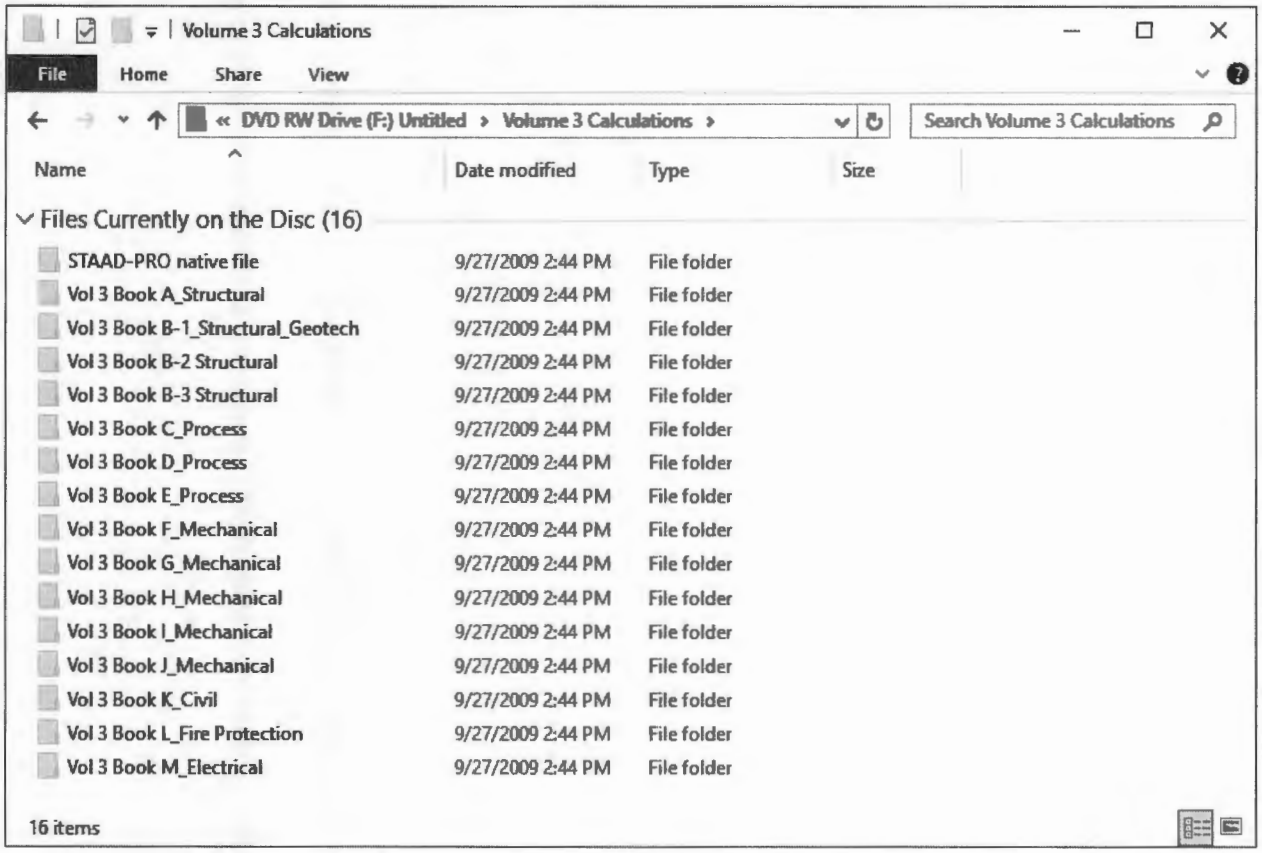
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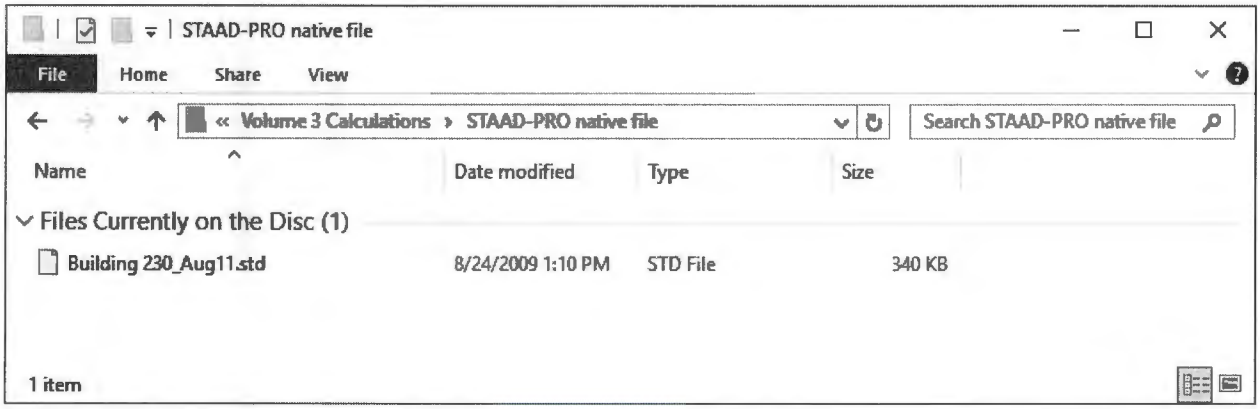
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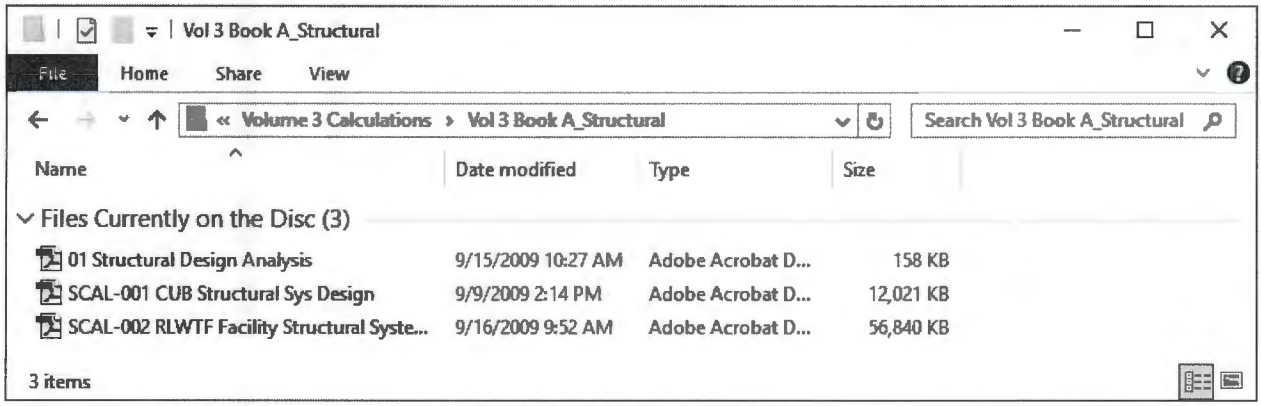
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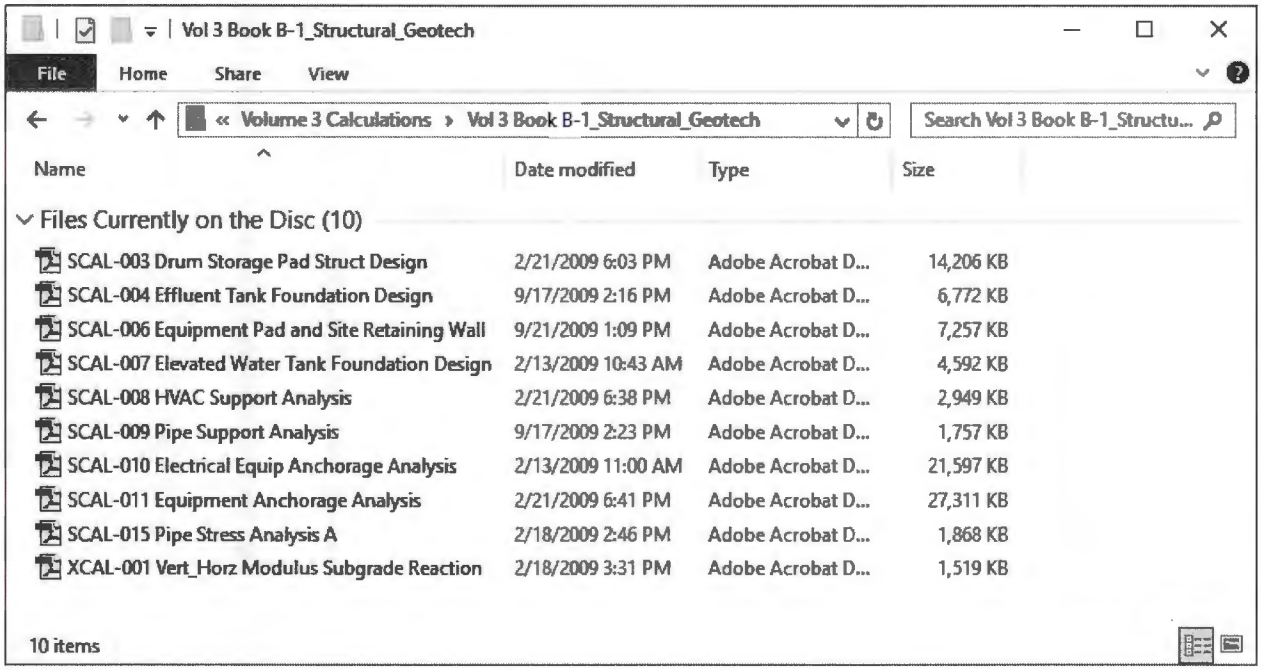
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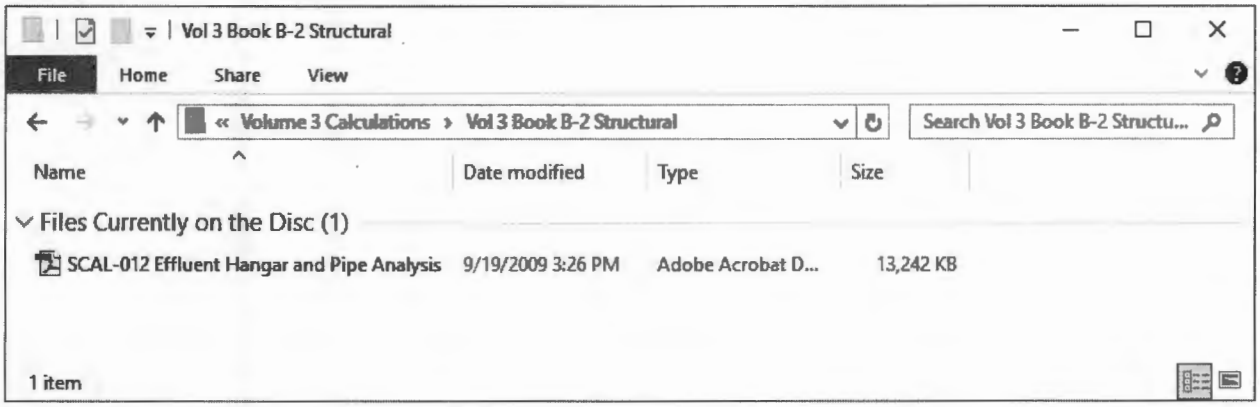
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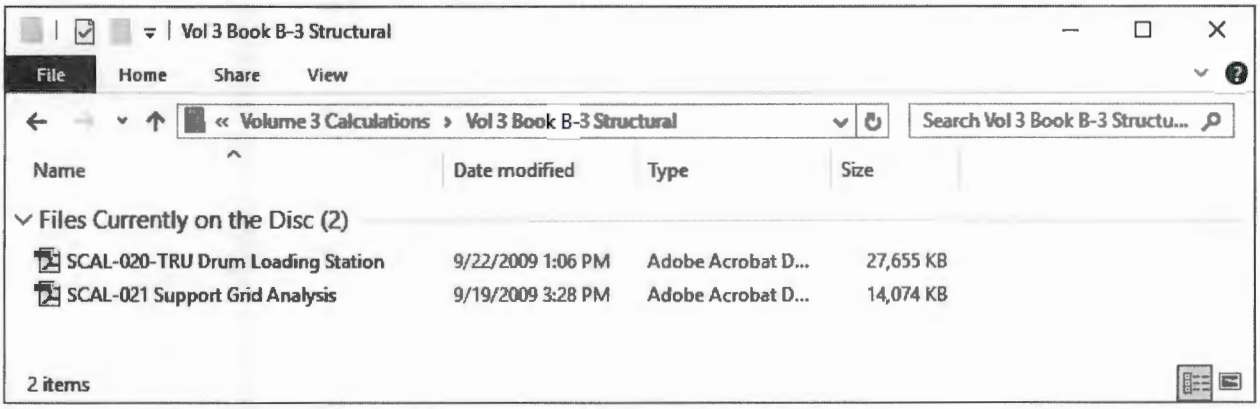
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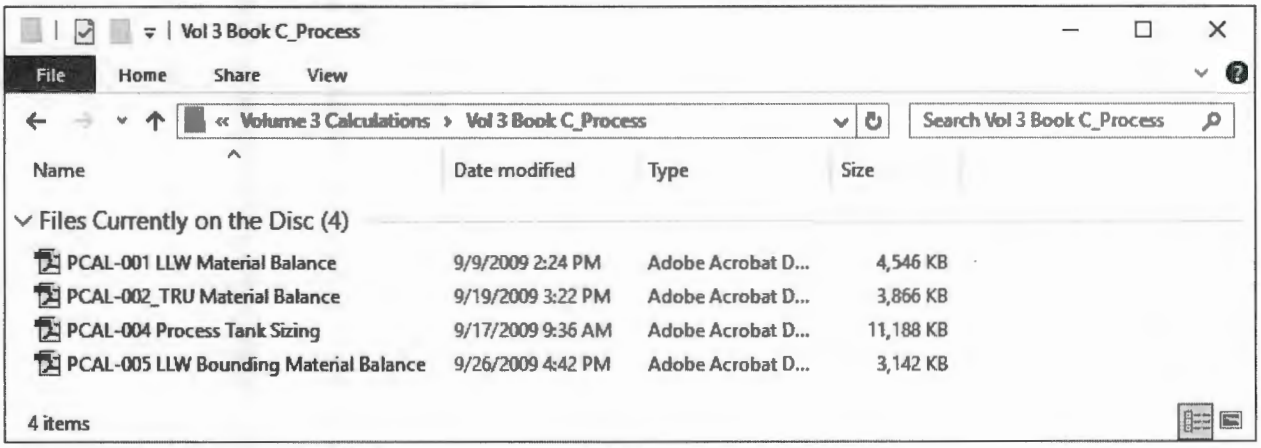
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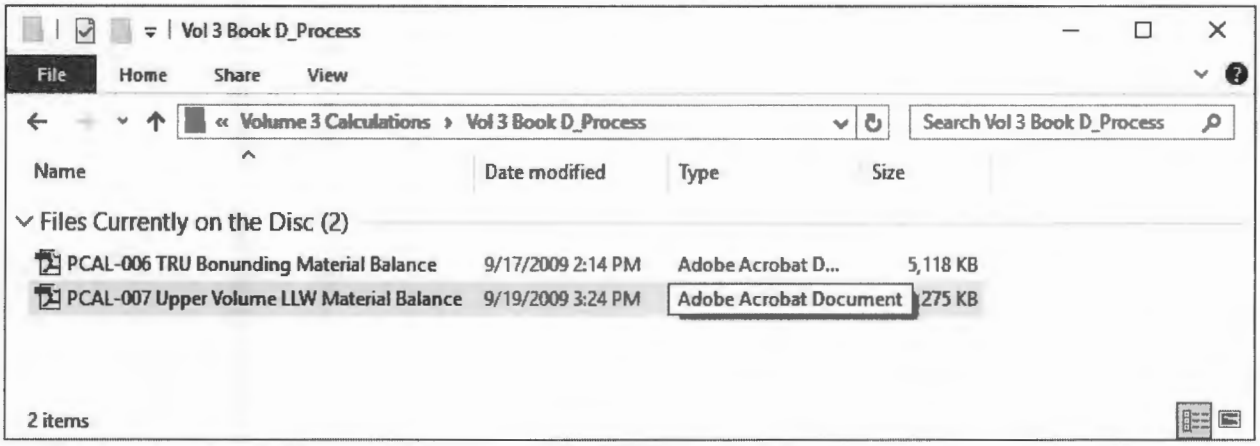
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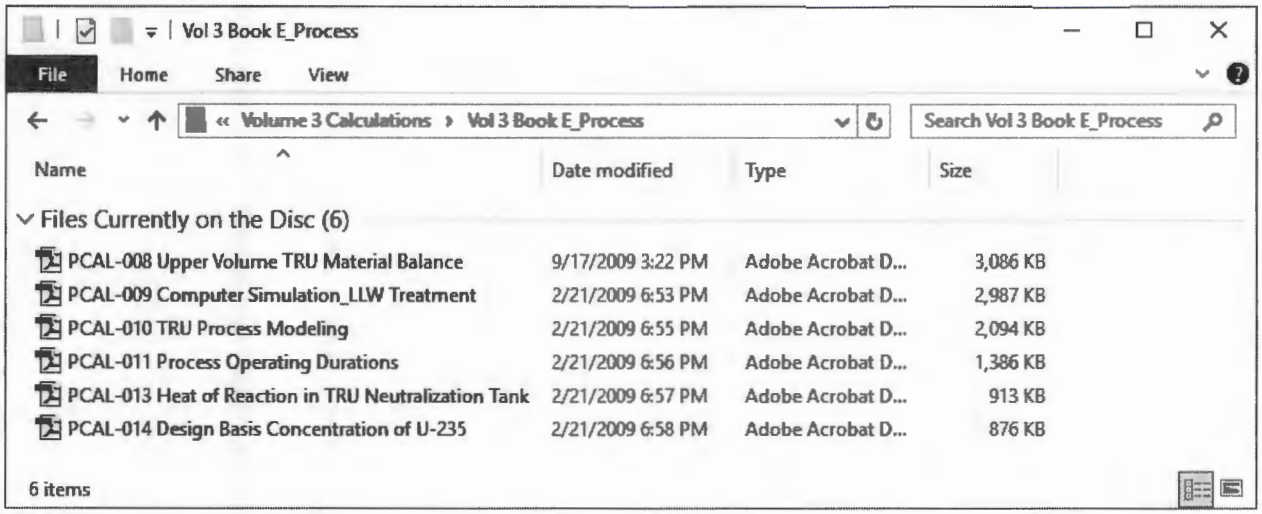
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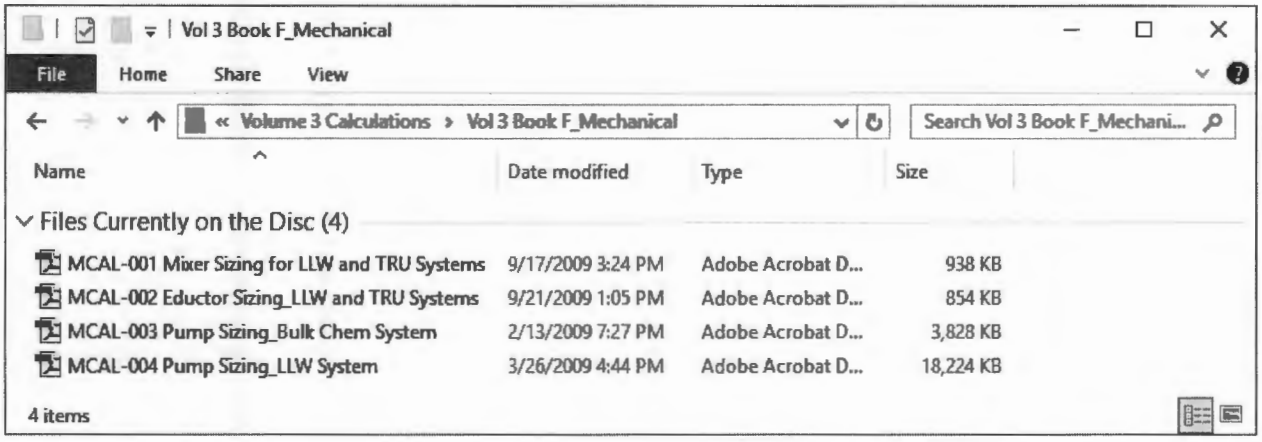
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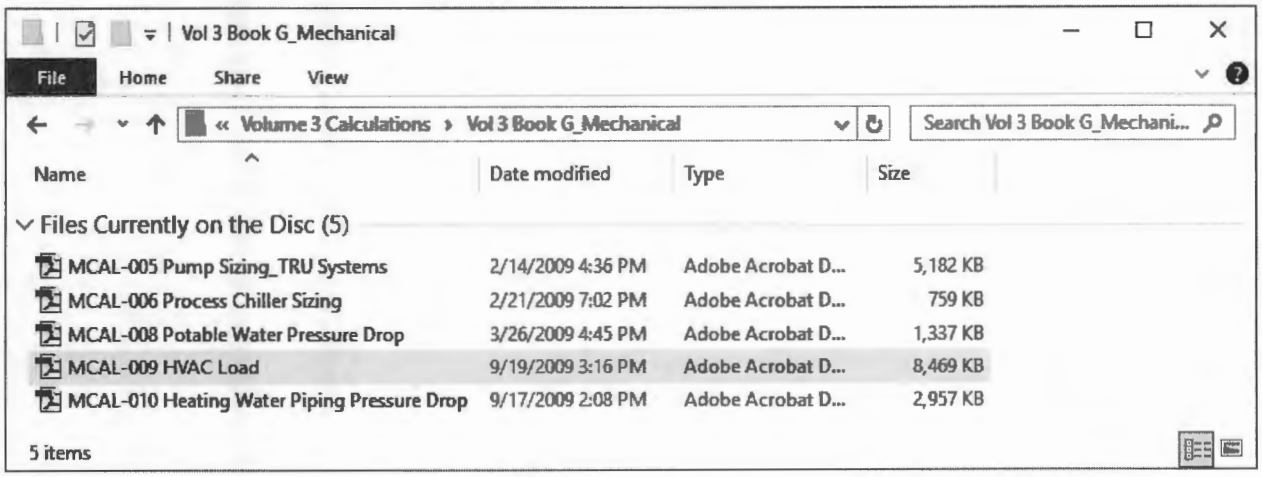
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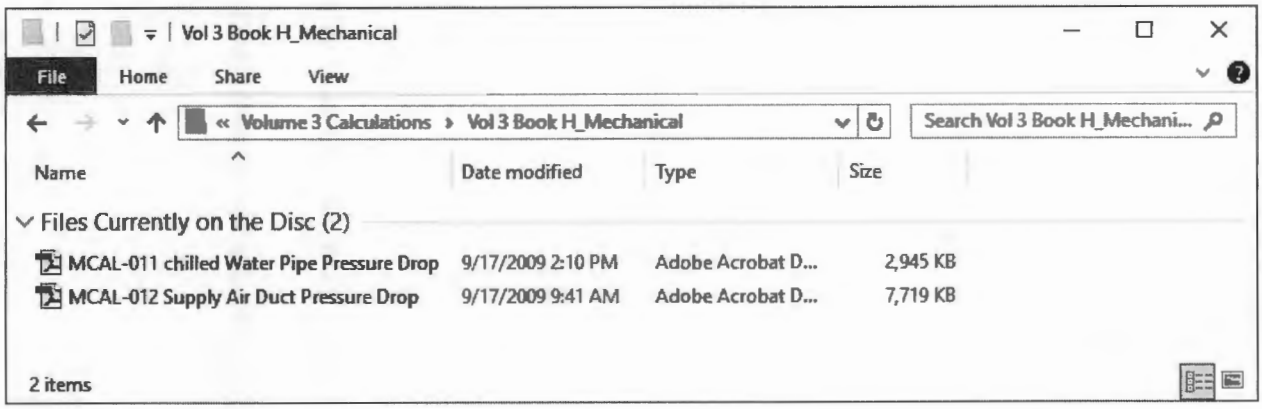
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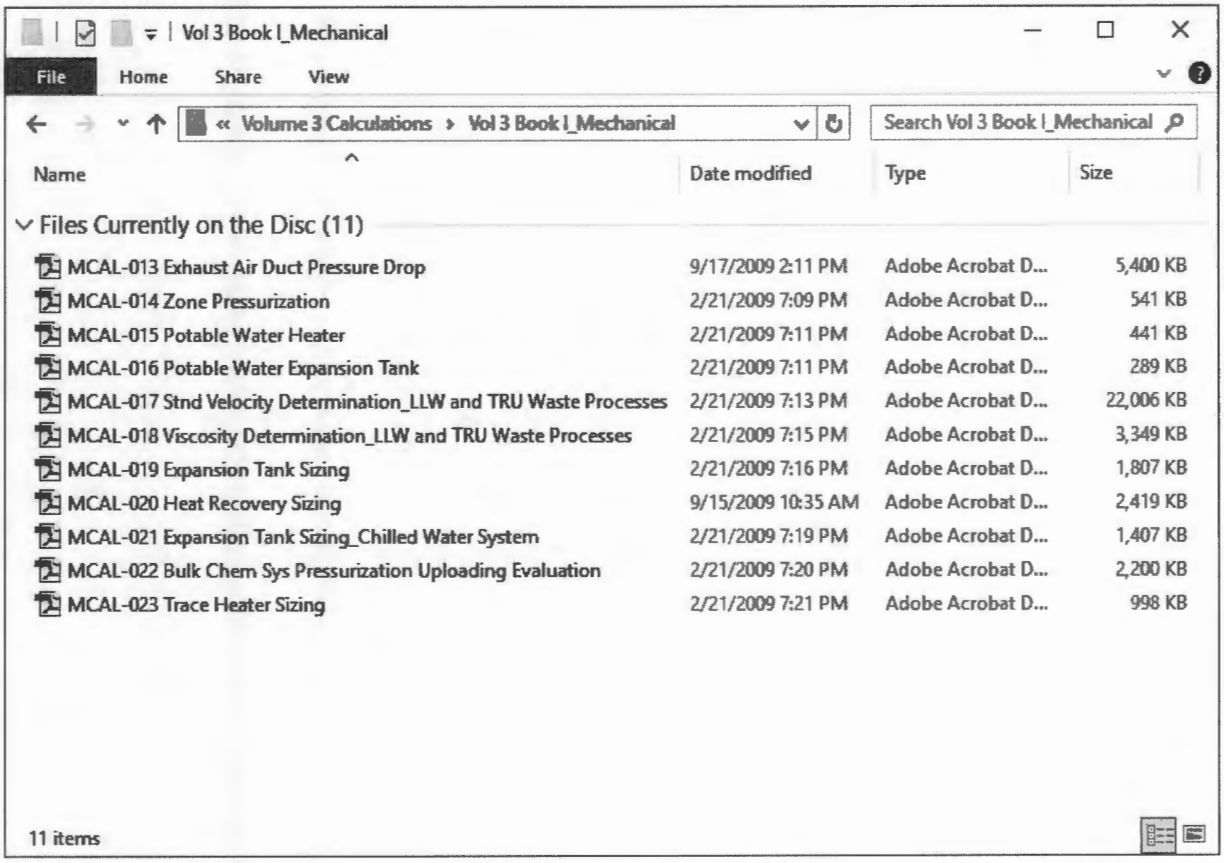
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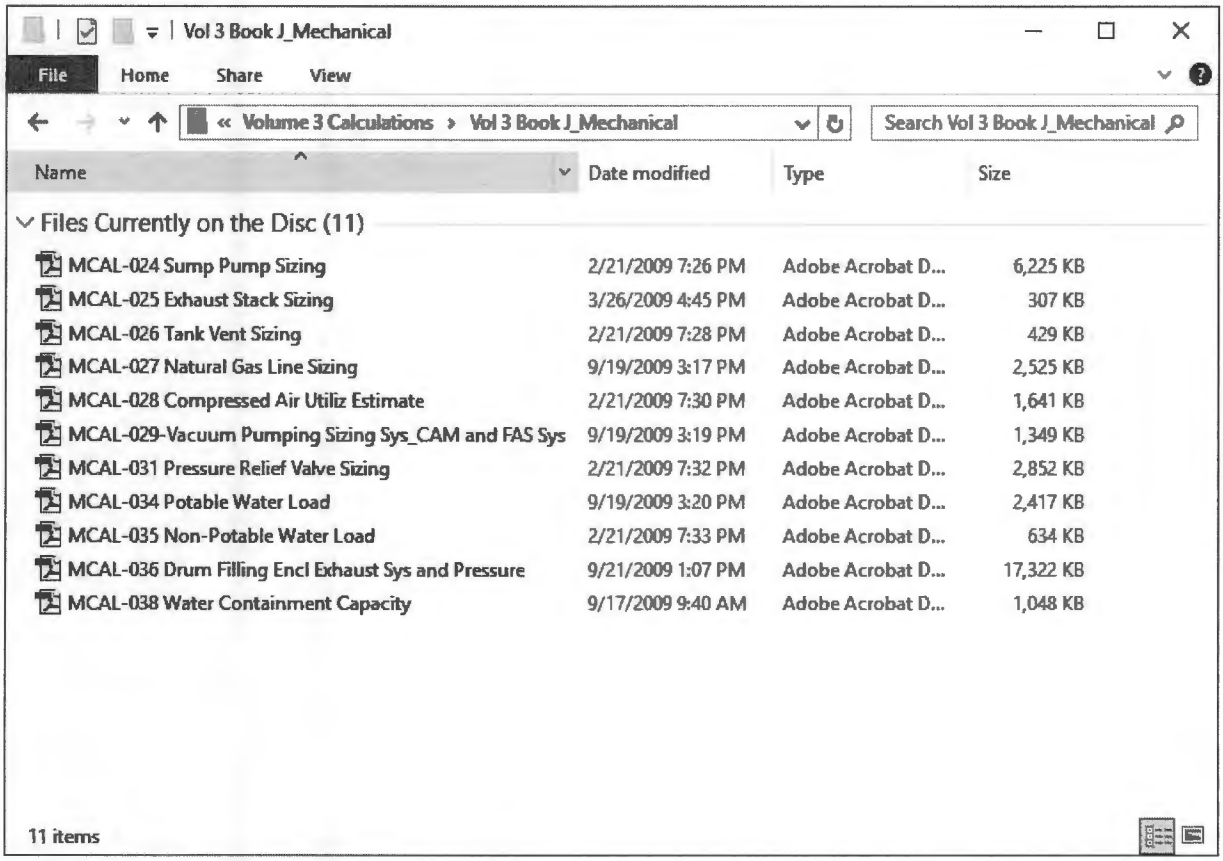
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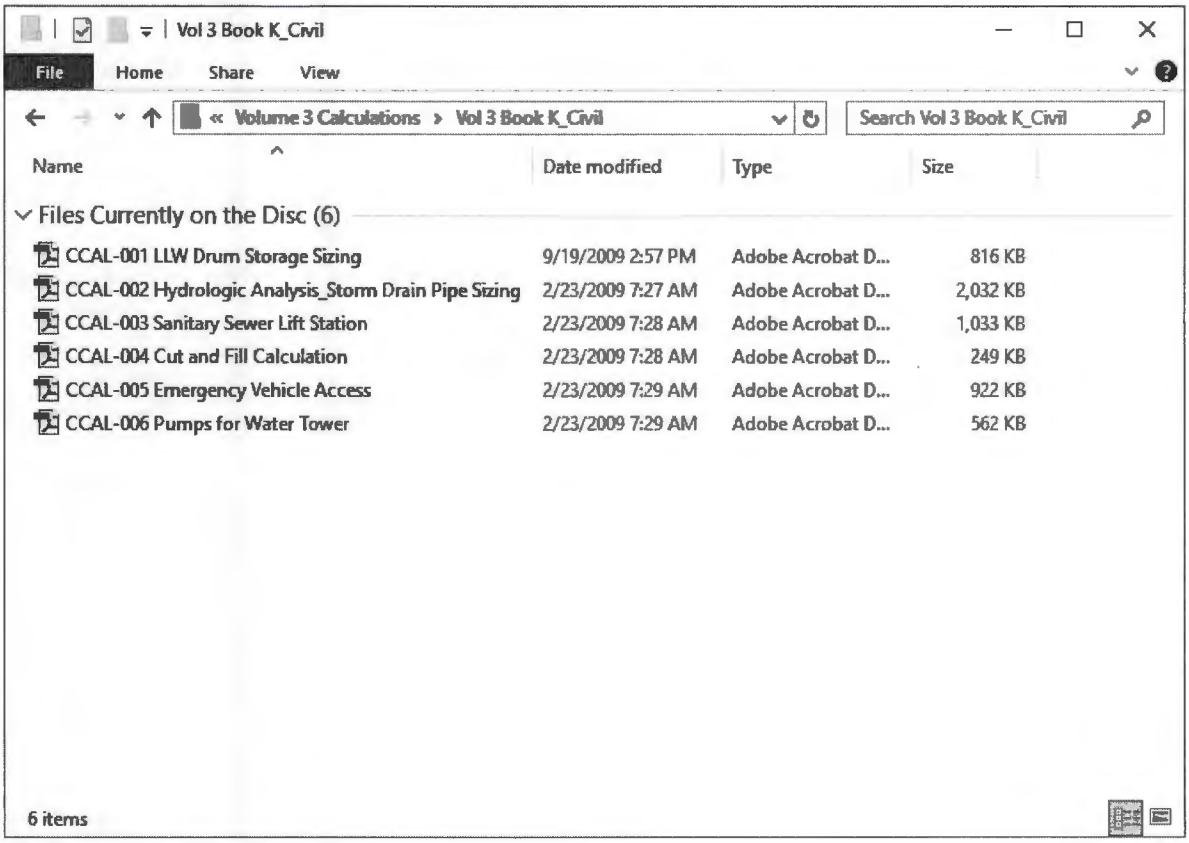
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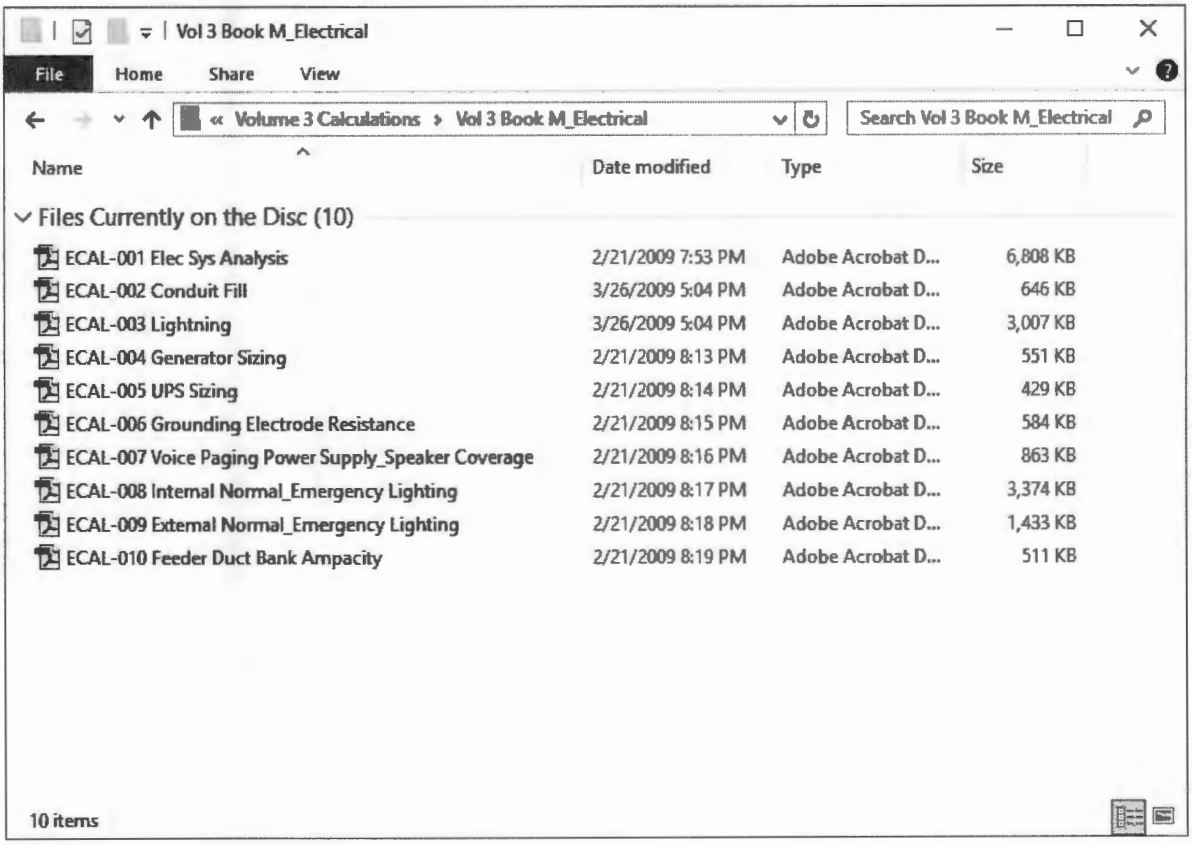
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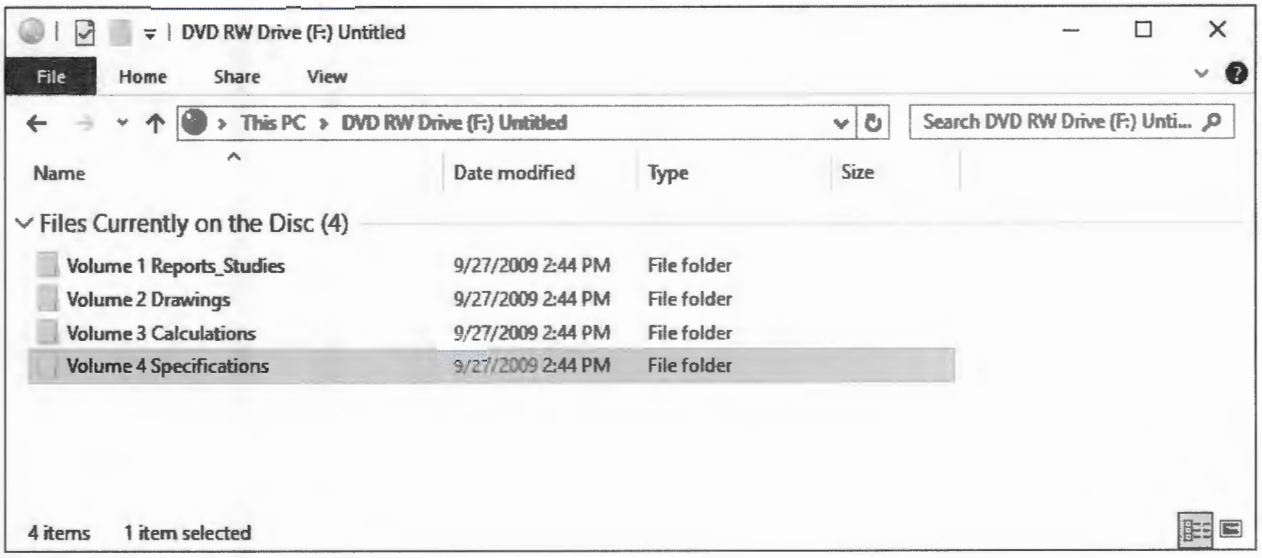
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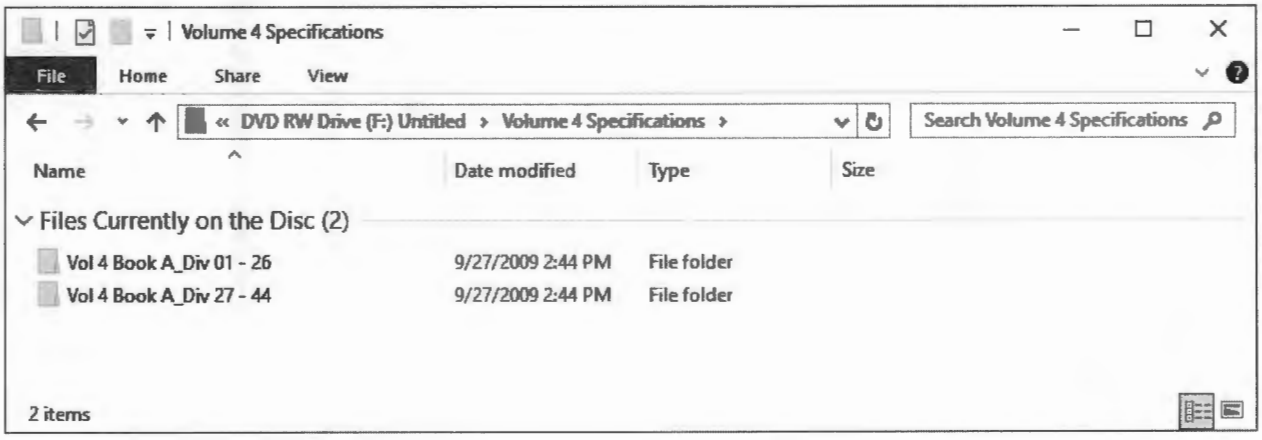
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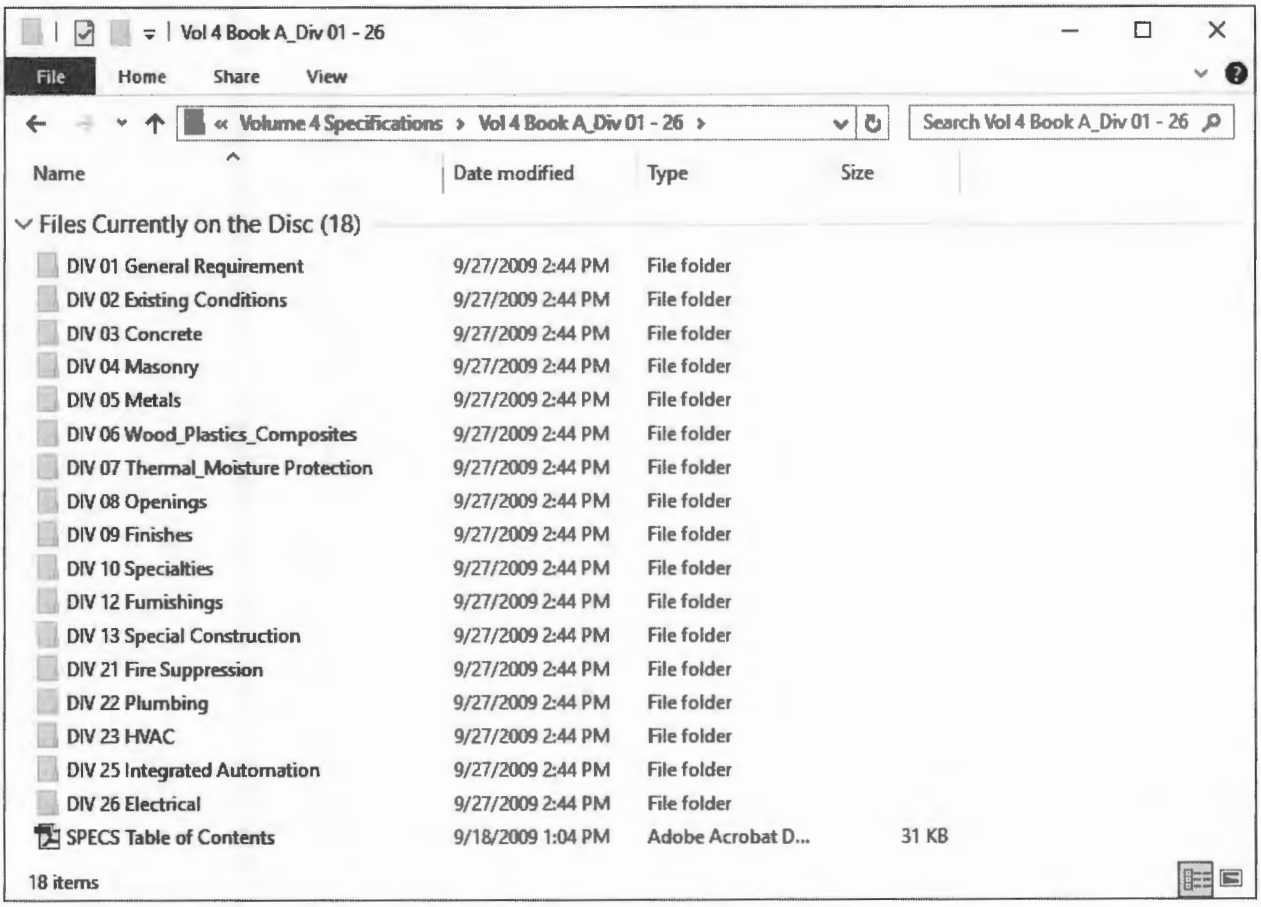
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DIV 05 Metals 9/27/2009 2:44 PM File folder
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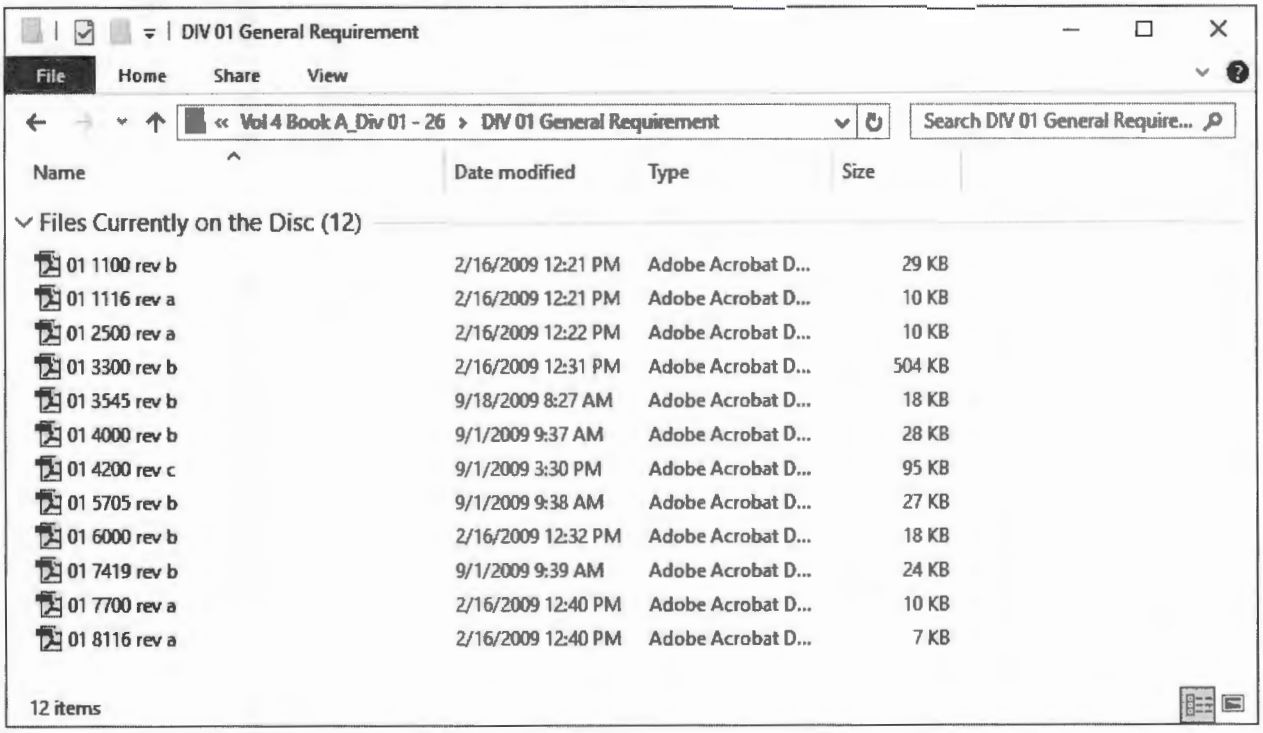
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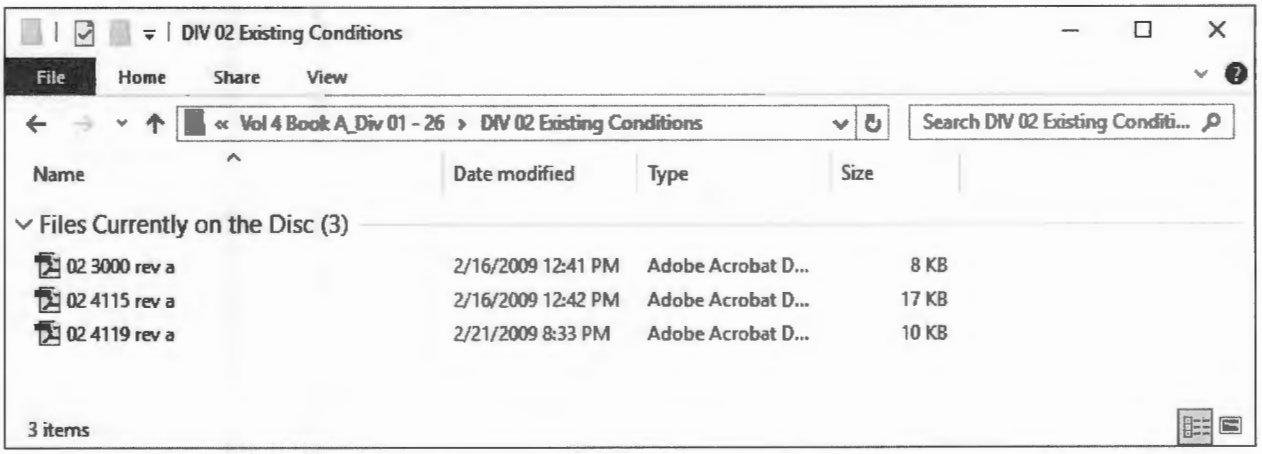
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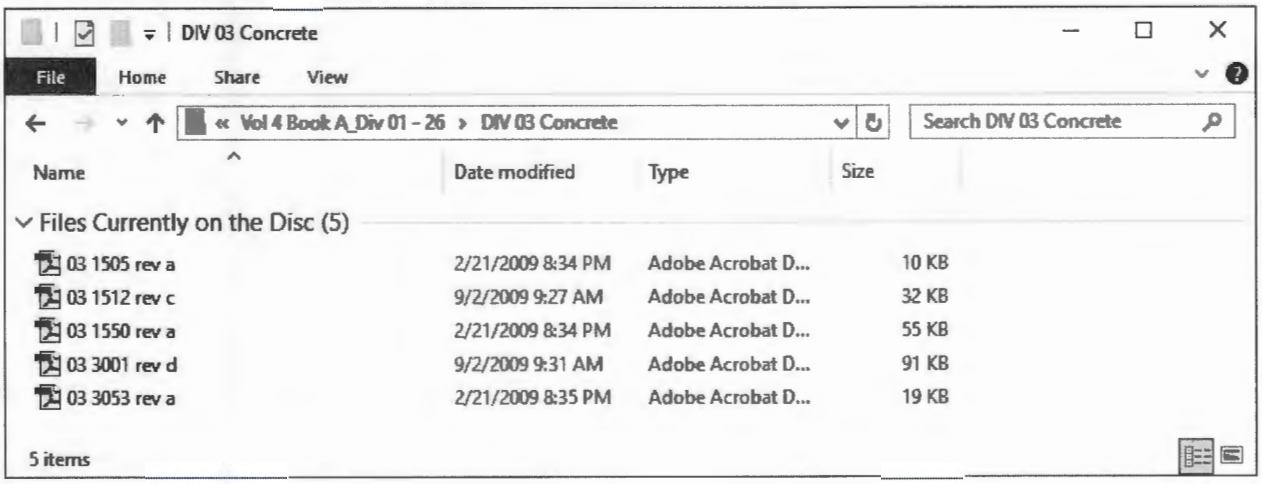
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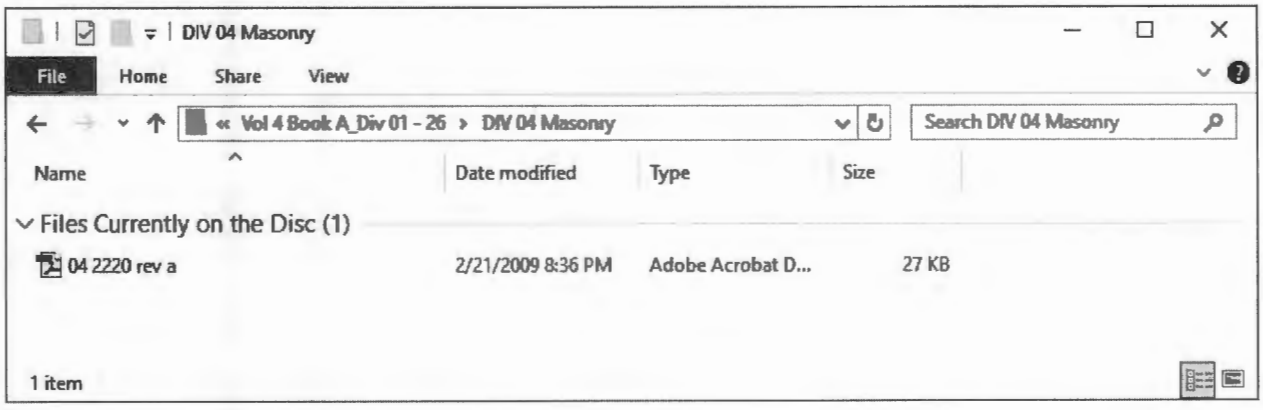
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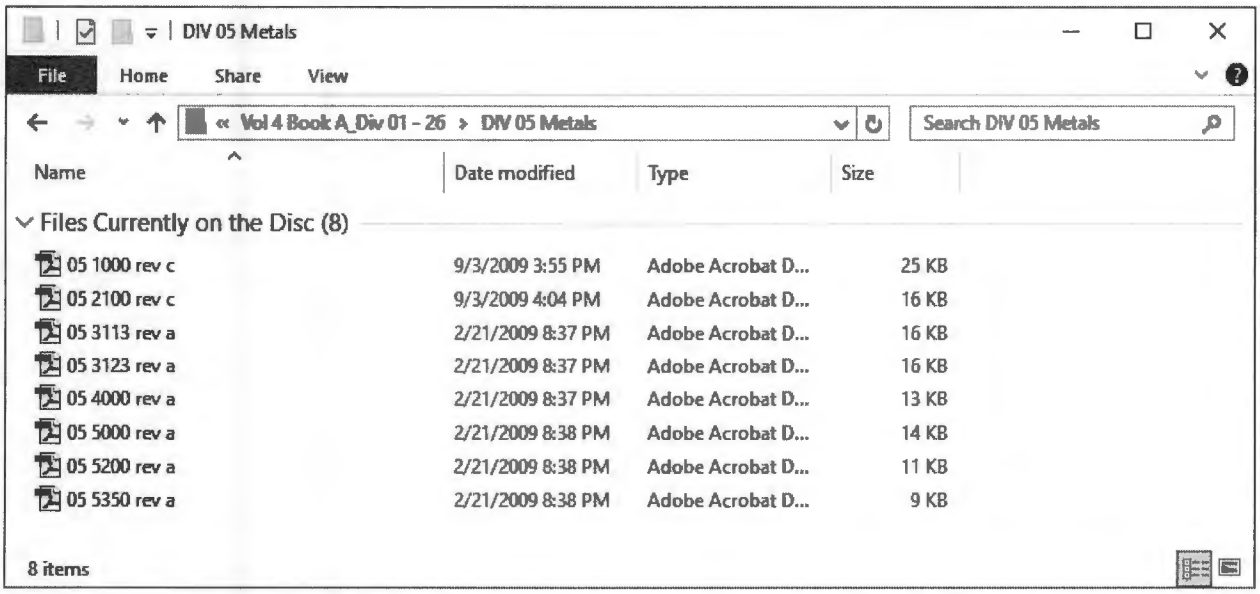
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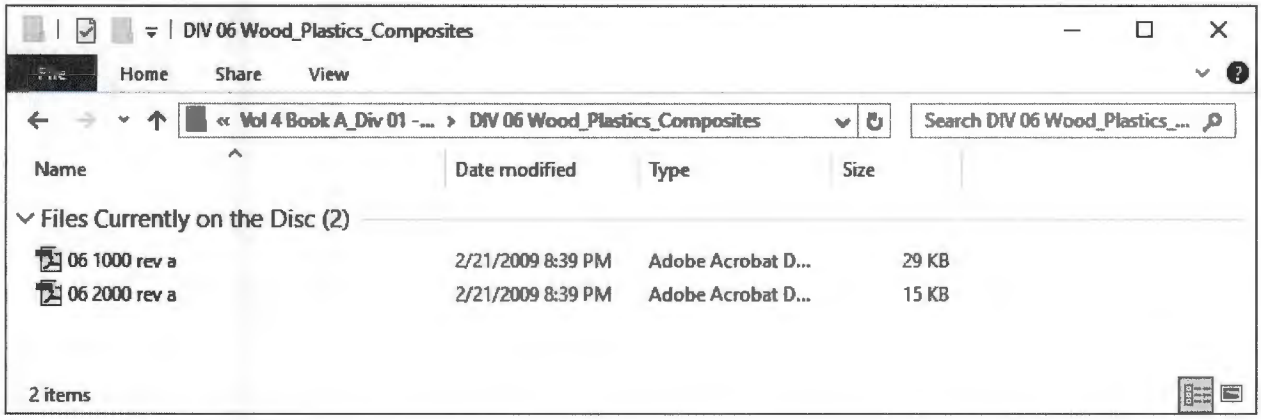
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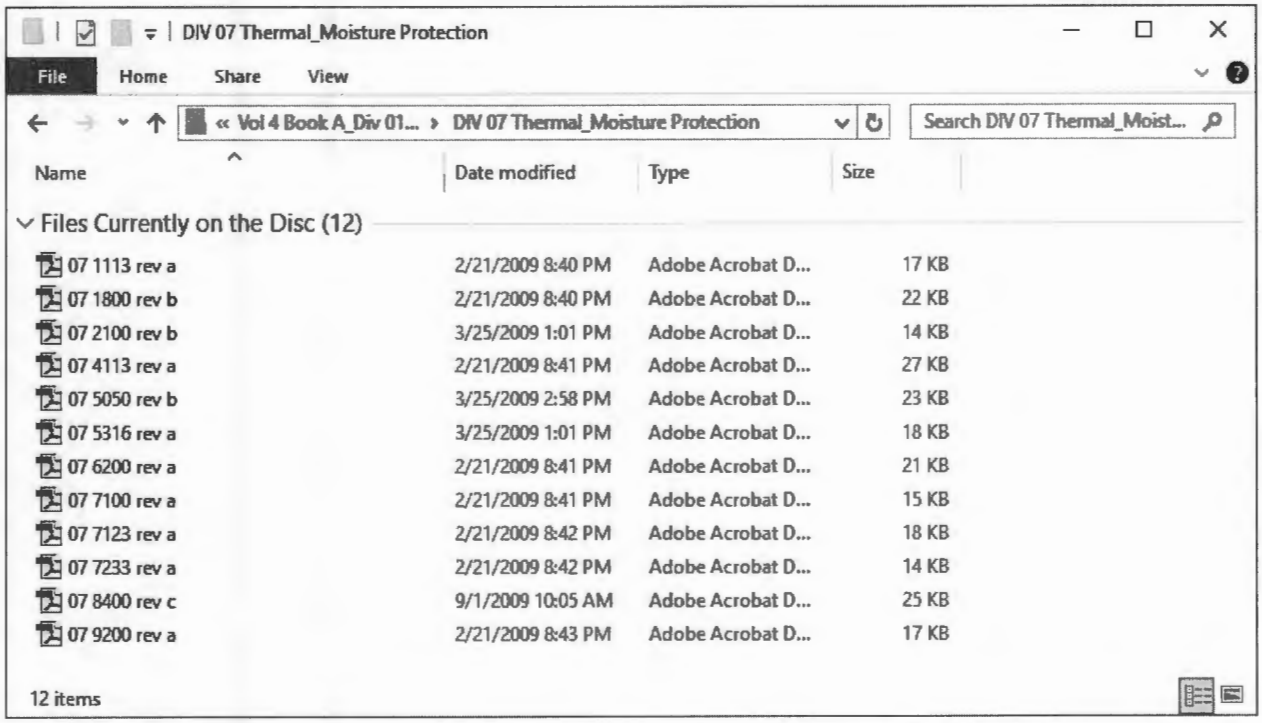
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Date modified
Type
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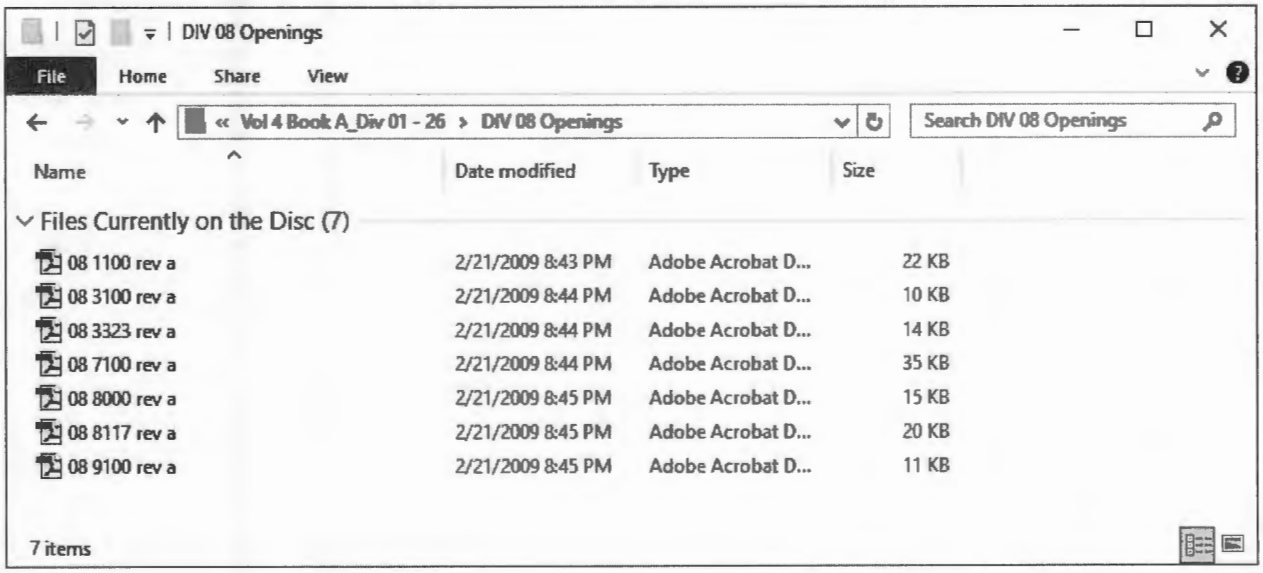
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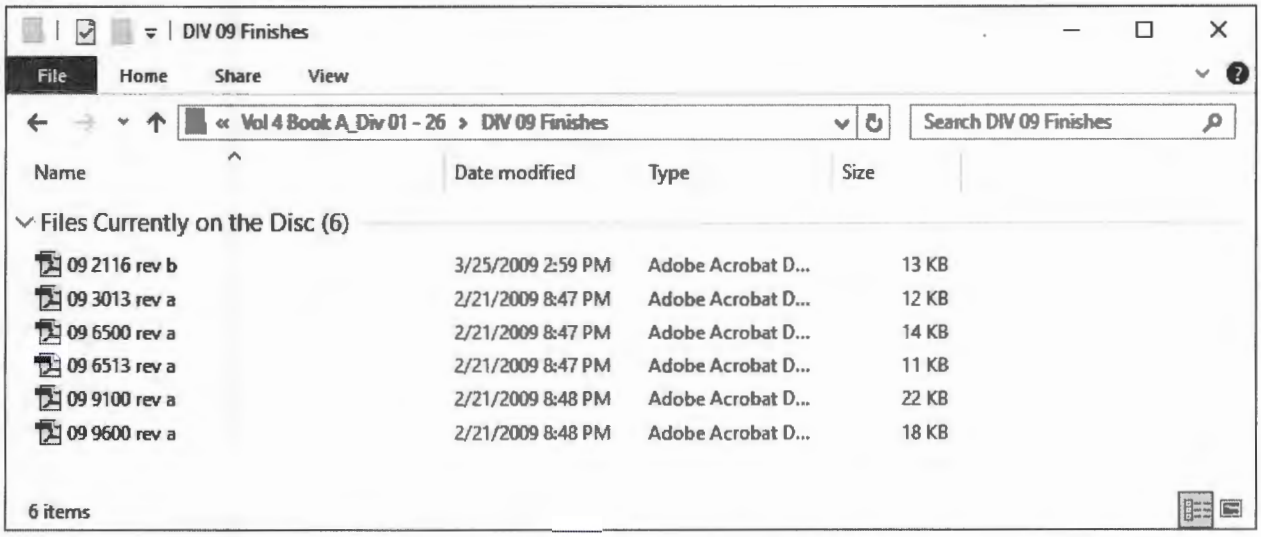
7 items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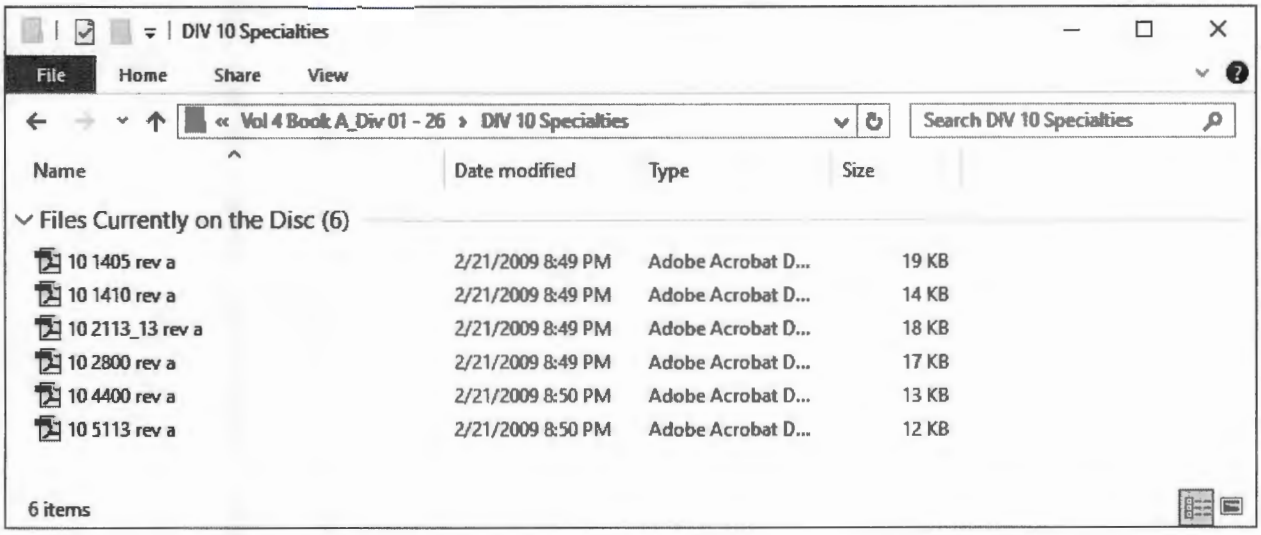
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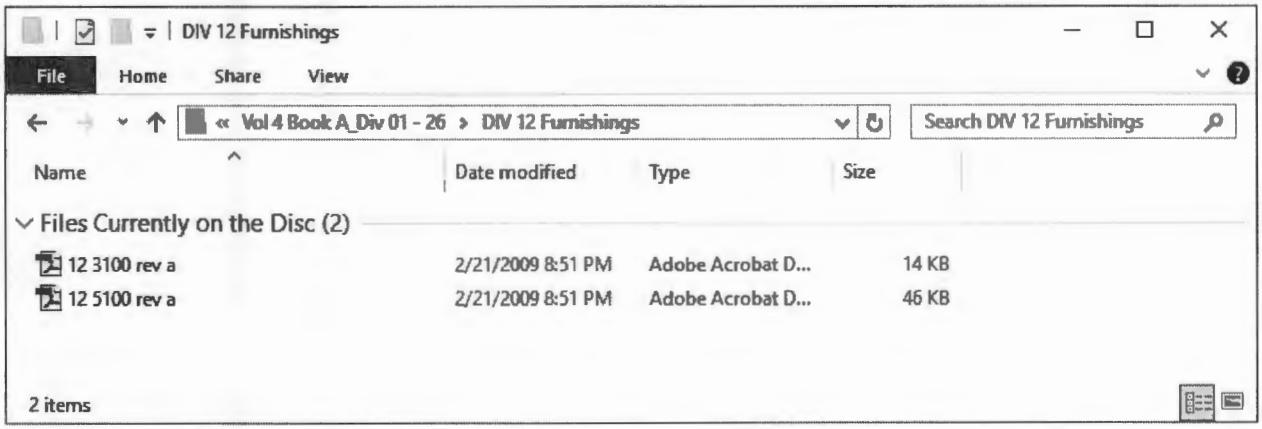
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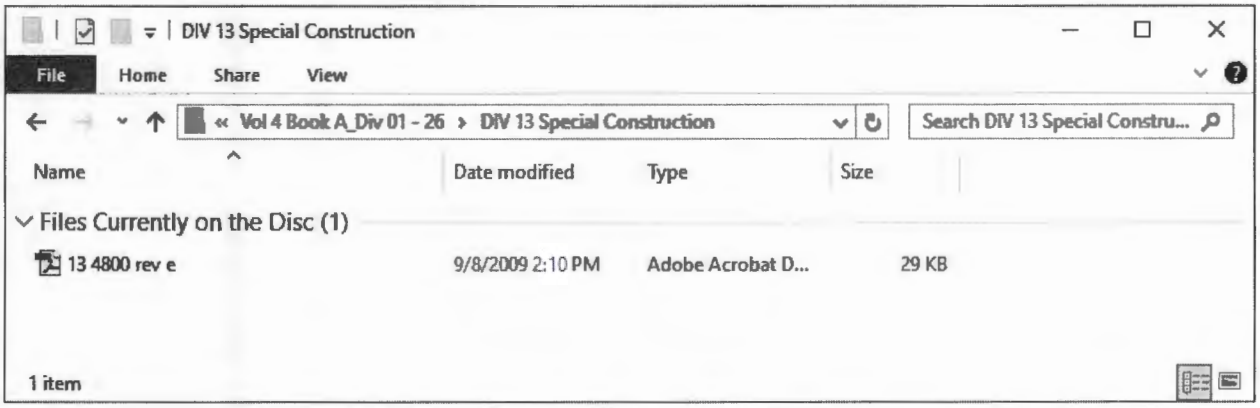
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Share
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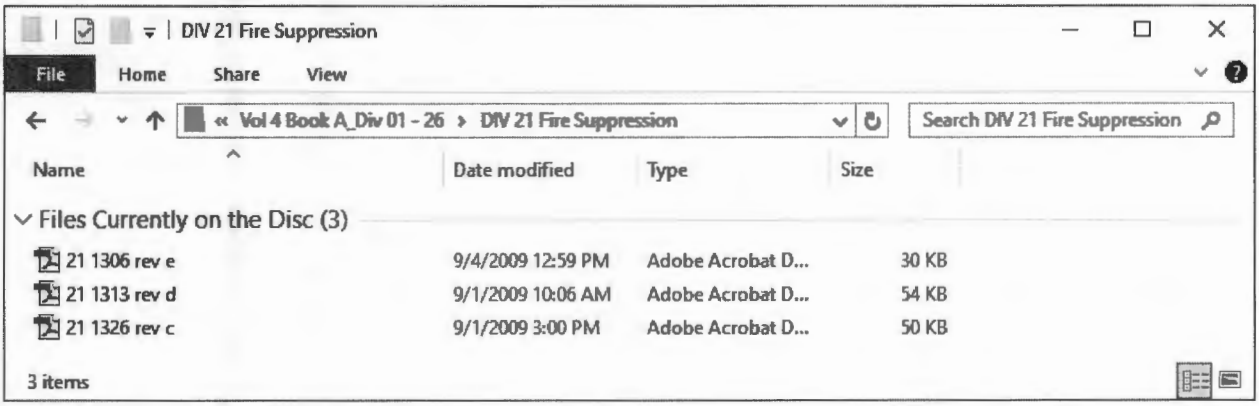
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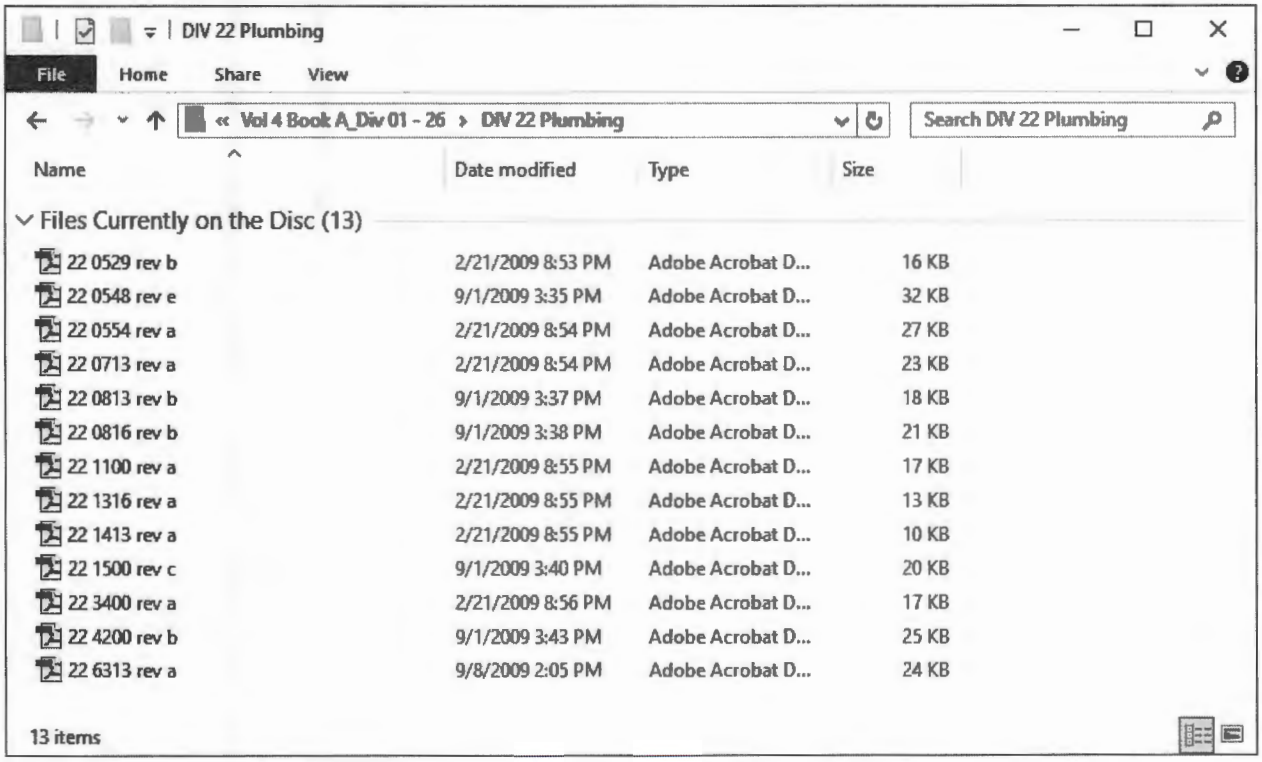
3 items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32 KB
22 0554 rev a
2/21/2009 8:54 PM
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27 KB
22 0713 rev a
2/21/2009 8:54 PM
Adobe Acrobat D...
23 KB
22 0813 rev b
9/1/2009 3:37 PM
Adobe Acrobat D...
18 KB
22 0816 rev b
9/1/2009 3:38 PM
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21 KB
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17 KB
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22 1413 rev a
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10 KB
22 1500 rev c
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17 KB
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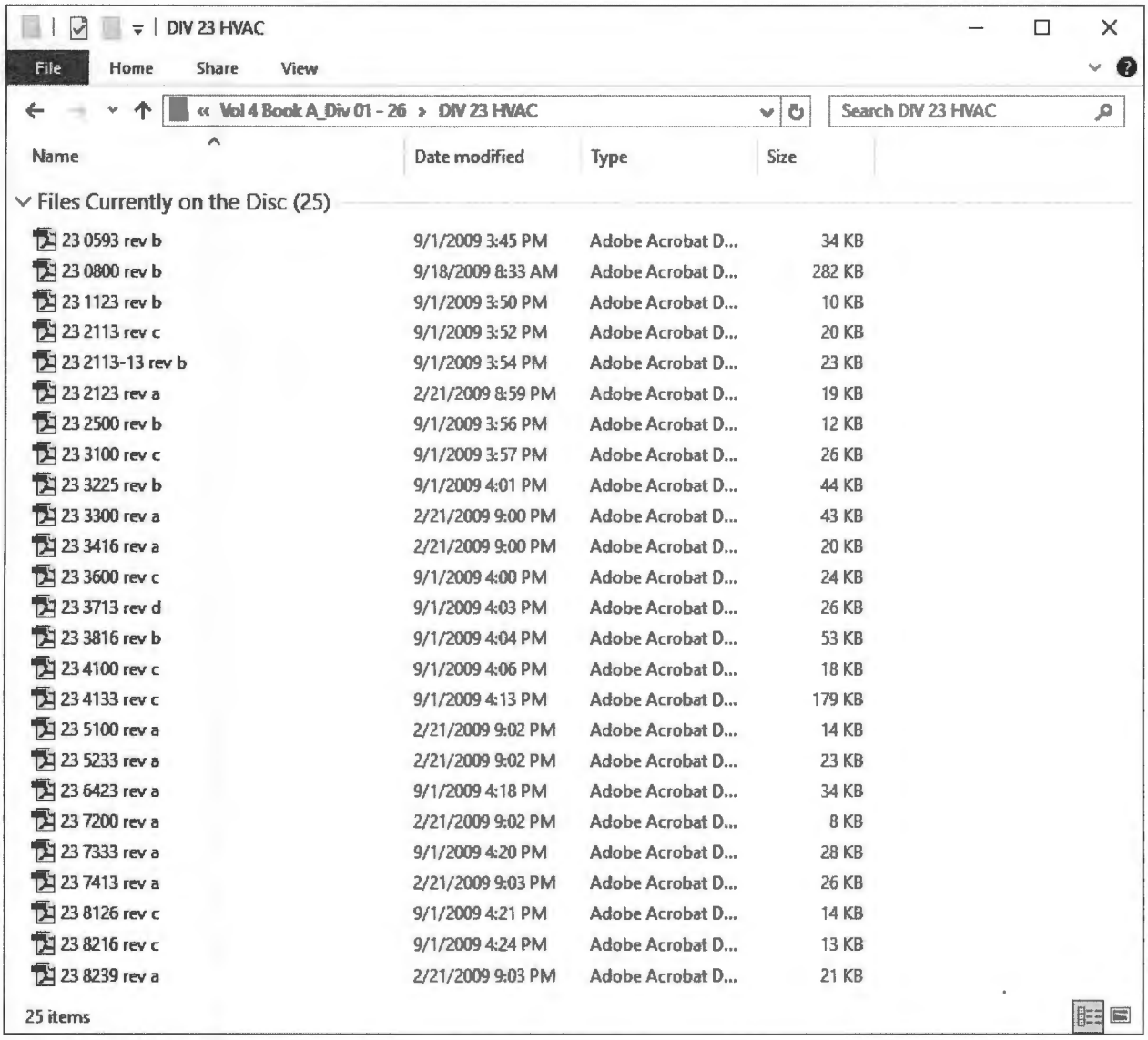
24 KB
13 items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Date modified
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23 3100 rev c 9/1/2009 3:57 PM Adobe Acrobat D... 26 KB
23 3225 rev b 9/1/2009 4:01 PM Adobe Acrobat D... 44 KB
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23 3416 rev a 2/21/2009 9:00 PM Adobe Acrobat D... 20 KB
23 3600 rev c 9/1/2009 4:00 PM Adobe Acrobat D... 24 KB
23 3713 rev d 9/1/2009 4:03 PM Adobe Acrobat D... 26 KB
23 3816 rev b 9/1/2009 4:04 PM Adobe Acrobat D... 53 KB
23 4100 rev c 9/1/2009 4:06 PM Adobe Acrobat D... 18 KB
23 4133 rev c 9/1/2009 4:13 PM Adobe Acrobat D... 179 KB
23 5100 rev a 2/21/2009 9:02 PM Adobe Acrobat D... 14 KB
23 5233 rev a 2/21/2009 9:02 PM Adobe Acrobat D... 23 KB
23 6423 rev a 9/1/2009 4:18 PM Adobe Acrobat D... 34 KB
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23 7333 rev a 9/1/2009 4:20 PM Adobe Acrobat D... 28 KB
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23 8126 rev c 9/1/2009 4:21 PM Adobe Acrobat D... 14 KB
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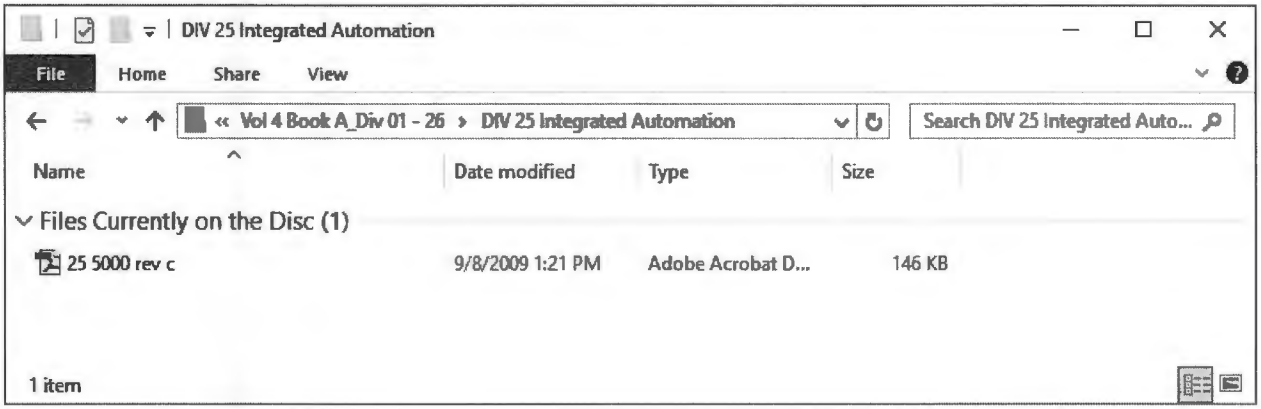
25 items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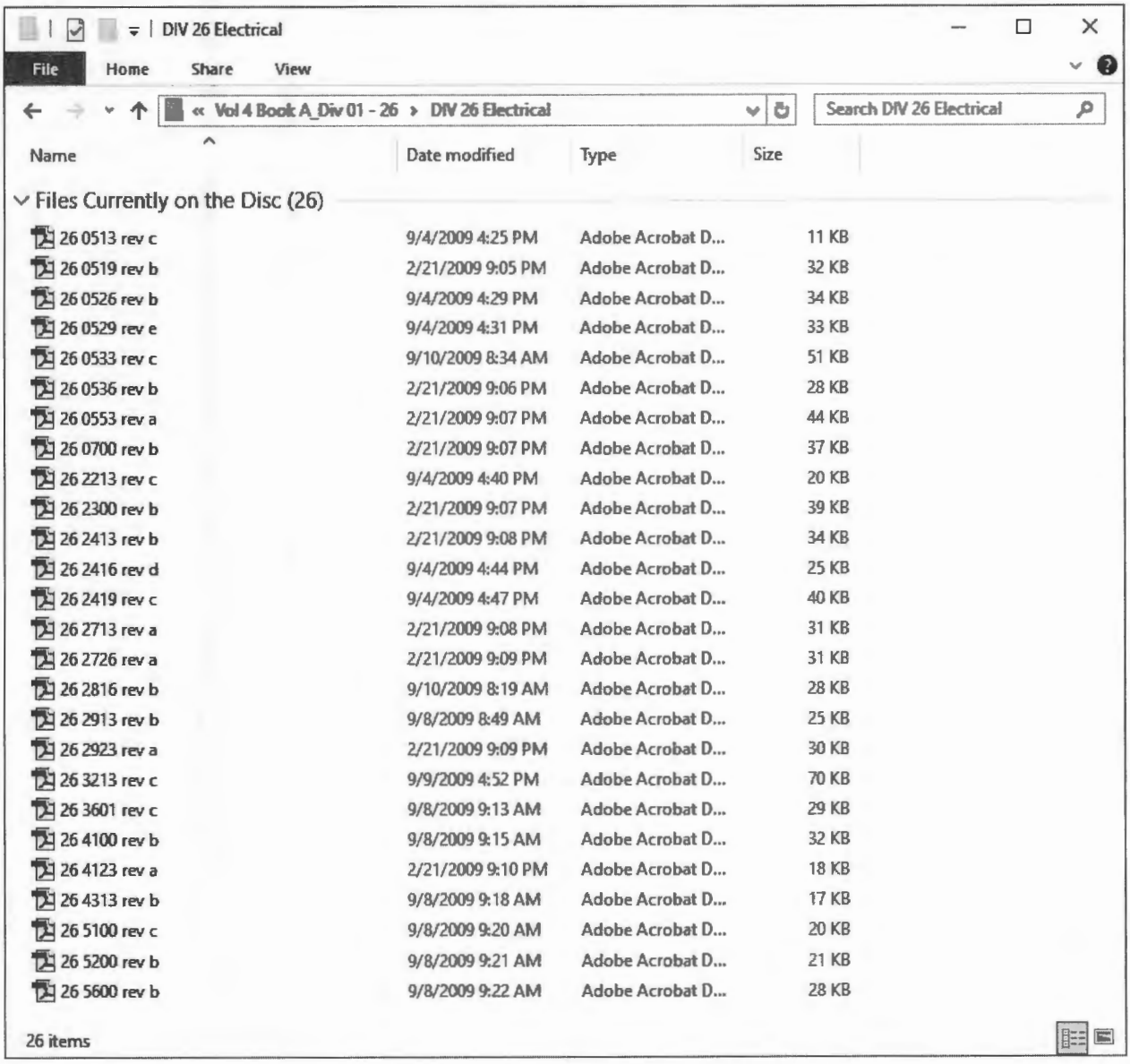
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26 0529 rev e 9/4/2009 4:31 PM Adobe Acrobat D... 33 KB
26 0533 rev c 9/10/2009 8:34 AM Adobe Acrobat D... 51 KB
26 0536 rev b 2/21/2009 9:06 PM Adobe Acrobat D... 28 KB
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26 2816 rev b 9/10/2009 8:19 AM Adobe Acrobat D... 28 KB
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26 3601 rev c 9/8/2009 9:13 AM Adobe Acrobat D... 29 KB
26 4100 rev b 9/8/2009 9:15 AM Adobe Acrobat D... 32 KB
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26 4313 rev b 9/8/2009 9:18 AM Adobe Acrobat D... 17 KB
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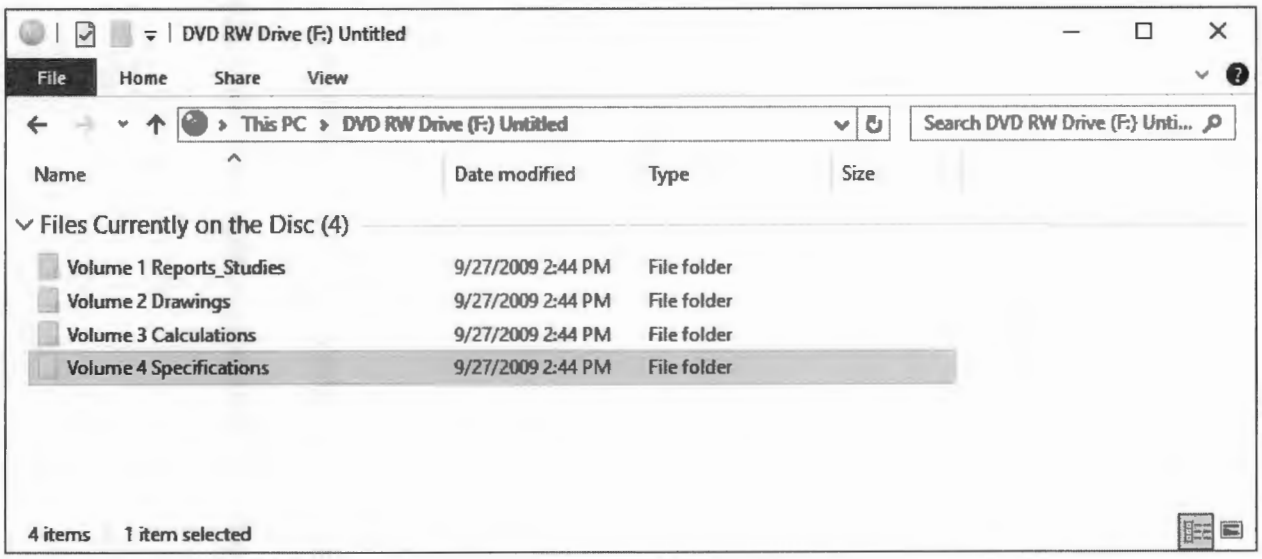
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Volume 3 Calculations 9/27/2009 2:44 PM File folder
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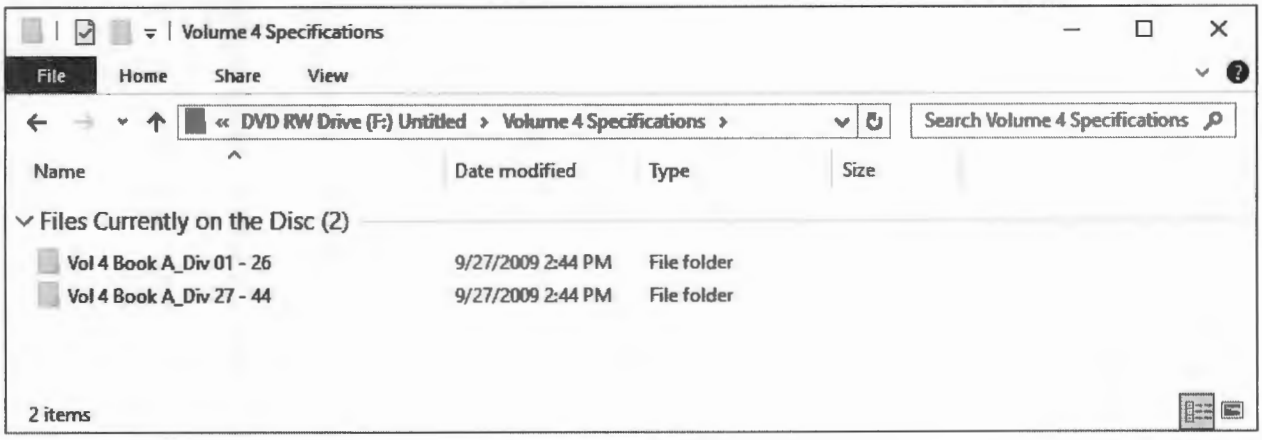
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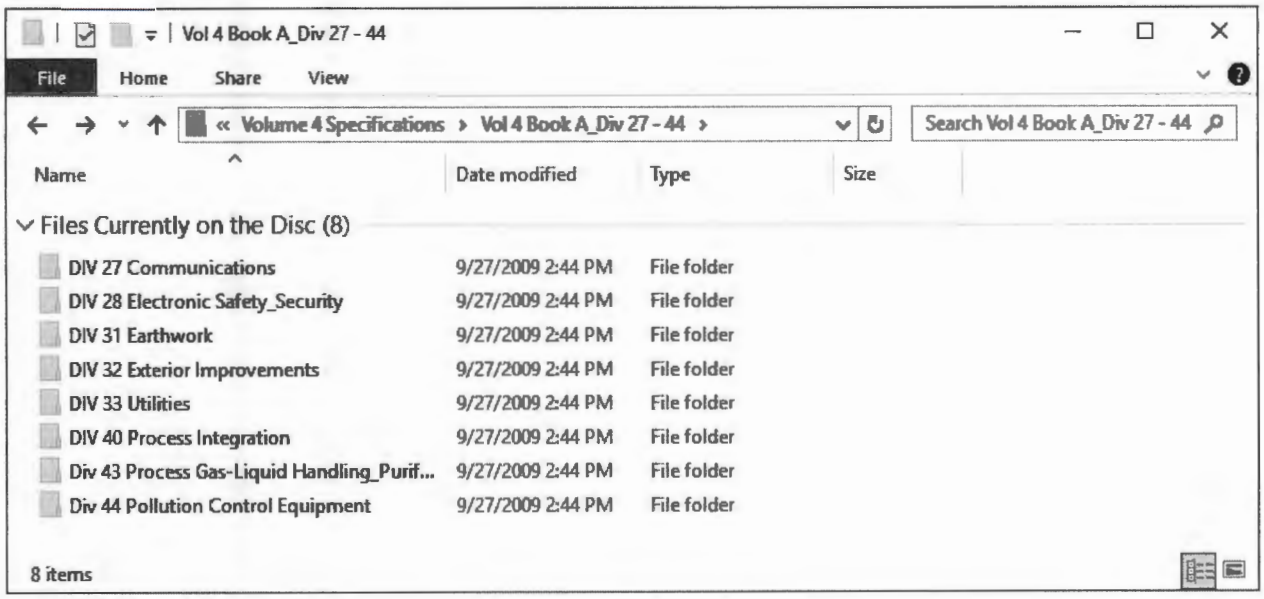
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DIV 28 Electronic Safety_Security 9/27/2009 2:44 PM File folder
DIV 31 Earthwork 9/27/2009 2:44 PM File folder
DIV 32 Exterior Improvements 9/27/2009 2:44 PM File folder
DIV 33 Utilities 9/27/2009 2:44 PM File folder
DIV 40 Process Integration 9/27/2009 2:44 PM File folder
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Div 44 Pollution Control Equipment 9/27/2009 2:44 PM File folder
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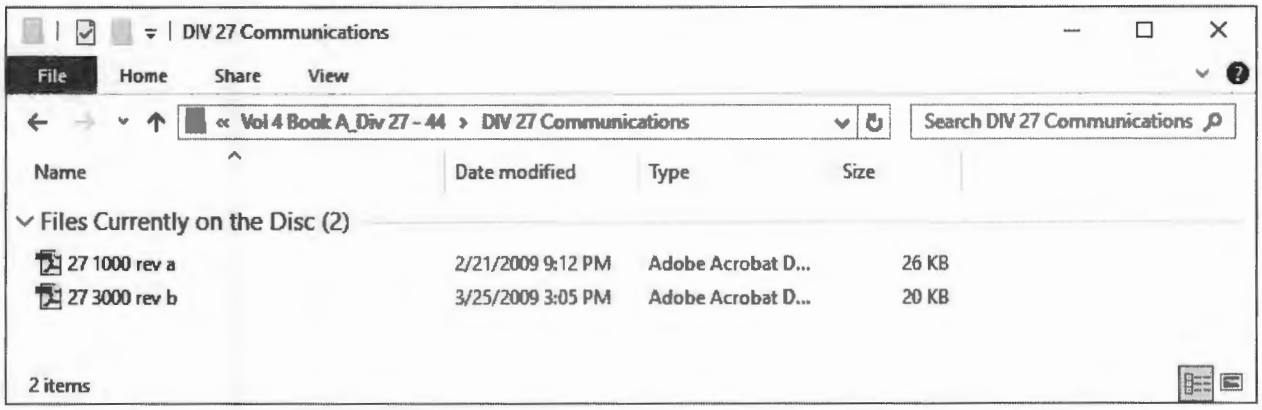
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Share
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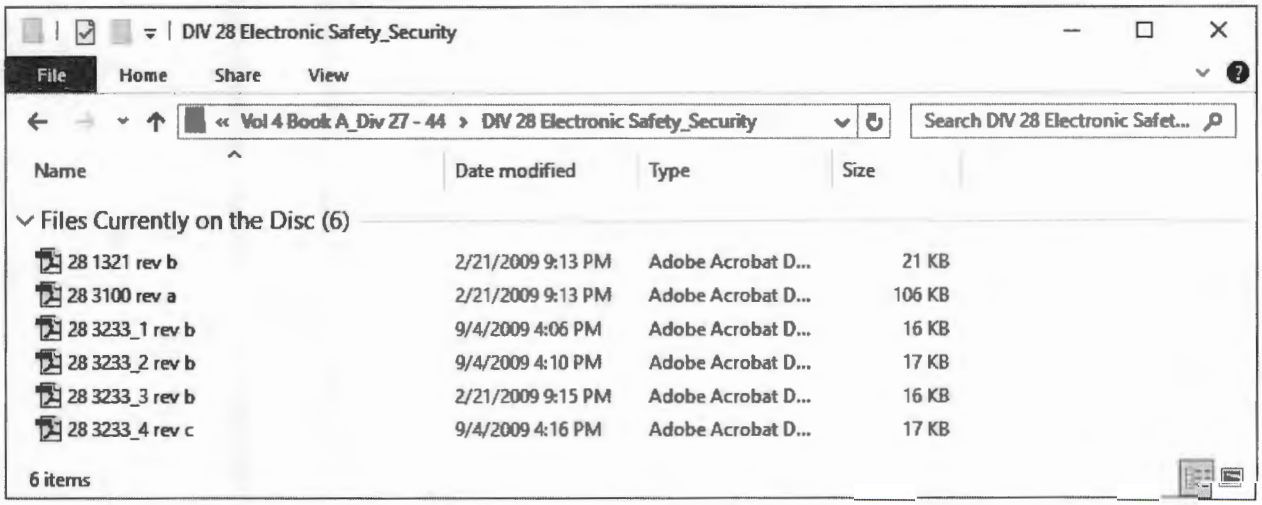
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21 KB
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106 KB
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28 3233_3 rev b
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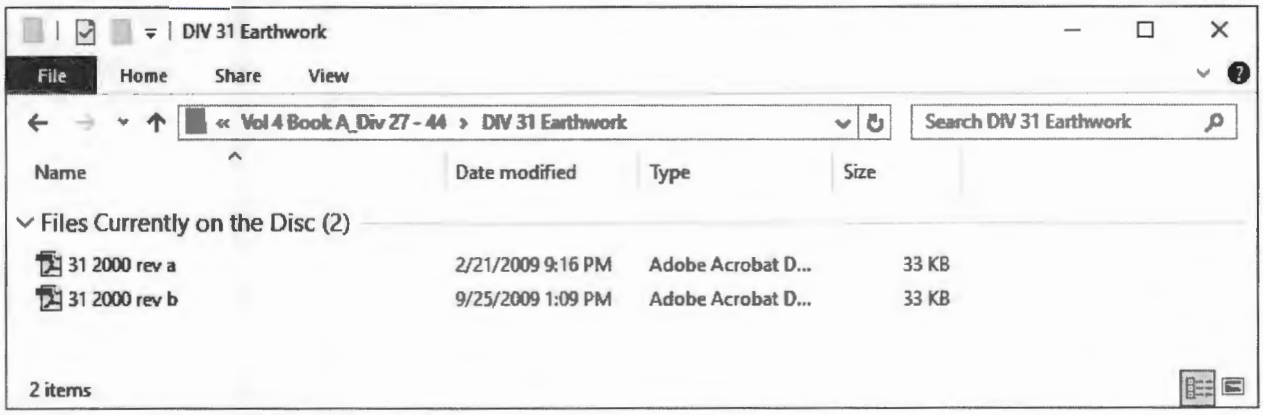
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Size
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31 2000 rev a
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9/25/2009 1:09 PM
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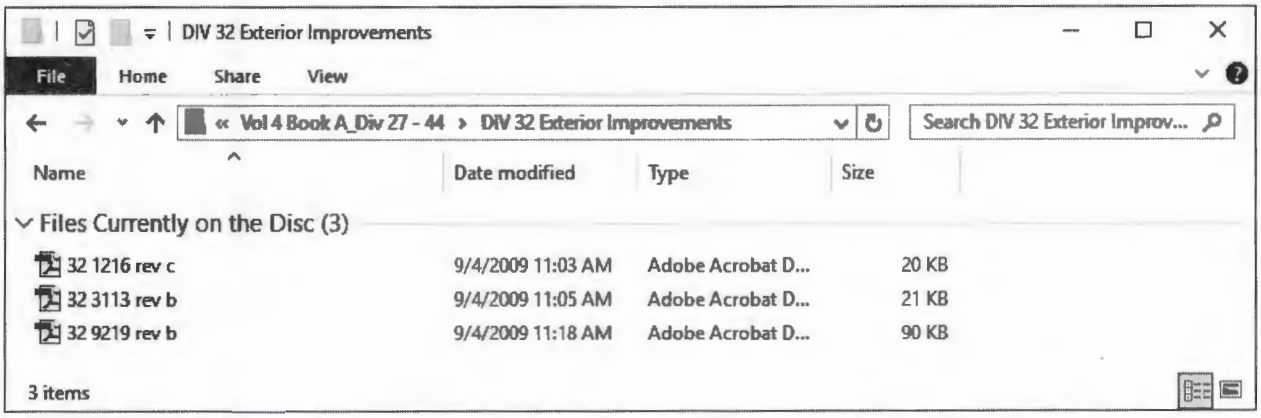
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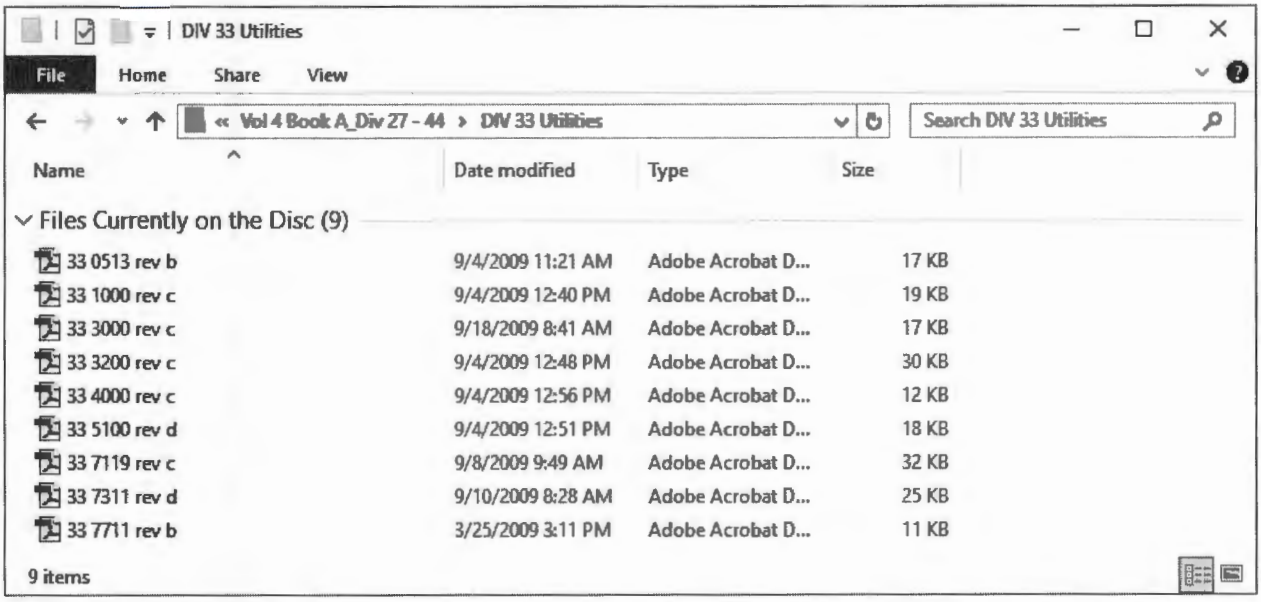
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33 3000 rev c 9/18/2009 8:41 AM Adobe Acrobat D... 17 KB
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33 5100 rev d 9/4/2009 12:51 PM Adobe Acrobat D... 18 KB
33 7119 rev c 9/8/2009 9:49 AM Adobe Acrobat D... 32 KB
33 7311 rev d 9/10/2009 8:28 AM Adobe Acrobat D... 25 KB
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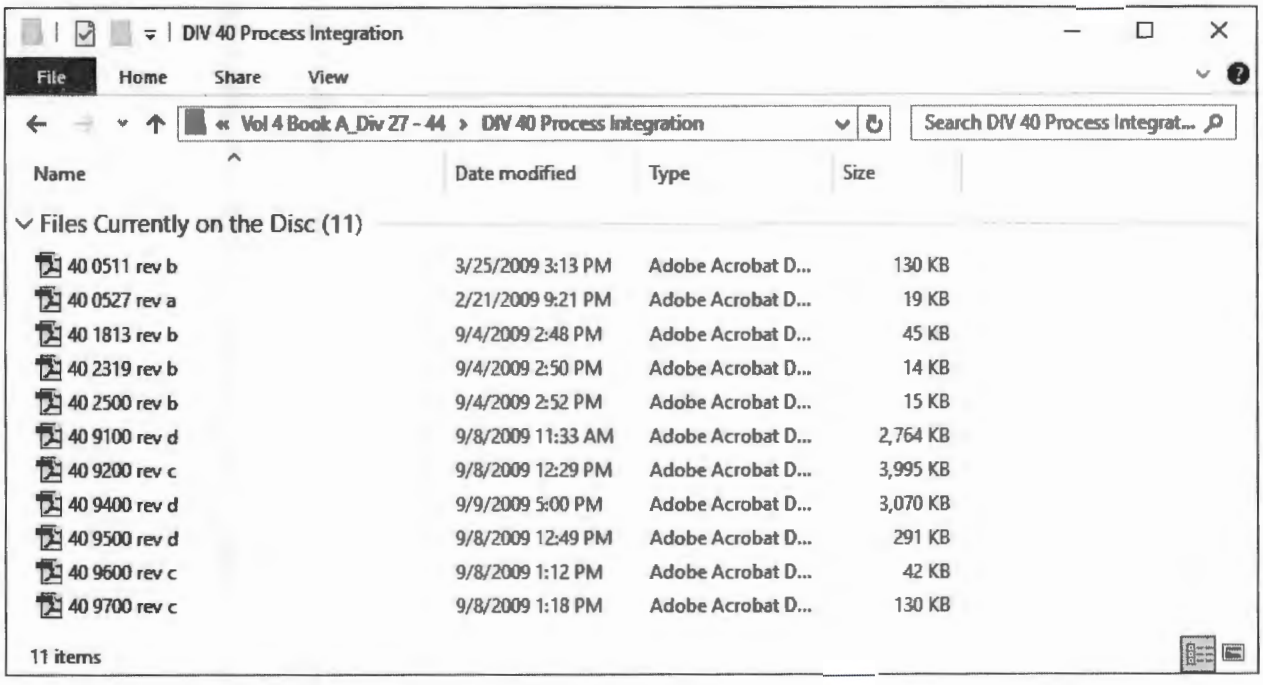
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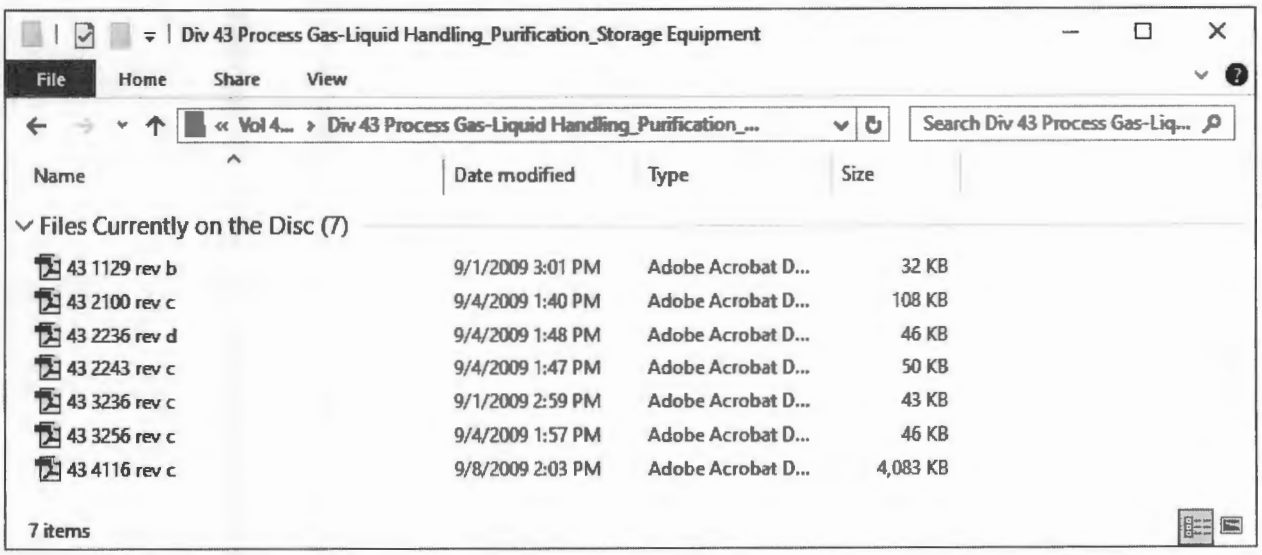
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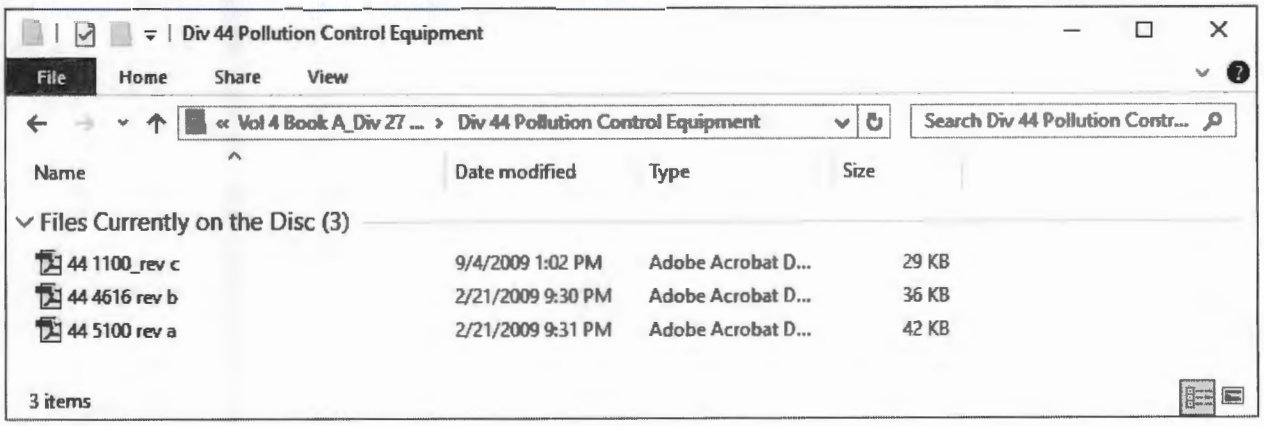
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DP-1132 Blue File Mk

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: July 28, 2010
Refer To: ENV-RCRA-10-141
LAUR: 10-04863

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN QUARTERLY REPORT, SECOND QUARTER 2010, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Groundwater Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the second quarter (April, May, and June) of 2010. Since the first quarter of 1999, Los Alamos National Laboratory (Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells
Table 1.0 presents the analytical results from sampling conducted at four Mortandad Canyon alluvial wells, MCO-3, MCO-4B, MCO-6, and MCO-7, during the second quarter of 2010. Samples are submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the second quarter of 2010. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program.

All of the FWC results presented in Table 2.0 are below the NM WQCC 3103 standards for NO_3-N, F, and TDS. The combined nitrate-nitrogen (NO_3-N) and nitrite-nitrogen (NO_2-N) concentration in three FWC samples—6/1/10, 6/7/10, and 6/28/10—was greater than 10 mg/L. The NM WQCC 3103 standard of 10 mg/L is for NO_3-N only. Separate NO_3-N and NO_2-N analyses are not performed by GEL due to the short analytical hold-time (48 hrs). However, the TA-50 RLWTF analytical laboratory performs individual NO_3-N and NO_2-N analyses on duplicate FWC samples. Duplicate sample results from the TA-50 RLWTF analytical laboratory show that all NO_3-N concentrations were below the NM WQCC 3103 standard of 10 mg/L.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for the second quarter of 2010. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NMWQCC 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Enclosures: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, M894
Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Michael Mallory, PADOPS, A102
J. Chris Cantwell, ADESHQ, K491

Cy (continued):
Randy Johnson, ENV-ES, E500
Mike Saladen, ENV-RCRA, K490
Robert C. Mason, TA55-DO, E583
Hugh McGovern, TA-55 RLW, E518
Pete Worland, TA-55-RLW, E518
Chris Del Signore, TA-55-RLW, E518
Steve Hanson, TA-55-RLW, E518
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 2nd Quarter, 2010.

Sampling Location	Sample Field Prep (F/UF)[1]	Sample Date	Perchlorate (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	F	05/14/10	1.11	1.1	0.249	<0.050	330	0.29
MCO-4B	F	05/14/10	7.07	0.88	0.093J	0.028J	373	0.58
MCO-6	F	05/11/10	4.61	1.3J	<0.140	<0.082	275	0.87
MCO-7	F	05/11/10	7.54	1.4J	<0.087	<0.047	289	1.0
NM WQCC 3103 Ground Water Standards			*NA*[2]	*10 mg/L*[3]	*NA*[2]	*NA*[2]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]All samples filtered with the exception of TKN.

[2]NA means that there is no NM WQCC 3103 standard for this analyte.

[3]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 2nd Quarter, 2010.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	**Sample Composite Date**	**Sample ID#**	**NO_3-N (mg/L)**	**NO_2-N (mg/L)**	**NO_3+NO_2-N (mg/L)**	**Perchlorate (ug/L)**	**Fluoride (mg/L)**	**TDS (mg/L)**
April	4/5/10	No Discharge[2]						
	4/12/10	50FWC-10-9947	5.0	0.45	4.99J	0.893	0.08J	137
	4/19/10	50FWC-10-9948	5.4	0.32	6.23J	0.611	0.14	239
	4/26/10	No Discharge						
May	5/3/10	50FWC-10-9949	7.6	0.30	8.23J	1.16	0.18	213
	5/10/10	50FWC-10-9950	5.9	0.36	6.45	1.96	0.22	270
	5/17/10	No Discharge						
	5/24/10	No Discharge						
June	6/1/10	50FWC-10-9951	9.3	1.9	11.3J+	1.36	0.31	382
	6/7/10	50FWC-10-9952	7.3	3.7	10.1	0.15J	0.34	339
	6/14/10	No Discharge						
	6/21/10	No Discharge						
	6/28/10	50FWC-10-9953	9.1	1.0	10.6J+	<0.2	0.21	326HJ-
2nd Quarter 2010 Averages[3]			**7.4**	**1.1**	**8.3**	**0.9**	**0.21**	**272**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]2nd quarter 2010 averages include the results from March 2010, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

H means that the analytical hold time was exceeded.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 2nd Quarter, 2010.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
April	5.1	<1	180	0.08
May	6.7	1.9	307	0.24
June	8.8	<1	259	0.12
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

Fullam Docs 03071-1 case loads / LANL / LANL emails

Fullam, Jennifer, NMENV

From: Jake Meadows <jmeadows@lanl.gov>
Sent: Friday, August 20, 2010 10:59 AM
To: Fullam, Jennifer, NMENV; Powell, Richard, NMENV
Subject: LANL Safety Shower Test Discharges

Hi Rich and Jennifer --

We have been investigating potential pathways for utilizing potable water associated with the Outfall Reduction Program and wanted to see if you could provide some guidance on the best path forward for properly managing potable water from some safety shower tests here.

In order to reduce flows to TA-50 RLWTF, LANL has initiated Stage 1 water restrictions for facilities tied to the plant. Weekly testing of the safety showers within TA-55 is one source of input to RLWTF and is a potential candidate to be removed as a source. The safety showers are connected to the potable water system and are tested weekly. The test discharges are captured in a clean 55 gallon drum and historically discharged to RLWTF. These safety shower test discharges are of clean potable water and total approximately 100 gallons per week. LANL has investigated testing the water at HPAL to verify that the water does not contain rad. Then, following verification, the water would be applied outside the facility for beneficial use such as landscape irrigation or as dust suppression. These discharges would be recorded on a General Discharge Form and submitted to NMED in the Quarterly Discharge Report. Discharges associated with the testing of eyewash stations and safety showers are included in the TA-55 SWPPP. The discharges would not cause erosion, impact a stormdrain or watercourse, or adversely impact any SWMUs or AOCs.

The proposed discharge would be temporary until the Stage 1 restrictions are lifted. Would this potable water discharge be a candidate for inclusion in the Quarterly Discharge Report under the LANL Discharge Reporting Decision Tree or would coverage under an individual NOI be more appropriate?

Thank you for your help --
Jake

DP-1132 Update

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: August 25, 2010
Refer To: ENV-RCRA-10-166
LAUR: 10-05665

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, DISCHARGE PLAN (DP-1132), MINOR MODIFICATION

In accordance with 20.6.2.3107 of the New Mexico Water Quality Control Commission Regulations, Los Alamos National Laboratory is notifying you of a minor modification to the TA-50 Radioactive Liquid Waste Treatment Facility's Discharge Plan (DP-1132). New, stringent copper and zinc limits became effective August 1, 2010, in the National Pollutant Discharge Elimination System (NPDES) Permit (NM0028355) issued to the National Nuclear Security Administration (NNSA) and Los Alamos National Security, LLC (LANS) for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF). The following changes are being made at the TA-50 RLWTF to reduce and/or eliminate the volume of treated effluent being discharged to NPDES Outfall 051 in Mortandad Canyon:

- Short-term
  A double-contained pipe will be installed from the effluent "Frac" tanks to allow for flows to both the existing cooling towers (Code 1-E) associated with the evaporator (Code 1-E) and for reprocessing. The blowdown from the cooling tower and over flow lines from the cooling towers will be routed for reprocessing.

- Long-term
  Alternatives are currently being evaluated to procure a trailer mounted evaporation system for effluent water entering the system that has sufficient capacity to ensure evaporation is greater than current effluent production and to account for cooling loss during winter months. Both the short-term and long-term changes are documented in the revised schematic for RLWTF (see Enclosure 1).

04016

Please contact Bob Beers at (505) 667-7969 of the Water Quality and RCRA Group (ENV-RCRA) if you have questions.

Sincerely,

A R Grieggs

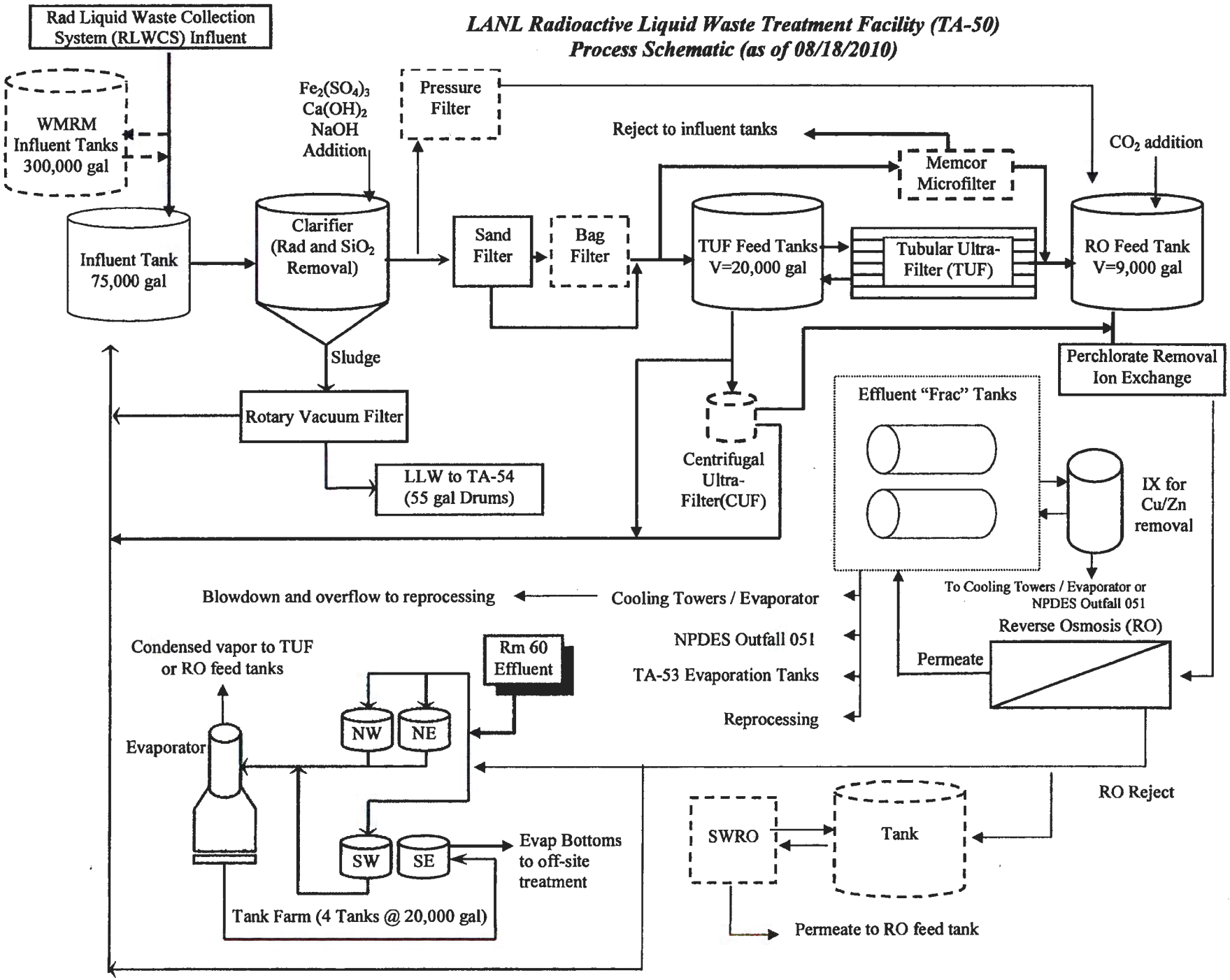
Anthony R. Grieggs
Group Leader
Water Quality & RCRA Group (ENV-RCRA)
Los Alamos National Security, LLC

ARG:BB/lm

Enclosure: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM, w/enc.
James Bearzi, NMED/HWB, Santa Fe, NM, w/enc.
Steve Yanicak, LASO-GOV, w/enc., M894
Hai Shen, LASO-EO, w/enc., A316
Gene Turner, LASO-EO, w/enc., A316
Michael Mallory, PADOPS, w/o enc., A102
J. Chris Cantwell, ADESHQ, w/o enc., K491
Robert Mason, TA55-DO, w/enc., E583
Denny L. Hjeresen, ENV-DO, w/enc., (E-File)
Randy Johnson, ENV-ES, w/enc., E500
Mike Saladen, ENV-RCRA, w/enc., (E-File)
Bob Beers, ENV-RCRA, w/enc., (E-File)
Hugh McGovern, TA-55 RLW, w/enc., E518
Pete Worland, TA-55-RLW, w/enc., E518
Chris Del Signore, TA-55-RLW, w/enc., E518
Steve Hanson, TA-55-RLW, w/enc., E518
ENV-RCRA File, K490
IRM-RMMSO, A150

ENCLOSURE 1


LANL Radioactive Liquid Waste Treatment Facility (TA-50)
Process Schematic (as of 08/18/2010)
Rad Liquid Waste Collection System (RLWCS) Influent
WMRM Influent Tanks 300,000 gal
Influent Tank 75,000 gal
$Fe_2(SO_4)_3$ $Ca(OH)_2$ NaOH Addition
Clarifier (Rad and SiO_2 Removal)
Pressure Filter
Sand Filter
Bag Filter
Reject to influent tanks
Memcor Microfilter
TUF Feed Tanks V=20,000 gal
Tubular Ultra-Filter (TUF)
CO_2 addition
RO Feed Tank V=9,000 gal
Perchlorate Removal Ion Exchange
Sludge
Rotary Vacuum Filter
LLW to TA-54 (55 gal Drums)
Centrifugal Ultra-Filter(CUF)
Effluent "Frac" Tanks
IX for Cu/Zn removal
To Cooling Towers / Evaporator or NPDES Outfall 051
Reverse Osmosis (RO)
Permeate
Blowdown and overflow to reprocessing
Cooling Towers / Evaporator
NPDES Outfall 051
TA-53 Evaporation Tanks
Reprocessing
Condensed vapor to TUF or RO feed tanks
Rm 60 Effluent
Evaporator
NW
NE
SW
SE
Evap Bottoms to off-site treatment
Tank Farm (4 Tanks @ 20,000 gal)
RO Reject
SWRO
Tank
Permeate to RO feed tank

New Mexico
ENVIRONMENT DEPARTMENT
Air Quality Bureau
1301 Siler Road, Building B
Santa Fe, NM 87507-3113
Phone (505) 476-4300
Fax (505) 476-4375
www.nmenv.state.nm.us

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

SARAH COTTRELL
Deputy Secretary

September 20, 2010

CERTIFIED MAIL NO. 7008 0500 0001 1250 1651

Patricia E. Gallagher
Los Alamos National Laboratory
Group Leader
Environmental Stewardship Department
PO Box 1663, MS J978
Los Alamos, NM 87545

No Permit Required (NPR)
No. 2195-U
Facility type: Thermal Evaporation Unit
IDEA ID No. 856 - PRN20100006
Los Alamos National Laboratory
AIRS No. 350280001

Dear Ms. Gallagher:

This letter acknowledges the receipt of your request for a permit applicability determination dated September 1, 2010 to construct and operate a natural gas-fired thermal evaporation unit for use in evaporating treated water from the existing LANL Radioactive Liquid Waste Treatment Facility (RLWTF) located within Technical Area (TA) – 50 at the Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico. The request was received by the Department on September 3, 2010.

A review has been completed and the information provided is sufficient to complete an evaluation of your No Permit Required request. The results demonstrate that the emissions from the units are too low to trigger 20.2.72 NMAC - Construction Permits or 2.73 - Notice of Intent and Emissions Inventory Requirements. Therefore this notice of No Permit Required authorizes you to operate the facility as stated in the application.

This facility may be subject to state and federal regulations ***such as, but not limited to,*** those found in Table 1. It is the responsibility of the owner and/or operator of the facility to determine applicability and to comply with all existing, revised, and new applicable regulations.

Table 1: Regulations

Citation	Title
20.2.61 NMAC	Smoke and Visible Emissions

File No. 2195-U
September 20, 2010

Please be advised that this No Permit Required determination was based upon the application submitted and these sources, when constructed, will be subject to inspection.

If you have any questions, please do not hesitate to contact me in Santa Fe at (505)476-5564.

Sincerely,

Norma Perez
Minor Source Unit
Air Quality Bureau

cc via e-mail: Bill Blankenship/ bblankenship@lanl.gov
Enclosure: Industry/Consultant Feedback Questionnaire with envelope

Los Alamos
NATIONAL LABORATORY
EST. 1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-0666/FAX: (505) 667-5224

Date: September 27, 2010
Refer To: ENV-RCRA-10-181
LAUR: 10-06430

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, DISCHARGE PLAN (DP-1132), MINOR MODIFICATION

In accordance with 20.6.2.3107 of the New Mexico Water Quality Control Commission Regulations, Los Alamos National Laboratory (the Laboratory) is notifying you of a minor modification to the TA-50 Radioactive Liquid Waste Treatment Facility's Discharge Plan (DP-1132).

The Radioactive Liquid Waste Treatment Facility (RLWTF) has recently made a number of operational treatment changes to reduce concentrations of copper and zinc being discharged to National Pollutant Discharge Elimination System (NPDES) Outfall 051 due to the new stringent effluent limits, effective August 1, 2010. The newly installed ion exchange media to remove copper and zinc to the new effluent limits appear to be effective. However, when the ion exchange media effluent waters are placed in the existing RLWTF effluent tanks (referred to as the N. and S. Frac tanks), the water is then found to be greater than the discharge limits. The Laboratory will install a new 1,000 gallon polymeric tank in Room 38 of the RLWTF to receive the ion exchange media effluent water. This new tank will be referred to as Tank 38. This new tank should eliminate any residual copper and zinc contamination that is suspected to be in the N. and S. Frac tanks. New hoses will be installed in Rooms 34B, 36 and 38 at the RLWTF to move water from the ion exchange vessels in Room 34B to Tank 38. New hoses, also, will be installed to transfer the Tank 38 water back to either Frac tank in Room 34B for reprocessing and for connecting Tank 38 to the line used to discharge effluent to Outfall 051. To determine if Tank 38 contents meet discharge requirements, a representative sample of the Tank 38 contents will be collected. The representative sample will be obtained from the re-circulation line after the 1,000 gallon contents of Tank 38 have been re-circulated for 80 minutes at a rate of 50 gallons per minute (gpm). If discharge to the outfall is from Tank 38, a new NPDES compliance sampling location is proposed. This location

will be in Room 38, on the discharge side of the pump that will pump the Tank 38 contents to the outfall. Enclosure 1 shows an isometric drawing of Tank 38, associated piping, recirculation/discharge pump, proposed NPDES sampling location and flow paths during discharge to Outfall 051. If discharges to Outfall 051 are made from the Frac tanks, the presently approved NPDES compliance sampling location in Room 116 at the RLWTF will continue to be used.

Additionally, RLWTF effluent waters that are not within discharge limits to the outfall may need to be stored in the TA-50-250 Waste Management Risk Mitigation (WMRM) facility. New hoses will be installed to move water from the Frac tanks in Room 34B to tank #6 in the WMRM facility. A copy of the revised treatment schematic is enclosed (see Enclosure 2).

Please contact Bob Beers at (505) 667-7969 of the Water Quality and RCRA Group (ENV-RCRA) if you have questions.

Sincerely,

A R Grieggs

Anthony R. Grieggs
Group Leader
Water Quality & RCRA Group (ENV-RCRA)
Los Alamos National Security, LLC

ARG:BB/lm

Enclosures: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM, w/enc.
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J. Chris Cantwell, ADESHQ, w/o enc., K491
Robert Mason, TA55-DO, w/enc., E583
Denny L. Hjeresen, ENV-DO, w/enc., (E-File)
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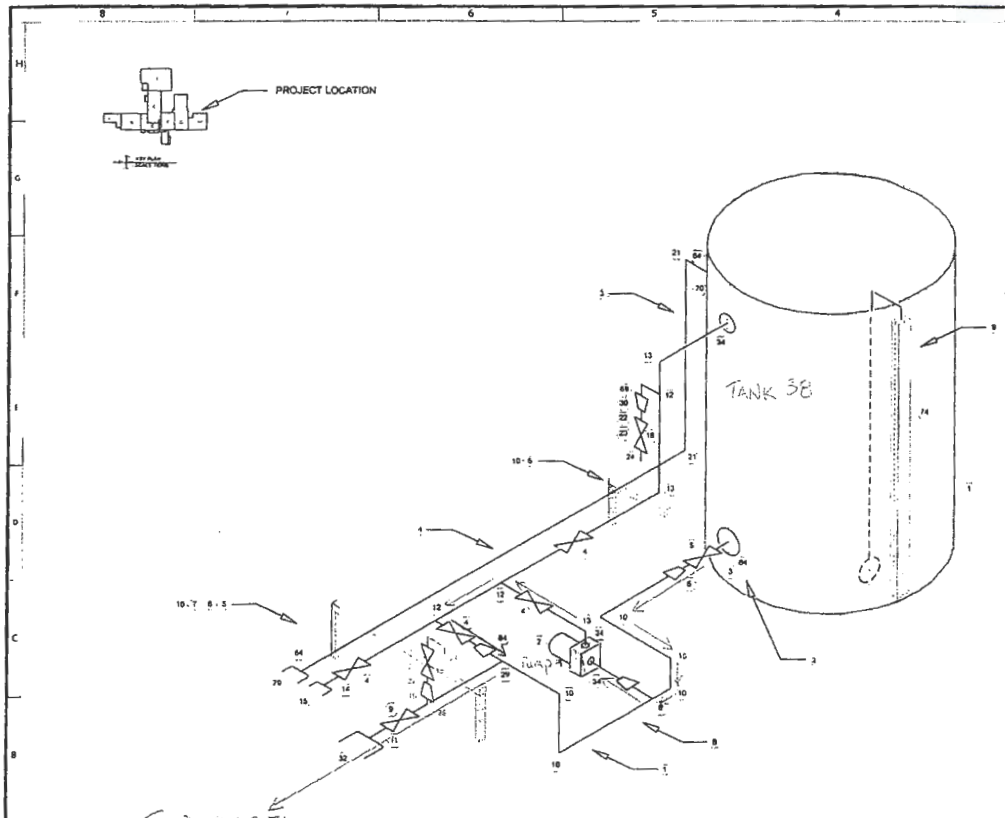
Mike Saladen, ENV-RCRA, w/enc., (E-File)
Bob Beers, ENV-RCRA, w/enc., (E-File)
Hugh McGovern, TA-55 RLW, w/enc., E518
Pete Worland, TA-55-RLW, w/enc., E518
Cindy Blackwell, LC-LESH, w/o enc., A187
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., A150

ENCLOSURE 1



1000 GAL. TANK PARTIAL PIPING - ISOMETRIC

SCALE NONE

GENERAL NOTES

1. SCALE – NONE.
2. "OR APPROVED EQUAL" IS ALWAYS IMPLIED AFTER A BRAND NAME, PATENTED PROCESS OR CATALOG NUMBER. THE CONTRACTOR MAY SUBSTITUTE ANY BRAND OR PROCESS APPROVED AN EQUAL BY SPECIFYING ARCHITECT/ ENGINEER. THE ONLY EXCEPTION IS WHERE "NO SUBSTITUTION" IS SPECIFIED.
3. REFER TO BILL OF MATERIALS (BOM) IN REFERENCED DCF FOR MATERIAL CALLOUTS AND INSPECTION REQUIREMENTS
4. ALL ITEMS ML-4.
5. ALL INSTALLATION SHALL CONFORM WITH TO LANL STANDARDS
6. FIELD ADJUST PIPE DIMENSIONS

KEYED NOTES

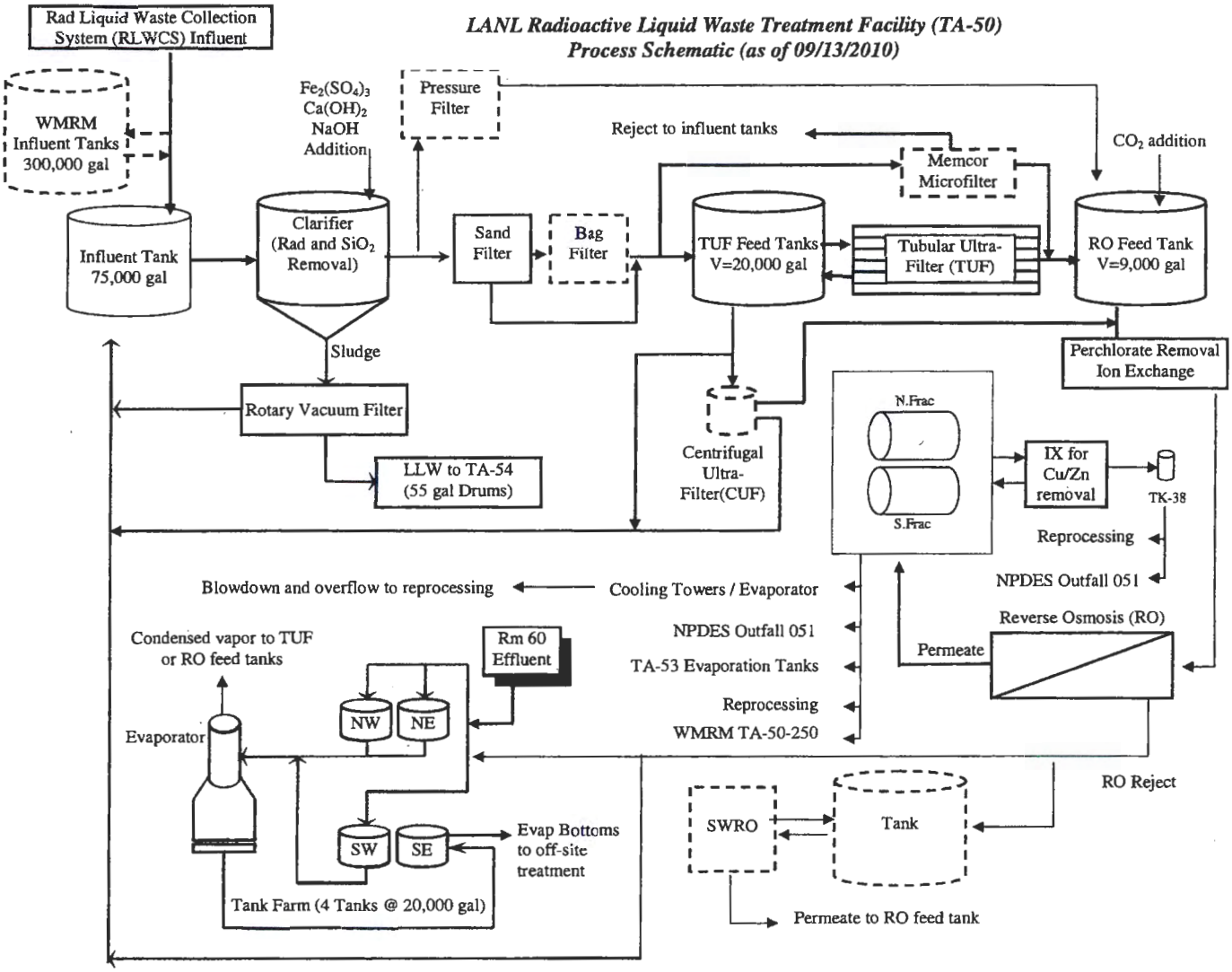
1. DISCHARGE HOSE & ASSOCIATED PIPING - 4" MINIMUM
2. TANK CONNECTION - 2" NPTF (DISCHARGE)
3. TANK CONNECTION - 1-½" NPTF (INLET)
4. EXTEND 2" LINE TO PIPE SUPPORT AND CONNECT HOSE TO DRAIN IN RODM 36 IF EXISTING DRAIN IN ROOM 38 IS PERMANENTLY BLOCKED. INSTALL THROUGHWALL FITTING AS HIGH AS POSSIBLE
5. INSTALL PIPE SECTIONS AT LEAST 3' APART
6. PIPING WEIGHS LESS THAN 5 LBS/FT. ANCHORING NON STRUCTURAL. NO SSI REQUIRED
7. ATTEMPT TO EQUATE OUTLET LINE HEIGHT TO THE SAME HEIGHT AS THE TANK DISCHARGE (UNION STRUT FOOTING MIGHT NOT BE REQUIRED OR CONSIDER ADDING A PIECE OF UNISTRUT UNDERNEATH PIPE SUPPORT)
8. ANCHOR PUMP TO THE FLOOR OR CONSIDER USING UNISTRUT, ¼" STEEL PLATE AND ½" HILTI ANCHORS IN ADDITION TO THE PUMP FOOT AND ANCHOR TO THE FLOOR
9. INSTALL LEVEL FLOATS & SCALE PER MANUFACTURER INSTRUCTIONS
10. BOM ITEMS 53 TO 59

No.	Date	Class Rev	ADC	Description	DFT	CSE LANE	CHK	SUB	APP
3									
2									
1									

ENGINEERING STANDARDS PROGRAM
Radioactive Liquid Waste Treatment Facility (RLWTF)

INTERIM DRAWING SUPPORTING DCF-10-TA50-0001-048	DRAWN J C Rutherford
TA50-0001 1000 GAL TANK BASEMENT, ROOM38	DESIGNED J C Rutherford
PARTIAL PIPING ISOMETRIC	CHECKED C DeRivera
BLDG-0001 ROOM-38 TA-50	Date
SUBMITTED	APPROVED FOR RELEASE
RLWTF EH	RLWTF EHS
Los Alamos National Laboratory Los Alamos, NM 87545	SHEET F-9000 1 OF 2
CLASSIFICATION UNCLASSIFIED	SIZE D
PROJECT IDENTIFIER N/A	INTERIM DRAWING NO DCF-10-TA50-0001-048-01
	REVISION 0

ENCLOSURE 2


LANL Radioactive Liquid Waste Treatment Facility (TA-50)
Process Schematic (as of 09/13/2010)
Rad Liquid Waste Collection System (RLWCS) Influent
WMRM Influent Tanks 300,000 gal
Influent Tank 75,000 gal
$Fe_2(SO_4)_3$ $Ca(OH)_2$ NaOH Addition
Clarifier (Rad and SiO_2 Removal)
Pressure Filter
Sand Filter
Bag Filter
Reject to influent tanks
Memcor Microfilter
TUF Feed Tanks V=20,000 gal
Tubular Ultra-Filter (TUF)
CO_2 addition
RO Feed Tank V=9,000 gal
Perchlorate Removal Ion Exchange
Sludge
Rotary Vacuum Filter
LLW to TA-54 (55 gal Drums)
Centrifugal Ultra-Filter(CUF)
N.Frac
S.Frac
IX for Cu/Zn removal
TK-38
Reprocessing
NPDES Outfall 051
Reverse Osmosis (RO)
Permeate
Blowdown and overflow to reprocessing
Cooling Towers / Evaporator
NPDES Outfall 051
TA-53 Evaporation Tanks
Reprocessing
WMRM TA-50-250
RO Reject
Condensed vapor to TUF or RO feed tanks
Rm 60 Effluent
Evaporator
NW
NE
SW
SE
Evap Bottoms to off-site treatment
Tank Farm (4 Tanks @ 20,000 gal)
SWRO
Tank
Permeate to RO feed tank

Jennifer
DP 1132 Blue Ink
MLs
OCT 2 9 2010

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: October 28, 2010
Refer To: ENV-RCRA-10-202
LAUR: 10-06936

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN QUARTERLY REPORT, THIRD QUARTER 2010, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY (DP-1132)

This letter is intended to serve as Los Alamos National Laboratory's quarterly Groundwater Discharge Plan (DP-1132) Report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the third quarter (July, August, September) of 2010. Since the first quarter of 1999, Los Alamos National Laboratory (the Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells

Table 1.0 presents the analytical results from sampling conducted at three Mortandad Canyon alluvial wells, MCO-4B, MCO-6, and MCO-7, during the third quarter of 2010. No sample was collected from alluvial well MCO-3 because the well was dry. Samples were submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NM WQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of the RLWTF's effluent for the third quarter of 2010. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program. All of the FWC results presented in Table 2.0 are below the NM WQCC 3103 standards for NO_3-N, F, and TDS.

It should be noted that no RLWTF effluent was discharged to the environment during August and September due to new stringent effluent limits for copper and zinc that became effective August 1, 2010, at National Pollutant Discharge Elimination System (NPDES) Outfall 051. Since July 31, 2010, treated effluent was stored onsite pending completion of a number of operational changes to reduce concentrations of copper and zinc to below NPDES permit limits. These operational changes were presented to your agency in two minor modification notices on August 25, 2010, and September 27, 2010 (ENV-RCRA-10-162 and ENV-RCRA-10-181, respectively).

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for July 2010. As explained previously, no effluent was discharged during July and August 2010. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NMWQCC 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Enclosures: a/s

Cy: Glenn Saums, NMED/SWQB, Santa Fe, NM
James Bearzi, NMED/HWB, Santa Fe, NM
Steve Yanicak, LASO-GOV, M894

Cy (continued):
Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Michael Mallory, PADOPS, A102
J. Chris Cantwell, ADESHQ, K491
Randy Johnson, ENV-ES, E500
Mike Saladen, ENV-RCRA, (E-File)
Robert C. Mason, TA55-DO, E583
Hugh McGovern, TA-55 RLW, E518
Pete Worland, TA-55-RLW, E518
Chris Del Signore, TA-55-RLW, E518
Steve Hanson, TA-55-RLW, E518
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 3rd Quarter, 2010.

Sampling Location	Sample Field Prep (F/UF)[1]	Sample Date	Perchlorate (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-3	The well was dry, no sample was collected.							
MCO-4B	F	07/06/10	8.7	0.58J-	0.04J-	0.069J-	431	0.483
MCO-4B Field Duplicate	F	07/06/10	9.1	0.61J-	0.41J-	0.044J-	425	0.481
MCO-6	F	07/07/10	7.3	1.1	0.19	0.033J-	337	0.742
MCO-7	F	07/07/10	8.2	1.3	0.13	0.016J-	292	0.894
NM WQCC 3103 Ground Water Standards			*NA*[2]	*10 mg/L*[3]	*NA*[2]	*NA*[2]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]All samples filtered with the exception of TKN.

[2]NA means that there is no NM WQCC 3103 standard for this analyte.

[3]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 3rd Quarter, 2010.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	**Sample Composite Date**	**Sample ID#**	**NO_3-N (mg/L)**	**NO_2-N (mg/L)**	**NO_3+NO_2-N (mg/L)**	**Perchlorate (ug/L)**	**Fluoride (mg/L)**	**TDS (mg/L)**
July	7/5/10	No Discharges	-----	-----	-----	-----	-----	-----
	7/13/10	50FWC-10-9954	6.2	1.8	8.10J	<0.2	0.14	154
	7/19/10	50FWC-10-9955	3.9	0.82	4.35	<0.2	0.11J-	149J
	7/26/10	50FWC-10-9956	9.3	0.81	9.58	<0.2	0.17	266HJ-
August	8/2/10	50FWC-10-9957	8.5	1.7	9.63	<0.2	0.25	307
	8/9/10	No Discharges	-----	-----	-----	-----	-----	-----
	8/16/10	No Discharges	-----	-----	-----	-----	-----	-----
	8/23/10	No Discharges	-----	-----	-----	-----	-----	-----
	8/30/10	No Discharges	-----	-----	-----	-----	-----	-----
September	9/6/10	No Discharges	-----	-----	-----	-----	-----	-----
	9/13/10	No Discharges	-----	-----	-----	-----	-----	-----
	9/20/10	No Discharges	-----	-----	-----	-----	-----	-----
	9/27/10	No Discharges	-----	-----	-----	-----	-----	-----
3rd Quarter 2010 Averages[3]			**7.0**	**1.3**	**7.9**	**<0.2**	**0.17**	**219**
NM WQCC 3103 Ground Water Standards			*10 mg/L*	*NA[5]*	*10 mg/L[4]*	*NA[5]*	*1.6 mg/L*	*1000 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]No Discharge means that the RLWTF did not discharge any effluent during the 7-day period precedeing the composite date.

[3]3rd quarter 2010 averages include the results from June 2010, if applicable.

[4]The NM WQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[5]NA means that there is no NM WQCC 3103 standard for this analyte.

[6]Pending means that the analytical results were pending at the time this report was prepared.

H means that the analytical hold time was exceeded.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 3rd Quarter, 2010.

Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
July	6.5	<1	47	0.10
August	---- No Discharges ----			
September	---- No Discharges ----			
NM WQCC 3103 Ground Water Standards	*10 mg/L*	*NA*[3]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.

Added to Blue Folder

Fullam, Jennifer, NMENV

From: Knutson, Gerald, NMENV
Sent: Tuesday, November 09, 2010 8:40 AM
To: Fullam, Jennifer, NMENV
Subject: LANL interested parties

Jennifer,

As per her request, please add Betty Fcannapieco, 2252 Espejo Place, Santa Fe, NM 87505 to the interested party list for TA-50 (DP-1132).

Jake

DP1132 Blue Folder

Los Alamos
NATIONAL LABORATORY
EST.1943

GROUND WATER
DEC 15 2010
BUREAU

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: December 15, 2010
Refer To: ENV-RCRA-10-243
LAUR: 10-08215

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY, DISCHARGE PLAN (DP-1132), MINOR MODIFICATION

In accordance with 20.6.2.3107 of the New Mexico Water Quality Control Commission Regulations, Los Alamos National Laboratory (the Laboratory) is notifying you of a minor modification to the Technical Area (TA)-50 Radioactive Liquid Waste Treatment Facility's Discharge Plan (DP-1132).

The Radioactive Liquid Waste Treatment Facility (RLWTF) plans to add hardness to the facility effluent waters. Hardness will be added by the addition of soluble calcium and/or magnesium salts to the RLWTF process water or effluent water. The purpose of adding hardness to the water is to reduce the toxicity of copper and zinc to the *Daphnia Pulex* organism. These metals have been shown to be major contributors to the failed Whole Effluent Toxicity (WET) tests at National Pollutant Discharge Elimination System (NPDES) Outfall 051.

The RLWTF treatment processes reduce the hardness of the effluent water to essentially zero hardness by the use of the clarifier (which operates as a softener) and the reverse osmosis treatment operation. This reduction of hardness exacerbates the toxicity of the copper and zinc to the *Daphnia Pulex* organism.

The hardness salts will be added either to the North or South Frac Tanks or to Tank 38. The hardness of the RLWTF effluent water will be adjusted to approximately 75 mg/L as $CaCO_3$ using calcium and/or magnesium salts.

A copy of the RLWTF's revised treatment schematic is enclosed (Enclosure 1).

Please contact me at (505) 667-7969 if you have questions.

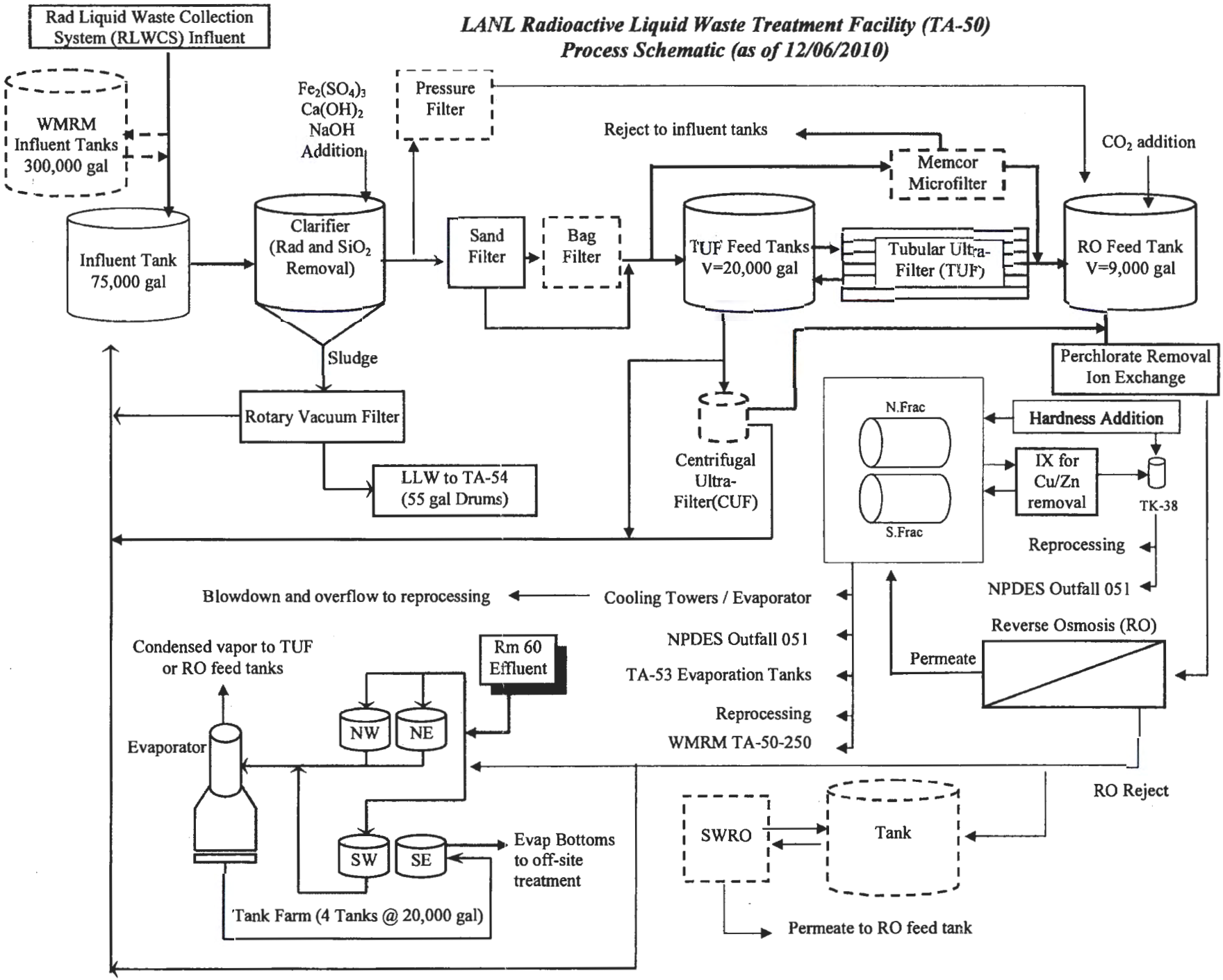
Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)
Los Alamos National Security, LLC

Enclosure: a/s

Cy: Marcy Leavitt, NMED/SWQB, Santa Fe, NM, w/enc.
James Bearzi, NMED/HWB, Santa Fe, NM, w/enc.
Steve Yanicak, LASO-GOV, w/enc., M894
Hai Shen, LASO-EO, w/enc., A316
Gene Turner, LASO-EO, w/enc., A316
Michael B. Mallory, PADOPS, w/o enc., AI02
Robert L. McQuinn, ADHHO, w/o enc., K778
Carl A. Beard, ADSMS, w/o enc., E585
J. Chris Cantwell, ADESHQ, w/o enc., K491
Dennis Hjeresen, ENV-DO, w/o enc., (E-File)
Robert Mason, TA55-DO, w/enc., E583
Hugh McGovern, TA-55-RLW, w/enc., E518
Pete Worland, TA-55-RLW, w/enc., E518
Mike Saladen, ENV-RCRA, w/enc., (E-File)
Marc Bailey, ENV-RCRA, w/enc., (E-File)
Cindy Blackwell, LC-LESH, w/o enc., A187
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., Al50

ENCLOSURE 1


LANL Radioactive Liquid Waste Treatment Facility (TA-50)
Process Schematic (as of 12/06/2010)
Rad Liquid Waste Collection System (RLWCS) Influent
WMRM Influent Tanks 300,000 gal
Influent Tank 75,000 gal
$Fe_2(SO_4)_3$ $Ca(OH)_2$ NaOH Addition
Clarifier (Rad and SiO_2 Removal)
Sludge
Pressure Filter
Sand Filter
Bag Filter
Reject to influent tanks
Memcor Microfilter
TUF Feed Tanks V=20,000 gal
Tubular Ultra-Filter (TUF)
CO_2 addition
RO Feed Tank V=9,000 gal
Perchlorate Removal Ion Exchange
Rotary Vacuum Filter
LLW to TA-54 (55 gal Drums)
Centrifugal Ultra-Filter(CUF)
N.Frac
S.Frac
Hardness Addition
IX for Cu/Zn removal
TK-38
Reprocessing
NPDES Outfall 051
Reverse Osmosis (RO)
Permeate
RO Reject
Blowdown and overflow to reprocessing
Cooling Towers / Evaporator
NPDES Outfall 051
TA-53 Evaporation Tanks
Reprocessing
WMRM TA-50-250
Condensed vapor to TUF or RO feed tanks
Rm 60 Effluent
Evaporator
NW
NE
SW
SE
Evap Bottoms to off-site treatment
Tank Farm (4 Tanks @ 20,000 gal)
SWRO
Tank
Permeate to RO feed tank

DP-1132 Qtr 4th
2010

Los Alamos
NATIONAL LABORATORY
EST.1943

Environmental Protection Division
Water Quality & RCRA Group (ENV-RCRA)
P.O. Box 1663, Mail Stop K490
Los Alamos, New Mexico 87545
(505) 667-7969/FAX: (505) 665-9344

Date: January 31, 2011
Refer To: ENV-RCRA-11-0015
LAUR: 11-00412

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
New Mexico Environment Department
Harold Runnels Building, Room N2250
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: GROUNDWATER DISCHARGE PLAN (DP-1132) QUARTERLY REPORT, FOURTH QUARTER 2010, TA-50 RADIOACTIVE LIQUID WASTE TREATMENT FACILITY

This letter is intended to serve as Los Alamos National Laboratory's Groundwater Discharge Plan (DP-1132) quarterly report for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) for the fourth quarter (October, November, and December) of 2010. Since the first quarter of 1999, Los Alamos National Laboratory (the Laboratory) has provided your agency with voluntary quarterly reports containing analytical results from effluent and groundwater monitoring.

Quarterly Monitoring Results, Mortandad Canyon Alluvial Groundwater Wells

Table 1.0 presents the analytical results from sampling conducted at three Mortandad Canyon alluvial wells, MCO-3, MCO-6, and MCO-7, during the fourth quarter of 2010. No sample was collected from alluvial well MCO-4B because the well was dry. Samples were submitted to General Engineering Laboratories (GEL), Charleston, SC, for analysis. All of the analytical results were below the New Mexico Water Quality Control Commission (NMWQCC) 3103 standards for nitrate-nitrogen (NO_3-N), fluoride (F), and total dissolved solids (TDS).

Analytical results from the sampling of intermediate and regional aquifer wells in Mortandad Canyon can be accessed online at the Risk Analysis, Communication, Evaluation and Reduction (RACER) Web site (www.racernm.com).

RLWTF Effluent Monitoring Results

Table 2.0 presents the analytical results from the weekly composite sampling of RLWTF effluent discharged through National Pollutant Discharge Elimination System (NPDES) Outfall 051 to Mortandad Canyon. The final weekly composite (FWC) samples are flow-proportioned composite samples prepared from each tank of effluent discharged to Mortandad Canyon during a 7-day period. Samples are submitted to GEL for analysis. In addition, the TA-50 RLWTF analytical laboratory analyzes duplicate FWC samples as part of the Laboratory's compliance monitoring program. No RLWTF effluent was discharged through NPDES Outfall 051 to Mortandad Canyon during October, November, and December 2010 with the exception of two effluent tanks during the weeks of November 22nd and 29th. All of the FWC results presented in Table 2.0 are below the NMWQCC 3103 standards for NO_3-N, F, and TDS.

Table 3.0 presents the final monthly composite (FMC) sample results for NO_3-N, ClO_4, F, and TDS for November 2010. As explained previously, no effluent was discharged during October and December 2010. The FMC samples are flow-proportioned composite samples prepared from each tank of effluent generated by the RLWTF during the month. Analysis is by the TA-50 RLWTF analytical laboratory. All of the analytical results presented in Table 3.0 were below the NMWQCC 3103 standards for NO_3-N, F, and TDS.

Please contact me at (505) 667-7969 if you would like additional information regarding this quarterly report.

Sincerely,

Robert Beers
Water Quality & RCRA Group (ENV-RCRA)

BB/lm

Enclosures: a/s

Cy: Hai Shen, LASO-EO, A316
Gene Turner, LASO-EO, A316
Steve Yanicak, LASO-GOV, M894
Michael Mallory, PADOPS, A102
J. Chris Cantwell, ADESHQ, K491
Randy Johnson, ENV-EAQ, E500
Mike Saladen, ENV-RCRA, K490, (E-File)
Robert C. Mason, TA55-DO, E583
Hugh McGovern, TA-55 RLW, E518
Pete Worland, TA-55-RLW, E518
ENV-RCRA File, K490
IRM-RMMSO, A150

Table 1.0. Mortandad Canyon Alluvial Well Sampling, 4th Quarter, 2010.

Sampling Location	Sample Field Prep (F/UF)[1]	Sample Date	Perchlorate (ug/L)	NO_3+NO_2-N (mg/L)	TKN[2] (mg/L)	NH3-N (mg/L)	TDS (mg/L)	F (mg/L)
MCO-4B	The well was dry, no sample was collected.							
MCO-3	F	11/17/10	0.598	0.50J	<0.1	<0.050	255	0.26
MCO-6	F	11/16/10	5.53	0.47	<0.1	0.054	336	0.85
MCO-7	F	11/16/10	7.82	0.96	<0.1	0.074	366	0.97
NM WQCC 3103 Ground Water Standards			*NA*[2]	*10 mg/L*[3]	*NA*[2]	*NA*[2]	*1000 mg/L*	*1.6 mg/L*

Notes:

[1]All samples filtered with the exception of TKN.

[2]NA means that there is no NM WQCC 3103 standard for this analyte.

[3]The NM WQCC 3103 Ground Water Standard is for NO_3-N.

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

Table 2.0. RLWTF Final Weekly Composite (FWC) Effluent Sampling, 4th Quarter, 2010.

			Analysis by RLWTF[1]		Analysis by General Engineering Laboratories, Inc.			
Monitoring Period	Sample Composite Date	Sample ID#	NO_3-N (mg/L)	NO_2-N (mg/L)	NO_3+NO_2-N (mg/L)	Perchlorate (ug/L)	Fluoride (mg/L)	TDS (mg/L)
October	10/4/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	10/11/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	10/18/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	10/25/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
November	11/1/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	11/8/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	11/15/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	11/22/10	50FWC-10-9958	1.1	0.60	1.58	<0.2	<0.1	93HJ-
	11/29/10	50FWC-10-9959	0.84	0.64	1.61	<0.2	<0.1	89
December	12/6/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	12/13/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	12/20/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
	12/27/10	No Discharge[2]	-----	-----	-----	-----	-----	-----
4th Quarter 2010 Averages			**0.97**	**0.62**	**1.60**	**<0.2**	**<0.1**	**91**
NMWQCC 3103 Groundwater Standards			***10 mg/L***	***NA[4]***	***10 mg/L[3]***	***NA[4]***	***1.6 mg/L***	***1000 mg/L***

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]Treated effluent was evaporated on-site with no discharge to NPDES Outfall 001 during the 7-day period preceding the composite date.

[3]The NMWQCC Regulation 3103 Ground Water Standard is for nitrate (NO_3-N).

[4]NA means that there is no NMWQCC 3103 standard for this analyte.

H means that the analytical hold time was exceeded.

J means the reported value is greater than the Method Detection Limit (MDL) but less than the Reporting Limit (RL).

J- means that the reported value is expected to be more uncertain than usual with a potential negative bias.

J+ means that the reported value is expected to be more uncertain than usual with a potential positive bias.

Table 3.0. RLWTF Final Monthly Composite (FMC) Effluent Sampling, 4th Quarter, 2010.

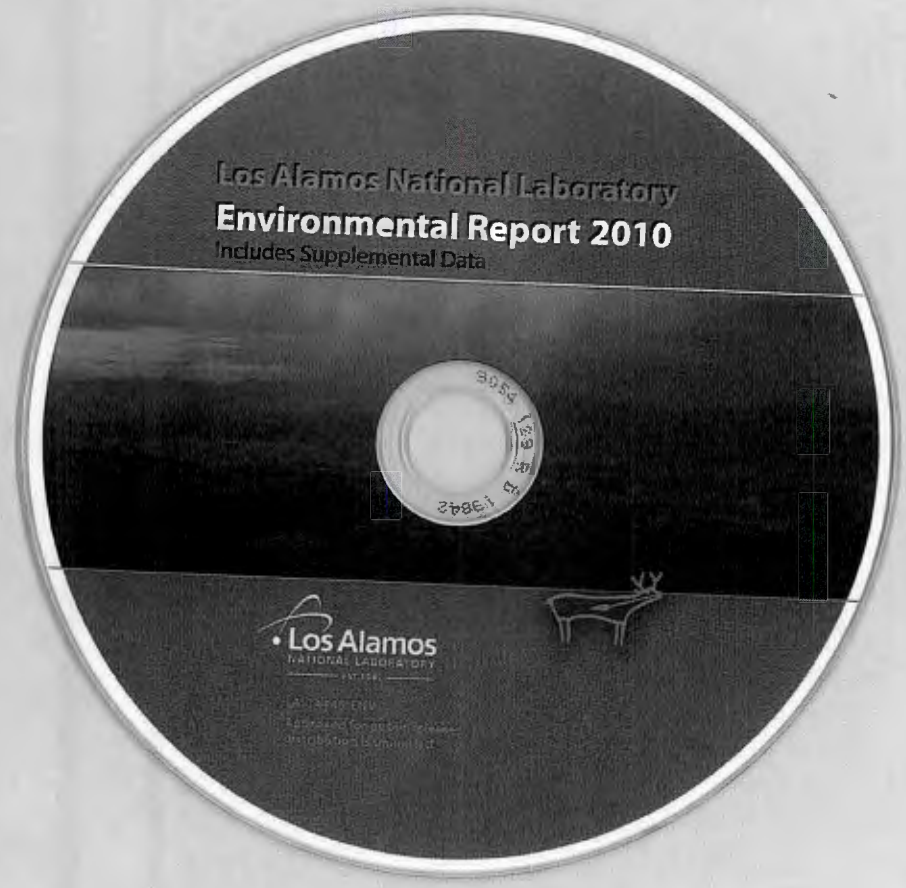
Monitoring Period	RLWTF FMC Results[1]			
	NO_3-N (mg/L)	Perchlorate by IC[2] (ug/L)	TDS (mg/L)	F (mg/L)
October 2010	---- No Discharges ----			
November 2010	1.1	<1	60	<0.01
December 2010	---- No Discharges ----			
NMWQCC 3103 Groundwater Standards	***10 mg/L***	***NA[3]***	***1000 mg/L***	***1.6 mg/L***

Notes:

[1]Analysis by the TA-50 Radioactive Liquid Waste Treatment Facility's analytical laboratory.

[2]IC means EPA Method 314.0, perchlorate analysis by Ion Chromatography.

[3]NA means that there is no NM WQCC 3103 standard for this analyte.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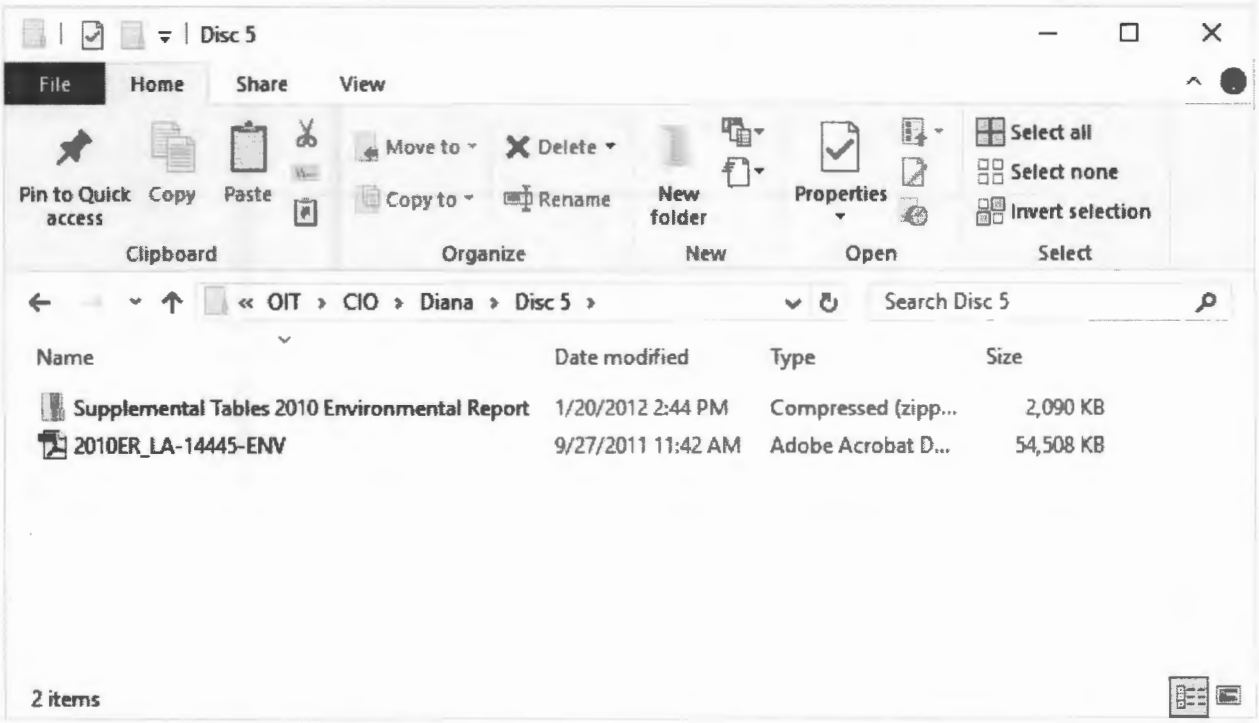
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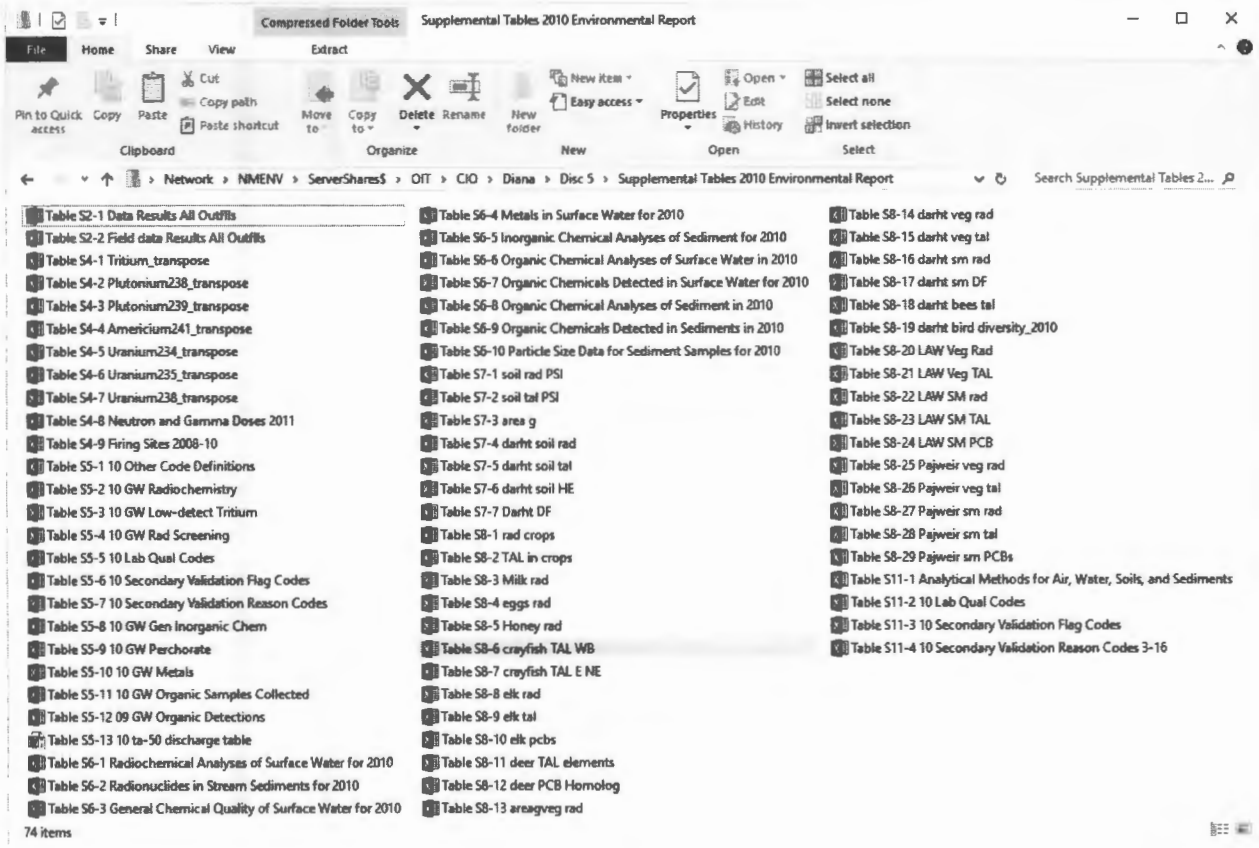
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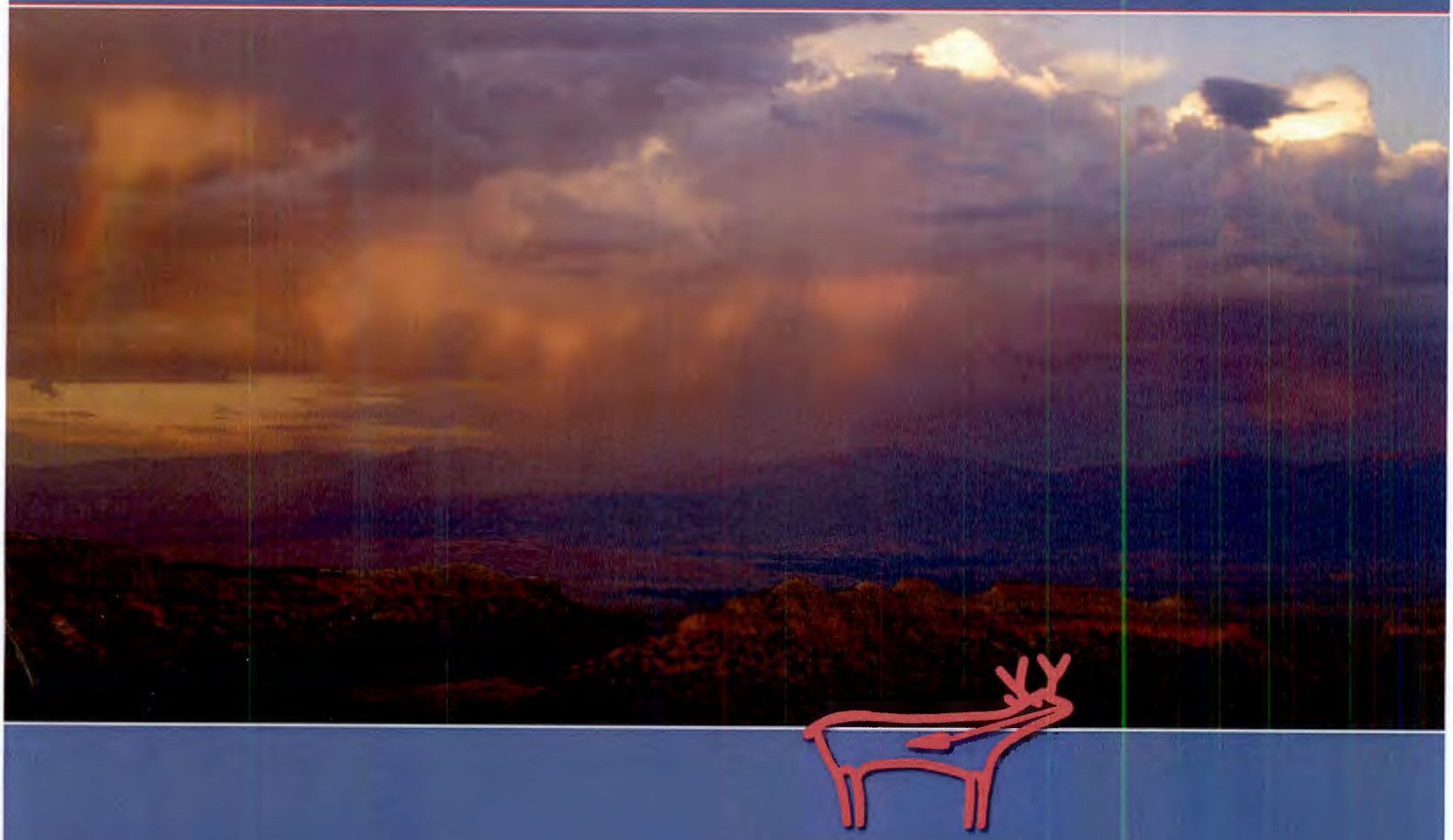

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Los Alamos National Laboratory Governing Policy for Environment

- We approach our work as responsible stewards of our environment to achieve our mission.
- We prevent pollution by identifying and minimizing environmental risk.
- We set quantifiable objectives, monitor progress and compliance, and minimize consequences to the environment, stemming from our past, present, and future operations.
- We do not compromise the environment for personal, programmatic, or operational reasons.

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Waste and Environmental Services Division
505-667-0808

Environmental Data and Analysis Group
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Environmental Programs Directorate
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Corrective Actions Program
505-665-3388

Engineering & Technology
505-667-3460

TA-21 Closure Project
505-665-4897

Environmental Protection Division
505-667-2211

Environmental Stewardship Group
505-665-8855

Water Quality and RCRA Group
505-665-0666

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Los Alamos National Laboratory Environmental Report 2010 reports are prepared annually by the Los Alamos National Laboratory (the Laboratory) environmental organizations, as required by US Department of Energy Order 450.1, *Environmental Protection Program*, and US Department of Energy Order 231.1A, *Environment, Safety, and Health Reporting*.

These annual reports summarize environmental data that are used to determine compliance with applicable federal, state, and local environmental laws and regulations, executive orders, and departmental policies. Additional data, beyond the minimum required, are also gathered and reported as part of the Laboratory's efforts to ensure public safety and to monitor environmental quality at and near the Laboratory.

Chapter 1 provides an overview of the LANL site and the Laboratory's major environmental programs. Chapter 2 reports the Laboratory's compliance status for 2010. Chapter 3 provides a summary of the maximum radiological dose the public and biota populations could have potentially received from Laboratory operations and discusses chemical exposures. The environmental surveillance and monitoring data are organized by environmental media (air in Chapter 4; water and sediments in Chapters 5 and 6; soils in Chapter 7; foodstuffs and biota in Chapter 8; and subsurface soil vapor in Chapter 10) in a format to meet the needs of a general and scientific audience. Chapter 9 provides a summary of the status of environmental restoration work around LANL. Chapter 11 provides an overview of the performance of the analytical chemistry laboratories that provide sample analyses to the Laboratory. Chapter 12 provides an overview of the health of the Rio Grande, monitoring results from the Valles Caldera and Jemez Mountains, and explains the actions taken to reduce environmental risks at the Laboratory. Appendix A explains the standards for environmental contaminants, Appendix B explains the units of measurements used in this report, Appendix C describes the Laboratory's technical areas and their associated programs, and Appendix D provides web links to more information. Appendix E provides a glossary of terms, Appendix F provides acronyms and abbreviations. Appendix G provides Elemental & Chemical Nomenclature, and Appendix H provides errata for the 2009 report.

In printed copies of this report, we've also enclosed a disk with a copy of the full report in Adobe Acrobat portable document format (PDF) and detailed supplemental tables of data from 2010 in Microsoft Excel format. These files are also available for download from the web.

An on-line web survey for providing comments, suggestions, and other input on the report is available at the web address given below. Inquiries or comments regarding these annual reports may be directed to

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http://www.lanl.gov/environment/all/esr.shtml

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LANL ENVIRONMENTAL REPORT 2010

This year's report incorporates some changes to the format and content, including a change in the report name, a change in the report's organization, and a summary of two major 2011 events, the Japanese Fukushima reactor accident and the Las Conchas forest fire.

CHANGE OF REPORT NAME

Starting this year, we have changed the report name to "Los Alamos National Laboratory Environmental Report 2010." The Laboratory has published a summary report of environmental monitoring since 1969. In 1973, the report title became "Environmental Surveillance at Los Alamos during 1973," and the report maintained this title convention through the 2009 report. The term surveillance was used to encompass the full range of environmental sampling and monitoring activities.

The new name more closely aligns the report's name and purpose with the DOE Order 231.1 requirement for an annual site environmental report. The report will continue to encompass the full range of environmental sampling and monitoring activities. In addition, as the Laboratory's environmental restoration program moves into the corrective measures phase, the report will evolve to provide a more integrated look at the long-term monitoring conducted to assure that corrective measures continue to protect the environment.

REPORT ORGANIZATION

Three major changes are implemented in the 2010 report organization:

- Consolidation of DOE Order compliance performance in Chapter 2,
- Presentation of soil gas monitoring information in Chapter 10, and
- Consolidation of analytical chemistry laboratory performance in Chapter 11.

The consolidation of DOE Order compliance performance in Chapter 2 allows the reader to find a comprehensive summary of DOE Order compliance in one location.

Soil gas monitoring has been conducted at Technical Area (TA)-54 and TA-21 for a number of years. Chapter 10 presents this contaminant pathway data, which is also used in developing the Consent Order corrective measures for these TAs.

In previous reports, analytical chemistry laboratory performance information was reported in each media sampling chapter, giving the appearance that LANL has many individual analytical laboratory programs. In fact, the Laboratory has one program for procuring analytical laboratory services, verifying and validating analytical data, and assessing analytical laboratory performance. Bringing each media together into Chapter 11 allows the reader to understand the entire program.

2011 EVENTS SUMMARIZED

The Laboratory performed sampling and monitoring of two significant environmental events during the first half of 2011: Japan's Fukushima reactor accident in March and the Santa Fe National Forest Las Conchas forest fire in June and July. Preliminary environmental monitoring and assessment information from these events are presented in the 2010 report. A more detailed discussion will be presented in the 2011 Environmental Report.

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Introduction

Los Alamos National Laboratory (LANL or the Laboratory) is located in Los Alamos County in north-central New Mexico (NM), approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure ES-1). The 36-square-mile Laboratory is situated on the Pajarito Plateau, a series of mesas separated by deep east-to-west-oriented canyons cut by stream channels. Mesa tops range in elevation from approximately 7,800 feet on the flanks of the Jemez Mountains to about 6,200 feet above the Rio Grande at White Rock Canyon. Most Laboratory and Los Alamos County developments are confined to the mesa tops. With the exception of the towns of Los Alamos and White Rock, the surrounding land is largely undeveloped, and large tracts of land north, west, and south of the Laboratory site are held by the Santa Fe National Forest, the US Bureau of Land Management, Bandelier National Monument, the US General Services Administration, and Los Alamos County. In addition, Pueblo de San Ildefonso borders the Laboratory to the east.

The mission of LANL is to develop and apply science and technology to (1) ensure the safety and reliability of the US nuclear deterrent, (2) reduce global threats, and (3) solve other emerging national security challenges. Meeting this diverse mission requires excellence in science and technology to solve multiple national and international challenges. Inseparable from the Laboratory's focus on excellence in science and technology is its commitment to environmental stewardship and full compliance with environmental protection laws. Part of LANL's commitment is to report on its environmental performance, and as such, this report does the following

- Characterizes LANL's environmental management, including effluent releases, environmental monitoring, and estimated radiological doses to the public and the environment,
- Summarizes environmental occurrences and responses,
- Confirms compliance with environmental standards and requirements, and
- Highlights significant programs and efforts.

Environmental Monitoring

The Laboratory monitors emissions, effluents, and environmental media to meet environmental compliance requirements, determine actions to protect the environment, and monitor the long term health of the local environment. We collect data from the surrounding region to establish baseline environmental conditions in areas not influenced by LANL operations. LANL monitoring includes the radiological ambient air sampling network (AIRNET); groundwater, soil, foodstuffs, and biota (plants and animals) sampling as far away as Dixon, NM (40 direct miles away); and sediment monitoring along the Rio Grande as far upriver as Abiquiu Reservoir and downriver as Cochiti Reservoir. We also collect data on site and at the Laboratory perimeter to determine if operations are impacting LANL or neighboring properties (e.g., Pueblo and Los Alamos County lands). Perimeter monitoring also measures the highest potential impact to the public. During 2010, the Laboratory collected environmental samples from more than 4,000 locations and received more than 1.4 million analyses or measurements on these samples.

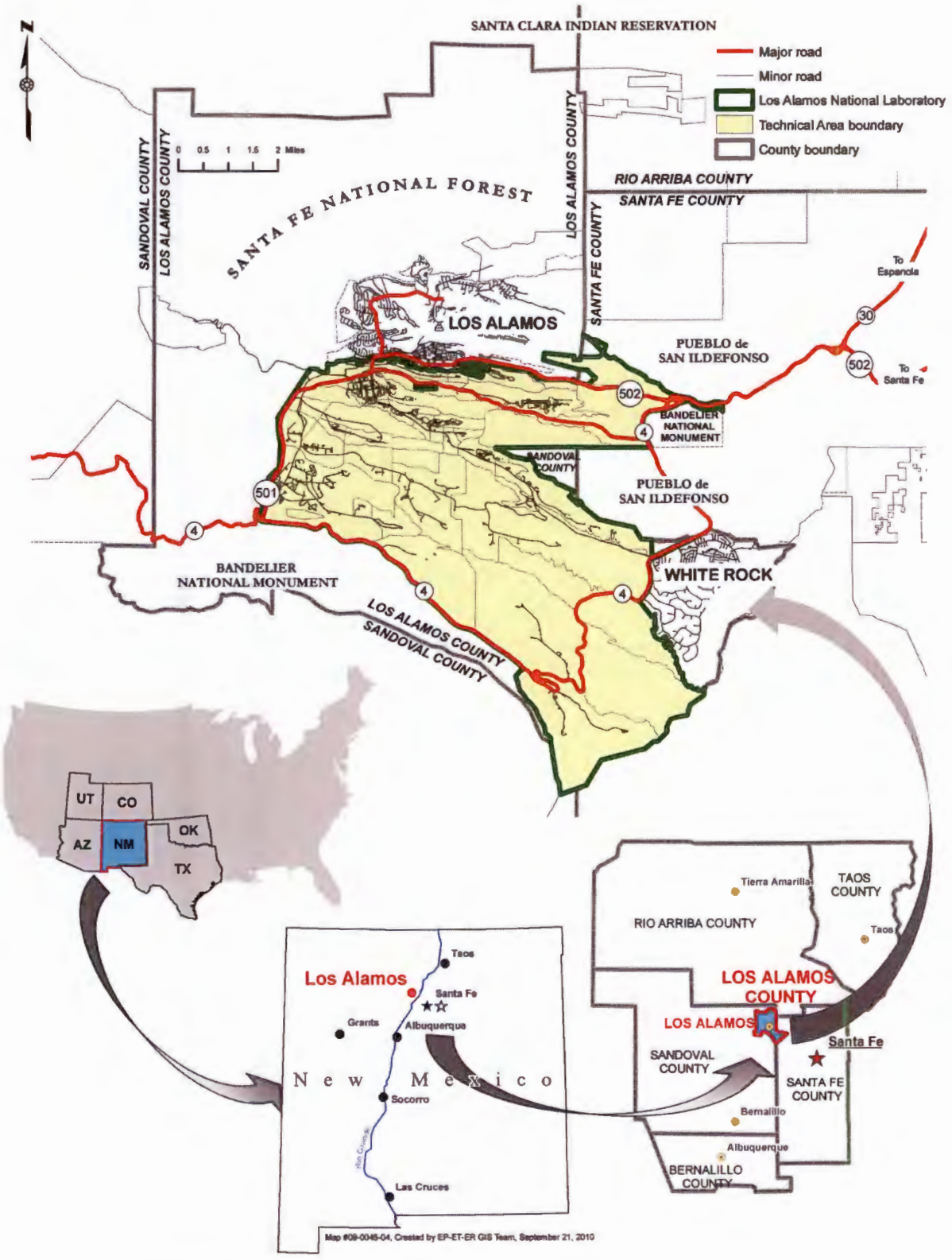

Figure ES-1 **Regional location of Los Alamos National Laboratory**

Environmental Protection Programs

The Department of Energy (DOE) has established a series of Orders directing each DOE site to implement sound stewardship practices that are protective of natural and cultural resources. These Orders require the implementation of an Environmental Management System (EMS), a Site Sustainability Plan, Radiation Protection of the Public, and Radioactive Waste Management.

As part of its commitment to protect the environment and improve its environmental performance, LANL continued the implementation of its EMS pursuant to DOE Order 450.1A and the international standard ISO14000-2004. The EMS is a continuous cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental missions and goals. Three audits of the LANL EMS occurred in 2010; no significant corrective actions were identified.

- LANL met six high-level environmental stewardship goals
- LANL met six of seven waste reduction goals.
- LANL won six NNSA Pollution Prevention Awards
- LANL published the first Site Sustainability Plan for energy, water, and transportation

LANL met six high-level environmental stewardship commitments during fiscal year (FY) 10.

- Increase public outreach events for environmental projects
- Maintain 98% and higher successful environmental program self-inspections
- Ensure compliant implementation of waste and air quality permits
- Improve transuranic (TRU) waste shipments to the Waste Isolation Pilot Plant (WIPP)
- Complete funded New Mexico Environment Department's (NMED's) Compliance Order on Consent (Consent Order) deliverables
- Implement a program for assuring that wastes are managed prior to employee departure from LANL and a chemical pharmacy that allows chemical users to purchase the exact amount of chemicals required to reduce chemical waste generation.

LANL FY10 waste generation was reduced over FY09 in all waste categories with the exception of routine hazardous waste.

The Pollution Prevention Program implements waste minimization, pollution prevention, sustainable design, and conservation projects to enhance operational efficiency, reduce life-cycle costs of programs or projects, and reduce risk to the environment. Reducing waste directly contributes to the efficient performance of the Laboratory's national security, energy, and science missions. LANL was awarded six NNSA awards in 2010:

- Video Teleconferencing Cuts Travel Costs and Reduces Greenhouse Gas Emissions
- Sustainable Projects for a Sustainable Future
- Sigma Electroplating Discharge Reduction
- Integration of Site Sustainability Plan Goals and LANL's EMS
- New Plutonium Removal Technique Means Less Waste
- LANL Algal Biofuels Consortium Development Team

LANL published the first Site Sustainability Plan in 2010. This plan sets energy, transportation, and water stewardship goals to assure that LANL can maintain its mission activities in a sustainable manner. During FY10, the Laboratory met milestones for the Sanitary Effluent Reclamation Facility (SERF) expansion, purchased renewable energy credits, reduced fleet petroleum consumption, and installed water and electricity metering at individual buildings.

The Laboratory met all DOE public and biota dose limits, As Low As Reasonably Achievable (ALARA) assessments, and clearance of real and personal property requirements during 2010.

DOE approved Laboratory operations to generate, treat, or dispose of radioactive waste during 2010. LANL generated, processed, and disposed of approximately 25,000 m^3 of low-level waste during 2010; approximately 10% was buried at Technical Area (TA)-54, Area G, and the remaining wastes were shipped off site for disposal. The Laboratory shipped 723 m^3 of TRU waste to WIPP during calendar year 2010 (Figure ES-2). DOE and LANL have set 2015 as the goal to complete the shipment of all stored TRU waste from Los Alamos to WIPP.

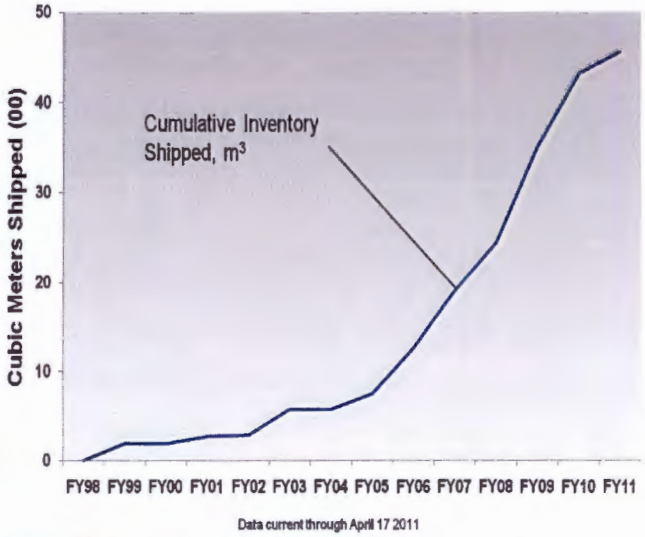

Figure ES-2 TRU waste shipping profile

Compliance with State and Federal Regulations

The Environmental Protection Agency (EPA) and NMED regulate Laboratory operations under various environmental statutes (e.g. Clean Air Act, Clean Water Act, etc.) through operating permits, construction approvals, and the DOE/NMED Consent Order. These permits are designed by the regulatory agencies to allow Laboratory operations to be conducted while assuring that the public, air, land, soils, water, and biota are protected. The Laboratory's compliance performance is an assessment of our protection of the environment. Table ES-1 presents a summary of the Laboratory's status in regard to environmental statutes and regulations for 2010.

- NMED renewed the LANL RCRA Hazardous Waste Facility Permit.
- EPA issued the Individual Permit for storm water discharges from Solid Waste Management Units (SWMUS) and Areas of Concern (AOCs).

NMED renewed the Laboratory's RCRA Hazardous Waste Facility Permit in November 2010 and the EPA issued the Individual Permit for storm water discharges from Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs). The Laboratory submitted Groundwater Discharge Permit applications to NMED for the TA-46 Sanitary Waste Water System and the Domestic Septic Tank/Leachfield Systems in 2010.

Compliance Order on Consent

The March 2005 Consent Order between LANL, DOE, and NMED is the principal regulatory driver for LANL's environmental restoration programs. The Consent Order contains requirements for investigation and cleanup of SWMUs and AOCs at the Laboratory. The major activities conducted by the Laboratory included investigations and cleanup actions. All major deliverables of the Consent Order were met by the Laboratory during 2010. The projects wrote and/or revised 22 work plans and 37 reports and submitted them to NMED. A total of 220 documents or reports were submitted to NMED. LANL installed two groundwater monitoring wells (with three screens) in the perched/intermediate aquifer and 12 groundwater monitoring wells (with 20 screens) in the regional aquifer to support Consent Order characterization and remediation activities.

- The Consent Order governs the Laboratory's environmental restoration. It specifies actions that the Laboratory must complete to characterize and remediate contaminated sites.
- The Laboratory met all 2010 Consent Order deliverables.

Table ES-1
Environmental Permits or Approvals under which the Laboratory Operated during 2010

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
RCRA[a] Permit	Hazardous Waste Facility Permit: Permitted hazardous waste storage units: TAs-3, -50, -54, and -55	November 1989, renewed November 2010	December 2020	NMED[b]
	40 CFR 265 Standards: Interim Status hazardous waste storage and treatment facilities: TAs-14, -16, -36, -39, and -54. Permit applications to be submitted to NMED.	Post-1980 hazardous waste units; Post-1991 mixed waste units	Inclusion in Hazardous Waste Facility Permit or closure	NMED
Consent Order	Legacy and contaminated waste site investigations, corrective actions, and monitoring; revised to establish new notification and reporting requirements for groundwater monitoring data	March 1, 2005; revised June 18, 2008	September 20, 2015	NMED
CWA[d]/NPDES[e]	Outfall permit for the discharge of industrial and sanitary liquid effluents	August 1, 2007	July 31, 2012	EPA[f]
	MSGP[g] for the discharge of storm water from industrial activities	September 29, 2008	September 29, 2013	EPA
	NPDES Individual Permit for storm water discharges from SWMUs and AOCs	November 1, 2010	March 31, 2014	EPA
	Construction General Permits (17) for the discharge of storm water from construction activities	June 30, 2008	July 31, 2011 (proposed extension until January 31, 2012)	EPA
CWA Sections 404/401	COE[h] Nationwide Permits (four)	NA	NA	COE/NMED
Groundwater Discharge Permit , TA-46 SWWS[i] Plant	Discharge to groundwater	July 20, 1992 Renewed January 7, 1998 Renewal application submitted on July 2, 2010	January 7, 2003*	NMED
Groundwater Discharge Plan, TA-50, Radioactive Liquid Waste Treatment Facility	Discharge to groundwater	Submitted August 20, 1996	Approval pending	NMED
Groundwater Discharge Plan, Domestic Septic Tank/Leachfield Systems	Discharge to groundwater	Submitted April 27, 2006 Application resubmitted on June 25, 2010	Approval pending	NMED

Table ES-1 (continued)

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
Air Quality Operating Permit (20.2.70 NMAC[j])	LANL air emissions Renewal 1	August 7, 2009	August 7, 2014	NMED
Air Quality Construction Permits (20.2.72 NMAC)	Portable rock crusher	June 16, 1999	None	NMED
	Retired and removed from operating permit	June 15, 2006		
	Permit number will remain active to track exempt sources at LANL			
	TA-3 Power Plant	September 27, 2000	None	NMED
	Permit revision	November 26, 2003		
	Permit modification 1, Revision 1	July 30, 2004		
	Permit modification 1, Revision 2	March 5, 2009		
	1600-kW generator at TA-33	October 10, 2002	None	NMED
	Permit revision	May 28, 2008	None	NMED
	Two 20-kW generators and one 225-kW generator at TA-33	August 8, 2007	None	NMED
	Asphalt Plant at TA-60	October 29, 2002	None	NMED
	Permit revision	September 12, 2006	None	NMED
	Data disintegrator	October 22, 2003	None	NMED
	Chemistry and Metallurgy Research Replacement (CMRR), Radiological Laboratory, Utility, Office Building (RLUOB)	September 16, 2005	None	NMED
Air Quality (NESHAP[k])	Beryllium machining at TA-3-141	October 30, 1998	None	NMED
	Beryllium machining at TA-35-213	December 26, 1985	None	NMED
	Beryllium machining at TA-55-4	February 11, 2000	None	NMED

[a] Resource Conservation and Recovery Act
[b] New Mexico Environment Department
[c] Hazardous and Solid Waste Amendments
[d] Clean Water Act
[e] National Pollutant Discharge Elimination System
[f] Environmental Protection Agency
[g] Multi-Sector General Permit
[h] US Army Corps of Engineers
[i] Sanitary Wastewater Systems Plant
[j] New Mexico Administrative Code
[k] National Emission Standards for Hazardous Air Pollutants

* Permit was administratively continued though 2010

The status of Consent Order investigations and remediations is presented in Figure ES-3. For those aggregate areas presented as complete, all investigation activities have been completed, and no additional field sampling campaigns, investigation reports, or corrective measures activities are anticipated. Aggregate areas listed as in progress include sites or areas where field sampling campaigns or corrective measure activities are currently being conducted, or investigation reports are being prepared or finalized. Aggregate areas listed as pending include sites or areas where work plan preparation and field sampling campaigns have not yet started. As of December 2010, scheduled investigation activities are complete at six aggregate areas, are in progress at 21 aggregate areas, and are pending at two aggregate areas. NMED granted Certificates of Completion for 34 SWMUs and AOCs in 2010.

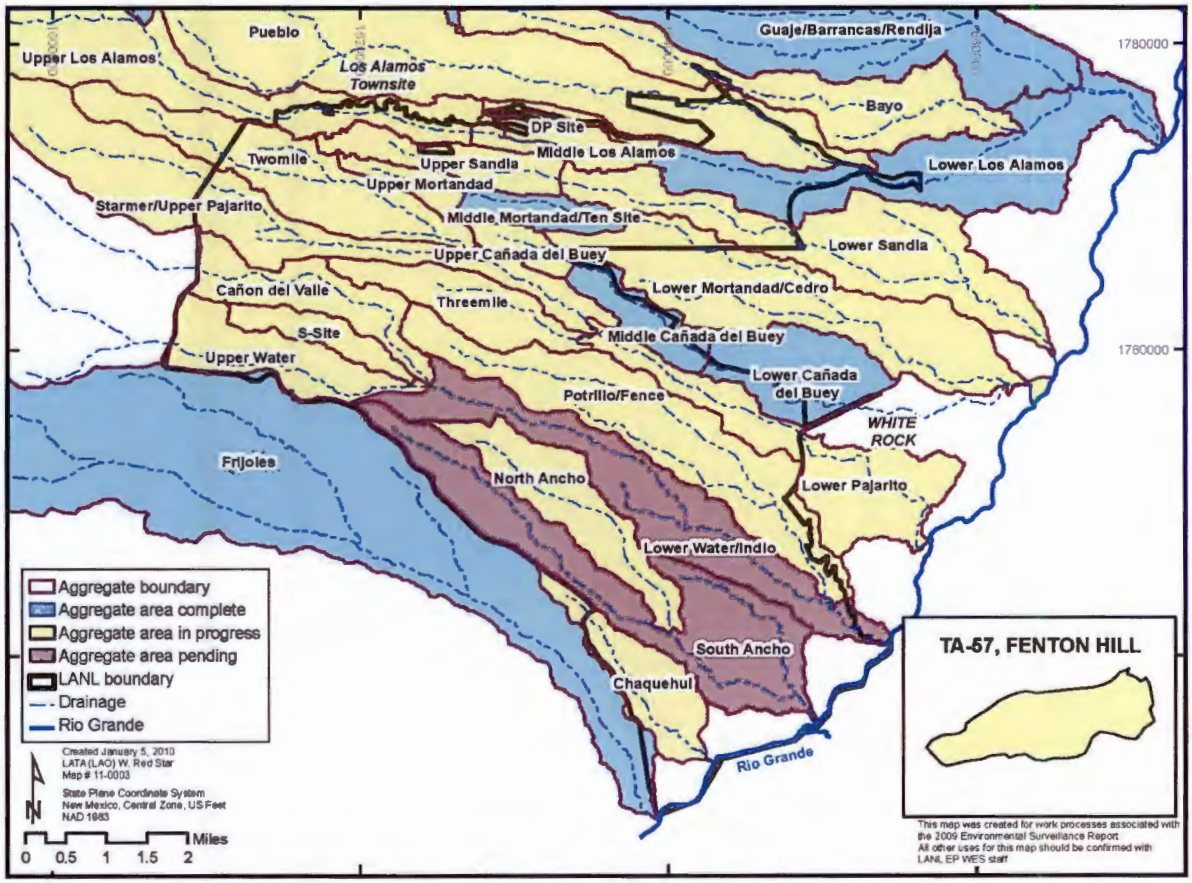

Figure ES-3 **Aggregate areas as defined for the NMED Consent Order and their status. Status is shown as aggregrate area activities complete, activities in progress, or activities pending.**

In November 2010, EPA Region 6 issued an Individual Permit (IP) that authorizes discharges of storm water from certain Potential Release Sites (PRSs), SWMUs, and AOCs at the Laboratory. The sites listed in the IP are associated with historical LANL operations dating back to the Manhattan Project era of the 1940s. The IP lists 405 permitted sites that must be managed to prevent the transport of contaminants off site via storm water runoff.

Site-specific storm water control measures that reflect best industry practice considering their technological availability, economic achievability and practicability are required for each of the 405 permitted sites to minimize or eliminate discharges of pollutants. These controls are referred to as Best Management Practices (BMPs).

The local storm water drainage around sites (called Site Monitoring Areas [SMAs]) has been hydrologically analyzed, and sampling locations have been identified to most effectively sample runoff from sites.

Stormwater is monitored from these SMAs to determine the effectiveness of the controls. When target action levels (TALs) which are based on New Mexico water quality standards, are exceeded, corrective actions are required. In 2010, the Laboratory completed the following tasks:

- Development of a Site Discharge Pollution Prevention Plan (SDPPP) for SWMU/AOCs that describes three main objectives: identification of pollutant sources, description of control measures and monitoring that determines the effectiveness of controls at all regulated SWMU/AOCs
- Fieldwork:
  - ❖ Completed more than 1,000 rain event inspections conducted on all 250 SMAs
  - ❖ Conducted BMP maintenance during inspection at 140 SMAs
  - ❖ Conducted BMP installation at 205 SMAs
  - ❖ Maintained 45 gauge stations for storm event sampling in support of environmental surveillance and Los Alamos/Pueblo canyon monitoring
  - ❖ Decommissioned/removed sampler and equipment at 45 previous Federal Facilities Compliance Agreement (FFCA) locations

Unplanned Releases

There were no unplanned airborne releases and no unplanned releases of radioactive liquids from LANL in 2010. There were 23 spills or releases of non-radioactive liquids, most of which were potable water, hydraulic fluid, or domestic wastewater. Other liquids included re-use water, steam condensate, and sanitary wastewater. LANL reported all liquid releases to NMED; the releases will be administratively closed upon final inspection.

Radiological Dose Assessment

Humans, plants, and animals potentially receive radiation doses from various Laboratory operations (Table ES-2). The DOE dose limits for the public and biota are the mandated criteria that are used to determine whether a measurement represents a potential exposure concern. Figure ES-4 shows doses to the hypothetical maximally exposed individual (MEI) via the air pathway over the last 10 years at an off-site location; this location was at LA Inn South in 2010. The annual dose to the MEI for the airborne pathway was approximately 0.33 mrem, similar to the previous four years, and well under the regulatory limit of 10 mrem (Figure ES-4). During 2010, the population within 80 km of LANL received a collective dose of about 0.22 person-rem, down from 0.57 person-rem in 2009. The doses received in 2010 from LANL operations by an average Los Alamos residence and an average White Rock residence were less than 0.1 mrem at each location. The maximum all-pathways dose, composed almost entirely of direct radiation from waste stored at TA-54, Area G, could result in an exposure of 0.9 mrem per year to a hypothetical individual in the adjacent sacred area of Pueblo de San Ildefonso. Doses were also calculated for members of the public who hike on LANL property or areas previously impacted by LANL effluents: Acid Canyon, Pueblo Canyon, lower Ancho Canyon, and along the Rio Grande. All doses were calculated to be less than 0.1 mrem.

- ❖ Radiation dose in 2010 to the MEI was similar to the very low-level dose calculated in 2009.
- ❖ The location of the hypothetical MEI for airborne radionuclides was determined to be at the LA Inn South in downtown Los Alamos. This location received low levels of radiation from resuspension of contaminated soils in Los Alamos Canyon.

Table ES-2
Sources of Radiological Doses

Source	Recipient	Dose	Location	Trends
Background (includes human-made sources)	Humans	~700 mrem/yr*	Not applicable	Not applicable
Air	Humans	0.33 mrem/yr	LA Inn South in downtown Los Alamos	Similar to very low level in previous four years
Direct radiation	Humans	0.9 mrem/yr	LANL-San Ildefonso boundary	Similar to previous years
Food	Humans	< 0.1 mrem/yr	All sites	Steady
Drinking water	Humans	< 0.1 mrem/yr	All sites	Steady
All	Terrestrial animals	< 0.01 rad/day	All sites	Steady
All	Terrestrial plants	< 0.1 rad/day	All sites	Steady

* Increased from previous years due to new information about average medical doses.

Biota Dose

The DOE biota dose limits are intended to protect populations of plants and animals, especially with respect to preventing the impairment of reproductive capability within the biota population. All radionuclide concentrations in vegetation sampled were far below the plant 0.1 rad/day biota dose screening level (10% of 1 rad/day dose limit), and all radionuclide concentrations in terrestrial animals sampled were far below the terrestrial animal 0.01 rad/day biota dose screening level (10% of 0.1 rad/day dose limit) (Table ES-2).

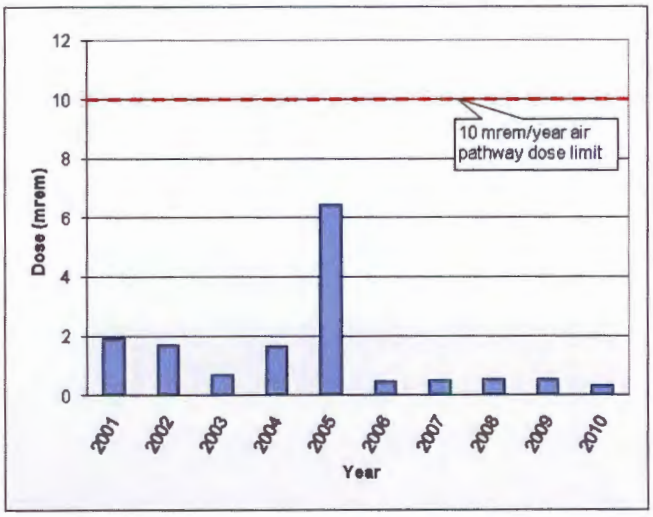

Figure ES-4 **Annual airborne pathway dose (mrem) to the off-site MEI over the past 10 years. The 2010 location of the calculated MEI is at the southern edge of the Los Alamos townsite, on the edge of Los Alamos Canyon.**

Radiological Air Emissions

The Laboratory measures the emissions of radionuclides at the emission sources (building stacks) and categorizes these radioactive stack emissions into one of four types: (1) particulate matter, (2) vaporous activation products, (3) tritium, and (4) gaseous air activation products (radioactive elements created by the Los Alamos Neutron Science Center [LANSCE] particle accelerator beam). In addition, the Laboratory collects air samples at general locations within LANL boundaries, at the LANL perimeter, and regionally to estimate the extent and concentration of radionuclides that may be released from Laboratory operations. These radionuclides include isotopes of plutonium, americium, uranium, and tritium.

LANL monitored 28 stacks for emissions of radioactive material to the ambient air in 2010. Total stack emissions during 2010 were approximately 298 curies (Ci), a decrease from 800 Ci in 2009, Short-lived air activation products from LANSCE stacks and diffuse emissions contributed 211 Ci of the total. Most of the curies from LANSCE are from very short-lived radionuclides that decay significantly before reaching the LANL site boundary. Tritium emissions composed about 87 Ci of the total. Combined airborne emissions of other radionuclides, such as plutonium, uranium, americium, and thorium, were less than 0.000020 Ci and emissions of particulate/vapor activation products were 0.016 Ci.

- As in previous years, there were no detections of radionuclides above background at Pueblo de San Ildefonso and regional locations.
- The largest off-site ambient air measurements of radionuclides occurred adjacent to the environmental restoration work at TA-21, MDA B. These concentrations were less than 9% of the EPA 10-mrem public dose limit.

Radionuclide concentrations in ambient air samples in 2010 were generally comparable with concentrations in prior years. As in past years, the AIRNET system detected slightly elevated radionuclides from known areas of contamination and active environmental remediation sites. At regional locations away from Los Alamos, all air sample measurements were consistent with background levels. Annual mean radionuclide concentrations at all LANL perimeter stations were less than 9% of the EPA dose limit for the public. Measurable amounts of tritium were reported at a number of on-site locations and at perimeter locations. The highest off-site tritium concentration was 0.2% of the EPA public dose limit. The highest on-site tritium measurement (less than 3% of the DOE limit for worker exposure) was made at Area G near disposal shafts containing tritium-contaminated waste. Environmental restoration work at TA-21, material disposal area (MDA) B, produced higher plutonium-239/240 concentrations at perimeter locations and at decontamination and demolition (D&D) locations during 2010 than in previous years. Maximum concentrations were less than 9% of the EPA dose limit for the public. The maximum annual uranium concentrations were from natural uranium at locations with high dust levels from local soil disturbances. There were three detections of enriched uranium (near the environmental restoration work at TA-21, MDA B) and two likely detections of depleted uranium (which has lower radioactivity than natural uranium).

Non-Radiological Air Emissions and Air Quality

LANL demonstrated full compliance with all Clean Air Act monitoring and reporting requirements. Emissions of criteria pollutants (nitrogen oxides, sulfur oxides, carbon monoxide, particulate matter, volatile organic compounds, and hazardous air pollutants) were similar to the previous five years. The TA-3 power plant and boilers located across the Laboratory were the major contributors of nitrogen oxides, carbon monoxide, and particulate matter. Science research and development activities were responsible for most of the volatile organic compound and hazardous air pollutant emissions. In 2010, LANL provided the second greenhouse gas emissions report to NMED, as required by state regulation. The 2009 emissions of carbon dioxide (reported in 2010) were approximately 56,426 metric tons of carbon dioxide equivalents from the combustion of fossil fuels. During 2010, LANL removed more than 5,900 pounds of ozone-depleting refrigerants from the active inventory.

Air monitoring for particles with diameters of 10 micrometers (μm) or less (PM-10) and for particles with diameters of 2.5 μm or less (PM-2.5) continued at one White Rock and one Los Alamos location. The annual averages at both locations for PM-10 was about 13 micrograms (μg)/m^3 and about 6 μg/m^3 for PM-2.5 and were mostly caused by natural dust and wildfire smoke. In addition, the 24-hour maxima for both PM-10 and PM-2.5 at both locations did not exceed 40% and 55% of the respective EPA standards.

The Laboratory analyzed air filter samples from 38 sites for beryllium, aluminum, and calcium. These sites are located near potential beryllium sources at LANL and in nearby communities. All concentrations measured this year were at or below 2% of the National Emission Standards for Hazardous Air Pollutants standard of 10 ng/m^3 and were similar to those of recent years. Past studies closely correlated beryllium concentrations with aluminum concentrations, which indicates that all measurements of beryllium are from naturally occurring beryllium in re-suspended dust. Aluminum and calcium are used to evaluate elevated uranium measurements and no unusual concentrations were measured.

Groundwater Monitoring

Groundwater at the Laboratory occurs as a regional aquifer (water-bearing rock capable of yielding significant quantities of water to wells and springs) at depths ranging from 600 to 1,200 feet and as perched groundwater of limited thickness and horizontal extent, either in canyon alluvium or at intermediate depths of a few hundred feet (Figure ES-5). All water produced by the Los Alamos County water supply system comes from the regional aquifer and meets federal and state drinking water standards. No drinking water is supplied from the alluvial and intermediate groundwater.

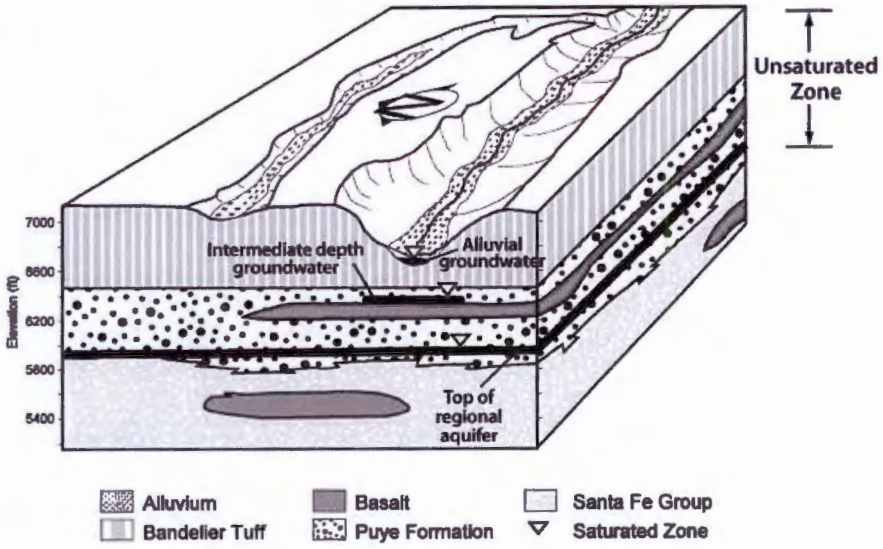

Figure ES-5 Three modes of groundwater occurrence

In 2010, LANL installed two perched intermediate groundwater monitoring wells and 12 regional aquifer monitoring wells. Eight regional wells were installed to monitor for potential contamination from MDAs in TA-54 and to support Corrective Measures Evaluation (CME) reports for MDAs at TA-54. Two regional wells were installed downgradient of TA-49 and MDA-AB. One regional well was installed east of TA-74 to monitor for potential contamination near the municipal production well Otowi 1. One regional well was installed in Mortandad Canyon as part of the ongoing chromium investigation. One intermediate well was installed as a hydrologic test well to support the TA-16 260 Outfall corrective measures implementation.

The Laboratory has changed groundwater quality through liquid effluent disposal, with the greatest impact on alluvial groundwater. Laboratory contaminants have also affected the intermediate perched zones and the regional aquifer. The contaminated alluvial and intermediate perched groundwater bodies are separated from the regional aquifer by hundreds of feet of dry rock, so infiltration from the shallow groundwater occurs slowly. As a result, less contamination reaches the regional aquifer and impacts on the regional aquifer are reduced.

Since the early 1990s, the Laboratory has significantly reduced both the number of industrial outfalls (from 141 to 12 active) and the volume of water released (by 80%). From 1993 to 1997, total estimated average release was 1,300 million (M) gal./yr. Flow decreased to 230 M gal./yr from 1998 to 2005 and was 141 M gal./yr in 2010. Major upgrades to the TA-50 Radioactive Liquid Waste Facility (RLWTF) in 1999 through 2002 brought effluents into compliance with standards for radionuclides and constituents regulated under NPDES and NM groundwater discharge permits. Alluvial groundwater quality in Mortandad Canyon has improved due to these project improvements. The Laboratory uses federal and state drinking water and human health standards as "screening levels" to evaluate concentrations in all groundwater, even though many of these standards only apply to drinking water.

Where Laboratory contaminants are found in deep groundwater, the setting is either a canyon where alluvial groundwater is usually present (because of natural runoff or Laboratory effluents) or a location where large amounts of liquid effluent have been discharged (e.g., Mortandad Canyon and upper Sandia Canyon). During 2010, LANL received and evaluated 153,000 analytical results for groundwater samples from wells and springs. Table ES-3 summarizes contaminants detected in portions of the groundwater system.

Table ES-3
LANL Impacts on Groundwater that Result in
Values Near or Above Regulatory Standards, Screening Levels, or Risk Levels

Chemical	On-Site	Off-Site	Significance	Trends
Chromium	Regional aquifer in Mortandad Canyon, intermediate groundwater in Mortandad and Sandia Canyons	No	Found in regional aquifer above groundwater standards; not affecting drinking water supply wells; source eliminated in 1972.	Increasing in Mortandad intermediate groundwater. Fairly steady over five years at other locations in Mortandad and Sandia canyons' intermediate and regional groundwater
Nitrate	Intermediate groundwater in Pueblo and Mortandad canyons, and regional groundwater in Sandia Canyon and Mortandad Canyon	Pueblo and Los Alamos Canyons	In Pueblo Canyon, may be due to Los Alamos County's Sewage Treatment Plant; otherwise due to past effluent discharges. TA-50 RLWTF effluents have met discharge limits since 2000.	Generally variable in Pueblo, steady in Sandia, decreasing in Mortandad Canyon
Perchlorate	Alluvial, intermediate, and regional groundwater in Mortandad Canyon; intermediate in Los Alamos Canyon; regional aquifer in Pueblo Canyon	Pueblo Canyon	Reflects past outfall discharges that have ceased	Decreasing in Mortandad Canyon alluvial groundwater due to effluent quality improvement; increasing at one location in the regional aquifer in Mortandad Canyon
Dioxane[1,4-]	Intermediate groundwater in Los Alamos, Mortandad, and Pajarito Canyons	No	Not used as drinking water supply; limited in extent	Fairly steady or decreasing concentrations over five years in Los Alamos and Mortandad; seasonal variation in Pajarito
Trichloroethane [1,1,1-]; dichloroethene[1,1-]	Intermediate groundwater near main warehouse	No	Not used as drinking water supply; limited in extent	Seasonally variable, undergoing corrective action
RDX	Alluvial and intermediate groundwater in Cañon de Valle, intermediate groundwater in Pajarito Canyon	No	Not used as drinking water supply; limited in extent	Generally stable, seasonal fluctuations. In the regional aquifer in Pajarito Canyon, values are below standards, but increasing at one location.
Barium	Alluvial groundwater in Cañon de Valle and Pajarito and Mortandad Canyons	No	Not used as drinking water supply; limited in extent	Generally stable in Cañon de Valle, in others likely due to cation-exchange caused by road salt
Boron	Intermediate groundwater in Cañon de Valle	No	Not used as drinking water supply; limited in extent	Generally stable, seasonal fluctuations
Tetrachloroethene, trichloroethene	Alluvial and intermediate groundwater in Cañon de Valle	No	Not used as drinking water supply; limited in extent	Generally stable, seasonal fluctuations
Strontium-90	Alluvial groundwater in Los Alamos and Mortandad canyons	No	Not used as a drinking water supply; has not penetrated to deeper groundwater. TA-50 RLWTF effluent discharges decreased since 2000.	Mainly fixed in location; some decrease due to effluent quality improvement
Fluoride	Alluvial groundwater in Los Alamos and Mortandad canyons. Intermediate groundwater in Pueblo and Los Alamos canyons. Regional aquifer in Pueblo Canyon	Pueblo Canyon	Result of past effluent releases; not affecting drinking water supply wells	In alluvium, slow decrease in concentration due to effluent quality improvement

Table ES-3 (continued)

Chemical	On-Site	Off-Site	Significance	Trends
Chloride, total dissolved solids	Alluvial groundwater in Pueblo, Los Alamos, Sandia, Mortandad, Pajarito canyons, intermediate groundwater near TA-3 main warehouse	Pueblo Canyon	Due to road salt in snowmelt runoff	Values generally highest in winter or spring samples
Fluoride, uranium, nitrate, total dissolved solids	No	Pine Rock Spring, Pueblo de San Ildefonso	Water quality apparently affected by irrigation with sanitary effluent at Overlook Park	Steady over several years

The Laboratory has detected hexavalent chromium in several regional aquifer monitoring wells: at up to 20 times above the NM groundwater standard in Mortandad Canyon and at 50% of the standard in nearby Sandia Canyon. Samples from an intermediate well in Sandia Canyon contain chromium at 10 times the standard and support a path for the chromium contamination from beneath Sandia Canyon southward to the regional aquifer below Mortandad Canyon. The Phase II Investigation Report for Sandia Canyon will be submitted to NMED in 2012; Corrective Measures Evaluations will be developed following NMED approval of this report.

- LANL continues to investigate the hexavalent chromium found at up to 20 times the NM groundwater standard in the regional aquifer under Mortandad Canyon and nearby Sandia Canyon. One new regional well north of the LANL/Pueblo de San Ildefonso boundary measured chromium above the NM groundwater standard.
- One regional well was installed in Mortandad Canyon as part of the ongoing chromium investigation.

Concentrations of chloride above one half of groundwater standards are present in alluvial groundwater in Pueblo, Los Alamos, Sandia, Mortandad, and Pajarito canyons, and in the intermediate groundwater near TA-3 main warehouse. The source is runoff from road salting during the winter months.

Nitrate was up to 60% of the NM groundwater standard in Sandia Canyon and Mortandad Canyon regional aquifer monitoring wells. Intermediate groundwater concentrations of nitrate have decreased below the groundwater standard in Mortandad Canyon. Intermediate groundwater concentrations of nitrate are about 50% of the groundwater standard in Pueblo and Lower Los Alamos canyons.

Perchlorate is detected in most groundwater samples analyzed across northern NM. Naturally occurring perchlorate concentrations range from about 0.1 µg/L to 1.8 µg/L. One unused drinking water well in the Los Alamos area has been impacted by past Laboratory discharges of perchlorate. During 2010, perchlorate concentrations in Well O-1 in Pueblo Canyon dropped to 1.3 µg/L. Perchlorate is above the 4 µg/L Consent Order screening level at a nearby regional aquifer Pueblo Canyon well, but below the EPA interim health advisory of 15 µg/L. Perchlorate concentrations in Mortandad intermediate groundwater wells are above the EPA screening level but have been decreasing over the past five years. Concentrations are also above the Consent Order screening level in the regional aquifer below Mortandad Canyon and have increased over the past four years.

Following well rehabilitation activities in 2008, trichloroethene was detected at 1,147 feet in Pajarito Canyon regional aquifer monitoring well R-20. Trichloroethene detections have continued for five consecutive sample events through the end of 2010. The concentrations have dropped from 60% to less than 20% of the 5 µg/L EPA screening level in 2010. The source has not been determined.

- Beginning in late 2008, trichloroethene was detected in Pajarito Canyon regional aquifer monitoring well R-20 for five consecutive sample events through the end of 2010. The concentrations have decreased from 60% to less than 20% of the 5 µg/L EPA screening level.

The intermediate groundwater in various locations shows localized levels of tritium, organic chemicals (RDX, chlorinated solvents, dioxane[1,4-]), and inorganic chemicals (hexavalent chromium, barium, boron, perchlorate, fluoride, and nitrate) from Laboratory operations. A series of actions began in 2009 to implement corrective measures for high explosives and barium at the 260 Outfall at TA-16, including soil removal and installing a permeable reactive barrier. Monitoring of the effectiveness of corrective measures will be reported in the 2011 environmental report,

The total radionuclide activity from LANL discharges exceeded the dose limit that is applicable to drinking water (4 mrem/yr) only in the alluvial groundwater in portions of Mortandad and DP/Los Alamos canyons. This is mainly due to the presence of strontium-90. Because strontium-90 bonds tightly to sediments, the contamination is not moving downward from the alluvial system. In addition, the TA-50 RLWTF discharges have been less than the 100 mrem/yr DOE public dose limits since the mid 1990s.

The Laboratory monitors springs in White Rock canyon as a principal discharge of regional aquifer groundwater that flows underneath the Laboratory. Naturally occurring levels of uranium, perchlorate, and arsenic are present in some springs. Similar results are found in samples from Pueblo de San Ildefonso wells.

Laboratory surveillance monitoring of the Los Alamos County drinking water system and the Santa Fe Buckman well field demonstrate no impact from LANL contaminants.

Watershed Monitoring

Watersheds that drain LANL property are dry for most of the year. Of the more than 80 miles of watercourse, approximately three miles are naturally perennial and approximately four miles are perennial water created by effluent discharges (most notably in upper Sandia Canyon). Snowmelt runoff originating in the Jemez Mountains can extend across the Laboratory to the Rio Grande. Storm water runoff transporting sediment can leave the Laboratory boundary, but is short-lived. The surface water within the Laboratory is not a source of municipal, industrial, or irrigation water, though wildlife does use the water.

- The overall quality of most surface water within the Los Alamos area is very good.
- Of the more than 100 analytes measured in watersheds across LANL, most are within normal ranges or at concentrations below regulatory standards or risk-based advisory levels.
- Nearly every major watershed, however, shows some effect from Laboratory operations.

None of the streams within the Laboratory boundary average more than one cubic foot per second (cfs) of flow annually. It is unusual for the combined mean daily flow from all LANL canyons to be greater than 10 cfs. The largest flows in 2010 occurred on August 16, with a total estimated mean daily flow of 25 cfs entering the Rio Grande from the Los Alamos Canyon watershed. By comparison, the average daily flow in the Rio Grande at Otowi Bridge on August 16 was 1,060 cfs.

Snowmelt runoff, estimated to be 185 acre-feet (ac-ft), crossed the eastern Laboratory boundary in Los Alamos Canyon continuously in April and May. Total storm water runoff at downstream gages in the canyons leaving the Laboratory is estimated at about 42 ac-ft, approximately 92% of this occurring in Los Alamos and Pueblo Canyons and 7% in Cañada del Buey above White Rock. In addition, approximately 4 acre-feet of effluent released from the Los Alamos County wastewater treatment plant is estimated to have passed the eastern LANL boundary in Pueblo Canyon.

The overall quality of most surface water in the Los Alamos area is good, with low levels of dissolved solutes. Of the more than 100 analytes measured in sediment and surface water within the Laboratory, most are at concentrations far below standards and screening levels. However, nearly every major watershed indicates some effect from Laboratory operations, often for just a few analytes. Table ES-4 lists the locations of Laboratory-impacted surface water. All radionuclide levels are well below applicable guidelines or standards.

Table ES-4
LANL Impacts on Surface Water that Result in Values Near or Above Screening Levels

LANL Impact	On-Site	Off-Site	Significance	Trends
Specific radionuclides (e.g., Pu-239/240, Sr-90, and Cs-137)	No	No	No LANL-derived radionuclides exceeded DOE biota concentration guides or derived concentration guidelines in 2010	Steady
Gross alpha radioactivity	Pueblo, Los Alamos, Sandia, Mortandad, Pajarito, and Water Canyons.	Yes, including canyons not affected by LANL	56% of storm water results from 2010 greater than New Mexico Water Quality Control Commission (NMWQCC) standards. Major source is naturally occurring radioactivity in sediments, except in Mortandad, Pueblo, and Los Alamos Canyons where there are LANL contributions	Steady
Chromium	Mortandad Canyon	No	Single result above standard	Steady
Copper	Mortandad and Sandia Canyons	No	Copper was elevated in 2010 at a few sites that receive runoff from developed areas, including TA-3 and the Los Alamos town site	Steady
Mercury	Los Alamos Canyon	No	Two results above standard	Steady
Zinc	Los Alamos and Sandia Canyons	No	Zinc was above standards at two locations with small drainage areas receiving runoff from paved roads and other developed areas	
Polychlorinated biphenyls (PCBs)	Los Alamos, Mortandad, and Sandia Canyons	Yes, including canyons not affected by LANL	Above standards. PCBs have been released by historic LANL discharges and from runoff from developed areas, including the Los Alamos town site. PCBs are also found in background areas on Santa Fe National Forest land, resulting from regional atmospheric fallout	Steady

Laboratory activities have caused contamination of sediment in several canyons, mainly because of past industrial effluent discharges. These discharges and contaminated sediment also affect the quality of storm water runoff, which carries much of this sediment during short periods of intense flow. In some cases, sediment contamination is present from Laboratory operations conducted more than 50 years ago. However, all measured sediment contaminant levels are below screening levels for recreational uses.

Consistent with previous years, many surface water samples in 2010 had gross alpha radiation greater than the surface water standard of 15 pCi/L for livestock watering. Laboratory impacts are relatively small and the majority of the alpha radiation in surface water on the plateau is due to the decay of naturally occurring isotopes in sediment and soil carried in storm water runoff from uncontaminated areas. This is supported by the generally positive correlation between gross alpha radiation and suspended sediment in non-filtered surface water samples.

Highest concentrations of radionuclides from Laboratory sources were measured in surface water samples from Acid, DP, Los Alamos, and Mortandad canyons downstream from facilities that have released radioactive effluents. Concentrations are highest near historic discharges points and directly above the Los Alamos Canyon weir; concentrations decrease below the Los Alamos Canyon weir. Concentrations were similar to previous years, and no values exceeded the DOE biota concentrations guides.

Eight radionuclides in sediment were detected above background concentrations in 2010: americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, uranium-234, uranium-235, and uranium-238. The maximum values for seven radionuclides were found in the Mortandad Canyon stream channel or in the Los Alamos Canyon sediment retention basins. The highest plutonium-239/240

- The highest concentrations of LANL-derived radionuclides in surface water samples were measured in Acid, DP, Los Alamos, and Mortandad Canyons. All measurements are consistent with previous years and are below screening levels.
- The highest concentrations of radionuclides in sediment were obtained from several locations in Acid, Los Alamos, and Mortandad canyons below present and former outfalls. Results and are consistent with previous years.

result occurred in the Acid Canyon stream channel below historic discharges from TA-1 and TA-45, consistent with previous years.

Seven inorganic chemicals from Laboratory sources, including runoff from developed areas, were detected above NMWQCC standards: arsenic, cadmium, chromium, copper, mercury, selenium, and zinc. The concentrations above standards resulted from 5% or less of the total number samples. Arsenic, cadmium, copper and zinc are only above standards in drainages that receive runoff from developed areas, including TA-3 and the Los Alamos town site.

Metals and other inorganic chemicals are found in sediments at concentrations above typical background levels in 3% to 16% of samples collected during 2010. These constituents partially represent historic discharges from Laboratory outfalls in Los Alamos, Sandia, and Mortandad canyons. Runoff from developed areas at the Laboratory and the Los Alamos town site also contribute to sediment concentrations of cadmium, copper, lead, manganese, selenium, and zinc. Some of the results also represent naturally elevated concentrations.

High explosives were detected in surface water samples from Cañon de Valle, downstream from a high explosive machining facility at TA-16. Concentrations were less than standards. These results are consistent with previous years. Corrective measures were implemented to address this high explosive contamination in 2009 and 2010.

PCBs were detected above the human health and wildlife standards in surface water in Los Alamos, Sandia, Mortandad, and Pajarito canyons. These results are consistent with previous years. PCBs were also measured above the screening level in runoff from developed areas, including the Los Alamos town site, and in background areas, such as Cañada de los Latas north of Los Alamos. The PCBs in background areas are derived from regional atmospheric fallout. In 2010, LANL constructed two grade control structures in DP and Pueblo Canyons to stabilize sediments in place and reduce the transport of PCBs in storm water in Los Alamos and Pueblo Canyons. Monitoring results show no measurable levels of PCBs from LANL in the Rio Grande.

- PCBs are measured in storm water in Los Alamos, Sandia, Mortandad, and Pajarito canyons above standards. PCBs are also detected above standards in runoff from the Los Alamos town site and in background areas, the latter derived from regional atmospheric fallout.
- LANL completed sediment control projects in Pueblo and DP canyons in 2010 to reduce the transport of contaminated sediments.
- The flux of LANL-contaminated sediments into the Rio Grande is small.

We obtained PCB congener data from sediment samples in Laboratory canyons and along the Rio Grande during 2010. Consistent with data from 2009, the mixtures of PCB congeners upriver and downriver from LANL sources are essentially identical, but different than the PCB signature in LANL canyons. These congener data, therefore, show no measureable evidence of LANL contributions to PCBs along the Rio Grande. The PCB data from the Rio Grande were also combined with data on suspended sediment flux to estimate PCB flux in the river above LANL drainages. A preliminary estimate of PCB flux from Los Alamos Canyon is about 0.003 to 0.005 kg/yr, or 1% to 3% of the flux in the Rio Grande.

Soil Monitoring

LANL conducts large-scale soil sampling within and around the perimeter of LANL every three years. The most recent comprehensive soil survey was conducted in 2009. In general, results confirmed the results from previous sampling events and show on-site and perimeter areas contained radionuclides at very low (activity) concentrations, and most were either not detected or below regional statistical reference levels (RSRLs) (equal to the average plus three standard deviations). The few samples with radionuclide concentrations above the RSRLs were collected near known or expected areas of contamination. These samples are below industrial screening levels and thus do not pose a potential unacceptable dose to the public.

We also annually collect soil samples from two locations on the Pueblo de San Ildefonso land downwind of TA-54, Area G. Radionuclides and metals in the 2010 soil samples were below background or near background and were consistent with levels measured in previous years.

- Concentrations of radionuclides in soil samples from TA-54, Area G, are above background and less than industrial screening levels.
- Uranium concentrations in soils at DARHT have decreased since the Laboratory began conducting high explosives test shots in containment vessels in 2007.

The annual samples from around the perimeter of Area G contained above-background concentrations of tritium, americium-241, plutonium-238, and plutonium-239/240 at levels similar to those found in previous years. The highest levels of tritium around Area G were detected at the southern end, and the highest levels of the americium and plutonium were detected around the northern, northeastern, and eastern sections. Although americium-241, plutonium-238, and plutonium-239/240 in soil along the northern, northeastern, and eastern sections of Area G are slightly elevated, all levels are well below residential screening levels used to trigger investigations and decrease rapidly with distance from Area G.

The Laboratory began using containment vessels for high explosives testing in 2007 at the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility. Soil concentrations of uranium-238 near the firing point showed significantly lower levels than measured prior to 2009, and the concentrations are well below industrial screening levels. High explosives were not detected in any samples around DARHT.

In 2008, the NMED collected five soil samples from high-elevation areas (11,099 to 12,476 ft) in New Mexico and Colorado and provided them to LANL to determin the origin of the detected concentrations of cesium and plutonium activity. In the four samples from New Mexico, approximately 75% of the radionuclides were from global fallout from large thermonuclear atmospheric tests conducted by the United States and the former Soviet Union, and 25% of the radionuclides were from regional fallout from much smaller atmospheric nuclear tests conducted at the Nevada Test Site (NTS). No measurable contribution to the plutonium concentration from LANL operations could be detected.

Foodstuffs Monitoring

In 2010, we collected 107 fruit and vegetable samples from on-site, perimeter (including crops irrigated with Rio Grande waters), and regional background locations. In general, all radionuclides in all produce samples were very low and primarily not detected or below the RSRLs. The highest tritium concentrations were found in fruit samples from on-site locations near tritium processing and waste operations at TA-21 and TA-54, Area G. Results were similar in past years.

Goat milk from perimeter and regional locations was sampled and analyzed. No radionuclides that we analyzed for were detected, similar to previous years.

Chicken eggs from perimeter and regional locations were sampled and analyzed. No radionuclides that we analyzed for were detected or similar to RSRLs.

Honey from bee hives located at on-site, perimeter, and regional locations were sampled and analyzed. Radionuclides, with the exception of tritium at TA-54, were either not detected or similar to RSRLs. Tritium in honey from TA-54 is from Area G operations and is not sold or consumed by the public; it is solely maintained as an experimental hive and shows that honey bees can be used as effective environmental monitors.

Crayfish were collected from the Rio Grande in one reach above LANL and in another reach downstream of the confluence of Los Alamos Canyon and the Rio Grande; the goal was to increase the number of samples and analyses available for evaluation. All concentrations of inorganic and metal constituents in the edible portions of the crayfish in the downstream reach were similar to the crayfish sampled in the reach above LANL.

Two elk were killed in vehicle accidents on Laboratory property in 2010; one within TA-36 and another within TA-54. Muscle and bone tissues from the animals were collected for analysis. Uranium concentrations were above RSRLs, but far below screening levels. Other radionuclides, inorganic constituents, and PCBs were either not detected or below RSRLs, in agreement with previous years' results. Two road-kill deer were analyzed: one from TA-46 and one from State Road 4 on Pueblo de San Ildefonso property. All radionuclide concentrations in muscle and bone were similar to those collected from regional background locations.

Biota Monitoring

No wide-scale monitoring of biota was conducted in 2010. Sampling in 2009 and in previous years shows that, in general, all concentrations of radionuclides and inorganic constituents in vegetation are very low and indistinguishable from regional background levels.

At TA-54, Area G, all radionuclides, with the exception of tritium, in native overstory vegetation (branches and needles) were either not detected or below the RSRLs. Tritium is detected above RSRLs in vegetation collected on the south side of TA-54, Area G, near tritium waste disposal shafts. Results are well below screening levels and similar to previous years.

- Vegetation at Area G contained elevated levels of radionuclides near known sources but far below screening levels.
- Biota samples at DARHT contained depleted uranium, but the levels were lower than previous years because of new contained testing measures.
- Biota samples collected above the Los Alamos Canyon Weir contained slightly elevated levels of some radionuclides and PCBs, but the concentrations were far below screening levels.

In vegetation around the DARHT facility, concentrations of radionuclides and metals were either not detected or below RSRLS. Uranium concentrations are lower than in previous years because high explosives testing is now conducted in metal vessels instead of in the open. Concentrations of radionuclides in mice at DARHT were not elevated with the exception of uranium. Uranium concentrations were slightly above baseline levels. The isotopic distribution of uranium isotopes indicates that the type of uranium is depleted uranium, released in historic open-air high explosives tests. Bees contained slightly higher levels of aluminum, copper, vanadium, and lead than RSRLs, but the concentrations were far below ecological screening levels.

Populations, composition, and the diversity of birds collected just west of the DARHT facility in 2010 were compared with samples collected in 1999 (preoperational phase). The purpose of the bird monitoring project is to determine the general ecological stress levels around the vicinity of DARHT that may be associated with facility operations (e.g., noise, disturbance, traffic, etc.). The number of birds, number of bird species, diversity, and evenness (distribution) collected in 2010 are similar to those collected before the start-up of operations at DARHT in 1999. In general, there are a large number of birds and types of birds located in the vicinity of the DARHT complex (see Figure ES-6).

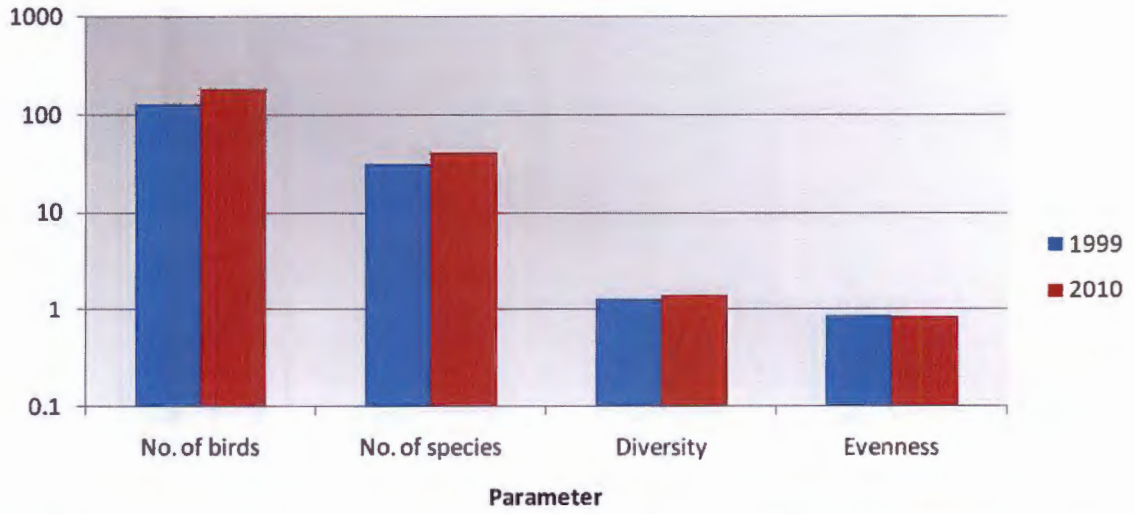

Figure ES-6 Populations, number of species, diversity, and evenness of birds occurring before (1999) and during (2010) operations at DARHT. Note the logarithmic scale on the vertical axis.

Special studies were conducted in 2010 to follow up on two Laboratory projects constructed following the 2000 Cerro Grande fire: Los Alamos Canyon weir and Pajarito Canyon Flood Control Retention Structure (FCRS). The weir was constructed to reduce the transport of contaminated sediments off site and the FCRS was constructed to protect Laboratory facilities downstream from post-fire flash flooding. Native vegetation and field mice were monitored for radionuclides, PCBs, organics, and inorganics. With a few exceptions, all contaminant concentrations in vegetation and field mice were not detected or below RSRLs. For the few contaminants above RSRLs, values were far below screening levels.

Environmental Restoration Program

Corrective actions proposed and/or conducted at LANL in 2010 follow the requirements of the Consent Order. The goal of the investigation efforts is to ensure that waste and contaminants from past operations do not threaten human or environmental health and safety. The investigation activities are designed to characterize solid waste management units (SWMUs), areas of concern (AOCs), consolidated units, aggregate areas, canyons, and watersheds. The characterization activities conducted include surface and subsurface sampling, drilling boreholes, geophysical studies, and installation of monitoring wells. Corrective action activities performed included the removal of structures (e.g., buildings, septic systems, sumps, and drain lines), excavation of contaminated media, and confirmatory sampling. These activities define the nature and extent of contamination and determine the potential risks and doses to human health and the environment.

- Characterization and cleanup of sites contaminated or potentially contaminated by past LANL activities follow the Consent Order.
- The Laboratory submitted 59 new or revised investigation work plans and reports.
- The Laboratory submitted initial or revised Corrective Measures Evaluations for TA-54, MDAs G, H, and L.
- The D&D of buildings at TA-21 was completed. The excavation of TA-21, MDA B was initiated.
- Investigations were completed or continued at TA-50, MDA C, TA-49, three canyons, and eight aggregate areas

Accomplishments in 2010 include the submission to NMED of initial or revised CME reports for TA-54, MDAs G, H, and L, completion of the D&D of buildings at TA-21, commencement of the TA-21, MDA B, excavation project, the completion of the remediation and investigations required by the TA-16 260 Outfall Corrective Measures Implementation (CMI) plan, and the completion or continued investigation of TA-50, MDA C, TA-49, three canyons, and eight aggregate areas. The CMEs recommend the removal of buildings from the TA-54 MDAs, construction of an evapotranspiration cover over disposal pits and shafts, and the operation of a soil vapor extraction (SVE) system at MDAs L and G. In conjunction with the CME reports, an SVE pilot test was conducted at MDA G demonstrating that this technology is effective

in removing volatile organic compound (VOC) vapors from the soil beneath the MDAs. Groundwater monitoring conducted to support the MDA G CME demonstrates no compelling evidence for the presence of contamination in the regional aquifer downgradient of MDA G.

The final buildings of the Laboratory's TA-21 plutonium processing facility were decontaminated and demolished during 2010. Excavation of MDA B began in June 2010. The asphalt cover on the site was removed and 7,265 yd^3 of waste materials were excavated. The active area of excavation was covered with a metal building with active air filtration to minimize the emission of contaminated soils during excavation operations.

The TA-16, 260 Outfall, CMI plan remediation and investigation activities were completed in 2010. Removal actions and final confirmation sampling were conducted in the lower drainage channel. Toxicity testing demonstrated no reductions in chironomids. A summary report on these activities was submitted to NMED. No potential unacceptable risks remain for industrial, construction worker, or residential scenarios. A CMI monitoring plan was submitted to NMED. Data generated from the monitoring activities will assist in determining if high explosives and barium contamination has been effectively remediated.

During 2010, environmental restoration activities collected samples at more than 1,600 locations and requested 850,000 analyses or measurements on these samples.

In 2010, LANL submitted 22 new or revised investigation work plans and 37 new or revised investigation reports to NMED. In 2010, NMED approved a total of 11 plans and 14 reports, most with modifications or directions. In addition, LANL submitted 35 periodic monitoring reports on periodic sampling activities, 53 plans and reports on groundwater monitoring well activities, and 24 miscellaneous reports or plans. NMED approved 34 SWMUs or AOCs as complete, requiring no further remedial actions.

Subsurface Vapor Monitoring

The Laboratory is conducting periodic monitoring of subsurface vapor at TA-54, MDAs G, H, and L, and at TA-21, MDAs T and V, for VOCs and tritium. The monitoring is conducted to determine if there is a threat to the groundwater from VOCs and tritium vapors originating from the waste buried at these MDAs. The Laboratory monitors subsurface vapors at 56 monitoring wells at a total of 196 ports. The ports are located from a few feet below the ground surface to as great as 700 feet below the ground surface. The approximate depth to the regional aquifer at TA-54 is between 930 and 1,300 feet. The Laboratory has also done some investigation sampling at TA-50 MDA C.

The primary VOCs of concern at MDA G and L are trichloroethane-1,1,1 (TCA) and trichloroethene (TCE) . We estimate that the mass of TCA and TCE at MDA G to be 210 kg and 79 kg, respectively. At MDA L, we estimate the mass of TCA and TCE to be 428 kg and 245 kg, respectively. The total amount of VOCs is much smaller at MDA H: we estimate the total mass of all VOCs to be less than 2 kg. Most of the mass of the VOC vapors below each of the TA-54 MDAs is contained within 200 feet of the surface, within the Bandelier tuff (Figure ES-7).

Subsurface tritium vapors at TA-54 are found primarily at MDA G which has active tritium waste disposal activities. The highest concentrations are located near tritium disposal shafts in the south-central portion of MDA G.

Methylene chloride, perchloroethylene (PCE), and TCA are the primary VOCs of concern at TA-21 MDA T; tritium is also monitored. VOCs and tritium consistently peak at a single depth below the surface over time. Further analyses are being conducted to support the Corrective Measures Evaluation (CME) report.

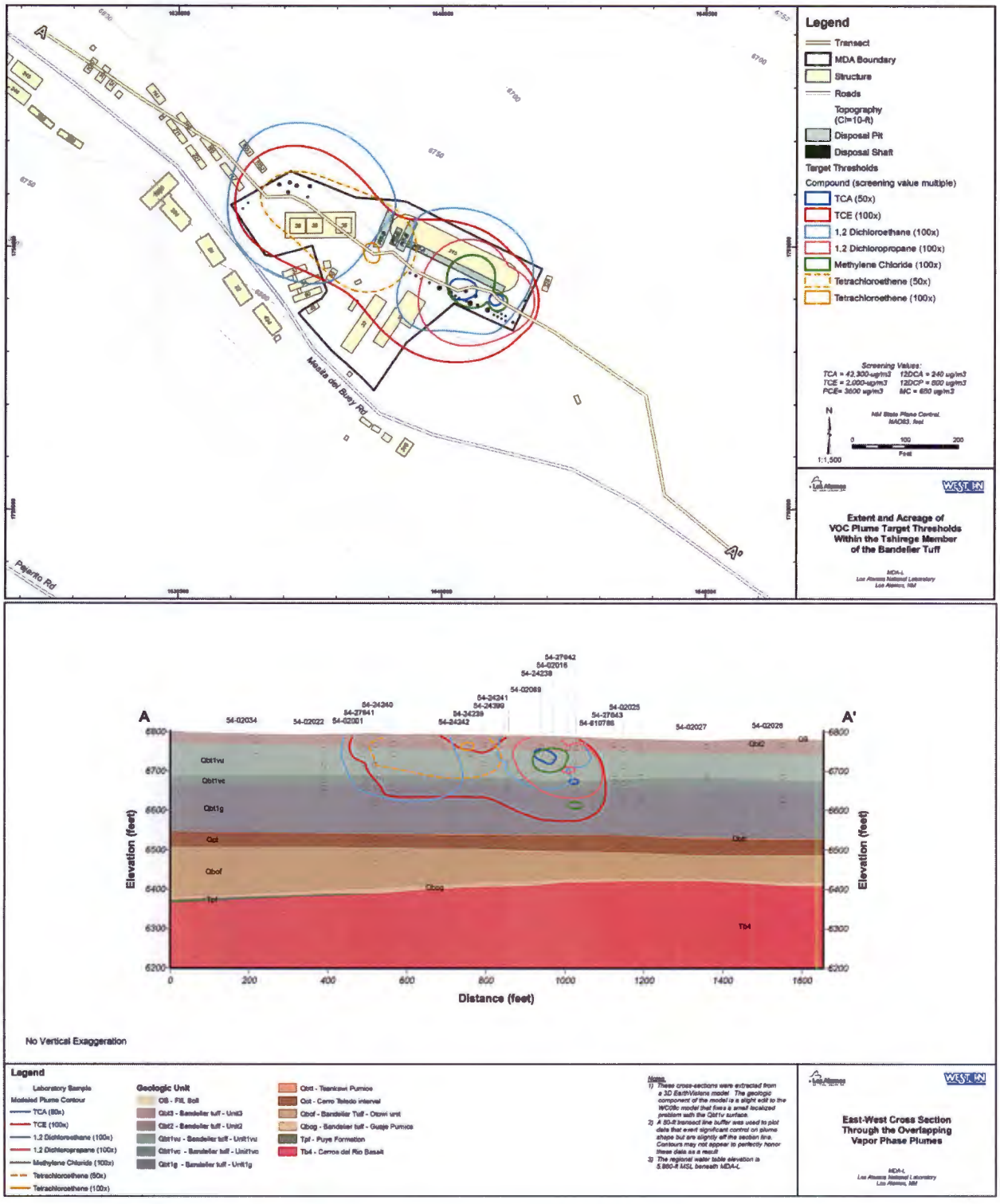

Figure ES-7 East-west horizontal and vertical cross-section of MDA L VOC plume thresholds, including 1,2-dichloroethane; 1,2-dichloropropane; methylene chloride; tetrachloroethene; TCA; and TCE

Remediation activities at TA-21, MDA V, were completed in 2005; however, the extent of tritium in subsurface vapors was not determined and so periodic monitoring has been conducted. A consistent prominent peak of tritium activity is found near 300 feet below ground surface. This may be produced by a subsurface geologic feature known as the Tsankawi pumice bed. Vapor monitoring will continue until remediation activities are completed at nearby MDA B.

Analytical Laboratory Quality Assurance

Environmental samples collected by the Laboratory are processed and analyzed by commercial independent analytical chemistry laboratories to determine contaminant concentrations in the samples. Each analytical laboratory must follow EPA-approved analysis methods to determine contaminant concentrations and implement a stringent quality assurance/quality control program to assure the accuracy of the results. All analytical laboratory results undergo validation by a LANL subcontractor. If data validation identifies analytical results that do not meet EPA or LANL requirements, then LANL will perform a follow-up assessment with the analytical laboratory to identify issues and corrective actions. Finally, LANL requires each analytical laboratory to participate in third-party independent review and certification programs as a further quality assurance requirement.

- Independent commercial chemistry laboratories analyze LANL environmental samples.
- The quality assurance performance of these laboratories is best-in-class.

For 2010, approximately 98% of all analytical chemistry results were of good quality and usable for environmental compliance and assessment. Approximately 16% of the accepted results were qualified due to some portion of the analysis not meeting requirements; however, the concentration results were still acceptable for use.

Data validation efforts identified three individual analytical laboratory data quality issues in 2010. Organic contaminants were introduced into several groundwater samples by the analytical laboratory or from sample bottles. Chromium concentrations in several groundwater samples that were near detection limits were incorrectly identified as detections due to analytical laboratory software issues. Selenium concentrations in soil were incorrectly identified as detections due to instrumentation errors. Each of these issues has been corrected and procedures implemented to prevent recurrence.

A new analytical laboratory for low-level tritium analyses was used by LANL during 2010; due to minor differences in analytical methods at the two laboratories, the more recent data are not directly comparable to earlier values.

LANL performed a review of some previous groundwater sampling results for plutonium-238 in the Buckman Well field. In 2006, one plutonium-238 detection was identified for a sample from Buckman Well #1. Upon additional review, this analysis was found to be incorrect; plutonium-238 was not detected in this 2006 sample. This information has been updated in the RACER database.

An analytical result data package assessment was conducted at one analytical laboratory during 2010, when validation identified more systematic issues at the analytical laboratory. A total of 109 individual issues and "time-savings" opportunities were identified. The analytical laboratory developed a comprehensive corrective action plan and each issue was resolved.

Each analytical laboratory participated in third party reviews; samples of known concentration are sent to the analytical laboratory and the laboratory must demonstrate that they can produce similar results. Each analytical laboratory that LANL uses met all independent testing and certification requirements during 2010.

Overall, the performance of LANL's analytical laboratories is excellent.

Monitoring of the Rio Grande

- LANL impacts on the Rio Grande are small.

Water quality, sediments, and biota/foodstuffs have been monitored for many years in and along the Rio Grande to assess LANL impacts. Radionuclides found in surface water samples are naturally occurring. In 2010, LANL sampled fruits and vegetables irrigated with Rio Grande water upstream and downstream of LANL. In general, contaminants in all produce samples were very low (pCi range) and most were either not detected or detected below the RSRLs.

Natural stream flow and sediment loading in the Rio Grande are quite large compared with Los Alamos area streams. A preliminary estimate of PCB flux in lower Los Alamos Canyon into the Rio Grande is 1% to 3% of the total estimated long-term flux in the Rio Grande. LANL installed grade control structures to stabilize sediments and contaminants in place to reduce the sediment from LANL property reaching the Rio Grande. Automated storm flow monitoring stations have been installed to notify BDD Project personnel of major flow events reaching the Rio Grande. Two storm water flows entered the Rio Grande from Los Alamos and Pueblo Canyons during 2010; notifications were made to BDD Project in both cases.

Past risk assessments of the potential risk to the public from chemicals and radioactive materials released from the Cerro Grande fire found minimal exposure risks. The Buckman Direct Diversion (BDD) Project Independent Peer Review found that no risk to BDD Project drinking water from LANL-derived radioactive or chemical contaminants.

In summary, any LANL contributions to the Rio Grande are masked and overwhelmed by contaminants from upriver sources. With the exception of mercury and PCBs in fish, derived from non-LANL sources, the levels of contaminants in the Rio Grande are below all levels of concern.

Monitoring In the Jemez Mountains and Valles Caldera

We performed a review of Laboratory environmental monitoring studies performed in the Jemez Mountains and the Valles Caldera to the west and southwest of the Laboratory. Elevated concentrations of trace elements occurred in vegetation when receiving episodic discharges from the Fenton Hill hot dry rock site. When the discharges ended, these elevated concentrations were no longer measured. A very few sporadic detections of radionuclides and chemicals have been measured in air, surface water, sediment, soil, and biota and foodstuffs over the period of record. The detections appear to be isolated instances and show no spatial or temporal trends. The detections cannot be attributed to Laboratory operations or influences.

Risk Reduction

- The Laboratory reduced environmental risks during 2010 though reduction in TRU waste inventories, D&D of plutonium processing buildings at TA-21, installation of sediment control structures, and ongoing wildland fire tree thinning.

The Laboratory is committed to reducing environmental hazards and the associated risk to people and the environment. Over the years, the Laboratory has decreased its release of materials into the environment and has reduced the amount of legacy contamination. These efforts have significantly reduced or eliminated potential exposure and risk to workers, the public, and the environment.

Examples of ongoing risk reduction activities include the transport of stored legacy transuranic waste from TA-54, Area G, to WIPP in Carlsbad, NM, the D&D and cleanup of the former plutonium processing facility at TA-21, and ongoing studies of groundwater contamination to evaluate future hazards and risks, and numerous investigations and corrective actions at potentially contaminated sites.

During 2010, the Laboratory continued design work on evaporation tanks to allow elimination of the TA-50 RLWTF outfall. The Laboratory also eliminated three cooling tower outfalls. LANL completed construction of grade control structures in Pueblo and DP Canyons to reduce the transport of contaminated sediments off LANL property. The Laboratory signed an MOU for five years of monitoring to support the BDD Project.

As part of the Laboratory's Wildland Fire Management Plan, the Laboratory performed tree thinning operations on 380 acres of LANL property. These mitigation actions were extremely important in minimizing the amount of LANL lands burned by wildfire during the 2011 Las Conchas fire.

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A. BACKGROUND AND REPORT PURPOSE

1. Background

In March 1943, a small group of scientists came to Los Alamos for Project Y of the Manhattan Project. Their goal was to develop the world's first nuclear weapon. Although planners originally expected that the task would require only 100 scientists, by 1945, when the first nuclear bomb was tested at Trinity Site in southern New Mexico, more than 3,000 civilian and military personnel were working at Los Alamos Laboratory. In 1947, Los Alamos Laboratory became Los Alamos Scientific Laboratory, which in turn became Los Alamos National Laboratory (LANL or the Laboratory) in 1981. Through May 2006, the Laboratory was managed by the Regents of the University of California through the Los Alamos Site Office of the US Department of Energy (DOE). In June 2006, a new management organization, Los Alamos National Security (LANS), LLC, took over management of the Laboratory.

The Laboratory's original mission to design, develop, and test nuclear weapons has broadened and evolved as technologies, priorities, and the world community have changed. LANL defines its vision as: "Los Alamos, the premier national security science laboratory." The current mission is to develop and apply science and technology to

- Ensure the safety and reliability of the United States' nuclear deterrent;
- Reduce global threats; and
- Solve other emerging national security challenges (LANL 2005).

Inseparable from the Laboratory's commitment to excellence in science and technology is its commitment to complete all work in a safe, secure, and environmentally responsible manner. The Laboratory uses Integrated Safety Management (ISM) to set, implement, and sustain safety performance and meet environmental expectations. In addition, the Laboratory uses an International Standards Organization (ISO) 14001-2004 registered Environmental Management System (EMS) as part of ISM to focus on environmental performance, protection, and stewardship. The foundation of the EMS and the demonstration of the Laboratory's commitment comprise the LANL environmental policy:

- We approach our work as responsible stewards of our environment to achieve our mission.
- We prevent pollution by identifying and minimizing environmental risk.
- We set quantifiable objectives, monitor progress and compliance, and minimize consequences to the environment, stemming from our past, present, and future operations.
- We do not compromise the environment for personal, programmatic, or operational reasons.

2. Report Purpose

As part of the Laboratory's commitment to our environmental policy, we monitor and report on how Laboratory activities are affecting the environment. The objectives of this environmental surveillance report, as directed by DOE Order 231.1A (DOE 2004), are to

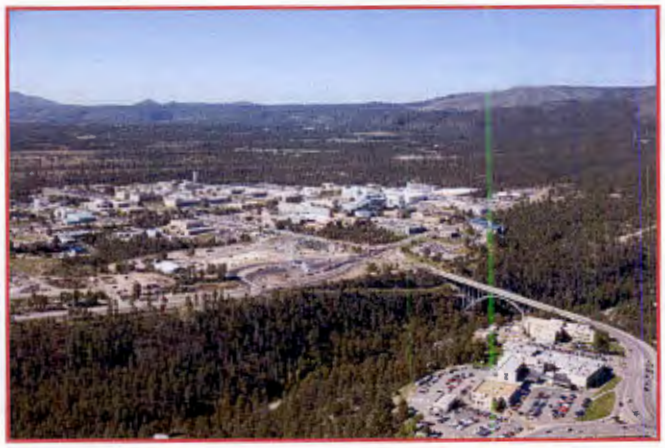
- Characterize site environmental management performance, including effluent releases, environmental monitoring, and estimated radiological doses to the public from releases of radioactive materials at DOE sites.

- Summarize environmental occurrences and responses reported during the calendar year.
- Confirm compliance with environmental standards and requirements.
- Highlight significant programs and efforts, including environmental performance indicators and/or performance measures programs.

B. ENVIRONMENTAL SETTING

1. Location

The Laboratory and the associated residential and commercial areas of Los Alamos and White Rock are located in Los Alamos County, in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure 1-1). The 36-square-mile Laboratory is situated on the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep east-to-west-oriented canyons cut by streams. Mesa tops range in elevation from approximately 7,800 ft on the flanks of the Jemez Mountains to about 6,200 ft at the edge of White Rock Canyon. Most Laboratory and community developments are confined to the mesa tops.



The surrounding land is largely undeveloped and large tracts of land north, west, and south of the Laboratory site are held by the Santa Fe National Forest, the US Bureau of Land Management, Bandelier National Monument, the US General Services Administration, and Los Alamos County. The Pueblo de San Ildefonso borders the Laboratory to the east.

2. Geology and Hydrology

The Laboratory lies at the western boundary of the Rio Grande Rift, a major North American tectonic feature. Three major potentially active local faults constitute the modern rift boundary. Studies indicate that the seismic surface rupture hazard associated with these faults is localized (Gardner et al., 1999). Most of the finger-like mesas in the Los Alamos area (Figure 1-2) are formed from Bandelier Tuff, which includes ash fall, ash fall pumice, and rhyolite tuff. Deposited by major eruptions in the Jemez Mountains volcanic center 1.2–1.6 million years ago, the tuff is more than 1,000 ft thick in the western part of the plateau and thins to about 260 ft eastward above the Rio Grande.

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps onto the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains. The tuff is underlain by the conglomerate of the Puye Formation in the central plateau and near the Rio Grande. The Cerros del Rio Basalts interfinger with the conglomerate along the river. These formations overlie the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 3,300 ft thick.

Surface water in the Los Alamos region occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the Laboratory property before the water is depleted by evaporation, transpiration, and infiltration.

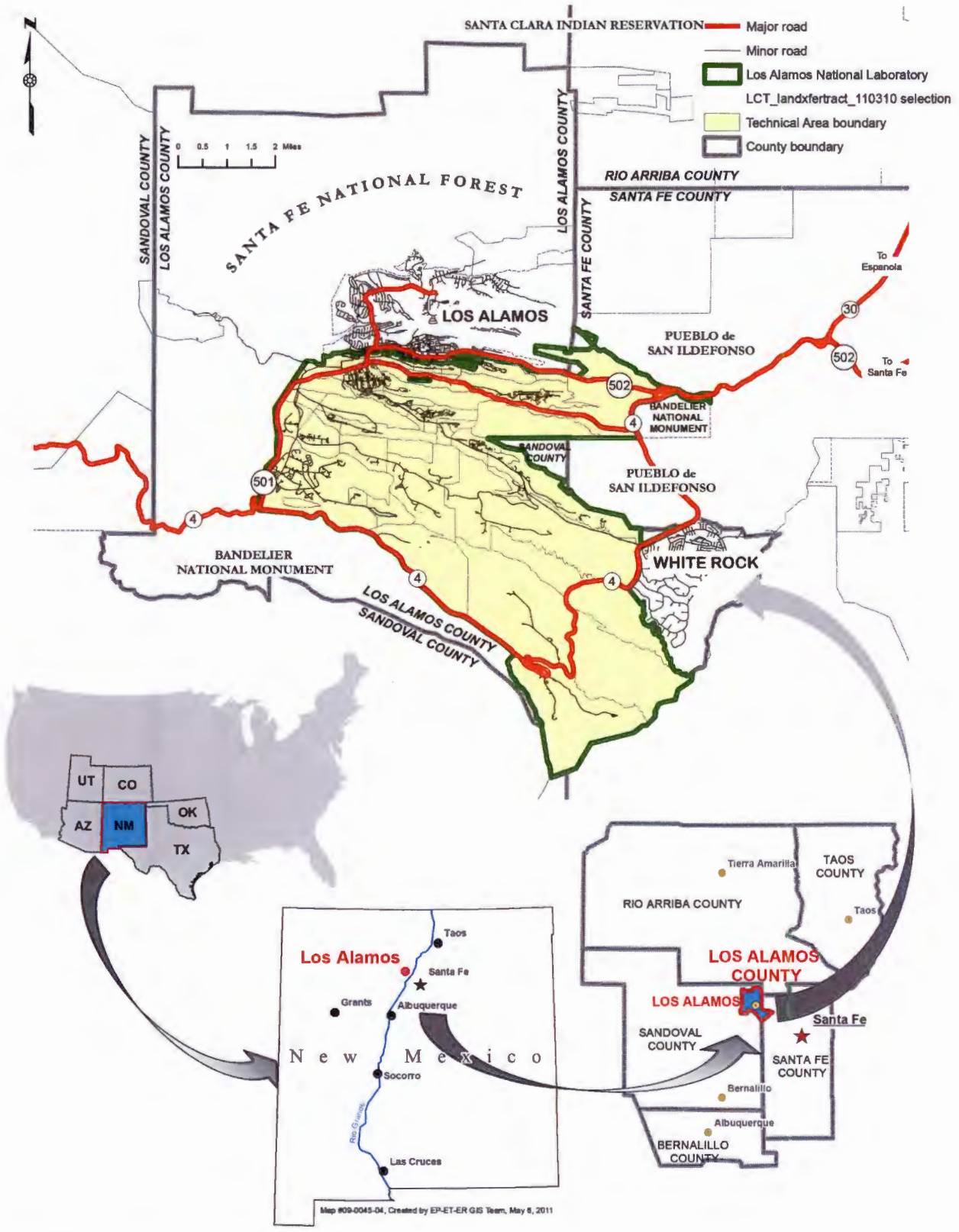


Figure 1-1 **Regional location of Los Alamos National Laboratory**

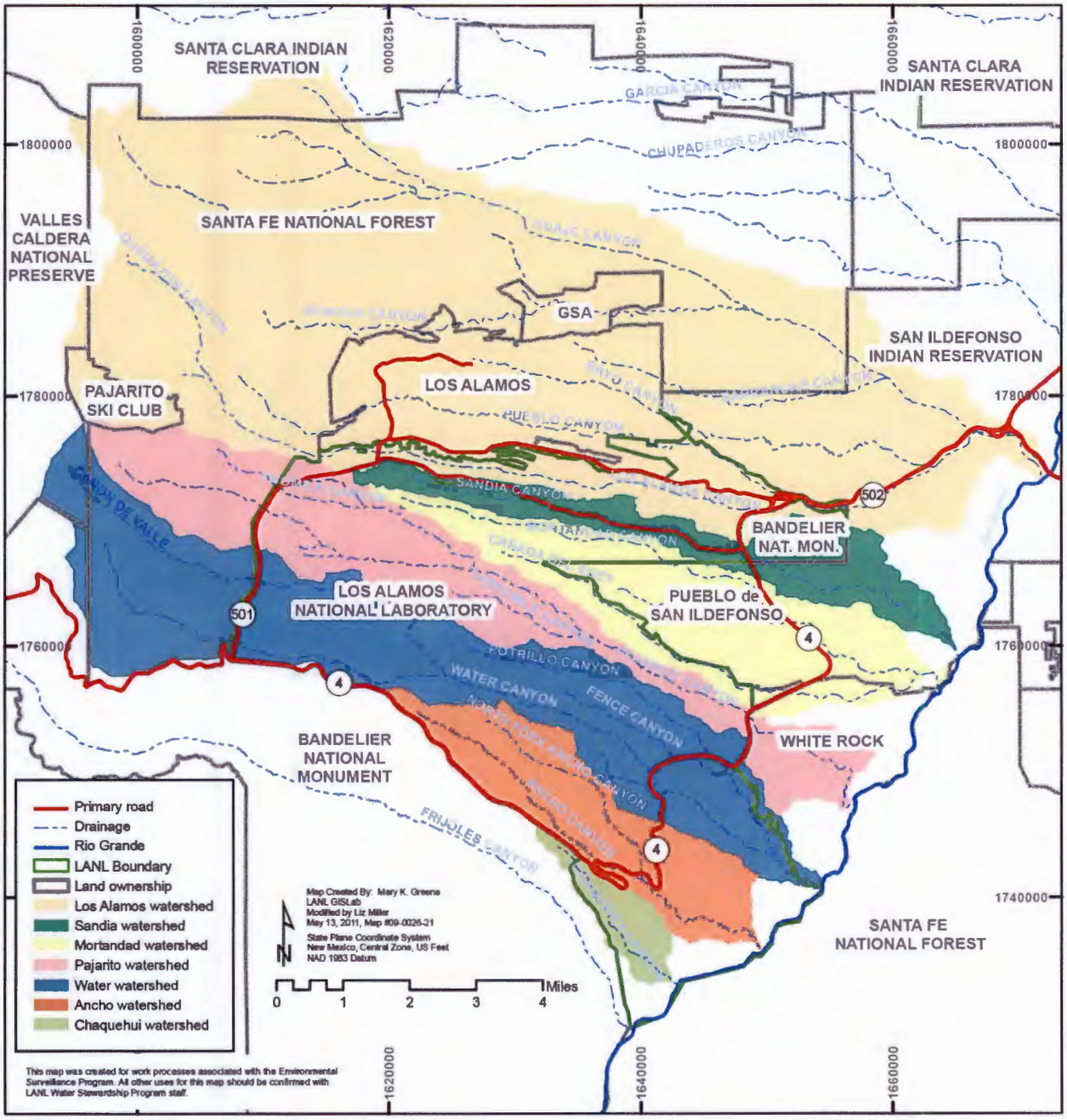


Figure 1-2 Primary watersheds at Los Alamos National Laboratory

Groundwater in the Los Alamos area occurs in three modes: (1) water in shallow alluvium in canyons, (2) intermediate perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the regional aquifer, which is the only aquifer in the area capable of serving as a municipal water supply. Water in the regional aquifer is in artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande (Purtymun and Johansen 1974). The source of most recharge to the regional aquifer appears to be infiltration of precipitation that falls on the Jemez Mountains. The regional aquifer discharges into the Rio Grande through springs in White Rock Canyon. The 11.5-mi reach of the river in White Rock Canyon, between Otowi Bridge and the mouth of Rio de los Frijoles, receives an estimated 4,300–5,500 acre-feet (ac-ft) of water from the regional aquifer.

3. Biological Resources

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. This diversity of ecosystems is due partly to the dramatic 5,000-ft elevation gradient from the Rio Grande on the east of the plateau up to the Jemez Mountains 12 mi (20 km) to the west and partly to the many steep canyons that dissect the area. Five major vegetative cover types are found in Los Alamos County. The juniper (*Juniperus monosperma* Englem. Sarg.)-savanna community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons at elevations between 5,600 and 6,200 ft. The piñon (*Pinus edulis* Engelm.)-juniper cover type, generally between 6,200 to 6,900 ft in elevation, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pine (*Pinus ponderosa* P. and C. Lawson) communities are found in the western portion of the plateau between 6,900 and 7,500 ft in elevation. These three vegetation types predominate the plateau, each occupying roughly one-third of the Laboratory site. The mixed conifer cover type, at an elevation of 7,500 to 9,500 ft, overlaps the Ponderosa pine community in the deeper canyons and on north-facing slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. The spruce (*Picea* spp.)-fir (*Abies* spp.) cover type is at higher elevations of 9,500 to 10,500 ft. Several wetlands and riparian areas enrich the diversity of plants and animals found on the plateau.

In May 2000, the Cerro Grande fire burned more than 43,000 ac of forest in and around LANL. Most of the habitat damage occurred on Forest Service property to the west and north of LANL. Approximately 7,684 ac, or 28% of the vegetation at LANL, was burned to varying degrees by the fire. However, few areas on LANL property were burned severely.

The extreme drought conditions prevalent in the Los Alamos area and all of New Mexico from 1998 through 2003 resulted directly and indirectly in the mortality of many trees. Between 2002 and 2005, more than 90% of the piñon trees greater than 10 ft tall died in the Los Alamos area. Lower levels of mortality also occurred in ponderosa and mixed conifer stands. Mixed conifers on north-facing canyon slopes at lower elevations experienced widespread mortality.

Tree mortality has leveled off since 2005, as much through lack of live trees as an improvement in forest health (LANL 2010). Understory plant species have thrived during the wetter years, but show a neutral or negative response during dry years. It is unlikely that there will be an appreciable increase in tree species until current climate trends improve.

4. Cultural Resources

The Pajarito Plateau is an archaeologically rich area. Approximately 86% of DOE land in Los Alamos County has been surveyed for prehistoric and historic cultural resources, and more than 1,800 sites have been recorded. During fiscal year 2006, sites that have been excavated since the 1950s were removed from the overall site count numbers. Thus, there are fewer recorded sites than the number reported in previous years. Nearly 80% of the resources are Ancestral Pueblo and date from the 13th, 14th, and 15th centuries. Most of the sites are found in the piñon-juniper vegetation zone, with more than 68% located between 5,800 and 7,100 ft. Sixty two percent of all cultural resources are found on mesa tops. Buildings and structures from the Manhattan Project and the early Cold War period (1943–1963) are being evaluated for eligibility for listing in the National Register of Historic Places, and more than 500 buildings have been evaluated to date. In addition, facilities considered of national historic significance dating from 1963 to the end of the Cold War in 1990 are being evaluated.

5. Climate

Los Alamos County has a temperate, semiarid mountain climate. Large differences in locally observed temperature and precipitation exist because of the 1,000-ft elevation change across the Laboratory site and the complex topography. Four distinct seasons occur in Los Alamos County. Winters are generally mild, with occasional winter storms. Spring is the windiest season. Summer is the rainy season, with occasional afternoon thunderstorms. Fall is typically dry, cool, and calm.

Daily temperatures are highly variable (a 23°F range on average). On average, winter temperatures range from 30°F to 50°F during the daytime and from 15°F to 25°F during the nighttime. The Sangre de Cristo mountains to the east of the Rio Grande Valley act as a barrier to wintertime arctic air masses that descend into the central United States, making the occurrence of local subzero temperatures rare. On average, summer temperatures range from 70°F to 88°F during the daytime and from 50°F to 59°F during the nighttime.

From 1981 to 2010, the average annual precipitation (which includes both rain and the water equivalent of frozen precipitation) was 18.95 in., and the average annual snowfall amount was 58.7 in. (Note: By convention, full decades are used to calculate climate averages [WMO 1984].) The months of July and August account for 36% of the annual precipitation and encompass the bulk of the rainy season, which typically begins in early July and ends in early September. Afternoon thunderstorms form as moist air from the Pacific Ocean and the Gulf of Mexico is convected and/or orographically lifted by the Jemez Mountains. The thunderstorms yield short, heavy downpours and an abundance of lightning. Local lightning density, among the highest in the United States, is estimated at 15 strikes per square mile per year. Lightning is most commonly observed between May and September (about 97% of the local lightning activity).

The complex topography of the Pajarito Plateau influences local wind patterns. Often a distinct diurnal cycle of winds occurs. Daytime winds measured in the Los Alamos area are predominately from the south, consistent with the typical upslope flow of heated daytime air moving up the Rio Grande valley. Nighttime winds (sunset to sunrise) on the Pajarito Plateau are lighter and more variable than daytime winds and typically from the west, resulting from a combination of prevailing winds from the west and downslope flow of cooled mountain air. Winds atop Pajarito Mountain are more representative of upper-level flows and primarily range from the northwest to the southwest, mainly because of the prevailing westerly winds.

C. LABORATORY ACTIVITIES AND FACILITIES

The Laboratory is divided into technical areas (TAs) used for building sites, experimental areas, support facilities, roads, and utility rights-of-way (Figure 1-3 and Appendix C, Description of Technical Areas). However, these uses account for only a small part of the total land area; much of the LANL land provides buffer areas for security and safety or is held in reserve for future use. The Laboratory has about 2,800 structures, with approximately 8.6 million square feet under roof, spread over an area of approximately 36 square miles.

DOE National Nuclear Security Administration (NNSA) issued a new Site-Wide Environmental Impact Statement (SWEIS) in May 2008 (DOE 2008a) and two Records of Decision (ROD) in September 2008 (DOE 2008b) and June 2009. In the SWEIS, LANL identified 15 Laboratory facilities as "Key Facilities" for the purposes of facilitating a logical and comprehensive evaluation of the potential environmental impacts of LANL operations (Table 1-1). Operations in the Key Facilities represent the majority of environmental impacts associated with LANL operations.

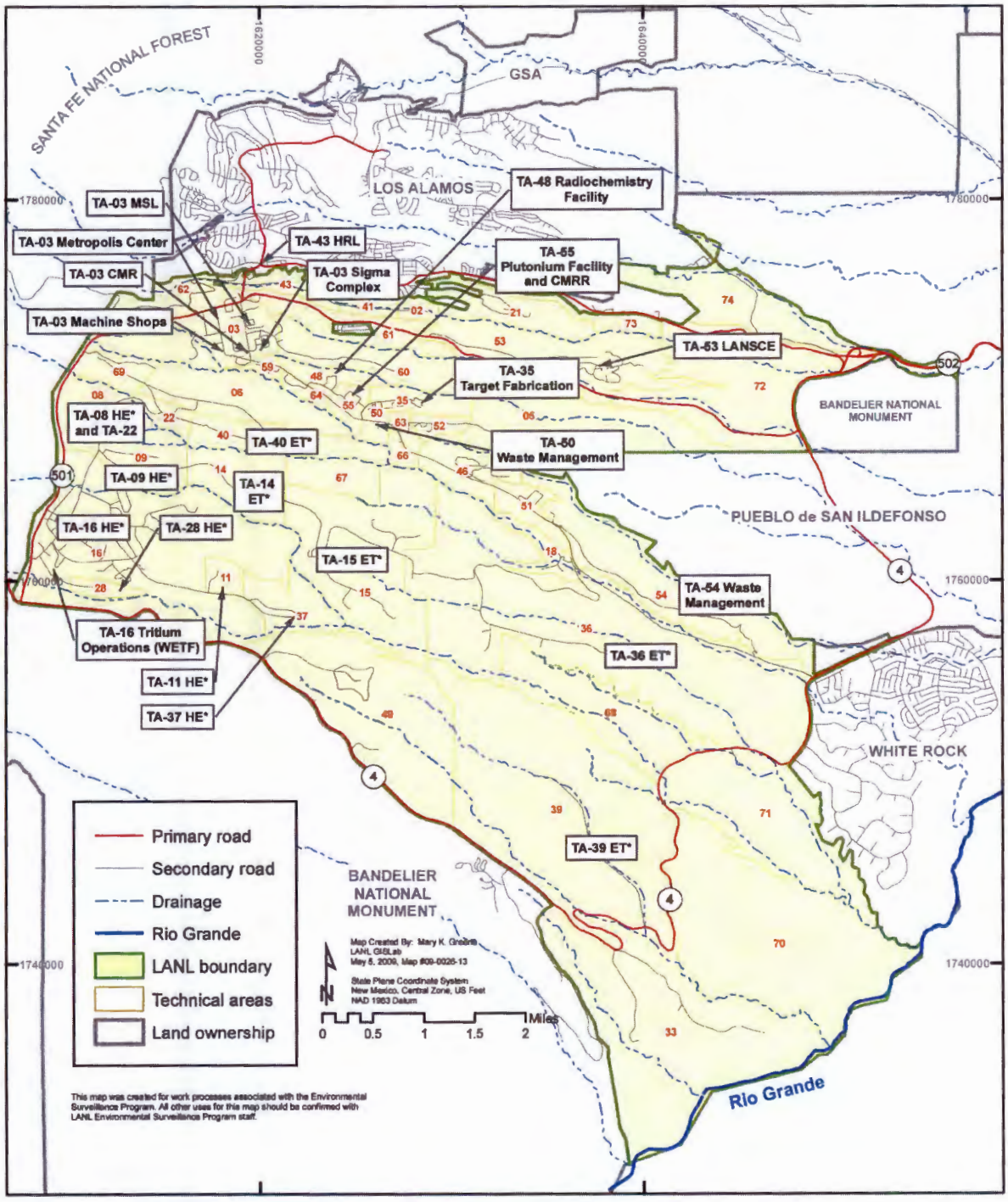


Figure 1-3 **Technical areas and key facilities of Los Alamos National Laboratory in relation to surrounding landholdings**

The facilities identified as "key" are those that house activities critical to meeting work assignments given to LANL. These facilities also:

- House operations that could potentially cause significant environmental impacts,
- Are of most interest or concern to the public based on scoping comments received, or
- Would be the facilities most subject to change as a result of programmatic decisions.

In the SWEIS, the remaining LANL facilities were identified as "Non-Key Facilities" because these facilities do not meet the above criteria. The Non-Key Facilities comprise all or the majority of 30 of LANL's 49 TAs and approximately 14,224 acres of LANL's 26,480 acres. The Non-Key Facilities also currently employ about 74% of the total LANL workforce (LANL 2010). The Non-Key Facilities include such important buildings and operations as the Nonproliferation and International Security Center (NISC), the new National Security Sciences Building (NSSB), which is now the main administration building, and the TA-46 sewage treatment facility.

Table 1-1
Key Facilities*

Facility	Technical Areas
Plutonium Complex	TA-55
Tritium Facilities	TA-16
Chemistry and Metallurgy Research (CMR) Building	TA-03
Sigma Complex	TA-03
Materials Science Laboratory (MSL)	TA-03
Target Fabrication Facility (TFF)	TA-35
Machine Shops	TA-03
Nicholas C. Metropolis Center for Modeling and Simulation	TA-03
High-Explosives Processing	TA-08, -09, -11, -16, -22, -37
High-Explosives Testing	TA-14, -15, -36, -39, -40
Los Alamos Neutron Science Center (LANSCE)	TA-53
Biosciences Facilities (formerly Health Research Laboratory)	TA-43, -03, -16, -35, -46
Radiochemistry Facility	TA-48
Radioactive Liquid Waste Treatment Facility (RLWTF)	TA-50
Solid Radioactive and Chemical Waste Facilities	TA-50, TA-54

*Data from 2008 SWEIS.

D. MANAGEMENT OF ENVIRONMENT, SAFETY, AND HEALTH

Safety, environmental protection, and compliance with environmental, safety, and health (ES&H) laws and regulations are underlying values of all Laboratory work. The Laboratory uses ISM to create a worker-based safety and environmental compliance culture in which all workers commit to safety and environmental protection in their daily work. Each Laboratory organization is responsible for its own environmental management and performance. Line management provides leadership and ensures ES&H performance is within the context of the Laboratory's values and mission. Laboratory managers establish and manage ES&H initiatives, determine and communicate expectations, allocate resources, assess performance, and are held accountable for safety performance.

Environmental management system, compliance, surveillance, and waste management operational support are managed within the Environment, Safety, Health, and Quality (ESH&Q) Directorate. Environmental characterization, remediation, and waste management programs are part of the Environmental Programs (EP) Directorate. An organizational chart and description is available at http://www.lanl.gov/organization/. The major environmental programs and management system are described below.

1. Environmental Management System

LANL has implemented a pollution-prevention-based-EMS, meeting the DOE Order 450.1A requirement to have an EMS implemented by December 31, 2005. An EMS is a systematic method for assessing mission activities, determining the environmental impacts of those activities, prioritizing improvements, and measuring results. LANL pursued and achieved registration to the ISO 14001-2004 standard in April 2006.

A key feature of the Laboratory EMS is the focus on ensuring that it is integrated with existing procedures and systems wherever possible. The intent is for the EMS to consolidate these existing programs into a systematic process for environmental performance improvement. The ISM provides an important foundation for the five core elements of the EMS:

1. Policy and Commitment
2. Planning
3. Implementation and Operation
4. Checking and Corrective Action
5. Management Review

More information about the EMS is available at http://www.lanl.gov/environment/risk/ems.shtml.

2. Waste Management Program

As part of the Laboratory's mission, the Laboratory generates

- Resource Conservation and Recovery Act (RCRA) regulated non-radioactive hazardous waste,
- Toxic Substances Control Act regulated waste (primarily PCB contaminated waste),
- Low-level radioactive waste (LLW), both solid and liquid,
- Mixed low-level waste (MLLW),
- Transuranic waste (TRU),
- Administratively controlled waste,
- Medical waste,
- New Mexico Special Waste, and
- Sanitary solid and liquid waste.

ADESHQ provides regulatory compliance support and technical assistance to waste generators to assure compliance with state, federal, and DOE requirements.

LANL disposes of wastes on-site and off-site. LANL releases liquid effluents liquid effluents from the Radioactive Liquid Waste Treatment Facility (RLWTF) and the Sanitary Wastewater Systems Plant into Mortandad and Sandia Canyons. Some LLW is disposed on site at TA-54-Area G. Waste acceptance criteria have been developed for each of these facilities to assure that all wastes disposed on-site meet state, federal, and DOE requirements. All other operational wastes, including the majority of LLW, are disposed off-site.

3. Pollution Prevention Program

The Pollution Prevention (P2) Program implements waste minimization, pollution prevention, sustainable design, and conservation projects to enhance operational efficiency, reduce life-cycle costs of programs or projects, and reduce risks to the environment. Reducing waste directly contributes to the efficient performance of the Laboratory's national security, energy, and science missions.

"Green purchasing" is mandated by an executive order and calls for considering environmental factors in purchasing decisions in addition to traditional factors such as performance, price, health, and safety.

4. Environmental Restoration Programs

The environmental restoration and cleanup work at LANL is organized into several projects that have responsibility for different aspects of environmental restoration:

- Corrective Actions Program (includes investigations and remediations in canyons)
- TA-21 Closure Project
- TA-54 Closure Project

The goal of these programs is to ensure that residual contaminants from past Laboratory operations do not threaten human or environmental health and safety. To achieve this goal, the Laboratory is investigating and, as necessary, remediating sites contaminated by past Laboratory operations. Program results for calendar year 2010 are presented in Chapter 9, Environmental Restoration.

5. Compliance and Surveillance Programs

LANL's environmental compliance and surveillance programs identify possible environmental hazards and impacts by regularly collecting samples and comparing results with previous results and applicable regulatory standards. The Laboratory routinely collects samples of air particles and gases, water, soil, sediment, foodstuffs, and associated biota from more than 4000 locations (Table 1-2). Program results for each of these monitoring programs are presented in Chapters 4-9 of this report. The Laboratory also works with and assists neighboring communities and pueblos in performing environmental monitoring.

Table 1-2
Approximate Numbers of Environmental Samples, Locations, and Analytes Collected in 2010

Sample Type or Media	Locations	Frequency of Sampling[a]	Analytes or Measurements
Ambient Air	63	Biweekly	7800[b]
Stack Monitoring	29	Weekly	23,000
Biota	38	Annual	1900
Routine Soil Surveillance Sampling	25	Annual	600
Sediment	601	Annual	180,000
Foodstuffs	136	Annual	3000
Groundwater	195	Quarterly/semi-annual/annual	160,000
NPDES Outfalls	14	Weekly	2200
Surface Water Base Flow	26	Quarterly/semi-annual/annual	16,000
Surface Water Storm Runoff	54	Following rains	25,000
Neutron Radiation	47	Quarterly	190
Gamma Radiation	98	Quarterly	390
Environmental Restoration Soil/Rock Investigation Sampling	1,609	Annual	850,000
Subsurface Vapor Monitoring	84	Monthly/Quarterly/Annually	160,000
Totals:	4145		1,430,000

Note: Not all the data counted in the table above are reported in this document. Totals include duplicate samples but do not include additional samples and results from the extensive quality assurance/quality control program, which are normally 10% to 20% more but can be over 60% more, depending on the media.

[a] Sampling frequency is location dependant, when more than one frequency is listed.

[b] Does not include particulate (in air) measurements made by four Tapered Element Oscillating Microbalance instruments that calculate particulate concentrations every half hour.

All monitoring data collected at LANL is available through the RACER Data Analysis Tool (http://www.racernm.com/). This tool was developed to provide public access to the same data that NMED and LANL use in making remediation and other environmental management decisions.

The Laboratory is regulated under 27 separate environmental regulatory permits issued by the New Mexico Environment Department and the Environmental Protection Agency (EPA). These permits govern air emissions, liquid effluents, waste generation/treatment/storage/disposal, and environmental restoration. The Laboratory's environmental compliance programs and results are presented in Chapter 2.

E. REFERENCES

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A. INTRODUCTION

Many operations at Los Alamos National Laboratory (LANL or the Laboratory) use or produce liquids, solids, and gases that may contain non-radioactive hazardous and/or radioactive materials. These operations, emissions, and effluents are regulated by US Department of Energy (DOE) orders and federal and state laws. DOE Orders require management systems for environmental protection, resource conservation and protection, and control of radionuclides. Federal and state environmental laws address (1) handling, transporting, releasing, and disposing of contaminants and wastes; (2) protecting ecological, archaeological, historic, atmospheric, soil, and water resources; and (3) conducting environmental impact analyses. Regulations provide specific requirements and standards to ensure maintenance of environmental quality. The US Environmental Protection Agency (EPA) and the New Mexico Environment Department (NMED) are the principal administrative authorities for these laws. Los Alamos National Security (LANS), LLC, operates LANL for the National Nuclear Security Administration (NNSA), an agency of DOE, and is a co-permittee, with DOE and/or NNSA on all EPA- or NMED-administered permits. This chapter provides a summary of LANL compliance and status with respect to DOE environmental requirements and state and federal environmental regulations.

B. DOE ORDERS AND EXECUTIVE ORDERS

1. DOE Order 231.1A, Environment, Safety, and Health Reporting

DOE Order 231.1A, Environment, Safety, and Health Reporting, requires the timely collection and reporting of information on environmental issues that could adversely affect the health and safety of the public and the environment (DOE 2004). Specifically, DOE Order 231.1A requires the Laboratory to publish an annual site environmental report. The objectives of this report, are to

- Characterize site environmental management performance, including effluent releases, environmental monitoring, and estimated radiological doses to the public from releases of radioactive materials at DOE sites.
- Summarize environmental occurrences and responses reported during the calendar year.
- Confirm compliance with environmental standards and requirements.
- Highlight significant programs and efforts, including environmental performance indicators and/or performance measures programs.

The Laboratory began environmental monitoring in the 1940s and published the first comprehensive environmental monitoring report in 1970.

2. DOE Order 450.1A, Environmental Protection Program

DOE Order 450.1A, Environmental Protection Program, requires all DOE sites to "implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by DOE operations and by which DOE cost-effectively meets or exceeds compliance with applicable environmental; public health; and resource protection laws, regulations, and DOE requirements." The order further states this objective must be accomplished by implementing an Environmental Management Systems (EMS) at each DOE site.

An EMS is a systematic method for assessing mission activities, determining the environmental impacts of those activities, prioritizing improvements, and measuring results. DOE Order 450.1A defines an EMS as "a continuous cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental missions and goals." This DOE order mandates that the EMS be integrated with an existing management system already established pursuant to DOE Policy 450.4.

LANL has implemented a pollution-prevention-based EMS, meeting the DOE Order 450.1A requirement to have an EMS implemented by December 31, 2005. LANL pursued and achieved registration to the ISO 14001-2004 standard in April 2006. There were two external audits and one internal audit of the LANL EMS system in 2010. No significant corrective actions were identified during these audits.

The EMS met several milestones in fiscal year (FY) 2010 (October 2009 – September 2010) and calendar year (CY) 2010. Multi-disciplinary teams from each Directorate identified their activities, products, and services and their potential environmental aspects. They prioritized these aspects to determine which were significant and developed an Environmental Action Plan designed to prevent or eliminate the environmental risk associated with those aspects. These plans committed to dozens of environmental improvement and pollution prevention actions for FY10 http://hsrasweb.lanl.gov/emsdb/org_list_public.asp. In addition, new action plans were developed for implementation in FY11 (October 2010 – September 2011).

We established six high level FY10 commitments to achieve our LANL goal of establishing excellence in environmental stewardship; these goals and our FY10 achievements are presented in Table 2.1. The Laboratory maintained a high level of environmental compliance performance, shipped a record number of transuranic (TRU) waste shipments to the Waste Isolation Pilot Project (WIPP), increased public involvement events, and maintained a fully compliant EMS.

Table 2.1
FY10 Environmental Stewardship Commitments and Results

Goal	Year End Final Status
Establish excellence in environmental stewardship. FY 10 Commitments (9/2010 target date unless otherwise noted) Increase the number of public outreach events focused on Environmental Management System (EMS) and Consent Order[a] activities to increase stakeholder knowledge and engagement.	During FY10, LANL held public forums related to several major environmental programmatic elements: Consent Order progress, Sanitary Effluent Reclamation Facility, NEPA[b], CMRR[c] Progress, Clean Air Act Compliance, and Water Quality Standards. The lab proactively met with the public and stakeholders to ensure that accurate information was available regarding our activities and commitment to env. Protection. As a result LANL increased the number of public interactions related to environment to 392 compared with 264 in FY09, including interactions with the Northern New Mexico Citizen's Advisory Board, testimony at the RCRA permit hearings, and interactions with several local government and citizen organizations. These efforts were rewarded with significant public support of the Laboratory mission in comments submitted to NMED.
Maintain 98% or higher successful inspection rates in all environmental self-inspection programs.	RCRA: 97.8%, Stormwater: 99.1%, NPDES[e]: 99%+, P2: rated outstanding.
Permits: RCRA Permit Implementation, Title V Air Permit Implementation.	Title V permit fully implemented, new RCRA permit not issued as of 10/1/10.
Mitigate potential environmental impact and risk to the public by completing the funded, FY10 Work-plan TRU waste shipments.	LANL achieved a record 158 transuranic waste shipments to WIPP[f] reducing the Material-at-Risk at Technical Area (TA)-54, Area G, from 88,000 plutonium-equivalent Curies to less than 81,000; LANL prepared 470 cubic meters of transuranic waste for disposition, LANL made 2,100 shipments of low-level waste off site, and increased transuranic waste processing capacity with start up of the Building 412 repacking system and upgrade of the Dome 231 line.

Table 2.1 (continued)

Goal	Year End Final Status
EMS: Implementation of departure process, materials clean-outs and pilot chemical pharmacy in support of materials disposition. Implement at least 15 GSAF projects for waste minimization. Develop Greenhouse Gas Baseline in support of energy conservation.	The Laboratory's ISO 14001 status is fully compliant. Third party surveillance audit in August found the EMS to be mature, leading to improvements in pollution prevention and regulatory compliance. Pilot chemical pharmacy centers opened in FY10, GSAF[h] projects were funded and first Greenhouse Gas Baseline completed in January 2010. First site Sustainability Plan was developed in FY10.

[a] NMED Order on Consent
[b] National Environmental Policy Act
[c] Chemistry and Metallurgy Research Replacement facility
[d] Resource Conservation and Recovery Act
[e] National Pollutant Discharge Elimination System
[f] Waste Isolation Pilot Project
[g] Material Disposal Area
[h] Generator Set Aside Funds

a. Pollution Prevention Program

The Pollution Prevention (P2) Program implements waste minimization, pollution prevention, sustainable design, and conservation projects to enhance operational efficiency, reduce life-cycle costs of programs or projects, and reduce risks to the environment. Reducing waste directly contributes to the efficient performance of the Laboratory's national security, energy, and science missions.

P2 projects in FY10 yielded millions of dollars in cost avoidances to the Laboratory and allowed hundreds of hours of labor to be spent more productively. DOE gave the P2 Program an overall performance rating of "outstanding" for FY10 from DOE. The rating system was established by DOE and is based on progress in seven categories including hazardous waste generation, low-level waste generation, mixed low-level waste generation, TRU/mixed (MTRU) waste generation, recycling percentage, weight of sanitary trash generated per person, and percentage of purchases that comply with affirmative procurement. For 2010, LANL's goal was to generate less routine waste in each category than in 2009, increase the percentage of recycling, and be 100% compliant with affirmative procurement. In FY10, LANL generated less routine low-level waste, mixed low-level waste, TRU and MTRU waste than in FY09. In FY10, LANL increased its recycling percentage and reduced the amount of routine sanitary waste generated per person over FY09 levels. In FY10, LANL was only 84% compliant with affirmative procurement due to new purchasing software that cannot capture justifications for purchasing products without recycled content. The differences in routine waste generation, recycling percentage, and affirmative procurement are shown in Table 2-2.

Table 2.2
Comparison of FY2009 and FY2010 Routine Waste Generation, Recycling Percentage, and Affirmative Procurement

FY10 LANL P2 Performance Index	FY09 Generation Baseline	FY10 Generation
Routine Hazardous Waste	11.6 metric tons	15 metric tons
Routine Low-Level Waste	888 cubic meters	809 cubic meters
Routine Mixed Low-Level Waste	10.4 cubic meters	3.7 cubic meters
Routine Sanitary Waste	148 kg/person	141 kg/person
Recycling	50%	58%
Affirmative Procurement	Not calculated	84%
Routine TRU/MTRU Waste	72.5 cubic meters	38.2 cubic meters

NNSA gave six Pollution Prevention awards for the following projects and programs:

- Video Teleconferencing Cuts Travel Costs and Reduces Green House Gas Emissions
- Sustainable Projects for a Sustainable Future
- Sigma Electroplating Discharge Reduction Integration of Site Sustainability Plan Goals and LANL's EMS
- New Plutonium Removal Technique Means Less Waste

- LANL Algal Biofuels Consortium Development Team
- *Affirmative procurement refers to* the practice of *purchasing* items that contain recycled content. The EPA designated seven categories of products that are known to offer many items that contain recycled content. These categories include paper and paper products, vehicular products, construction products, transportation products, park and recreation products, landscaping products, and non-paper office products. DOE requires that LANL report each year how much money was spent in each category and how much of that money was spent on products that contain recycled content. It's also acceptable to purchase products in these categories without recycled content if there is a justification such as the recycled-content product costs significantly more, the recycled-content product does not meet project specifications, or the recycled-content product cannot arrive quickly enough.

DOE's goal for LANL is to purchase all recycled-content products in these categories or justify all non-recycled content purchases. The old purchasing system at LANL, the Just-in-Time (JIT) catalog, was programmed to highlight recycled-content products and to mandate that users choose a justification if a non-recycled content product was chosen from one of EPA's categories. The new Oracle-based purchasing system at LANL does not currently highlight recycled-content products or require that users choose a justification for a non-recycled content purchase. Thus, LANL went from having 100% of their JIT catalog purchases compliant with affirmative procurement in 2008 to having a compliance percentage that could not be calculated. LANL is hoping to find a method for calculating a compliance percentage with affirmative procurement in 2011.

b. Energy, Transportation, and Water Stewardship

The Laboratory's energy conservation, transportation, and water conservation activities are governed by DOE Order 436.1, Departmental Sustainability, and Executive Orders (EO) 13423, Strengthening Federal Environmental, Energy, and Transportation Management, and EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance. These orders provide requirements for managing sustainability within the Laboratory to ensure operations incorporate energy, water, and greenhouse gas reduction strategies and commit to implementing a Site Sustainability Plan. Site sustainability seeks to reduce consumption of natural resources so that we can expand and increase mission growth. An environmentally sustainable organization seeks to participate within its community and seeks to balance economy, society and environment within its operations.

In 2008, DOE established specific FY15 goals of 30% reductions in energy usage per square foot of building space over FY03 and 16% reductions in potable water use over FY07. The Laboratory's Site Sustainability Plan identifies appropriate projects that will contribute to meeting the DOE's sustainability goals. Performance goals have been established for the Laboratory in these directives, including reductions in energy intensity, potable and industrial water use, green house gas (GHG) emissions, and waste generation. The Laboratory is dependent on the success of a number of projects, including the Energy Savings Performance Contract (ESPC), the Sanitary Effluent Reclamation Facility (SERF) expansion, High Performance Sustainable Building (HPSB) implementation, lighting retrofits, building automation system night setback scheduling, and the associated footprint reduction efforts to achieve our energy, water, and greenhouse gas management goals. In addition, to address the Laboratory's increased water usage, the LANL Generator Set Aside Funds (GSAF) program funded projects that contribute to water reduction goals. Specific projects include Use of Biodiesel Co-product to Boost Biological Oxygen Demand (BOD) at the LANL sanitary wastewater facility (SWWS) was initiated in FY10. Preliminary results indicate that it is possible to boost the BOD at the SWWS via crude glycerol, a by-product of biodiesel production. Long-term implementation of this project may allow increased hydraulic throughput at the SWWS. Increased flows to the SWWS (hydraulic throughput) eventually end up at the planned expanded-SERF. Processing of sanitary effluent at the SERF will directly contribute to reductions in potable water consumption. The SWWS BOD project may allow increased flows from routing cooling tower blowdown from permitted National Pollutant Discharge Elimination System (NPDES) outfalls to the SWWS, and therein the SERF.

Significant effort was devoted to the NPDES Outfall Reduction Project (ORP) in 2009 and 2010. This program addresses the remaining NPDES permitted outfalls at LANL, currently discharging approximately 154 million gallons per year. The ORP is intended to assist compliance with the EPA's NPDES permit for LANL, support increased efficiency and effective management of water, increase the use of "reclaimed water," and ensure compliance with DOE Order 430.2B. The ORP Integrated Project Team developed a plan for implementation of the program, which includes groups of projects designed to contribute to the FY15 goals established in DOE Order 430.2B. Conceptual design and total project costs were validated based on the FY08 Project Execution Plans developed by the ORP Integrated Project Team.

The DOE required its subcontractors to publish Site Sustainability Plans as part of meeting the requirements set forth in its Strategic Sustainability Performance Plan. The Laboratory published a FY10 Site Sustainability Plan (LANL 2010), and Table 2.3 shows the Laboratory's performance status toward meeting the sustainability goals.

Table 2.3
Sustainability Performance Status

DOE Goal	Performance Status
28% Scope 1 & 2 GHG reduction by FY20 from a FY08 baseline (related goals intended below)	In FY10, LANL increased Scope 1 & 2 GHG levels by 3% compared with the FY08 baseline.
30% energy intensity reduction by FY15 from a FY03 baseline and target reduction for FY10 of 15%	Between FY03 and FY10, LANL reduced its cumulative energy intensity by approximately 15%.
7.5% of a site's annual electricity consumption from on-site renewable sources by FY10	31,950 megawatt/hr (MWhr) renewable energy credits (RECs) were purchased in FY10: these comprise 7.5% of the total electrical energy use.
Every site to have at least one on-site renewable energy generating system	Currently, LANL has several solar power lighting systems in place. Additionally, Los Alamos Power Pool is proceeding with installation of the Abiquiu Dam low-flow turbine, which will be fully installed in 2011.
10% annual increase in fleet alternative fuel consumption relative to a FY05 baseline	LANL met this goal for FY10. Thirty-six percent of LANL's fleet is capable of using alternative fuels. Unfortunately, not all E-85 capable vehicles use E-85 due to lack of local supply. However, E-85 is being used in protective force vehicles due to an off hours refueling truck.
2% annual reduction in fleet petroleum consumption relative to a FY05 baseline	LANL met this goal for FY10. During FY09 LANL used 24,575 gallons of E-85 which represents 4% of the total fuel consumption. This 4% of E-85 meets the 2% petroleum reduction requirement.
75% of new light duty vehicle leases must consist of alternative fuel vehicles (AFV)	LANL met this goal for FY 2010. Fleet management developed a FY09 policy that states all new vehicles leases must be AFVs.
To the maximum extent practicable: advanced metering for electricity (by October 2012), steam, and natural gas (by October 2016); standard meters for water	LANL has achieved 81% of the Energy Policy Act of 2005 electric metering goal.
Cool roofs, unless uneconomical, for roof replacements unless project already has Critical Decision (CD)-2 approval. New roofs must have thermal resistance of at least R-30	LANL met this goal for FY 2010. Under the Roof Assessment Management Program (RAMP), LANL has been installing cool roofs for the last three years. Most current projects are CMR (145,000 sf), 55-0114 (8,000 sf), 03-0132 (11,000 sf), and 03-0039 (155,000 sf) in FY09.

Table 2.3 (continued)

DOE Goal	Performance Status
Training and outreach. DOE facility energy mangers to be Certified Energy Managers by September 2012	30 Sustainability/Energy-related training days were completed in FY10. In FY10, outreach included an Energy Town Hall with presentations open to the public. Currently, one Utilities & Institutional Facilities (UI) staff member is a Certified Energy Manager (CEM).
Sulfur hexafluoride (SF6) capture program by September 2012	According to our FY08 emissions, SF6 represents approximately 5% of our Scope 1 & 2 emissions.
10% Scope 3 GHG reduction by FY20 from a FY08 baseline	Recent investigation revealed that employee commuting comprises the majority of LANL's Scope 3 GHG emissions, which is 73,821 metric tons CO_2 equivalent.
All new construction and major renovations greater than $5 million to be LEED® Gold certified. Meet High Performance and Sustainable Building (HPSB) Guiding Principles if less than or equal to $5 million	CMRR/RLUOB* is in construction phase and is anticipated to achieve at least LEED Silver as the first LANL facility to achieve LEED certification. Projects in design and conceptual design phases are incorporating LEED Gold into project requirements.
15% of existing buildings larger than 5,000 gross square feet (GSF) to be compliant with the five guiding principles of HPSB by FY 2015	A gap analysis was completed to identify necessary systematic improvements. A plan was developed to bring identified HPSBs into compliance. DOE's HPSB Assessment Tool will be used to meet the Guiding Principles.
16% water use reduction by FY15 from a FY07 baseline - 2% reduction each year based on the previous year, 26% by FY 2020	Water use has increased by approximately 22% since FY07.
20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY20 from a FY 2010 baseline	LANL has determined that more than 500K square feet of non-native grass can be removed to reduce non-potable water use.

* Chemistry and Metallurgy Research Replacement facility/Radiological Laboratory/Utility/Office Building

3. DOE Order 5400.5, Radiation Protection of the Public and the Environment

DOE Order 5400.5, Radiation Protection of the Public and the Environment, establishes the requirements to protect the public and the environment against undue risk from radiation associated with activities conducted by DOE facilities. The Order establishes the all-pathway public dose limit of 100 mrem, requirements for clearance of real and personal property, As Low As Reasonably Achievable (ALARA) public exposure requirements, requirements for environmental monitoring, and all-pathway dose limits for the protection of biota.

The Laboratory was in compliance with DOE Order 5400.5 during 2010. Public and biota dose assessments, ALARA assessments, and the clearance of real and personal property are presented in Chapter 3, Radiological and Non-Radiological Dose Assessment.

4. DOE Order 435.1, Radioactive Waste Management

Laboratory operations generate four types of radioactive wastes: low-level waste (LLW), mixed low-level waste (MLLW), TRU waste, and mixed TRU waste. (Waste definitions are provided in the Glossary). MLLW is LLW that also contains a hazardous (RCRA-regulated) component, and mixed TRU waste is TRU waste with a hazardous component. Only LLW is disposed at LANL; all other radioactive wastes are shipped off-site for final treatment, if required, and disposal. All aspects of radioactive waste generation, storage, and disposal are regulated by DOE Order 435.1 and DOE Manual 435.1. LANL submitted a compliance report to DOE (LANL 2009) which was approved by DOE in 2009. The hazardous component of MLLW and mixed TRU wastes is also regulated under RCRA and the LANL Hazardous Waste Facility Permit.

a. Institutional Requirements

All LANL operations that generate, store, treat, or dispose radioactive waste must have a DOE/Los Alamos Site Office (LASO)-approved Radioactive Waste Management Basis (RWMB). DOE/LASC approved the most recent RWMB on December 28, 2010 for continued facility operations. The RWMB identifies the

physical and administrative controls to ensure the protection of workers, the public, and the environment. The RWMB documents that generated wastes (a) will meet the acceptance requirements for a disposal facility, (b) will meet LANL on-site storage requirements, and (c) can be transported to a disposal facility. Registration, facility self inspections, and surveillance of radioactive staging and storage areas ensure LANL radioactive waste management practices are consistent with the requirements in DOE Order/Manual 435.1.

During FY10, eight Laboratory Facility Operation Directorates (FODs) were approved to generate, treat, or dispose of radioactive waste. Four LANL FODs had received approval to extensions of their current operations, while their RWMB documentation was updated. During FY10, 171 internal inspections were conducted at LANL generation, storage, treatment, and disposal facilities. Eighteen findings were identified; corrective actions were implemented and closed out. DOE/LASO participates as an observer on internal inspections to assure continued compliance with the RWMB.

b. Low-Level Waste

The Laboratory disposes LLW on-site at TA-54 Area G. In order to dispose of LLW at Area G, DOE Order 435.1 requires the Laboratory to have an approved operational Closure Plan and Performance Assessment/Composite Analysis (PA/CA). The Closure Plan demonstrates the Laboratory's plan for decommissioning LLW disposal operations at TA-54, Area G. The TA-54, Area G Performance Assessment demonstrates that a reasonable expectation exists that the potential doses to representative future members of the public and potential releases from the facility will not exceed performance objectives established in DOE Order 435.1 during a 1,000-year period after closure. The TA-54 Area G Composite Analysis accounts for all sources of radioactive material that are planned to remain onsite at LANL that may interact with the low-level waste disposal facility, contributing to the dose projected to a hypothetical member of the public from Area G. As with the Area G PA, the Composite Analysis demonstrates a reasonable expectation of compliance with DOE Order 435.1 performance objectives. The status of Laboratory documents demonstrating DOE approval to dispose of LLW at TA-54, Area G is presented in Table 2-4. The Laboratory received authorization from DOE for continued operations from DOE on March 17, 2010.

Table 2-4
DOE Approval to Dispose of LLW at TA-54 Area G

DOE Order 435.1 Requirement	LANL Document	LANL or DOE Approval
Closure Plan	Closure Plan for Los Alamos National Laboratory Technical Area 54, Area G, LA-UR-09-02012	LANL approval March 2009
PA/CA	Performance Assessment and Composite Analysis for Los Alamos National Laboratory Technical Area 54, Area G, LA-UR-08-06764	DOE approval; September 15, 2009 via letter from Thad T. Konopnicki (DOE/HQ) to Donald L. Winchell (DOE/LASO)
PA/CA Maintenance Plan	Area G Performance Assessment and Composite Analysis Maintenance Program Plan, LA UR-11-01522, March 2011	LANL approval March 2011
Authorization to Dispose of LLW at Area G	Disposal Authorization Statement for the Department of Energy Los Alamos National Laboratory Area G in Technical Area 54	Issued March 17, 2010 via letter from Randal S. Scott (DOE HQ) to Donald L. Winchell (DOE/LASO)

During CY10, LANL generated, processed and disposed of approximately 25,000 m^3 of LLW. This amount includes waste generated during routine operations and by campaigns, such as environmental restoration clean-ups. During 2010, LLW generation was higher than in previous years because of American Recovery and Reinvestment Act (ARRA) funded decontamination and decommissioning (D&D) of TA-21 buildings (Figure 2-1). Approximately ten percent of this LLW was buried at TA-54 Area G. During CY10, LANL generated and processed approximately 119 m^3 of MLLW and shipped these wastes to an approved disposal facility in Clive, Utah. LANL maintained compliance with all aspects of its RWMB during 2010.

The Laboratory is implementing a strategy to shift to off-site LLW disposal where feasible and cost-effective, but continues to dispose of some LLW at TA-54, Area G.

c. Transuranic Waste

The transuranic waste disposition program expedites the disposal of TRU waste in storage and newly-generated transuranic waste to the WIPP located east of Carlsbad, NM. The program also ensures appropriate facilities and equipment are available to prepare legacy and current TRU for disposal at WIPP. Figure 2-2 presents the cumulative inventory of TRU wastes that have been shipped to WIPP from Los Alamos. During CY10, 723 m^3 of TRU (including MTRU) were shipped to WIPP. The DOE and Laboratory have set 2015 as the goal to complete the shipment of all stored TRU waste from Los Alamos to WIPP. After 2015, after all of the TRU waste stored at TA-54 has been shipped to WIPP, newly generated TRU is expected to be shipped at approximately 85 m^3 per year (approximately 18 shipments to WIPP per year) after all of the TRU waste stored at TA-54 has been shipped to WIPP.

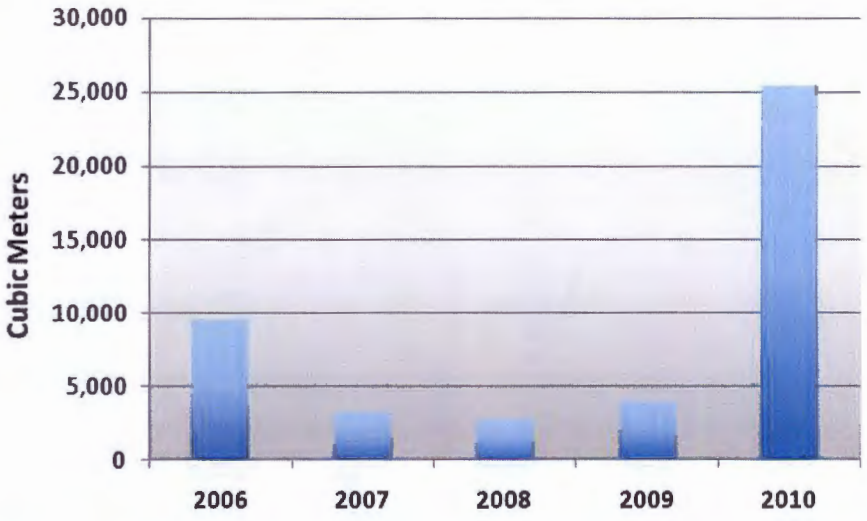

Figure 2-1 LANL LLW Generation

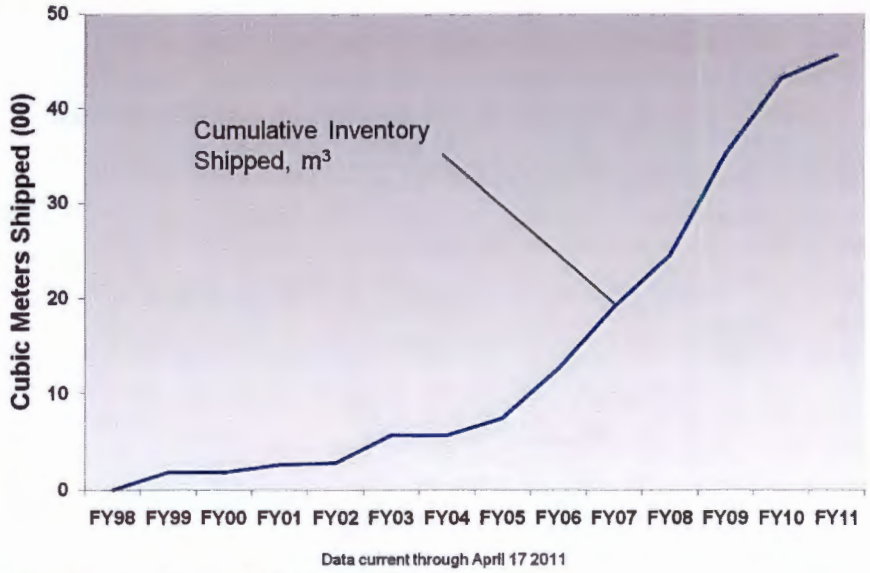

Figure 2-2 TRU waste shipping profile

C. COMPLIANCE STATUS

The EPA and NMED regulate Laboratory operations under various environmental statutes (e.g. Clean Air Act, Clean Water Act, etc.) through operating permits, construction approvals, and the DOE/NMED Consent Order. These permits are designed by the regulatory agencies to allow Laboratory operations to be conducted while assuring that the public, air, land, soils, water, and biota are protected. The Laboratory's compliance performance is an assessment of our protection of the environment. Table 2-5 presents the environmental permits or approvals the Laboratory operated under in 2010 and the specific operations and/or sites affected. Table 2-6 lists the various environmental inspections and audits conducted at the Laboratory during 2010. The following sections summarize the Laboratory's regulatory compliance performance during 2010.

Table 2-5
Environmental Permits or Approvals under which the Laboratory Operated during 2010

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
RCRA[a] Permit	Hazardous Waste Facility Permit: Permitted hazardous waste storage units: Technical Areas (TA)-3, 50, 54, and TA-55	November 1989, renewed November 2010	December 2020	NMED[b]
	40 CFR 265 Standards: Interim Status hazardous waste storage and treatment facilities: TAs-14, -16, -36, -39, and -54. Permit applications to be submitted to NMED.	Post-1980 hazardous waste units; Post-1991 mixed waste units	Inclusion in Hazardous Waste Facility Permit or closure	NMED
Consent Order	Legacy and contaminated waste site investigations, corrective actions, and monitoring; revised to establish new notification and reporting requirements for groundwater monitoring data	March 1, 2005; revised June 18, 2008	September 20, 2015	NMED
CWA[d]/NPDES[e]	Outfall permit for the discharge of industrial and sanitary liquid effluents	August 1, 2007	July 31, 2012	EPA[f]
	MSGP[g] for the discharge of storm water from industrial activities	September 29, 2008	September 29, 2013	EPA
	NPDES Individual Permit for storm water discharges from Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs)	November 1, 2010	March 31, 2014	EPA
	Construction General Permits (17) for the discharge of storm water from construction activities	June 30, 2008	July 31, 2011 (proposed extension until January 31, 2012)	EPA
CWA Sections 404/401	COE[h] Nationwide Permits (four)	NA	NA	COE/NMED
Groundwater Discharge Permit , TA-46 SWWS[i] Plant	Discharge to groundwater	July 20, 1992 Renewed January 7, 1998 Renewal application submitted on July 2, 2010	January 7, 2003*	NMED
Groundwater Discharge Plan, TA-50, Radioactive Liquid Waste Treatment Facility	Discharge to groundwater	Submitted August 20, 1996	Approval pending	NMED
Groundwater Discharge Plan, Domestic Septic Tank/Leachfield Systems	Discharge to groundwater	Submitted April 27, 2006 Application resubmitted on June 25, 2010	Approval pending	NMED

Table 2-5 (continued)

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
Air Quality Operating Permit (20.2.70 NMAC[j])	LANL air emissions Renewal 1	August 7, 2009	August 7, 2014	NMED
Air Quality Construction Permits (20.2.72 NMAC)	Portable rock crusher	June 16, 1999	None	NMED
	Retired and removed from operating permit	June 15, 2006		
	Permit number will remain active to track exempt sources at LANL			
	TA-3 Power Plant	September 27, 2000	None	NMED
	Permit revision	November 26, 2003		
	Permit modification 1, Revision 1	July 30, 2004		
	Permit modification 1, Revision 2	March 5, 2009		
	1600-kW generator at TA-33	October 10, 2002	None	NMED
	Permit revision	May 28, 2008	None	NMED
	Two 20-kW generators and one 225-kW generator at TA-33	August 8, 2007	None	NMED
	Asphalt Plant at TA-60	October 29, 2002	None	NMED
	Permit revision	September 12, 2006	None	NMED
	Data disintegrator	October 22, 2003	None	NMED
	Chemistry and Metallurgy Research Replacement (CMRR), Radiological Laboratory, Utility, Office Building (RLUOB)	September 16, 2005	None	NMED
Air Quality (NESHAP[k])	Beryllium machining at TA-3-141	October 30, 1998	None	NMED
	Beryllium machining at TA-35-213	December 26, 1985	None	NMED
	Beryllium machining at TA-55-4	February 11, 2000	None	NMED

[a] Resource Conservation and Recovery Act
[b] New Mexico Environment Department
[c] Hazardous and Solid Waste Amendments
[d] Clean Water Act
[e] National Pollutant Discharge Elimination System
[f] Environmental Protection Agency
[g] Multi-Sector General Permit
[h] US Army Corps of Engineers
[i] Sanitary Wastewater Systems Plant
[j] New Mexico Administrative Code
[k] National Emission Standards for Hazardous Air Pollutants

*Permit was administratively continued though 2010

Table 2-6
Environmental Inspections and Audits Conducted at the Laboratory during 2010

Date	Purpose	Performing Agency
3/9/10–3/11/10	Environmental Management System audit	Third Party Certifier
9/9/2010	TA-46 SWWS Plant Groundwater Discharge Permit	NMED
9/23-9/242010	Septic Tank/Leachfield Systems Discharge Plan	NMED
9/8/10-9/9/10	Title V Operating Permit compliance inspection	NMED
8/31/10–9/2/10	Environmental Management System audit	Third Party Certifier

1. Resources Conservation and Recovery Act

a. Introduction

As a research facility, the Laboratory produces a wide variety of hazardous wastes. Wastes are generated primarily from research and development activities, processing and recovery operations, D&D projects, and environmental restoration activities. Most of these waste streams are in small quantities compared with industrial facilities of comparable size because of the relatively diverse activities and the many research projects at the Laboratory.

RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, establishes a comprehensive program to regulate hazardous wastes from generation to ultimate disposal. The EPA has authorized the State of New Mexico to implement the requirements of the program, which it does through the New Mexico Hazardous Waste Act and regulations found in the New Mexico Administrative Code (NMAC) Title 20, Chapter 4, Part 1, as revised October 1, 2003.

The federal and state laws regulate management of hazardous wastes based on a combination of the facility's status, the quantities of waste generated, and the types of waste management conducted by the facility. Certain operations require a hazardous waste facility permit, often called a RCRA permit. The LANL hazardous waste facility permit was initially granted in 1989 for storage and treatment operations.

b. RCRA Permitting Activities

2010 marked the renewal and upgrading of the 1989 LANL Hazardous Waste Facility Permit. In 2007, NMED issued a preliminary draft of the permit for public comment. NMED received comments from the Northern New Mexico Citizens' Advisory Board, the Embudo Valley Environment Monitoring Group, the Southwest Research and Information Center, the Natural Resources Defense Council, the Concerned Citizens for Nuclear Safety, Nuclear Watch New Mexico, the Pueblos de San Ildefonso and Santa Clara, the EPA, several private citizens, and the Laboratory. These comments were extensive and addressed many conditions of the draft permit, including emergency procedures, information availability, seismic considerations, financial assurance, open burning operations, and hazardous waste management unit decontamination, among others. All commenters who requested a hearing were invited to participate in NMED-mediated permit negotiations to resolve comments.

The negotiations began in August 2008 and extended into January 2010. The negotiations included presentations, discussions and comment resolution that supported the development of a second revised draft permit. NMED issued the revised draft permit on July 6, 2009. Another public comment period for review of this draft was opened at that time. Additional negotiations addressing the revised draft were concluded in January 2010. A public hearing procedure regarding the draft permit was held from April 6 through May 7, 2010, including public meetings in Santa Fe, Pojoaque, Ohkay Owingeh, Albuquerque, and Los Alamos. The public comment period ended with the termination of the hearings. Among a wide range of comments received, major topics included open burning of hazardous waste, federal financial assurance for unit closures, public information procedures, waste disposal practices during unit closures, seismic concerns, and LANL waste generation practices. A corrected revised proposed permit was issued on September 10, 2010. On November 30, 2010, the NM Secretary of the Environment issued an order renewing the permit with an

effective date of December 30, 2010. The order also denied approval for the open burn units originally included in the permit applications.

In February 2010, the Laboratory submitted and provided public notice for a Request for TA-54 Class 1 Permit Modifications. The modifications revised the figures and descriptions of structures and equipment at TA-54 in the existing permit to reflect various changes occurring in support of waste management activities and closure of the area. This submittal also included additional figures and descriptions to revise or supplement the information included in the draft renewal permit then being negotiated with the NMED. The proposed modifications were approved on March 17, 2010.

In March 2010, the Laboratory submitted and provided public notice for a Class 1 Permit Modification to the Emergency Equipment Listing in the Contingency Plan. The permit modification updated the emergency equipment listing within the plan and updated the emergency communication procedures at the permitted hazardous waste storage units at TA-50 and TA-54. NMED approved the proposed modifications on April 23, 2010.

No hazardous waste management units at the Laboratory underwent full closure activities in 2010.

c. Other RCRA Activities

The compliance assurance program performed Laboratory self-assessments to determine whether hazardous waste and mixed waste are managed to meet the requirements of federal and state regulations, DOE orders, and Laboratory policy. The program communicated findings from these self-assessments to waste generators, waste-management coordinators, and waste managers who help line managers implement appropriate actions to ensure continual improvement in LANL's hazardous waste program. In 2010, the Laboratory completed 1,650 self-assessments.

d. RCRA Compliance Inspection

From December 1, 2009 to December 10, 2009, NMED conducted a hazardous waste compliance inspection at the Laboratory. The Laboratory received one violation from this inspection.

e. Site Treatment Plan

In October 1995, the State of New Mexico issued a Federal Facility Compliance Order to the DOE and the University of California (UC), requiring compliance with the Site Treatment Plan (STP). On June 1, 2006, LANS replaced UC as the operating contractor at LANL, and LANS assumed responsibility for compliance with the order. The plan documents the use of off-site facilities for treating and disposing of mixed waste generated at LANL and stored for more than one year. In 2010, the Laboratory shipped approximately 76 m^3 of STP-covered low-level mixed waste and approximately 319 m^3 of covered MTRU waste for treatment and disposal.

f. Solid Waste Disposal

LANL sends sanitary solid waste (trash) and construction and demolition debris for transfer through the Los Alamos County Eco-Station on East Jemez Road. The DOE owns the property and leases it to Los Alamos County under a special-use permit. Los Alamos County operates this transfer station and is responsible for obtaining all related permits for this activity from the state. The transfer station is registered with the NMED Solid Waste Bureau. Laboratory trash sent to the transfer station in 2010 included 6,034 metric tons of trash and 1,208 metric tons of construction and demolition debris. Through LANL's recycling efforts in 2010, 8,594 metric tons of material was recycled and did not go to a landfill.

g. Compliance Order on Consent (Consent Order)

The Consent Order is an enforcement document that prescribes the requirements for corrective action at the Laboratory. The purposes of the Consent Order are (1) to define the nature and extent of releases of contaminants at, or from, the facility; (2) to identify and evaluate, where needed, alternatives for corrective measures to remediate contaminants in the environment and prevent or mitigate the migration of contaminants at, or from, the facility; and (3) to implement such corrective measures. The Consent Order supersedes the corrective action requirements previously specified in Module VIII of the Laboratory's

Hazardous Waste Facility Permit and applies to Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) subject to RCRA and HSWA requirements, but not to sites that are regulated by DOE under the Atomic Energy Act, such as those containing or releasing radionuclides. The Consent Order does not apply to those SWMUs and AOCs that received "no further action" decisions from EPA when it had primary regulatory authority. A description of the Consent Order work done in 2010 is presented in Chapter 9 of this report.

In 2010, the Laboratory submitted 220 deliverables (plans and reports) required by the Consent Order on time to NMED (see Tables 9-1 and 9-2 in Chapter 9 of this report).

Figure 2-3 shows each aggregate area, as defined by the Consent Order, and indicates the status of LANL investigation activities in these aggregate areas as (1) complete, (2) in progress, or (3) pending. For those aggregate areas presented as complete in Figure 2-3, all investigation activities have been completed, and no additional field sampling campaigns, investigation reports, or corrective measures activities are anticipated. Aggregate areas listed as in progress include sites or areas where field sampling campaigns or corrective measure activities are currently being conducted, or investigation reports are being prepared or finalized. Aggregate areas listed as pending include sites or areas where work plan preparation and field sampling campaigns have not yet started. As of December 2010, Scheduled investigation activities are complete at six aggregate areas, are in progress at twenty one aggregate areas, and are pending at two aggregate areas.

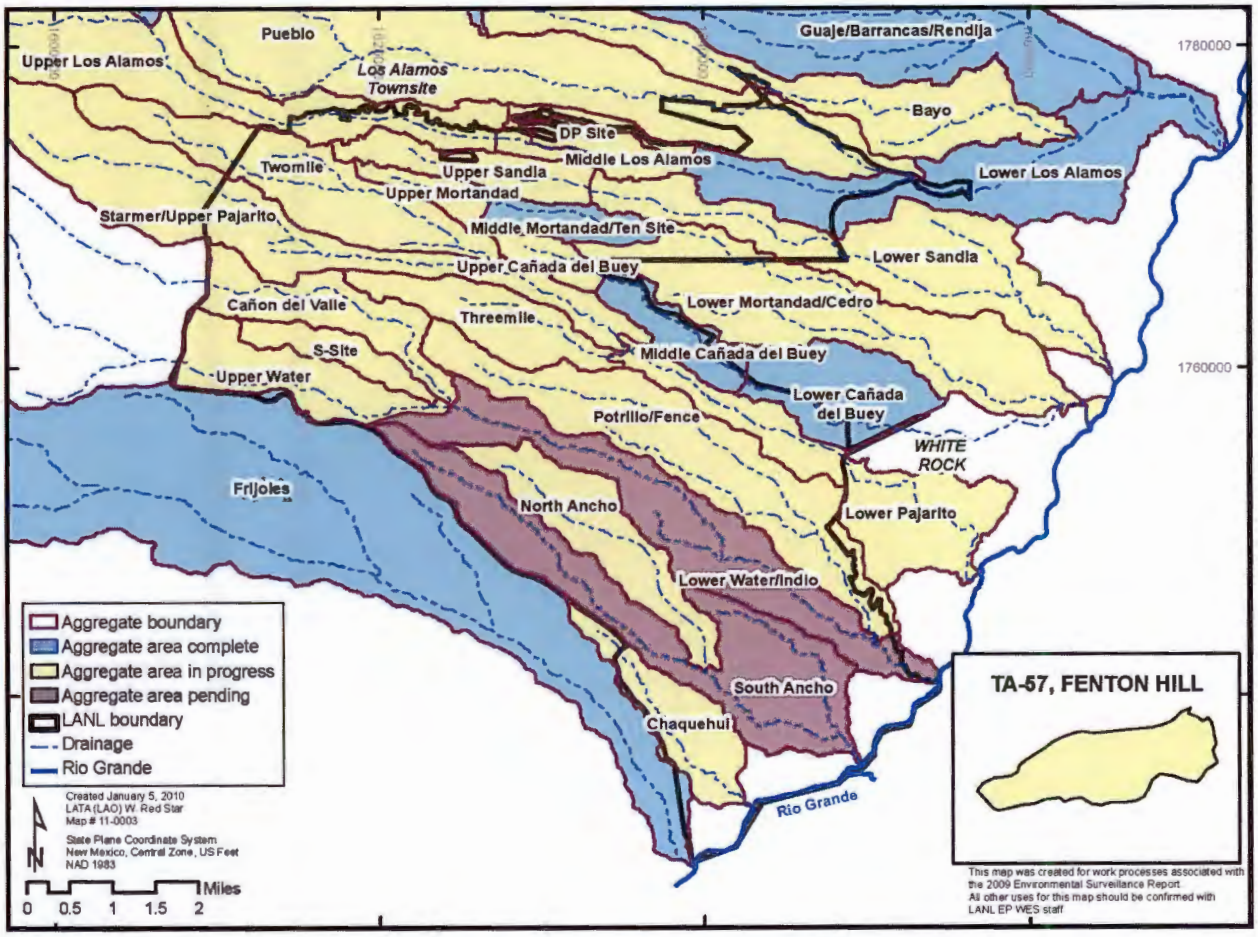

Figure 2-3 **Aggregate areas as defined for the NMED Consent Order and their status. Status is shown as aggregrate area activities complete, activities in progress, or activities pending.**

h. Notices of Violation

In September 2010 the NMED Hazardous Waste Bureau issued LANS and DOE a Notice of Violation (NOV) identifying two alleged violations noted during the December 2009 RCRA compliance inspection. In January 2011, the NMED Hazardous Waste Bureau issued LANS and DOE a Resolution of Notice of Violation identifying one violation noted during the December 2009 inspection. A penalty was not assessed because it was determined that the violation was adequately addressed and no further action was required.

i. Other RCRA Non-Compliances

The following waste storage or transportation violations were found by internal inspections during waste processing operations at LANL:

- Seven hazardous waste labels were found to not include all of the required EPA Hazardous Waste Numbers applicable to the waste. The labels were corrected with the additional EPA Hazardous Waste Numbers.
- Internal RCRA inspections are required the day of or the day following waste management operations. At TA-50-69, waste management occurred on Thursday, August 5, 2010, however, no RCRA inspection occurred for the week of August 2, 2010, through August 8, 2010.

These incidents did not result in any actual or potential hazards to the environment and human health outside the facility, and no material was lost or had to be recovered as a result of any of these incidents. None of these incidents required other reporting to the NMED under the LANL Hazardous Waste Facility Permit.

2. Comprehensive Environmental Response, Compensation, and Liability Act

a. Land Transfer

Tracts A-13 and C-1 (http://www.lanl.gov/environment/nepa/docs/LA-UR-06-8860_ctmap_09-0027-01.pdf) were conveyed to Los Alamos County under Public Law 105-119 in 2010. Environmental Baseline Survey Reports for both tracts were completed, transmitted to, and accepted by LASO prior to conveyance to satisfy the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 120(h) requirements for environmental disclosure in federal real property transfers.

b. Natural Resource Damage Assessment

Under a memorandum of agreement established in 2008, the DOE and several other federal, state, and tribal entities in the region continued to work towards completing a natural resources damages assessment (NRDA) for LANL. Participating entities include the DOE, the Department of Interior, the Department of Agriculture, the State of New Mexico, and the Pueblo de San Ildefonso, Santa Clara Pueblo, and Jemez Pueblo (collectively known as Trustees). The governing regulations include the Clean Water Act (CWA), the Oil Pollution Act of 1990, the DOE Organization Act, CERCLA, and the New Mexico Natural Resources Trustee Act.

The Trustees may assess and recover compensatory damages for injuries to natural resources (including air, surface water, groundwater, soils, and biota) that have resulted from the release of hazardous substances to the environment from LANL. Damages may include the cost of restoring the injured resources to their baseline condition (i.e., the condition that would have existed but for the release) as well as the value of interim service losses pending restoration. Damages are used to restore, rehabilitate, replace, or acquire the equivalent of services provided by injured natural resources.

The LANL Natural Resource Trustee Council released a pre-assessment screen in January 2010. The pre-assessment screen is the initial step in the NRDA process and provides a rapid review of readily available information on hazardous substance releases and the potential impacts of those releases on natural resources. The Trustee Council determined that the pre-assessment screen criteria have been met and it is appropriate to pursue a full-scale assessment. In September 2010, the DOE completed procurement of an NRDA contractor to support Trustee Council development of an assessment plan for a full-scale assessment. Completion of the assessment plan is anticipated in 2012.

3. Emergency Planning and Community Right-to-Know Act

a. Introduction

The Laboratory is required to comply with the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management.

b. Compliance Activities

For 2010, the Laboratory submitted reports to fulfill its requirements under EPCRA, as shown in Table 2-7 and described below.

Table 2-7
Compliance with Emergency Planning and Community Right-to-Know Act during 2010

Statute	Brief Description	Compliance
EPCRA Sections 302–303 Planning Notification	Requires emergency planning notification to state and local emergency planning committees.	No changes to the notification have been made since the July 30, 1999, notification and an update in 2000.
EPCRA Section 304 Release Notification	Requires reporting of releases of certain hazardous substances over specified thresholds to state and local emergency planning committees and to the National Response Center.	No leaks, spills, or other releases of chemicals into the environment required EPCRA Section 304 reporting during 2010.
EPCRA Sections 311–312 Material Safety Data Sheets and Chemical Inventories	Requires facilities to provide appropriate emergency response personnel with an annual inventory and other specific information for any hazardous materials present at the facility over specified thresholds.	The presence of 20 hazardous materials stored at LANL over specified quantities in 2010 required submittal of a hazardous chemical inventory to the State Emergency Response Commission and the Los Alamos County Fire and Police Department.
EPCRA Section 313 Annual Toxic Release Inventory	Requires all federal facilities to report total annual releases of listed toxic chemicals used in quantities above reportable thresholds.	Laboratory use of lead exceeded the reporting thresholds in 2010, requiring submittal of Toxic Chemical Release Inventory Reporting Forms (Form Rs) to the EPA and the State Emergency Response Commission.

i. Emergency Planning Notification

Title III, Sections 302–303, of EPCRA require the preparation of emergency plans for more than 360 extremely hazardous substances if stored in amounts above threshold limits. The Laboratory is required to notify state and local emergency planning committees (1) if any changes at the Laboratory might affect the local emergency plan or (2) if the Laboratory's emergency planning coordinator changes. No updates to this notification were made in 2010.

ii Emergency Release Notification

Title III, Section 304, of EPCRA requires facilities to provide emergency release notification of leaks, spills, and other releases of listed chemicals into the environment if these chemicals exceed specified reporting quantities. Releases must be reported immediately to the state and local emergency planning committees and to the National Response Center. No leaks, spills, or other releases of chemicals into the environment required EPCRA Section 304 reporting during 2010.

iii. Material Safety Data Sheet/Chemical Inventory Reporting

Title III, Sections 311–312, of EPCRA require facilities to provide an annual inventory of the quantity and location of hazardous chemicals above specified thresholds present at the facility. The inventory includes hazard information and the storage location for each chemical. The Laboratory submitted a report to the State Emergency Response Commission and the Los Alamos County Fire and Police Departments listing 20 chemicals and explosives at the Laboratory stored on site in quantities that exceeded reporting threshold limits during 2010.

iv. Toxic Release Inventory Reporting

Executive Order 13423 requires all federal facilities to comply with Title III, Section 313, of EPCRA. This section requires reporting of total annual releases to the environment of listed toxic chemicals that exceed activity thresholds. Beginning with reporting year 2000, new and lower chemical-activity thresholds were put in place for certain persistent, bioaccumulative, and toxic chemicals and chemical categories. The thresholds for these chemicals range from 0.1 g to 100 lb. Until this change went into effect, the lowest threshold was 10,000 lb. LANL operations exceeded the threshold for use of lead in 2010 and therefore was required to report the uses and releases of this chemical. The largest use of reportable lead is at the on-site firing range where security personnel conduct firearms training. Table 2-8 summarizes the reported releases in 2010.

Table 2-8
Summary of 2010
Reported Releases under EPCRA Section 313

	Lead (lb)
Air Emissions	5.62
Water Discharges	0.012
On-Site Land Disposal	3,260
Off-Site Waste Transfers	7,759

4. Toxic Substances Control Act

Given that the Laboratory's activities are focused on R&D rather than the manufacture of commercial chemicals, the Laboratory's main concerns under the Toxic Substances Control Act (TSCA) are the regulations covering polychlorinated biphenyls (PCBs) and the import/export of R&D chemical substances. The PCB regulations govern substances including, but not limited to, dielectric fluids, contaminated solvents, oils, waste oils, heat-transfer fluids, hydraulic fluids, slurries, soil, and materials contaminated by spills.

During 2010, the Laboratory shipped 399 containers of PCB waste off site for disposal or recycling. The quantities of waste disposed of included 2,994 lb (1358 kg) of capacitors and 25,574lb (11,600 kg) of fluorescent light ballasts. The Laboratory manages all wastes in accordance with 40 Code of Federal Regulations (CFR) 761 manifesting, record keeping, and disposal requirements. PCB wastes go to EPA-permitted disposal and treatment facilities. Light ballasts go off-site for recycling. The primary compliance document related to 40 CFR 761.180 is the annual PCB document log that the Laboratory maintains on file for possible inspection by EPA Region 6. The renewal request for the Area G PCB disposal authorization was withdrawn in 2006. During 2010, EPA did not perform a PCB site inspection. Approximately 23 TSCA reviews were conducted on imports and exports of chemical substances for the Laboratory's Property Management Group Customs Office.

5. Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates the manufacturing of pesticides and protection of workers who use these chemicals. Sections of this act that apply to the Laboratory include requirements for certification of workers who apply pesticides. The New Mexico Department of Agriculture has the primary responsibility to enforce pesticide use under the act. The New Mexico Pesticide Control Act applies to the licensing and certification of pesticide workers, record keeping, equipment inspection, as well as application, storage, and disposal of pesticides.

The New Mexico Department of Agriculture did not conduct assessments or inspections of the Laboratory's pesticide application program in 2010. The Laboratory conducted three inspections of the pesticide storage area in 2009 and found that the storage area was maintained in accordance with FIFRA regulations.

Table 2-9 shows the amounts of pesticides and herbicides the Laboratory used in 2010.

6. Clean Air Act

Through the federal Clean Air Act (CAA) Amendments and NMAC 20.2.70 Operating Permits, LANS is authorized to operate applicable air emission sources at LANL. The Laboratory was issued Operating Permit No. P100 in April 2004. The term of this permit was five years, thus an application to renew the permit was submitted to NMED in April 2008. The renewed permit, P100R1, was issued in August 2009. This permit provides the terms and conditions that must be followed in order to operate the applicable air emission sources. The operating permit conditions are a collection of existing source-specific permit conditions that address operation, record keeping, monitoring, and reporting. By complying with the conditions of the Title V Operating Permit, the Laboratory is deemed to be in compliance with all applicable air requirements existing at the date of permit issuance.

As part of the Title V Operating Permit program, LANL reports the emissions from sources included in the Operating Permit to NMED twice a year. These sources include multiple boilers and electric generators, a power plant, a combustion turbine generator, a data disintegrator, two carpenter shops, a degreaser, and an asphalt plant. LANL also reports emissions from chemical use associated with R&D and permitted beryllium activities.

Table 2-9
Herbicides and Pesticides Used at LANL in 2010

Herbicides	Amount
Velossa (5905-579)	35 gal.
Velossa (5905-580)	16.7 quarts
Velpar L (Liquid)	1.5 gal.
Insecticides	**Amount**
Advion ANT Bait (Gel)	120 g
Prescription Treatment (PT) P.I. Contact	8 oz
Prescription Treatment (PT) Wasp Freeze	24 oz
Maxforce Ant Bait (granular)	46 oz
Maxforce Ant Bait Stations (Bait)	6
Silver Fish Bait	0.05 oz
Suspend SC	10 oz
Tempo WP	2.2 oz
Wasp Freeze	26 oz
Water Treatment Chemicals	**Amount**
Garrat-Callahan 312	2 gal.
Garrat-Callahan 314	2 gal.
Garrat-Callahan 314T	3,490 lbs
Garrat-Callahan 315	5.5 gal
Garrat-Callahan 316	38 packs
Sump Buddy	140 packs
Repellant	**Amount**
Bird-X Bird Proof (Liquid)	30 oz

The Title V Operating Permit requires the Laboratory to submit an Annual Compliance Certification to NMED. In the 2010, the Laboratory did not have any permit deviations or excess emissions.

LANL demonstrated full compliance with all applicable air permit terms and conditions and met all required reporting deadlines during 2010.

In 2010, LANL requested a revision to the Title V Operating Permit. The revision will incorporate the permit revisions found in the CMRR-RLUOB New Source Review (NSR) permit 2195-N. This permit revision is expected to be issued in 2011. In addition, a new template is being used by NMED for Title V Operating Permits and this revision will include additional formatting changes that will change the flow and look of the permit.

In 2010, LANL provided the second annual GHG emissions report to NMED, as required by NMAC 20.2.87. The 2010 report provided emissions of carbon dioxide (CO_2) and methane (CH_4) for the 2009 calendar year. The amount of these two gases emitted during 2009 was approximately 56,426 metric tons of CO_2 equivalents from the combustion of fossil fuels. The 2010 emissions for these two gases were approximately 60,460 metric tons of CO_2 equivalents from the combustion of fossil fuels. EPA will also require GHG emission reporting for the first time starting in 2011, for emissions during calendar year 2010. The DOE has set aggressive goals to reduce greenhouse gas emissions; the data submitted in the annual emission reports will be used to track progress made towards these goals.

Under the Title V Operating Permit program, LANL is considered a major source of pollutants, based on the potential to emit NO_X, CO, and volatile organic compounds (VOCs). In 2010, the TA-3 power plant and boilers located across the Laboratory were the major contributors of NO_X, CO, and particulate matter (PM).

However, LANL's highest emissions are still significantly lower than the permit limits, for example NOx emissions contributed to 20% of the permit limit, 10 % for CO, and 0.04% for PM. R&D activities were responsible for most of the VOC and hazardous air pollutant emissions. Table 2-10 summarizes these data.

Table 2-10
Calculated Emissions of Regulated Air Pollutants Reported to NMED in 2010

	Pollutants[a], tons					
Emission Units	**NO_x**	**SO_x**	**PM**	**CO**	**VOC**	**HAPs**
Asphalt Plant	0.05	0.003	0.03	1.60	0.006	0.006
TA-3 Power Plant (3 boilers)	13.2	0.14	1.7	9.1	1.3	0.43
TA-3 Power Plant (combustion turbine)	1.97	0.14	0.27	0.41	0.09	0.06
Regulated Boilers	6.6	0.044	0.6	4.8	0.39	0.13
R&D Chemical Use	NA[b]	NA	NA	NA	6.7	3.7
Degreaser	NA	NA	NA	NA	0.009	0.009
Data Disintegrator	NA	NA	0.05	NA	NA	NA
Carpenter Shops	NA	NA	0.06	NA	NA	NA
Stationary Standby Generators[c]	6.0	0.26	0.30	1.38	0.30	0.002
Miscellaneous Small Boilers[c]	21.3	0.13	1.60	18.0	1.17	0.41
TA-33 Generators (4 units)	1.88	0.24	0.08	1.24	0.06	<0.001
TOTAL	**50.98**	**0.957**	**3.69**	**36.53**	**10.025**	**4.748**

[a] NOx = nitrogen oxides; SOx = Sulfur oxides; PM = particulate matter; CO = carbon monoxide; VOC = volatile organic compounds; HAPs = hazardous air pollutants.
[b] NA = Not applicable.
[c] Emissions from these source categories were reported for the first time in 2004, as required by the Title V Operating Permit. Emissions units in these categories are exempt from construction permitting and annual emission inventory reporting requirements and are not included in Figure 2-4.

LANL staff calculates air emissions using emission factors from source tests, manufacturer's data, and EPA documents. Calculated emissions are based on actual production rates, fuel usage, and/or material throughput. To satisfy requirements found in NMAC 20.2.73, Notice of Intent and Emissions Inventory Requirements, and the Title V Operating Permit, LANL submits an annual Emissions Inventory Report and semi-annual Emissions Reports, respectively, to NMED. Figure 2-4 depicts a five-year history of criteria pollutant emissions. Emissions from 2006 through 2010 are very similar and remain relatively constant.

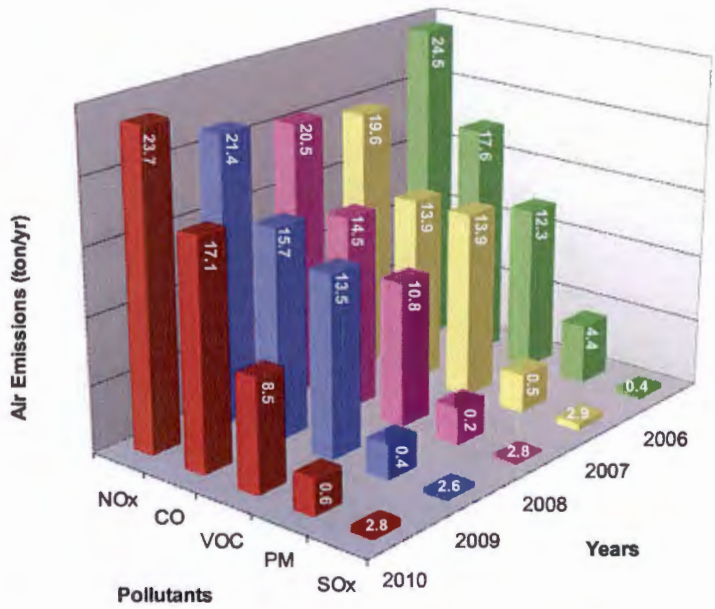

Figure 2-4 **LANL criteria pollutant emissions from 2006 through 2010 for annual emissions inventory reporting. Totals from the emissions inventory report do not include small boilers or standby generators.**

a. New Mexico Air Quality Control Act

i. Permits

LANL reviews plans for new and modified projects, activities, and operations to identify all applicable air quality requirements including the need to apply for construction permits or to submit notifications to NMED. In August 2009, NMED renewed and issued the Title V

Operating Permit. During 2010, the Laboratory requested a Title V Operating Permit revision. The permit revision will include requirements from the CMRR-RLUOB NSR permit. LANL submitted two exemption notifications to NMED during 2010. The exemptions were for bulb crushers and a small generator. During 2010, LANL operated under the air permits listed in Table 2-5.

ii. Open Burning

LANL may perform open burning under 20.2.60 NMAC (Open Burning) or 20.2.65 NMAC (Smoke Management) to thin vegetation and reduce the threat of fire. LANL did not perform any open burning during 2010.

iii. Asbestos

The National Emission Standard for Hazardous Air Pollutants (NESHAP) for Asbestos requires that LANL provide advance notice to NMED for large renovation jobs that involve asbestos and for all demolition projects. The asbestos NESHAP further requires that all activities involving asbestos be conducted in a manner that mitigates visible airborne emissions and that all asbestos-containing wastes be packaged and disposed of properly.

LANL continued to perform renovation and demolition projects in accordance with the requirements of the asbestos NESHAP. In 2010, 25 large renovation and demolition projects were completed. NMED was provided advance notice on each of these projects. All waste was properly packaged and disposed of at approved landfills. To ensure compliance, the Laboratory conducted internal inspections of job sites and asbestos packaging approximately monthly.

b. Federal Clean Air Act

i. Ozone-Depleting Substances

Title VI of the CAA contains specific sections that establish regulations and requirements for ozone-depleting substances (ODS), such as halons and refrigerants. The main sections applicable to the Laboratory prohibit individuals from knowingly venting or otherwise releasing into the environment any refrigerant or refrigerant substitute during maintenance, repair, service, or disposal of halon fire-suppression systems and air-conditioning or refrigeration equipment. All technicians who work on refrigerant systems must be EPA-certified and must use certified recovery equipment. The Laboratory is required to maintain records on all work that involves refrigerants and the purchase, usage, and disposal of refrigerants. The Laboratory's standards for refrigeration work are covered under Criterion 408, EPA Compliance for Refrigeration Equipment, of the LANL Operations and Maintenance Manual.

The Laboratory continued to work at eliminating the use of Class I and Class II ODS. Class I and Class II ODS are the refrigerants that have high ozone-depleting potentials. In 2010, the Laboratory removed approximately 5,873 pounds of Class I ODS and 690 pounds of Class II ODS from the active inventory.

ii. Radionuclides

Under the NESHAP regulations, which regulate the air emissions of radionuclides other than radon from facilities owned or operated by the DOE, the EPA limits to 10 mrem/yr the effective dose equivalent of airborne releases of radioactive material from a DOE facility, such as LANL, to any member of the public. The 2010 annual dose to the maximally exposed individual (MEI), as calculated using EPA-approved methods, was 0.33 mrem. The location of the highest dose was on the rim of Los Alamos Canyon, immediately south of the Los Alamos Lodge (formerly the Los Alamos Inn). Resuspension of plutonium contaminated soils on the south facing slopes of Los Alamos canyon contributed over half of this dose; the remainder came from other Laboratory stack emissions and environmental cleanup work. See Chapter 4 for more information about these emissions.

7. Clean Water Act

a. NPDES Industrial Point Source Outfall Self-Monitoring Program

The primary goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The act established the requirements for NPDES permits for point-source effluent

discharges to the nation's waters. The NPDES Industrial Point Source outfall permit establishes specific chemical, physical, and biological criteria that the Laboratory's effluent must meet before it is discharged.

LANS and DOE/NNSA are co-permittees of the NPDES permit covering Laboratory operations. EPA Region 6 in Dallas, Texas, issues and enforces the permit. NMED certifies the EPA-issued permit and performs some compliance-evaluation inspections and monitoring for the EPA. During 2010, the Laboratory's industrial point-source NPDES permit contained 15 permitted outfalls that include one sanitary outfall and 14 industrial outfalls (Table 2-11). To facilitate full compliance with the requirements in the current permit, the Laboratory is planning to eliminate outfalls and to add additional treatment technologies. The Laboratory's NPDES permit is available online at http://www.lanl.gov/environment/h2o/permits.shtml?1. Outfalls listed on the current permit that did not discharge in CY10 include Outfall 02A129 (TA-21 Steam Plant has not been used since 2007 and is scheduled for D & D), Outfall 03A021 (air washers at CMR that were engineered to operate without discharging in late 2007), and Outfall05A055 (The High Explosives Wastewater Treatment Facility (HEWTF) currently uses a mechanical evaporator). Projects were completed in CY10 through the Outfall Reduction Program at Outfalls 03A021, 03A130, and 03A185 that will result in no future discharges at these outfalls. It is anticipated that these outfalls, in addition to Outfall 02A129, will be removed from the current permit in CY11.

Table 2-11
Volume of Effluent Discharge from NPDES Permitted Outfalls in 2010

Outfall Number	TA-Bldg	Description	Watershed (Canyon)	2010 Discharge (gal.)
02A129	21-357	TA-21 Steam Plant	Los Alamos	0
03A048	53-963/978	LANSCE Cooling Tower	Los Alamos	17,433,300
051	50-1	TA-50 Radioactive Liquid Waste Treatment Facility	Mortandad	571,088
03A021	3-29	CMR Building Air Washers	Mortandad	0
03A022	3-2238	Sigma Cooling Tower	Mortandad	847,260
03A160	35-124	National High Magnetic Field Laboratory Cooling Tower	Mortandad	18,771
03A181	55-6	Plutonium Facility Cooling Tower	Mortandad	1,042,273
13S	46-347	Sanitary Wastewater Treatment Plant	Sandia	98,666,000
001	3-22	Power Plant (includes treated effluent from Outfall 13S)	Sandia	94,968,216
03A027	3-2327	Strategic Computing Complex Cooling Tower	Sandia	16,778,600
03A113	53-293/952	LANSCE Cooling Tower	Sandia	442,205
03A199	3-1837	Laboratory Data Communications Center	Sandia	9,164,120
03A130	11-30	TA-11 Cooling Tower	Water	48
03A185	15-312	DARHT Cooling Tower	Water	542,788
05A055	16-1508	High Explosives Wastewater Treatment Facility	Water	0
			2010 Total:	**141,808,699**

The Laboratory's current NPDES outfall permit requires weekly, monthly, quarterly, and yearly sampling to demonstrate compliance with effluent quality limits. The Laboratory reports analytical results to EPA and NMED at the end of the monitoring period for each respective outfall category. During 2010, none of the 76 samples collected from the SWWS Plant's outfall exceeded effluent limits; however, four of the 1,243 samples collected from industrial outfalls exceeded effluent limits (described below). Monitoring data obtained from sampling at NPDES permitted outfalls are in Supplemental Data Table S2-1 and S2-2 (on included compact disc) and available online at www.racernm.com/.

EPA Region 6 issued LANS and DOE two NOV for exceedences of the NPDES permit limits in 2010. The first NOV was issued on March for 8 permit exceedences from February 2009 through January 2010. The second NOV was issued on November for 2 permit exceedences that occurred June through September.

The following is a summary of the corrective actions the Laboratory took during 2010 to address the NPDES outfall permit noncompliances cited above.

- *TA-55 PF Outfall 03A18:*. On January 20, 2010, during a discharge, a total residual chlorine (TRC) measurement of 0.11 mg/L was above the permit limit of 0.011 mg/L. The pump that injects chlorine neutralizer into the blowdown had a faulty diaphragm, resulting in inadequate dechlorination of the effluent. When the pump is set at a low rate, chlorine neutralizer was not delivered with every stroke of the pump. The rate of the pump was increased. A new pump was ordered and has been installed. The pump will be entered on a replacement schedule based on manufacturer's recommendations. Facility personnel have ordered and are using additional chlorine monitoring equipment for operational sampling of the cooling system.
- *TA-53 LANSCE Outfall 03A048*: On June 17, 2010, at 2:20 p.m. during a cooling tower discharge, the TRC result was measured at 0.72 mg/L, which is above the permit limit of 0.011 mg/L. A check valve on the chemical feed pump for the de-chlorination system was stuck closed and was fixed at 3:00 p.m. on June 17, 2010. Facility personnel are in the process of installing a chlorination control system that will continually monitor and control the amount of free chlorine in the cooling tower basin, keeping levels within a tight range. The new system will continually monitor the total chlorine in the blow down line and will initiate a redundant chlorine neutralization pump if total chlorine is detected. The completion is anticipated no later than May 31 2011.
- *TA-53 LANSCE Outfall 03A048:* On September 27, 2010 at 2:20 p.m. during a cooling tower discharge, the TRC result was measured at >2.2 mg/L which is above the permit limit of 0.011 mg/L. The chemical injector pump that feeds the de-chlorinator into the blowdown was seized. The pump was replaced on September 28, 2010. Facility personnel are in the process of installing a chlorination control system that will continually monitor and control the amount of free chlorine in the cooling tower basin, keeping levels within a tight range. The new system will continually monitor the total chlorine in the blow down line and will initiate a redundant chlorine neutralization pump if total chlorine is detected. The completion is anticipated no later than May 31, 2011.
- *TA-53 LANSCE Outfall 03A048:* On December 7, 2010, at 11:54 a.m., during a cooling tower discharge, the total arsenic was measured at 13.5 ug/L. This result (received January 3, 2011) exceeded the monthly average permit limit of 0.010 mg/L (10 ug/L). Facility personnel decreased the cycles of concentration from 2.75 cycles to 2.25 cycles on January 4, 2011, at approximately 3:30 PM. At the time compliance samples were collected, arsenic levels in the cooling tower were not being monitored by an installed arsenic analyzer. The arsenic analyzer malfunctioned at the end of November 2010 and the facility was awaiting the vendor to arrive and inspect the arsenic analyzer. The analyzer was functioning properly on December 14, 2010. A procedure to implement administrative controls when the analyzer is off-line is being finalized and an alarm is being tied in to the computer control system.

b. NPDES Sanitary Sewage Sludge Management Program

The Laboratory's TA-46 SWWS Plant is an extended-aeration, activated-sludge sanitary wastewater treatment plant. The activated-sludge treatment process requires periodic disposing of excess sludge (waste-activated sludge) from the plant's clarifiers to synthetically lined drying beds. After air-drying for a minimum of 90 days to reduce pathogens, the dry sludge is characterized and disposed of as a New Mexico Special Waste. During 2010, the SWWS Plant generated approximately 19.3 dry tons (45,833 dry lbs) of sewage sludge. All of this sludge was disposed of as a New Mexico Special Waste at a landfill authorized to accept this material.

c. NPDES Storm Water Construction Permit Program

The NPDES Construction General Permit (CGP) Program regulates storm water discharges from construction activities disturbing one or more acres, including those construction activities that are part of a larger common plan of development collectively disturbing one or more acres.

LANL and the general contractor apply individually for NPDES CGP coverage and are co-permittees at most construction sites. Compliance with the NPDES CGP includes developing and implementing a Storm Water Pollution Prevention Plan (SWPPP) before soil disturbance can begin and conducting site inspections once soil disturbance has commenced. A SWPPP describes the project activities, site conditions, best management practices (erosion control measures), and permanent control measures required for reducing pollution in storm water discharges and protecting endangered or threatened species and critical habitat. Compliance with the NPDES CGP is demonstrated through periodic inspections that document the condition of the site and also identify corrective actions required to keep pollutants from moving off the construction site. Data collected from these inspections are tabulated weekly, monthly, and annually in the form of Site Inspection Compliance Reports.

During 2010, the Laboratory implemented and maintained 48 construction site SWPPPs and addendums to SWPPPs and performed 599 storm water inspections. The Laboratory uses a geographic information system to manage project information and generate status reports that facilitate reporting under the Director's Portfolio Reviews. The overall CGP inspection compliance record in 2010 was 99.5%, which is 596 of the 599 inspections.

The LANL storm water team continued to use relatively new methods to assist with storm water compliance. Improvements in accounting for non-uniform distribution of precipitation were made by using a network of rain gauges in association with the Thiessen polygon method. This method associated 13 precipitation gauges across the Laboratory with LANL construction projects to ensure refined data were used for triggering storm water inspections. The gauges were equipped with 5-minute tipping buckets connected to existing stations with data loggers. The team incorporated solutions for preventing non-compliances in its Quality Improvement Performance Report. To further reduce future CGP non-compliances and to increase awareness of CGP requirements, the storm water team briefed subcontractors on CGP requirements at pre-bid and pre-construction meetings. Storm water requirements were put into subcontract requirements, so each bidder who responds to or bids on a subcontract for a Laboratory project is given project-specific environmental requirements. The team also gave presentations to multiple LANL organizations to increase awareness of CGP requirements and continued to hold a standing weekly meeting with LANL Project Management personnel to review the storm water compliance status of projects.

d. NPDES Industrial Storm Water Program

The NPDES Industrial Storm Water Permit Program regulates storm water discharges from identified regulated industrial activities (including SWMUs) and their associated facilities. These activities include metal fabrication; hazardous waste treatment and storage; vehicle and equipment maintenance; recycling activities; electricity generation; warehousing activities; and asphalt manufacturing.

LANS and the DOE are co-permittees under the EPA 2008 NPDES Storm Water Multi-Sector General Permit for Industrial Activities (MSGP-2008). MSGP-2008 requires the development and implementation of site-specific SWPPPs, which must include identifying potential pollutants and activities and installing erosion control measures. Permit requirements also include monitoring storm water discharges from permitted sites. In 2010, LANL implemented and maintained 15 SWPPPs under the MSGP-2008 requirements, covering 19 facilities. Compliance with the requirements for these sites is achieved primarily by implementing the following activities:

- Identifying potential contaminants and activities that may impact surface water quality and identifying and providing structural and nonstructural controls to limit the impact of those contaminants.
- Developing and implementing facility-specific SWPPPs
- Implementing corrective actions identified during inspections throughout the year
- Monitoring storm water runoff at facility gauging stations and stand-alone samplers for industrial sector-specific benchmark parameters, impaired water constituents, and effluent limitations, and

visually inspecting storm water runoff to assess color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of storm water pollution

e. NPDES Individual Permit for Storm Water Discharges from SWMUs/AOCs

In November 2010, EPA Region 6 issued a permit that authorizes discharges of storm water from certain Potential Release Sites (PRSs), SWMUs, and AOCs at the Laboratory. The individual permit (IP) was issued in September 2010 and became effective on November 1, 2010 (NPDES Permit No. NM0030759).

The sites listed in the IP are associated with historical LANL operations dating back to the Manhattan Project era of the 1940s. The IP lists 405 permitted sites that must be managed to prevent the transport of contaminants off site via storm water runoff. Potential contaminants of concern within these sites are metals, organics, high explosives and radionuclides. These contaminants are present in soils near the top of the soil profile and are susceptible to storm event driven erosion and transport through storm water runoff.

The IP is unique in that it is a technology-based permit and relies, in part, on non-numeric technology-based effluent limits. Site-specific storm water control measures that reflect best industry practice considering their technological availability, economic achievability and practicability are required for each of the 405 permitted sites to minimize or eliminate discharges of pollutants. These controls are referred to as Best Management Practices (BMPs). BMPs are routinely inspected and maintenance is performed as required.

The local storm water drainage around sites (called Site Monitoring Areas [SMAs]) has been hydrologically analyzed, and sampling locations have been identified to most effectively sample runoff from sites. Stormwater is monitored from these SMAs to determine the effectiveness of the controls. When target action levels (TALs) which are based on New Mexico water quality standards are exceeded, corrective actions are required. In summary, the process of complying with the IP can be broken down into five phases: (1) Installation and maintenance of baseline controls; (2) storm water confirmation sampling in support of baseline controls; (3) corrective action (if TAL exceeded); (4) confirmation sampling in support of corrective actions; and (5) closeout or alternative compliance.

In 2010, the Laboratory completed the following tasks:

- Development of a Site Discharge Pollution Prevention Plan (SDPPP) for SWMU/AOCs that describes three main objectives: identification of pollutant sources, description of control measures and monitoring that determines the effectiveness of controls at all regulated SWMU/AOCs
- Fieldwork:
- Completed more than 1,000 rain event inspections conducted on all 250 SMAs
- Conducted BMP maintenance during inspection at 140 SMAs
- Conducted BMP installation at 205 SMAs
- Maintained 45 gauge stations for storm event sampling in support of ESR and Los Alamos/Pueblo canyon monitoring
- Decommissioned/removed sampler and equipment at 45 previous Federal Facilities Compliance Agreement (FFCA) locations

f. Aboveground Storage Tank Compliance Program

The Laboratory's Aboveground Storage Tank (AST) Compliance Program is responsible for ensuring compliance with the requirements established by EPA (Clean Water Act, 40 CFR, Part 112) and NMED's Petroleum Storage Tank Bureau (PSTB) Regulations (20.5 NMAC). During 2010, the Laboratory was in full compliance with both EPA and NMED requirements.

Spill Prevention Control and Countermeasures (SPCC) Plans fulfill the federal requirements for the AST Compliance Program, as required by the CWA (Oil Pollution Prevention Regulations, 40 CFR, Part 112).

Comprehensive SPCC Plans are developed to meet EPA requirements that regulate water pollution from oil spills.

EPA proposed additional extensions to compliance deadlines for meeting new regulatory requirements under the federal Clean Water Act (40 CFR, Part 112). Proposed new regulations will require the Laboratory to modify and implement its SPCC Plans by November 10, 2011. Primary modifications address AST storage capacity, inspection frequency, integrity testing requirements, and equipment. The Laboratory completed four modifications to existing and new SPCC Plans and implementation of those modifications is in process. The Laboratory continues to maintain and operate ASTs in compliance with 20.5 NMAC of the NMED-PSTB regulations. The Laboratory paid annual AST registration fees of $100 per AST. The Laboratory has three tank systems that are operational pursuant to 20.5 NMAC. The remaining four tanks systems are under temporary closure status pursuant to 20.5 NMAC.

During 2010, the Laboratory continued to work on removing and decommissioning ASTs that are no longer in service. Four AST systems are expected to be officially closed out with NMED-PSTB pursuant to 20.5 NMAC in 2011.

g. Dredge and Fill Permit Program

Section 404 of the Clean Water Act requires the Laboratory to obtain permits from the US Army Corps of Engineers to perform work within perennial, intermittent, or ephemeral watercourses. Section 401 of the Clean Water Act requires states to certify that Section 404 permits issued by the Corps of Engineers will not prevent attainment of state-mandated stream standards. NMED reviews Section 404/401 joint permit applications and issues separate Section 401 certification letters, which may include additional permit requirements to meet state stream standards for individual Laboratory projects. In addition, the Laboratory must comply with 10 CFR 1022, which specifies how DOE sites comply with Executive Order 11988, Floodplain Management, and Executive Order 11990, *Protection of Wetlands*.

During 2010, Section 404/401 permits were issued for four construction projects at the Laboratory:

- Stream Gage E110 Construction Project, Los Alamos Canyon (Nationwide Permits Nos. 5, 18, and 43, for Scientific Measurement Devices, Minor Discharges, and Stormwater Management Facilities, respectively)
- Stream Gages E042 and E050 Construction Project, Los Alamos Canyon (Nationwide Permits Nos. 5, 18, 33, and 43, for Scientific Measurement Devices, Minor Discharges, Temporary Construction Access and Dewatering, and Stormwater Management Facilities, respectively)
- Stream Gage E059 Construction Project, Pueblo Canyon (Nationwide Permit No. 5, Scientific Measurement Devices)
- Tactical Training Facility Project, Installation of a Temporary Culvert, Cañon de Valle (Nationwide Permit No. 14, Linear Transportation Projects)

In addition, LANL reviewed 597 excavation permits and 79 project profiles for potential impacts to watercourses, floodplains, or wetlands. One Floodplain/Wetland Assessment was prepared in 2010 for potential impacts to the wetlands and floodplain in Sandia Canyon resulting from changes in discharge volumes from NPDES Outfall 001 and from possible clean-up activities. One violation of the DOE Floodplains/Wetlands Environmental Review Requirements was recorded in 2010. The construction of a temporary fill bridge over Cañon de Valle violated 10 CFR 1022 and was reported to DOE LASO. NMED and the Corps of Engineers did not inspect any sites permitted under the Section 404/401 regulations during 2010.

8. Safe Drinking Water Act

Los Alamos County, as owner and operator of the Los Alamos water supply system, is responsible for compliance with the requirements of the federal Safe Drinking Water Act (SDWA) and the New Mexico Drinking Water Regulations (NMEIB 2007). The SDWA requires Los Alamos County to collect samples

from various points in the water distribution systems at the Laboratory, Los Alamos County, and Bandelier National Monument to demonstrate compliance with SDWA maximum contaminant levels (MCLs). EPA has established MCLs for microbiological organisms, organic and inorganic constituents, and radioactivity in drinking water. The State of New Mexico has adopted these standards in the New Mexico Drinking Water Regulations (http://www.nmenv.state.nm.us/dwb/regulations/). EPA has authorized NMED to administer and enforce federal drinking water regulations and standards in New Mexico. Information on the quality of the drinking water from the Los Alamos County water supply system is in the County's annual Consumer Confidence Report, available online at http://www.losalamosnm.us/.

In 2010, the Laboratory conducted additional confirmation monitoring of the Los Alamos County water supply system for quality assurance purposes. The data are presented in Chapter 5 of this report and at the online RACER Data Analysis Tool (www.racernm.com/). Drinking water supplied by Los Alamos County has not been impacted by any LANL contaminants.

9. Groundwater

a. Groundwater Protection Regulations

New Mexico Water Quality Control Commission (NMWQCC) regulations control liquid discharges onto or below the ground surface to protect all groundwater in New Mexico. Under the regulations, when required by NMED, a facility must submit a discharge plan and obtain a permit from the NMED (or approval from the New Mexico Oil Conservation Division for energy/mineral-extraction activities). Subsequent discharges must be consistent with the terms and conditions of the discharge permit. In 2010, the Laboratory had one discharge permit and two discharge plans pending NMED approval (see Table 2-5).

i. TA-46 SWWS Plant Discharge Permit DP-857

On July 20, 1992, the Laboratory was issued a discharge permit for the TA-46 SWWS Plant. The permit was renewed on January 7, 1998, and modified by the NMED on October 1, 2002. The permit requires quarterly sampling of the SWWS Plant's effluent, NPDES Outfalls 001 and 03A027, and Cañada del Buey alluvial groundwater well CDBO-6 to demonstrate compliance with NMWQCC groundwater standards. The Laboratory reports the analytical results to the NMED quarterly. During 2010, none of samples collected exceeded NMWQCC groundwater standards. Monitoring data are available online at the RACER Data Analysis Tool (www.racernm.com/). On April 6, 2010, the NMED requested an application for renewal and modification of discharge permit DP-857. Accordingly, the Laboratory submitted a renewal application on July 2, 2010. The NMED conducted a site inspection of the TA-46 SWWS Plant on September 9, 2010. Approval of the renewal application was pending at the end of 2010.

ii. TA-50 RLWTF Discharge Plan DP-1132

On August 20, 1996, at the NMED's request, the Laboratory submitted a discharge plan application for the RLWTF at TA-50; NMED approval was pending at the end of 2010. Since 1999, the Laboratory has conducted voluntary quarterly sampling of the RLWTF's effluent and alluvial groundwater monitoring wells MCO-3, MCO-4B, MCO-6, and MCO-7 in Mortandad Canyon for nitrate (as N), fluoride, and total dissolved solids (TDS). The Laboratory reports the analytical results to the NMED quarterly. During 2010, none of the quarterly discharge plan samples exceeded NMWQCC groundwater standards. Monitoring data are available online at the RACER Data Analysis Tool (www.racernm.com/).

iii. Domestic Septic Tank/Leachfield Systems Discharge Plan DP-1589

On April 27, 2006, at the NMED's request, the Laboratory submitted a discharge plan application for the discharge of domestic wastewater from 21 septic systems. These septic systems (a combined septic tank and leach field) are located in remote areas of the Laboratory where access to the SWWS Plant's collection system is not practicable. On April 6, 2010, the NMED requested that LANL submit a new, up-to-date septic tank/leachfield systems discharge plan application. Accordingly, on June 25, 2010, LANL submitted an updated discharge plan application for 15 septic tank/leachfield systems. The NMED conducted a site inspection of all septic tank/leachfield systems on September 23-24, 2010. Approval of the new application was pending at the end of 2010.

b. Groundwater Monitoring Activities

The Laboratory performed significant groundwater compliance work in 2010 pursuant to the Consent Order. These activities included groundwater monitoring, groundwater investigations, and installation of monitoring wells and a hydrologic test well in support of various groundwater investigations and corrective measure evaluations (CMEs).

In 2010, LANL installed two monitoring wells (with three screens) in the perched/intermediate aquifer and 12 monitoring wells (with 20 screens) in the regional aquifer (Table 2-12). Figure 2-5 shows the locations of the new wells; maps of all monitoring well locations can be found in Chapter 5.

Table 2-12
Monitoring Wells Installed in 2010

Type[a]	Identifier	Watershed (Canyon)	Total Completed depth[b] (ft bgs)	Screened interval(s) (ft bgs)	Initial Water level (famsl)	Comments
I	CdV-16-4ip	Cañon de Valle	1146.0	815.6–879.2 1110–1141.1	6655 (Screen 1) 6375 (Screen 2)	Hydrologic test well installed downgradient of the 260 Outfall (Consolidated Unit 16-021(c)-99) to evaluate the hydrologic properties of the deep perched intermediate aquifer in TA-16. Completed on 8/23/2010.
R	R-3	Pueblo Canyon	1006.8	974.5–995.0	5743	Monitoring well installed in Pueblo Canyon, near the eastern boundary of the Laboratory's TA-74. Objective of the well was to provide a regional aquifer monitoring well within potential contamination flow paths in the regional aquifer near municipal production well Otowi 1. Completed on 6/21/2010.
R	R-29	Water/Ancho	1191.8	1170.0–1180.0	5949.2	Monitoring well installed to provide a regional aquifer monitoring well downgradient of TA-49 and MDA AB to determine whether zones of perched-intermediate groundwater occur under MDA AB and to reduce geologic uncertainty. Completed on 3/31/2010.
R	R-30	Water/Ancho	1171.8	1140.0–1160.9	5949.8	Monitoring well installed to provide a regional aquifer monitoring well at the eastern edge of TA-49 and downgradient of MDA AB, to determine whether zones of perched-intermediate groundwater occur under MDA AB, and to reduce geologic uncertainty. Completed on 4/3/2010.
R	R-50	Mortandad	1217.5	1077.0–1087.0 1185.0–1205.6	5837.0 (Screen 1) 5836.7 (Screen 2)	Monitoring well installed on the mesa south of Mortandad Canyon to define the southern extent of chromium contamination in the regional aquifer. Completed on 2/13/2010.
R	R-51	Pajarito	1046.1	915.0 to 925.2 1031.0 to 1041.0	5870.1 (Screen 1) 5868.6 (Screen 2)	Monitoring well installed west of MDAs H and J, and northwest of TA-18. Monitors TA-54 and other potential contaminant sources in Pajarito Canyon. Completed on 2/8/10.
R	R-52	Pajarito	1128.7	1035.2–1055.7 1107.0–1117.0	5865.7 (Screen 1) 5863.9 (Screen 2)	Monitoring well installed north-northeast of MDAs H and J, on mesa south of Cañada del Buey. Monitors for potential releases of contaminants from MDAs H and J. Completed on 3/31/10.

Table 2-12 (continued)

Type[a]	Identifier	Watershed (Canyon)	Total Completed depth[b] (ft bgs)	Screened interval(s) (ft bgs)	Initial Water level (famsl)	Comments
R	R-53	Pajarito	1001.9	849.2–859.2 959.7–980.2	5861.1 (Screen 1) 5852.0 (Screen 2)	Monitoring well installed north of MDA L in Cañada del Buey; monitors for potential releases from MDA L. Completed on 3/1/10.
R	R-54	Pajarito	936.0	830.0–840.0 915.0–925.0	5862.8 (Screen 1) 5864.6 (Screen 2)	Monitoring well installed immediately west of MDA L in Pajarito Canyon; monitors for potential releases from MDA L. Completed on 1/29/10.
R	R-55	Pajarito	1021.0	860.0–880.6 994.4–1015.4	5698.8 (Screen 1) 5698.6 (Screen 2)	Monitoring well installed downgradient of MDA G; monitors for potential contaminant releases from MDA G and other sources in Pajarito Canyon. Completed on 8/25/2010.
R	R-56	Pajarito	1078.8	945.0–965.6 1046.6 to 1067.1	5858.5 (Screen 1) 5855.8 (Screen 2)	Monitoring well installed on Mesita del Buey between MDA G and MDA L; monitors for potential contaminant releases from MDAs G and L, and other sources in Pajarito Canyon. Completed on 7/19/2010.
R	R-57	Pajarito	1013.8	910.0–930.5 971.5–992.1	5758.5 (Screen 1) 5750.2 (Screen 2)	Monitoring well installed downgradient of MDA G at the eastern end of TA-54; monitors for potential releases from MDA G. Completed on 6/8/2010.
R	R-60	Pajarito	1360.9	1330.0–1350.9	5908.7	Monitoring well installed east of MDA C; monitors for potential contaminant releases from MDA C. Completed on 10/18/2010.
I	TW-2Ar	Pueblo	113.9	102.0–112.0	6553.3	Replacement monitoring well for TW-2A; monitors perched-intermediate groundwater in lower Pueblo Canyon. Completed on 3/4/10.

[a] I = Perched intermediate aquifer well; R = regional aquifer well.

[b] Total depth refers to the completed well; bgs = below ground surface; famsl = feet above mean sea level.

Intermediate well CdV-16-4ip was installed downgradient of the 260 Outfall in TA-16 as a hydrologic test well to evaluate the properties of the deep perched groundwater. Regional well R-3 was installed east of TA-74 to monitor for potential contamination near the municipal production well Otowi 1. Regional wells R-29 and R-30 were installed downgradient of TA-49 and MDA-AB. Regional well R-50 was installed on the mesa south of Mortandad Canyon as part of the ongoing chromium investigation. Regional wells R-50, R-51, R-52, R-53, R-54, R-55, R-56, and R-57 were installed to monitor for potential contamination from material disposal areas (MDAs) in TA-54 and to support CMEs for MDAs at TA-54.

Sample analytical and other groundwater data can be reviewed online on the RACER Data Analysis Tool (www.racernm.com/). Periodic monitoring reports and water-level and well construction data can be found on the Laboratory's Environment Website at http://www.lanl.gov/environment/h2o/reports.shtml.

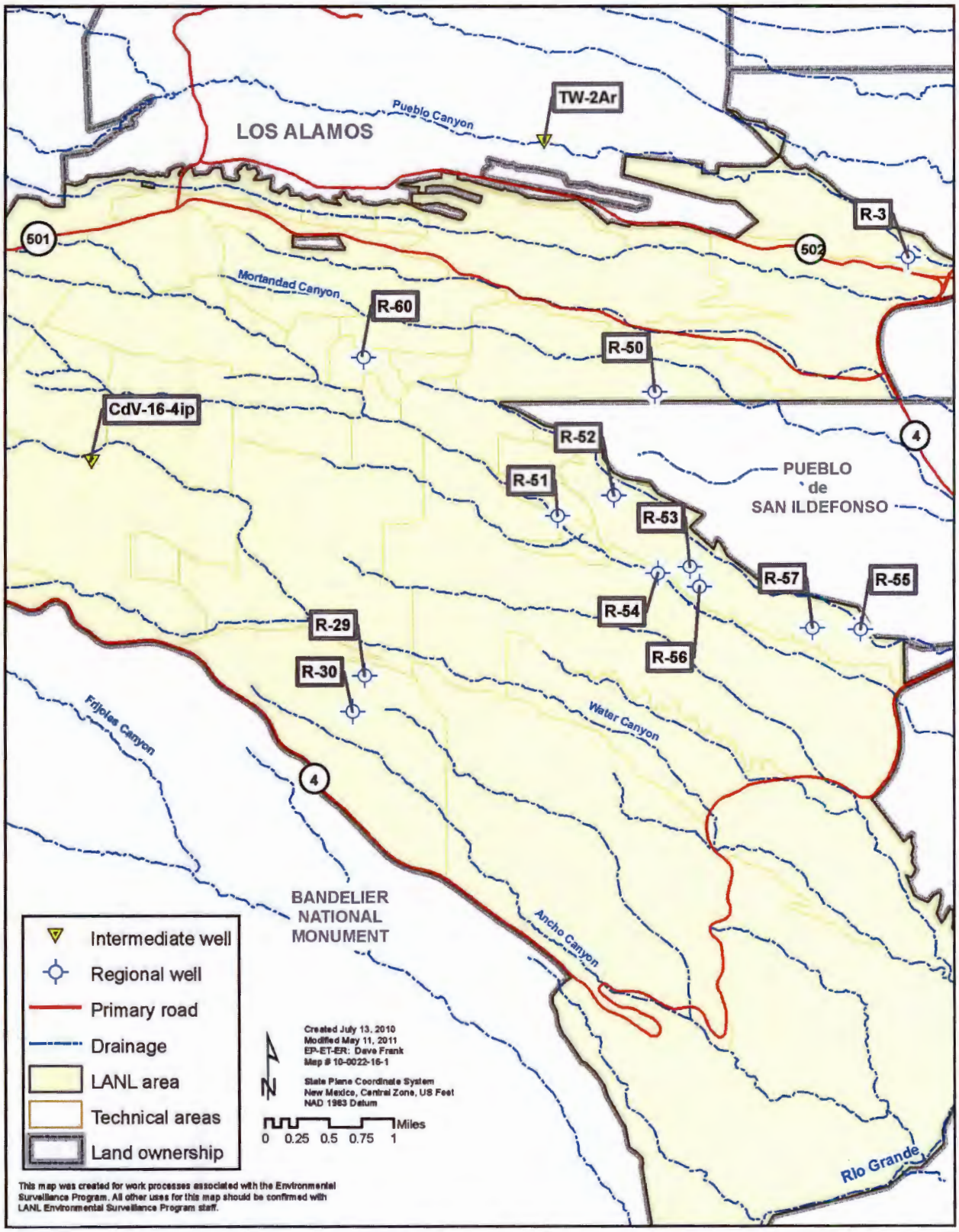

Figure 2-5 **Groundwater monitoring wells installed during 2010**

10. National Environmental Policy Act

Under the National Environmental Policy Act (NEPA) (42 U.S.C. 4331 et seq.), federal agencies such as DOE/NNSA must consider the environmental impacts of proposed projects and ensure public participation as part of the decision-making process. The Laboratory's Environmental Stewardship Group devotes considerable resources to assist NNSA in compliance with NEPA, pursuant to DOE Order 451.1B. Proposed projects and actions at LANL are reviewed to determine potential resource impacts and the appropriate coverage under NEPA, and these recommendations are provided to NNSA.

The DOE NEPA implementing regulations (10 CFR Part 1021.330[d]) require a Site-Wide Environmental Impact Statement (SWEIS) to be reviewed at least every five years and a Supplemental Analysis to examine whether the SWEIS still adequately covers site operations. In August 2005, a memo was issued to LANL from DOE/NNSA to prepare a new SWEIS. The final SWEIS was issued in May 2008 (DOE 2008a). Two Records of Decision (ROD) have been issued to date, one in September 2008 (DOE 2008b) and one in June 2009 (DOE 2009). In both RODs, DOE/NNSA decided to implement the No Action Alternative with the addition of some elements of the Expanded Operations Alternative.

The first Supplement Analysis to the 2008 SWEIS was issued by DOE in October 2009. This analysis was prepared to determine if the 2008 SWEIS adequately bounded offsite transportation of low specific activity and LLW by a combination of truck and rail to EnergySolutions in Clive, Utah. DOE/NNSA concluded that the proposed shipment of waste to EnergySolutions by truck and rail are bounded by 2008 SWEIS transportation analysis.

LANL reviews all proposed projects and verifies that they will be compliant with the existing SWEIS or other NEPA documents. In some cases, further NEPA analysis is done, and NEPA documents are prepared. For example, in 2010, LANL supported the completion of an environmental assessment for the Sanitary Effluent Reclamation Facility and Environmental Restoration of Reach S-2 of Sandia Canyon (DOE/EA-1736).

11. Endangered Species Act

The Endangered Species Act requires federal agencies to protect populations and habitats of federally listed threatened or endangered species. LANL implements these requirements through the Biological Resources Management Plan (LANL 2007) and the Habitat Management Plan (LANL 2011).

The Laboratory contains potential habitat for two federally endangered species (Southwestern willow flycatcher, *Empidonax traillii extimus*, and black-footed ferret, *Mustela nigripes*), one federally threatened species (Mexican spotted owl, *Strix occidentalis lucida*), and three candidate species (yellow-billed cuckoo, *Coccyzus americanus*, Jemez Mountains salamander, *Plethodon neomexicanus*, and New Mexico meadow jumping mouse, *Zapus hudsonius luteus*). The Southwestern willow flycatcher, black-footed ferret, and New Mexico meadow jumping mouse have not been observed on Laboratory property. In addition, several federal species of concern and state-listed species potentially occur within LANL (Table 2-13).

Table 2-13
Threatened, Endangered, and Other Sensitive Species Occurring or Potentially Occurring at LANL

Scientific Name	Common Name	Protected Status[a]	Potential to Occur[b]
Empidonax traillii extimus	Southwestern Willow Flycatcher	E	Moderate
Mustela nigripes	Black-footed Ferret	E	Low
Strix occidentalis lucida	Mexican Spotted Owl	T	High
Coccyzus americanus	Yellow-billed Cuckoo	C, NMS	Moderate
Zapus hudsonius luteus	New Mexico meadow jumping mouse	C, NMS	Moderate
Haliaeetus leucocephalus	Bald Eagle	NMT, S1	High
Cynanthus latirostris magicus	Broad-billed Hummingbird	NMT, S1	Low
Gila pandora	Rio Grande Chub	NMS	Moderate

Table 2-13 (continued)

Scientific Name	Common Name	Protected Status[a]	Potential to Occur[b]
Plethodon neomexicanus	Jemez Mountains Salamander	C, NME	High
Falco peregrinus anatum	American Peregrine Falcon	NMT, FSOC	High
Falco peregrinus tundrius	Arctic Peregrine Falcon	NMT, FSOC	Moderate
Accipiter gentiles	Northern Goshawk	NMS, FSOC	High
Lanius ludovicianus	Loggerhead Shrike	NMS	High
Vireo vicinior	Gray Vireo	NMT	Moderate
Plegadis chihi	White-faced Ibis	S1	Moderate
Myotis ciliolabrum melanorhinus	Western Small-footed Myotis Bat	NMS	High
Myotis volans interior	Long-legged Bat	NMS	High
Euderma maculatum	Spotted Bat	NMT	High
Plecotus townsendii pallescens	Townsend's Pale Big-eared Bat	NMS, FSOC	High
Nyctinomops macrotis	Big Free-tailed Bat	NMS	High
Myotis thysanodes thysanodes	Fringed Bat	NMS	High
Myotis yumanensis yumanensis	Yuma Bat	NMS	High
Myotis evotis evotis	Long-eared Bat	NMS	High
Bassariscus astutus	Ringtail	NMS	High
Vulpes vulpes	Red Fox	NMS	Moderate
Ochotona princeps nigrescens	Goat Peak Pika	NMS, FSOC	Low
Lilium philadelphicum var. andinum	Wood Lily	NME	High
Cypripedium calceolus var. pubescens	Greater Yellow Lady's Slipper	NME	Moderate
Speyeria Nokomis nitocris	New Mexico Silverspot Butterfly	FSOC	Moderate

[a] E = Federal Endangered; T = Federal Threatened; C = Federal Candidate Species; NMS = New Mexico Sensitive Taxa (informal); S1 = Heritage New Mexico: Critically Imperiled in New Mexico; NMT = New Mexico Threatened; NME = New Mexico Endangered; FSOC = Federal Species of Concern.

[b] Low = No known habitat exists on LANL; Moderate = Habitat exists, though the species has not been recorded recently; High = Habitat exists, and the species occurs at LANL.

The Laboratory meets its requirements for threatened and endangered species protection through implementation of its Threatened and Endangered Species Habitat Management Plan and review of excavation permit requests and project profiles. During 2010, LANL reviewed 622 excavation permits and 148 project profiles for potential impacts to threatened or endangered species. The Laboratory conducted surveys for the Mexican spotted owl, Southwestern willow flycatcher, Jemez Mountains salamander, and grey vireo. The Laboratory also updated its Sensitive Species Best Management Practices Source Document.

12. Migratory Bird Treaty Act

Under the provisions of the Migratory Bird Treaty Act, it is unlawful "by any means or manner to pursue, hunt, take, capture [or] kill" any migratory birds except as permitted by regulations issued by the US Fish and Wildlife Service. In the project review process, LANL biologists provided specific comments for projects with the potential to impact migratory birds, their eggs, or nestlings if, for example, a project proposed an electrical power line or a project disturbed vegetation during the bird nesting season. During 2010 the Laboratory also updated its Migratory Bird Best Management Practices Source Document.

13. Cultural Resources

The goal of the National Historic Preservation Act (NHPA) of 1990 is to have federal agencies act as responsible stewards of the nation's resources when their actions affect historic properties. NHPA Section 106 requires federal agencies to take into account the effects projects may have on historic properties and to allow

for comment by the Advisory Council on Historic Preservation. Section 106 regulations outline a project review process conducted on a project-by-project basis. LANL describes its implementation of Section 106 in the Cultural Resources Management Plan (LANL 2004) available online.

In 2010, the Laboratory conducted 44 projects that required some field verification of previous cultural surveys. Three new archaeological sites and 19 new historical buildings were identified in 2010. Twelve historic buildings were determined eligible for the National Register of Historic Places. As part of Section 106, LANL conducts public outreach and provides site tours of historic and cultural sites for stakeholders, DOE/NNSA, and representatives of other federal agencies.

The Laboratory continued the Land Conveyance and Transfer Project (C&T) in 2010. The DOE/NNSA is in the process of conveying and transferring approximately 2,000 acres of DOE lands to Los Alamos County and to the Bureau of Indian Affairs to be held in trust for the Pueblo of San Ildefonso. Thirty-nine archaeological sites were excavated during the 2002 to 2005 field seasons, with more than 200,000 artifacts and 2,000 samples collected. During 2010, the artifacts and records from the C&T project were transferred for curation to the Museum of Indian Arts and Culture in Santa Fe, New Mexico. Data collected from these sites provide new insights into past activities on the Pajarito Plateau from 5000 B.C. to A.D. 1943. From a compliance perspective, these excavations resolve the anticipated adverse effects to archaeological sites from the future development of lands to be conveyed to Los Alamos County. These sites are also ancestral places to the local Pueblo populations, and, as such, representatives from the Pueblos de San Ildefonso and Santa Clara acted as tribal consultants and monitors on the project. The final report was submitted to the New Mexico State Historic Preservation Office in fulfillment of the Data Recovery Plan and the Programmatic Agreement between the DOE/LASO, the Advisory Council on Historic Preservation, and the State Historic Preservation Office and is available online.

In support of LANL's 2010 D&D program, square footage reduction, and Laboratory consolidation, the Laboratory conducted historic building assessments and other final documentation work related to five proposed projects as required under the provisions of the NHPA. Buildings included in these projects are located at TAs-3, -9, -18, and -21. This work included field visits to historic properties (including interior and exterior inspections), digital and archival photography, and architectural documentation (using standard LANL building recording forms). Additional documentation included the production of location maps for each of the evaluated projects. Historical research was also conducted using source materials from the LANL archives and records center, historical photography, the Laboratory's public reading room, and previously conducted oral interviews.

The Laboratory continues to consult with the Pueblos with respect to identifying and protecting traditional cultural properties, human remains, and sacred objects in compliance with the NHPA and Native American Graves Protection and Repatriation Act. During FY10 consultations with the Pueblo de San Ildefonso were completed regarding the culturally affiliated human remains discovered in TA-36 the previous year. The area was protected with geotextile fabric covered by a soil layer.

D. UNPLANNED RELEASES

1. Air Releases

No unplanned air releases occurred at LANL during 2010.

2. Water Releases

No unplanned releases of radioactive liquids occurred on Laboratory lands in 2010. There were 23 unplanned releases of non-radioactive liquids in 2010 that were reported to NMED pursuant to 20.6.2.1203 NMAC (Table 2-14).

Table 2-14
2010 Unplanned Non-Radioactive Releases

Material Released	Instances	Approximate Total Release (gallons)
Potable Water	14	2,025,000
Hydraulic Fluid	2	52
Sanitary Wastewater	2	1900
Fire Suppression Water	1	200
Organic Solvent	1	5
Re-Use Water	2	100,100
Steam Condensate	1	5000

In addition, there were 12 reports for groundwater detections in excess of New Mexico Groundwater Quality Standards and 7 well packer failures that were reported pursuant to 20.6.2.1203 NMAC.

The Laboratory investigated all unplanned releases of liquids as required by the NMWQCC Regulations 20.6.2.1203 NMAC. Upon cleanup, the NMED and the DOE Oversight Bureau inspected the unplanned release sites as required to ensure adequate cleanup. In 2010, the Laboratory was in the process of administratively closing all releases for 2010 with the NMED and the DOE Oversight Bureau and anticipates these unplanned release investigations will be closed out after final inspections.

E. REFERENCES

DOE 2004: "Environment, Safety, and Health Reporting." US Department of Energy Order 231.1A.

DOE 2008a: "Final Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico," US Department of Energy report DOE/EIS-0380 (May 16, 2008).

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DOE 2009: "Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico." US Department of Energy, NNSA (June 29 2009).

LANL 2004: "A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico," Los Alamos National Laboratory document LA-UR-04-8964.pdf (2004) http://www.lanl.gov/environment/cultural/docs/CRMP_

LANL 2007: "Biological Resources Management Plan for Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-07-2595, (2011). http://int.lanl.gov/environment/bio/docs/BRMP_LA-UR-07-2595.pdf

LANL 2010: Fiscal Year 2011 Site Sustainability Plan, Los Alamos National Laboratory document LA-UR-11-01856 (2010).

LANL 2011: "Threatened and Endangered Species Habitat Management Plan," Los Alamos National Laboratory document LA-UR-11-02582. http://www.lanl.gov/environment/bio/docs/HMP_LA-UR-11-02582.pdf

NMEIB 2007: "Drinking Water Regulations" (as amended through April 2007), found at 20.7.10 NMAC, New Mexico Environmental Improvement Board, State of New Mexico (2007).

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A. INTRODUCTION

This chapter presents the results of the calculation of radiological dose to the public and biota from Los Alamos National Laboratory (LANL or the Laboratory) operations in 2010 and reports whether the doses are below specified limits. This chapter also provides a measure of the significance of environmental radioactivity in the context of its potential dose to humans and biota. In this respect, the human dose assessment provides a different perspective from the biota dose assessment. The calculated human dose is received near the publicly accessible Laboratory boundaries, whereas the calculated biota dose is potentially received throughout the interior of Laboratory property, usually at locations rarely visited by humans. In addition, the potential risks from non-radiological materials detected during 2010 and previous years' sampling activities are summarized.

As defined by US Department of Energy (DOE) Standard 1153-2002 (DOE 2002), biota are divided into plants and animals. Plants receive the highest radiation dose because they grow and remain in one location. Most animals range over an area, which usually minimizes their dose. Humans receive the lowest radiation dose because they limit their time in areas with residual contamination and do not typically eat the vegetation or drink the water in these areas. Therefore, locations with no significant human radiation dose may have a higher biota radiation dose.

B. RADIOLOGICAL DOSE ASSESSMENT FOR HUMANS

1. Overview of Radiological Dose Equivalents

Radiological dose equivalents presented are calculated using standard methods specified in guidance documents (DOE 1988a, 1988b, 1991; EPA 1988, 1993, 1997, 1999; ICRP 1996; NRC 1977). The effective dose equivalent, referred to here as "dose," is calculated using radiation weighting factors and tissue weighting factors to adjust for the various types of radiation and the various tissues in the body. The final result, measured in millirem (mrem), is a measure of the overall dose to an individual, whether from external radiation or contact with radioactive material. For example, from a human health risk perspective, 1 mrem of direct gamma radiation is effectively equivalent to 1 mrem from inhalation of plutonium. In addition, the dose results within this chapter reflect potential dose to hypothetical people and biota and are not to be construed as a dose assessment for any specific individual or organism.

Federal government standards limit the dose that the public may receive from Laboratory operations. The primary risk of receiving radiation dose is cancer. For low doses of radiation, the risk of contracting cancer is 8×10^{-7} per mrem received.

The DOE dose limit to a member of the public is 100 mrem/yr (DOE 1993) received from all pathways (i.e., all ways in which a person can be exposed to radiation, such as inhalation, ingestion, and direct radiation). Furthermore, doses to members of the public must be reduced to low levels consistent with a documented "as low as reasonably achievable" (ALARA) process (LANL 2008a) and generally should not exceed a dose constraint of one-quarter of the primary dose limit, or 25 mrem/yr (DOE 1999). The dose received from airborne emissions of radionuclides is further restricted by the US Environmental Protection Agency (EPA) dose standard of 10 mrem/yr (EPA 1986), also known as the National Emission Standards for Hazardous Air Pollutants for Emissions of Radionuclides Other than Radon from DOE (Rad-NESHAP) dose limit. These doses are in addition to exposures from natural background, consumer products, and medical sources. Doses from community drinking water supplies are limited in accordance with the Clean

Water Act, either by established maximum contaminant levels (MCLs) for some radionuclides or by dose rate (4 mrem/yr for man-made radionuclides) (EPA 2004).

2. Public Dose Calculations

a. Scope

The objective of our public dose calculations is to report incremental (above-background) doses resulting from LANL operations. Therefore, we do not include dose contributions from radionuclides present in our natural environment or from radioactive fallout.

Annual radiation doses to the public are evaluated for three principal exposure pathways: inhalation, ingestion, and direct (or external) radiation. We calculate doses for the following cases:

1. The entire population within 80 km of the Laboratory
2. The maximally exposed individual (MEI) not on LANL property for the airborne pathway dose only and compared with the EPA Rad-NESHAP dose limit of 10 mrem/yr
3. The MEI not on LANL property for the all-pathways dose and compared with the DOE Order 5400.5 dose limit of 100 mrem/yr
4. Residents in Los Alamos and White Rock
5. Recreational scenarios on public trails near Los Alamos

b General Considerations

As discussed in Section B.4, below, the dose rate from naturally occurring radioactivity is approximately 450 mrem/yr. Additional man-made sources of radiation, such as medical/dental uses of radiation and building products such as stone walls, raise the total US per capita background dose to about 700 mrem/yr on average (NCRP 1975, 1987a, 1987b, 2009). It is extremely difficult to measure doses from LANL that are less than 0.1% of natural doses. As the dose rates become smaller, the estimates become less certain and less significant. Generally, we conclude that a dose rate less than 0.1 mrem/yr is essentially zero and cannot be distinguished from natural background radiation.

We begin with environmental measurements of radionuclides in air, water, soil, foodstuffs, sediment, and non-foodstuffs biota. We compare the concentrations of these radionuclides in the various media to pre-determined radionuclide-specific screening levels that are equivalent to 0.1 mrem/yr for specific exposure pathways such as ingestion of drinking water, ingestion of foodstuffs, and exposure to residual contamination in soil (LANL 2003). If the concentrations do not exceed the screening levels, no further assessment is required and the doses are assumed to be essentially zero. If the concentrations do exceed the screening levels, further dose assessment is required, and specific numerical dose values are reported in this chapter (LANL 2008b).

i. Direct Radiation Exposure

The Laboratory monitors direct radiation from gamma photons or neutrons at about 100 locations in and around LANL (see Chapter 4, Section C). Direct radiation doses above natural background are measured near Technical Area (TA) -54, but there are no other Laboratory sources of external radiation that can be measured at off-site areas.

To receive a measurable dose, a member of the public must be within a few hundred meters of the source of external radiation. At distances more than one kilometer, the decrease in radiation dose rate with increasing distance from the radiation source (inverse-square law), combined with scattering and attenuation or shielding in the air, reduces the dose to much less than 0.1 mrem/yr, which cannot be distinguished from natural background radiation. This means the only significant above-background doses from direct radiation are measured near TA-54 (see Section B.3.b of this chapter).

To estimate the dose to the public near TA-54, we multiply the measurements of neutron dose by an occupancy factor of 1/16 (NCRP 1976). The direct radiation measurements reported in Chapter 4 apply to an individual who is at a particular location continuously (i.e., 24 hours/day and 365 days/yr). We followed

standard guidance and assumed continuous occupancy for residences and places of business. For all other locations, we multiplied the measured dose by the 1/16 occupancy factor.

ii. Airborne Radioactivity (Inhalation Pathway)

At distances of more than a few hundred meters from LANL sources, the dose to the public is almost entirely from airborne radioactive material. Whenever possible, we use the direct measurements of airborne radioactivity concentrations measured by the Ambient Air Sampling Network (AIRNET) and reported in Chapter 4, Section A. Where local concentrations are too small to measure, we calculate the doses using the CAP88 model (PC Version 3.0) (EPA 2007), an atmospheric dispersion and dose calculation computer code that combines stack radionuclide emissions information with meteorological data to estimate where the released radioactive material may have gone and the dose from that radioactive material.

In particular, some of the radionuclide emissions from the Los Alamos Neutron Science Center (LANSCE) are not measured by AIRNET. These emissions are measured at the stacks (see Chapter 4, Section B), and the resulting doses are calculated with CAP88. These doses decrease substantially with distance from the stack because the radioactive half-lives of these radionuclides are short (mostly 20 minutes or less).

iii. Water (Ingestion Pathway)

The majority of radionuclides detected in groundwater samples collected from known or potential drinking water sources (i.e., Los Alamos County drinking water supply wells, Buckman wells, and natural springs) in 2010 resulted from the presence of natural radioactivity in these sources. These radionuclides include natural uranium and its decay products, such as radium-226. Except for tritium (refer to section B.d.*i.* in this chapter), radionuclides attributable to Laboratory operations are not found in recognized drinking water sources.

iv. Soil (Direct Exposure Pathway)

We report measurements of radionuclide concentrations in surface soil in Chapter 7. As described in Chapter 7, Section C.1, soil samples are collected on the perimeter of the Laboratory and at regional and on-site locations on a triennial basis (every three years). Routine soil samples were previously collected in 2006 and were collected again in 2009. No regional samples have had radionuclide concentrations detected above the regional statistical reference levels (RSRLs). RSRLs represent background radionuclide concentrations plus three standard deviations in media, such as soil, sediment, and crops, collected or harvested in regional areas far from the influence of the Laboratory, averaged over a period of five years. In 2010, soil samples were collected on Pueblo de San Ildefonso lands, at the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility, and at TA-54, Area G.

v. Food (Ingestion Pathway)

We report measurements of the radioactive content of food, mostly crops, fish, and native vegetation, in Chapter 8. The food is collected on a triennial basis, rotating with the collection of soils. In 2010, emphasis was placed on the collection of crops on site, around the perimeter of the Laboratory, and in the region.

vi. Release of Items and Real Property

The Laboratory releases miscellaneous surplus items of salvageable office and scientific equipment to the general public, following Laboratory requirements for release of such items (LANL 2009). All items destined for release from known or potentially contaminated areas are screened for radioactive contamination in accordance with the procedures of LANL's Health Physics Operations Group. Any items with surface contamination or dose levels above the authorized release limits for uncontrolled use are not released to the public. In addition, items are not released if they are from a known or potentially contaminated area that cannot be completely surveyed. The authorized release limits for items (LANL 2009) are the limits in Figure IV-1 of DOE requirements (DOE 1993, DOE 1995).

The Land Conveyance & Transfer Project (LC&T) is a Department of Energy (DOE), National Nuclear Security Administration (NNSA) project for which Los Alamos National Laboratory (LANL) provides technical and project management support under Public Law (PL) 105-119. On November 26, 1997, Congress passed Public Law 105-119, the Departments of Commerce, Justice, and State, the Judiciary, and

Related Agencies Appropriations Act. Section 632 of that law directed the Secretary of Energy to convey or transfer parcels of Department of Energy (DOE) land in the vicinity of Los Alamos National Laboratory to the Incorporated County of Los Alamos, New Mexico, and to the Secretary of the Interior, in trust for the Pueblo of San Ildefonso. Such parcels or tracts of land were required to meet the suitability criteria established by the law:

- They were not required for the national security mission before the end of November 26, 2012
- They could be restored or remediated by November 26, 2012 (now extended to 2022)
- They were suitable for historic, cultural, or environmental preservation, economic diversification, or community self-sufficiency

In 1998, the DOE identified 10 tracts of land totaling approximately 4,800 acres for potential transfer to the County of Los Alamos or to San Ildefonso Pueblo. The original 10 tracts have been subdivided into 32 tracts. Some of the tracts withdrawn due to mission needs or remediation activities may be conveyed to Los Alamos County upon cleanup of Technical Area (TA) 21. The 2011 National Defense Authorization Act extended the PL to September 2022. To date, 20 parcels have been conveyed or transferred to the Incorporated County of Los Alamos, the Los Alamos Public Schools and to the Bureau of Indian Affairs to be held in trust for the Pueblo de San Ildefonso. All parcels were transferred with concentrations of residual radioactive material in the soil attributable to Laboratory operations less than the radionuclide screening levels for the residential scenario, which is the most conservative scenario. This approach results in a potential dose to the public of 15 mrem/yr or less. In addition, the ALARA concept has been applied to these transfers such that the potential dose is much less than 15 mrem/yr.

3. Dose Calculations and Results

a. Collective Dose to the Population within 80 Kilometers

We used the local population distribution to calculate the dose from 2010 Laboratory operations to the population within 80 km (50 miles) of LANL. Approximately 280,000 persons live within an 80-km radius of the Laboratory. We used New Mexico county population estimates provided by the University of New Mexico Bureau of Business and Economic Research (available at http://www.unm.edu/~bber/).

The collective population dose from Laboratory operations is the sum of the estimated doses for each member of the public within an 80-km radius of LANL. For example, if two persons each receive 3 mrem, the collective dose is 6 person-mrem. This collective dose results from airborne radioactive emissions only. Other potential sources, such as direct radiation, are essentially zero. We calculated the collective dose by modeling the transport of radioactive air emissions using CAP88.

The 2010 collective population dose attributable to Laboratory operations to persons living within 80 km of the Laboratory is 0.22 person-rem, which is less than the collective population dose of 0.57 person-rem reported for 2009. Tritium contributed 31% of the dose, and short-lived air activation products such as carbon-11 from LANSCE contributed 60% of the dose. LANSCE has historically been the major contributor to the collective population dose. Collective population doses for the past 16 years have generally declined from a high of 4 person-rem in 1994 to less than 1 person-rem in 2010 (Figure 3-1). It is expected that future collective population doses will be less than 1 person-rem. No observable health effects in the local population are expected from this dose.

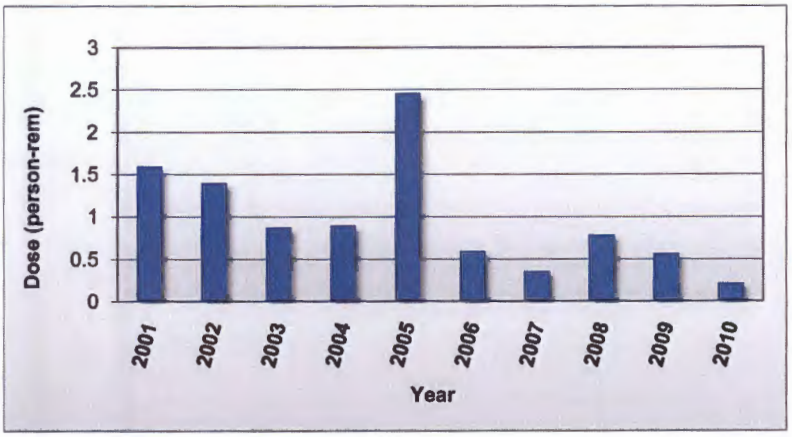

Figure 3-1 **Annual collective dose (person-rem) to the population within 80 km of LANL over the past 10 years**

b. Dose to the Maximally Exposed Individual

The MEI is a hypothetical member of the public who, while not on DOE/LANL property, receives the greatest dose from LANL operations. For most of the past 10 years, the airborne pathway (Rad-NESHAP) MEI location has been at 2470 East Road, usually referred to as "East Gate." East Gate has normally been the location of greatest exposure because of its proximity to LANSCE and the prevailing wind direction. During LANSCE operations, short-lived positron emitters, such as carbon-11, nitrogen-13, and oxygen-15, are released from the stacks and diffuse from the buildings. These emitters release photon radiation as they decay, producing a potential radiation dose.

i. Airborne Pathway (Rad-NESHAP) MEI Dose

Because the LANSCE emissions after 2005 have been reduced to such low levels (< 1.0 mrem/yr), the location of the MEI for 2010 was not as readily apparent as in the past and required more detailed evaluation, as follows.

We know the dose from LANSCE emissions is a significant contributor at the East Gate location, but much less so at other possible MEI locations. We evaluated the air pathway dose at the East Gate location from all LANSCE emissions. This air pathway dose totaled 0.0699 mrem. To this we added the contribution from the East Gate AIRNET station (0.021 mrem) for a total of 0.091 mrem. We used this value as a point of comparison for examining the dose at other AIRNET locations summed with the dose from the LANSCE emissions at each location.

Two AIRNET stations with relatively higher doses located at places of a business or residence close to LANSCE were considered. The first is AIRNET station 317, adjacent to the material disposal area (MDA)-B remediation project, representing a receptor at 278 DP Road. The second is AIRNET station 257, called the LA Inn-South station, representing a cluster of receptors along the southern edge of the Los Alamos town site near the former Los Alamos Inn. The 2010 AIRNET dose at the DP Road location is 0.133 mrem and the dose at the LA Inn-South location is 0.174 mrem for 2010. The LANSCE facility doses at these locations were 0.00781 mrem and 0.00404 mrem, respectively. The sums of the AIRNET dose and the LANSCE facility dose at each location were 0.141 mrem at the DP Road location and 0.178 mrem at the LA Inn South location. Because the dose at the LA Inn-South location is greater than the dose at DP Road, it is the Rad-NESHAP MEI location for 2010 operations. The total dose at the LA Inn-South location from all air emissions LANL sources for 2010 was 0.33 mrem (Fuehne 2011).

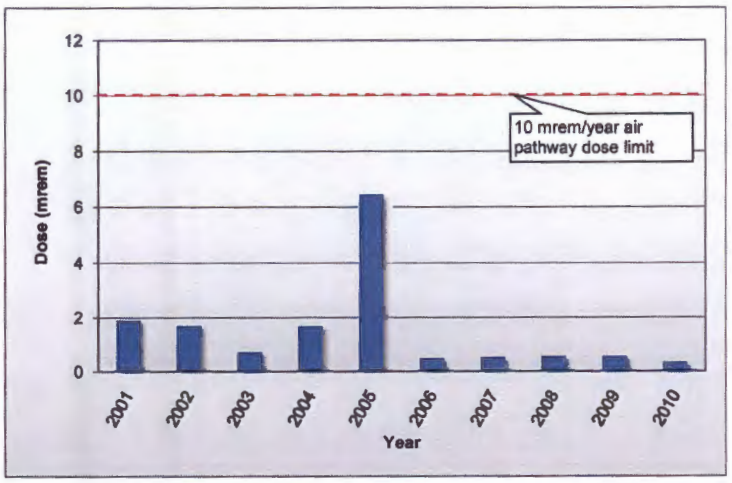

Figure 3-2 **Annual airborne pathway (Rad-NESHAP) dose (mrem) to the MEI over the past 10 years**

ii. All-Pathways MEI Dose

The location evaluated in 2010 as the potential all-pathways MEI is the Laboratory boundary near the Pueblo de San Ildefonso sacred area north of TA-54, Area G. Transuranic waste at Area G awaiting shipment to the Waste Isolation Pilot Plant in Carlsbad, New Mexico, emits neutrons. The measured neutron dose at the boundary was 13 mrem/yr for 2010. After subtracting a 2-mrem/yr neutron background dose and applying the standard occupancy factor of 1/16 (NCRP 1976), the individual neutron dose is 11 mrem/16 = 0.7 mrem/yr. The gamma dose is calculated to be less than 0.01 mrem and is not included because it cannot be distinguished from the much larger gamma background measured at this and other nearby monitoring locations. To estimate the contributions from airborne radionuclides at this location, we used CAP88 to model the dose contribution from the LANL stacks as 0.01 mrem/16 = 0.001 mrem/yr. We added the dose derived from measurements at the highest-dose AIRNET station along the northern boundary of Area G (3 mrem/yr) close to where the neutron dose was measured and applied the occupancy factor of 1/16 to obtain a dose of 0.2 mrem/yr. This resulted in a total dose at this location of approximately 0.9 mrem/yr, which is greater than the airborne pathway MEI dose at the LA Inn-South location.

iii. MEI Dose Summary

The Rad-NESHAP MEI dose of 0.33 mrem/yr at the LA Inn-South location is below the 10 mrem/yr EPA airborne emissions dose limit for the public (EPA 1986), and, based on previous studies, we conclude it causes no observable health effects (BEIR 2006). The all-pathways MEI dose of 0.9 mrem/yr at the Laboratory boundary of the Pueblo de San Ildefonso sacred area north of Area G is below the 100 mrem/yr DOE limit for all pathways and the 25 mrem/yr dose constraint (DOE 1993, DOE 1999). We conclude this dose will not result in observable human health effects.

In most past years, LANSCE has been the major contributor to the Rad-NESHAP MEI dose. Future operations of the facility and associated emissions are expected to stay consistent with recent past years' levels. The 2009 and 2008 Rad-NESHAP MEIs were located at East Gate and were primarily due to short-lived air activation emissions from LANSCE. The 2007 Rad-NESHAP MEI was located on DP Road and was primarily due to the re-suspension of plutonium-239 in soil from MDA B. With continued remediation activities at MDA B during 2011, it is possible that the Rad-NESHAP MEI may once again be located on DP Road in 2011.

c. Doses in Los Alamos and White Rock

We used background-corrected AIRNET data (reported in Chapter 4, section A) and the factors in EPA guidance (EPA 1986) to calculate an annual dose at the perimeter AIRNET stations that represent the

Los Alamos resident and the White Rock resident. To these doses, we added the contributions from LANSCE and other stack emissions, calculated using CAP88 for two representative locations: 5 km northwest of LANSCE in Los Alamos and 6.8 km southeast of LANSCE in White Rock.

i. Los Alamos

During 2010, the Laboratory contributions to the airborne pathway dose at an average Los Alamos residence were less than 0.1 mrem.

ii. White Rock

During 2010, the Laboratory contributions to the airborne pathway dose at an average White Rock residence were also less than 0.1 mrem.

iii. Dose Summary

The dose contributions from food, water, and soil are discussed in section B.3.d. and are considered to be essentially a zero dose (i.e., <0.1 mrem/yr). In summary, the total annual dose in 2010 to an average White Rock/Los Alamos resident from all pathways was less than 0.1 mrem and is well below the all-pathways dose limit of 100 mrem/yr and the 25 mrem/yr dose constraint. No observable human health effects are expected from this dose.

d. Pathway-Specific Doses

While the maximum airborne pathway dose for 2010 is described above in section 2.b.*i.*, other pathway-specific doses are presented below.

i. Water (Ingestion Pathway)

The highest concentration of tritium detected in a Los Alamos County drinking water supply well was 7 pCi/L in a sample collected from the Otowi-4 well located in Upper Los Alamos Canyon and is at the low end of the range of tritium concentrations found in rainwater (5 to 200 pCi/L) (Okada 1993). This concentration is far below the EPA MCL of 20,000 pCi/L and results in a dose of much less than 0.1 mrem/yr if this water were to be ingested for an entire year (assumes 730 L ingested for the year). Tritium was also detected in water samples from Basalt Spring on Pueblo de San Ildefonso land at levels up to 51 pCi/L, also within the range found in rainwater. The dose from ingesting this water for an entire year (730 L) would also be much less than 0.1 mrem/yr.

Surface water samples were obtained in 2010 from three locations along the Rio Grande: at Otowi Bridge, at the planned diversion site for the Buckman Direct Diversion Project, and at the mouth of Frijoles Canyon in Bandelier National Monument (downriver from all canyons draining LANL). Radionuclide analysis of these samples indicated the presence of radium-226, radium-228, thorium-228, thorium-230, thorium-232, tritium, uranium-234, uranium-235/236, and uranium-238. The tritium and uranium could possibly be attributed to Laboratory legacy operations. However, tritium is a component of nuclear fallout from previous atmospheric testing and is also cosmogenically produced, that is, created in the upper atmosphere from the interaction of cosmic radiation with gases. In addition, these concentrations are well within the tritium levels seen in rainwater from these non-LANL sources. In addition, the uranium-234 and uranium-238 concentrations are also well within natural background radioactivity levels, and the ratio of the two isotopes within each sample are indicative of natural uranium (~1:1). While some of the measured uranium concentrations exceed the 0.1 mrem/yr screening level specific to uranium (LANL, 2003), the doses are attributable to natural background levels, not to past or current Laboratory operations.

In conclusion, these water ingestion doses are very small relative to the 4-mrem/yr EPA community drinking water dose limit.

ii. Soil (Direct Exposure Pathway)

Because soil samples are collected every three years and the focus of the 2010 collection period was on crops, only a small number of soil samples was collected during this time frame. Radionuclide concentrations measured in soil samples collected from Pueblo de San Ildefonso lands (Tsankawai/PM-1 and San Ildefonso) during 2010 were all well below the 0.1 mrem/yr screening levels (LANL 2003). Screening of these offsite

soil concentrations indicates that the annual dose from the soil exposure pathway would result in less than 0.1 mrem/yr to a member of the public residing in these areas.

Only six sample results, from locations in and around TA-54, Area G, and the DARHT facility, exceeded the 0.1 mrem/yr screening criteria: two for transuranic radionuclides (Area G), one for tritium (Area G), and three for uranium-238 (DARHT). However, because these locations are not accessible to the public, there is no public dose through the soil exposure pathway.

In summary, we conclude that the dose from soil at the off site locations is less than 0.1 mrem/yr (essentially zero), and the anthropogenic radionuclides detected at those locations are primarily due to worldwide fallout.

iii. Food (Ingestion Pathway)

In 2010, we focused our analysis on crops, goat milk, eggs, honey, and road-killed elk.

Radionuclides analyzed in crops collected from regional, perimeter, and on-site locations in 2010 did not have concentrations above the 0.1 mrem/yr screening levels for food (LANL 2003). Radionuclide concentrations measured in goat milk collected from the perimeter of the Laboratory and in the regional locations in 2010 did not exceed 0.1 mrem/yr. In addition, both measured concentrations were below the RSRL. Radionuclide concentrations measured in medium sized chicken eggs collected from perimeter and regional sites in 2010 were well below the 0.1 mrem/yr screening levels for food. Honey collected at perimeter and regional locations during 2010 did not exceed the 0.1 mrem/yr screening levels. None of the muscle and bone radionuclide concentrations measured in road-killed elk found on Laboratory property exceeded the 0.1 mrem/yr screening levels. Consumption of these elk would, therefore, result in a dose to the public of less than 0.1 mrem/year. In conclusion, the food ingestion doses are very small relative to the all-pathways dose limit of 100 mrem/yr and the 25-mrem/yr dose constraint.

iv. Release of Items and Real Property

As part of the TA-21 closure program (refer to Chapter 9, section D.2. for further information), several lots of D&D (decontamination and demolition) debris were shipped to industrial landfills (974 cubic yards to Safe Harbors, Deer Trail, Colorado; 1466 cubic yards to U.S. Ecology in Idaho; and 320 cubic yards to Waste Control Specialists in Texas) for disposal in 2010. Some of this debris contained radioactive surface contamination below the authorized release limits in Figure IV-1 of DOE requirements (DOE 1993, DOE 1995). This debris met the waste acceptance criteria of each industrial landfill and each state's regulatory authority approved the acceptance of the waste. Given the levels of the surface contamination, the potential dose to the public from this pathway is expected to be negligible.

The transfer of real property (land) from DOE to the public is allowed if the modeled dose is no greater than the authorized release limit of 15 mrem/yr and the modeled dose is ALARA. An environmental ALARA analysis was performed during 2010 for the transfer of land tract A-18-a. Land tract A-18-a is part of the Pueblo Canyon stream channel and floodplain just west of the State Route 4/State Route 502 interchange, also known as the White Rock "Y." A draft quantitative analysis was performed for the land tract because the individual dose was assessed above 3 mrem/yr, but less than 15 mrem/yr (authorized release limit for real property). However, the analysis indicated that the cost of further remediation for this land tract far exceeded the benefit, and, therefore, the dose is ALARA and no further action was recommended. It should be noted that tract A-18-a has not been transferred into the public domain at this time, pending full implementation of DOE Order 458.1.

e. Doses from Recreation near Los Alamos

In the past, contamination from Laboratory operations was discharged into nearby canyons. In this section, we consider the potential dose to a recreational hiker in those canyons that are accessible to the public: Acid Canyon, Pueblo Canyon, the Rio Grande, and lower Ancho Canyon.

From 1943 through 1964, radioactive liquid waste was discharged into Acid Canyon. The resulting contaminated sediment was transported through Pueblo Canyon to Los Alamos Canyon and from there to the Rio Grande.

i. Pueblo Canyon

At some locations, the sediment contains 100 pCi/g of plutonium-239, 10 pCi/g of americium-241, 4 pCi/g of uranium-238 and -234, 2 pCi/g of cesium-137, and smaller amounts of other radionuclides (LANL 2004a). Almost all of this material is beneath the surface of the streambed or banks so resuspension is very small (LANL 2002). We used RESRAD (http://web.ead.anl.gov/resrad/home2/) using the default parameters, to calculate the dose to a hiker who walks directly on the contaminated sediment for 10 hours. This is a realistic scenario because the contaminated sediment is a very small fraction of the total exposed soil. In this case, the dose is less than 0.1 mrem (McNaughton 2011).

ii. Ancho Canyon

There are several public hiking trails in Ancho Canyon to the east of State Road 4. However, there is no measurable contamination from LANL (LANL 2011) and the annual dose from LANL operations is much less than 0.1 mrem (McNaughton 2011.)

iii. Rio Grande

It is difficult to measure the contamination in the Rio Grande from LANL operations because the radioactivity is similar to natural background and global fallout (LANL 2010, McNaughton 2011, ChemRisk 2010, and Englert 2008.)

However, detailed investigation by the New Mexico Environment Department (NMED) Oversight Bureau demonstrated the presence of legacy contamination that was carried in sediment from Los Alamos Canyon to a channel near Cañada Ancha, near the Buckman Direct Diversion Project (Englert 2008.) The average sediment concentrations are 0.22 pCi/g of cesium-137 and 0.012 pCi/g of plutonium-239. For any scenario, the annual dose from this sediment is less than 0.1 mrem (McNaughton 2011.)

4. Estimation of Radiation Dose Equivalents for Naturally Occurring Radiation

In this section, we discuss the potential LANL dose contribution relative to natural radiation and radioactive materials in the environment (NCRP 1975, 1987a, 1987b).

External radiation comes from two sources that are approximately equal: cosmic radiation from space and terrestrial gamma radiation from naturally occurring radionuclides. Doses due to cosmic radiation range from 50 mrem/yr at lower elevations near the Rio Grande to about 90 mrem/yr in the higher elevations west of Los Alamos (Bouville and Lowder 1988). In addition, background doses from terrestrial radiation range from about 50 to 150 mrem/yr.

The largest dose from radioactive material is from the inhalation of naturally occurring radon and its decay products. Nationwide, the average dose from radon is about 200 to 300 mrem/yr (NCRP 1987b.) In Los Alamos County, the average residential radon concentration results in a dose of 270 mrem/yr and is within the range of the national average (Whicker 2010). An additional 40 mrem/yr results from naturally occurring radioactive materials in the body, primarily potassium-40, which is present in all food and living cells.

In addition, members of the US population receive an average dose of 300 mrem/yr from medical and dental uses of radiation. Compared to estimates used in previous years, this is a significant increase and is attributable to new information about the average medical dose received by members of the US population (NCRP 2009). About 10 mrem/yr comes from man-made products, such as stone or adobe walls, and less than 1 mrem/yr comes from global fallout from nuclear weapons tests. Therefore, the average total annual dose from sources other than LANL is approximately 790 mrem. Figure 3-3 compares the average natural radiation background (and other sources) in Los Alamos to the average background dose in the United States. The estimated LANL-attributable 2010 all-pathways MEI dose, 0.9 mrem/yr, is about 0.2% of the average US background radiation dose from all sources.

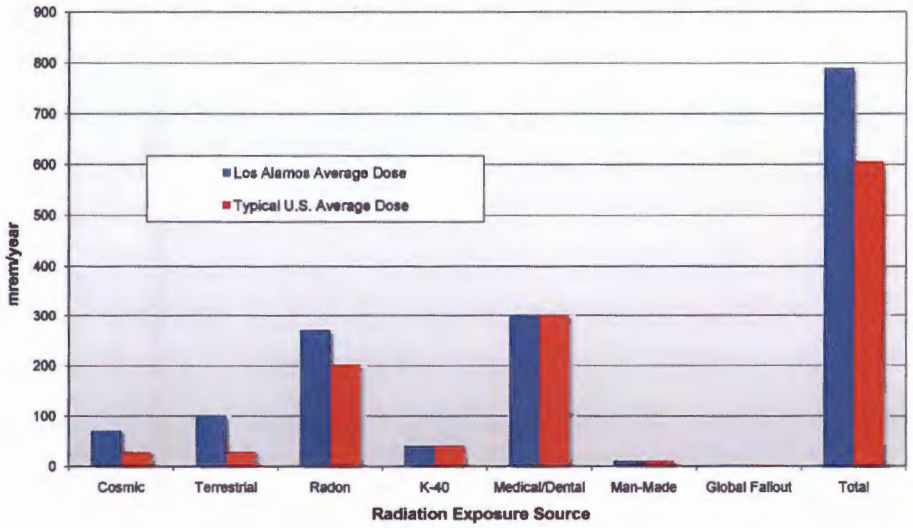

Figure 3-3 **Average Los Alamos County radiation background dose compared with average US radiation background dose. Los Alamos County-specific background doses have not been determined for potassium-40 (K-40), man-made radiation, and global fallout and are assumed to be the same as the US average in this figure.**

5. Effect to an Individual from Laboratory Operations

Health effects from radiation exposure have been observed in humans at doses in excess of 10 rem (10,000 mrem), and as low as 1 rem (1,000 mrem) for the in utero fetus (BEIR 2006). However, doses to the public from LANL operations are much smaller (Table 3-1). Therefore, the doses presented in this chapter do not cause observable human health effects.

Table 3-1
LANL Radiological Doses for Calendar Year 2010

Pathway	Dose to Maximally Exposed Individual (mrem/yr)	% of DOE 100 mrem/yr Limit	Estimated Population Dose (person-rem)	Population within 80 km	Estimated Background Radiation Population Dose (person-rem)
Air	0.33[a]	0.33%	0.22	NA[b]	NA
Water	< 0.1	< 0.1%	0	NA	NA
Other Pathways (foodstuffs, soils, etc.)	< 0.1	< 0.1%	0	NA	NA
All Pathways	0.9[c]	0.9%	0.22	~280,000	~220,000[d]

[a] Rad-NESHAP MEI dose determined at LA Inn-South AIRNET station 257.

[b] NA = Not applicable. Pathway-specific populations are not specified, and pathway-specific background doses have not been determined, as allowed by DOE guidance.

[c] All-pathways MEI dose at the boundary of the Pueblo de San Ildefonso sacred area north of Area G.

[d] Based on 270 mrem/yr from inhalation of radon and its decay products, 70 mrem/yr from cosmic radiation, 100 mrem/yr from terrestrial radiation, 40 mrem/yr from potassium-40, 300 mrem/yr from medical and dental uses of radiation, and 10 mrem/yr from man-made products (see Section B.4).

C. BIOTA DOSE ASSESSMENT

1. Biota Dose Assessment Approach

a. Overview

The biota dose assessment methods are described in detail in the DOE Standard 1153-2002 (DOE 2002) and in the computer program RESRAD-BIOTA (http://web.ead.anl.gov/resrad/home2/biota.cfm). Because the calculations apply to all types of biota and all types of ecosystems, the DOE methods are general in nature and allow specific parameters to be adjusted according to local conditions. The site-specific methods used at LANL are specified in the quality assurance project plan for Biota Dose Assessment (available at http://www.lanl.gov/environment/air/qa.shtml?2), and McNaughton (2005) describes in detail the application of these methods to specific locations at LANL.

We calculate the dose to selected plants and animals following the guidance of DOE Standard 1153-2002 (DOE 2002) and LANL (LANL 2004b). Trees of the pine family (Pinaceae) are representative of terrestrial plants because they are radiosensitive (UNSCEAR 1996) and because their deep roots might tap into buried contamination (Foxx et al. 1984a, 1984b; Tierney and Foxx 1987). Deer mice are representative of terrestrial animals because of their relatively small home range, which means the maximally exposed mouse might spend a large fraction of its time in the most contaminated location. These representative plants and animals are common and widespread within LANL and the surrounding area. Other plants and animals (including aquatic plants and animals) may be collected and analyzed to estimate biota dose depending on availability and locations of interest.

b. Biota Dose Limits

The biota dose limits (DOE 2002) are applied to representative biota populations rather than to the MEIs because it is DOE's goal to protect populations, especially with respect to preventing the impairment of reproductive capability within the population.

The DOE dose limits to biota populations are

- Terrestrial animals: 0.1 rad/day (100 mrad/day)
- Terrestrial plants: 1 rad/day (1,000 mrad/day)
- Aquatic animals: 1 rad/day (1,000 mrad/day)

c. Methods

To ensure that the assessment is comprehensive, we began with a Level 1 initial screening (DOE 2002) comparing the maximum radionuclide concentrations in soil, sediment, and surface water with the DOE Biota Concentration Guides (BCGs). The DOE Standard (DOE 2002) states, "An important point is that exceeding the BCGs should not force a mandatory decision regarding remediation of the evaluation area, but rather is an indication that further investigation is likely necessary." If the BCGs are exceeded, a Level 2 site-specific assessment (DOE 2002) is conducted that uses average concentrations and incorporates site-specific bioaccumulation factors. Following the guidance of the DOE Standard (DOE 2002), we did not include external-radiation dose from experimental facilities such as the DARHT facility and LANSCE.

2. Biota Dose Results

As reported in Chapters 5 through 8, we collected water, soil, sediment, vegetation, bees, and small mammals from several locations in 2010. All radionuclide concentrations in vegetation sampled were below the plant 0.1 rad/day biota dose screening level (10% of the 1 rad/day dose limit), and all radionuclide concentrations in terrestrial animals sampled were below the terrestrial animal 0.01 rad/day biota dose screening level (10% of the 0.1 rad/day dose limit).

D. NON-RADIOLOGICAL RISK ASSESSMENT

1. Overview

Risk to members of the public and the environment from LANL radiological hazards is well understood and extensively documented. We place equal emphasis on the risk to members of the public and the risk to the environment from non-radiological hazards present at LANL, such as heavy metals and organic compounds.

This section assesses the potential human health risk from non-radiological materials released from LANL during 2010 and, in some cases, during the previous 65 years of operations at LANL. The Clean Air Act regulates non-radiological air pollutants, as discussed in Chapter 2, Section 6. The applicable standards for other media are summarized in Table 5-1, Table 6-1, Table 8-1, and Appendix A. Air emissions data are reported in Chapter 2, ambient air data are reported in Chapter 4, and the data for other environmental media are reported in Chapters 5 through 8. The resulting potential human health risks are summarized below.

2. Results

a. General Considerations

Off-site concentrations of non-radiological contaminants in air, water, soil, and food described elsewhere in this report are well below the applicable standards or risk-based concentrations (NMED 2009). The results from LANL monitoring and their potential human health impacts are summarized below.

i. Air (Inhalation Pathway)

Assessments of ambient air quality of non-radiological constituents, as reported in Chapter 4, Section D, indicate that LANL operations are not adversely impacting public health. The assessment of the ambient air impacts of high explosives testing, reported in Chapter 4, Section D.4, indicates no adverse impacts to the public. The beryllium concentrations reported in Chapter 4, Section D.5, are less than 1% of the National Emission Standards for Hazardous Air Pollutants (NESHAP) recommended concentration of 10 ng/m^3, and the PM-10 and PM-2.5 concentrations are lower than EPA limits (Chapter 4, Section D.3).

ii. Groundwater (Ingestion)

Past liquid effluent discharges have affected groundwater quality, but primarily in shallow perched alluvial aquifers in a few canyons. These aquifers are separated from deeper regional aquifers by hundreds of feet of dry rock preventing or minimizing the impact of these contaminants on drinking water quality. LANL sampled groundwater at numerous depths and in locations both within and beyond LANL boundaries. Results show that the levels of chemicals in potential sources of groundwater drinking water are below NMED and EPA recommended levels and thus, the drinking water is safe to drink. The details and a summary of the results of all groundwater measurements are provided in Chapter 5.

The only measureable Laboratory impact on a potential drinking water supply is at well Otowi-1 in Pueblo Canyon. For 2010, groundwater samples from this well had perchlorate concentrations ranging from up to 31% of the Compliance Order on Consent screening level (4 µg/L) and 8% of the EPA interim health advisory for perchlorate in drinking water of 15 µg/L, as referenced in Chapter 5. Although Los Alamos County does not use this well for its drinking water supply, these levels are safe and do not present a potential risk to human health.

LANL has detected hexavalent chromium in the Mortandad Canyon regional aquifer monitoring well samples at levels 25 times the New Mexico groundwater standard (50 µg/L of any dissolved form of chromium) and at about 40% of the New Mexico standard in a Sandia Canyon regional aquifer monitoring well. However, hexavalent chromium has not been detected in Los Alamos County and Santa Fe Buckman drinking water supply wells above natural levels, so there is no potential unacceptable human health risk from ingestion of water from the drinking water supply wells.

iii. Surface Water and Sediment

The concentrations of chemicals in surface water and sediment are reported in Chapter 6. No potentially hazardous chemicals of LANL origin were detected off site. We conclude there is no current risk to the public from surface water and sediment exposure due to LANL operational releases.

Polychlorinated biphenyls (PCBs) are present in the onsite surface water and sediment at levels consistent with previous years. However, there are no aquatic organisms within the LANL boundaries that are part of a food ingestion pathway to humans. PCBs are carried in sediment by storm water runoff to the Rio Grande, so in 2010, sediment samples from the Rio Grande and the Abiquiu and Cochiti reservoirs were analyzed for PCBs using the Aroclor method. Results from upstream and downstream sampling locations show that sources for PCBs are primarily non-LANL. Looking at these data together, we conclude that there is no measurable contribution of PCBs from LANL to the Rio Grande and, therefore, no detrimental human health impacts exist from PCBs.

iv. Soil

Soil concentrations are reported in Chapter 7. The mean contaminant concentrations are below conservative soil screening levels and, therefore, do not pose a potential unacceptable human health risk.

v. Foodstuffs (Ingestion)

The concentrations of non-radioactive materials in foodstuffs are reported in Chapter 8. Of particular interest are PCB levels in crayfish sampled upriver and downriver of LANL in the Rio Grande. Edible portions of the crayfish from both locations contained low levels of PCBs with similar concentrations for crayfish upstream and downstream of the Laboratory. The levels are substantially below consumption limits for fish. Concentrations of target analyte list (TAL) metals in the edible portions of downstream crayfish were similar to upstream crayfish. TAL concentrations in both upstream and downstream crayfish are low. These concentrations represent a negligible contribution to human health risk (Chapter 8, section A.3.d.).

Concentrations of TAL metals and PCBs in several road-killed deer and elk from the Pajarito Plateau were measured. The concentrations are presented in Chapter 8 in Table S8-5 and Table S8-6. Concentrations of PCBs in the muscle and bone are low though there is no literature data to compare against. Human health risk from TAL metals and PCBs in deer is negligible.

vi. Biota Sampling

Metal concentrations were measured in several important indicator species to assess potential impacts of particular LANL operations. Specifically, deer mice and several species of birds were sampled near the DARHT facility (Chapter 8, section B.4.b.). Results show that the concentrations of TAL metals were either not detected or were below the RSRL. The concentrations of these metals in the soil near DARHT are below the LANL ecological screening levels. Also, no detectable concentrations of dioxin or furan congeners were measured in field mice near DARHT.

Additionally, overstory vegetation was sampled and analyzed for TAL metals, and concentrations were less than the RSRLs (Table S8-8). In a special study, PCBs in mice around the Los Alamos Canyon Weir were elevated, but the levels decreased down gradient of the weir and were below screening levels.

vii. Potential Future Risks

The possibility of hexavalent chromium and perchlorate from LANL sources entering the drinking water supply in the future is being evaluated. Our goal is to assess both present and future risk. Models to calculate future risks are being developed.

3. Conclusion

The environmental data collected in 2010 show that there is no potential human health and biota risk from non-radiological materials released from LANL.

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A. AMBIENT AIR SAMPLING

1. Introduction

The radiological air sampling network, AIRNET, measures levels of airborne environmental radionuclides, such as plutonium, americium, uranium, tritium, and some activation products. Most regional airborne radioactivity is from fallout (from past nuclear weapons tests worldwide), natural radioactive constituents in particulate matter, terrestrial radon and its decay products, and cosmic radiation products. Table 4-1 summarizes regional levels of airborne radioactivity for the past five years. A discussion of negative concentration values is presented in Appendix B.

Table 4-1
Average Net Background Concentrations of Radioactivity in the Regional[a] Atmosphere

			Annual Averages				
Analyte	Units[b]	EPA Concentration Limit[c]	2006	2007	2008	2009	2010
Tritium[c]	pCi/m^3	1,500	-0.2	0.2	0.8	0.2	-0.2
Am-241	aCi/m^3	1,900	0.2	-0.1	-0.3	-0.6	-0.4
Pu-238	aCi/m^3	2,100	-0.3	-0.3	0.1	0.4	1.2
Pu-239	aCi/m^3	2,000	0.1	0.6	-0.1	1.0	0.0
U-234	aCi/m^3	7,700	17	15	18	17	16
U-235	aCi/m^3	7,100	0.8	0.8	1.3	0.7	0.6
U-238	aCi/m^3	8,300	16	15	17	16	15

[a] Regional air sampling stations operated by LANL (locations can vary by year).

[b] Units definitions are presented in Appendix B.

[c] Each EPA Concentration Limit is from 10 CFR 40 and corresponds to 10 mrem/year.

[d] Tritium values have been corrected for the tritium lost to bound water in the silica gel.

Particulate matter in the atmosphere is primarily caused by aerosolized soil. Windy, dry days increase soil entrainment; precipitation washes particulate matter out of the air. Meteorological conditions cause large daily and seasonal fluctuations in airborne radioactivity concentrations.

LANL staff compared ambient air concentrations and resulting off-site dose equivalents to the Environmental Protection Agency (EPA) (EPA 1989) 10-mrem annual dose equivalent concentration limit. On-site air concentrations and resulting dose equivalents are compared to the Department of Energy (DOE) 100 mrem annual dose equivalent concentration limit (DOE 1993).

2. Air Monitoring Network

During 2010, LANL operated 60 environmental air stations to sample radionuclides by collecting water vapor and particulate matter. After reviewing the program LANL decided to eliminate gross alpha and gross beta analyses as these two are not required to be measured and because we could continue to depend on quarterly isotopic analysis to meet compliance requirements.

Tritium monitoring was stopped at a number of stations because no tritium had been detected at these stations in years and also because there is no reasonable expectation of detection at them. Tritium monitoring at compliance stations continues unchanged.

AIRNET sampling locations (Figures 4-1 through 4-4) are categorized as regional, pueblo, perimeter, waste site (Technical Area [TA] -54), decontamination and decommissioning (D&D) at Material Disposal Area B (MDA-B), or other on-site locations.

3. Sampling Procedures, Data Management, Chemical Analysis and Quality Assurance

The AIRNET quality assurance project plan and implementing procedures provide details about sample collection, sample management, chemical analysis, and data management. These documents are available at http://www.lanl.gov/environment/air/qa.shtml.

a. Sampling Procedures

Particulate and water-vapor samples are (1) collected from commercially available media of known performance, (2) collected under common chain-of-custody procedures using field-portable electronic data systems to minimize the chances of data transcription errors, and (3) prepared in a secure and radiologically clean laboratory for shipment. We deliver the samples to all internal and external analytical laboratories under full chain-of-custody, including secure FedEx shipment, and track them at all stages of their collection and analysis through the AIRNET database. Field sampling and analytical completeness in AIRNET are assessed for each collection period.

The AIRNET run time for compliance stations averaged 99.3% for the year.

A station collects a continuous two-week sample. Particulate matter is collected on 47-mm polypropylene filters at airflow rates around 110 liters per minute. Cartridges containing about 135 grams of desiccant (silica gel) collect water vapor samples at some stations, with an air flow rate of 0.2 liters per minute. The silica gel is dried in an oven before use. After use in the field, the silica gel is removed from the cartridge and shipped to the analytical laboratory where the moisture is distilled and then analyzed for tritium.

b. Data Management

In the field, personnel record the sampling data on a palm-held microcomputer, including timer readings, volumetric flow rates at the beginning and end of the sampling period, and comments pertaining to these data. These data are later transferred to a database and are checked thereafter.

c. Chemical Analysis and Quality Assurance

A commercial laboratory analyzes the filters. Filters are grouped by geographical location into 'clumps' and screened for gamma-emitting radionuclides. At the end of the quarter a composite for each station is made up of six or seven half-filters. Analysts at the laboratory dissolve the composites, do a chemical separation, and then analyze for americium, plutonium, and uranium isotopes using alpha spectroscopy. Liquid scintillation spectrometry is used to analyze the gel distillate for tritium. Analytical procedures satisfy Title 40 Code of Federal Regulations (CFR) Part 61, Appendix B. The AIRNET quality assurance project plan specifies the target minimum detectable activities for all samples.

AIRNET maintains a program of blank, spike, duplicate, and replicate analyses. This program provides information on the quality of the data received from the analytical laboratory. These data are reviewed to ensure they meet all quality assurance requirements.

Electronic analytic data are uploaded into the AIRNET databases and promptly checked for quality and consistency. Analytical completeness is calculated, tracking and trending of all blank and control-sample data are performed, and all tracking information documented in the quality assessment memo mentioned in the field sampling section. All parts of the data management process are tracked electronically in database, and periodic reports to management are prepared.

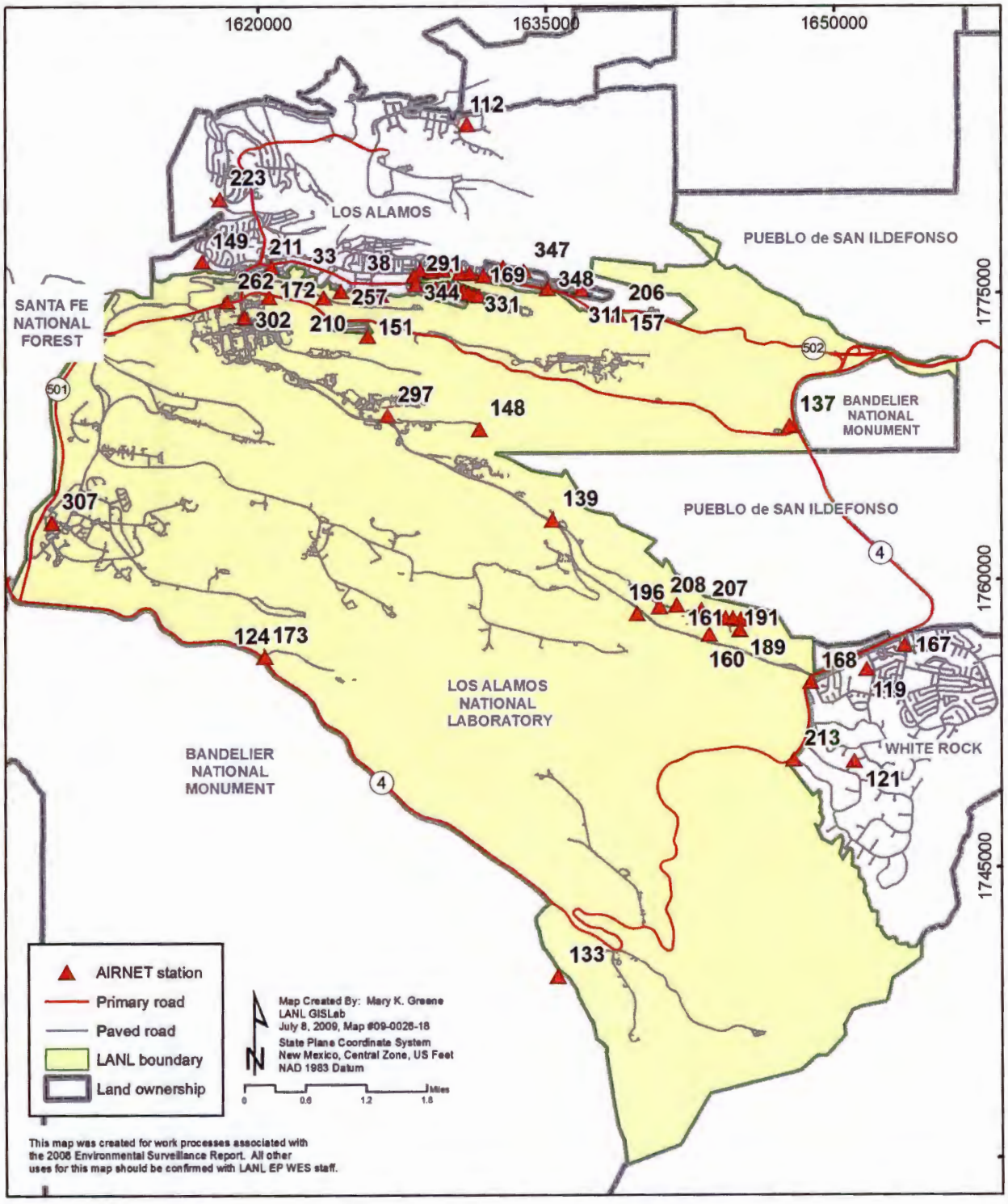

Figure 4-1 **AIRNET locations at and near Los Alamos National Laboratory**

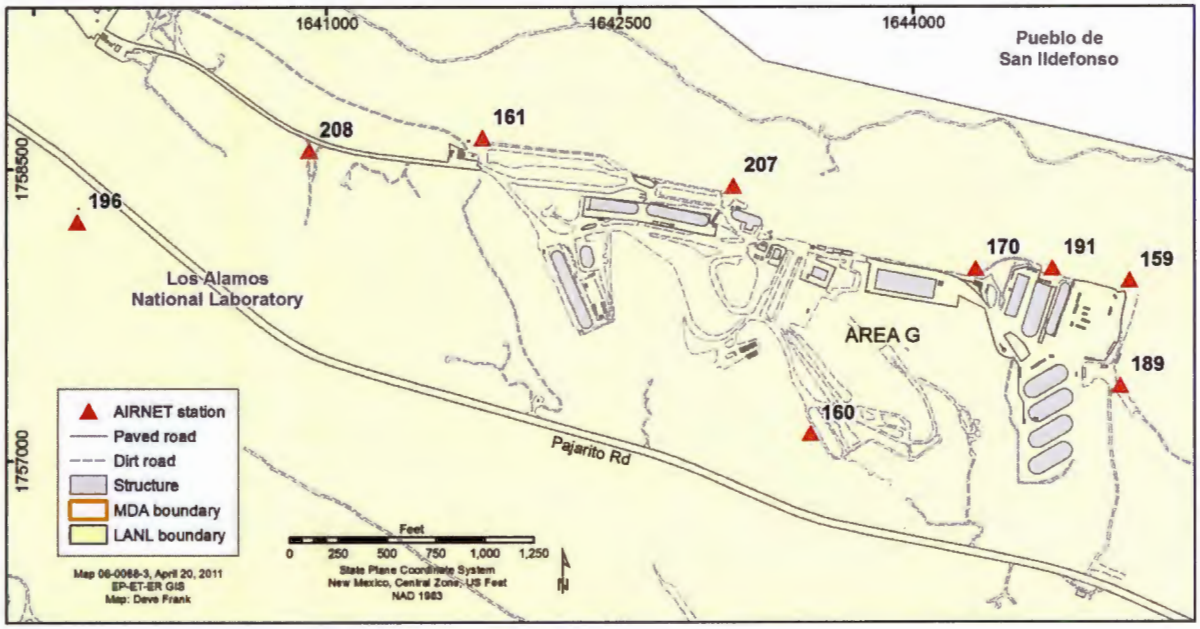

Figure 4-2 AIRNET station locations at TA-54, Area G, Los Alamos National Laboratory

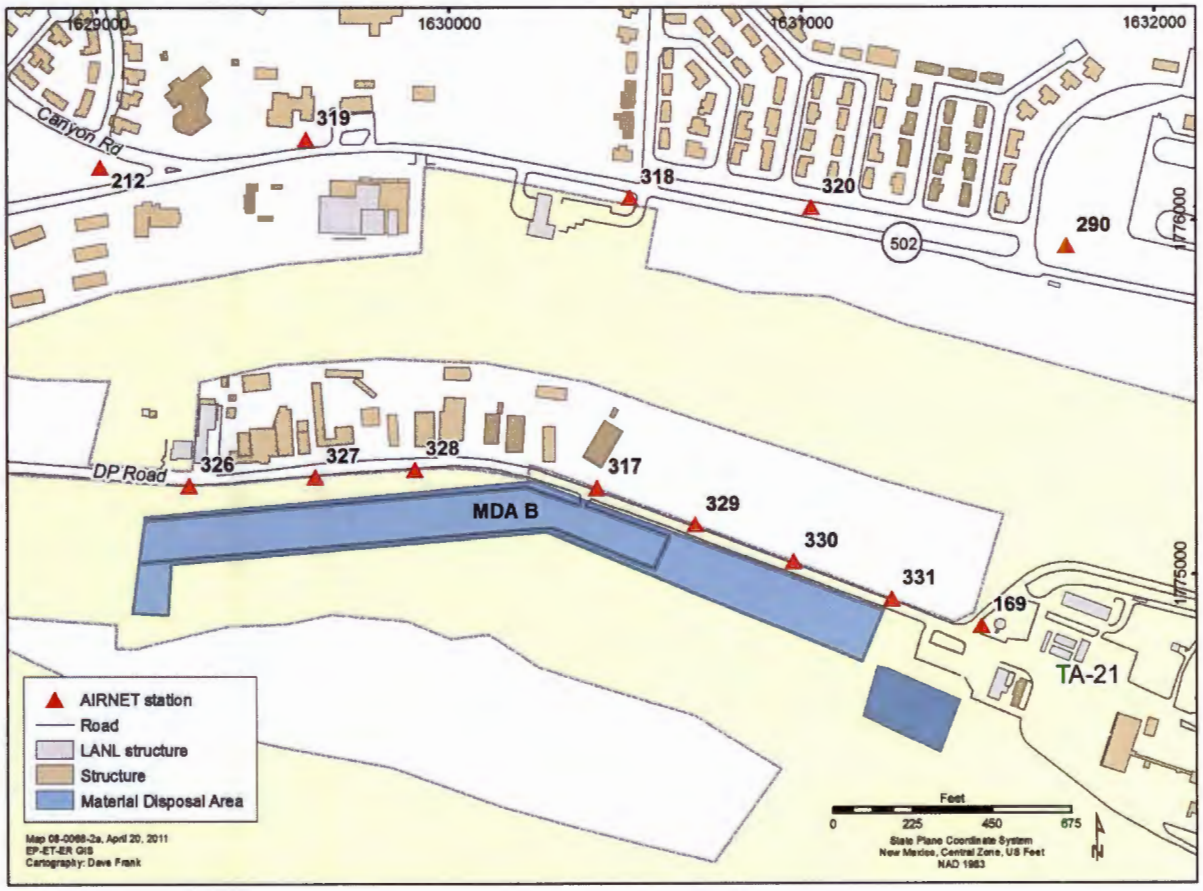

Figure 4-3 AIRNET station locations near TA-21, MDA B

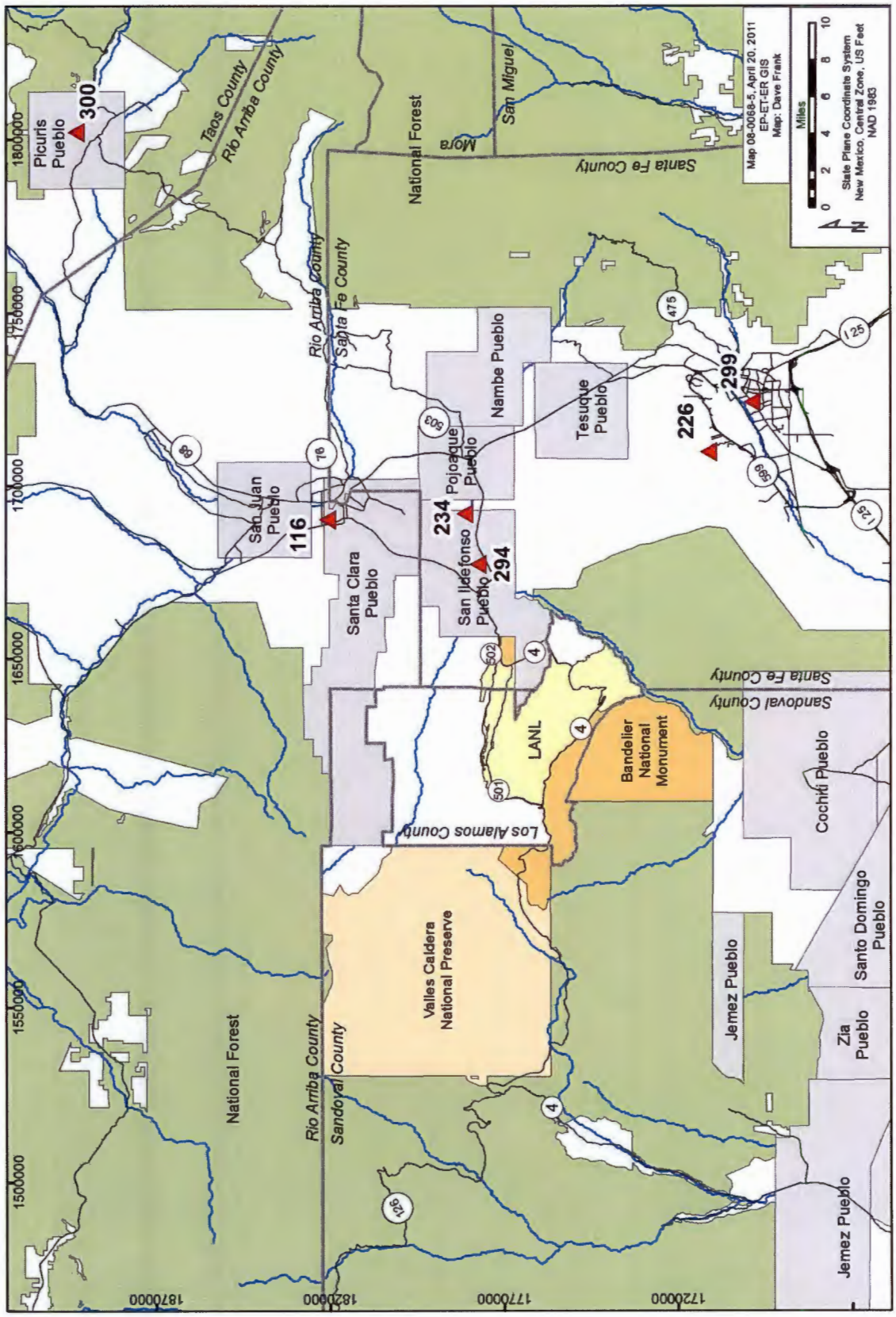

Figure 4-4 Regional and Pueblo AIRNET locations

Analytical data completeness was 100% for AIRNET filters and 99.4% for AIRNET silica gel. These numbers indicate that the analytical laboratory continues to perform at the same high level of control as seen in the past several years. See Chapter 11 for results from independent audits of the contracted laboratories.

4. Ambient Air Concentrations

a. Explanation of Reported Concentrations

Tables 4-2 through 4-10 summarize measured 2010 ambient air concentrations. The supplemental data tables (on included compact disc). Tables S4-1 through S4-7, provide data from individual sites. AIRNET concentrations do not have background subtraction, but do include blank corrections for radioactivity in the filter material, acids used to dissolve the filter, and tracers added to determine recovery efficiencies. The net uncertainties include the variation added by correcting for the blank measurements.

Uncertainties for all data in this ambient air sampling section represent a 95% confidence (two sigma [2s]) interval. Since confidence intervals are calculated with data from multiple sites and throughout the year, they include not only random measurements and analytical errors but also seasonal and spatial variations. The 95% confidence intervals are overestimated for the average concentrations and may represent confidence intervals closer to 99%. Negative values are included in averages as their omission would bias averages.

Concentrations greater than their 3s uncertainties are used to identify samples of interest or detected concentrations. A control limit of 3s is widely used for statistical quality control charts (Duncan 1986, Gilbert 1987) since the rate of false positives or detections is 5% at 2s but only 0.3% at 3s.

b. Investigation of Elevated Air Concentrations

We have established two action levels to determine the potential impact of an unplanned release. The "investigation" action level, or screening level, is triggered when an air concentration exceeds a five-year average plus 3s at that location. "Alert" action levels are higher concentrations that are based on allowable EPA and DOE annual doses and require a more thorough and immediate follow-up.

When a measured air concentration exceeds an action level, we verify that the calculations were done correctly and that the sampled air concentrations are representative. If so, we work with LANL operations personnel to assess potential sources and implement possible mitigation plans.

During the year, investigation levels were exceeded 73 times, but no tritium, americium, plutonium or uranium concentrations exceeded their (EPA 10 mrem) alert action levels. All tritium measurements were below 0.5% of the EPA 10 mrem concentration. Americium-241 concentrations were all under 1% of the EPA standard. The plutonium-238 measurements did not exceed 0.5% of the 10 mrem standard. Only one plutonium-239 measurement, near the canyon edge south of Ashley Pond, was not on-site or near the MDA-B remediation. Of all the plutonium-239 investigations, only two (near MDA-B) were above 5% of the EPA 10 mrem concentration. These two measurements were between 25 and 30% of the standard but were not sustained or in the same location. We had discussions with MDA-B management on possible sources and mitigation measures. A more stringent effort was made to seal work enclosures. Concentrations outside the structures dropped in the following periods, seeming to respond.

The uranium investigations were all less than 1% of their EPA standards. They are discussed in more detail below in Section 4.g. on uranium.

c. Gross Alpha and Gross Beta Radioactivity

We discontinued the optional gross alpha and gross beta analyses during 2010. We continue to depend on quarterly isotopic analysis to meet compliance requirements for monitoring radio-isotopic particulate matter. Data from the first half of the year are in the supplementary data tables and exhibit similar patterns to previous years.

d. Tritium

Tritium is present in the environment primarily as the result of past nuclear weapons tests and natural production by cosmogenic processes (Eisenbud and Gesell 1997). We measure tritiated water (HTO) because

the dose impact is about 25,000 times higher than from gaseous HT or T_2 (ICRP 1978). We used water-vapor concentrations in the air and tritium concentrations in the water vapor to calculate ambient levels of tritium, including corrections for blanks, bound water in the silica gel, and isotopic distillation effects.

During 2010, all annual mean concentrations were well below EPA and DOE guidelines (Table 4-2). The highest off-site annual tritium concentration is equivalent to about 0.2% of the EPA public dose limit. We measured elevated tritium concentrations at a number of on-site stations, with the highest annual mean concentration near a known source at TA-54 but at less than 3% of the on-site worker exposure limit.

Tritium concentrations reflect current operations and show no distinctive trends (Figure 4-5).

The number of stations measuring tritium was reduced in July 2010. Values for waste site and on-site average concentrations in Table 4.2 and Figure 4.5 include data up to June only.

Table 4-2
Airborne Tritium as Tritiated Water Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³)	
				Quarterly	Annual
Regional[a]	108	-0.2	±0.3	2	-0.1
Pueblo[a]	65	0.3	±0.4	3	0.4
Perimeter[a]	665	0.7	±0.1	8	2
Waste Site[b]	124	30	±34	1590	430
On-Site[b]	96	1.6	±1.3	60	13
D&D[a]	220	0.8	±0.3	9	3

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 1,500 pCi/m^3.

[b] Ten times the public limit given in a.

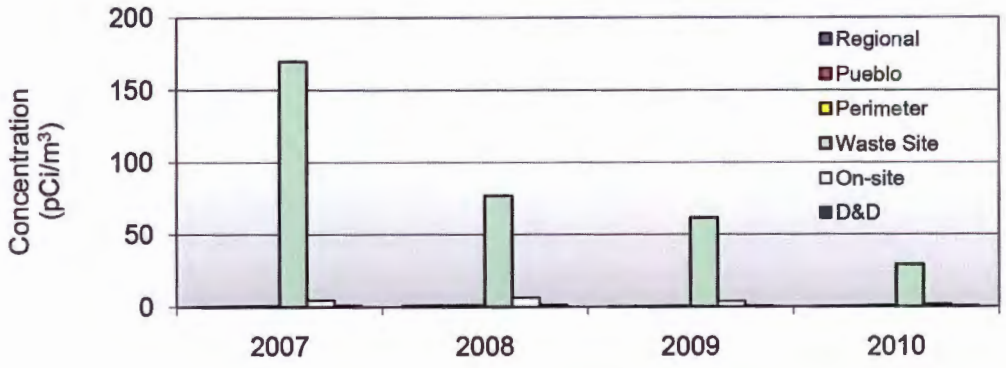

Figure 4-5 Annual average concentrations of tritium by group

e. Americium-241

Americium is present in very low concentrations in the environment. Table 4-3 summarizes the americium-241 sampling data. The highest annual off-site and on-site averages were about 0.25% and 0.02% of the public and worker limits, respectively.

Americium concentrations show no distinctive trends over the past four years (Figure 4-6).

Table 4-3

Airborne Americium-241 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³)	
				Quarterly	Annual
Regional[a]	16	-0.4	±1.2	1.4	-0.4
Pueblo[a]	9	-0.1	±1.9	2.8	0.3
Perimeter[a]	104	-0.2	±0.3	2.8	1.0
Waste Site[b]	32	0.7	±1.3	13	4
On-Site[b]	20	-0.1	±0.7	2	0.5
D&D[a]	52	0.9	±1.1	12	5

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 1,900 aCi/m^3.

[b] Ten times the public limit given in a.

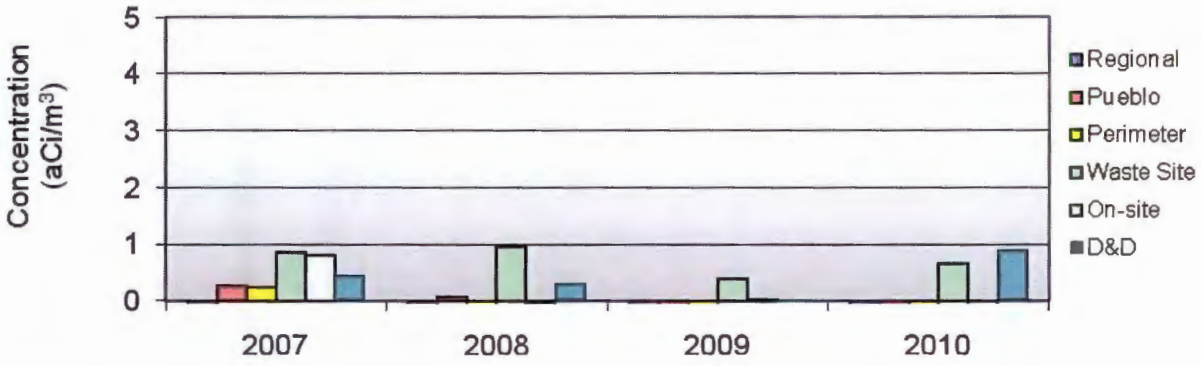

Figure 4-6 **Annual average concentrations of Americium-241 by group**

f. Plutonium

Plutonium occurs naturally at extremely low concentrations from cosmic radiation and spontaneous fission (Eisenbud and Gesell 1997). Measurable sources in air are usually plutonium research activities, nuclear weapons production and testing, the nuclear fuel cycle, and other related activities. With few exceptions, fallout from atmospheric testing of nuclear weapons is the primary source of plutonium in ambient air.

Table 4-4 summarizes the plutonium-238 data for 2010. The highest annual off-site and on-site averages were about 0.2% and 0.01% of the public and worker limits, respectively.

Table 4-4

Airborne Plutonium-238 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³)	
				Quarterly	Annual
Regional[a]	16	1.2	±0.9	3	2
Pueblo[a]	9	0.8	±0.8	2	1
Perimeter[a]	104	0.8	±0.3	4	3
Waste Site[b]	32	1.1	±0.6	3	2
On-Site[b]	20	0.9	±0.8	4	1
D&D[a]	52	1.8	±0.6	7	4

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 2,100 aCi/m^3.

[b] Ten times the public limit given in a.

Table 4-5 summarizes the plutonium-239/240 data. The highest annual off-site and on-site averages were about 9% and 0.09% of the public and worker limits, respectively. Higher than usual off-site concentrations are due to work at the MDA-B clean-up site.

Table 4-5
Airborne Plutonium-239/240 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³) Quarterly	Annual
Regional[a]	16	0.0	±0.7	1.7	0.4
Pueblo[a]	9	0.0	±1.4	1.7	0.7
Perimeter[a]	104	2.1	±2.8	72	32
Waste Site[b]	32	5.0	±7.6	61	18
On-Site[b]	20	2.0	±3.4	16	8
D&D[a]	52	31	±46	590	179

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 2,000 aCi/m^3.

[b] Ten times the public limit given in a.

Concentrations of plutonium show no distinctive trends over the past four years. Figures 4-7 and 4-8 show the annual grouping average concentrations. The increased concentration of plutonium-239 in 2010 was due to operations involving cleanup at MDA-B.

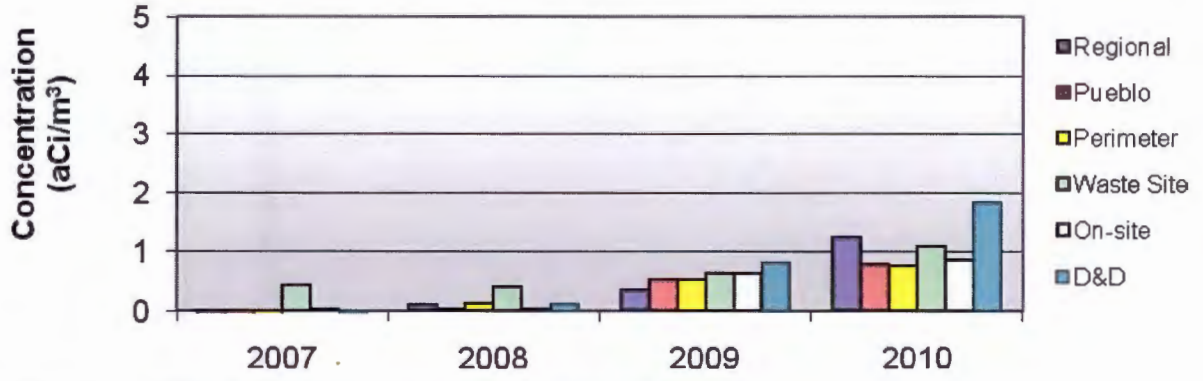

Figure 4-7 **Annual average concentrations of plutonium-238 by group**

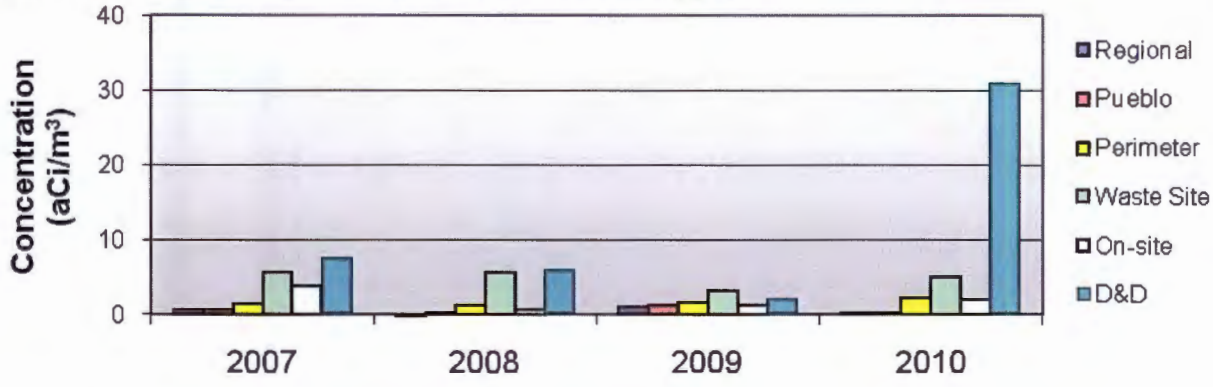

Figure 4-8 **Annual average concentrations of plutonium-239/240 by group**

g. Uranium

Uranium-234, -235, and -238 are found in nature. Natural uranium has constant and known relative isotopic abundances. Uranium-238 activity is roughly equal to uranium-234 (Walker et al., 1989). LANL emissions over the past 60 years have been either enriched in uranium-234 and uranium -235 (EU) or depleted uranium (DU). LANL compares uranium-234 concentrations to uranium-238 concentrations to estimate LANL's contributions to uranium in the environment. If uranium-234 and -238 concentrations differ by more than 3s, the sample was considered to have significant concentrations of EU or DU.

Off-site annual mean concentrations of uranium isotopes (Tables 4-6 to 4-8) were at or below 0.4% of the EPA guidelines; the on-site concentrations were below 0.05%. The highest annual uranium concentrations are typically at dusty locations. Over the last five years the trends have been flat.

Table 4-6

Airborne Uranium-234 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³)	
				Quarterly	Annual
Regional[a]	16	16	±8	35	23
Pueblo[a]	9	18	±18	46	28
Perimeter[a]	104	9	±2	63	28
Waste Site[b]	32	17	±13	104	36
On-Site[b]	20	9	±5	28	14
D&D[a]	52	19	±4	47	29

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 7,700 aCi/m^3.

[b] Ten times the public limit given in a.

Table 4-7

Airborne Uranium-235 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³)	
				Quarterly	Annual
Regional[a]	16	0.6	±0.7	2	1
Pueblo[a]	9	1.6	±1.3	3	2
Perimeter[a]	104	0.6	±0.3	8	2
Waste Site[b]	32	0.8	±0.7	5	2
On-Site[b]	20	0.8	±0.7	3	1
D&D[a]	52	1.1	±0.4	4	2

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 7,100 aCi/m^3.

[b] ten times the public limit given in a.

Table 4-8
Airborne Uranium-238 Concentrations for 2010 — Group Summaries

Station Grouping	Number of Quarterly Samples	Mean ± 99.7% Confidence Interval (aCi/m³)		Maximum Station Concentration (aCi/m³) Quarterly	Annual
Regional[a]	16	15	±8	33	20
Pueblo[a]	9	18	±15	40	28
Perimeter[a]	104	10	±3	67	31
Waste Site[b]	32	17	±12	93	32
On-Site[b]	20	10	±5	28	16
D&D[a]	52	17	±4	40	27

[a] EPA 40, CFR Part 61, Appendix E, public concentration limit is 8,300 aCi/m^3.

[b] Ten times the public limit given in a.

During 2010 EU was detected three times (near the environmental restoration work on MDA-B, a known source of EU). This is an increase from previous years (on detection in 2006; none in 2007; none in 2008; and one detection in 2009). DU was detected twice this year, a decrease from previous years (two detections in 2006; seven in 2007; one in 2008; and 15 in 2009).

h. Gamma Spectroscopy Measurements

For gamma screening, we group filters across sites in "clumps" for each sampling period and analyze for the following: arsenic-73 and 74, cadmium-109, cobalt-57 and 60, cesium-134 and 137, manganese-54, sodium-22, rubidium-83, rubidium-103, selenium-75, and zinc-65. We investigate any measurement of these analytes above its minimum detectable activity which we use as a screening level. None have been detected in the last five years.

We analyze for the naturally occurring radionuclides beryllium-7, potassium-40, and lead-210. We initiate investigations when elevated levels are found. No elevations were detected during 2010.

5. Special Monitoring

a. Fukushima Daiichi

On March 11, 2011, the Fukushima Daiichi nuclear power plant was damaged by the tsunami that followed the Great East Japan Earthquake, and the reactors subsequently leaked radioactive material. In response, LANL augmented the routine ambient (AIRNET) and stack (Rad-NESHAP) measurements with three high-volume samplers: #167 at the Old White Rock Fire Station; #173 at the TA-49 gate, and #211 at the Los Alamos Medical Center.

Previous accidents, such as the Three-Mile-Island accident in 1979 and the Chernobyl accident in 1986, indicated that the most likely releases were (a) the noble gases: krypton and xenon; and (b) the volatile elements: cesium, tellurium, and iodine. At the latitude of Fukushima, the predominant winds across the Pacific Ocean are from west to east, and models predicted that the plume would arrive in the western United States on about March 18. By this time, the shorter-lived isotopes would have decayed. Therefore, the expected radionuclides were xenon-133, cesium-134, cesium-136, cesium-137, tellurium-132, iodine-131, and iodine-132.

As expected, cesium-134, cesium-136, cesium-137, tellurium-132, iodine-131, and iodine-132 were all detected by all three high-volume samplers during March 17-21. The concentrations peaked during the March 24-28 period. After this, concentrations of all nuclides declined. In general, the concentrations were consistent with those measured by the EPA RadNet system and many other monitoring systems throughout the world. The EPA RadNet data are available at http://www.epa.gov/japan2011/rert/radnet-data-map.html.

At the time of writing, preliminary results from the AIRNET and Rad-NESHAP systems are being reported. More detailed results are described in McNaughton 2011 and will be reported in full in the annual environmental report for 2011.

All previous releases from nuclear reactors have been dominated by noble gases, primarily krypton and xenon, which are not measured by the high-volume samplers or the AIRNET system. However, in sufficient concentrations these and other fission products would be detected by NEWNET.

Consistent with this possibility, all NEWNET detectors recorded an increase of 0.2 μR/h from March 19-21, followed by an additional increase of 0.1 μR/h on March 24 (Figure 4-9). The consistency of the NEWNET stations is indicated by the error bars, which represent the standard error of the mean of the individual stations.

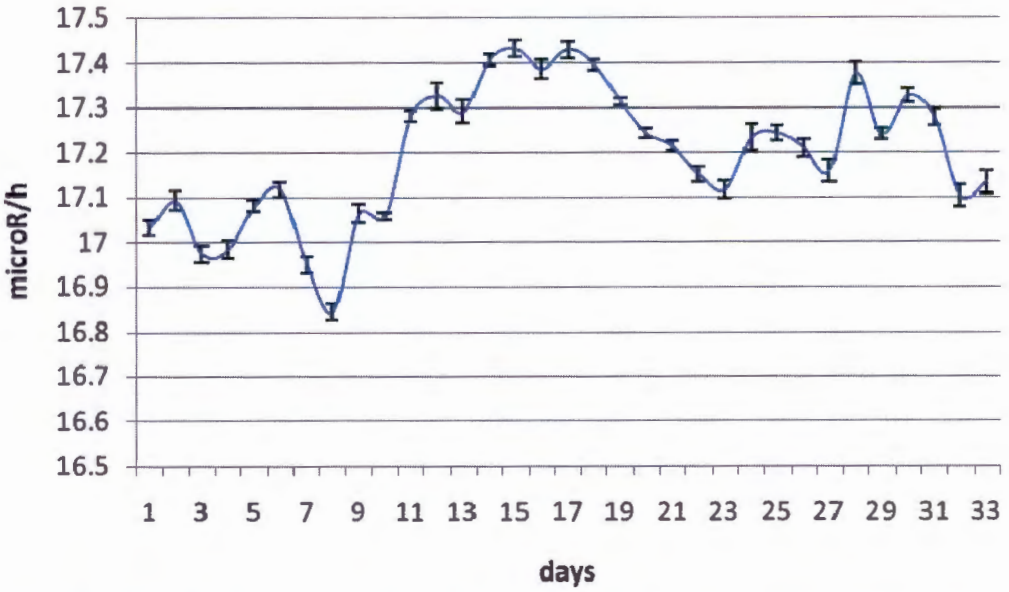

Figure 4-9 **Average radiation (microR/h) recorded by NEWNET from March 11 (day 1) through April 12 (day 33)**
The annual average is 17 microR/h. The increased radiation from day 9 (March 19) through day 23 (April 2) may be caused by xenon-133 and other fission products from the Fukushima Daiichi nuclear power station. The fluctuations during days 1-9 and days 23-33 are caused by natural radon decay products. In addition, during these 33 days, there is probably a gradual increase in natural terrestrial radiation as the ground becomes dry.

Over the next 10 days, the NEWNET readings declined with approximately the 5-day half life of xenon-133, returning to near normal levels on April 2. After this, any further decrease was masked by high radon concentrations on April 3, by a weather system that moved into New Mexico on April 4, and by rainfall on April 6-9. Furthermore, it is likely that all NEWNET detectors responded to a gradually increasing trend in terrestrial radiation during the month of March as the ground dried out.

It is difficult to distinguish the hypothetical effects of xenon-133 from the fluctuations of radon decay products. However, at present we do not have an alternative hypothesis for the sharp increase that was observed in all NEWNET stations from March 19-21. Perhaps some of the increase was caused by radon or terrestrial radiation, in which case the observed increase is an upper limit to that caused by releases from Fukushima.

LANL data are consistent with those of the EPA Radnet monitoring system. The EPA has repeatedly stated that "The levels detected are far below levels of concern" (EPA 2011).

Additional analyses of AIRNET samples were requested in response to the incident, but these data are not yet available. This and further work will be discussed further in more detail in the 2011 edition of this document.

b. Las Conchas Fire

The Las Conchas fire started onSunday June 26, 2011 in the Santa Fe National Forest, approximately 12 miles southwest of LANL(http://www.inciweb.org/incident/2385/). Investigators believe the fire started after an aspen tree was blown down onto nearby power lines during a period of strong winds. Mandatory evacuation of the Los Alamos townsite was ordered on Monday June 27 and the Laboratory remained closed from June 27 through July 5. One spot fire occurred on the LANL property during this time period. This fire was approximately 2 acre in size, along the south boundary of TA-49. It was on the mesa top, not in the canyon. Additionally, 90 acres of LANL land burned during back burns west of State Road 501.

Air monitoring used several independent systems. The standard AIRNET system was supplemented by high-volume samplers operated by the AIRNET team, by the LANL Field Monitoring Team, and by the RAP team http://www.nv.doe.gov/library/factsheets/RAP.pdf . Data were also obtained by the EPA's Airborne Spectral Photometric Environmental Collection Technology, ASPECT http://www.epa.gov/NaturalEmergencies/flyinglab.htm .

Preliminary air monitoring results are consistent with those measured during the Cerro-Grande fire (SWEIS 2000, Dewart 2003, Eberhart 2010) and indicate no measurable LANL contamination. The complete set of data will be reported in RACER and discussed in the Environmental Report for 2011.

B. STACK SAMPLING FOR RADIONUCLIDES

1. Introduction

Radioactive materials are an integral part of many activities at LANL. Some operations involving these materials may be vented to the environment through a stack or other forced air release point. Members of the stack monitoring team at LANL evaluate these operations to determine potential impacts to the public and the environment. Emissions are estimated using engineering calculations and radionuclide materials usage information with the assumption there are no emission controls in place, such as the high-efficiency particulate air filters which are present on all stacks. If this evaluation shows that emissions from a stack may potentially result in a member of the public receiving as much as 0.1 mrem in a year, LANL must sample the stack in accordance with 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" (Rad-NESHAP) (EPA 1989).

During 2010, we identified 28 stacks meeting this criterion. Two new stacks at TA-54 became operational in 2010, supporting waste processing activities at Materials Disposal Area G.

2. Sampling Methodology

In 2010, we continuously sampled 28 stacks for the emission of radioactive material to the ambient air. LANL categorizes its radioactive stack emissions into one of four types: (1) particulate matter, (2) vaporous activation products, (3) tritium, and (4) gaseous mixed activation products (GMAP). For each of these emission types, LANL employs an appropriate sampling method, as described below.

We sample emissions of radioactive particulate matter generated by operations at facilities, such as the Chemistry and Metallurgy Research Building and the TA-55 Plutonium Facility, using a glass-fiber filter. A continuous sample of stack air is pulled through a filter that captures small particles of radioactive material. We collect these samples weekly and ship them to an off-site analytical laboratory. The analytical laboratory uses gross alpha/beta counting and gamma spectroscopy to identify any increase in emissions and to identify short-lived radioactive materials. Every six months, the analytical laboratory composites these samples and analyzes them to determine the cumulative activity on all the filters of radionuclides such as uranium-234, -235, and-238, plutonium-238 and -239/240, and americium-241. We use the isotopic data to calculate emissions from the stack for the six-month period.

A charcoal cartridge samples emissions of vapors, such as bromine-82, and highly volatile compounds, such as selenium-75, generated by operations at the Los Alamos Neutron Science Center (LANSCE) and hot cell activities at the Chemistry and Metallurgy Research Building and TA-48. A continuous sample of stack air is pulled through a charcoal filter that adsorbs vaporous emissions of radionuclides. This charcoal filter is mounted downstream of a glass-fiber filter (discussed above) that removes any particulates from this sample media prior to the vapor sampling. Gamma spectroscopy determines the amount and identity of the radionuclide(s) present on the charcoal filter, which is collected weekly at the same time as the filter.

We measure tritium emissions from LANL's tritium facilities with a collection device known as a bubbler. This device enables us to determine not only the total amount of tritium released but also whether it is in the elemental (HT) or oxide (HTO) form. The bubbler pulls a continuous sample of air from the stack, which is then "bubbled" through three sequential vials containing ethylene glycol. The ethylene glycol collects the water vapor from the sample of air, including any tritium that may be part of a water molecule (HTO). "Bubbling" through these three vials removes essentially all HTO from the air, leaving only HT. The air is then passed through a palladium catalyst that converts the HT to HTO. The sample is pulled through three additional vials containing ethylene glycol, which collect the newly formed HTO. We collected the vials of ethylene glycol weekly and sent them to an analytical laboratory for liquid scintillation counting to determine the amount of HTO and HT.

In previous years, we monitored stacks at LANSCE for tritium. After an historical evaluation of HTO emissions from LANSCE in 2001, we discontinued sampling tritium following the July 2001 report period based on the low historical emissions of HTO from TA-53 and the low relative contribution of tritium to the off-site dose from TA-53 emissions. Emissions of tritium reported in 2010 from LANSCE are based on 2001 tritium generation rates.

We measure GMAP emissions from LANSCE activities using real-time monitoring data. A sample of stack air is pulled through an ionization chamber that measures the total amount of radioactivity in the sample. Gamma spectroscopy and decay curves are used to continuously identify specific radioisotopes and the quantity of each. From these data, the total emissions of each radionuclide are calculated.

3. Sampling Procedures and Data Analysis

a. Sampling and Analysis

Analytical methods used comply with EPA requirements in 40 CFR 61, Appendix B, Method 114 (EPA 1989). Section F of this chapter presents the results of analytical quality assurance measurements. This section discusses the sampling and analysis methods for each type of LANL's emissions.

b. Particulate Matter Emissions

Each week, we remove and replace the glass-fiber filters that sample facilities with significant potential for radioactive particulate emissions, and we then ship them to an off-site analytical laboratory. Prior to shipping, we screen each sample filter with a hand-held instrument to determine if there are any unusually high levels of gross alpha or beta radioactivity. The laboratory performs analyses for the presence of alpha and beta radioactivity after the sample has been allowed to decay for approximately one week (to allow short-lived radon progeny to decay). In addition to alpha and beta analyses, the laboratory performs gamma spectroscopy analysis to identify specific isotopes in the sample. While alpha and beta counting are performed on individual glass-fiber filters, gamma spectroscopy is performed on "clumps" of filters, a group of seven or eight filters stacked together to allow quick analysis for gamma-emitting radionuclides. Subsequent analyses, if needed, are performed on individual filters.

The glass-fiber filters are composited every six months for radiochemical analysis because gross alpha/beta counting cannot identify specific radionuclides. We use the data from these composite analyses to quantify emissions of radionuclides, such as the isotopes of uranium and plutonium. The Rad-NESHAP team compares the results of the isotopic analysis with gross activity measurements to ensure that the requested analyses (e.g., uranium-234, -235, and -238; and plutonium-238 and -239/240, etc.) identify all significant activity in the composites.

For particulate filters from the LANSCE accelerator facility, the analytical laboratory only performs gamma spectroscopy analyses based on the anticipated suite of emissions from this facility. Again, we perform hand-screening of each filter prior to shipping them to the off-site analytical laboratory.

c. Vaporous Activation Products Emissions

We remove and replace the charcoal canisters weekly at facilities with the potential for significant vaporous activation products emissions and ship the samples to the off-site analytical laboratory where gamma spectroscopy identifies and quantifies the presence of vaporous radioactive isotopes. For charcoal filters, gamma spectroscopy analyses are performed on individual filters instead of clumped filters.

d. Tritium Emissions

Each week, we collected tritium bubbler samples, used to sample facilities with the potential for significant elemental and oxide tritium emissions, and transport them to LANL's Health Physics Analytical Laboratory. The Health Physics Analytical Laboratory adds an aliquot of each sample to a liquid scintillation cocktail and determines the amount of tritium in each vial by liquid scintillation counting.

e. Gaseous Mixed Activation Products (GMAP) Emissions

To record and report GMAP emissions, we used continuous monitoring, rather than off-line analysis, for two reasons. First, the nature of the emissions is such that standard filter paper and charcoal filters will not collect the radionuclides of interest. Second, the half-lives of these radionuclides are so short that the activity would decay away before any sample could be analyzed off-line. The GMAP monitoring system includes a flow-through ionization chamber in series with a gamma spectroscopy system. Total GMAP emissions are measured with the ionization chamber. The real-time current this ionization chamber measures is recorded on a strip chart and the total amount of charge collected in the chamber over the entire beam operating cycle is integrated on a daily basis. The gamma spectroscopy system analyzes the composition of these GMAP emissions. Using decay curves and energy spectra to identify the various radionuclides, we determine the relative composition of the emissions. Decay curves are typically taken one to three times per week based on accelerator operational parameters. When major ventilation configuration changes are made at LANSCE, new decay curves and energy spectra are recorded.

4. Analytical Results

Measurements of LANL stack emissions during 2010 totaled approximately 298 Ci (compared to almost 800 Ci in 2009). Of this total, tritium emissions contributed approximately 87 Ci (compared to 80 Ci in 2009), and air activation products from LANSCE stacks contributed nearly 211 Ci (compared to nearly 716 Ci in 2009). Combined airborne emissions of materials such as plutonium, uranium, americium, and thorium were less than 0.000020 Ci. Emissions of particulate matter plus vaporous activation products (P/VAP) were about 0.016 Ci, which is slightly lower than recent years.

Table 4-9 provides detailed emissions data for LANL buildings with sampled stacks.

Table 4-9
Airborne Radioactive Emissions from LANL Buildings with Sampled Stacks in 2010 (Ci)

TA-Bldg	H-3[a]	Am-241	Pu[b]	U[c]	Th[d]	P/VAP[e]	GMAP[f]	Sr-90[g]
TA-03-029		7.39×10^{-7}	7.83×10^{-6}	6.97×10^{-6}	5.11×10^{-7}			1.71×10^{-7}
TA-03-102			6.90×10^{-11}	3.48×10^{-9}	5.20×10^{-10}			
TA-16-205/450	4.78×10^{1}							
TA-48-001				7.57×10^{-9}	2.89×10^{-9}	5.37×10^{-3}		2.36×10^{-9}
TA-50-001		3.79×10^{-9}		7.91×10^{-8}	4.85×10^{-8}			
TA-50-037								
TA-50-069		7.77×10^{-11}	1.24×10^{-8}	9.89×10^{-10}	4.87×10^{-10}			
TA-53-003	1.86×10^{1}					1.53×10^{-3}	5.44×10^{1}	
TA-53-007	4.79×10^{0}					3.60×10^{-3}	1.57×10^{2}	
TA-54-231		2.00×10^{-10}						7.08×10^{-10}
TA-54-412		5.78×10^{-11}	3.43×10^{-10}		5.99×10^{-10}			
TA-55-004	1.62×10^{1}	2.05×10^{-9}	1.85×10^{-9}	3.71×10^{-8}	2.26×10^{-8}			1.34×10^{x101}
Total[h]	*8.73×10^{1}*	*7.45×10^{-7}*	*7.85×10^{-6}*	*7.09×10^{-6}*	*5.87×10^{-7}*	*1.05×10^{-2}*	*2.32×10^{2}*[i]	*1.76×10^{-7}*

Note: Some buildings have more than one sampled stack..

[a] Includes both gaseous and oxide forms of tritium.

[b] Includes Pu-238, Pu-239, and Pu-240.

[c] Includes U-234, U-235, and U-238. Does not include radioactive progeny of U-238.

[d] Includes Th-228, Th-230, and Th-232.

[e] P/VAP = Particulate/vapor activation products (with measured radionuclides and short-lived radioactive progeny).

[f] GMAP = Gaseous mixed activation products.

[g] Strontium-90 values do not include short-lived radioactive progeny of yttrium-90.

[h] Some differences may occur because of rounding.

[i] Total for GMAP includes 20.5 curies released from diffuse sources at TA-53.

Table 4-10 provides a detailed listing of the constituent radionuclides in the groupings of GMAP and P/VAP.

Table 4-11 presents the half-lives of the radionuclides typically emitted by LANL. During 2010, the LANSCE facility non-point source emissions of activated air comprised approximately 20 Ci of carbon-11 and 1 Ci of argon-41.

5. Long-Term Trends

Figures 4-10 to 4-13 present radioactive emissions from sampled LANL stacks and illustrate trends in measured emissions for plutonium, uranium, tritium, and GMAP emissions, respectively. As the figures demonstrate, emissions from plutonium and uranium isotopes stayed relatively steady over recent years, varying slightly each year but staying in the low-microcurie range. Tritium emissions showed a decrease in emissions relative to recent years, reflecting minimal operations taking place at the main tritium facility during the year. In 2010, emissions of GMAP decreased dramatically from 2010 levels due to a change-out of the primary beam irradiation target at TA-53 Building 7.

Table 4-10
Detailed Listing of
Activation Products Released
from Sampled LANL Stacks in 2010 (curies)

TA-Building	Nuclide	Emission (Ci)
TA-48-0001	As-73	0.000000602
TA-48-0001	As-74	0.00000102
TA-48-0001	Br-77	0.000192
TA-48-0001	Ga-68	0.00504
TA-48-0001	Ge-68	0.00504
TA-48-0001	Hg-197	0.0000285
TA-48-0001	Hg-197m	0.0000285
TA-48-0001	Se-75	0.000104
TA-53-0003	Ar-41	2.18
TA-53-0003	Be-7	0.00106
TA-53-0003	Br-76	0.00000337
TA-53-0003	Br-77	0.00000930
TA-53-0003	Br-82	0.0000818
TA-53-0003	C-11	52.2
TA-53-0003	Co-60	0.0000000734
TA-53-0003	Ga-68	0.00000199
TA-53-0003	Ge-68	0.00000199
TA-53-0003	H-3 (HTO)	18.6
TA-53-0003	Na-24	0.000371
TA-53-0003	V-48	0.00000297
TA-53-0007	Ar-41	15.3
TA-53-0007	As-73	0.00000688
TA-53-0007	Br-76	0.000327
TA-53-0007	Br-77	0.0000387
TA-53-0007	Br-82	0.00267
TA-53-0007	C-10	0.379
TA-53-0007	C-11	64.1
TA-53-0003	H-3 (HTO)	4.79
TA-53-0007	Hg-197	0.000525
TA-53-0007	Hg-197m	0.000525
TA-53-0007	N-13	30.4
TA-53-0007	N-16	0.575
TA-53-0007	Na-24	0.0000147
TA-53-0007	O-14	0.547
TA-53-0007	O-15	45.4
TA-53-0007	Os-191	0.00000507
TA-53-0007	Se-75	0.0000182

Table 4-11
Radionuclide Half-Lives

Nuclide	Half-Life
H-3	12.3 yr
Be-7	53.4 d
C-10	19.3 s
C-11	20.5 min
N-13	10.0 min
N-16	7.13 s
O-14	70.6 s
O-15	122.2 s
Na-22	2.6 yr
Na-24	14.96 h
P-32	14.3 d
K-40	1,277,000,000 yr
Ar-41	1.83 h
Mn-54	312.7 d
Co-56	78.8 d
Co-57	270.9 d
Co-58	70.8 d
Co-60	5.3 yr
As-72	26 h
As-73	80.3 d
As-74	17.78 d
Br-76	16 h
Br-77	2.4 d
Br-82	1.47 d
Se-75	119.8 d
Sr-85	64.8 d
Sr-89	50.6 d
Sr-90	28.6 yr
I-131	8 d
Cs-134	2.06 yr
Cs-137	30.2 yr
Os-183	13 h
Os-185	93.6 d
Os-191	15.4 d
Hg-193	3.8 h
Hg-195	9.5 h
Hg-195m	1.67 d
Hg-197	2.67 d
Hg-197m	23.8 h
U-234	244,500 yr
U-235	703,800,000 yr
U-238	4,468,000,000 yr
Pu-238	87.7 yr
Pu-239	24,131 yr
Pu-240	6,569 yr
Pu-241	14.4 yr
Am-241	432 yr

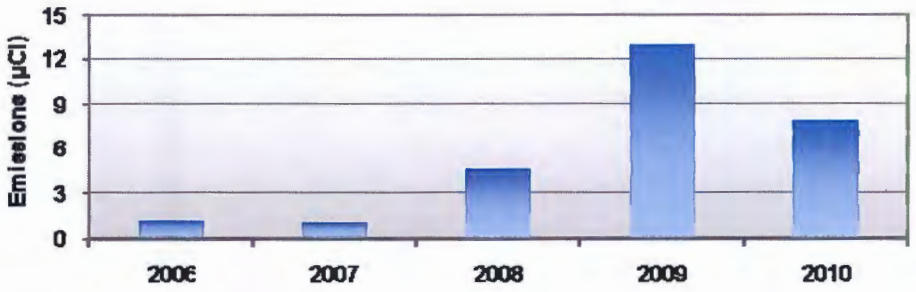

Figure 4-10 Plutonium emissions from sampled LANL stacks

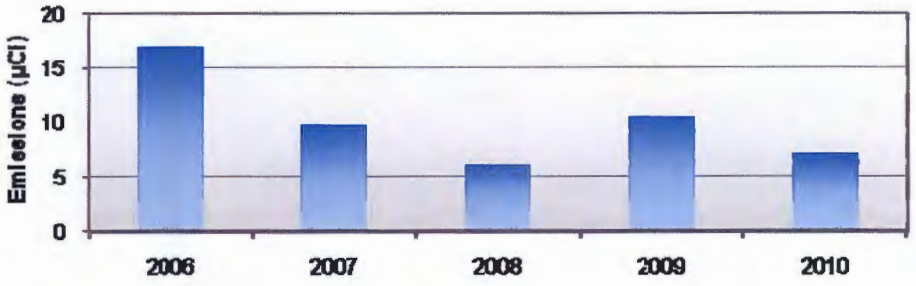

Figure 4-11 Uranium emissions from sampled LANL stacks

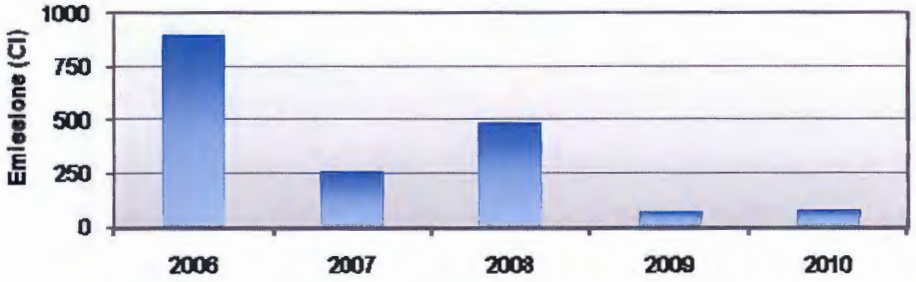

Figure 4-12 Tritium emissions from sampled LANL stacks

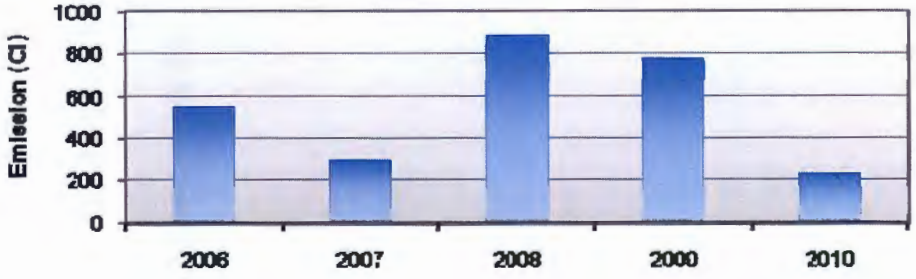

Figure 4-13 GMAP emissions from sampled LANL stacks

LANSCE operated in the same configuration as recent years, with continuous beam operations to the 1L Target and the Lujan Neutron Scattering Center, causing the majority of radioactive air emissions. Operations to the 1L Target took place from late spring of 2010 through the end of the calendar year.

The emissions control system at the LANSCE 1L Target is a "delay line," which retains the short-lived activation products for a short time before release out the stack. This time interval allows decay of the short-lived radionuclides to non-radioactive components.

As mentioned, the primary beam irradiation target at TA-53 Building 7 was changed out prior to the 2010 run cycle. This resulted in a more controlled irradiation environment and less generation of activated air or other particulates and vapors.

Figure 4-14 shows the individual contribution of each emission type to total LANL emissions. It clearly shows that GMAP emissions and tritium emissions make up the vast majority of radioactive stack emissions. This plot does not directly relate to off-site dose because some radionuclides have a higher dose impact per curie released than others. GMAP and tritium remain the highest contributors to the total curies released. These gas-phase nuclides are not easily removed from an exhaust stack air stream by standard control techniques, such as filtration. GMAP and tritium emissions continue to fluctuate as the major emissions type; tritium facility operations and LANSCE operations vary from year to year. GMAP emissions are normally the greatest source of off-site dose from the airborne pathway because of the close proximity of the LANSCE facility to the LANL boundary.

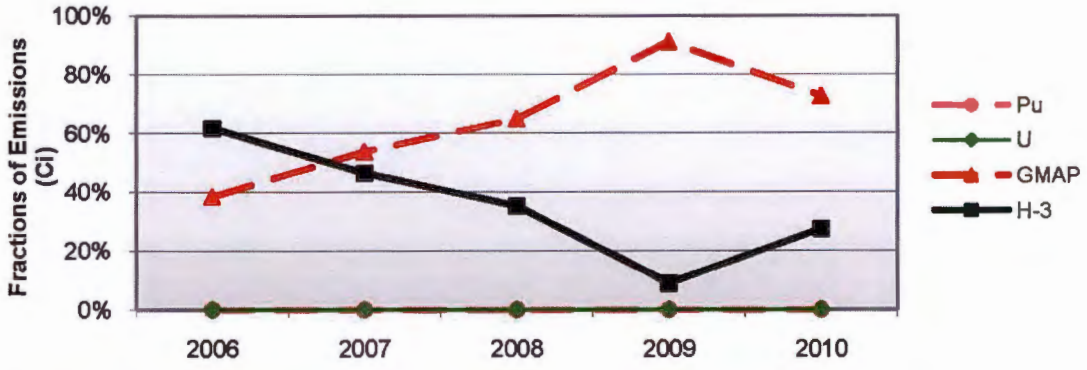

Figure 4-14 Fraction of total annual stack emissions resulting from plutonium, uranium, tritium, and GMAP

C. GAMMA AND NEUTRON RADIATION MONITORING PROGRAM

1. Introduction

We monitor gamma and neutron radiation in the environment—that is, outside of the workplace—according to the criteria specified in McNaughton et al. (2000) as part of a network of radiation detectors known as the Direct Penetrating Radiation Monitoring Network (DPRNET). Naturally occurring radiation originates from terrestrial and cosmic sources. It is extremely difficult to distinguish man-made sources from the natural background because the natural radiation doses are generally much larger than those from man-made sources. The external dose rate from natural terrestrial and cosmic sources measured by the dosimeters varies from approximately 100 to 200 mrem/yr.

2. Monitoring Network

a. Dosimeter Locations

In an attempt to distinguish any impact from LANL operations on the public, we located 98 thermoluminescent dosimeter (TLD) stations around LANL and in the surrounding communities. There is a TLD at every AIRNET station (shown in Figures 4-1 and 4-3). The corresponding TLD station numbers are listed in Supplementary Data Table S4-10. Additional stations are around TA-54, Area G (shown in

Figure 4-15); at TA-53, LANSCE (eight stations); at Santa Clara Pueblo (five stations); and inside the Pueblo de San Ildefonso sacred area (two stations).

b. Neutron Dosimeters

We monitor potential neutron doses with 47 albedo TLD stations near known or suspected sources of neutrons: TA-53 (LANSCE) and TA-54 (Area G). Albedo dosimeters are sensitive to neutrons and use a hydrogenous material that causes neutron backscatter to simulate the human body.

c. Neutron Background

We measure the neutron background at station #25, near Bandelier National Monument, and #101 in Santa Fe. The average neutron background at these two stations is 2 ± 1 mrem. To be consistent with previous estimates, we use 2 mrem/yr as our estimated neutron background.

3. Quality Assurance

The calibration laboratory at LANL's Health Physics Measurements Group (RP-2) calibrates the dosimeters every quarter of the calendar year. The DOE Laboratory Accreditation Program has accredited the dosimeters that RP-2 provides, and RP-2 provides quality assurance (QA) for the dosimeters. The uncertainty in the TLD data is estimated from the standard deviation of data from dosimeters exposed to the same dose. The overall uncertainty (one standard deviation) is similar to previous data and is 8%.

4. Results

The annual dose equivalents at all stations except those within TA-53 or near Area G are consistent with natural background radiation and with previous measurements. Detailed results are listed in the Supplemental Data Table S4-8. The only locations with a measurable contribution from LANL operations are within the boundaries of TA-53 (Los Alamos Neutron Science Center [LANSCE]) and near TA-54 (Area G). Figure 4-15 shows the locations of the stations at TA-54, Area G.

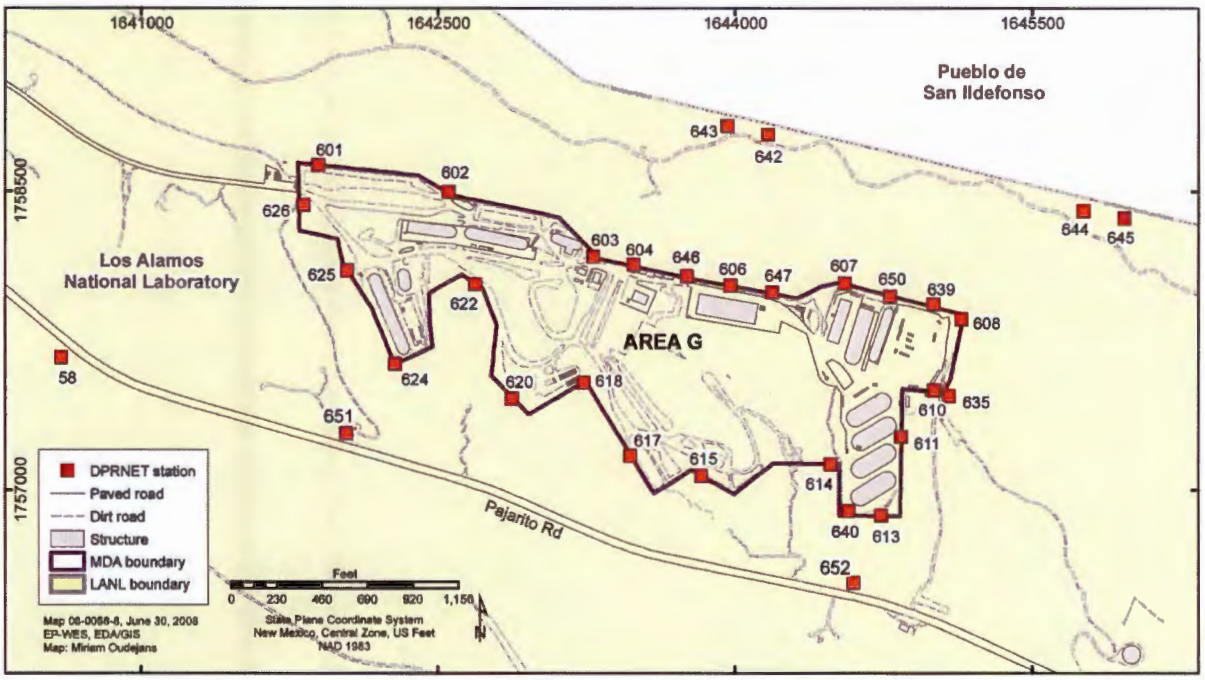

Figure 4-15 Thermoluminescent dosimeter locations at TA-54, Area G, as part of the Direct Penetrating Radiation Monitoring Network (DPRNET)

South of the line of TLDs from #601 to #608, Area G is a controlled-access area, so these data are not representative of a potential public dose. However, TLDs #642 and #643 are close to the boundary of the

Pueblo de San Ildefonso sacred area, which is accessible to members of the Pueblo. Furthermore, TLDs #133 and #134 are deployed by Pueblo staff within the boundaries of the sacred area.

After subtracting background, the annual doses measured by TLDs #134, #642, and #643 were 11 mrem, 7 mrem, and 8 mrem, respectively. The dose measured by TLD #134 is higher than the others because TLDs #642 and #643 are in Cañada del Buey and are partially shielded by the rim of the canyon. These are the doses that would be received by a person who is at the location of the TLDs 24 hours per day, 365 days per year. As discussed in Chapter 3, we apply an occupancy factor of 1/16 (NCRP 1976) so the public dose near TLD #134 is calculated to be 0.7 mrem/yr, which is similar to previous years.

TLD #133 is located several hundred meters farther from Area G and measures nothing above the terrestrial and cosmic-ray natural background. This is expected because of the distance and the shielding provided by the air. Annual doses of 15 mrem were measured by TLDs #651 and #652, which are located along Pajarito Road, south of Area G. This section of Pajarito Road has limited public access.

D. NON-RADIOLOGICAL AMBIENT AIR MONITORING

1. Introduction

The non-radioactive ambient air monitoring network consists of two types of measurements: AIRNET total suspended particulate matter samples analyzed for selected non-radiological species and TEOM samplers, which directly measure particulate matter less than 10 micrometers (PM-10) and particulate matter less than 2.5 micrometers (PM-2.5).

2. Air Monitoring Network and Equipment

Ambient particulate matter monitoring continued at the old White Rock Fire Station on Rover Boulevard and at the Los Alamos Medical Center. Two monitors run at each location: one for particles smaller than 10 micrometers (PM-10) and another for those smaller than 2.5 micrometers (PM-2.5). A tapered-element oscillating microbalance ambient particulate monitor is fitted with an appropriate sample inlet. The microbalance has an oscillating ceramic "finger" with a filter that collects particles. The mass of accumulated particulate matter is derived and saved for later download. These data measure the dust and pollutant loadings in the atmosphere.

3. Ambient Air Concentrations

This year, the particulate matter data collection efficiency was above 97%. Annual averages, 24-hour maxima and EPA standards are shown in Table 4-12.

Table 4-12

PM-2.5 and PM-10 Concentration Summary for 2010

Station Location	Constituent	Maximum 24 Hour (µg/m³)	Annual Average (µg/m³)
Los Alamos Medical Center	PM-10	58	13
	PM-2.5	12	6
White Rock Fire Station	PM-10	60	13
	PM-2.5	19	6
EPA Standard[a]	PM-10	150	n/a[b]
	PM-2.5	35	15

[a] EPA 40 CFR Part 50 and http://www.epa.gov/air/criteria.html.

[b] None applicable.

4. Detonation and Burning of Explosives

LANL uses explosives at firing sites and maintains records that include the type of explosives used and other materials expended. Supplemental Table S4-9 summarizes the amounts of expended materials for the last three years. LANL also burns scrap and waste explosives because of treatment requirements and safety concerns. In 2010, LANL burned roughly 3,600 kilograms of high explosives. An assessment of the ambient impacts of high-explosives testing (DOE 1999) indicated no adverse air-quality impacts.

5. Beryllium Sampling

We analyzed quarterly composite samples from 38 sites for beryllium (Supplemental Data Table S4-11). These sites are located near potential beryllium sources at LANL, or in nearby communities. New Mexico has no ambient air quality standard for beryllium. All concentrations measured this year were at or below about 2% of the NESHAP standard of 10 ng/m^3 from 40 CFR Part 61 Subpart C (EPA 1989) and were similar to concentrations found in recent years.

E. METEOROLOGICAL MONITORING

1. Introduction

Data obtained from the meteorological monitoring network support many Laboratory activities, including emergency management and response, regulatory compliance, safety analysis, engineering studies, and environmental surveillance programs. To accommodate the broad demands for weather data at the Laboratory, the meteorology team measures a wide variety of meteorological variables across the network, including wind, temperature, pressure, relative humidity and dew point, precipitation, and solar and terrestrial radiation. The Meteorological Monitoring Plan (Johnson and Young 2008) provides details of the meteorological monitoring program. An electronic copy of the "Meteorological Monitoring Plan" is available online at http://www.weather.lanl.gov/.

2. Monitoring Network

A network of seven stations gathers meteorological data at the Laboratory (Figure 4-16). Four of the stations are located on mesa tops (TA-6, TA-49, TA-53, and TA-54), two are in canyons (TA-41 in Los Alamos Canyon and MDCN in Mortandad Canyon), and one is on top of Pajarito Mountain (PJMT). A precipitation gauge is also located in North Community (NCOM) of the Los Alamos town site. The TA-6 station is the official meteorological measurement site for the Laboratory. A sonic detection and ranging (SODAR) instrument is part of the TA-6 meteorological station and measures wind speed and direction to an elevation of approximately 2000 meters above ground level.

3. Sampling Procedures, Data Management, and Quality Assurance

We place instruments in the meteorological network in areas with good exposure to the elements being measured, usually in open fields, to avoid wake effects on wind and precipitation measurements. Temperature and wind are measured at multiple levels on open lattice towers at TA-6, TA-41, TA-49, TA-53, and TA-54. The multiple levels provide a vertical profile of conditions important in assessing boundary layer flow and stability conditions. The multiple levels also provide redundant measurements that support data quality checks. The boom-mounted temperature sensors are shielded and aspirated to minimize solar-heating effects. The Mortandad Canyon (MDCN) station includes a 10-m tripod tower which measures wind at a single level (tower top). In addition, temperature and humidity are measured at ground level at all stations except North Community (NCOM) which only measures precipitation.

Data loggers at the station sites sample most of the meteorological variables at 0.33 Hz, store the data, average the samples over a 15-min period, and transmit the data by telephone or cell phone to a Hewlett-Packard workstation located at the Meteorology Laboratory (TA-59) by telephone or cell phone. The workstation automatically edits measurements that fall outside of realistic ranges. Time-series plots of the data are also generated for a meteorologist's data-quality review. Daily statistics of certain meteorological variables (e.g., daily minimum and maximum temperatures, daily total precipitation, maximum wind gust, etc.) are also generated and checked for quality. For more than 50 years, we have provided these daily weather statistics to the National Weather Service. In addition, cloud type and percentage cloud cover are logged three times daily.

We calibrate all meteorological instruments through the LANL Standards and Calibration Laboratory on an annual basis. An external audit of the instrumentation and methods is typically performed once every three to five years. The most recent audit was an "assist visit" by the DOE Meteorological Coordinating Council (DMCC) in August 2006. The DMCC report can be requested at http://www.weather.lanl.gov/. An external subcontractor inspects and performs maintenance on the station network structures and hoists on an annual basis.

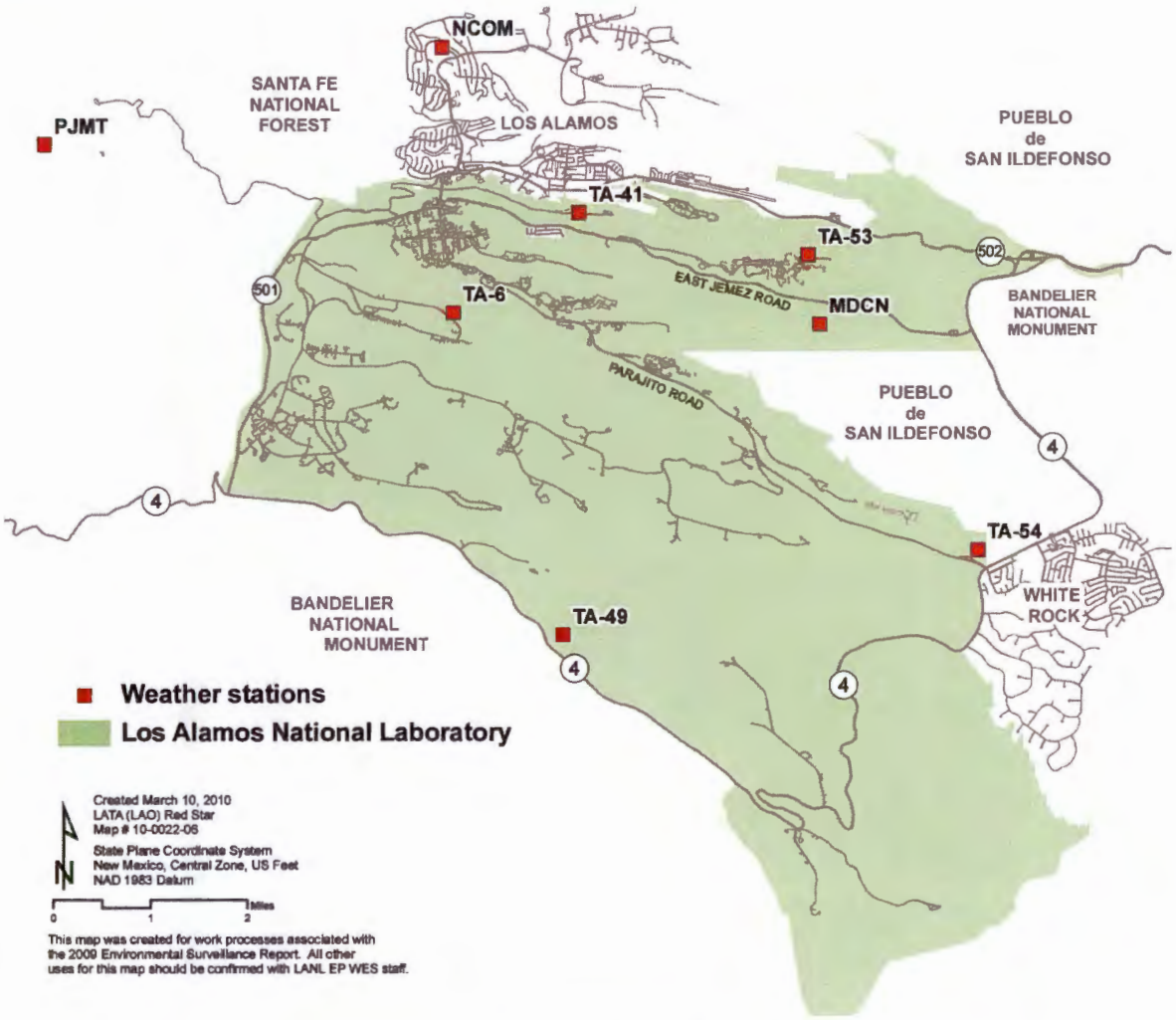

Figure 4-16 Location of meteorological monitoring towers and rain gauges

4. Climatology

Los Alamos has a temperate, semiarid mountain climate. Atmospheric moisture levels are low, and clear skies are present about 75% of the time. These conditions lead to high solar heating during the day and strong long-wave radiative cooling at night. Winters are generally mild, with occasional winter storms. Spring is the windiest season. Summer is the rainy season, with frequent afternoon thunderstorms. Fall is typically dry, cool, and calm. The climate statistics summarized here are from analyses of historical meteorological databases maintained by the meteorology team and following Bowen (1990 and 1992).

The years from 1981 to 2010 represent the time period over which the climatological standard normal is defined. According to the World Meteorological Organization, the standard should be 1961–1990 until 2021 when 1991–2020 will become the standard, and so on every 30 years (WMO 1984). In practice, however, normals are computed every decade, and so 1981–2010 is generally used. Our averages are calculated according to this widely followed practice.

December and January are the coldest months. The majority (90%) of minimum temperatures during December and January range from 4°F to 31°F. Minimum temperatures are usually reached shortly before sunrise. Ninety percent of maximum temperatures, which are usually reached in mid-afternoon, range from 25°F to 55°F. The record low temperature of -18°F was recorded on January 13, 1963. Wintertime arctic air masses that descend into the central United States tend to have sufficient time to heat before they reach our

southern latitude so the occurrence of local subzero temperatures is rare. Winds during the winter are relatively light, so extreme wind chills are uncommon.

Temperatures are highest from June through August. During these months, 90% of minimum temperatures range from 45°F to 61°F. Ninety percent of maximum temperatures range from 67°F to 89°F. The record high temperature of 95°F was recorded on June 29, 1998.

The average annual precipitation, which includes both rain and the water equivalent from frozen precipitation, is 18.97 in. The average annual snowfall is 57.0 in. The largest winter precipitation events in Los Alamos are caused by storms approaching from the west to southwest. Snowfall amounts are occasionally enhanced as a result of orographic lifting of the storms by the high terrain. The record single-day snowfall is about 39 inches, which occurred between 11 a.m. on January 15, 1987, and 11 a.m. the next day. The record single-season snowfall is 153 in. set in 1986–87.

Precipitation in July and August account for 36% of the annual precipitation and encompass the bulk of the rainy season, which typically begins in early July and ends in mid-September. Afternoon thunderstorms form as moist air from the Gulf of California and the Gulf of Mexico is convected and/or orographically lifted by the Jemez Mountains. The thunderstorms yield short, heavy downpours and an abundance of lightning.

The complex topography of Los Alamos influences local wind patterns. Often a distinct diurnal cycle of winds occurs. As air close to the ground is heated during the day, it tends to flow upslope along the ground. This is called anabatic flow. During the night, cool air that forms close to the ground tends to flow downslope and is known as katabatic flow. As the daytime anabatic breeze flows up the Rio Grande valley, it adds a southerly component to the prevailing westerlies of the Pajarito Plateau. Nighttime katabatic flow enhances the local westerly winds. Flow in the east-west-oriented canyons of the Pajarito Plateau is generally aligned with the canyons, so canyon winds are usually from the west at night as katabatic flow and from the east during the day.

5. 2010 in Perspective

Figure 4-17 presents a graphical summary of Los Alamos weather for 2010. The figure depicts the year's monthly average temperature ranges, monthly precipitation, and monthly snowfall totals compared with monthly normals (averages during the 1981–2010 time period). Table 4-13 presents a tabular perspective of Los Alamos weather during 2010.

The year 2010 was slightly warmer and drier than normal. The average annual temperature in 2010 of 49.0°F exceeded the normal annual average of 48.4°F by 0.6°F. The total precipitation of 18.8 in. was 99% of normal (18.97 in.). The first half of the year was generally cooler than normal and the second half was warmer than normal. June and September in particular were considerably warmer than normal. The year began with two snowy months and then precipitation see-sawed through the year. March was dry, April was wet, May was dry, and so on. June and November were particularly dry. July had an abundance of monsoon precipitation. The total precipitation at year's end was close to normal and the total snowfall of 5 feet was 2 inches above normal.

Temperature and precipitation data have been collected in the Los Alamos area since 1910. Figure 4-18 shows the historical record of temperatures in Los Alamos from 1925 through 2010. The annual average temperature is not the average temperature per se, but the mid-point between daily high and low temperatures, averaged over the year. One-year averages are shown in green in Figure 4-18. To aid in showing longer-term trends, the five-year running mean is also shown. With five-year averaging, for example, it appears that the warm spell during the past decade is not as extreme as the warm spell during the early-to-mid 1950s. On the other hand, the current warm trend is longer-lived.

Figure 4-19 shows the historical record of the annually summed total precipitation. The most recent drought spanned the years 1998 through 2003. The 2010 total of 18.8 in. was slightly below normal. As with the historical temperature profile, the five-year running mean is also shown. The five-year average suggests not only that the recent drought is behind us, but that it was the most severe drought during the 80-year record. Precipitation in 2009 and 2010 has been very close to normal, but again warm temperatures have resulted in a 25% decrease in snowfall over the past two years.

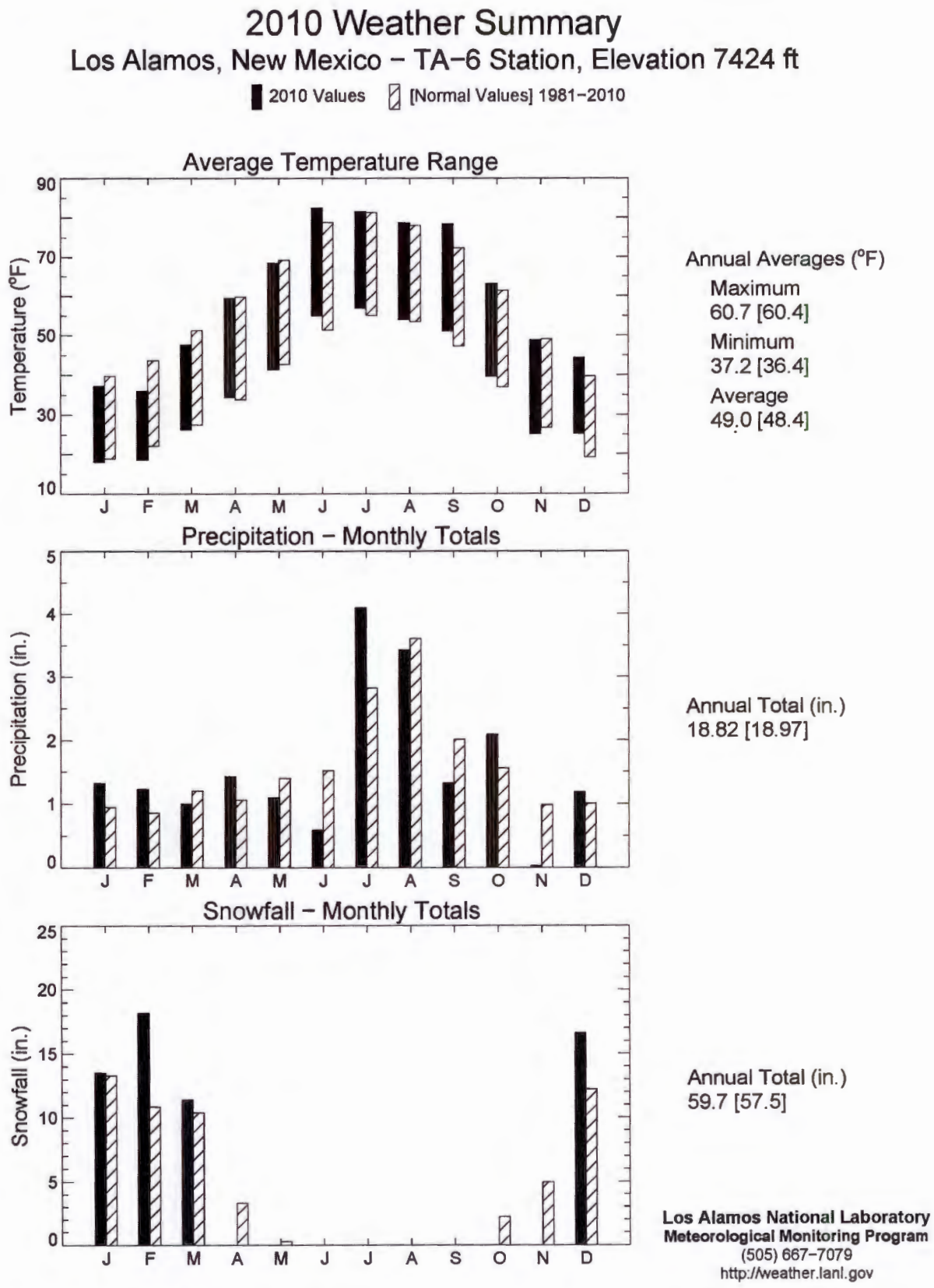

Figure 4-17 **Weather summary for Los Alamos for 2010 at the TA-6 meteorology station**

Table 4-13

Monthly and Annual Climatological Data for 2010 at Los Alamos

Month	Temperatures (°F)[a]								Precipitation (inches)[a]				12-meter wind (mph)[a]				
	Averages				Extremes						Snowfall				Peak Gusts		
	Daily Maximum	Daily Minimum	Overall	Departure[b]	Highest	Date	Lowest	Date	Total	Departure[b]	Total	Departure[b]	Average Speed	Departure[c]	Speed	From	Date
January	37.3	18.0	27.6	-1.8	45	11th	3	8th	1.32	0.37	13.5	0.2	4.9	-0.1	47	WNW	23rd
February	36.0	18.6	27.3	-5.6	44	18th	4	23rd	1.23	0.37	18.2	7.3	8.5	2.7	36	WNW	22nd
March	47.8	26.2	37.0	-2.4	70	30th	15	20th	1.0	-0.2	11.4	1.0	6.6	0.1	49	WNW	26th
April	59.5	34.3	46.9	0.1	70	12th	19	2nd	1.44	0.38	0	-3.3	9.6	2.0	53	WNW	23rd
May	68.5	41.5	55.0	-1.0	80	27th	27	1st	1.1	-0.29	0	-0.3	9.2	1.8	51	WNW	23rd
June	82.4	55.0	68.7	3.6	90	5th	44	13th	0.59	-0.92	0	0	8.1	1.0	47	SSW	19th
July	81.5	56.9	69.2	1.0	91	19th	51	8th	4.1	1.28	0	0	6.2	0.6	33	NW	20th
August	78.7	54.1	66.4	-1.4	84	14th	44	25th	3.43	-0.18	0	0	6.0	0.7	42	NW	12th
September	78.5	51.1	64.8	5.0	85	16th	41	11th	1.32	-0.69	0	0	6.6	0.9	38	WNW	9th
October	63.2	39.6	51.4	2.2	76	1st	23	26th	2.09	0.54	0	-2.2	6.3	0.6	61	W	25th
November	48.8	25.1	37.0	-0.9	65	6th	8	30th	0.03	-0.95	0	-4.9	6.7	1.4	49	WNW	16th
December	44.5	25.2	34.9	5.5	57	3rd	-4	31st	1.18	0.17	16.6	4.4	5.4	0.6	41	W	31st
Year	60.7	37.2	49.0	1.1	91	July 19th	-4	Dec 31st	18.8	-0.13	59.7	1.0	6.7	0.7	61	W	Oct 25th

[a] Data from Technical Area 6, the official Los Alamos weather station.

[b] Departure columns indicate positive or negative departure from 1981-2010 (30-year) climatological average.

[c] Departure column indicates positive or negative departure from 1990-2010 (21-year) climatological average.

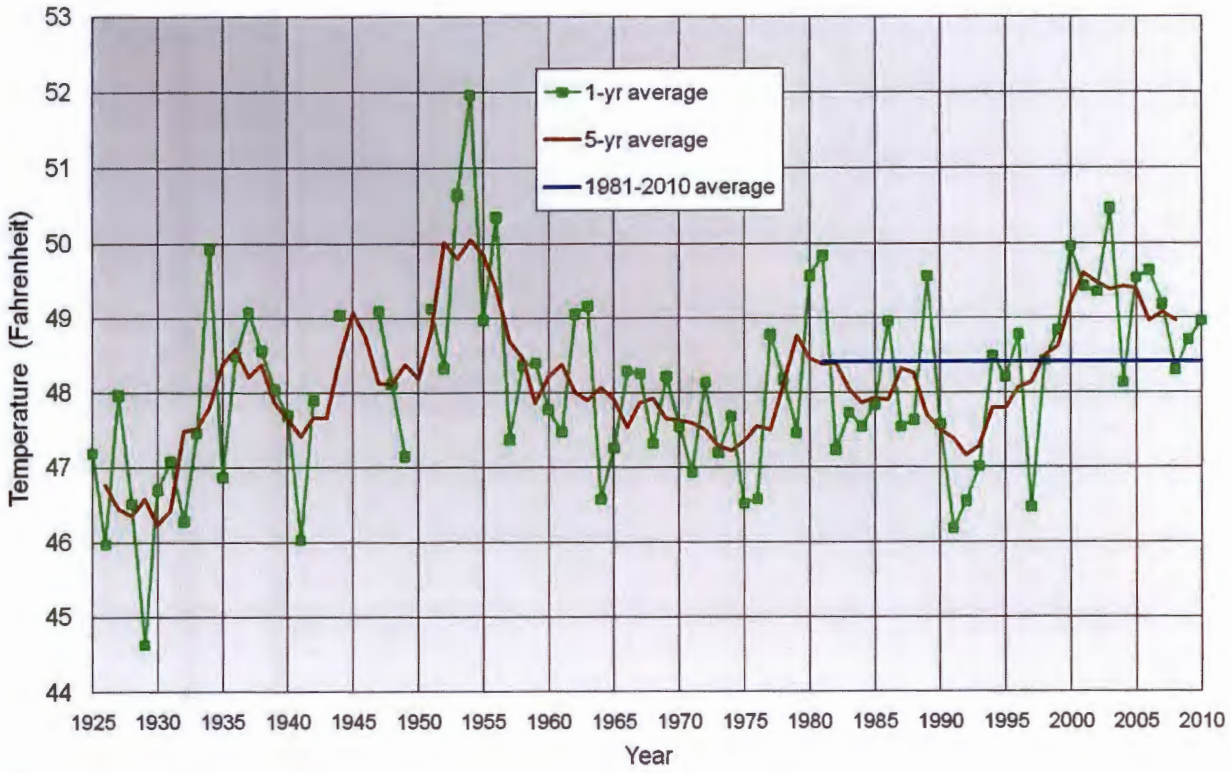

Figure 4-18 Temperature history for Los Alamos

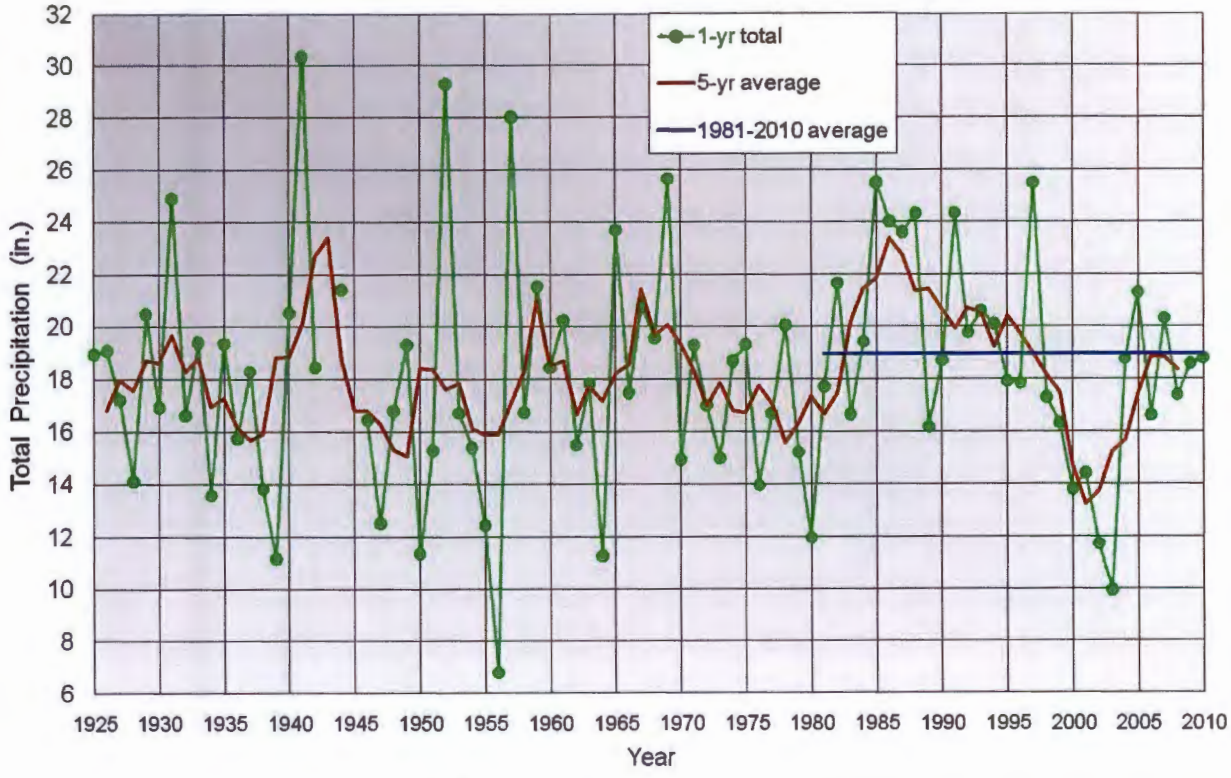

Figure 4-19 Total precipitation history for Los Alamos

Daytime winds (sunrise to sunset) and nighttime winds (sunset to sunrise) are shown in the form of wind roses in Figure 4-20. Wind roses depict the percentage of time that wind blows from each of 16 direction bins. For example, winds are directly from the south at TA-6 over 15% of the time during days in 2010. Winds are directly from the north just over 2% of the time during the day. Wind roses also show the distribution of wind speed. A little over 8% of the time, for example, winds at TA-6 are from the south and range from 2.5 to 5 meters per second. Winds from the south at TA-6 exceed 7.5 meters per second only a fraction of 1% of the time, and winds are calm there 1.3% of the time.

The wind roses are based on 15-minute-averaged wind observations for 2010 at the four Pajarito Plateau stations. Although it is not shown here, wind roses from different years are almost identical, indicating that wind patterns are constant when averaged over a year.

Daytime winds measured by the four Pajarito Plateau stations are predominately from the south, consistent with the typical upslope flow of heated daytime air moving up the Rio Grande valley. Nighttime winds on the Pajarito Plateau are lighter and more variable than daytime winds and typically have a westerly component, resulting from a combination of prevailing westerly winds and downslope katabatic flow of cooled mountain air.

Winds on the Pajarito Plateau are faster during the day than at night. This is due to vertical mixing that is driven by sunshine. During the day, the mixing is strong and brings momentum down to the surface, resulting in faster surface winds. At night, there is little mixing so wind at the surface receives less boosting from aloft.

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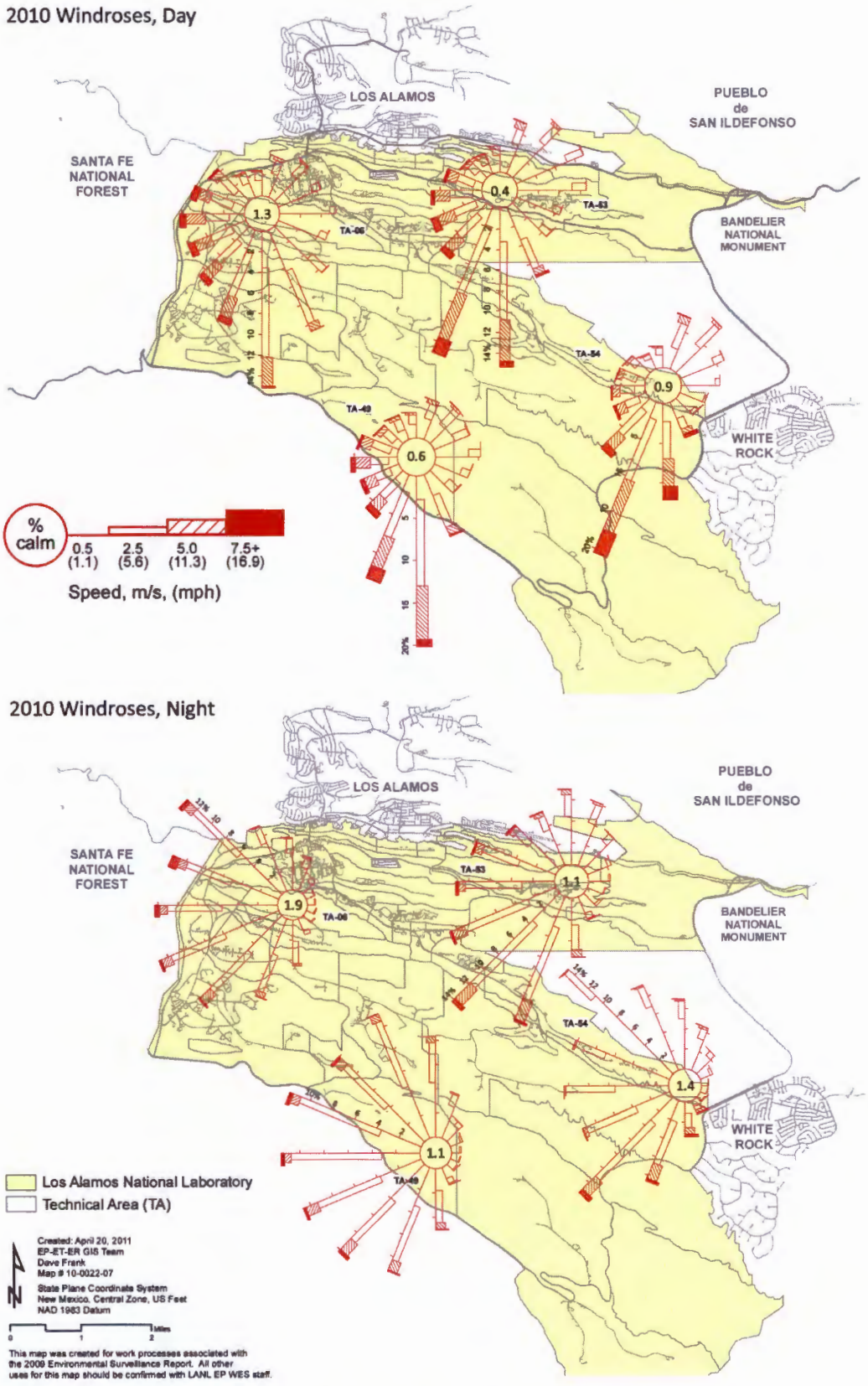

Figure 4-20 Daytime and nighttime wind roses for 2010

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A. INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) routinely analyzes groundwater samples to monitor water quality beneath the Pajarito Plateau and the surrounding area. The Laboratory conducts groundwater monitoring and characterization programs to comply with the requirements of the Department of Energy (DOE) Orders and New Mexico (NM) and federal regulations. The objectives of the Laboratory's groundwater programs are to determine compliance with waste discharge requirements and to evaluate any impact of Laboratory activities on groundwater resources.

Because of the Laboratory's semiarid, mountainside setting, significant groundwater is found only at depths of more than several hundred feet. The Los Alamos County public water supply comes from supply wells that draw water from the regional aquifer, which is found at a depth that ranges from 600 to 1,200 ft. Groundwater protection efforts at the Laboratory focus on the regional aquifer and also include small bodies of shallow perched groundwater found within canyon alluvium and at intermediate depths above the regional aquifer.

Most of the groundwater monitoring conducted during 2010 was carried out according to the Interim Facility-wide Groundwater Monitoring Plans (LANL 2009a, 2010) approved by the New Mexico Environment Department (NMED) under the Compliance Order on Consent (Consent Order). The LANL Environmental Programs Directorate collected groundwater samples from wells and springs within or adjacent to the Laboratory and from the nearby Pueblo de San Ildefonso.

B. HYDROGEOLOGIC SETTING

The following sections describe the hydrogeologic setting of the Laboratory and include a summary of groundwater contaminant sources and distribution. Additional detail can be found in reports available at http://lanl.gov/environment/.

1. Geologic Setting

The Laboratory is located in northern New Mexico on the Pajarito Plateau, which extends eastward from the Sierra de los Valles, the eastern range of the Jemez Mountains (Figure 5-1). The Rio Grande borders the Laboratory on the east. Rocks of the Bandelier Tuff cap the Pajarito Plateau. The tuff was formed from volcanic ashfall deposits and pyroclastic flows that erupted from the Jemez Mountains volcanic center approximately 1.2 to 1.6 million years ago. The tuff is more than 1,000 ft thick in the western part of the plateau and thins eastward to about 260 ft adjacent to the Rio Grande.

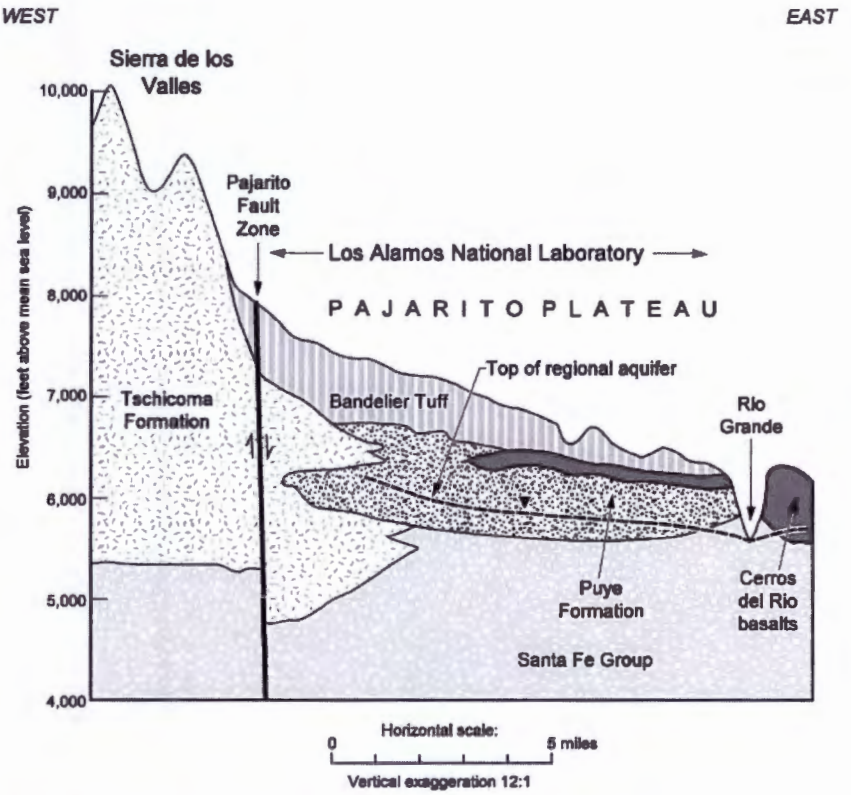

Figure 5-1 Generalized geologic cross-section of the Pajarito Plateau

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains (Figure 5-1). The Puye Formation conglomerate underlies the tuff beneath the central and eastern portion of the plateau. The Cerros del Rio basalt flows interfinger with the Puye Formation conglomerate beneath the Laboratory. These formations overlie the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 3,300 ft thick.

2. Groundwater Occurrence

Due to its location on a semiarid mountainside, the Laboratory land sits atop a thick zone of mainly unsaturated rock, with the principal aquifer found 600 to 1,200 ft below the ground surface. Groundwater beneath the Pajarito Plateau occurs in three modes, two of which are perched (Figure 5-2). Perched groundwater is a zone of saturation with limited extent that is retained above less permeable layers and is separated from underlying groundwater by unsaturated rock.

The three modes of groundwater occurrence are (1) perched alluvial groundwater in canyon bottoms, (2) discontinuous zones of intermediate-depth perched groundwater whose location is controlled by availability of recharge and by subsurface changes in rock type and permeability, and (3) the regional aquifer beneath the Pajarito Plateau. The regional aquifer extends throughout the neighboring Española Basin.

Stream runoff may be supplemented or maintained by Laboratory discharges. Many relatively dry canyons have little surface water flow and little or no alluvial groundwater. Streams have filled some parts of canyon bottoms with alluvium up to a thickness of 100 ft. In wet canyons, runoff percolates through the alluvium until downward flow is impeded by less permeable layers of tuff or other rock, maintaining shallow bodies of perched groundwater within the alluvium. These saturated zones have limited extent; evapotranspiration and percolation into underlying rocks deplete the alluvial groundwater as it moves down the canyon.

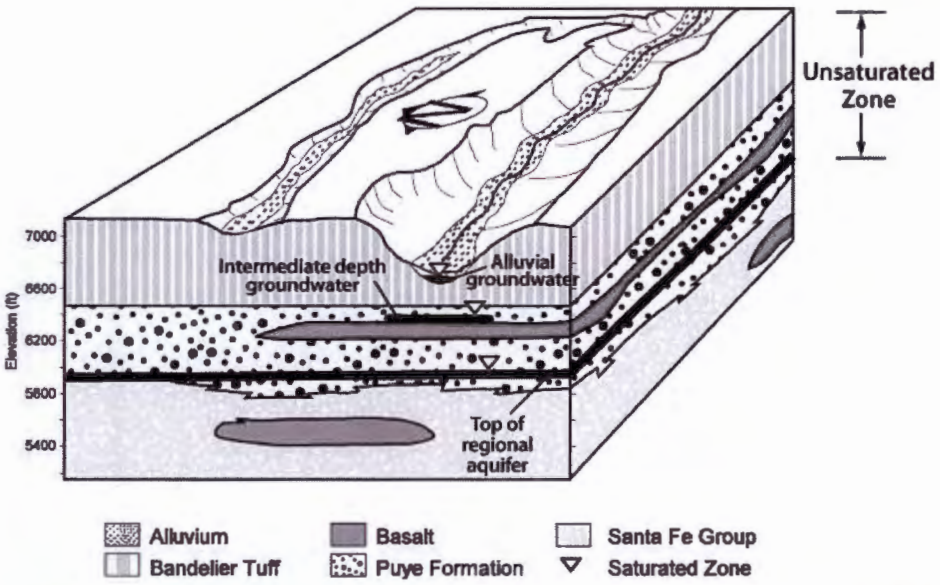

Figure 5-2 **Illustration of geologic and hydrologic relationships on the Pajarito Plateau, showing the three modes of groundwater occurrence**

Underneath portions of Pueblo, Los Alamos, Mortandad, Sandia, and other canyons, intermediate perched groundwater occurs within the lower part of the Bandelier Tuff and the underlying Puye Formation and Cerros del Rio basalt (Figure 5-2). These intermediate-depth groundwater bodies are formed in part by recharge from the overlying perched alluvial groundwater. The intermediate groundwater may be discontinuous or may connect with other zones across canyons. Depths of the intermediate perched groundwater vary. For example, the depth to intermediate perched groundwater is approximately 120 ft in Pueblo Canyon, 450 ft in Sandia Canyon, and 500–750 ft in Mortandad Canyon.

Some intermediate perched groundwater occurs in volcanic rocks on the flanks of the Sierra de los Valles to the west of the Laboratory. This water discharges at several springs and yields a significant flow from a gallery in Water Canyon. Two types of intermediate groundwater occur in the southwest portion of the Laboratory just east of the Sierra de los Valles. A number of intermediate springs, fed by local recharge, discharge from mesa edges along canyons. Also, intermediate groundwater is found in the Bandelier Tuff at a depth of approximately 700 ft. The source of this deeper perched groundwater may be percolation from streams that discharge from canyons along the mountain front or may be underflow of recharge from the Sierra de los Valles.

The regional aquifer occurs at a depth of 1,200 ft along the western edge of the plateau and 600 ft along the eastern edge (Figures 5-1 and 5-3). The regional aquifer lies about 1,000 ft beneath the mesa tops in the central part of the plateau. This is the only aquifer in the area capable of serving as a municipal water supply. Water in the regional aquifer generally flows east or southeast toward the Rio Grande. Groundwater model studies indicate that underflow of groundwater from the Sierra de los Valles is the main source of regional aquifer recharge (LANL 2005a). Groundwater velocities vary spatially but are typically 30 ft/yr.

The surface of the aquifer rises westward from the Rio Grande within the Tesuque Formation, part of the Santa Fe Group (Figure 5-1). Underneath the central and western part of the plateau, the aquifer rises farther into the Cerros del Rio basalt and the lower part of the Puye Formation.

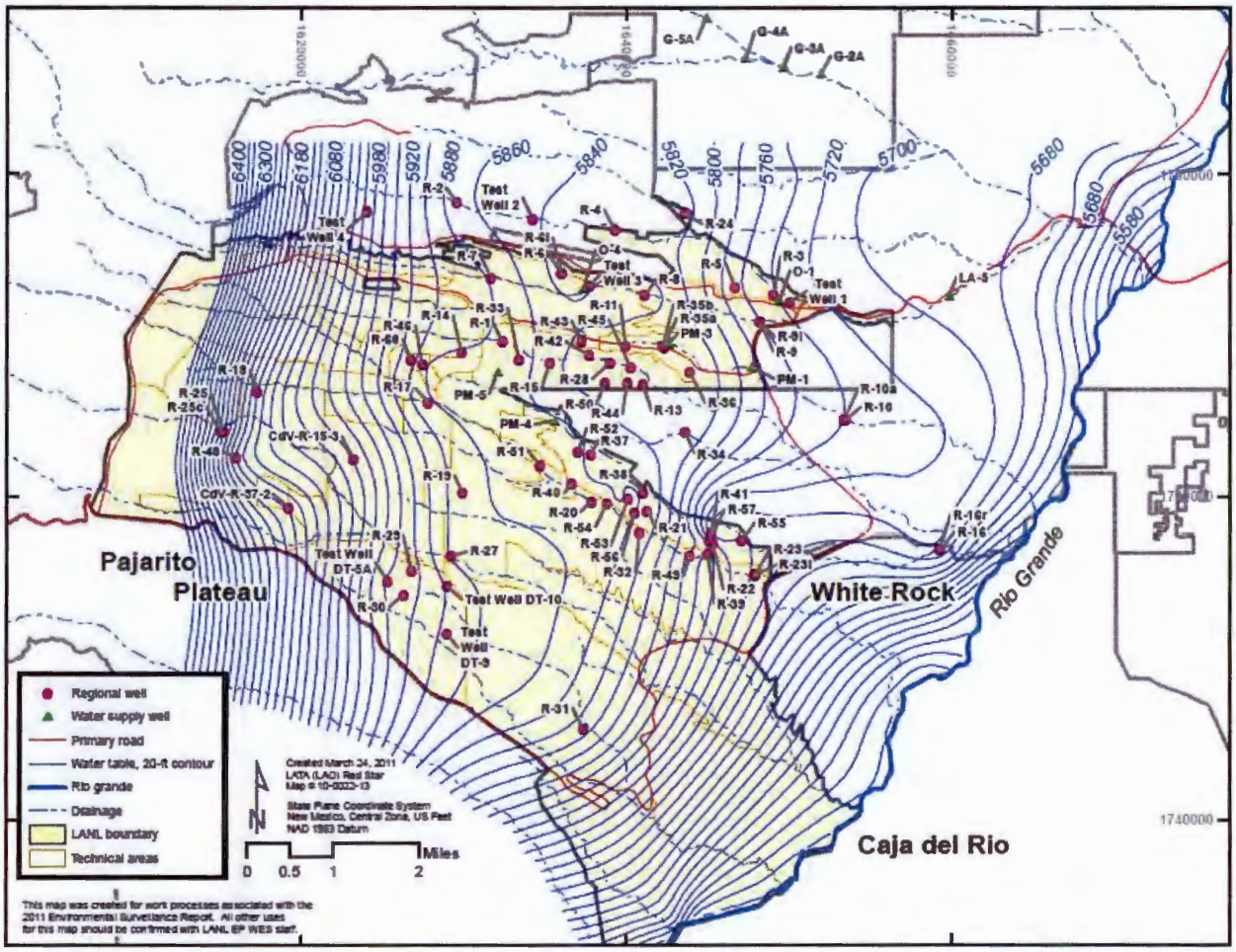

Figure 5-3 **Contour map of average water table elevations for the regional aquifer (based on a map in LANL 2011). This map represents a generalization of the data; other interpretations are possible.**

The regional aquifer is separated from alluvial and intermediate perched groundwater by approximately 350 to 600 ft of unsaturated tuff, basalt, and sediments with generally low moisture content (< 10%). Water lost by downward seepage from alluvial and intermediate groundwater zones travels through the underlying rock by unsaturated flow. This percolation is a source of certain contaminants, mobile in water, which may reach the regional aquifer within a few decades. The limited extent of the alluvial and intermediate groundwater bodies, along with the dry rock that underlies them, restricts their volumetric contribution to recharge reaching the regional aquifer.

3. Overview of Groundwater Quality

Since the 1940s, liquid effluent discharge by the Laboratory has affected water quality in the shallow perched alluvial groundwater that lies beneath the floor of a few canyons. Liquid effluent discharge is also the primary means by which Laboratory contaminants have affected the quality of intermediate perched zones and the regional aquifer. Where contaminants are found at depth, the setting is either a canyon where alluvial groundwater is usually present (perhaps because of natural runoff or Laboratory effluents) or a location beneath a mesa-top site where large amounts of liquid effluent have been discharged.

The contaminated alluvial and intermediate perched groundwater bodies are separated from the regional aquifer by hundreds of feet of dry rock, so recharge from the shallow groundwater occurs slowly. As a result, less contamination reaches the regional aquifer than is found in the shallow perched groundwater bodies, and impacts on the regional aquifer are reduced or not present.

Drainages that received liquid radioactive effluents include Mortandad Canyon, Pueblo Canyon from its tributary Acid Canyon, and Los Alamos Canyon from its tributary DP Canyon (Figure 5-4). Rogers (2001) and Emelity (1996) summarize radioactive effluent discharge history at the Laboratory.

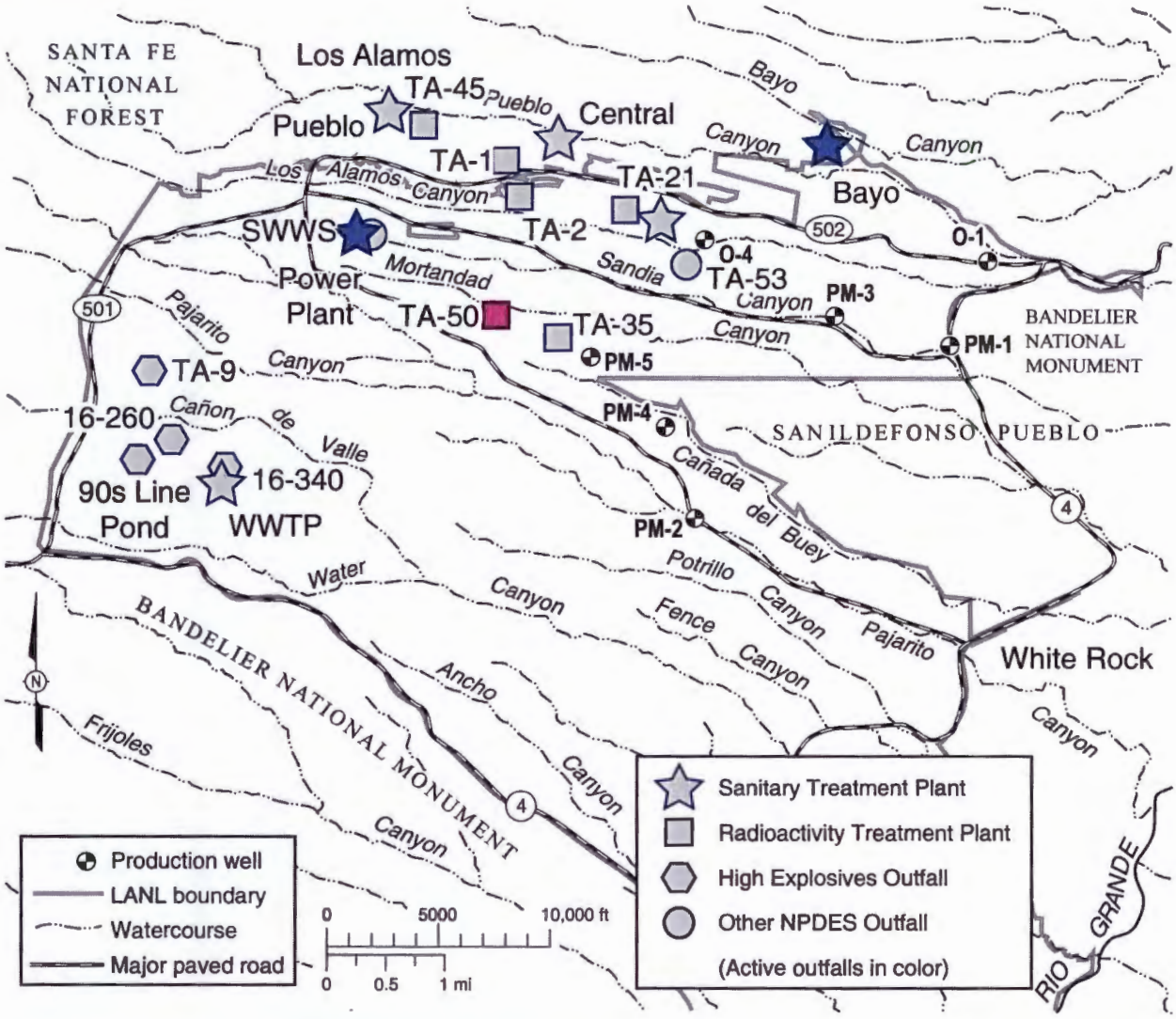

Figure 5-4 **Major liquid release sources (effluent discharge) potentially affecting groundwater. Active outfalls are in color; most outfalls shown are inactive.**

Because of releases of power plant cooling water and water from the Laboratory's Sanitary Wastewater Systems (SWWS) Plant, Sandia Canyon has received the largest liquid discharge volumes of any canyon. Water Canyon and its tributary Cañon de Valle have received effluents produced by high explosives (HE) processing and experimentation (Glatzmaier 1993; Martin 1993).

Over the years, Los Alamos County has operated several sanitary wastewater treatment plants in Pueblo Canyon (ESP 1981). Only the Los Alamos County Wastewater Treatment Plant is currently operating. The Laboratory has also operated numerous sanitary treatment plants, three of which are shown in Figure 5-4.

Since the early 1990s, the Laboratory has significantly reduced both the number of industrial outfalls (from 141 to 17) and the volume of water released (by more than 80%). From 1993 to 1997, total estimated average flow was 1,300 million gallons per year (M gal./yr); flow decreased to 230 M gal./yr from 1998 to 2005

(Rogers 2006) and to 133 M gal./yr in 2009. The quality of the remaining discharges has been improved through treatment process improvements so that they meet applicable standards.

Certain chemicals are good indicators of the possible effect of Laboratory effluents on groundwater. These chemicals are described as being chemically conservative; that is, their concentrations are usually not affected by chemical reactions. Examples of these conservative chemicals include perchlorate, tritium, hexavalent chromium, and, to a lesser extent, nitrate. Nitrate is often conservative but its concentration may be affected by bacterial activity. Groundwater that has background concentrations of perchlorate, tritium, hexavalent chromium, and nitrate is not necessarily affected by LANL discharges.

Liquid effluent discharges have affected intermediate perched groundwater and the regional aquifer to a lesser degree than the shallow perched alluvial groundwater. The intermediate groundwater in various locations shows localized contamination from Laboratory operations, including presence of tritium, high explosives compounds, chlorinated organic chemical compounds, dioxane(1,4-), hexavalent chromium, barium, boron, perchlorate, fluoride, and nitrate.

In 2010, the HE compound Research Department Explosive (RDX) continued to be detected in the regional aquifer at Pajarito Canyon monitoring well R-18. The RDX concentration was at 15% of the Environmental Protection Agency's (EPA's) Human Health tap water screening level of 6.1 µg/L. Earlier detection of RDX in the regional aquifer at regional aquifer well R-25 (to the south of R-18) was probably due to cross-contamination from shallower well screens that occurred for several months before the sampling system was installed, allowing flow between the screens.

Hexavalent chromium and nitrate have been found in several regional aquifer monitoring wells. In regional aquifer monitoring wells R-42 and R-28 in Mortandad Canyon, hexavalent chromium is found at concentrations of about 25 times and nine times the 50 µg/L NM groundwater standard, respectively. Beginning in 2010, LANL has detected chromium at concentrations up to 81 µg/L (in May 2011) at 1077 ft in regional aquifer monitoring well R-50, which is about 250 ft north of the LANL/San Ildefonso boundary. Nitrate (as nitrogen) concentrations in regional aquifer monitoring wells R-43 and R-11 in Sandia Canyon and R-42 in Mortandad Canyon are up to 60% of the 10 mg/L NM groundwater standard. Traces of tritium and perchlorate are also found in the regional aquifer. Tritium activities are far below the EPA maximum concentration level (MCL) of 20,000 pCi/L, but at a few wells, perchlorate concentrations are above the 4 µg/L Consent Order screening level.

Beginning in late 2008, trichloroethene was detected at 1,147 ft in Pajarito Canyon regional aquifer monitoring well R-20 and continues to be detected in every sample event. The concentrations increased to 60% of the 5 µg/L EPA MCL screening level in late 2009 but during 2010 fell to 11% of the screening level.

With one exception, drinking water wells in the Los Alamos area have not been impacted by Laboratory discharges. The exception is well O-1 in Pueblo Canyon, where perchlorate was found during 2010 at concentrations up to 31% of the 4 µg/L Consent Order screening level. These values are also 8% of the EPA's interim health advisory of 15 µg/L for perchlorate in drinking water. Even though the perchlorate levels are below regulatory limits, this well is not used by Los Alamos County for water supply. All drinking water produced by the Los Alamos County water supply system meets federal and state drinking water standards.

C. GROUNDWATER STANDARDS AND SCREENING LEVELS

In evaluating groundwater samples, we applied regulatory standards and risk levels as described in Table 5-1. For drinking water supply wells, which draw water from the regional aquifer, we compared concentrations of radionuclides in samples to (1) the derived concentration guides (DCGs) for ingested water calculated from DOE's 4-mrem/yr drinking water dose limit and (2) the EPA MCLs. EPA MCLs are the maximum permissible level of a contaminant in water delivered to any user of a public water system. Thus, compliance with the MCL is measured after treatment; measurements in a water supply well may be higher and allow the MCLs to be met through blending of water in a distribution system.

Table 5-1
Application of Standards or Screening Levels to LANL Groundwater Monitoring Data

Constituent	Sample Type	Standard	Risk-Based Screening Level	Reference	Location	Notes
Radionuclides	Water supply wells	DOE 4-mrem/yr DCGs, EPA MCLs	None	DOE Order 5400.5, 40 CFR 141-143	On site and off site	A 4-mrem/yr dose limit and EPA MCLs apply to water provided to users of drinking water systems
Radionuclides	Effluent samples	DOE 100-mrem/yr DCGs	None	DOE Order 5400.5	On site	DOE public dose limit of 100 mrem/yr applies to effluent discharges
Radionuclides	Non water supply groundwater samples	None	4-mrem/yr DCGs EPA MCLs	DOE Order 5400.5, 40 CFR 141-143	On site and off site	A 4-mrem/yr dose limit and EPA MCLs are for comparison purposes because they apply only to drinking water systems
Non-radionuclides	Water supply wells	EPA MCLs, NM groundwater standards, EPA Human Health 10–5, and HQ = 1 tap water risk levels for NM toxic pollutants with no standard	None	40 CFR 141-143, 20.6.2 NM Administrative Code, http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm	On site and off site	EPA MCLs apply to water provided to users of drinking water systems. Use EPA Human Health tap water table for 10–5 and HQ = 1 risk levels
Non-radionuclides	Non-water supply groundwater samples	NM groundwater standards, EPA Human Health 10–5 and HQ = 1 tap water risk levels for NM toxic pollutants with no standard	EPA MCLs	40 CFR 141-143, 20.6.2 NM Administrative Code, http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm	On site and off site	NMED regulations apply to all groundwater. EPA MCLs are for comparison purposes because they apply only to drinking water systems. Use EPA Human Health tap water table for 10–5 and HQ = 1 risk levels

For radioactivity in groundwater other than drinking water, there are the New Mexico Water Quality Control Commission (NMWQCC) groundwater standards (NMWQCC 2002) for uranium and radium. For risk-based screening of other radioactivity, groundwater samples from sources other than water supply wells may be compared with DOE's 4-mrem/yr drinking water DCGs and with EPA MCLs. Where used in this chapter for such comparison purposes, in assessing water samples from sources other than water supply wells, these DCGs and EPA MCLs are referred to as screening levels. The DCGs for the 100-mrem/yr public dose limit apply as effluent release guidelines.

The NM drinking water regulations and EPA MCLs apply as regulatory standards to nonradioactive constituents in water supply samples after treatment. They may be used as risk-based screening levels for other groundwater samples. The NMWQCC groundwater standards apply to concentrations of nonradioactive chemical quality parameters in all groundwater samples. Except for mercury and organic compounds, these standards apply only to dissolved (that is, filtered) concentrations. Because many metals are either chemically bound to or components of aquifer material that makes up suspended sediment in water

samples, the unfiltered concentrations of these substances are often higher than the filtered concentrations. The EPA MCLs are intended for application to water supply samples that generally have low turbidity. As the EPA does not specify that the MCLs apply to dissolved concentrations, we use them to screen both filtered and unfiltered concentrations. The Consent Order specifies a screening level for perchlorate of 4 µg/L.

The Consent Order and NMWQCC (2002) specify how to determine standards for the toxic pollutants listed in the NMWQCC groundwater standards if they have no other state or federal standard. As required in the Consent Order, we screened results for these compounds at a risk level of 10^{-5} for cancer-causing substances or a hazard quotient of one (HQ = 1) for non-cancer-causing substances. A HQ of one or less indicates that no (noncancer) adverse human health effects are expected to occur from that chemical. We used the EPA Human Health tap water screening levels to screen these toxic pollutant compounds (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm). For cancer-causing substances, the EPA Human Health tap water screening levels are at a risk level of 10^{-6}, so we use 10 times the values to screen at a risk level of 10^{-5}. These screening levels are updated several times each year; the November 11, 2010, edition was used to prepare this report.

Groundwater is a source of flow to springs and other surface water that may be used by neighboring tribal members and wildlife. NMWQCC's surface water standards (NMWQCC 2000), including the wildlife habitat standards, also apply to this surface water. (For a discussion of surface water, see Chapter 6.)

D. MONITORING NETWORK

In 2005, DOE and its Operations and Management Contractor and NMED signed a Consent Order, which specifies the process for conducting groundwater monitoring at the Laboratory. The Consent Order requires that the Laboratory annually submit an Interim Facility Groundwater Monitoring Plan (Interim Plan) to NMED for its approval. Groundwater monitoring conducted during calendar year 2010 was carried out according to two Interim Plans approved by NMED under the Consent Order (LANL 2009a, 2010). The monitoring locations, analytical suites, and frequency of monitoring reflect the technical and regulatory status of each area and are updated annually in the Interim Plan. In some cases, when monitoring results demonstrate little change or no impacts, sampling frequency has decreased.

Groundwater sampling locations are divided into three principal groups related to the three modes of groundwater occurrence: perched alluvial groundwater beneath the floor of some canyons, localized intermediate-depth perched groundwater systems, and the regional aquifer (Figures 5-5 through 5-9).

To document the potential impact of Laboratory operations on Pueblo de San Ildefonso land, the DOE signed a memorandum of understanding in 1987 with the Pueblo and the Bureau of Indian Affairs to conduct environmental sampling on Pueblo land. Groundwater monitoring stations at Pueblo de San Ildefonso are shown in Figure 5-9 and mainly sample the regional aquifer. Basalt Spring, Los Alamos Spring, and Pine Rock Spring are intermediate groundwater sampling points, and wells LLAO-4 and LLAO-5 sample alluvial groundwater. The Laboratory also monitors Los Alamos County water supply wells (Figure 5-7) and three City of Santa Fe supply wells (Figure 5-9).

LANL conducts a regular program of water level measurements for monitoring wells. A summary of groundwater level measurements for 2010 is given in Koch et al. (2011).

1. Regional Aquifer and Intermediate Perched Groundwater Monitoring

Sampling locations for the regional aquifer and intermediate perched groundwater include monitoring wells, supply wells, and springs. The majority of the monitoring network consists of wells constructed since the Hydrogeologic Workplan (LANL 1998). The Laboratory added several new wells to the monitoring well network in 2010, as described in Chapter 2, Section C.9.b. A column on the supplemental data tables for Chapter 5 (located on the included compact disk) identifies the groundwater zones sampled by different screens of the wells and gives the depth of the sampled well screen for multiscreen wells or top of the sampled well screen for single screen wells.

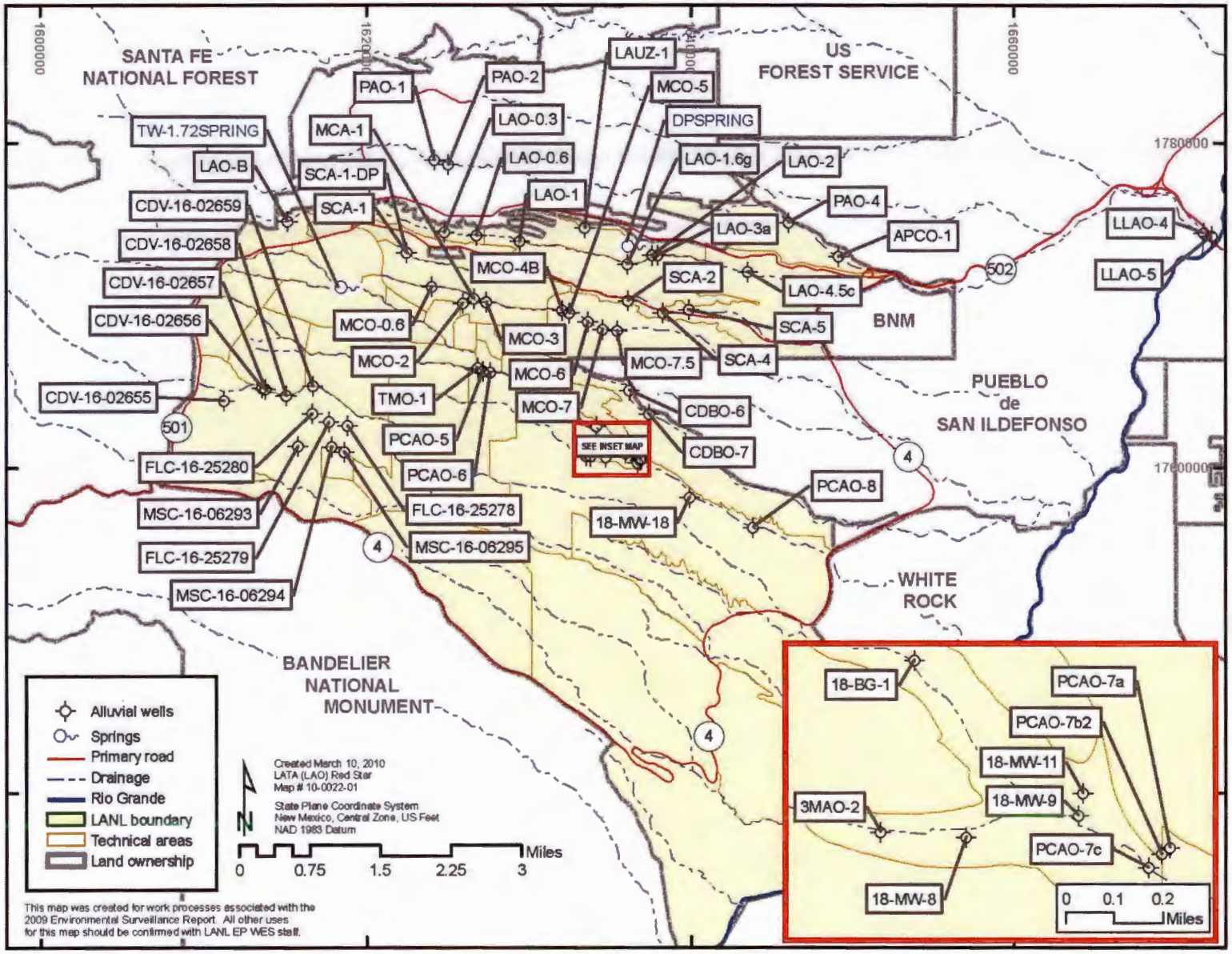

Figure 5-5 **Springs and wells used for alluvial groundwater monitoring**

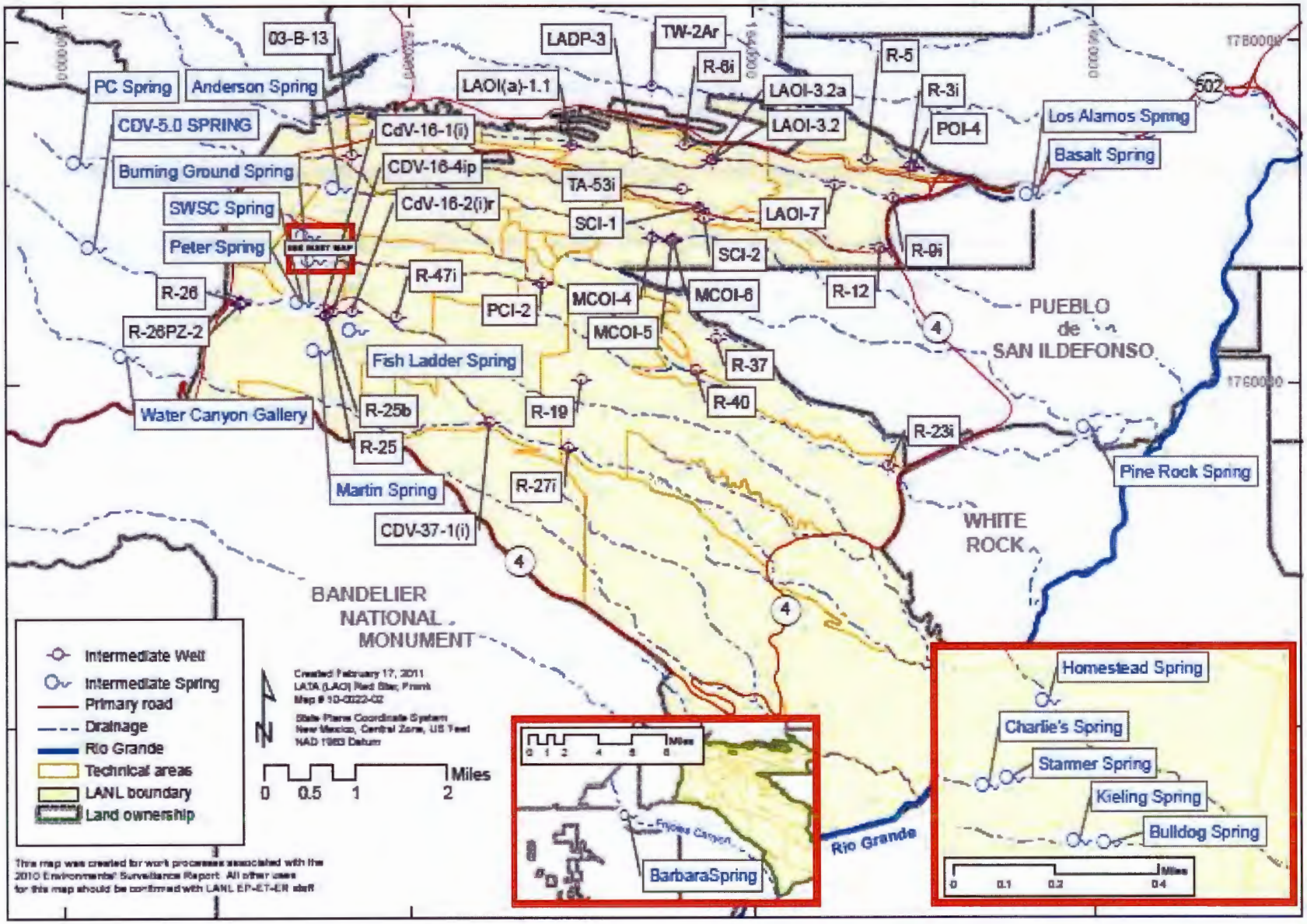

Figure 5-6 Springs and wells used for intermediate-depth perched zone monitoring

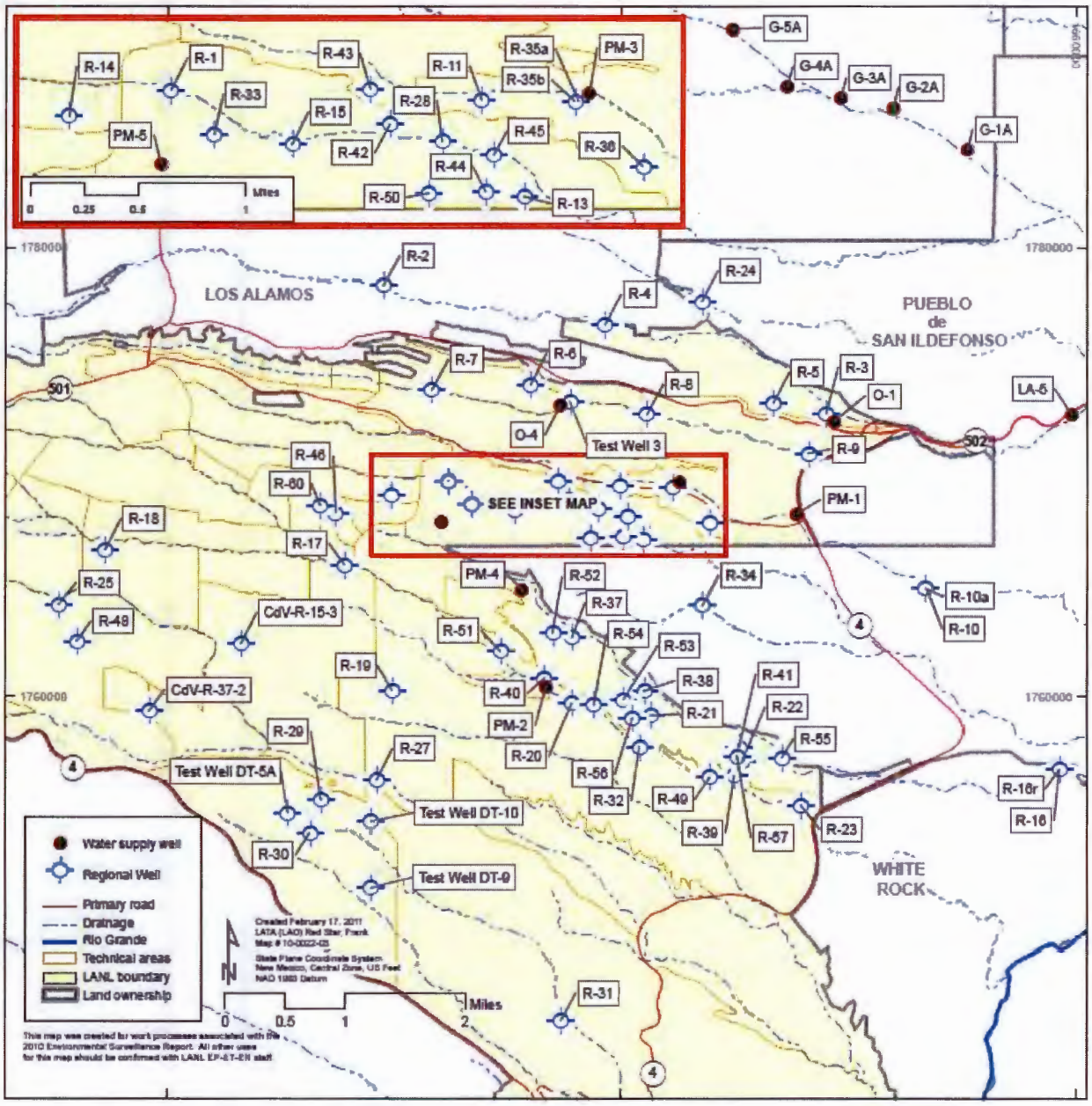

Figure 5-7 **Wells used for regional aquifer monitoring**

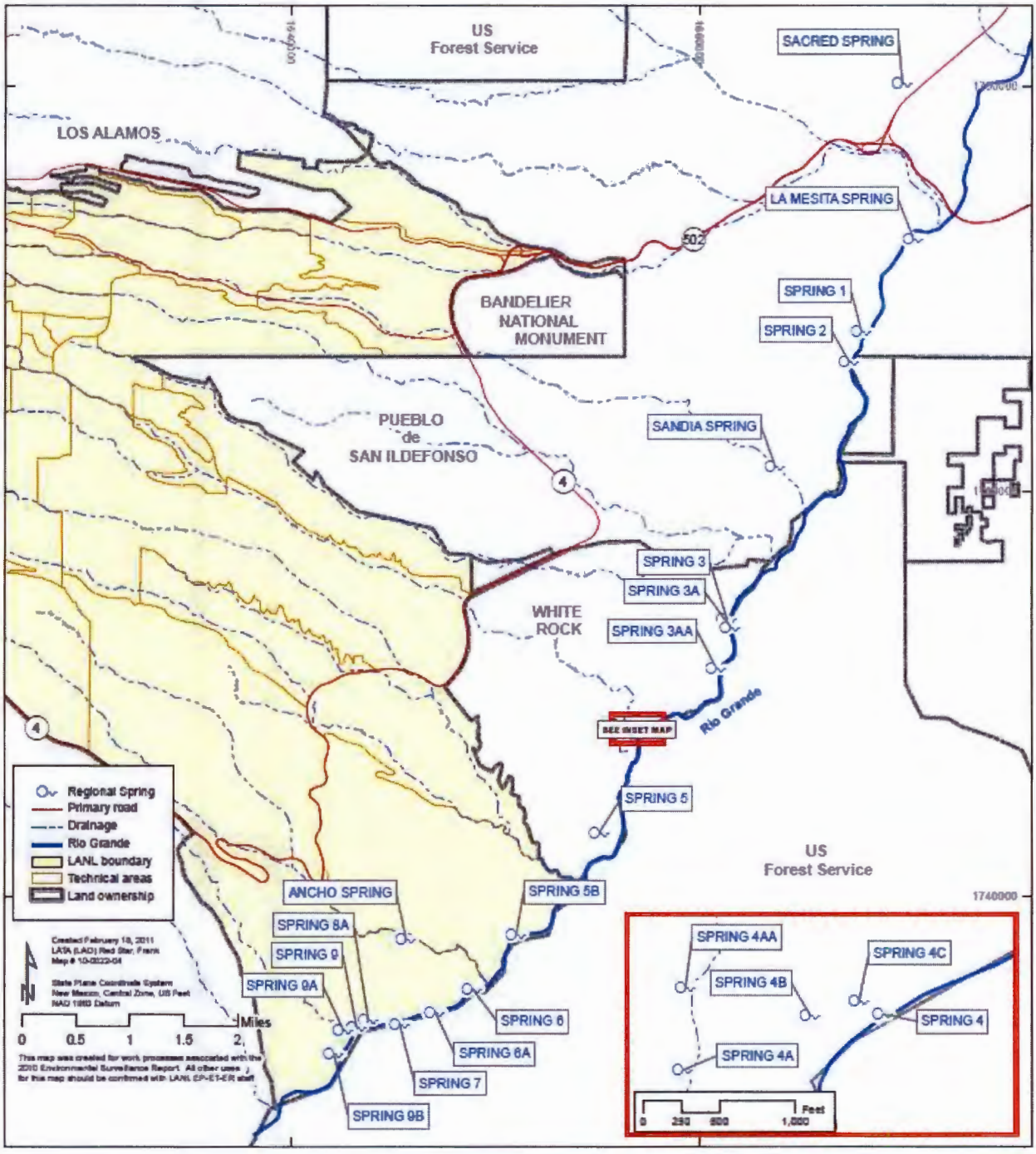

Figure 5-8 **Springs used for regional aquifer monitoring**

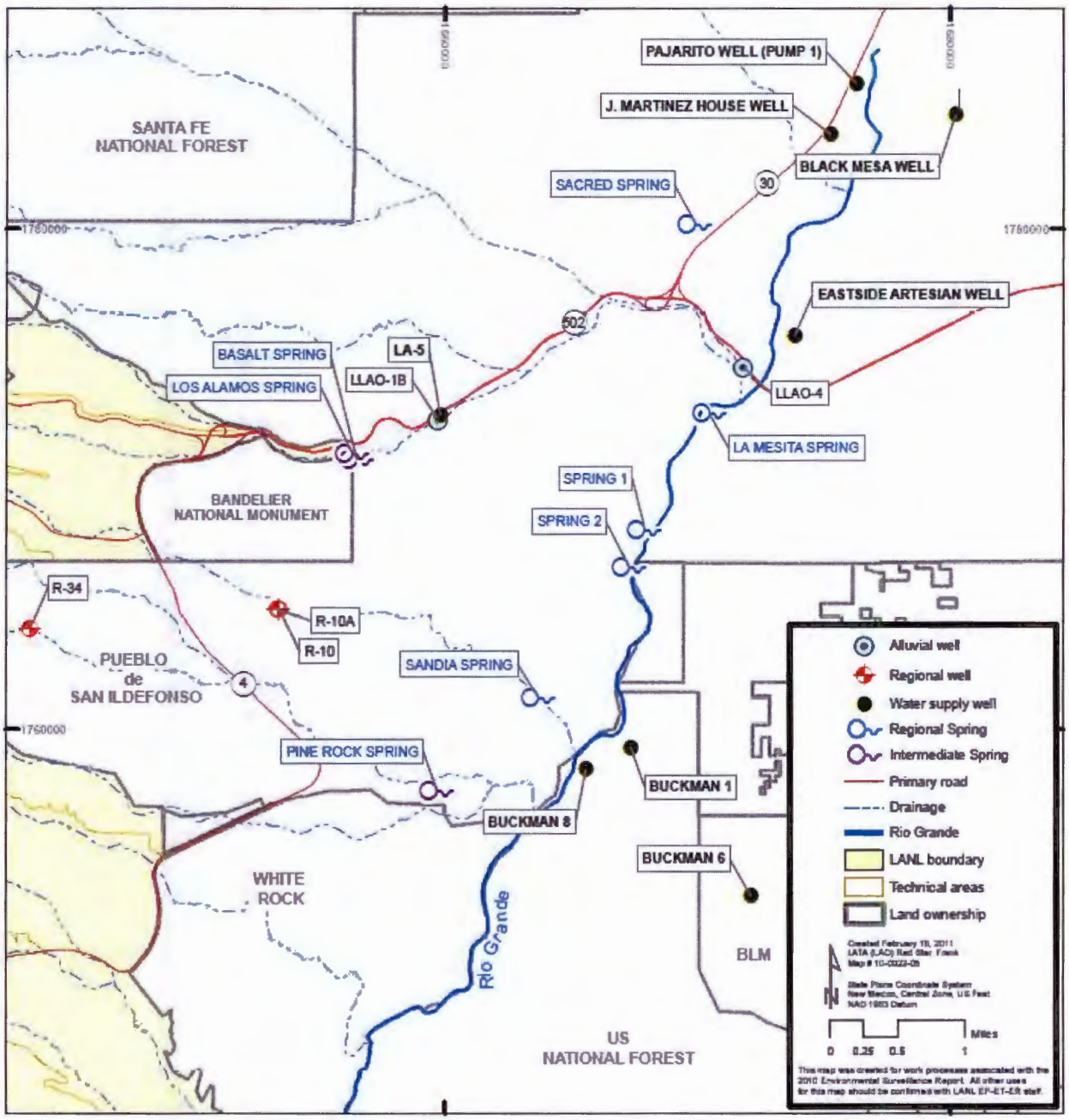

Figure 5-9 **Springs and wells used for groundwater monitoring on neighboring Pueblo de San Ildefonso lands and at the City of Santa Fe Buckman well field**

The Laboratory collects samples from 12 Los Alamos County water supply wells in three well fields that produce drinking water for the Laboratory and the community. The water supply wells are screened up to lengths of 1,600 ft within the regional aquifer, and they draw samples that integrate water over a large depth range. Los Alamos County owns and operates these wells and is responsible for demonstrating that the supply system meets Safe Drinking Water Act requirements. This chapter reports on supplemental sampling of those wells by the Laboratory.

Additional regional aquifer samples came from wells located on Pueblo de San Ildefonso lands and from the Buckman well field operated by the City of Santa Fe.

We also sample numerous springs near the Rio Grande because they represent natural discharge from the regional aquifer (Purtymun et al., 1980). Sampling the springs allows us to detect possible discharge of contaminated groundwater from underneath the Laboratory into the Rio Grande.

2. Alluvial Groundwater Monitoring

To determine the effect of present and past industrial discharges on water quality, we used shallow wells and some springs to sample perched alluvial groundwater in several canyons. In any given year, some of these alluvial observation wells may be dry, and water samples cannot be obtained. Some observation wells in Water, Fence, and Sandia canyons have been dry most often since their installation in 1989. All but one of the wells in Cañada del Buey are generally dry.

3. Well Plugging and Abandonment

During the last fiscal year, using funds from the American Reinvestment and Recovery Act, we plugged and abandoned Test Well 1, Test Well 1A, Test Well 2, Test Well 2A, Test Well 2B, and Test Well 4. We also plugged and abandoned two alluvial wells in Water Canyon; WCO-1 and WCO-3 and installed replacements for these two alluvial wells.

Test Well 1 and Test Well 1A were replaced by TW-1Ar; Test Well 2 and Test Well 2A were replaced by TW-2Ar; WCO-1 was replaced by WCO-1r; and WCO-3 was replaced by WCO-3r.

E. SUMMARY OF 2010 SAMPLING RESULTS

In 2010, LANL sampled 232 groundwater wells, well screens, and springs in 561 separate sampling events. The samples collected were analyzed for about 215,636 separate results. If results for field parameters (for example, temperature or pH) and field quality control blanks are excluded, the samples were analyzed for 155,984 results. The total numbers of results are given in Table 5-2 for each analytical suite and groundwater zone. The bottom row of the table gives the number of sample results, not including field quality control blanks or field parameters.

Table 5-3 gives the total number of sample results that were above the screening levels described in Section C. About 0.2% of the results had values greater than a screening level. These totals are based on omitting field quality control blanks, field parameters, and measurements made at an in-house analytical laboratory. Samples analyzed in-house are used mainly for evaluating water quality in newly drilled wells or in wells affected by drilling fluids; these samples are not used for compliance monitoring. The analytes, number of times above the screening level, and the screening level value are given in Table 5-4.

The total number of sample results that were above the screening levels (Tables 5-3 and 5-4) may be an overestimate for several reasons. In many cases the given screening level may not apply to a particular groundwater sample. For example, some of the screening levels (the EPA MCLs and EPA Human Health tap water screening levels) apply specifically to drinking water and not to a sample result from a non-drinking water source. As well, for a particular sample event, multiple measurements made for an analyte may be included in the total. The multiple measurements could include both filtered and unfiltered sample results, multiple analytical laboratory analyses (for example, made on diluted samples to improve analytical accuracy), and results from field duplicate samples. The monitoring results are described in detail in the following sections.

Table 5-2
Total Number of Groundwater Sample Results Collected by LANL in 2010

Groundwater Zone	Total Results	Dioxins & Furans	Diesel Range Organics	General Inorganic Chemistry	Gasoline Range Organics	Herbicides	High Explosives	Isotopes	Metals	Pesticides & PCBs	Radio-activity	Semivolatile Organic Compounds	Volatile Organic Compounds
Alluvial	27,024	350		2,382		10	1,346		3,867	501	729	5,279	12,560
Alluvial Spring	102			37					49		16		
Intermediate	49,385	1,100	1	4,003		50	1,743	3	6,169	2,070	1,366	11,120	21,760
Intermediate Spring	8,821			787			554		1,369		351	1,440	4,320
Regional	113,686	3,250	1	9,827	1	60	4,157	24	15,263	4,482	3,181	24,480	48,960
Regional Spring	10,346			980			412		1,473	24	421	2,316	4,720
Water Supply	6,273		2	727			400		754	152	478	1,040	2,720
Total	215,637	4,700	4	18,743	1	120	8,612	27	28,944	7,229	6,542	45,675	95,040
Number of groundwater sample results omitting field parameters and field quality control blanks													
Total	155,985	3,875	3	14,330	1	110	8,316	27	26,750	5,607	6,327	38,717	49,280

Table 5-3
Total Number of Groundwater Sample Results above Screening Levels in 2010
(Omitting Field Parameters, Field Quality Control Blanks, and Data Analyzed in-House)

Analytical Suite	Total Results	Dioxins & Furans	Diesel Range Organics	General Inorganic Chemistry	Gasoline Range Organics	Herbicides	High Explosives	Isotopes	Metals	Pesticides & PCBs	Radio-activity	Semivolatile Organic Compounds	Volatile Organic Compounds
Number of results	153,343	3,875	3	14,330	1	110	8,316	27	26,750	5,607	6,327	38,717	49,280
Number above Screening Level	261	0	0	61	0	0	27	0	97	2	18	32	24
% above Screening Level	0.17	0.00	0.00	0.43	0.00	0.00	0.32	0.00	0.36	0.04	0.28	0.08	0.05

Table 5-4
Groundwater Analytes with Results above Screening Levels in 2010
(Omitting Field Parameters, Field Quality Control Blanks, and Data Analyzed In-House)

Suite or Analyte	No. of Results	Screening Level	Units	Screening Level Type
General Inorganic Chemistry	61			
Chloride	6	250	mg/L	NM groundwater standard
Perchlorate	40	4	µg/L	NM Consent Order
Fluoride	2	1.6	mg/L	NM groundwater standard
Nitrate + Nitrite (as nitrogen)	9	10	mg/L	NM groundwater standard
Total Dissolved Solids	4	1,000	mg/L	NM groundwater standard
High Explosives	**27**			
RDX	27	6.11	µg/L	EPA Human Health tap water screening level
Metals	**112**			
Aluminum	5	5,000	µg/L	NM groundwater standard
Arsenic	4	10	µg/L	EPA MCL[a]
Boron	3	750	µg/L	NM groundwater standard
Barium	9	1,000	µg/L	NM groundwater standard
Beryllium	1	4	µg/L	EPA MCL
Chromium (dissolved)	24	50	µg/L	NM groundwater standard
Chromium (total)	15	100	µg/L	EPA MCL
Iron	21	1,000	µg/L	NM groundwater standard
Manganese	19	200	µg/L	NM groundwater standard
Nickel	1	200	µg/L	NM groundwater standard
Lead (total)	4	15	µg/L	EPA Drinking Water System Action Level
Antimony	6	6	µg/L	EPA MCL
Radioactivity	**18**			
Gross Alpha	4	15	pCi/L	EPA MCL
Gross Beta	4	50	pCi/L	EPA Drinking Water Screening Level
Radium-228	2	4	pCi/L	DOE 4 mrem/yr DCG[b]
Strontium-90	5	8	pCi/L	EPA MCL
Uranium	3	30	µg/L	NM groundwater standard
Pesticides/PCBs	**2**			
Aroclor-1242	1	0.5	µg/L	EPA MCL
Aroclor-1254	1	0.5	µg/L	EPA MCL
Semivolatile Organic Compounds	**32**			
Benzo(a)pyrene	4	0.2	µg/L	EPA MCL
Benzo(b)fluoranthene	3	0.29	µg/L	EPA Human Health tap water screening level
Bis(2-ethylhexyl)phthalate	6	6	µg/L	EPA MCL
Dibenz(a,h)anthracene	1	0.029	µg/L	EPA Human Health tap water screening level
Dioxane[1,4-]	15	6.7	µg/L	EPA Human Health tap water screening level
Indeno(1,2,3-cd)pyrene	2	0.29	µg/L	EPA Human Health tap water screening level
Pentachlorophenol	1	1	µg/L	EPA MCL

Table 5-4 (continued)

Suite or Analyte	No. of Results	Screening Level	Units	Screening Level Type
Volatile Organic Compounds	10			
Dichloroethene[1,1-]	4	5	µg/L	NM groundwater standard
Methylene Chloride	1	5	µg/L	EPA MCL
Naphthalene	1	1.4	µg/L	EPA Human Health tap water screening level
Tetrachloroethene	1	5	µg/L	EPA MCL
Trichloroethane[1,1,1-]	3	60	µg/L	NM groundwater standard

[a] MCL = Maximum contaminant level

[b] DCG = DOE derived concentration guide

F. GROUNDWATER SAMPLING RESULTS BY CONSTITUENTS

The supplemental data tables for this chapter present groundwater quality monitoring data for 2010 (on the included compact disc). Columns on the data tables identify the groundwater zones sampled—whether alluvial, intermediate, or regional; the latter includes water supply wells—or indicate if the location is a spring. For wells with several sampling screens, the depth and groundwater zone sampled for each screen appear in the table. For single-screen wells, the depth of screen top is given. Springs have a depth of 0 ft, and wells with unknown depth list a value of –1. Supplemental Data Table S5-1 provides definitions for sample description codes used in the data tables.

Table S5-2 lists the results of radiochemical analyses of groundwater samples for 2010. The table also gives the total propagated one standard deviation analytical uncertainty and the analysis-specific minimum detectable activity (MDA), where available. A "<" symbol indicates that based on the analytical laboratory or secondary validation qualifiers the result was a nondetect. Uranium was analyzed by chemical methods and by isotopic methods. Table S5-3 shows low-detection-limit tritium results. In 2010, we changed analytical laboratories for low-level tritium analyses. In August 2011 investigation revealed that results from the new provider (ARSL) were subject to calculation errors. At the time of this report, these data had not been corrected.

Table S5-4 lists radionuclides detected in groundwater samples, as reported by the analytical laboratory. For most radionuclide measurements, we reported a detection as an analytical result that does not include an analytical laboratory (or in some cases, secondary validation) qualifier code of X or U (which indicates that the result is a nondetect). The analytical laboratory reports a result that is greater than the measurement-specific MDA as detected. Some low-detection-limit tritium data do not have laboratory qualifiers; in that case, a result is considered as detected when analytical results are greater than three times the reported one standard deviation uncertainty.

Data with qualifier codes other than X or U are shown in Table S5-4 to provide additional information on analytical results; in some cases, there were analytical quality issues. The table shows two categories of qualifier codes: those from the analytical laboratory and those from secondary validation (Tables S5-5, S5-6, and S5-7). After we received the analytical laboratory data packages, an independent contractor, Analytical Quality Associates, Inc. (AQA), performed a secondary validation on the packages. The reviews by AQA include verifying that holding times were met, that all documentation is present, and that analytical laboratory quality control measures were applied, documented, and kept within contract requirements.

Because uranium, gross alpha, and gross beta are usually detected in water samples and to focus on the higher measurements, Table S5-4 only includes occurrences of these measurements above threshold values. (All of the results are included in Table S5-2.) We selected threshold levels of 5 µg/L for uranium, 5 pCi/L for gross alpha, and 20 pCi/L for gross beta, which are lower than the respective EPA MCLs or screening levels

(30 µg/L for uranium, 15 pCi/L for gross alpha, and 50 pCi/L for gross beta). The right-hand columns of Table S5-4 compare results with the regulatory standards or screening levels listed on the table.

Table S5-8 lists the results of general chemical analyses of groundwater samples for 2010. Table S5-9 lists perchlorate results. We analyzed samples for perchlorate by the liquid chromatography/mass spectrometry/mass spectrometry (LC/MS/MS) method (SW-846:6850). The results of trace metal analyses appear in Table S5-10.

1. Contaminant Distribution Maps

In the following sections, we discuss groundwater quality results for each of the three groundwater modes in the major watersheds that cross Laboratory property. The accompanying maps depict the location of groundwater contaminants that are found at levels near or above screening levels or standards. The maps provide a spatial context for distribution of groundwater contamination.

The contaminant distribution maps show contaminant locations extrapolated beyond the area covered by monitoring wells. This extrapolation takes into account the location of contaminant sources and direction of groundwater flow. Question marks on the maps indicate where contaminant extent is inferred but not confirmed by monitoring coverage. For alluvial groundwater in canyons, the extent of contamination lateral to the canyon is not to scale; contaminated groundwater is confined to the canyon bottom alluvium and is quite narrow at the map scale.

2. Organic Chemicals in Groundwater

In 2010, we analyzed samples from selected springs and monitoring wells for organic chemicals. Table S5-11 summarizes the stations sampled and organic chemical suites for which samples were analyzed. These samples were analyzed for some or all of the following organic chemical suites: volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls (PCBs), pesticides, diesel-range organics (DRO), and HE. Chapter 11 presents analytical chemistry quality assurance results for 2010. Table S5-12 shows organic chemicals detected during 2010 in groundwater and field QC samples.

Certain organic compounds used in analytical laboratories or derived from sampling equipment are frequently detected in laboratory blanks, that is, contamination introduced by the sampling or analytical process is common for these compounds. These compounds include acetone, methylene chloride, toluene, 2-butanone, di-n-butyl phthalate, di-n-octyl phthalate, and bis(2-ethylhexyl)phthalate (Fetter 1993) and many others.

Bis(2-ethylhexyl)phthalate is derived from plastics including sample bottles and tubing. It has been detected repeatedly at several wells since 2005, particularly in a few wells drilled since 2008. In some cases, the compound was found at concentrations above the 6 µg/L EPA MCL. From the bis(2-ethylhexyl)phthalate concentration histories, it appears that the compound initially leaches from some material used during drilling or well construction. Concentrations generally have fallen significantly during the years following initial well sampling.

The first samples, collected in 2010, from Water Canyon intermediate well CDV-37-1(i) had bis(2-ethylhexyl)phthalate concentrations up to 13 µg/L. Remaining samples during 2010 had concentrations between 3 µg/L and 4 µg/L.

Five newly-drilled wells first sampled in late 2008 or 2009 also show high initial bis(2-ethylhexyl)phthalate detections: regional wells R-36, R-38 (Figure 5-10), R-42, and R-46, and intermediate well TA-53i.

Mortandad Canyon intermediate well MCOI-6 showed bis(2-ethylhexyl)phthalate concentrations ranging from 2.3 µg/L to 12.4 µg/L between June 2005 and August 2007. The compound was detected at concentrations just above the MDL in three samples since that time. Two other wells constructed nearby at the same time (MCOI-4 and MCOI-5) did not show such frequent bis(2-ethylhexyl)phthalate detections; one June 2006 sample in MCOI-4 contained 16.2 µg/L.

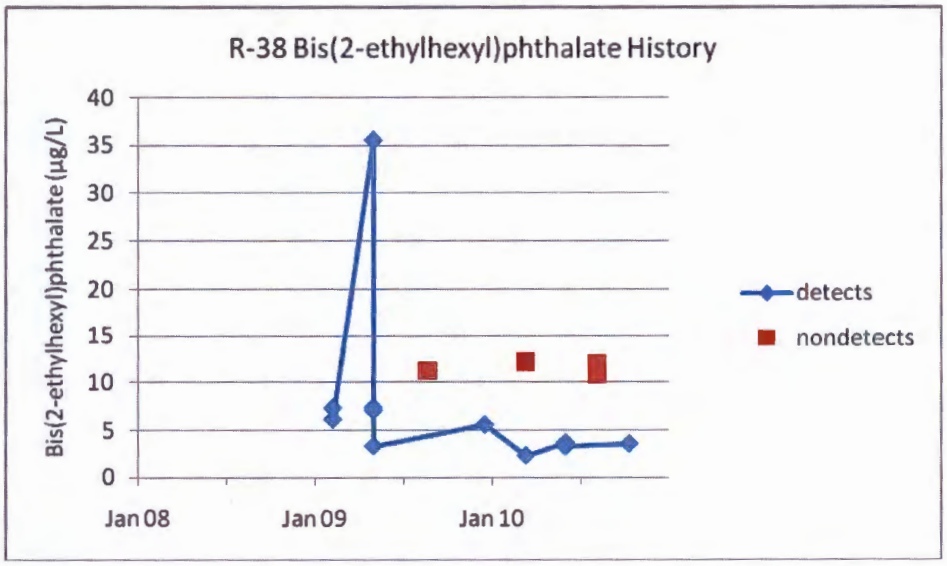

Figure 5-10 **Bis(2-ethylhexyl)phthalate concentration history for regional aquifer monitoring well R-38. Nondetects are reported at the practical quantitation limit (PQL) of about 11 µg/L; the MDL is about 2.2 µg/L. For comparison purposes, theEPA MCL is 6 µg/L.**

The detection of several other organic compounds in well samples was likely the result of analytical contamination rather than their presence in groundwater. Two Aroclor (PCB) compounds were found in a field duplicate from R-16 but not in the primary sample or any previous sample. Several polycyclic aromatic hydrocarbon compounds (such as benzo(a)pyrene) were found in samples from MCOI-6, PCI-2, R-27, R-60 and R-55. In these cases, some compounds were found in a primary sample or field duplicate sample, but not both. The compounds have generally not been detected in other samples from the wells.

3. Radioactivity in Groundwater

The principal radioactive element detected in the regional aquifer is naturally occurring uranium, found at high concentrations in springs and wells throughout the Rio Grande Valley. Other radioactivity in groundwater samples comes from members of the decay chains for naturally occurring uranium-235, uranium-238 (including radium-226 and uranium-234), and thorium-232 (including radium-226). Potassium-40 is also a source of natural radioactivity.

A May 18, 2010, sample from Los Alamos County water supply well G-1A in Guaje Canyon had a gross alpha activity of 41.4 pCi/L, above the EPA drinking water screening level of 15 pCi/L (Table 5-5). A reanalysis of the sample gave 50.2 pCi/L. Results for sample events before and after were nondetections with results below 0.25 pCi/L and MDAs below 2.9 pCi/L. Other than the May 2010 result, 63 gross alpha results for this well taken since 1968 include a maximum value of 7.6 pCi/L (in 1974). The remaining results are mostly nondetections, having one or two standard deviation total propagated uncertainties greater than or equal to the result.

Table 5-5

Radioactivity Results above Screening Levels in Regional Aquifer Groundwater for 2010

Chemical	Location	Result	Trends
Gross Alpha	G-1A	41.4 pCi/L and reanalysis of 50.2 pCi/L, above EPA screening level of 15 pCi/L	Most of results since 1968 are nondetects
Radium-228	O-4	11.8 pCi/L, above EPA MCL screening level of 5 pCi/L; field duplicate was nondetect at < 0.412 pCi/L	Naturally occurring isotope, first detection of seven sample events
Radium-228	PM-5	6.58 pCi/L, above EPA MCL screening level of 5 pCi/L	Naturally occurring isotope, first detection of seven sample events

In 2008, the method for analyzing radium-228 changed from EPA:901.1 to EPA:904, with a corresponding decrease in MDA from a range of 10 to 30 pCi/L to a range of 0.3 to 1 pCi/L. This change in method sensitivity corresponds to an increased number of detections. In 2010, radium-228 was detected in water supply wells O-4 and PM-5 at respective concentrations of 11.8 pCi/L and 6.58 pCi/L, above the EPA MCL of 5 pCi/L. A result at O-4 for a field duplicate sample was nondetect at <0.412 pCi/L. Each well has been sampled six previous times since 2001 for radium-228, and all earlier results were nondetects.

Otherwise, no activity or concentration value for a radioactivity analyte in a water supply well exceeded any regulatory standard, including the 4-mrem/yr DOE DCGs applicable to drinking water.

Pine Rock Spring, which flows from intermediate groundwater on Pueblo de San Ildefonso lands, had a uranium concentration above the NM groundwater standard (Table 5-6). The high uranium value may be due to dissolution of uranium from the bedrock by sanitary effluent, which is used to water athletic fields at nearby Overlook Park (Teerlink 2007). The gross alpha result is correspondingly high, reflecting the uranium content.

The uranium result from a filtered sample in the 755-ft intermediate screen of monitoring well R-25 was also above the NM groundwater standard. A reanalysis of the result gave a value in line with the usual much lower uranium concentration. The unfiltered result for the sample was also much lower, suggesting that the filtered result was an analytical artifact.

Other radioactivity results near screening levels are shown in Table 5-6.

Table 5-6

Radioactivity Results near Screening Levels in Intermediate Groundwater for 2010

Chemical	Location	Result	Trends
Uranium	Pine Rock Spring (Pueblo de San Ildefonso)	34.6 µg/L, above NM groundwater standard of 30 µg/L	Steady over five years, may be leached from bedrock by percolation of sanitary effluent used to irrigate Overlook Park athletic fields
Gross Alpha	Pine Rock Spring (Pueblo de San Ildefonso)	24.6 pCi/L, above EPA screening level of 15 pCi/L	Results since 2006 range from 20 pCi/L to 40 pCi/L; gross alpha is due to uranium content
Uranium	R-25 at 755 ft	43.7 µg/L, above NM groundwater standard of 30 µg/L; unfiltered sample result was 0.506 µg/L and reanalysis was 0.696 µg/L	Apparent analytical artifact; previous filtered results are between 0.475 µg/L and 1.43 µg/L
Tritium	MCOI-4, MCOI-5, MCOI-6 in Mortandad Canyon	3,020 to 7,000 pCi/L, below EPA MCL screening level of 20,000 pCi/L	Values decreasing slowly over six years of sampling; wells sample separate isolated perched zones

Results for strontium-90 from alluvial groundwater in Mortandad Canyon (and past results from Los Alamos Canyon, not sampled in 2010) were near or exceeded the 4-mrem/yr DOE DCG and EPA MCL screening levels (Table 5-7, Figures 5-11 and 5-12). For samples taken in 2010, strontium-90 contributed most of the dose in alluvial groundwater; other radioactive analytes contributed little. In past years, americium-241, plutonium-238, and plutonium 239/240 results in some Mortandad Canyon alluvial wells have occasionally exceeded the 4 mrem/yr DOE DCG screening levels, mainly in unfiltered samples. Note that strontium-90 has a half-life of 28.8 years.

Table 5-7

Radioactivity Results above Screening Levels in Alluvial Groundwater for 2010

Chemical	Location	Result	Trends
Strontium-90	Four wells in Mortandad Canyon	29.3 pCi/L to 61.6 pCi/L, above EPA MCL screening level of 8 pCi/L and 40 pCi/L 4-mrem/yr DOE DCG screening level	Fairly stable for 10 years due to retention on sediments
Gross Beta	Four wells in Mortandad Canyon	94 pCi/L to 136 pCi/L, above EPA drinking water screening level of 50 pCi/L	Due to strontium-90 content
Gross Alpha	CDV-16-02655	15.8 pCi/L, above EPA screening level of 15 pCi/L	Second measurement, twice the 2009 result

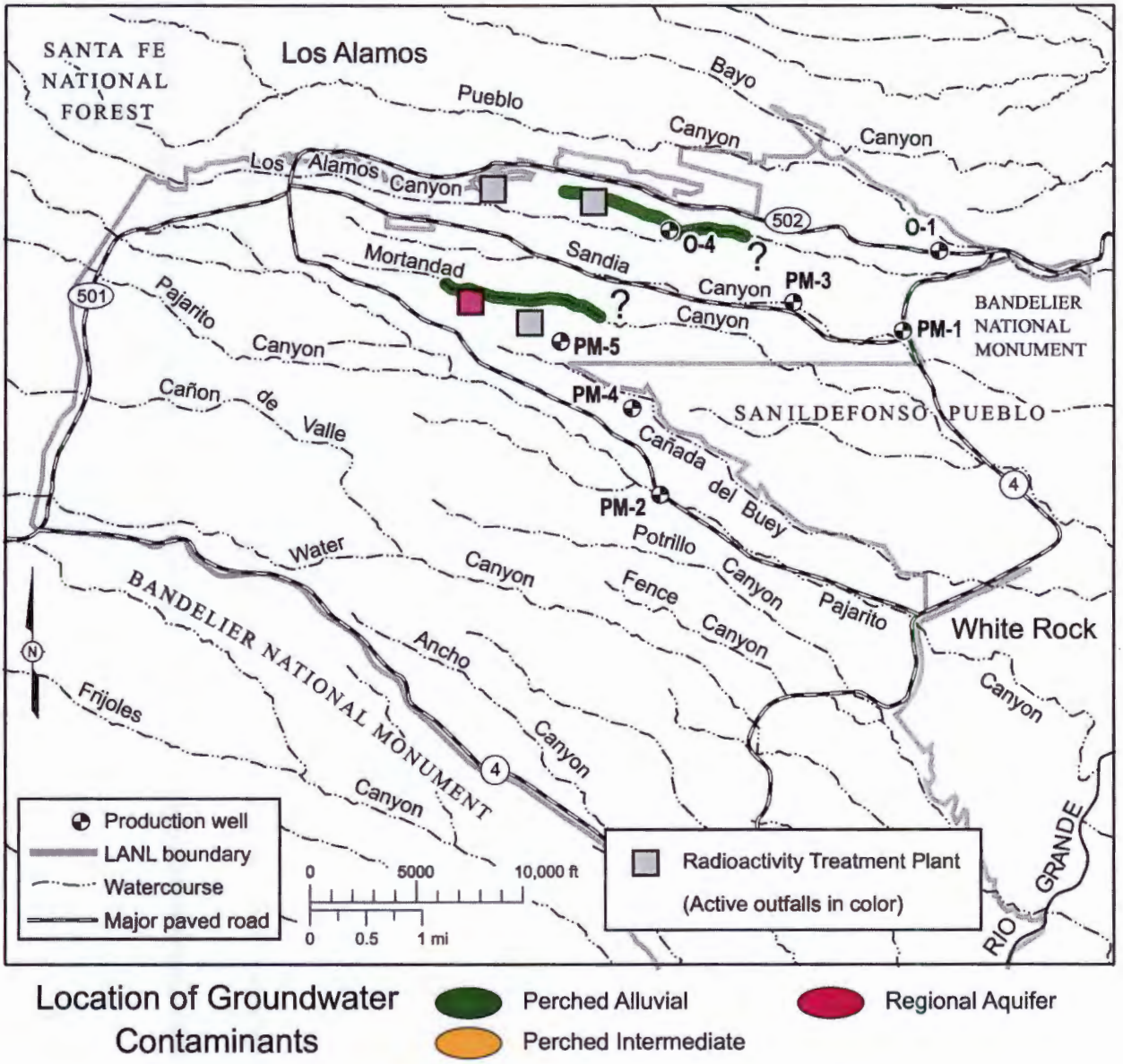

Figure 5-11 **Location of groundwater contaminated by strontium-90 above the 8-pCi/L EPA MCL screening level. (The MCL applies only to drinking water, not to alluvial groundwater.) Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage. Along canyons, the extent of alluvial groundwater contamination lateral to the canyon is not to scale; contamination is confined to the alluvium within the canyon bottom and is narrow at the map scale.**

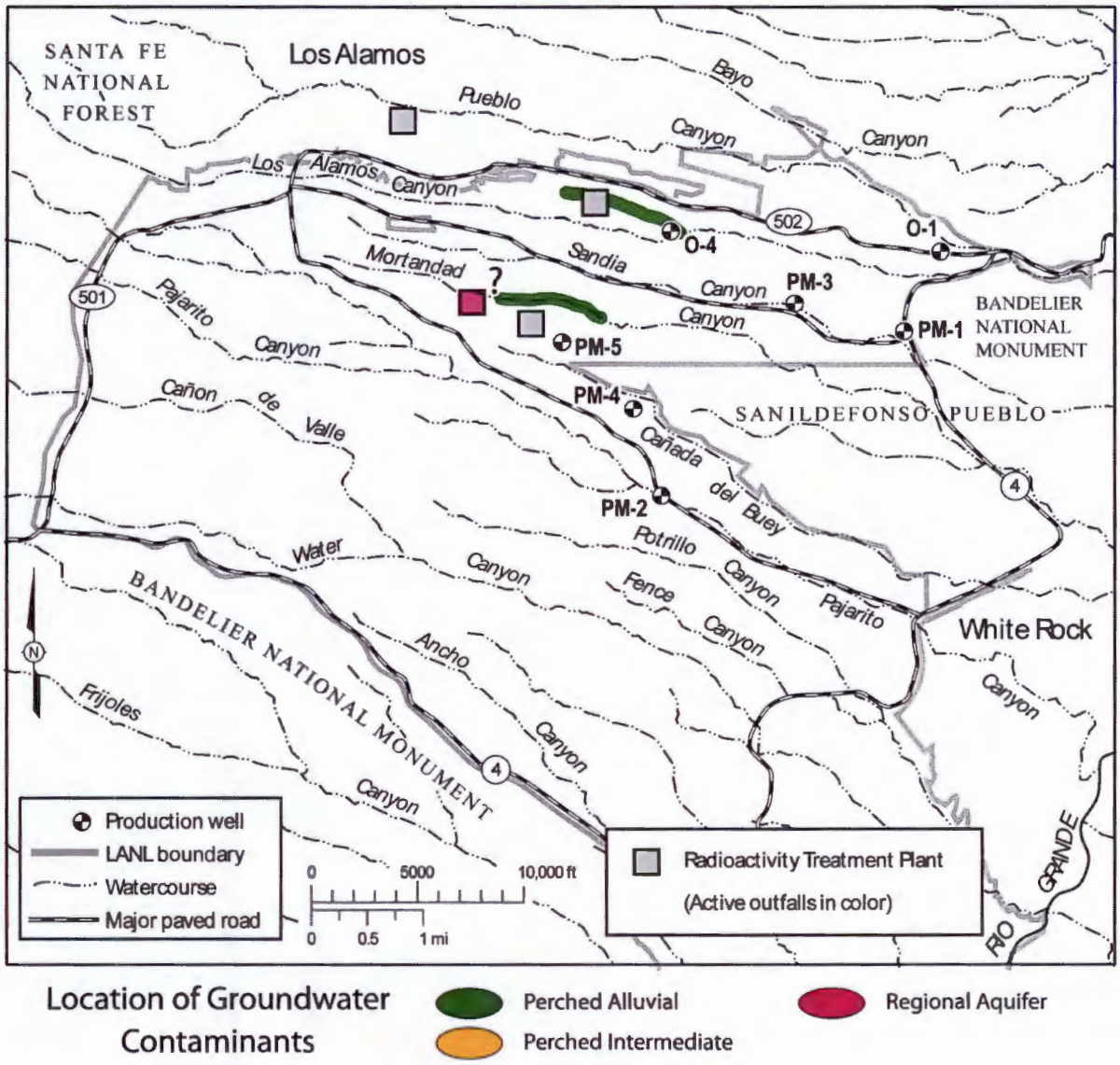

Figure 5-12 **Location of groundwater contaminated by radioactivity: areas indicated have the sum of radioactivity from a DOE source (that is, Sr-90, Pu-238, Pu-239/240, and Am-241) above the 4-mrem/yr DOE DCG screening level. (The 4-mrem/yr DOE DCG applies only to drinking water, not to alluvial groundwater.) Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage.**

In 2010, we changed analytical laboratories for low-level tritium analyses. In August 2011 investigation revealed that results from the new provider (ARSL) were subject to calculation errors. At the time of this report, these data had not been corrected.

4. Perchlorate in Groundwater

Perchlorate is an important contaminant to monitor at LANL because it was discharged in some effluents and travels readily through groundwater. In December 2008, EPA issued an interim health advisory of 15 µg/L for perchlorate in drinking water (http://water.epa.gov/drink/contaminants/unregulated/perchlorate.cfm). The Consent Order mandates a 4 µg/L screening level for perchlorate.

Several studies indicate that perchlorate occurs naturally in groundwater of arid regions due to atmospheric deposition and other sources. Plummer et al. (2006) found perchlorate concentrations ranging from 0.12 µg/L to 1.8 µg/L in samples of north-central NM groundwater that have ages predating anthropogenic influence and that are not affected by industrial perchlorate sources. At LANL, perchlorate concentrations in groundwater samples from Pueblo, Los Alamos, and Mortandad canyons are above background as a result of past effluent discharges (Figure 5-13), above the Consent Order screening level, and in some cases, above the EPA Health Advisory. Otherwise perchlorate concentrations are near the values found by Plummer et al. (2006).

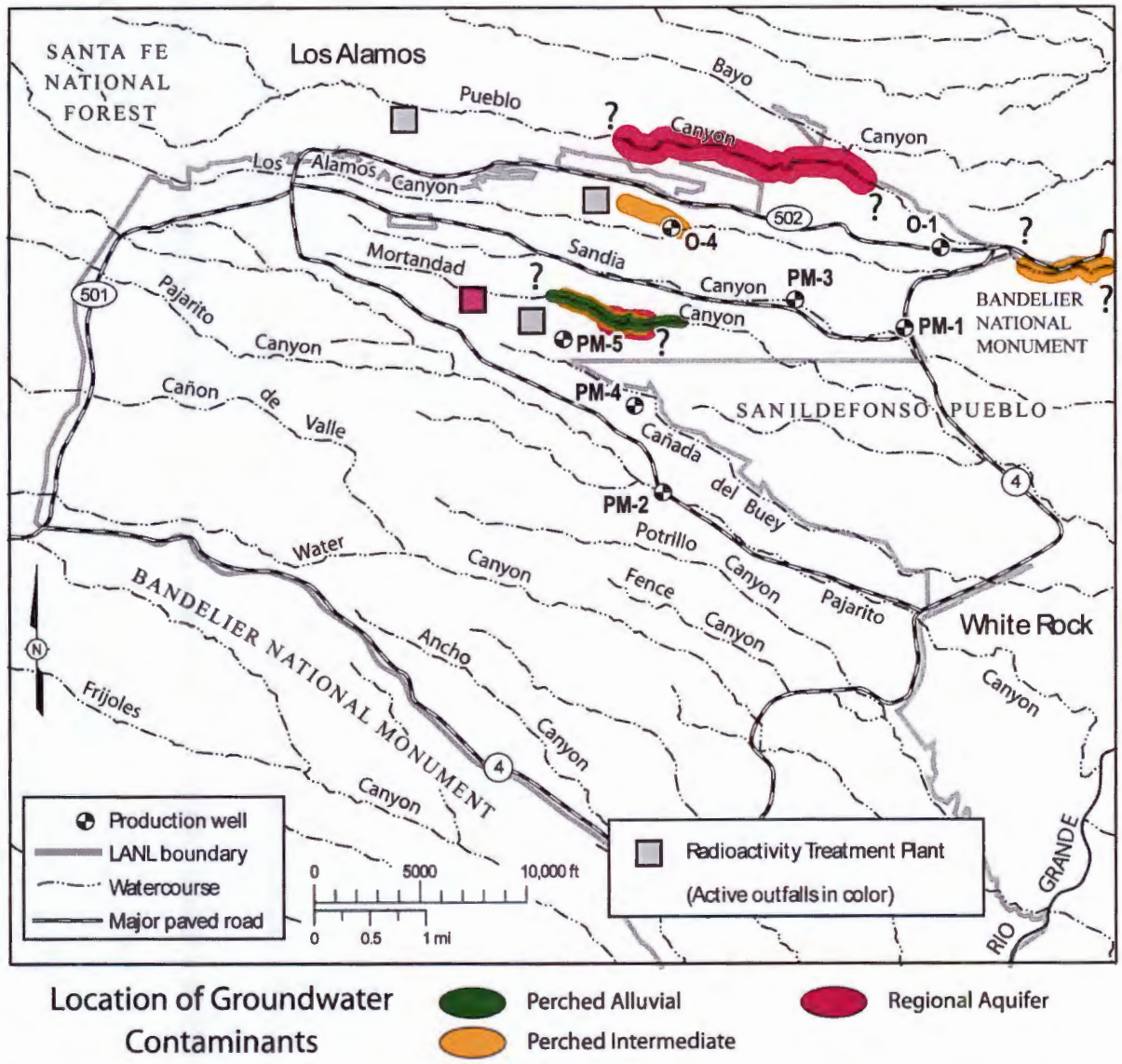

Figure 5-13 **Location of groundwater contaminated by perchlorate; the concentrations in the areas indicated are above the 4 µg/L NM Consent Order screening level. Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage.**

5. Metals in Groundwater

The presence of some metals in groundwater at concentrations near or above screening levels may be due to natural occurrence or to well sampling and well construction issues, rather than LANL releases.

In some LANL characterization wells the use of fluids to assist well drilling affected the chemistry of groundwater samples. From 1998 through 2006, more than 40 new wells were drilled for hydrogeologic characterization beneath the Pajarito Plateau as part of the Laboratory's Hydrogeologic Workplan (LANL 1998) or as part of corrective measures. The potential for residual drilling fluids and additives to mask detection of certain contaminants led to concern about the reliability or representativeness of the groundwater quality data obtained from some wells, as described in the "Well Screen Analysis Report, Rev. 2" (LANL 2007).

Addition of the organic matter in drilling fluids into the aquifer near a well stimulates bacterial activity, consuming available oxygen and changing chemical behavior of several constituents found in groundwater and adjacent aquifer material. With reducing conditions (absence of oxygen), the solubility of metals such as manganese and iron increases, and they are dissolved from the surface of minerals that make up the aquifer's rock framework or possibly from well fittings. Wells drilled since 2007 have been drilled without the use of drilling fluids other than water in the saturated zone. There have been minor exceptions of using foam approximately 100 ft above the water table. These wells also undergo extensive well development at the outset to remove drilling fluids and reduce the turbidity of water samples.

In addition to the effect of drilling fluids, well samples may have relatively high turbidity or natural colloid content. The presence of residual aquifer or soil material in groundwater samples leads to detection of metals such as aluminum, iron, and manganese, which are primary constituents of the silicate and other minerals that make up the aquifer framework. The effects of turbidity on water quality are also seen in many samples from alluvial wells and springs. This occurs in the case of springs because samples may incorporate surrounding soil material.

G. GROUNDWATER SAMPLING RESULTS BY WATERSHED

In the following sections, we discuss groundwater quality results for each of the three groundwater modes in the major watersheds that cross Laboratory property. The tables and discussions are grouped according to groundwater mode, proceeding from the regional aquifer to the alluvial groundwater. Contamination found in the regional aquifer results from effluents released in past decades because of the time required for percolation to that depth. Contaminants found in alluvial groundwater reflect contamination that occurred during the past few years, except for adsorbed or reactive contaminants such as barium or strontium-90.

The accompanying tables and text mainly address contaminants found at levels near or above standards or screening levels. In the case of the regional aquifer, information regarding contaminants (such as nitrate, perchlorate, and tritium) found at lower concentrations but possibly indicating effects by LANL activities is included. The discussion addresses radioactivity, general inorganic compounds (major anions, cations, and nutrients), metals, and then organic compounds for each groundwater zone. The accompanying plots and maps give a temporal and spatial context for most of the contaminants found near or above screening levels.

1. Guaje Canyon (includes Rendija and Barrancas Canyons)

Guaje Canyon is a major tributary in the Los Alamos Canyon watershed that heads in the Sierra de los Valles and lies north of Laboratory land. The canyon has not received any effluents from LANL activities (Table 5-8). The Guaje well field, located northeast of the Laboratory, contains five drinking water supply wells. Naturally occurring arsenic has generally been found in this well field at levels above the EPA MCL of 10 µg/L since the field was developed in the early 1950s (Table 5-9). In 2010, two arsenic sample results were above the 5 µg/L practical quantitation limit (PQL). One gross alpha result in G-1A was unusually high. An alluvial spring in Upper Guaje Canyon, Campsite Spring, shows background water quality.

The tributary Rendija and Barrancas Canyons have seen, respectively, little and no past Laboratory activity, have only ephemeral surface water, and have no known alluvial or intermediate groundwater.

Table 5-8
Summary of Groundwater Contamination in Guaje Canyon
(includes Rendija and Barrancas Canyons)

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
Guaje, Rendija, and Barrancas Canyons	Minor non-effluent sources	None, alluvial groundwater only in upper Guaje Canyon	No intermediate groundwater	Natural arsenic above EPA MCL

Table 5-9
Groundwater Quality in Guaje Canyon
(includes Rendija and Barrancas Canyons)

Chemical	Location	Result	Trends
Gross Alpha	G-1A	41.4 pCi/L and reanalysis of 50.2 pCi/L, above EPA screening level of 15 pCi/L	Most of results since 1968 are nondetects
Arsenic	Regional aquifer water supply wells	Two highest results of 5.9 µg/L and 7.2 µg/L, below EPA MCL of 10 µg/L; NM groundwater standard is 100 µg/L	Sporadic values above EPA MCL for many years in this well field

2. Los Alamos Canyon (includes Bayo, Acid, Pueblo, and DP Canyons)

Bayo Canyon contained a now-decommissioned firing site. The canyon has only ephemeral surface water and no known alluvial or intermediate groundwater (Table 5-10).

Table 5-10
Summary of Groundwater Contamination in Los Alamos Canyon
(includes Bayo, Acid, Pueblo, and DP Canyons)

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
Bayo Canyon	Minor past dry and liquid sources	No alluvial groundwater	No intermediate groundwater	None
Pueblo and Acid Canyons	Multiple past effluent discharges, current sanitary effluent	Not sampled in 2010	Not sampled in 2010 except for one new well	Many wells not sampled in 2010, trace perchlorate, tritium, and nitrate
Los Alamos and DP Canyons	Multiple past effluent discharges	Not sampled in 2010	Perchlorate above Consent Order screening level, tritium up to 17% of EPA MCL screening level, fluoride at 56% of NM groundwater standard and dioxane[1,4-] at 54% of EPA tap water screening level	Ra-228 above EPA MCL screening level in O-4
Lower Los Alamos Canyon	Multiple past effluent discharges	None	Perchlorate at 57% of Consent Order screening level, fluoride at 52% of NM groundwater standard	None

Pueblo Canyon receives effluent from the new Los Alamos County Wastewater Treatment Plant. Acid Canyon, a tributary, received radioactive industrial effluent from 1943 to 1964. Little radioactivity is found in current groundwater samples. Perchlorate results from one regional aquifer monitoring well in this canyon are above the Consent Order screening level, and tritium, nitrate, and fluoride concentrations in some wells are elevated but are below standards. These findings may indicate a lingering influence on the regional aquifer of past discharges from radioactive wastewater discharges in Acid Canyon. In the case of nitrate in regional aquifer wells, the source may also be from past sanitary effluent discharges in the upper part of the canyon. In recent years, the high nitrate (as well as total dissolved solids [TDS] and boron) concentrations found in alluvial and intermediate groundwater in lower Pueblo Canyon and downstream in lower Los Alamos Canyon may be due to sanitary effluent from the former Los Alamos County Bayo Sewage Treatment Plant.

Los Alamos Canyon received releases of radioactive effluents during the earliest Manhattan Project operations at Technical Area (TA)-1 (1942–1945) and until 1993 from nuclear reactors at TA-2. From 1952 to 1986, a liquid-waste treatment plant discharged effluent containing radionuclides from the former plutonium-processing facility at TA-21 into DP Canyon, a tributary to Los Alamos Canyon. Los Alamos Canyon also received radionuclides and metals in discharges from the sanitary sewage lagoons and cooling towers at the Los Alamos Neutron Science Center (LANSCE) at TA-53. Except for strontium-90, contaminant concentrations in shallow groundwater have decreased dramatically in recent decades.

No alluvial wells in Pueblo Canyon or Upper Los Alamos Canyon were sampled in 2010. A number of intermediate and regional wells in Pueblo Canyon also were not sampled. These wells will be sampled during 2011.

a. Pueblo Canyon

The levels of tritium, perchlorate (Figure 5-14), and nitrate at supply well O-1, though below standards or screening levels, indicate the presence of past effluent and surface water recharge in the regional aquifer (Table 5-11). Los Alamos County does not use the well for water supply, although the concentrations are below the 4 µg/L Consent Order screening level and the 15 µg/L EPA interim health advisory for perchlorate in drinking water.

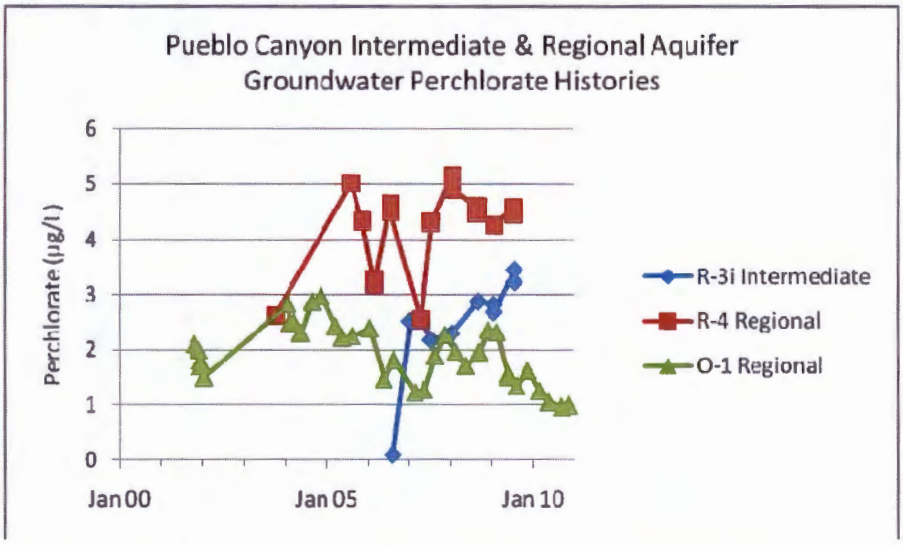

Figure 5-14 **Perchlorate in Pueblo Canyon intermediate and regional aquifer groundwater. The Consent Order screening level is 4 µg/L.**

Table 5-11
Groundwater Quality in Pueblo Canyon (includes Acid Canyon)

Chemical	Location	Result	Trends
Tritium	Water supply well O-1	3.6 pCi/L, below EPA MCL of 20,000 pCi/L	New analytical provider; results are variable between 14 pCi/L and 58 pCi/L since 2000; have declined since 2004
Perchlorate	Water supply well O-1	0.96 µg/L to 1.25 µg/L, below Consent Order screening level of 4 µg/L	Variable between 1.2 µg/L and 3 µg/L since 2001; values have declined since 2008

Only one Pueblo Canyon regional aquifer monitoring well, R-4, located downstream from the former Acid Canyon outfall, has shown perchlorate or low-detection-limit tritium values indicative of past discharges. Perchlorate concentrations in R-4 have been above the Consent Order screening level of 4 µg/L (Figures 5-13 and 5-14). The tritium values range up to 60 pCi/L. Two regional aquifer wells (R-4 and R-5) have shown fluoride values higher than those in unaffected wells, but the results were below the NM groundwater standard.

Intermediate groundwater samples have also shown the effects of past effluent releases, with concentrations near standards of perchlorate, fluoride, and nitrate (Figures 5-14 through 5-16). The nitrate concentration in intermediate well POI-4 has nearly doubled over 14 years of sampling (Figure 5-17). Intermediate locations R-3i and Basalt Spring show nitrate concentrations and patterns similar to POI-4. An intermediate screen in regional aquifer well R-5 shows fluoride values higher than that in unaffected wells, but the results are below the NM groundwater standard. The 2009 uranium concentrations in samples from Pueblo Canyon intermediate well R-3i ranged from 9.2 µg/L to 9.7 µg/L, above levels in unaffected wells but below the standard. The higher uranium may result from dissolution of uranium from surrounding bedrock by sanitary effluent (Teerlink 2007).

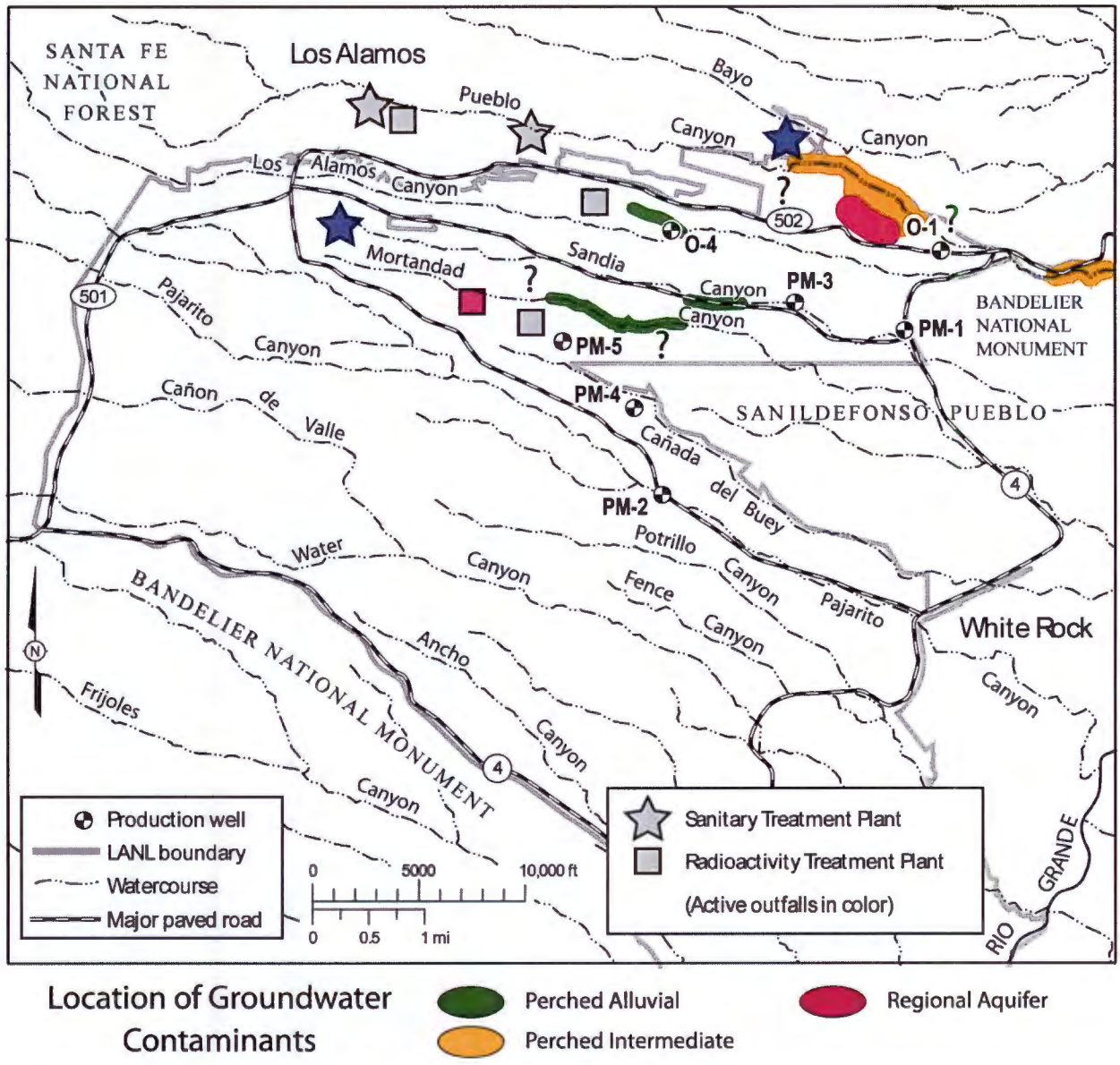

Figure 5-15 **Location of groundwater containing fluoride above one half of the 1.6-mg/L NM groundwater standard. Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage.**

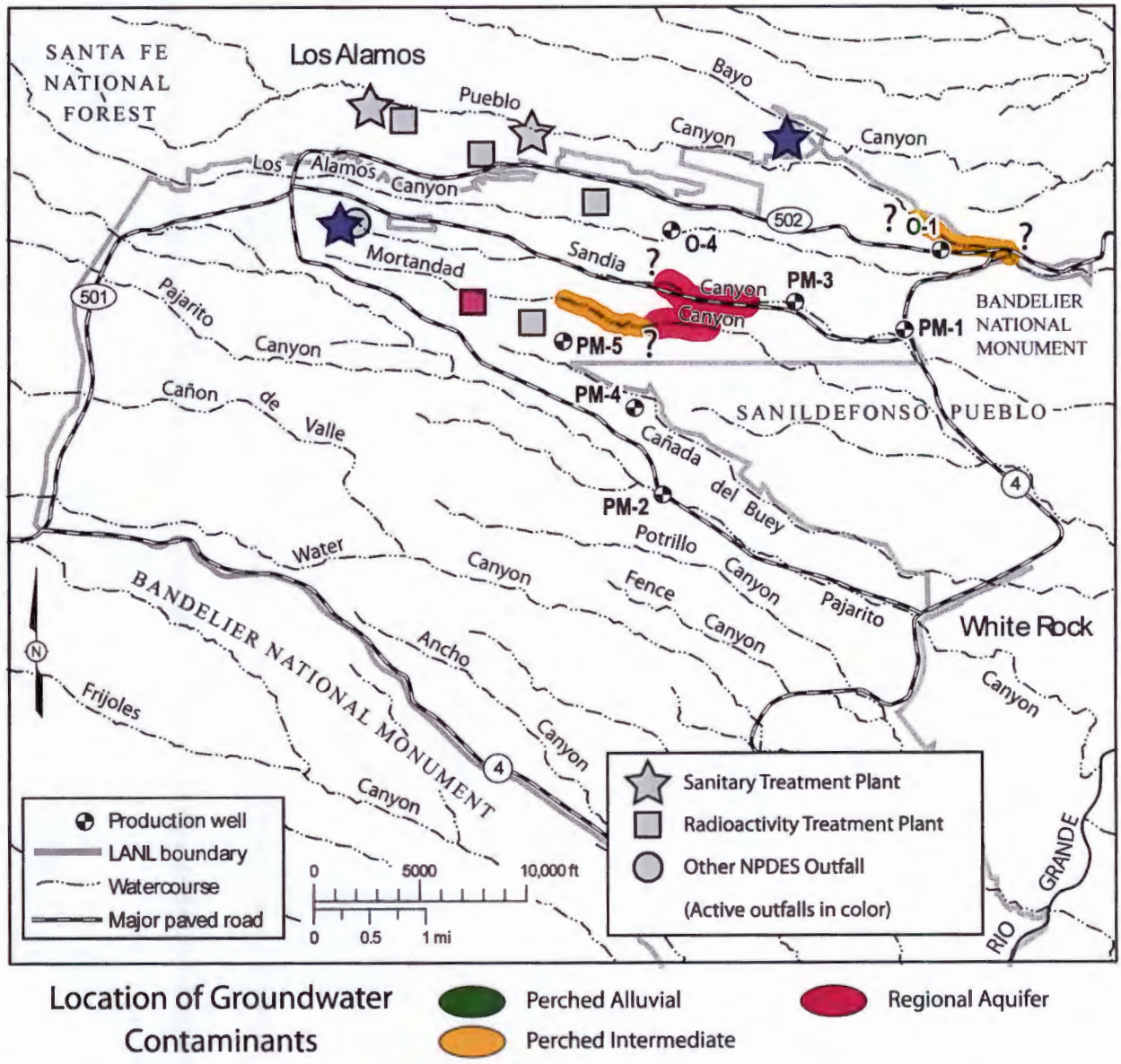

Figure 5-16 **Location of groundwater containing nitrate (as nitrogen) above one half of the 10 mg/L NM groundwater standard. Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage.**

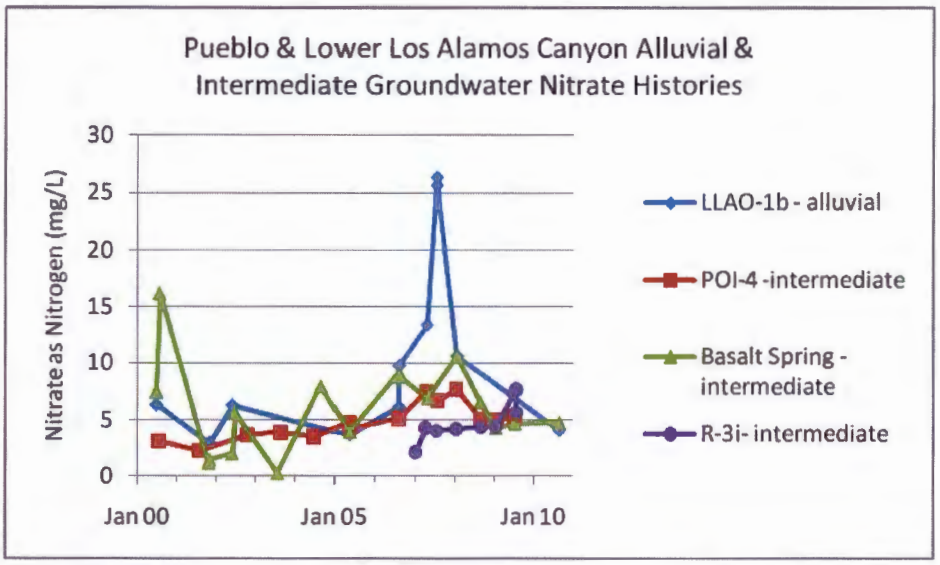

Figure 5-17 **Nitrate (as nitrogen) in Pueblo Canyon and lower Los Alamos Canyon alluvial and intermediate groundwater. The NM groundwater standard is 10 mg/L. Many of the values, including the 2007 higher results in LLAO-1b, are estimated due to analytical quality issues.**

Beginning in 2006, several alluvial wells in Pueblo Canyon have shown unusually high unfiltered plutonium-239/240 results near or above the 4-mrem/yr DOE DCG screening level of 1.2 pCi/L. In general, these results corresponded to unusually high sample turbidity. The first high values appeared to be caused by flooding in August 2006 that submerged the wells. In 2009, the highest plutonium-239/240 activity was in PAO-4, at 0.84 pCi/L. These wells were not sampled in 2010.

Prior to 2007, samples at many surface water and alluvial groundwater locations were often taken annually. Beginning in 2007, more frequent samples from Pueblo Canyon locations showed higher chloride concentrations in mid-winter and early spring. Along with similar sodium and TDS concentrations trends, this suggests an impact on water quality by runoff from road salting (Figure 5-18). High chloride concentrations in 2007 and 2008 were up to 280 mg/L in surface water and 135 mg/L in groundwater. Locations that previously showed highest winter chloride concentrations were not sampled in early 2009 or in 2010.

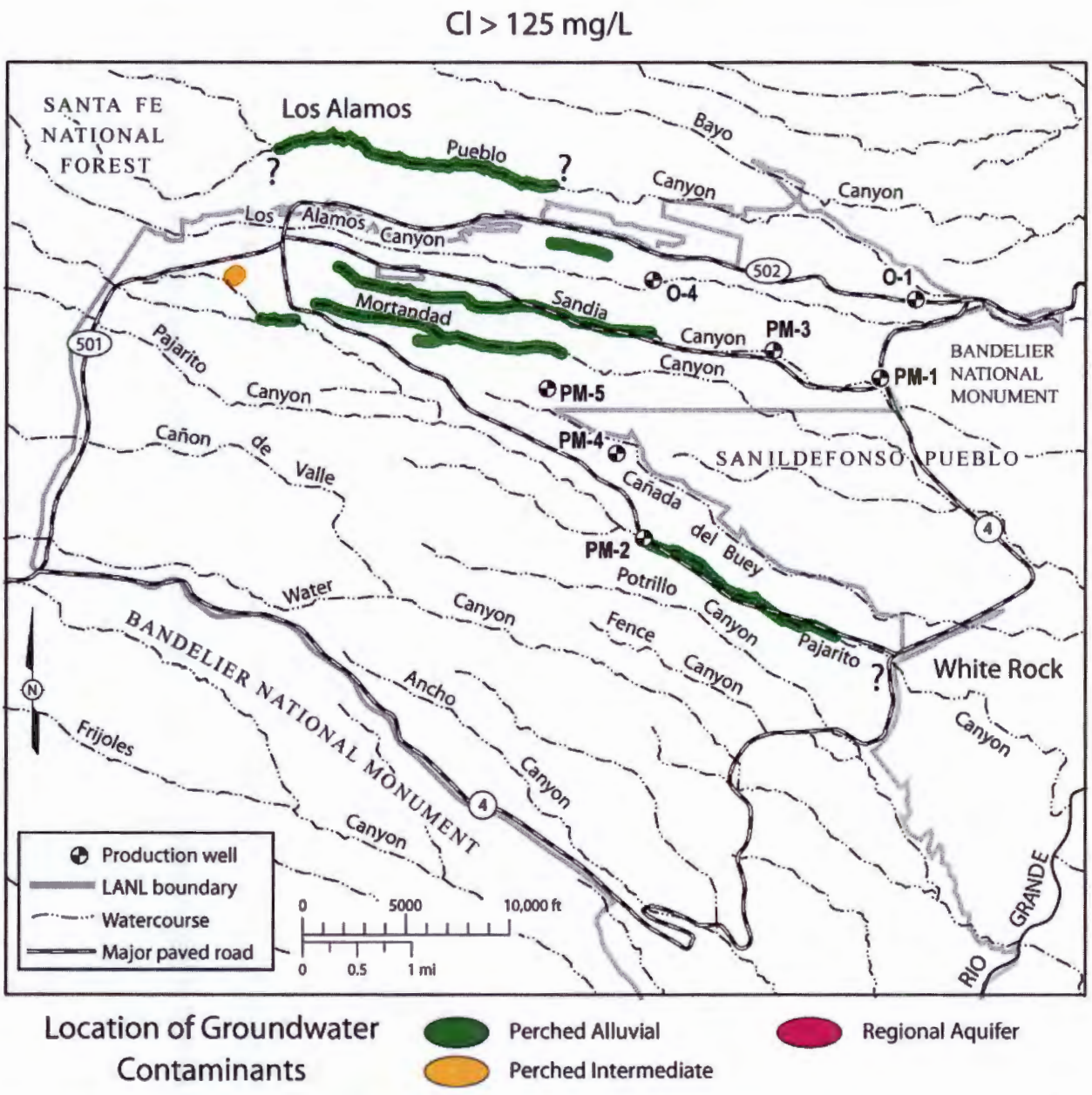

Figure 5-18 **Location of groundwater containing chloride above one half of the 250 mg/L NM groundwater standard. Different colors indicate the affected groundwater zones. Question marks indicate where contaminant extent is inferred but not confirmed by monitoring coverage.**

b. Los Alamos Canyon

Alluvial and intermediate groundwater in Los Alamos Canyon show effects of past effluent releases (Table 5-12).

Table 5-12
Groundwater Quality in Los Alamos Canyon (includes DP Canyon)

Chemical	Location	Result	Trends
Radium-228	O-4	11.8 pCi/L, above EPA MCL screening level of 5 pCi/L; field duplicate was nondetect at < 0.412 pCi/L	Naturally occurring isotope, first detection of seven sample events
Tritium	Five intermediate wells	435 pCi/L to 3,490 pCi/L, below EPA MCL screening level of 20,000 pCi/L	Highest activities in R-6i, decreasing in LAOI-3.2 and LAOI-3.2a
Nitrate (as N)	Intermediate wells R-6i, LAOI-3.2, LAOI-3.2a	1.8 mg/L to 3.9 mg/L, below NM groundwater standard of 10 mg/L	Highest in R-6i, decreasing in other wells
Perchlorate	Intermediate wells R-6i, LAOI-3.2, LAOI-3.2a, R-9i	2.1 µg/L to 6.7 µg/L, above Consent Order screening level of 4 µg/L	Highest in R-6i, lowest but steady for two years in R-9i, decreasing in other wells
Dioxane[1,4-]	Intermediate well R-6i	2.6 µg/L to 3.6 µg/L, below EPA Human Health tap water screening level of 6.7 µg/L	Detected in nearly every sample event since 2006, all values just above 2 µg/L MDL and estimated
Bis(2-ethylhexyl)phthalate	Intermediate well TA-53i	2.4 µg/L to 2.9 µg/L, below EPA MCL screening level of 6 µg/L	Steady decline since first sample in May 2009
Nitrate (as N)	Intermediate Basalt and Los Alamos Springs (Pueblo de San Ildefonso)	2.8 mg/L to 4.8 mg/L, below NM groundwater standard of 10 mg/L	Apparent result of discharge from Bayo Sanitary Treatment Plant, above standard in past years
Perchlorate	Intermediate Basalt Spring (Pueblo de San Ildefonso)	2.3 µg/L, below Consent Order screening level of 4 µg/L	At times above 4 µg/L since August 2008; about 1 µg/L for prior four years
Fluoride	Intermediate Los Alamos Spring (Pueblo de San Ildefonso)	0.85 mg/L, below NM groundwater standard of 1.6 mg/L	Similar levels since 1961

Samples from intermediate wells R-6i, LAOI-3.2, LAOI-3.2a, and LAOI-7 contained up to 3,490 pCi/L of tritium (Figure 5-19). These moderate values indicate a residual impact of past effluent discharges; the wells lie downstream from the former radioactive liquid waste discharge from TA-21 in DP Canyon. Nitrate (as nitrogen) concentrations in these wells have fluctuated over the period of sampling but are below the 10 mg/L NM groundwater standard. The perchlorate concentrations in these wells ranged up to 6.7 µg/L, above the Consent Order screening level of 4 µg/L (Figure 5-13, Figure 5-20).

The perchlorate concentration in the deeper intermediate screen at R-9i since late 2008 has been between 2.0 µg/L and 2.4 µg/L (Figure 5-21). At Basalt Spring, fed by intermediate groundwater in lower Los Alamos Canyon on Pueblo de San Ildefonso land, perchlorate concentrations since late 2008 have been near or above the Consent Order screening level of 4 µg/L but declined in 2010.

In 2006, we measured and detected dioxane[1,4-] for the first time in intermediate well R-6i. The compound has been detected in nearly every sample event (Figures 5-22 and 5-23). The dioxane[1,4-] EPA Human Health tap water screening level is 6.7 µg/L. In November 2010, the screening level was revised from a previous value of 61 µg/L.

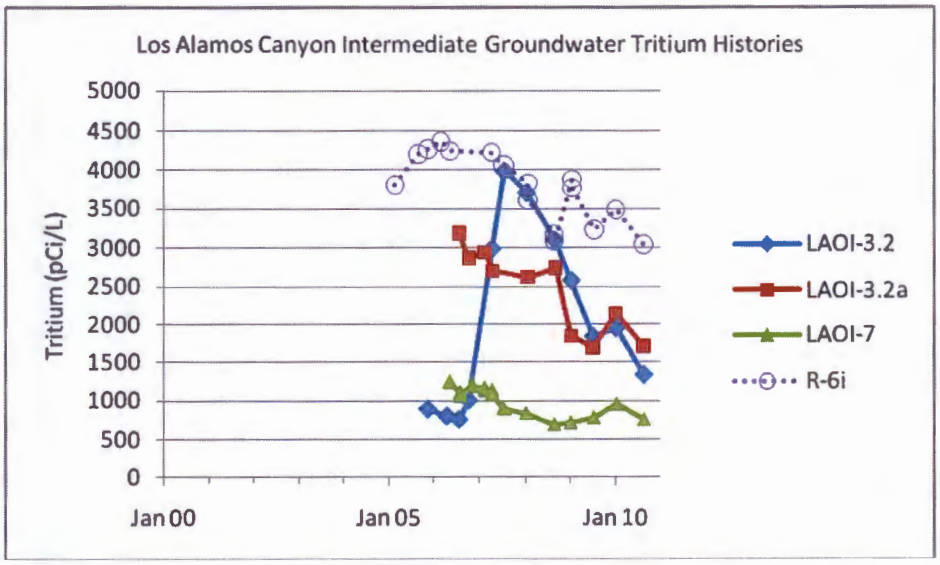

Figure 5-19 **Tritium in Los Alamos Canyon intermediate groundwater. For comparison purposes, the EPA MCL screening level is 20,000 pCi/L.**

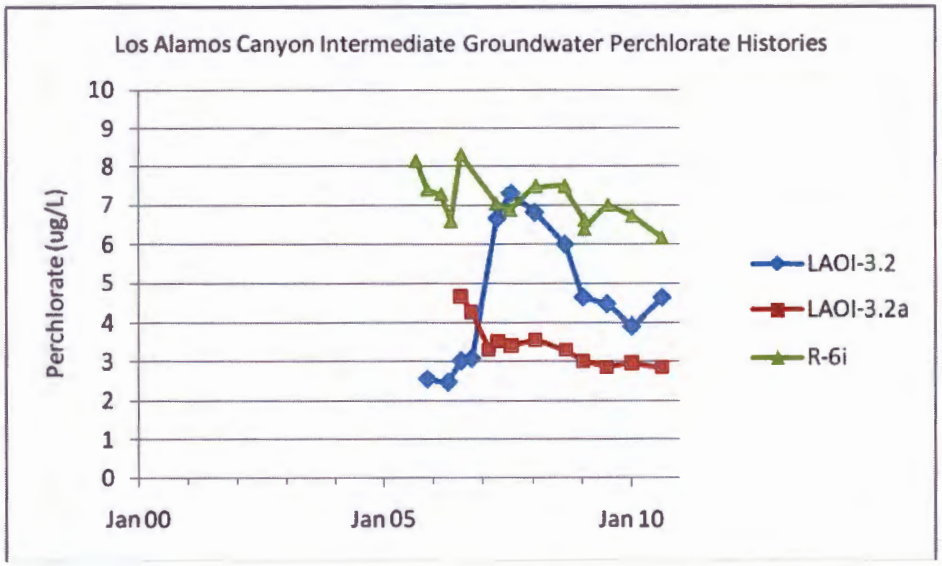

Figure 5-20 **Perchlorate in Los Alamos Canyon intermediate groundwater. The Consent Order screening level is 4 µg/L.**

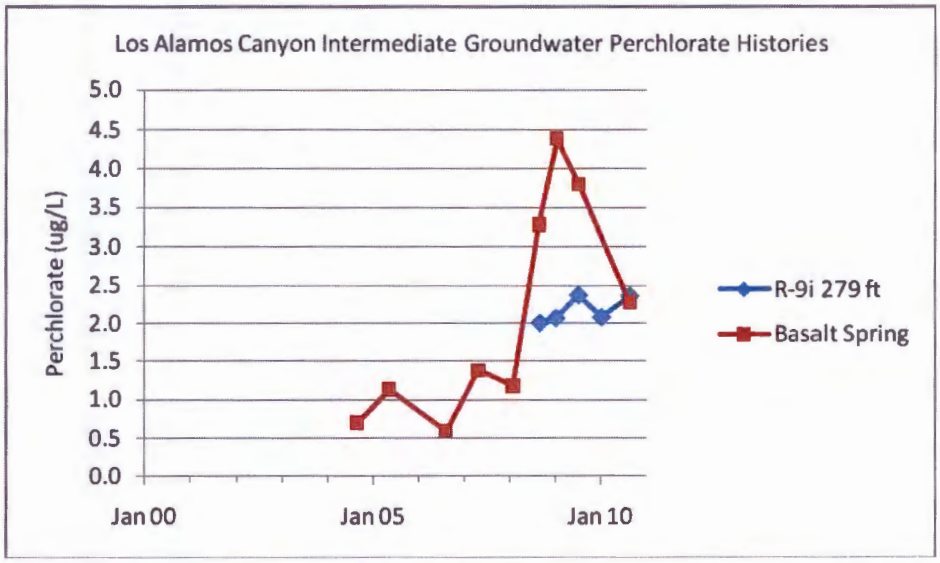

Figure 5-21 **Perchlorate in Los Alamos Canyon intermediate groundwater. The Consent Order screening level is 4 µg/L.**

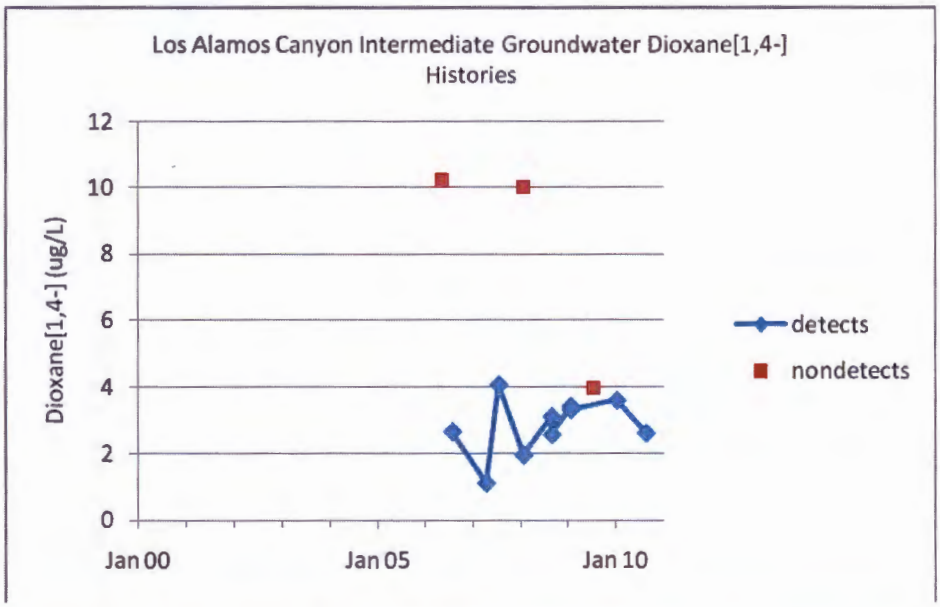

Figure 5-22 **Dioxane[1,4-] in Los Alamos Canyon intermediate groundwater at R-6i. For comparison purposes ; the EPA Human Health tap water screening level is 6.7 µg/L. All of the detected results are estimated; nondetects (ND) are indicated separately, generally at the 10 µg/L PQL.**

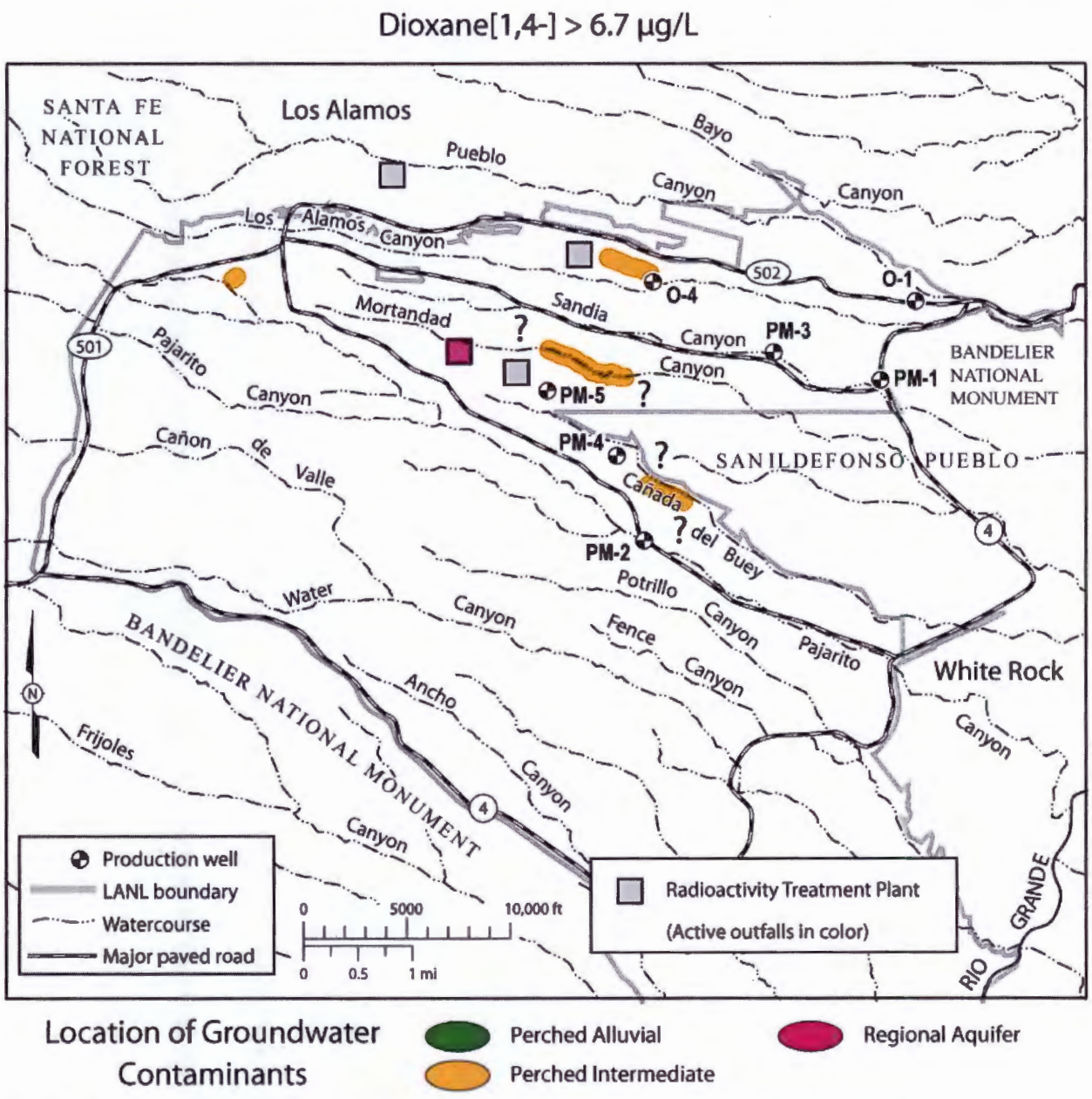

Figure 5-23 **Location of groundwater containing dioxane[1,4-] above one half of the 6.7 µg/L EPA Human Health tap water screening level. Different colors indicate the affected groundwater zones.**

Los Alamos Spring is near Basalt Spring on Pueblo de San Ildefonso land; both are fed by intermediate groundwater. One 2008 nitrate (as nitrogen) result from Basalt Spring was above the NM groundwater standard of 10 mg/L. For 2009 and 2010, the nitrate (as nitrogen) concentrations at the two springs ranged from 2.8 mg/L to 4.8 mg/L. The source of nitrate may be releases into Pueblo Canyon from the present and former Los Alamos County sanitary treatment plants.

Alluvial groundwater in DP and Los Alamos Canyons continues to show high activities of strontium-90; the values range up to and above the 8 pCi/L EPA MCL screening level (Figures 5-11 and 5-24). These locations were not sampled in 2010. Results from filtered and unfiltered samples from the same date are usually similar so both are shown in Figure 5-24. Fluoride is also present in samples as a result of past effluent release but at concentrations below the NM groundwater standard of 1.6 mg/L. In 2009, fluoride

concentrations in four alluvial wells and a spring in DP and Los Alamos Canyons ranged from 0.53 mg/L to 0.76 mg/L.

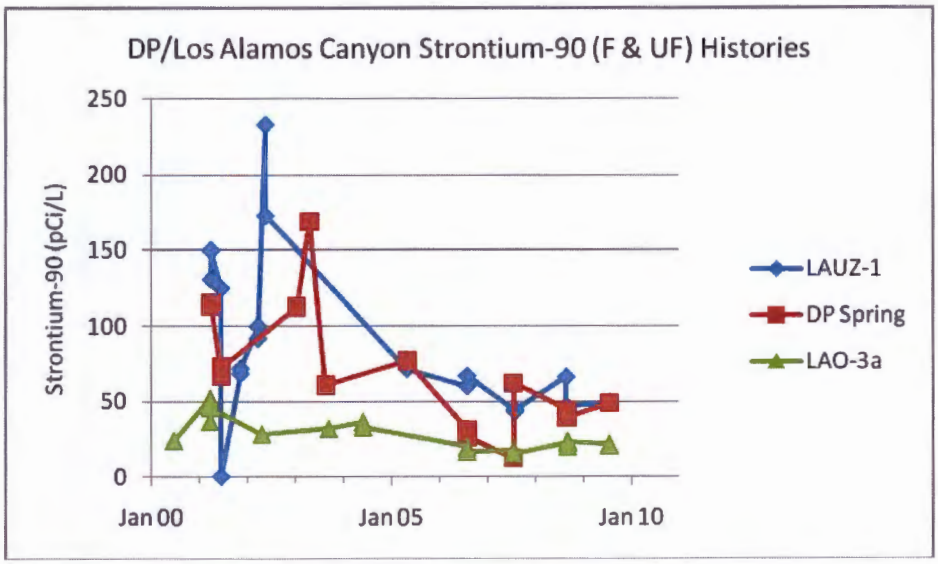

Figure 5-24 **Strontium-90 in Los Alamos Canyon alluvial groundwater, showing both filtered and unfiltered results. For comparison purposes, the EPA MCL screening level is 8 pCi/L.**

3. Sandia Canyon

Sandia Canyon has a small drainage area that heads at TA-3. The canyon receives the largest liquid discharges of any canyon at the Laboratory, including sanitary effluent, releases from the steam plant, and cooling tower discharges from computing facilities and the TA-3 power plant (Table 5-13). Treated sanitary effluent from the TA-46 SWWS Plant has been routed to Sandia Canyon since 1992. Chromate was used to treat cooling water at the power plant until 1972 (ESP 1973). These earlier discharges are identified as the source for hexavalent chromium concentrations discovered in intermediate groundwater and the regional aquifer beneath Sandia and Mortandad Canyons that are above the 50 µg/L NM groundwater standard (Figure 5-25). This standard applies to dissolved chromium (regardless of the chemical form). Sandia and Mortandad Canyons lie close together, and water percolating downward beneath Sandia Canyon may have been diverted to the south by southwesterly dipping strata prior to reaching the regional aquifer (ERSP 2006, LANL 2008a).

Table 5-13
Summary of Groundwater Contamination in Sandia Canyon

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
Sandia Canyon	Multiple liquid discharges	Chloride above and TDS at 80% of NM groundwater standard; total chromium at 98% of EPA MCL screening level	Chromium 12 times above NM groundwater standard	Chromium at 45% and nitrate at 57% of NM groundwater standard; and bis(2-ethylhexyl)phthalate above EPA MCL screening level

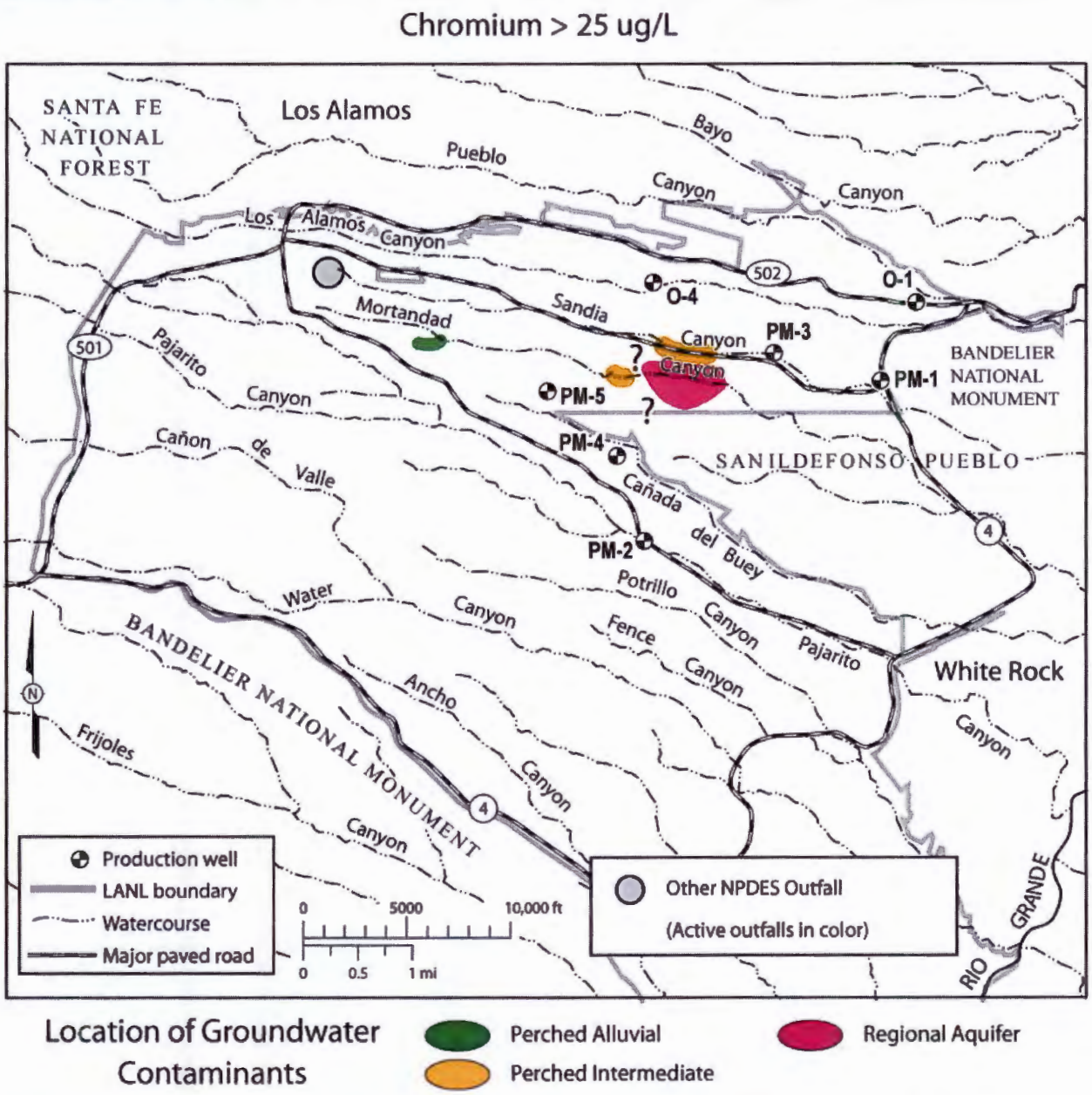

Figure 5-25 **Location of groundwater containing dissolved or hexavalent chromium above one half of the 50 µg/L NM groundwater standard. Different colors indicate the affected groundwater zones.**

In 2010, chromium concentrations in samples from regional aquifer well R-11 in Sandia Canyon were up to 22.7 µg/L or 45% of the groundwater standard (Table 5-14, Figure 5-26); other analyses show the chromium is in the hexavalent form. Nitrate (as nitrogen) in R-11 and regional aquifer well R-43 were up to 61% of the NM groundwater standard, due to past Laboratory sanitary effluent releases (Figure 5-16, Figure 5-28).

Intermediate well SCI-2 had chromium at concentrations up to 12 times the NM groundwater standard (Table 5-14, Figure 5-27). The nitrate concentration in this well was 44% of the NM groundwater standard (Figure 5-16, Figure 5-28).

Table 5-14
Groundwater Quality in Sandia Canyon

Chemical	Location	Result	Trends
Chromium	Regional aquifer monitoring well R-11	15 µg/L to 23 µg/L, below NM groundwater standard of 50 µg/L	Rose to 35 µg/L over four years of sampling, now decreasing
Nitrate (as N)	Regional aquifer monitoring wells R-11, R-43	4.3 mg/L to 5.7 mg/L, below NM groundwater standard of 10 mg/L	Some fluctuation over four years of sampling, recent range is 4 mg/L to 6 mg/L
Bis(2-ethylhexyl)phthalate	Regional aquifer monitoring well R-36	6.4 µg/L, above EPA MCL screening level of 6 µg/L	Steady decline with one detection in 2010
Chromium	Intermediate well SCI-2	512 µg/L to 615 µg/L, above NM groundwater standard of 50 µg/L	Some fluctuation over two years of sampling
Nitrate (as N)	Intermediate well SCI-2	4.4 mg/L to 4.8 mg/L, below NM groundwater standard of 10 mg/L	Some fluctuation over one year of sampling, recent range is mainly 4 mg/L to 5 mg/L
Chloride	Alluvial wells SCA-1-DP and SCA-2	66 mg/L to 263 mg/L, above NM groundwater standard of 250 mg/L	Variable results over four years, high in winter/spring and low in summer/fall
TDS	Alluvial well SCA-1-DP	419 mg/L to 798 mg/L, below NM groundwater standard of 1,000 mg/L	Somewhat steady for four years, though higher in winter/spring
Perchlorate	Alluvial well SCA-4	1.7 µg/L, below Consent Order screening level of 4 µg/L	Highest result for well, most below 0.44 µg/L for four years
Total Chromium	Alluvial well SCA-1-DP	Unfiltered concentrations of 8.5 µg/L to 98 µg/L, below EPA MCL screening level of 100 µg/L	Highest results for well

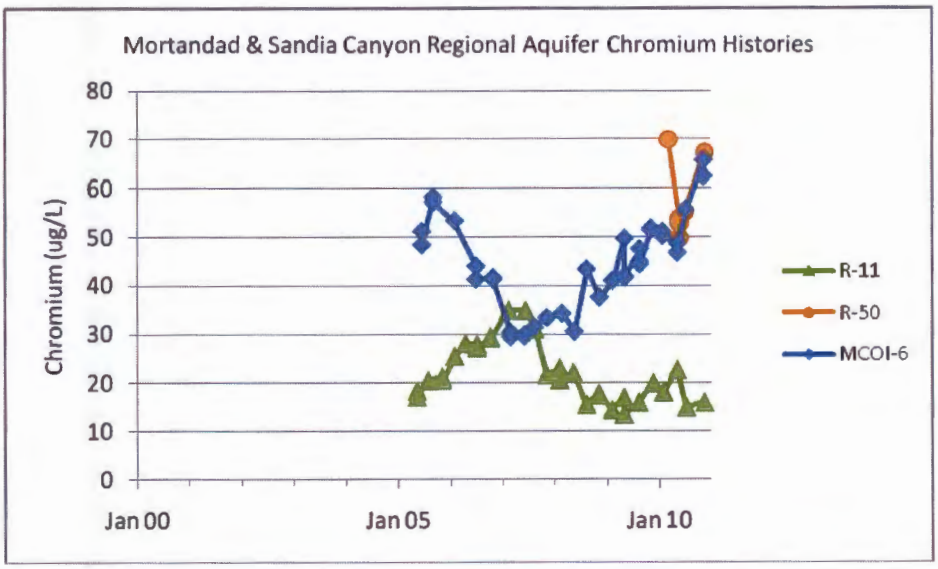

Figure 5-26 **Filtered chromium in Sandia and Mortandad Canyon intermediate and regional aquifer groundwater. The NM groundwater standard is 50 µg/L.**

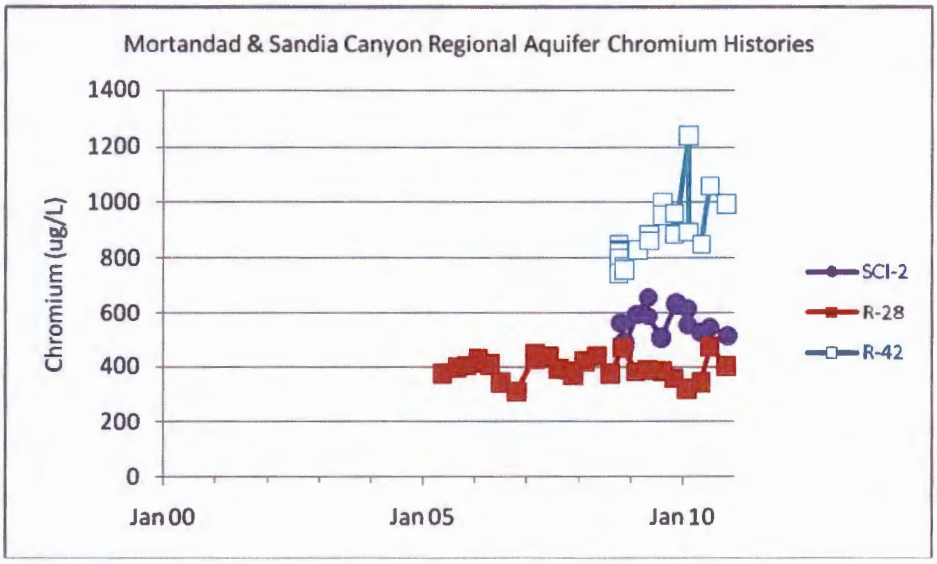

Figure 5-27 **Filtered chromium in Sandia and Mortandad Canyon intermediate and regional aquifer groundwater. The NM groundwater standard is 50 µg/L.**

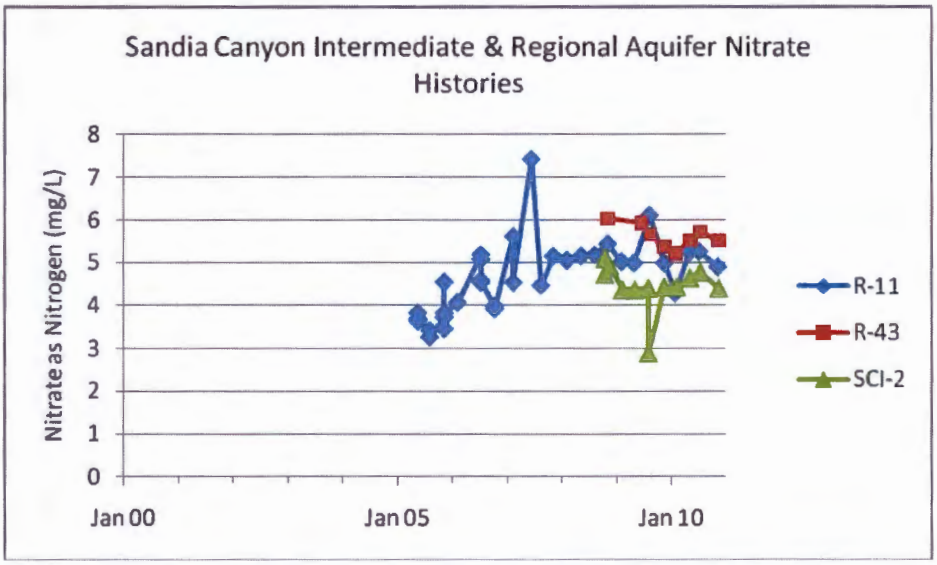

Figure 5-28 **Nitrate (as nitrogen) in Sandia Canyon intermediate and regional aquifer groundwater. The NM groundwater standard is 10 mg/L. Many of the results in 2007 and 2008 were estimated due to analytical quality issues.**

Perchlorate concentrations in Sandia Canyon surface water and alluvial groundwater samples since 2007 show an annual cycle (Figures 5-29 and 5-30). The locations of surface water monitoring stations are shown in Chapter 6. At the surface water location named Sandia right fork at Power Plant, the perchlorate concentration on February 1, 2010 was 5.8 µg/L, above the 4 µg/L Consent Order screening level. At two surface water locations farther downstream, unusually high concentrations of perchlorate were seen in late 2009 and early 2010. The concentration on November 3, 2009, in alluvial well SCA-2 reached 2.7 µg/L, or 67% of the screening level. The perchlorate concentration was 5.2 µg/L on November 23, 2009, in a sample taken from the Power Plant outfall (EPA NPDES outfall 1) by the NMED Oversight Bureau. This suggests

that variation in downstream surface and groundwater concentrations is caused by effluent perchlorate concentration variation.

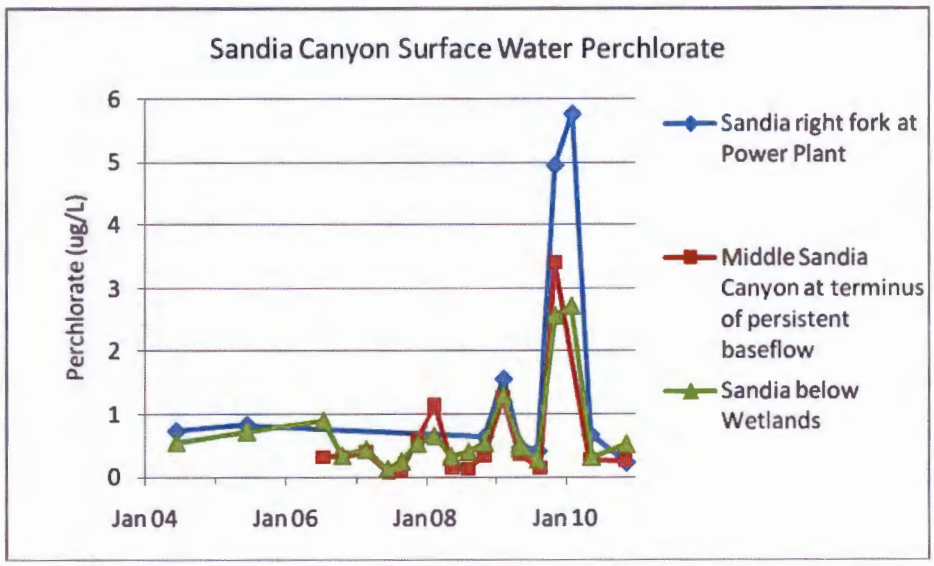

Figure 5-29 **Perchlorate in Sandia Canyon surface water. The Consent Order screening level is 4 µg/L.**

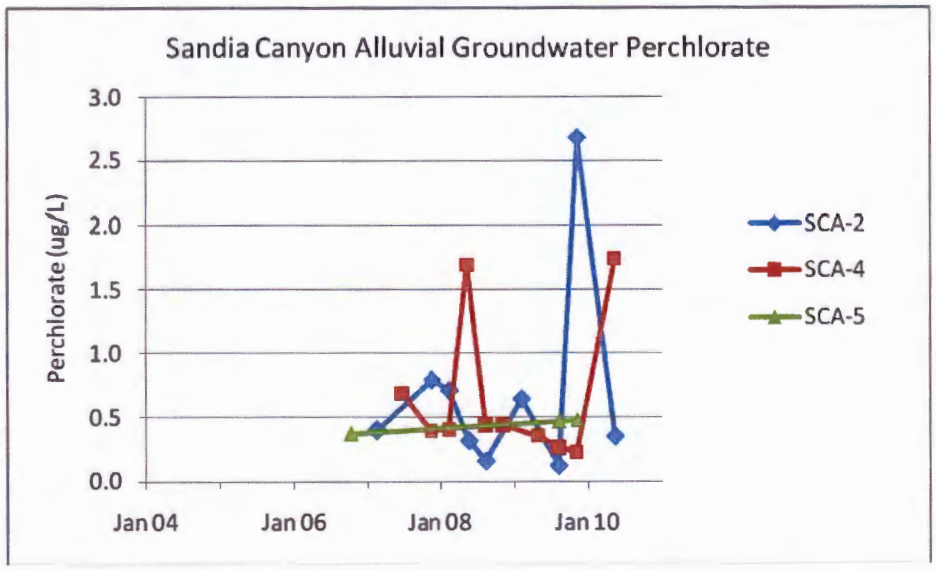

Figure 5-30 **Perchlorate in Sandia Canyon alluvial groundwater. The Consent Order screening level is 4 µg/L.**

Two alluvial wells, SCA-1-DP (a substitute for SCA-1) and SCA-2, had results for chloride and TDS that were above or approached NM groundwater standards. Data from these wells and more frequent data from adjacent surface water monitoring locations indicate seasonal variation in chloride concentrations, with highest values in winter (Figure 5-18, 5-31, and 5-32). The surface water locations show peaks in chloride concentrations in early winter, evidently the result of road salt runoff. Similar trends occur in sodium and

TDS concentrations (not shown). Although alluvial groundwater data are less frequent, they support the pattern of high concentrations of chloride, sodium, and TDS in winter. At SCA-4, the well located farthest downstream, the chloride concentration peaks appear to be delayed and have lower amplitude.

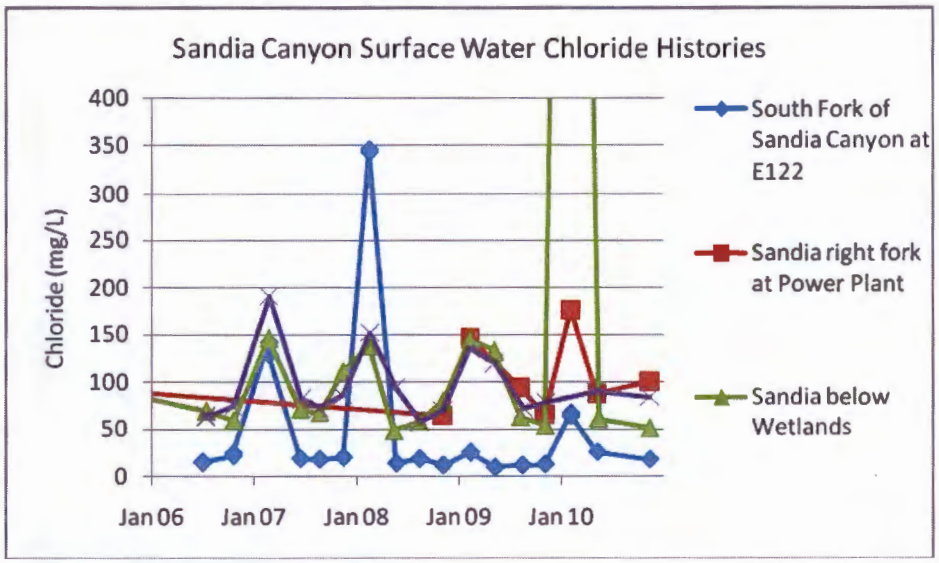

Figure 5-31 **Chloride in Sandia Canyon surface water. The concentration in January 2010 at Sandia below Wetlands was 1,820 mg/L. The NM groundwater standard is 250 mg/L.**

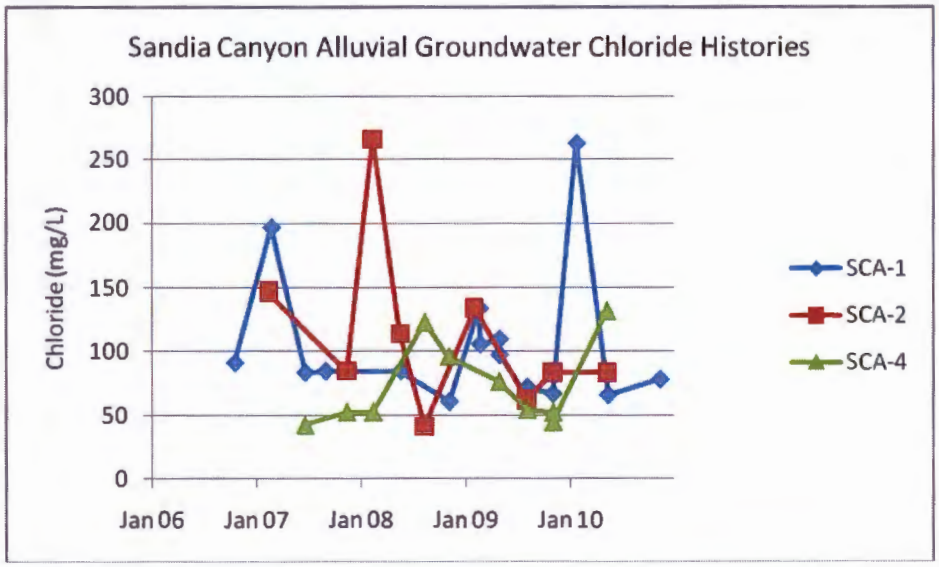

Figure 5-32 **Chloride in Sandia Canyon alluvial groundwater. Because two wells are substitute monitoring locations, data for SCA-1 and SCA-1-DP are shown together. The NM groundwater standard is 250 mg/L.**

4. Mortandad Canyon (includes Ten Site Canyon and Cañada del Buey)

Mortandad Canyon has a small drainage area that heads at TA-3. This drainage area receives inflow from natural precipitation and a number of National Pollutant Discharge Elimination System (NPDES) outfalls, including one from the Radioactive Liquid Waste Treatment Facility (RLWTF) at TA-50 (Table 5-15). Past

discharges into tributary Ten Site Canyon included a previous radioactive effluent treatment plant at TA-35. These discharges have affected groundwater quality in the canyons (Table 5-16).

Table 5-15
Summary of Groundwater Contamination in Mortandad Canyon (includes Ten Site Canyon and Cañada del Buey)

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
Mortandad and Ten Site Canyons	Multiple past and current effluent discharges	Chloride, fluoride, TDS and barium above and cobalt at 71% of NM groundwater standards; strontium-90 and total chromium above EPA MCL screening levels; perchlorate above Consent Order screening level	Nitrate, chromium and uranium above, fluoride at 80%, and TDS at 65% of NM groundwater standards; tritium up to 35% of EPA MCL screening level; dioxane[1,4-] above EPA Human Health tap water screening level; total lead at 59% of EPA drinking water system action level, perchlorate above Consent Order screening level	Chromium above and nitrate at 63% of NM groundwater standards; perchlorate above Consent Order screening level; bis(2-ethylhexyl)phthalate above, antimony at 63% of EPA MCL screening levels, total lead above EPA drinking water system action level
Cañada del Buey	Major dry, minor liquid sources	None, little alluvial groundwater	No intermediate groundwater	None

Table 5-16
Groundwater Quality in Mortandad Canyon (includes Ten Site Canyon and Cañada del Buey)

Chemical	Location	Result	Trends
Chromium	Regional aquifer monitoring wells R-28, R-42, and R-50	Average of 384 µg/L at R-28, 1008 µg/L at R-42, and 58 µg/L at R-50, above NM groundwater standard of 50 µg/L	Increasing over three years of samples at R-42; results at R-28 in this range for six years of sampling; R-50 first sampled in 2010
Nitrate (as N)	Regional aquifer monitoring wells R-42, R-28, R-45 and R-15	1.9 mg/L to 6.3 mg/L, below NM groundwater standard of 10 mg/L	Higher values in R-42 and lowest in R-15 and R-45, results in this range in R-28 and R-15 for six years of sampling
Perchlorate	Regional aquifer monitoring well R-15	7.0 µg/L to 8.1 µg/L, above Consent Order screening level of 4 µg/L	Results generally between 5.5 µg/L to 7.5 µg/L since 2004
Total lead	Regional aquifer monitoring well R-15	< 2 µg/L to 39.5 µg/L, above EPA drinking water system action level of 15 µg/L; filtered lead < 2 µg/L	Earlier results were nondetects or were below 2 µg/L
Bis(2-ethylhexyl) phthalate	Regional aquifer monitoring wells R-38, R-46	About 3 µg/L in R-38, up to 35 µg/L in R-46, above EPA MCL screening level of 6 µg/L	Declining concentrations after first sample rounds
Tritium	Intermediate wells MCOI-4, MCOI-5, MCOI-6	3,000 to 7,000 pCi/L, below EPA MCL screening level of 20,000 pCi/L	Values decreasing over five years of sampling; wells sample separate isolated perched zones
Nitrate (as N)	Intermediate wells MCOI-4, MCOI-5, MCOI-6	4.2 mg/L to 11.6 mg/L, above NM groundwater standard of 10 mg/L	Results decreasing in MCOI-6 for three years, in MCOI-4 for five years; wells sample separate isolated perched zones
Perchlorate	Intermediate wells MCOI-4, MCOI-5, MCOI-6	50 µg/L to 99 µg/L, above Consent Order screening level of 4 µg/L	Results decreasing in MCOI-6 for three years, decreasing in MCOI-4 for five years
Chromium	Intermediate well MCOI-6	47 µg/L to 66 µg/L, above NM groundwater standard of 50 µg/L	Increasing for four years following two-year decrease
Dioxane[1,4-]	Intermediate wells MCOI-4, MCOI-5, MCOI-6	7.1 µg/L to 32 µg/L, above EPA Human Health tap water screening level of 6.7 µg/L	Results at MCOI-4 and MCOI-5 fairly steady over four years; many estimated results; 50% decline at MCOI-6 for two years

Table 5-16 (continued)

Chemical	Location	Result	Trends
Dioxane[1,4-]	929 ft Intermediate screen of R-37	4.1 µg/L to 5.0 µg/L, below EPA Human Health tap water screening level of 6.7 µg/L	Detected in nearly every sample event for two years; all values just above 2 µg/L MDL and estimated
Uranium	Intermediate Pine Rock Spring (Pueblo de San Ildefonso)	23.4 µg/L to 34.6 µg/L, above NM groundwater standard of 30 µg/L	Between 22.3 µg/L and 34.6 µg/L for five years, may be leached from bedrock by sanitary effluent used to irrigate Overlook Park athletic fields
Nitrate (as N)	Intermediate Pine Rock Spring (Pueblo de San Ildefonso)	9.6 mg/L, below NM groundwater standard of 10 mg/L	Values range from 3.6 mg/L to 14.4 mg/L over five years; from sanitary effluent used to irrigate Overlook Park athletic fields
Fluoride	Intermediate Pine Rock Spring (Pueblo de San Ildefonso)	1.28 mg/L, below NM groundwater standard of 1.6 mg/L	Values range from 0.84 mg/L to 1.4 mg/L over five years
TDS	Intermediate Pine Rock Spring (Pueblo de San Ildefonso)	645 mg/L, below NM groundwater standard of 1,000 mg/L	Values range from 528 mg/L to 645 mg/L over five years; from sanitary effluent used to irrigate Overlook Park athletic fields
Strontium-90	Alluvial wells MCO-3, MCO-4B, MCO-5, MCO-6	29 pCi/L to 62 pCi/L, above EPA MCL screening level of 8 pCi/L and 40 pCi/L 4-mrem/yr DOE DCG screening level	Fairly stable between 30 pCi/L to 80 pCi/L for 10 years due to retention on sediments
Fluoride	Eight alluvial wells	0.21 mg/L to 8.8 mg/L, above NM groundwater standard of 1.6 mg/L	Results stable below RLWTF outfall and generally below standard since 1999 effluent treatment upgrades; unusually high above outfall in MCO-2 due to road salt runoff
Chloride	Alluvial wells MCO-0.6, MCO-2, MCO-3, MCO-4B	26 mg/L to 3,300 mg/L, above NM groundwater standard of 250 mg/L	Caused by road salt runoff; peaks in mid-winter; generally above standard for six years at MCO-0.6 and MCO-2
TDS	Alluvial wells MCO-0.6, MCO-2	685 mg/L to 6,180 mg/L, above NM groundwater standard of 1,000 mg/L	Caused by road salt runoff; often above standard for six years at MCO-0.6, highest results at MCO-2
Perchlorate	Six alluvial wells	4.6 µg/L to 23 µg/L, above Consent Order screening level of 4 µg/L	Results substantially decreasing since 2002 effluent treatment upgrades
Barium	Alluvial wells MCO-0.6, MCO-2	223 µg/L to 2,360 µg/L, above NM groundwater standard of 1,000 µg/L	Caused by road salt runoff; often at 60% of standard for five years at MCO-0.6, highest results at MCO-2
Cobalt	Alluvial well MCO-0.6	35.6 µg/L, 71% of NM groundwater standard of 50 µg/L	6.3 µg/L to 25.4 µg/L for six years; values generally increase with turbidity
Total Chromium	Alluvial well MCO-0.6	662 µg/L, above EPA MCL screening level of 100 µg/L	< 3 µg/L to 112 µg/L for six years; values correspond somewhat to turbidity

Cañada del Buey, a tributary to Mortandad Canyon, contains a shallow perched alluvial groundwater system of limited extent, and only two wells have ever contained water. Because treated effluent from the Laboratory's SWWS facility may at some time be discharged into the Cañada del Buey drainage system, a network of five shallow groundwater monitoring wells and two moisture-monitoring holes was installed during 1992 within the upper and middle reaches of the drainage. Past discharges included accidental releases from experimental reactors and laboratories at TA-46.

a. 2010 Radioactive Liquid Waste Treatment Facility Discharges

Data on the RLWTF's yearly radionuclide discharge into Mortandad Canyon from 2008 through 2010 appear in Supplemental Data Table S5-13. Table S5-13 shows mean annual levels in effluent for each radionuclide and the ratio of each of these to the 100-mrem/yr DOE DCG for public dose. Figures 5-33 and 5-34 show RLWTF average annual radionuclide activities in discharges compared to DOE DCGs and the fluoride and nitrate concentrations relative to NM groundwater standards since 1996.

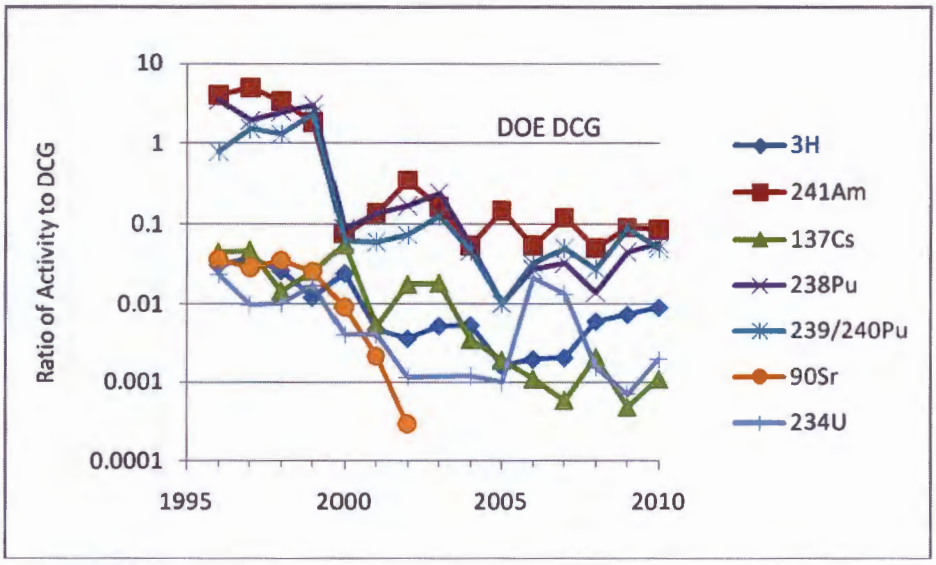

Figure 5-33 **Ratio of 1996–2010 average annual radionuclide activity in RLWTF discharges to the 100-mrem/yr public dose DOE DCGs, which are applicable to effluent releases**

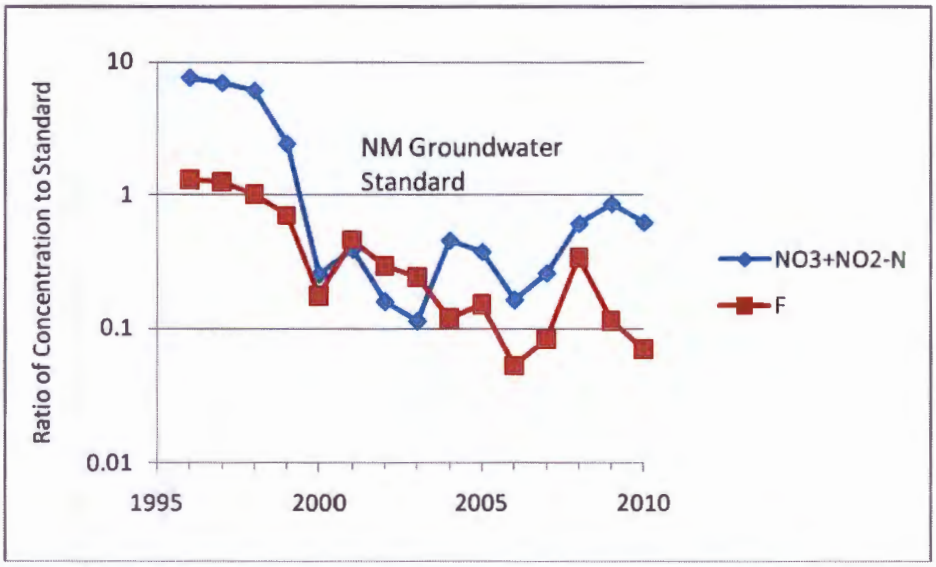

Figure 5-34 **Ratio of 1996–2010 average annual nitrate plus nitrite (as nitrogen) and fluoride concentrations in RLWTF discharges to the NM groundwater standards**

Beginning in 1999, LANL made significant upgrades to the RLWTF treatment system. As a result, activities of radionuclides in the effluent have dropped one or more orders of magnitude, and several can no longer be detected in samples. For the last 10 years, including 2010, the RLWTF has met all DOE radiological discharge standards. Concentrations of nitrate, fluoride, and TDS in the effluent decreased substantially. A system for removing perchlorate from the RLWTF effluent became operational on March 26, 2002. Since then, perchlorate was detected in effluent samples only for five weeks in 2008.

From 2000 to 2009, the nitrate (as nitrogen) concentrations of all monthly analyses of effluent discharges from the RLWTF were less than the NM groundwater standard for nitrate (as nitrogen) of 10 mg/L. However, in some cases the nitrate + nitrite (as nitrogen) concentration of the effluent discharges was near or slightly above 10 mg/L. During 2010, the nitrate (as nitrogen) concentrations of most monthly analyses of

effluent discharges from the RLWTF were less than the NM groundwater standard. In May 2010, the nitrate (as nitrogen) concentration was 11 mg/L. In June 2010, the nitrate + nitrite (as nitrogen) concentration of the effluent discharges was 10.8 mg/L. The average 2010 effluent total nitrate + nitrite (as nitrogen) concentration was 6.16 mg/L. In 2010, no base flow grab samples were collected in Mortandad Canyon below the outfall in Effluent Canyon (a tributary).

The fluoride concentration in the effluent has also declined over the last few years (Figure 5-35). The 2010 effluent fluoride concentration (average value of 0.11 mg/L) was below the NM groundwater standard of 1.6 mg/L. In 2010, no base flow grab samples were collected in Mortandad Canyon below the Effluent Canyon outfall.

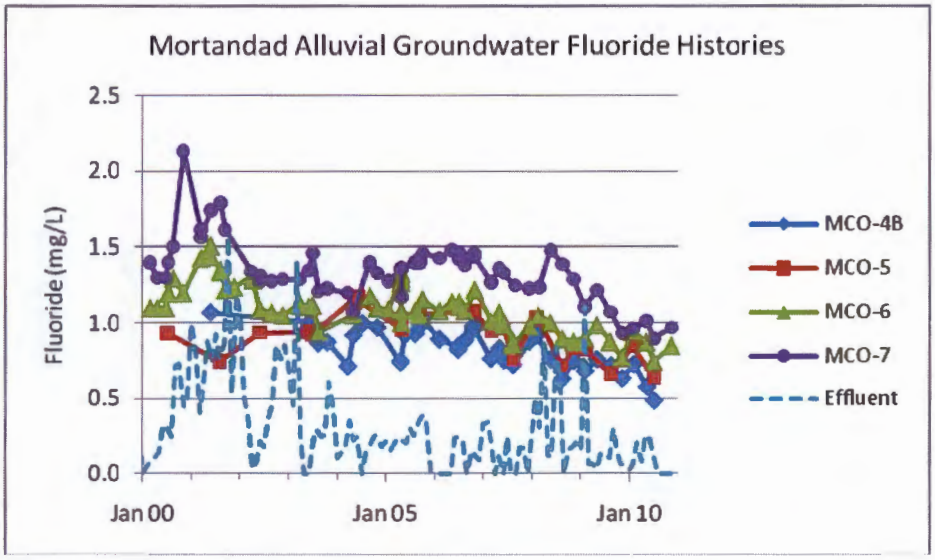

Figure 5-35 **Fluoride in RLWTF effluent and Mortandad Canyon alluvial groundwater. The NM groundwater standard is 1.6 mg/L.**

b. Mortandad Canyon Intermediate Groundwater and Regional Aquifer

The regional aquifer beneath Mortandad Canyon shows impacts from past LANL discharges; intermediate groundwater shows a larger effect. In 2010, sampling at two regional aquifer monitoring wells continued to show contamination by hexavalent chromium above the NM groundwater standard of 50 µg/L (which applies to any dissolved form of chromium) (Table 5-16, Figures 5-25 to Figure 5-28). The concentrations found at regional aquifer monitoring well R-42 averaged 1,008 µg/L, and in R-28 averaged 384 µg/L. A new regional aquifer monitoring well, R-50, had an average concentration of 58 µg/L. The Laboratory is investigating this issue in cooperation with NMED and identified past cooling tower discharges in Sandia Canyon as the likely source (ERSP 2006, LANL 2008a, LANL 2009k).

The 2010 nitrate (as nitrogen) concentration in R-28 was up to 47% of the NM groundwater standard (Figure 5-36). The nitrate (as nitrogen) concentration in R-42 was up to 63% of the standard. In nearby regional aquifer monitoring well R-15, results for tritium are higher than in unaffected wells but are below standards or screening levels. Nitrate (as nitrogen) concentrations in 2010 in R-15 ranged up to 22% of the NM groundwater standard and the 880-ft screen of R-45 had concentrations up to 23% of the standard. The perchlorate concentration in R-15 was above the Consent Order screening level of 4 µg/L (Figure 5-37). Samples taken from R-15 since June 2004 generally have perchlorate concentrations between 5.5 µg/L and 7.5 µg/L.

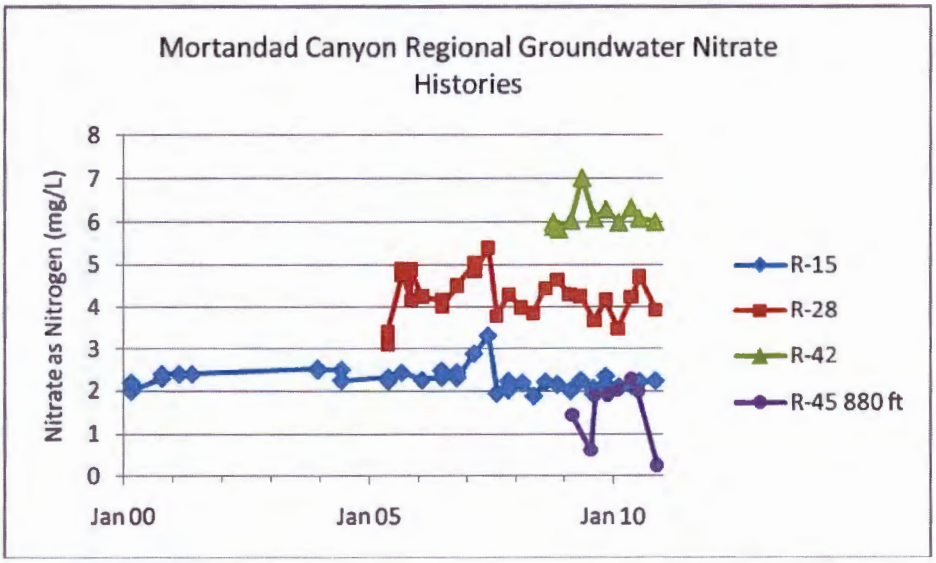

Figure 5-36 **Nitrate (as nitrogen) in Mortandad Canyon regional aquifer groundwater. The NM groundwater standard is 10 mg/L. Most of the 2007 and some 2009 results were estimated due to analytical quality issues.**

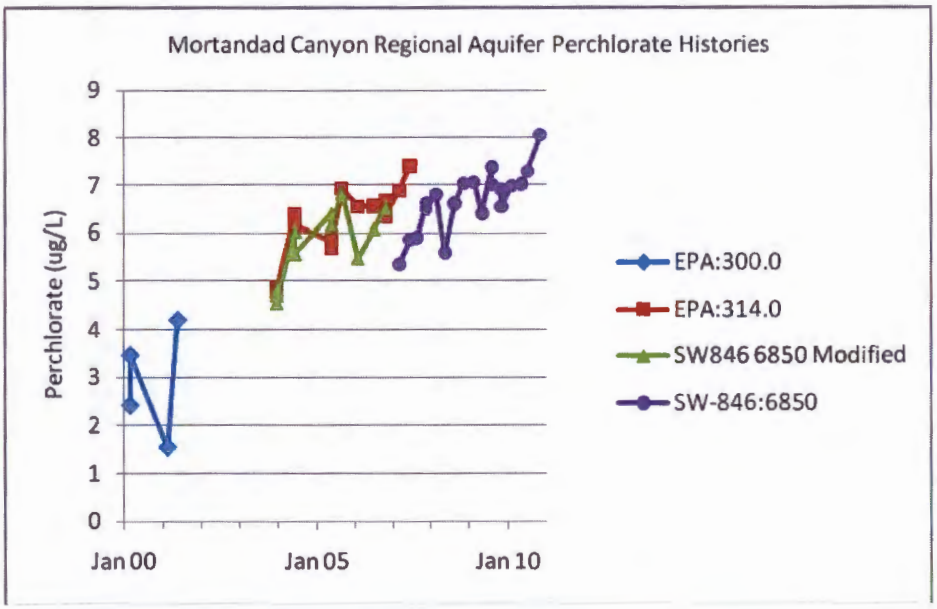

Figure 5-37 **Perchlorate in Mortandad Canyon regional aquifer well R-15. The Consent Order screening level is 4 µg/L. Data are separated by analytical method. Most results by SW846 6850 Modified were estimated due to analytical laboratory quality issues.**

In 2009, bis(2-ethylhexyl)phthalate was detected in samples from new regional aquifer wells R-38 and R-46 at concentrations above the 6 µg/L EPA MCL screening level. The concentrations, apparently caused by drilling or construction materials, ranged from 3.3 µg/L to 96 µg/L and are declining with time (Figures 5-10 and 5-15). Benzene was found in R-38 in 2009 at concentrations up to 24 µg/L, above EPA MCL screening level of 5 µg/L, but was not detected in samples during 2010.

Contaminants found in Mortandad Canyon intermediate groundwater indicate an impact by LANL effluents, with some concentrations near or exceeding regulatory standards or screening levels. MCOI-6, an intermediate groundwater well, consistently shows chromium in filtered samples at concentrations near the NM groundwater standard (Figures 5-25 and 5-26). Nitrate (Figures 5-16, 5-38, and 5-39), dioxane[1,4-] (Figures 5-23, 5-40, and 5-41), and perchlorate (Figures 5-13 and 5-42) are consistently near or above standards or screening levels in some of these intermediate groundwater monitoring wells.

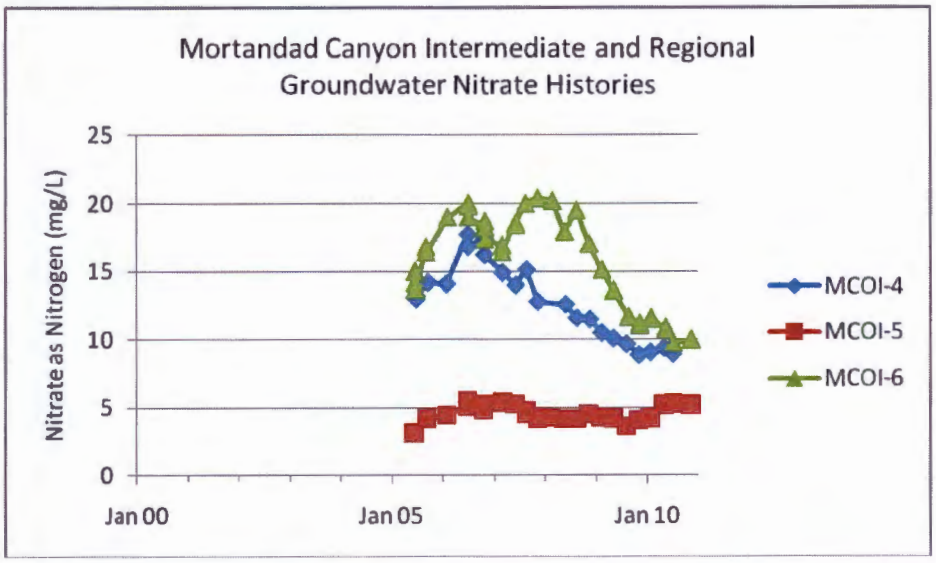

Figure 5-38 **Nitrate (as nitrogen) in Mortandad Canyon intermediate groundwater. The NM groundwater standard is 10 mg/L. Many of the results, particularly in 2006, were estimated due to analytical laboratory quality issues.**

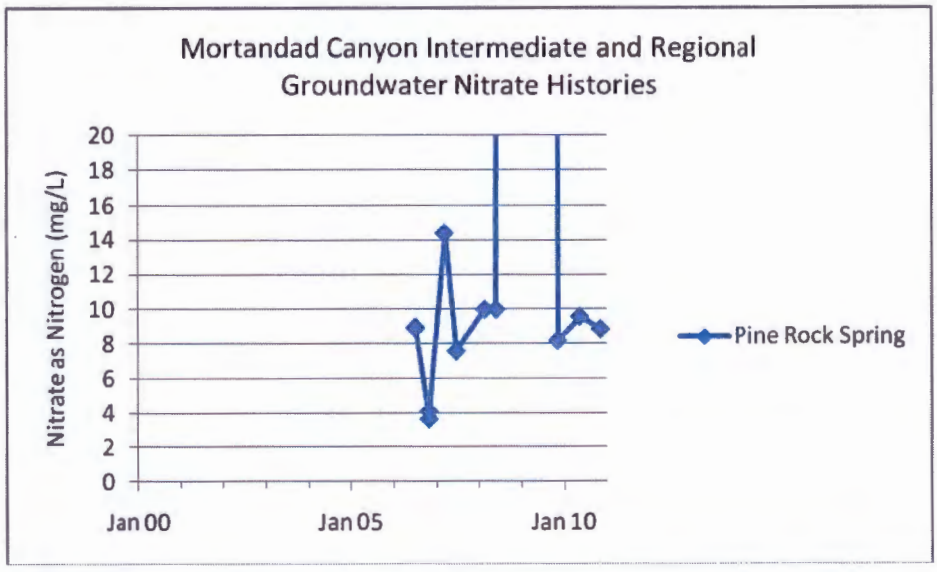

Figure 5-39 **Nitrate (as nitrogen) in Mortandad Canyon intermediate groundwater at Pine Rock Spring on Pueblo de San Ildefonso land. The NM groundwater standard is 10 mg/L. A high May 2009 result was caused by a field preservation error.**

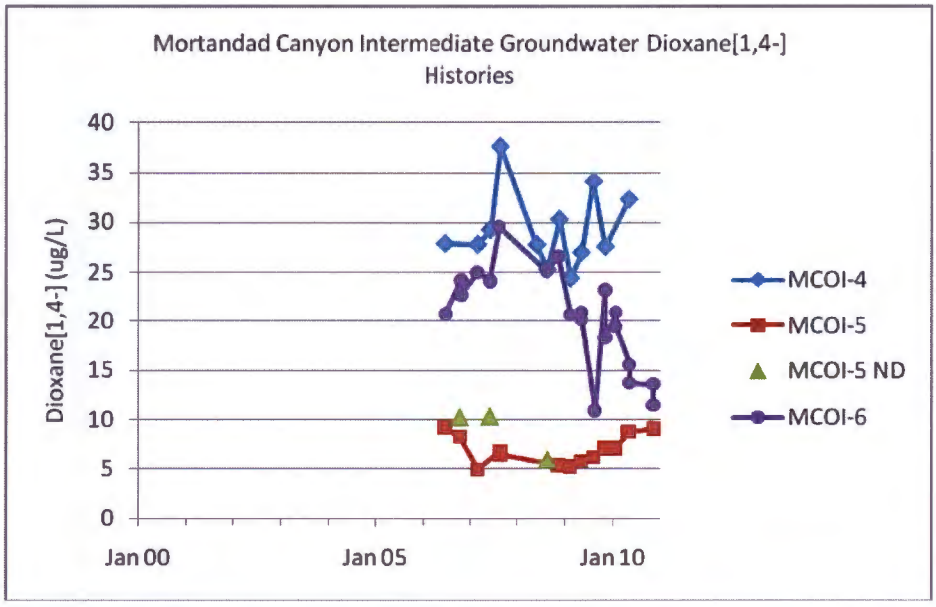

Figure 5-40 **Dioxane[1,4-] in Mortandad Canyon intermediate groundwater; for comparison purposes, the EPA Human Health tap water screening level is 6.7 µg/L. About half the results are estimated; nondetects (ND) are indicated separately for MCOI-5.**

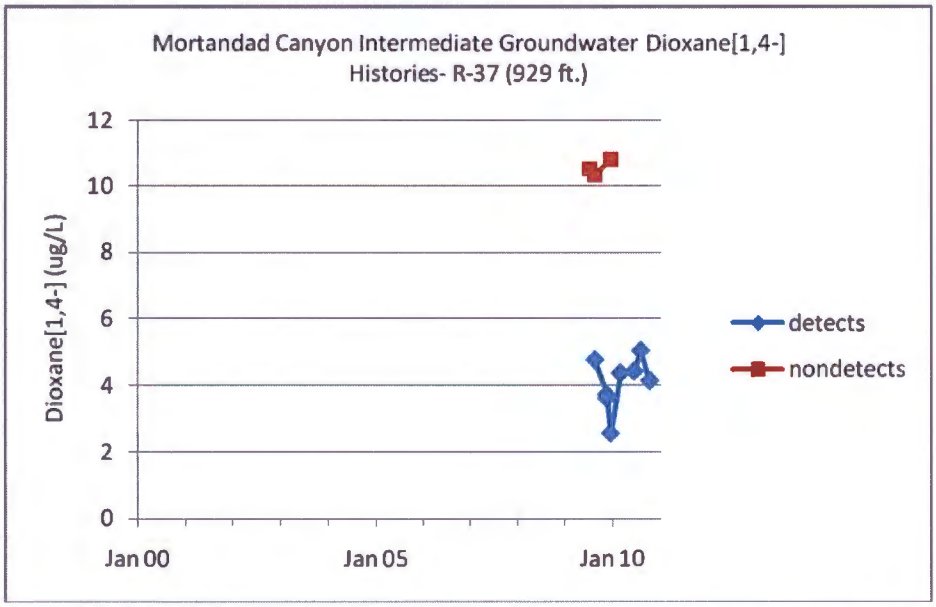

Figure 5-41 **Dioxane[1,4-] in Mortandad Canyon intermediate groundwater at 929 ft in R-37; for comparison purposes, the EPA Human Health tap water screening level is 6.7 µg/L. All detected results are estimated; nondetects (ND) are indicated separately at the PQL.**

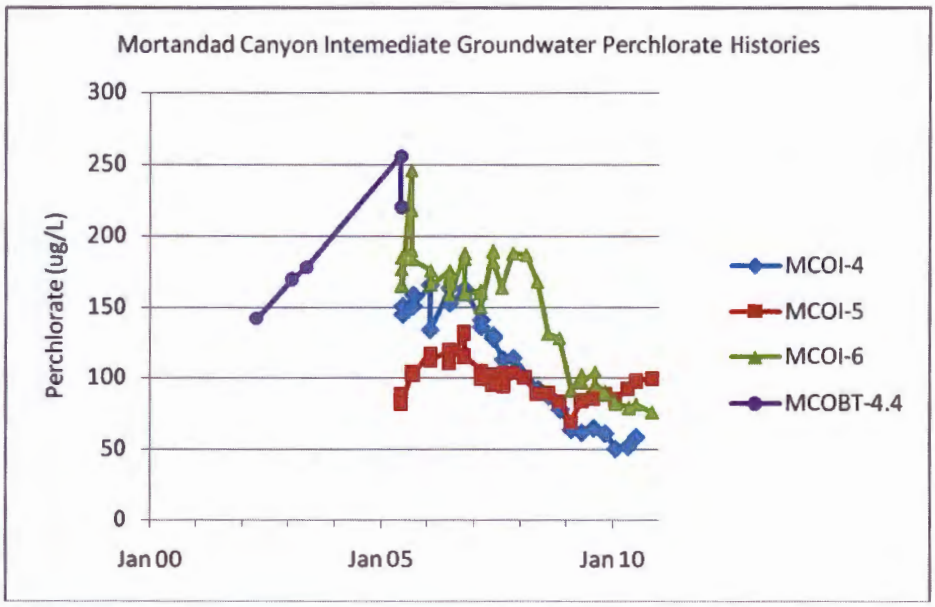

Figure 5-42 **Perchlorate in Mortandad Canyon intermediate groundwater. The Consent Order screening level is 4 µg/L.**

Three intermediate wells in Mortandad Canyon (MCOI-4, MCOI-5, and MCOI-6) had tritium activities that ranged from 15% to 35% of the EPA MCL screening level of 20,000 pCi/L (Figure 5-43). Tritium activities in these wells have decreased during the past three to four years. Another intermediate well, MCOBT-4.4, was installed in 2001 and had construction problems that caused groundwater to leak from the perched zone it sampled; it was plugged and abandoned in 2009 (LANL 2009b). The Laboratory drilled nearby MCOI-4 as a replacement.

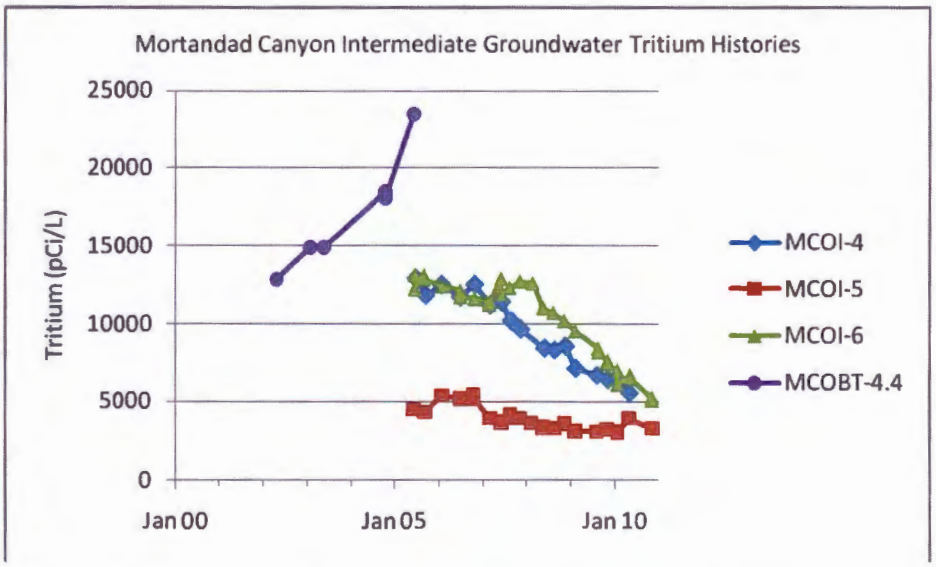

Figure 5-43 **Tritium in Mortandad Canyon intermediate groundwater. For comparison purposes, the EPA MCL screening level is 20,000 pCi/L.**

Pine Rock Spring on Pueblo de San Ildefonso land had uranium concentrations above and nitrate concentrations (Figure 5-39) just below the NM groundwater standards. Fluoride and TDS were also near the NM groundwater standards. The uranium values may be caused by dissolution of uranium from the

bedrock by sanitary effluent used to water athletic fields at nearby Overlook Park (Teerlink 2007). The nitrate, fluoride, and TDS concentrations also appear to be caused by the contribution of effluent to spring flow. One total lead measurement at the spring, of 8.9 µg/L, was at 59% of the EPA drinking water system action level. Another result in 2010 was a nondetection. Total lead has been detected in most samples at this location since 2008, at concentrations up to 14.2 µg/L. All of the filtered lead samples and the 2006 and 2007 total lead samples were nondetects.

In 2005, we measured and detected dioxane[1,4-] for the first time in two intermediate wells in Mortandad Canyon. Dioxane[1,4-] has been detected since 2006 in MCOI-4, MCOI-5, and MCOI-6 using the semivolatile organic compound method SW-846:8270C (Figures 5-23 and 5-40). The dioxane[1,4-] EPA Human Health tap water screening level is 6.7 µg/L. In November 2010, the screening level was revised from a previous value of 61 µg/L. In 2010, the highest result of 32 µg/L was in MCOI-4, above the screening level. Earlier results using the volatile organic compound method SW-846:8260B were higher, but results lack accuracy; the method is not suitable for this compound.

Dioxane[1,4-] was also detected at the 929-ft intermediate screen of a new well, R-37, located near the upper part of Cañada del Buey (Figures 5-23 and 5-41). The highest value was 75% of the EPA Human Health tap water screening level. All of the results were estimated as they were near the MDL of about 2.1 µg/L.

c. Alluvial Groundwater

Prior to effluent quality improvements in 1999, radionuclide levels in Mortandad Canyon alluvial groundwater were, in general, highest just below the TA-50 RLWTF outfall at wells MCO-3 or MCO-4B and decreased down the canyon. Most radionuclides adsorb to sediment closer to the outfall and subsequently move with sediment rather than in groundwater. Since the early 1990s, radionuclide levels in alluvial groundwater samples have not exceeded the 100-mrem/yr public dose DOE DCG screening levels (applicable to effluent discharges).

The strontium-90 activity in the RLWTF effluent has been below detection since 2003 (Figure 5-33). The inventory of strontium-90 in the alluvium is gradually declining, since discharge amounts have decreased and the half-life of strontium-90 is 28.8 years. Strontium-90 continues to be found in groundwater samples because it has been retained by cation exchange on sediment within the upstream portion of the alluvium.

In 2010, total LANL-derived radioactivity exceeded the 4-mrem/yr DOE DCG screening level in Mortandad Canyon alluvial groundwater samples from wells MCO-4B and MCO-5, was 99% of the screening level in MCO-3, and 95% of the screening level in MCO-6 (Figure 5-12). Strontium-90 was the dominant contributor to dose in these samples. The 2010 results for strontium-90 were close to or exceeded the 4-mrem/yr DOE DCG screening level (40 pCi/L) and the EPA MCL screening level (8 pCi/L) in all four wells (Figure 5-11, Figure 5-44).

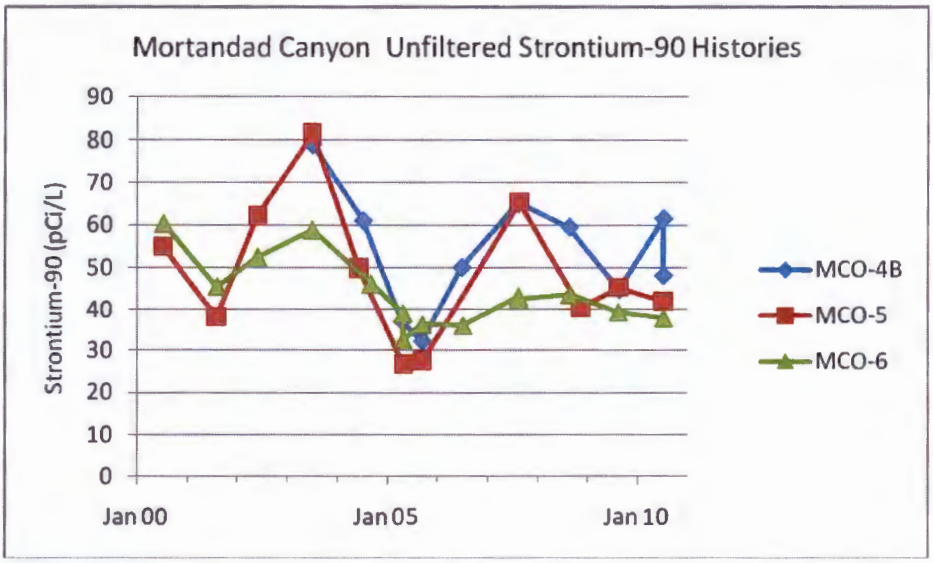

Figure 5-44 **Total (unfiltered) strontium-90 in Mortandad Canyon alluvial groundwater. For comparison purposes, the EPA MCL screening level is 8 pCi/L.**

Variable americium-241, plutonium-238, and plutonium-239/240 results in some Mortandad Canyon alluvial wells have occasionally exceeded the 4-mrem/yr DOE DCG screening levels in the last decade. In a 2009 sample at MCO-3, americium-241, plutonium-238, and plutonium-239/240 activities were each above the 4-mrem DCGs. In 2010, these radionuclides were detected at 5% to 9% of their DCGs.

Four alluvial wells (MCO-0.6, MCO-2, MCO-3, and MCO-4B) had results for chloride and TDS that approached or exceeded NM groundwater standards. MCO-0.6 is in Mortandad Canyon upstream of Effluent Canyon, and MCO-2 is in Effluent Canyon. For the past four years, more frequent data from these wells and from adjacent surface water monitoring locations show seasonal variation in chloride concentrations, with highest values beginning in winter (Figure 5-18, Figures 5-45 and 5-46). The locations of surface water monitoring stations are shown in Chapter 6. These locations show peaks in chloride concentrations in early winter, evidently the result of runoff affected by road salting. Similar trends occur in sodium concentrations and TDS (not shown).

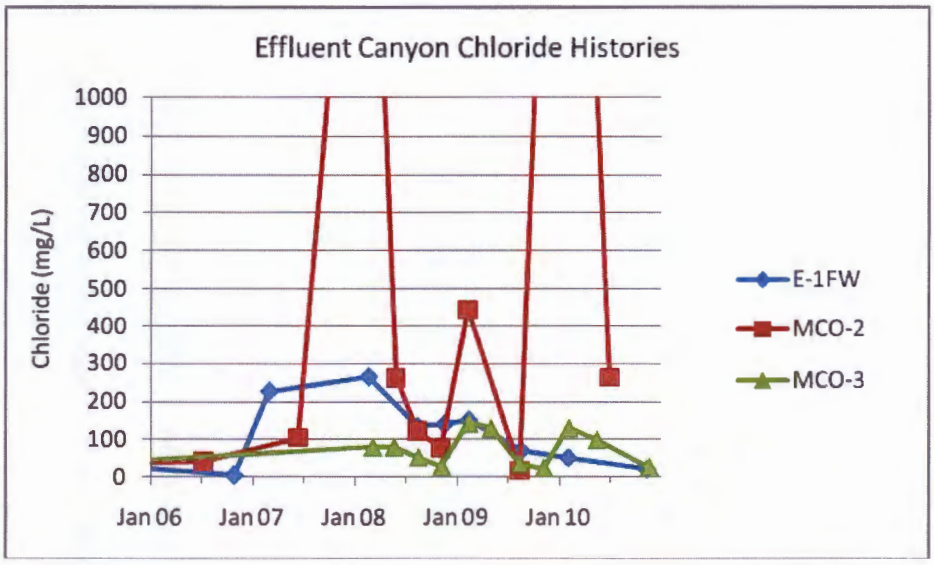

Figure 5-45 **Chloride in Mortandad Canyon surface water and alluvial groundwater. The NM groundwater standard is 250 mg/L. Surface water location E-1FW and alluvial well MCO-2 are in Effluent Canyon, a tributary of Mortandad Canyon.**

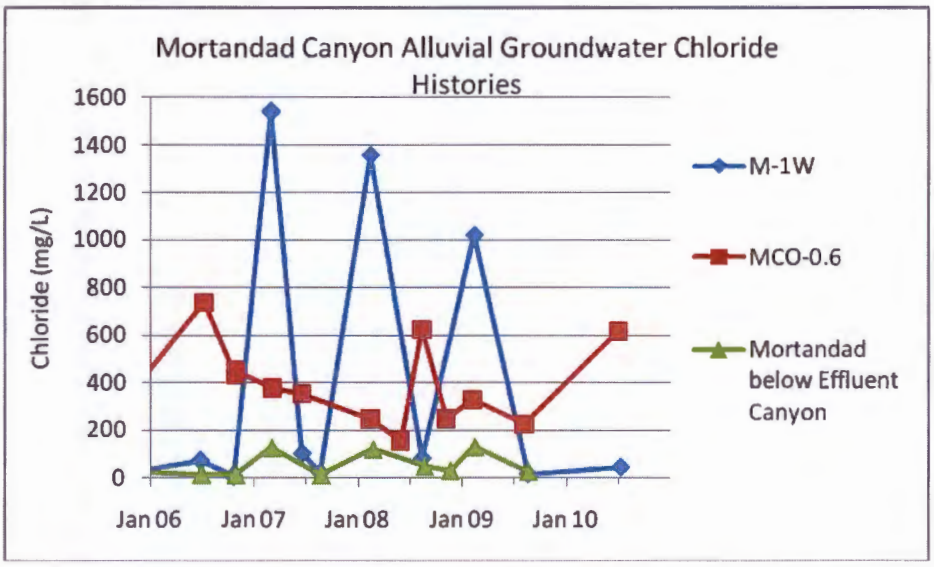

Figure 5-46 **Chloride in Mortandad Canyon surface water and alluvial groundwater. The NM groundwater standard is 250 mg/L. Surface water location M-1W and alluvial well MCO-0.6 are in Mortandad Canyon, upstream of Effluent Canyon, a tributary. Mortandad below Effluent Canyon is a surface water monitoring location.**

The highest surface water chloride concentrations were seen at location M-1W (Figure 5-46) in February of 2007, 2008, and 2009 (up to 1,540 mg/L, above the 250 mg/L NM groundwater standard). This station is in upper Mortandad Canyon, just east of a large area of roads and parking lots in the Laboratory's main technical area. Since September 2005, the chloride concentration at alluvial well MCO-0.6, located farther down the canyon, ranged from 155 mg/L to 759 mg/L. The highest values at MCO-0.6 occurred in August 2006 and 2008 and July 2010; the cause of this timing is unclear.

Surface water locations in Effluent Canyon show similar chloride concentrations pattern (Figure 5-45). The chloride concentration at E-1FW in February 2008 was 265 mg/L. Alluvial groundwater data at MCO-2 (in the middle of Effluent Canyon) also show a pattern of high concentrations of chloride and sodium in winter. High chloride concentrations occurred at MCO-2 in February 2008 (2,180 mg/L), February 2009 (444 mg/L), and January 2010 (3,300 mg/L). These two monitoring locations are upstream of the RLWTF outfall in Effluent Canyon. The canyon receives runoff from a large area of roads and parking lots.

At surface water location Mortandad below Effluent Canyon (Figure 5-46), located downstream of these monitoring sites and the RLWTF outfall, chloride concentrations also have peaked in February 2007, 2008, and 2009 (up to 132 mg/L, below the 250 mg/L NM groundwater standard). At nearby alluvial well MCO-3, chloride values in 2008 through 2010 were highest each year during February through May, up to 144 mg/L (Figure 5-45). MCO-3 has been sampled since 1963. With the exception of a few chloride results in about 1971 and 1990, the recent chloride concentrations at MCO-3 are the highest measured at the well over its monitoring history.

The chloride concentrations at MCO-3 and downstream alluvial groundwater wells have risen since 2003 and are now higher than most previous values (Figure 5-47). The annual volume of RLWTF effluent discharge and the total chloride mass discharged have decreased since 1990. The annual average effluent chloride concentration has also decreased. As the RLWTF effluent is now contributing less volume to stream flow in Mortandad Canyon and less chloride mass, this is not likely to be the cause of the increasing chloride concentration in downstream alluvial groundwater samples. These results suggest that increased application of road salt during the past few years has a greater impact on groundwater chloride concentrations than the past RLWTF effluent discharges did.

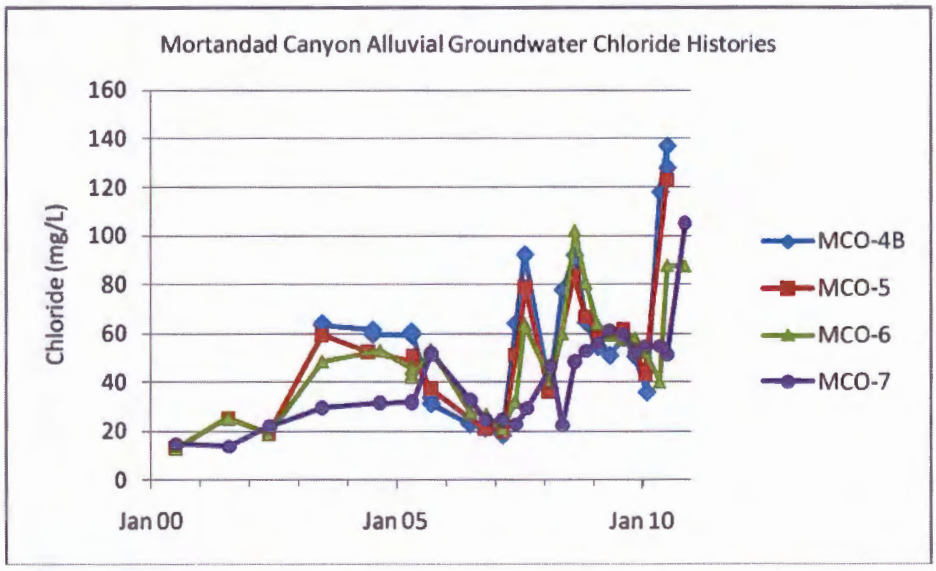

Figure 5-47 **Chloride histories for Mortandad Canyon alluvial groundwater. The NM groundwater standard is 250 mg/L.**

The high salinity runoff during the winter appears to be the cause of unusually high concentrations for other constituents observed in some alluvial wells. A January 2010 sample from MCO-2 had a TDS of 6180 mg/L, above the NM groundwater standard of 1000 mg/L. TDS results are available for MCO-2 mainly since 2006 and this is the highest TDS for the well. A prior high of 3800 mg/L was measured in February 2008. Further, these are the highest TDS results for any Mortandad Canyon alluvial well, some sampled since the 1960s.

The fluoride concentration for the January 2010 sample from MCO-2 of was 8.75 mg/L, above the NM groundwater standard of 1.6 mg/L. The highest prior fluoride results were 1.0 mg/L in 1961 and 0.88 mg/L in 2000. The barium concentration of 2360 µg/L was above the NM groundwater standard of 1000 µg/L. The high sodium concentration in road salt runoff increases the groundwater barium concentration through

cation exchange replacement of barium bound to sediments. This is the highest barium result observed at MCO-2; earlier values have been elevated in winter samples as a result of road salt runoff.

Similarly, the July 2010 sample at MCO-0.6 (upstream of Effluent Canyon and the RLWTF outfall) had a TDS of 1,560 mg/L (above the NM groundwater standard). TDS at MCO-0.6 has often been above the standard during six years of sampling. The barium concentration of 670 µg/L was below the NM groundwater standard. During the past five years, the barium concentrations have frequently reached 60% of the 1,000 µg/L standard.

In addition to high concentrations related to increased runoff salinity, other metals results from the July 2010 sample at MCO-0.6 were near or above standards. The filtered cobalt concentration of 35.6 µg/L was at 71% of the 50 µg/L NM groundwater standard. Previous filtered cobalt results collected since 2005 range from 6.3 µg/L to 25.4 µg/L.

The filtered iron and manganese results at MCO-0.6 were above the respective NM groundwater standards of 1,000 µg/L and 200 µg/L. Most of the prior results at this well have been above the standards. The 2010 filtered iron result of 49,500 µg/L at MCO-0.6 is the highest measured at the location; earlier values since 2005 range from 364 µg/L to 26,500 µg/L. The filtered manganese result of 7,800 µg/L was also the highest measured at MCO-0.6; earlier values since 2005 range from 1,460 µg/L to 5,870 µg/L.

The total chromium concentration at MCO-0.6 of 662 µg/L was above the 100 µg/L EPA MCL screening level. Previous total chromium results range from nondetect (<3.3 µg/L) to 112 µg/L. Filtered chromium measurements at this location are below 17.7 µg/L. The turbidity measured on this date was the instrument maximum of 1000 nephelometric turbidity units (NTU). Earlier values ranged from 8.9 NTU to 77 NTU.

As shown in Figures 5-34 and 5-35, the nitrate plus nitrite (as nitrogen) and fluoride concentrations of effluent discharge from the RLWTF after March 1999 have generally been below the NM groundwater standards. As mentioned above, in some cases the combined nitrate + nitrite (as nitrogen) concentration of the effluent discharges after 1999 was near or slightly above 10 mg/L. Under the groundwater discharge plan application for the RLWTF, the Laboratory collected additional quarterly samples for nitrate, fluoride, perchlorate, and TDS during 2010 from four alluvial monitoring wells below the outfall in Mortandad Canyon: MCA-5 (or MCO-3), MCO-4B, MCO-6, and MCO-7.

The 2010 nitrate (as nitrogen) concentrations in these wells were below the NM groundwater standard of 10 mg/L; the maximum was 2.67 mg/L in MCO-3. Fluoride concentrations were below the NM groundwater standard of 1.6 mg/L (Figure 5-35). Many alluvial groundwater samples collected below the RLWTF outfall had fluoride concentrations above 50% of the NM groundwater standard (Figures 5-15 and 5-35). The highest groundwater fluoride concentration downstream of the RLWTF outfall was 1.48 mg/L in MT-3.

Mortandad Canyon alluvial groundwater samples from wells downstream of the RLWTF outfall had high perchlorate concentrations (Figures 5-13 and 5-48). The 2010 concentrations at six alluvial wells were above the Consent Order screening level of 4 µg/L. Alluvial groundwater concentrations of perchlorate have dropped, especially near the outfall, following the removal of perchlorate from RLWTF effluent in March 2002.

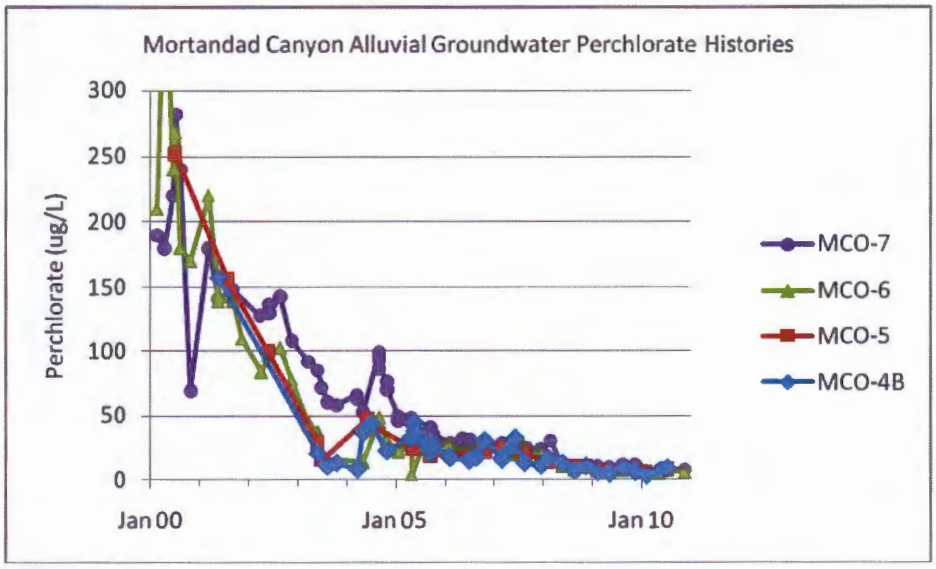

Figure 5-48 **Perchlorate in Mortandad Canyon alluvial groundwater. The Consent Order screening level is 4 µg/L.**

d. Cañada del Buey

Alluvial well CDBO-6 in Cañada del Buey was sampled three times in 2010. There were no results measured near or above regulatory standards or screening levels. All other alluvial wells in Canada del Buey were dry.

5. Pajarito Canyon (includes Twomile and Threemile Canyons)

Pajarito Canyon has a drainage that extends into the Sierra de los Valles, west of the Laboratory. Saturated alluvium occurs in lower Pajarito Canyon near the eastern Laboratory boundary, but does not extend beyond the boundary. In the past, the Laboratory released small amounts of wastewater into tributaries of Pajarito Canyon from several HE-processing sites at TA-9 (Table 5-17). Some firing sites border portions of tributaries Twomile and Threemile canyons. A nuclear materials experimental facility occupied the floor of Pajarito Canyon at TA-18. Waste management areas at TA-54, used for disposal of organic chemicals and low-level radioactive waste, occupy the mesa north of the lower part of the canyon. A small contaminated body of shallow intermediate groundwater occurs behind a former Laboratory warehouse location at TA-3, where the Laboratory disposed of waste materials. The main water quality impacts are from organic chemicals released at the TA-3 warehouse and from HE (Table 5-18).

Table 5-17
Summary of Groundwater Contamination in Pajarito Canyon (includes Twomile and Threemile Canyons)

		Groundwater Contaminants		
Canyon	Contaminant Sources	Alluvial	Intermediate	Regional
Pajarito, Twomile, and Threemile Canyons	Major non-effluent sources; liquid sources major in past but minor currently	Barium at, chloride, and TDS above NM groundwater standards	Dichloroethene[1,1-] and trichloroethane[1,1,1-] above and chloride at 88% of NM groundwater standards; total antimony above, trichloroethene at 33%, and total beryllium at 65% of EPA MCL screening levels; dioxane[1,4-] above and RDX at 61% of EPA Human Health tap water screening level; total lead above EPA drinking water system action level	Trichloroethene at 35% of EPA MCL screening level; trace RDX

Table 5-18
Groundwater Quality in Pajarito Canyon (includes Twomile and Threemile Canyons)

Chemical	Location	Result	Trends
RDX	Regional aquifer well R-18	0.80 µg/L to 0.89 µg/L, below EPA Human Health tap water screening level of 6.1 µg/L	Found in all sample events since August 2006; values increasing
Trichloroethene	Regional aquifer well R-20	0.56 µg/L to 1.8 µg/L, below EPA MCL screening level of 5 µg/L	Found in every sample event since December 2008; concentration decreasing since December 2009
Chloride	Intermediate well 03-B-13	75 mg/L to 221 mg/L, below NM groundwater standard of 250 mg/L	From road salt; previously above standard; highest results during March and December for four years of sampling
Total lead	Intermediate well 03-B-13	1.1 µg/L to 21.8 µg/L, above EPA drinking water system action level of 15 µg/L; filtered lead up to 7.1 µg/L	Detected in nearly every sample for five years; variable concentrations
Dichloroethene [1,1-]	Intermediate well 03-B-13	1.12 µg/L to 13.9 µg/L, above NM groundwater standard of 5 µg/L	Detected in every sample for five years; seasonally variable with highest concentrations in 2008
Trichloroethane [1,1,1-]	Intermediate well 03-B-13	39.9 µg/L to 176 µg/L, above NM groundwater standard of 60 µg/L	Detected in every sample for five years; seasonally variable with highest concentrations in 2006
Trichloroethene	Intermediate well 03-B-13	0.53 µg/L to 1.6 µg/L, below EPA MCL screening level of 5 µg/L	Detected in every sample for five years; seasonally variable with highest concentrations in 2006
Dioxane[1,4-]	Intermediate well 03-B-13	10.2 µg/L to 919 µg/L, above EPA Human Health tap water screening level of 6.7 µg/L	Detected for five years; seasonally variable with highest concentration in June 2010
Trichloroethene	Intermediate well R-40	0.46 µg/L to 0.81 µg/L, below EPA MCL screening level of 5 µg/L	Found in two of three sample events in 2010; not found in 2011 or 2009
RDX	Intermediate Bulldog Spring	3.7 µg/L, below EPA Human Health tap water screening level of 6.1 µg/L	Found in every sample at Bulldog Spring; sampled since 2004; values fluctuate
Total antimony	Intermediate well R-40	0.6 µg/L to 8.9 µg/L, above EPA MCL screening level of 6 µg/L	High and low values in two of four sample events in 2010, reflecting higher turbidity of 4.7 NTU
Chloride	Alluvial wells PCAO-7a, PCAO-7b2, 18-MW-18, PCO-2, PCAO-8, PCAO-9	38.6 mg/L to 590 mg/L, above NM groundwater standard of 250 mg/L	Concentrations peak in summer, possibly delayed movement of road salt plume
TDS	Alluvial wells PCAO-8, PCAO-9	604 mg/L to 1,740 mg/L, above NM groundwater standard of 1,000 mg/L	Concentrations peak in summer, possibly delayed movement of road salt plume
Barium	Alluvial well PCAO-7a, PCAO-7b2, PCAO-8, PCAO-9	117 µg/L to 998 µg/L, near NM groundwater standard of 1,000 µg/L	Possibly due to cation exchange caused by high sodium in road salt runoff

Rehabilitation activities were conducted at regional aquifer well R-20 through December 2007 to improve sample quality (LANL 2008b). Beginning with a December 18, 2008, sample, trichloroethene has been detected at the 1,147-ft regional aquifer screen in every sample event (Figure 5-49). Results from the first sample events were near the detection limit of 0.25 µg/L and were estimated. Results from the next two sample events reached 3.04 µg/L in December 2009. Sample concentrations declined during 2010. The EPA MCL for trichloroethene is 5 µg/L. Trichloroethene has not been detected at the shallower 904 ft regional screen and was not detected at R-20 prior to rehabilitation. A source for trichloroethene has not been determined at this time, and additional wells are being drilled to investigate water quality in the area.

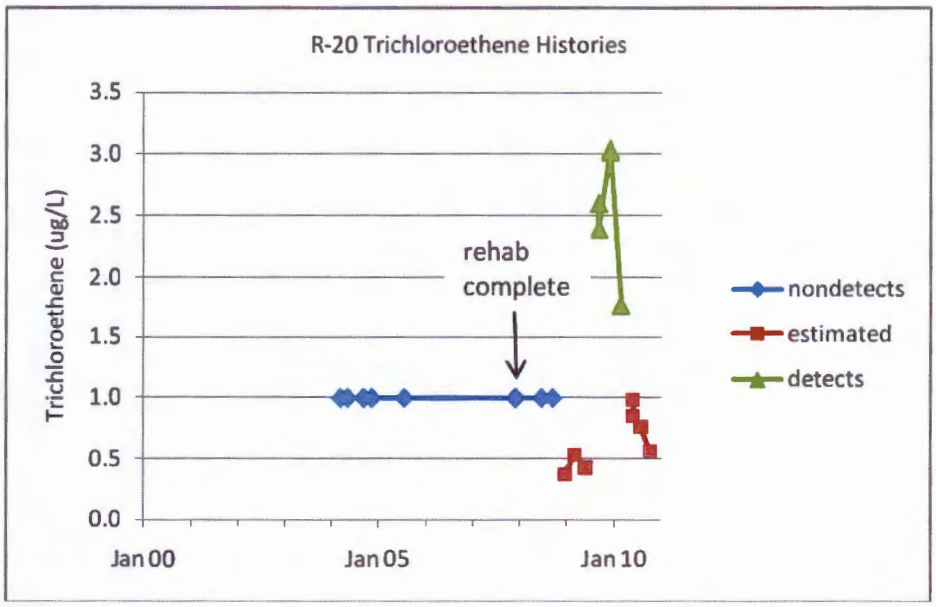

Figure 5-49 **Trichloroethene in Pajarito Canyon regional aquifer well R-20. For comparison purposes, the EPA MCL is 5 µg/L. Nondetects are reported at the PQL of 1 µg/L; the MDL is 0.25 µg/L. The well underwent rehabilitation in 2007.**

Trichloroethene was also detected twice (out of four sample events) during 2010 at the 751-ft intermediate screen in R-40. This well is about 0.25 mile up Pajarito Canyon from R-20. The estimated concentrations were 0.46 µg/L and 0.81 µg/L. Trichloroethene was not detected in 2009 or 2011 at this screen, or at all in the other intermediate screen (at 649 ft) or the regional screen (at 849 ft) of R-40.

The total antimony concentrations at the 751-ft intermediate screen in R-40 ranged from 0.6 µg/L to 8.9 µg/L, above the EPA MCL screening level of 6 µg/L. Two of four sample events in 2010 had values at the high end of the range, reflecting higher turbidity of 4.7 NTU.

RDX was detected at Pajarito Canyon regional well R-18 at a concentration that is at 15% of the EPA Human Health tap water screening level. RDX has been detected at this well since August 2006 in every sample at increasing concentrations.

During sampling of three wells in 2010, samples were improperly preserved with nitric acid instead of another acid. As a result high nitrate (as nitrogen) concentrations were found in samples at R-20 (at 904 ft on August 3), R-19 (at 1412 ft on October 14) and at PCI-2 (an intermediate well, on August 2). The nitrate (as nitrogen) concentrations in these samples ranged from 735 mg/L to 810 mg/L and were far above the measured TDS values of 120 mg/L to 145 mg/L.

Samples from several of the intermediate groundwater springs in upper Pajarito Canyon contained RDX, HMX, and other HE compounds as in prior years. One RDX result from Bulldog Spring was just below the EPA Human Health tap water screening level (Figures 5-50 and 5-51).

SWMU 03-010(a) is the outfall area from a former vacuum repair shop and is currently under investigation (LANL 2005b). The outfall area is located on a steep slope on the rim of Twomile Canyon about 30 ft west of a general warehouse (Building 03-30). Technicians working at the vacuum repair shop discarded vacuum pump oil at this site in the 1950s. The oil contained radionuclides, rinse solvents, and mercury. A small zone of shallow intermediate perched groundwater is apparently recharged by runoff from the parking lot and building roofs; the groundwater becomes contaminated through contact with the soil.

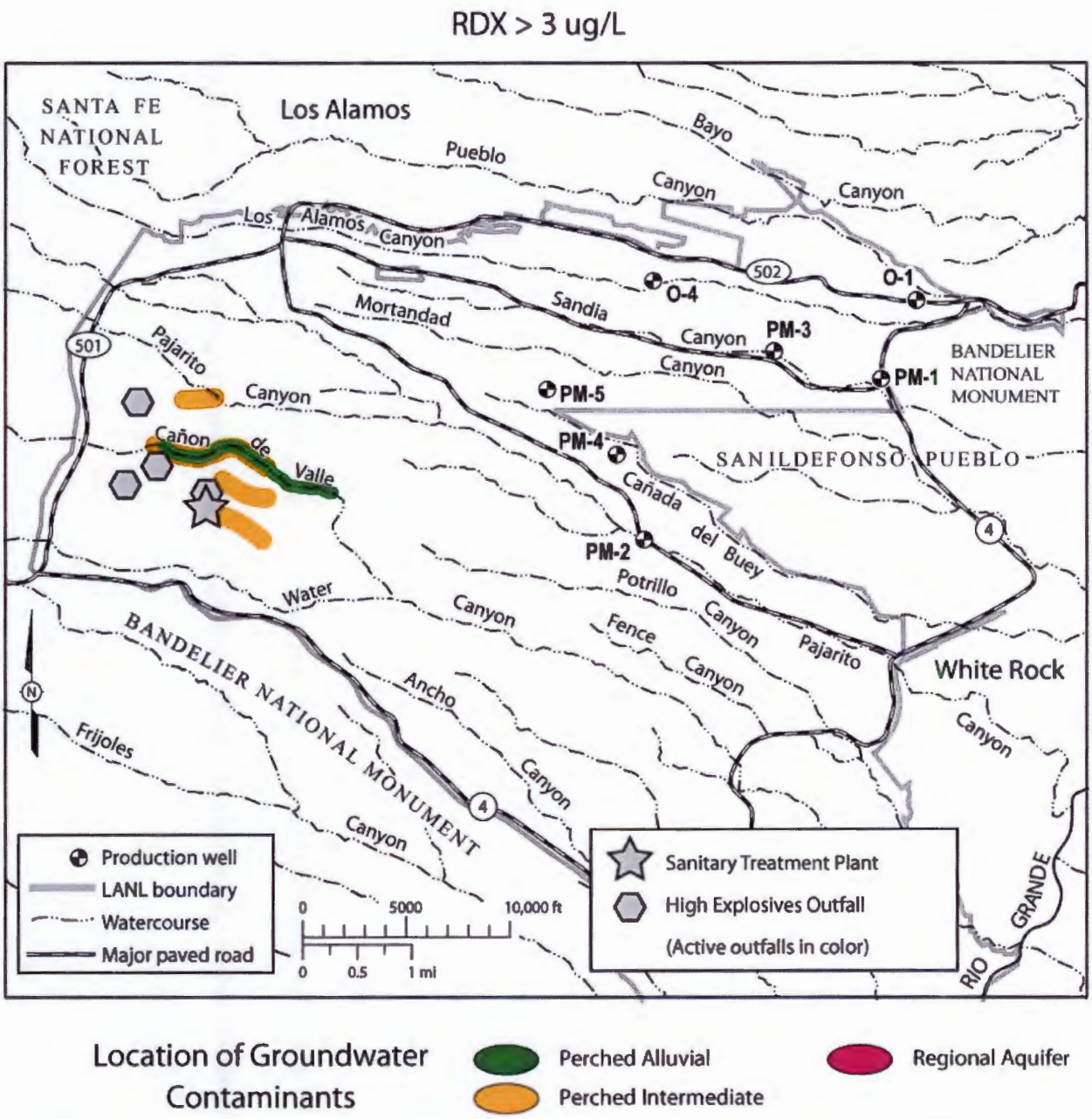

Figure 5-50 **Location of groundwater containing RDX above one half of the EPA Human Health tap water screening level of 6.1 µg/L. Different colors indicate the affected groundwater zones.**

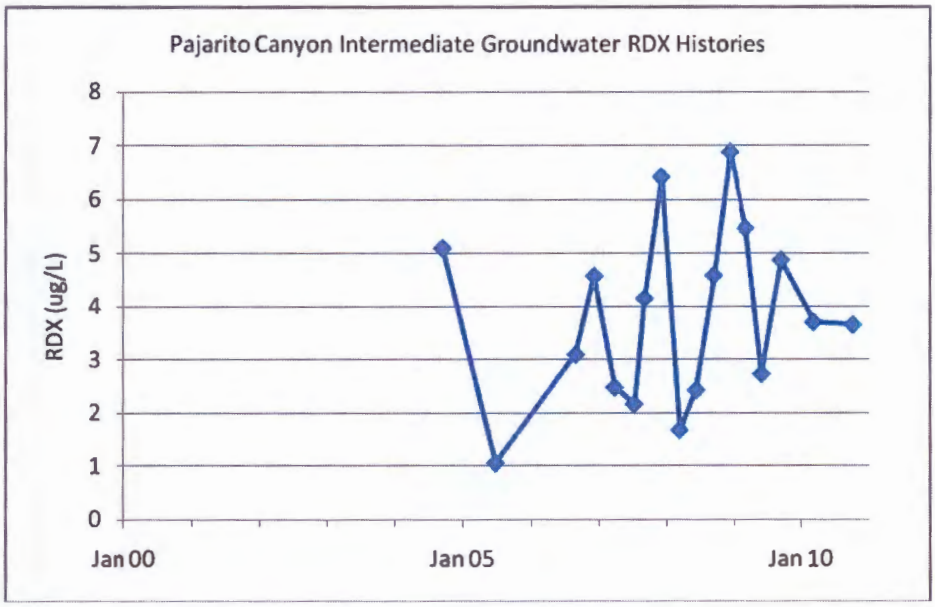

Figure 5-51 **RDX in Pajarito Canyon intermediate groundwater at Bulldog Spring. For comparison purposes, the EPA Human Health tap water screening level is 6.1 µg/L.**

This perched groundwater is tapped by well 03-B-13. Two other wells, 03-B-09 and 03-B-10, were plugged and abandoned in 2009 (LANL 2009c). Samples from 03-B-13 during 2010 had chloride (Figure 5-18, Figure 5-52) and TDS (not shown) results that were high but below groundwater standards. The seasonal pattern of sodium (not shown) and chloride concentrations, with high values in winter, suggest that road salting is the source of this variation. Samples from these wells also contained several organic chemicals including four chlorinated solvents (Table 5-18). Several organic chemicals were at concentrations exceeding NM groundwater standards or other screening levels. Compounds found in well samples included dichloroethane[1,1-], dichloroethene[1,1-], trichloroethene, trichloroethane[1,1,1-], and dioxane[1,4-].

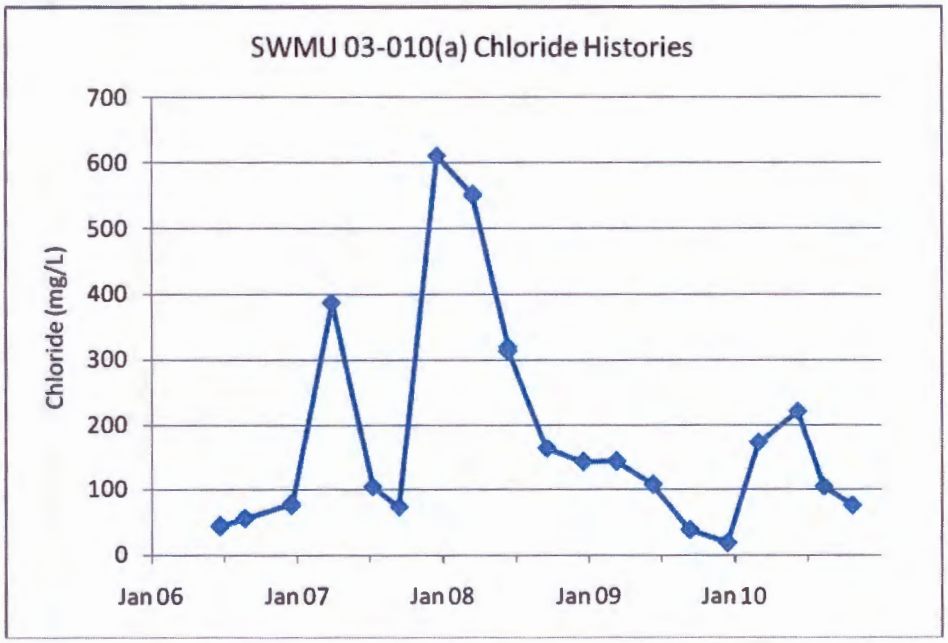

Figure 5-52 **Chloride history in Pajarito Canyon intermediate groundwater at TA-3 well 03-B-13. The NM groundwater standard is 250 mg/L.**

Seasonal variation is shown by several other field parameters and chemical compounds measured in water samples from wells 03-B-10 and 03-B-13 (LANL 2009). Variation in oxidation-reduction potential (ORP) and total organic carbon (TOC) indicate changes in reducing conditions. Changes in oxidation-reduction potential lead to observed seasonal changes in turbidity and concentrations of dissolved iron and manganese; under more reducing conditions, iron and manganese are more soluble.

Figures 5-53 through 5-55 show dichloroethene[1,1-], trichloroethane[1,1,1-], and dioxane[1,4-] histories for 03-B-13. For some solvents, their retention on solid surfaces is lower in higher ionic strength solutions. Thus, increases in concentration of dichloroethene[1,1-] and trichloroethane[1,1,1-] could result from increasing concentration of sodium and chloride, which releases these compounds from the aquifer matrix. For example, the high chloride (Figure 5-52) and TDS observed in the groundwater in December 2007 might cause release of trichloroethane[1,1,1-] during the following months (Figure 5-54).

The 2010 total lead concentration in 03-B-13 of up to 21.8 µg/L was above the EPA drinking water system action level of 15 µg/L. Total lead has been detected at variable concentrations in nearly every sample for five years.

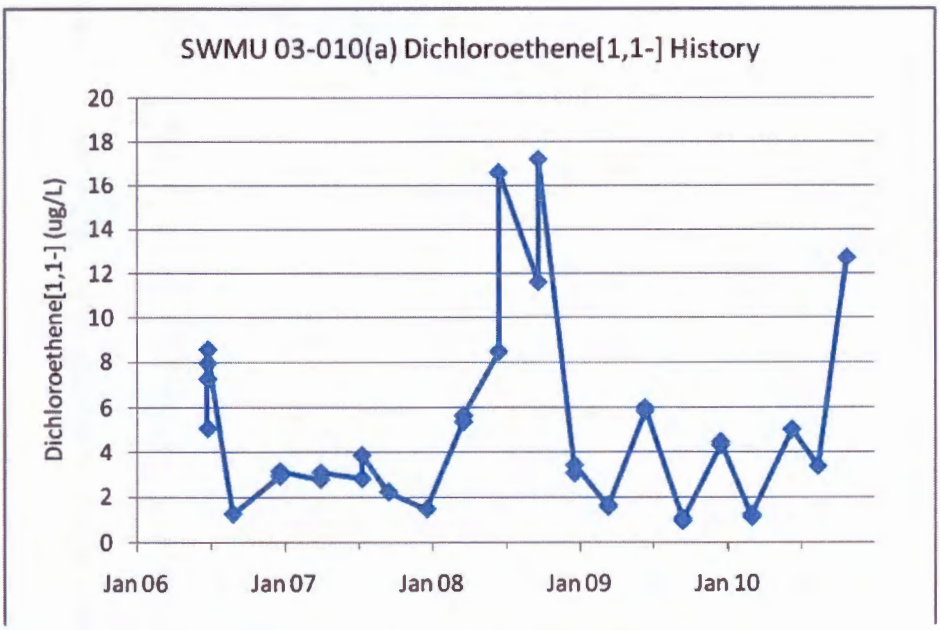

Figure 5-53 **Dichloroethene[1,1-] history in Pajarito Canyon intermediate groundwater at TA-3 well 03-B-13. The NM groundwater standard is 5 µg/L.**

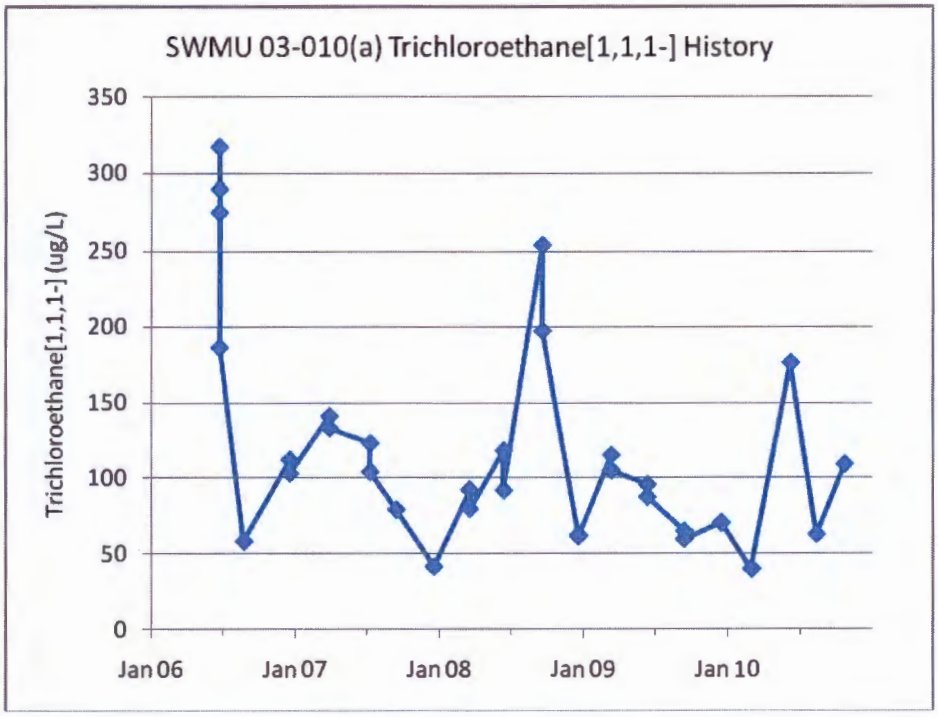

Figure 5-54 **Trichloroethane[1,1,1-] history in Pajarito Canyon intermediate groundwater at TA-3 well 03-B-13. The NM groundwater standard is 60 µg/L.**

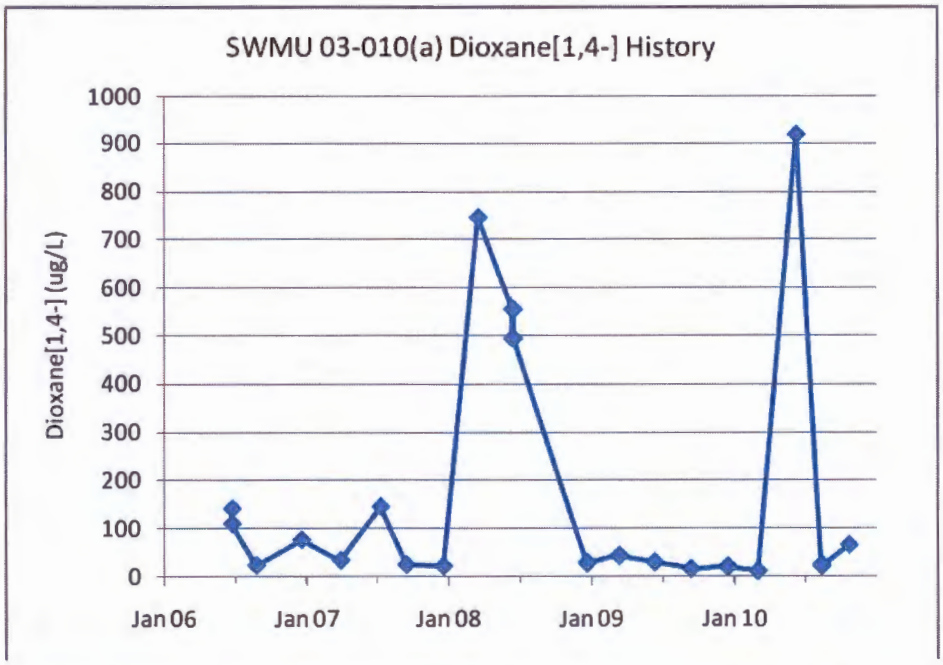

Figure 5-55 **Dioxane[1,4-] history in Pajarito Canyon intermediate groundwater at TA-3 well 03-B-13. For comparison purposes, the EPA Human Health tap water screening level is 6.7 µg/L.**

Several alluvial groundwater wells along Pajarito Road (including PCAO-7a, PCAO-7b2, 18-MW-18, PCO-2, PCAO-8, and PCAO-9) showed high chloride (Figures 5-18 and 5-56) and TDS concentrations

during 2010. More frequent sampling in recent years shows a seasonal pattern of winter increase in concentrations of chloride, sodium, and TDS. Runoff related to road salting is the apparent cause. The highest chloride concentrations in 2010 were at PCAO-8 (203 mg/L) and PCAO-9 (590 mg/L). The concentration at PCAO-9 was above the NM groundwater standard of 250 mg/L. These two wells are not shown on Figure 5-56 because they are often dry. Chloride and TDS concentrations at these wells peak in the summer, possibly due to slow movement of the chloride plume. An alluvial spring, TW-1.27 Spring in upper Pajarito Canyon, also shows high winter chloride concentrations. In March 2009, the chloride concentration at TW-1.72 Spring was 170 mg/L, below the NM groundwater standard. The spring was not sampled in 2010.

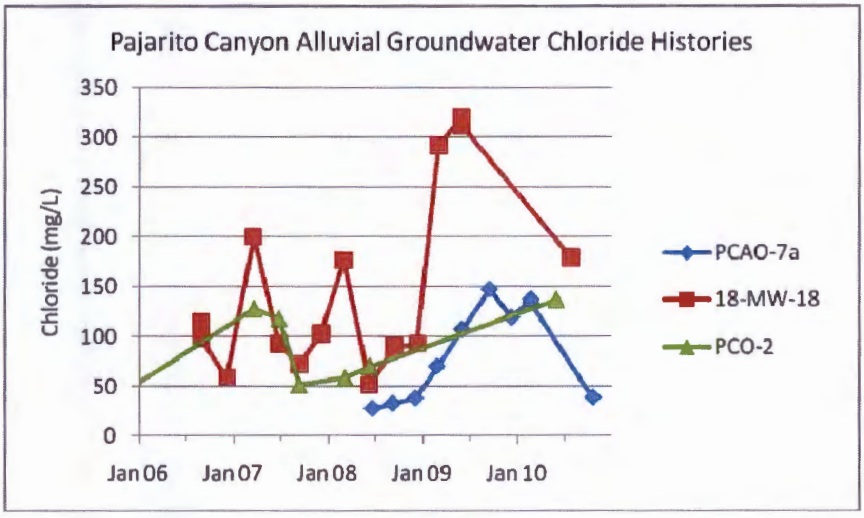

Figure 5-56 **Histories for chloride in Pajarito Canyon alluvial groundwater. The NM groundwater standard is 250 mg/L.**

Barium concentrations are elevated in several alluvial wells and, at 998 µg/L in PCAO-9, are just below the NM groundwater standard of 1,000 µg/L (Figures 5-57 and 5-58). Barium concentrations show seasonal fluctuations; high sodium concentrations in road salt runoff lead to cation exchange replacement of barium bound to sediments, increasing the groundwater barium concentration.

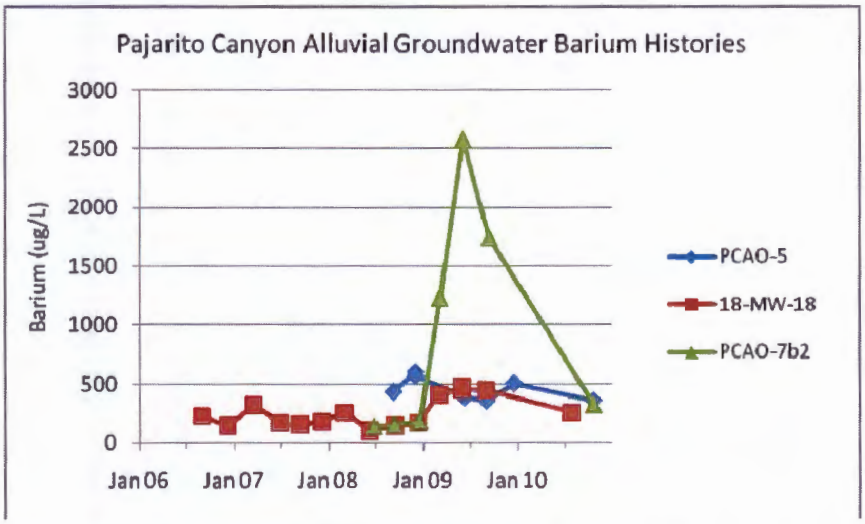

Figure 5-57 **Histories for barium in Pajarito Canyon alluvial groundwater. The NM groundwater standard is 1,000 µg/L.**

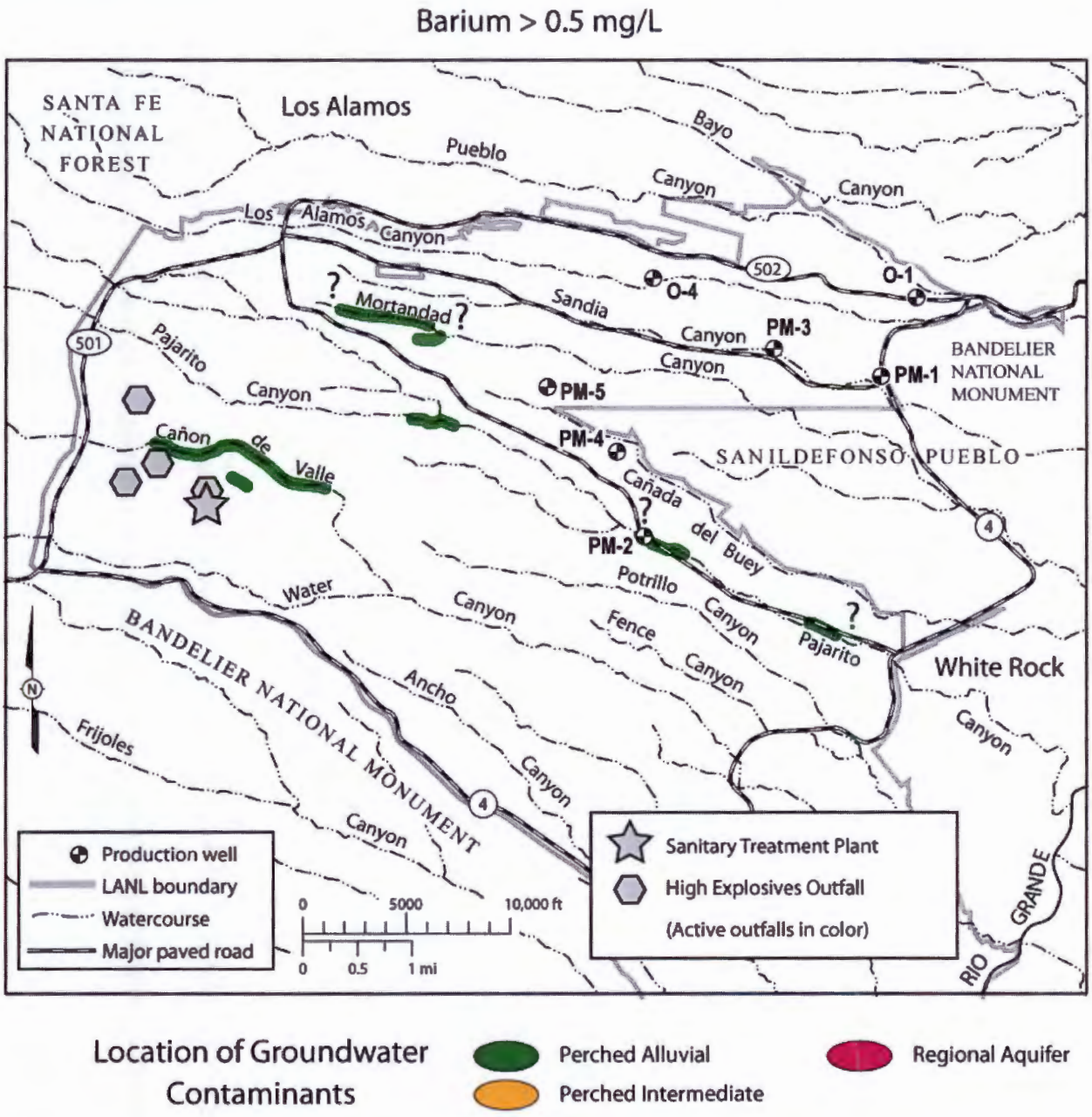

Figure 5-58 **Location of groundwater containing barium above one half of the NM groundwater standard of 1,000 µg/L. Different colors indicate the affected groundwater zones.**

Samples from alluvial well PCAO-5 had the highest 2009 filtered manganese values of any groundwater samples, up to 14,000 µg/L, above the 200 µg/L NM groundwater standard. The 2010 filtered manganese result was 8,350 µg/L. Filtered iron values were also high: up to 20,800 µg/L in 2009, above the 1,000 µg/L NM groundwater standard. The 2010 filtered iron result was 12,200 µg/L. Turbidity values for 2009 and 2010 were below 2 NTUs. This well is located in a wetland. Based on high TOC values, the groundwater is under reducing conditions. These reducing conditions would increase solubility of iron, manganese, and other metals. Alternatively, the metals could be present in groundwater as organic-metal colloids.

6. Water Canyon (includes Cañon de Valle, Potrillo, Fence, and Indio Canyons)

Water Canyon and Cañon de Valle (a tributary) traverse the southern portion of LANL where the Laboratory conducts explosives development and testing. In the past, the Laboratory released wastewater into both canyons from several HE processing sites in TA-16 and TA-9 (Table 5-19). In 1997, the Laboratory consolidated these individual NPDES outfalls into one outfall from the High Explosives Wastewater Treatment Facility. This outfall discharges a much smaller amount of water that generally meets NPDES permit requirements. Alluvial groundwater in Cañon de Valle shows barium above 1,000 µg/L, the NM groundwater standard (Table 5-20, Figure 5-58), and RDX above the EPA Human Health tap water screening level of 6.1 µg/L (Figure 5-50). Intermediate perched groundwater in this area also shows RDX at concentrations above 6.1 µg/L. The Potrillo, Fence, and Indio canyon watersheds contain several open-burning/open-detonation and firing sites used for testing of weapons system components. These three small canyons have surface water only in response to precipitation events and no known alluvial or intermediate groundwater.

Table 5-19
Summary of Groundwater Contamination in Water Canyon
(includes Cañon de Valle, Potrillo, Fence, and Indio Canyons)

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
Cañon de Valle	Multiple dry and past effluent sources	Barium and boron above and TDS at 86% of NM groundwater standards; tetrachloroethene, and total beryllium above and trichloroethene at 77% of EPA MCL screening levels; total lead above EPA drinking water system action level; and RDX above EPA Human Health tap water screening level	Boron and nickel above NM groundwater standards; total chromium above , tetrachloroethene at 32%, and trichloroethene at 32% of EPA MCL screening levels; total lead at 71% of EPA drinking water system action level; RDX above EPA Human Health tap water screening level	Trace tetrachloroethene, trace RDX
Water Canyon	Multiple dry and past effluent sources	None, little alluvial groundwater	No intermediate groundwater	None
Potrillo, Fence, and Indio Canyons	Minor non-effluent sources	No alluvial groundwater	No intermediate groundwater	None

Table 5-20
Groundwater Quality in Water Canyon (includes Cañon de Valle, Potrillo, Fence, and Indio Canyons)

Chemical	Location	Result	Trends
RDX	Regional aquifer well R-25	0.37 µg/L, below EPA Human Health tap water screening level of 6.1 µg/L	Perhaps present due to well construction delays in 2000; levels have decreased; present in two regional screens in 2010
Tetrachloroethene	Regional aquifer well R-25	0.38 µg/L, below EPA MCL screening level of 5 µg/L	Present for four years of sampling at shallowest regional screen
Boron	Intermediate Martin Spring	1,240 µg/L to 1,440 µg/L, above NM groundwater standard (for irrigation use) of 750 µg/L	Consistent with results collected over 20-year period; approximate 40% decrease since 2003
Nickel	Intermediate well R-25	454 µg/L, above NM groundwater standard of 200 µg/L	Similar results in shallowest screen since 2001 due to construction damage
Total chromium	Intermediate well R-25	29 µg/L, below EPA MCL screening level of 100 µg/L	High total results in shallowest screen due to construction damage, declining from 153 µg/L since 2005
Total lead	Fish Ladder Spring	9.6 µg/L, below EPA drinking water system action level of 15 µg/L	Variable concentrations, often this high for 12 years of sampling

Table 5-20 (continued)

Chemical	Location	Result	Trends
RDX	Three intermediate springs, eight wells or well screens	Up to 265 µg/L, above EPA Human Health tap water screening level of 6.1µg/L	Present for 15 years of sampling at springs, during several years of sampling of wells
Tetrachloroethene	Three intermediate springs, nine wells or well screens	0.34 µg/L to 1.6 µg/L, below EPA MCL screening level of 5 µg/L	Present for 15 years of sampling at springs, during several years of sampling of wells
Trichloroethene	Three intermediate springs, five wells or well screens	0.31 µg/L to 1.6 µg/L, below EPA MCL screening level of 5 µg/L	Present for 15 years of sampling at springs, during several years of sampling of wells
Barium	Four alluvial wells in Cañon de Valle, one in Fish Ladder Canyon	713 µg/L to 6,470 µg/L, above NM groundwater standard of 1,000 µg/L	Present at these levels for 13 years of sampling in Cañon de Valle, three years in Fish Ladder Canyon
Total beryllium	Alluvial well CDV-16-2644	4.01 µg/L, above EPA MCL screening level of 4 µg/L	< 1 µg/L to 9.6 µg/L during 14 years of samples
Boron	Martin Spring Canyon alluvial well MSC-16-06293	929 µg/L, above NM groundwater standard (for irrigation use) of 750 µg/L	Median of concentrations in five samples since 2000
Total Lead	CDV-16-02655, FLC-16-25280	10 µg/L to 19 µg/L, above EPA drinking water system action level of 15 µg/L	Similar results for three years in Fish Ladder Canyon well, many detections up to 67 µg/L in Cañon de Valle well
TDS	Cañon de Valle alluvial well CDV-16-02655	858 mg/L, below NM groundwater standard of 1,000 mg/L	In mid-range of concentrations since 1998
RDX	Alluvial wells in Cañon de Valle, Martin Spring Canyon, Fish Ladder Canyon	0.2 µg/L to 18 µg/L, above EPA Human Health tap water screening level of 6.1 µg/L	Highest in Cañon de Valle, present at these levels for 12 years; also near screening level in Fish Ladder Canyon
Tetrachloroethene	Fish Ladder Canyon alluvial well FLC-16-25280	127 µg/L, above EPA MCL screening level of 5 µg/L	Similar concentrations for three years
Trichloroethene	Fish Ladder Canyon alluvial well FLC-16-25280	3.3 µg/L, below EPA MCL screening level of 5 µg/L	Fourth sample in five years, previously up to 11.8 µg/L

Boron was found in samples from intermediate Martin Spring at concentrations above the NM groundwater standard for irrigation use, a reflection of past effluents (Figure 5-59). This spring is not used for irrigation. Boron is also present at high levels in downstream alluvial wells (Figure 5-60).

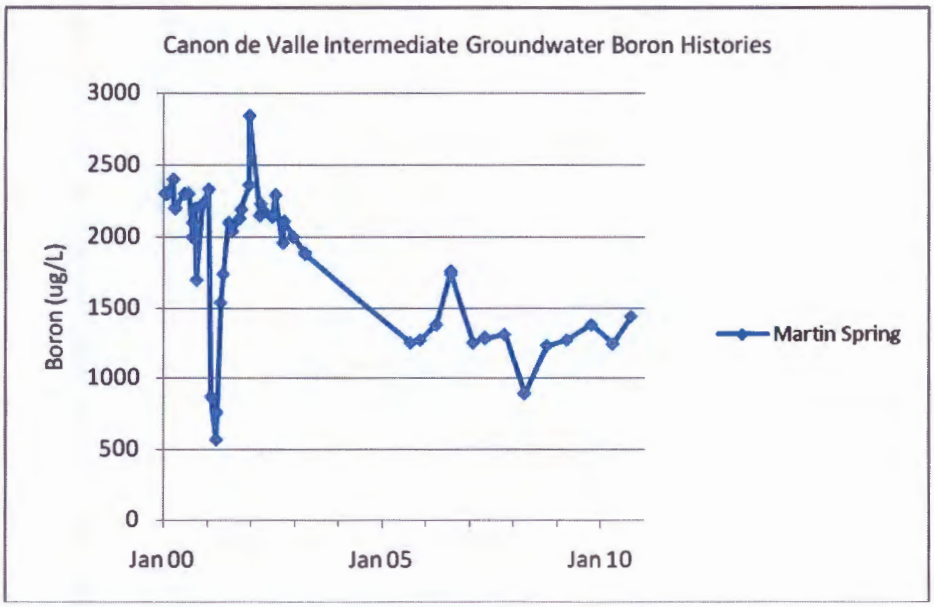

Figure 5-59 **Boron in Cañon de Valle tributary Martin Spring Canyon intermediate groundwater at Martin Spring. The NM groundwater standard (for irrigation use) is 750 µg/L.**

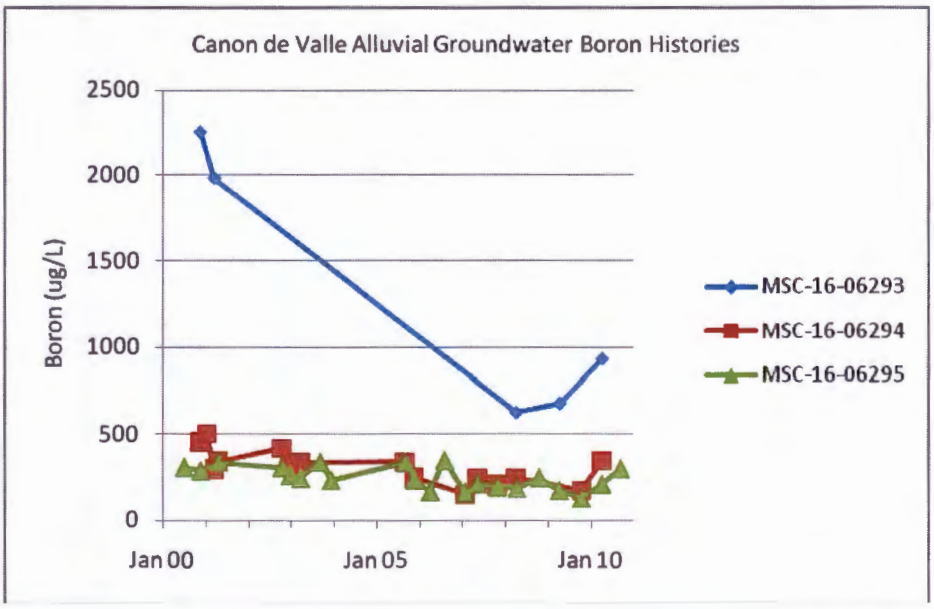

Figure 5-60 **Boron in Cañon de Valle (tributary Martin Spring Canyon) alluvial groundwater. The NM groundwater standard (for irrigation use) is 750 µg/L.**

The shallowest two screens at well R-25 (which sample intermediate groundwater) have shown high concentrations of metals such as nickel and chromium for several years. These screens were damaged during drilling of the well. In 2008, new wells were drilled to replace some of the upper R-25 screens.

A number of intermediate perched zone well and spring samples contained several HE compounds. Of these compounds, RDX was present at the highest concentrations compared with screening levels, above the 6.1 µg/L EPA Human Health tap water screening level (Figures 5-50, 5-61, 5-62, and 5-63). The RDX levels have been fairly steady at most of these monitoring sites. The concentrations show some seasonal fluctuation, for example, at Martin Spring (Figure 5-63).

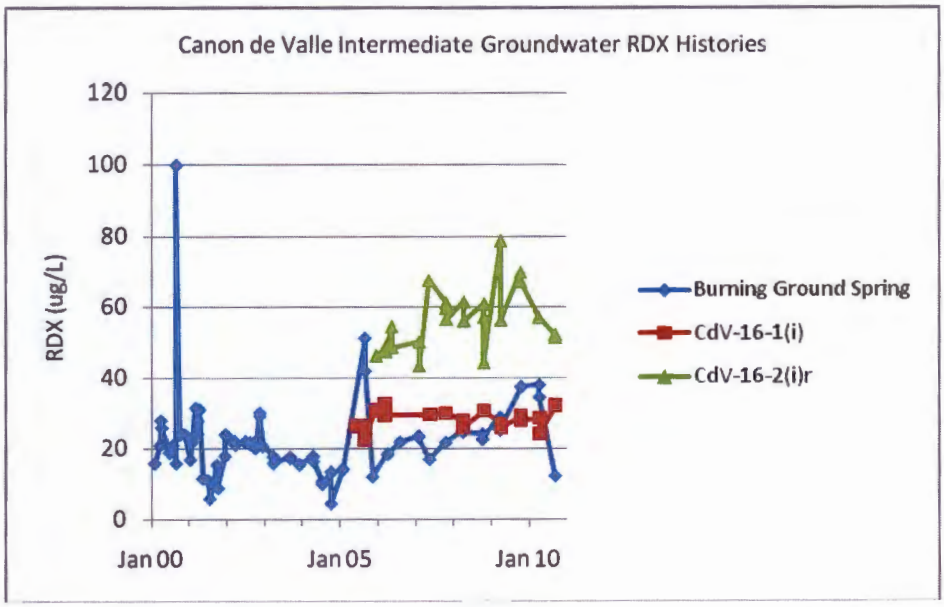

Figure 5-61 **RDX in Cañon de Valle intermediate groundwater. For comparison purposes, the EPA Human Health tap water screening level is 6.1 µg/L.**

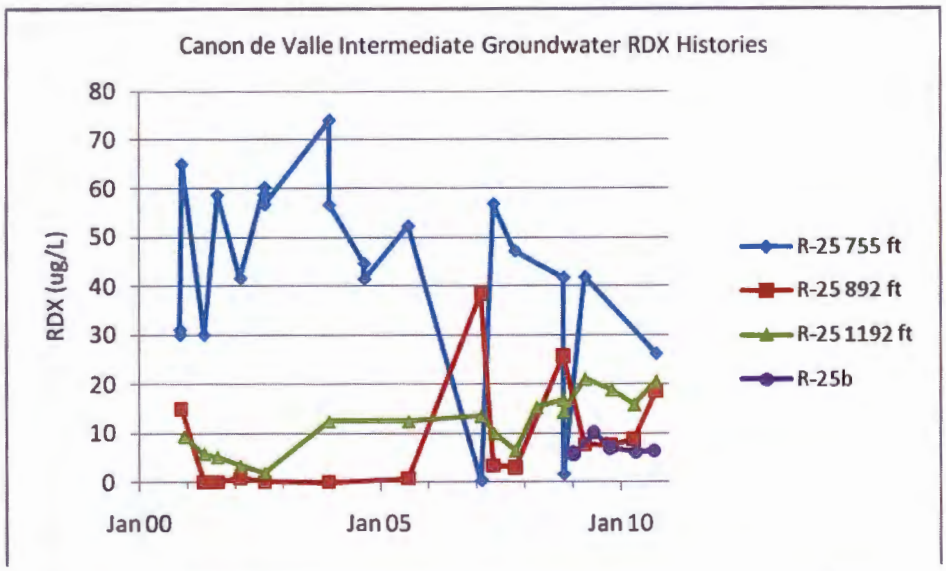

Figure 5-62 **RDX in Cañon de Valle intermediate groundwater. For comparison purposes, the EPA Human Health tap water screening level is 6.1 µg/L.**

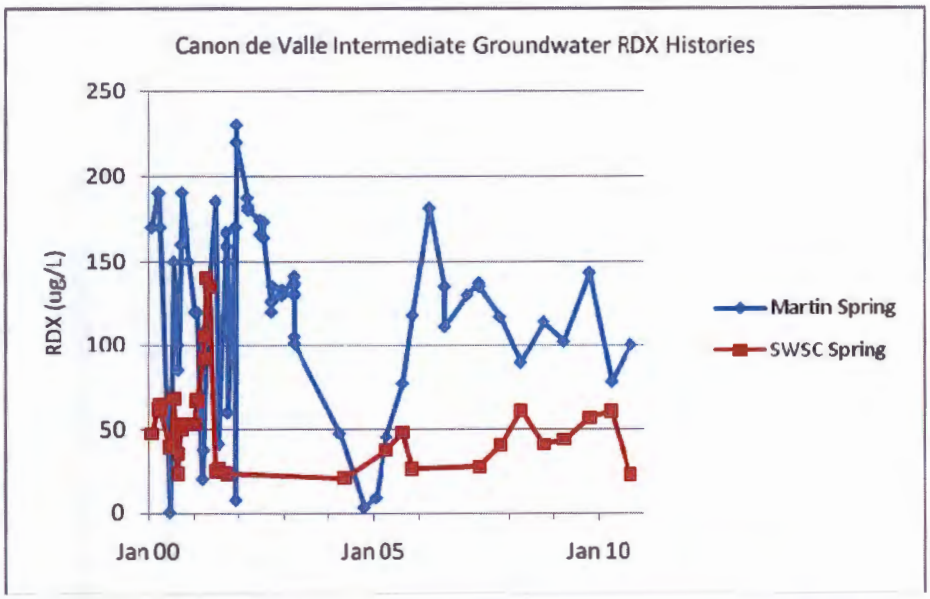

Figure 5-63 **RDX in Cañon de Valle intermediate groundwater. For comparison purposes, the EPA Human Health tap water screening level is 6.1 µg/L.**

As seen in Figure 5-62, samples from the shallowest two screens at well R-25, which sample intermediate groundwater, show variability that may be due to switching of samples or drilling of new nearby wells (LANL 2009d).

The chlorinated solvents tetrachloroethene and trichloroethene continue to be found in several intermediate wells and springs (Table 5-20).

Barium, present due to past HE wastewater discharges, exceeded the NM groundwater standard in several alluvial wells in Cañon de Valle (Figures 5-58 and 5-64). These alluvial well samples also contained several HE compounds. As with intermediate perched groundwater, RDX was the HE compound present in alluvial groundwater at the highest concentrations compared with risk levels, with some sample results above the 6.1 µg/L EPA Human Health tap water screening level (Figures 5-50 and 5-65).

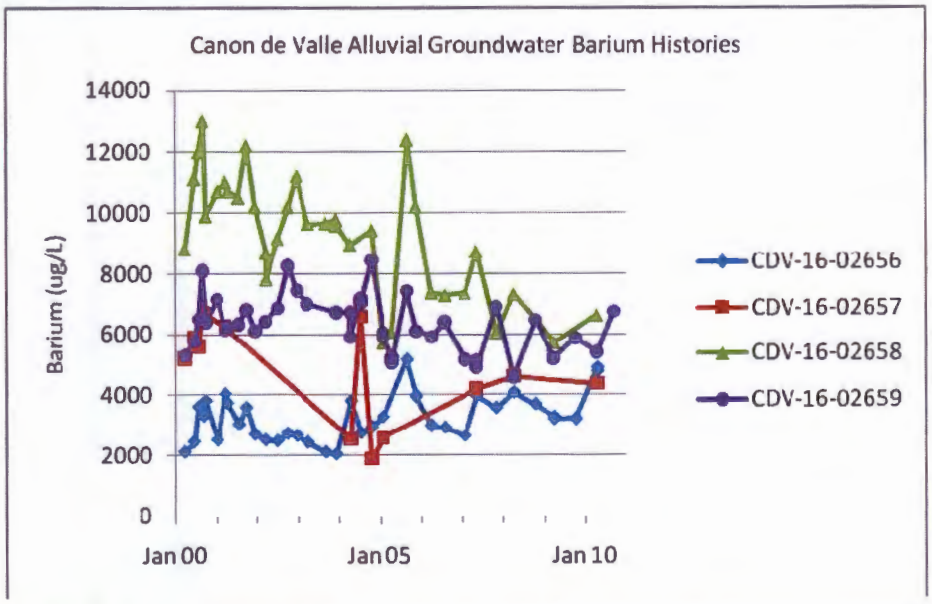

Figure 5-64 **Barium in Cañon de Valle alluvial groundwater. The NM groundwater standard is 1,000 µg/L.**

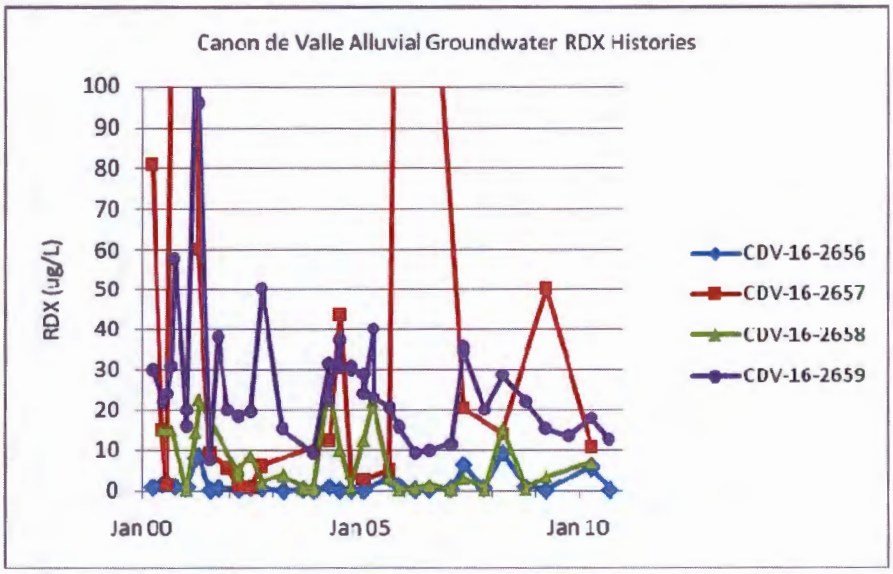

Figure 5-65 **RDX in Cañon de Valle alluvial groundwater. For comparison purposes, the EPA Human Health tap water screening level is 6.1 µg/L.**

The 2010 sample from alluvial well FLC-16-25280 in Fish Ladder Canyon contained high concentrations of tetrachloroethene (127 µg/L) and trichloroethene (3.5 µg/L) (Figures 5-66 and 5-67). Tetrachloroethene was above the EPA MCL screening level of 5 µg/L. This is the fourth sample at this well; the first sample was collected in 2006. Similarly high tetrachloroethene concentrations of about 40 µg/L have also been found in past samples from nearby Fish Ladder Spring. Otherwise, the tetrachloroethene concentration measured at FLC-16-25280 is the highest in groundwater samples at LANL, by nearly two orders of magnitude. The trichloroethene concentration measured at FLC-16-25280 is also among the highest measured. Both compounds are found in other groundwater samples in this part of LANL.

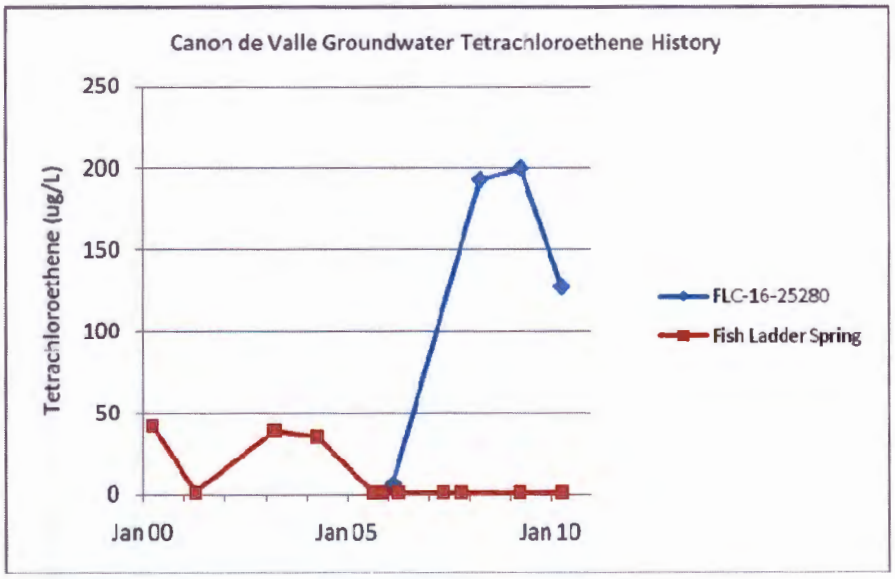

Figure 5-66 **Tetrachloroethene in Cañon de Valle alluvial and intermediate groundwater; for comparison purposes, the EPA MCL is 5 µg/L. Recent results at Fish Ladder Spring are nondetects reported at the PQL of 1 µg/L; the MDL is 0.25 µg/L.**

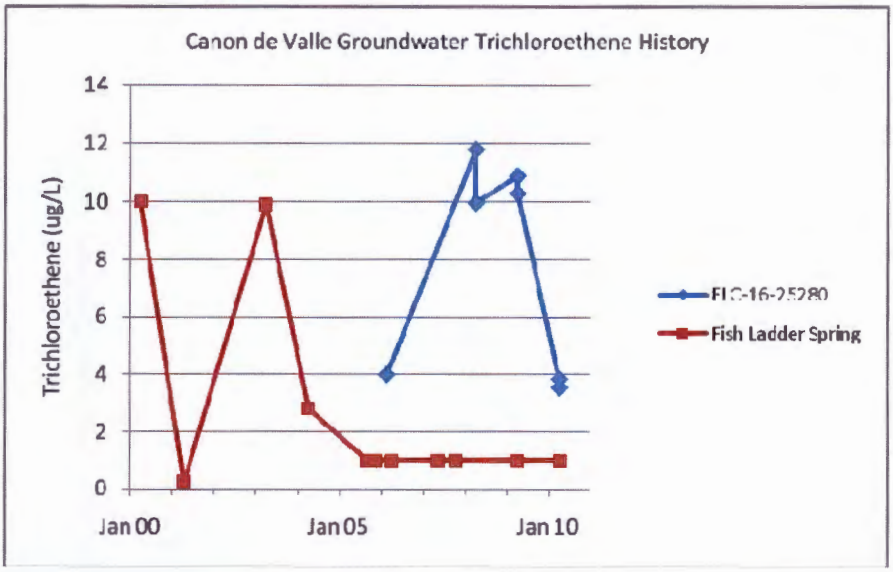

Figure 5-67 **Trichloroethene in Cañon de Valle alluvial and intermediate groundwater; for comparison purposes, the EPA MCL is 5 µg/L. Recent results at Fish Ladder Spring are nondetects reported at the PQL of 1 µg/L; the MDL is 0.25 µg/L.**

7. Ancho Canyon

Area AB at TA-49 was the site of underground nuclear weapons component testing from 1959 to 1961 (Purtymun and Stoker 1987; ESP 1988). The tests involved insufficient HEs and fissionable material to produce a nuclear reaction. The canyons in the watershed are mainly dry with little alluvial and no known intermediate groundwater. In 1960, the US Geological Survey drilled three deep wells (Test Wells DT-5A, DT-9, and DT-10) to monitor regional aquifer water quality. Another regional aquifer well, R-31, lies downstream from firing sites at TA-39. No contaminants were found in these wells at concentrations near or above standards (Table 5-21). As with other wells installed during that period, samples from these three test wells have shown high metals concentrations related to corrosion or flaking of well components. In 2010, the total lead concentration in a sample from Test Well DT-9 of 20.1 µg/L was above the EPA drinking water system action level of 15 µg/L. Another sample during the year had a total lead result of < 2 µg/L. Some results during the 1990s were above 50 µg/L.

Table 5-21
Summary of Groundwater Contamination in Ancho Canyon

		Groundwater Contaminants		
Canyon	Contaminant Sources	Alluvial	Intermediate	Regional
Ancho Canyon	Minor non-effluent sources and past effluent sources	Little or no alluvial groundwater	No intermediate groundwater	None

8. White Rock Canyon Springs

The springs that issue along the Rio Grande in White Rock Canyon represent a principal discharge of regional aquifer groundwater that flows underneath the Laboratory (Purtymun et al., 1980). The White Rock Canyon springs serve as boundary monitoring points for evaluating the Laboratory's impact on the regional aquifer and the Rio Grande (Table 5-22). A few springs such as Spring 2B (near Spring 2 on Figure 5-8) appear to represent discharge of intermediate perched groundwater; that spring is supplied by percolation of

municipal sanitary effluent discharge or irrigation with effluent from athletic fields near White Rock. It has only been sampled in 2003 and 2005 due to lack of flow. Other springs may be a mixture of regional aquifer groundwater, intermediate perched groundwater, and percolation of recent precipitation (Longmire et al., 2007).

Table 5-22
Summary of Groundwater Contamination in White Rock Canyon Springs

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
White Rock Canyon: Springs	Sources in tributary canyons	No alluvial groundwater	Little intermediate groundwater	Natural fluoride, arsenic, uranium

In 2010, we changed analytical laboratories for low-level tritium analyses. In August 2011 investigation revealed that results from the new provider (ARSL) were subject to calculation errors. At the time of this report, these data had not been corrected. Nonetheless, the tritium values in the White Rock Canyon springs are broadly similar to results measured during the last decade. Tritium was not detected in most of the springs.

In previous years, the highest results have been found at the Spring 4 group of springs. Tritium activities in samples from these springs decreased after 2002 and in 2009 were about 8 pCi/L at Spring 4 and Spring 4C and 23 pCi/L at Spring 4B. In 2010, results were nondetect at Spring 4 (due to method blank contamination), 6.7 pCi/L at Spring 4C, and 29.5 pCi/L at Spring 4B. These three springs discharge within a hundred yards of each other near the Rio Grande.

Other than tritium, the only radionuclide detection of note in White Rock Canyon springs was natural uranium in La Mesita Spring (Table 5-23). Naturally occurring uranium is commonly detected in this spring and a few other nearby wells and springs.

Table 5-23
Groundwater Quality in White Rock Canyon Springs

Chemical	Location	Result	Trends
Uranium	Regional aquifer La Mesita Spring, east of Rio Grande (Pueblo de San Ildefonso)	12.7 µg/L, below NM groundwater standard of 30 µg/L	Naturally occurring
Total arsenic	Regional aquifer Spring 2 (Pueblo de San Ildefonso)	Up to 13 µg/L, above EPA MCL screening level of 10 µg/L; NM groundwater standard is 100 µg/L	Naturally occurring

Results for White Rock Canyon spring perchlorate samples collected in 2010 are consistent with prior data; concentrations are below background levels observed in sampling of NM groundwater by Plummer et al. (2006). The highest perchlorate value occurs east of the Rio Grande at La Mesita Spring on Pueblo de San Ildefonso land at a concentration of 0.87 µg/L. This spring also shows high nitrate and uranium values; it is not located near any apparent sources of contamination. Several of the springs in the Spring 4 series had perchlorate values of 0.5 to 0.7 µg/L, the highest concentrations for springs along the west side of the Rio Grande.

9. Pueblo de San Ildefonso

This section covers results from Pueblo de San Ildefonso supply wells that lie near and east of the Rio Grande (Table 5-24). Other Pueblo de San Ildefonso wells and springs were covered in prior sections. The groundwater data for these wells and springs indicate the widespread presence of naturally occurring uranium at levels below the NM groundwater standard of 30 µg/L (Table 5-25). These measurements are consistent with previous samples. Naturally occurring uranium concentrations near or exceeding the NM groundwater standard are prevalent in well water throughout the Pojoaque area and Pueblo de San Ildefonso lands.

Table 5-24
Summary of Groundwater Contamination in White Rock Canyon Wells

Canyon	Contaminant Sources	Groundwater Contaminants		
		Alluvial	Intermediate	Regional
White Rock Canyon: San Ildefonso Pueblo and Buckman Well Field	None	No alluvial groundwater	No intermediate groundwater	Natural fluoride, arsenic, boron, and uranium

Table 5-25
Groundwater Quality in White Rock Canyon Wells

Chemical	Location	Result	Trends
Uranium	Pueblo de San Ildefonso and Buckman Well Field supply wells	Up to 15 µg/L at Pueblo de San Ildefonso and 21 µg/L at Buckman Well field, below NM groundwater standard of 30 µg/L	Naturally occurring
Fluoride	Buckman Well Field	Up to 0.83 mg/L, below NM groundwater standard of 1.6 mg/L	Naturally occurring
Boron	Pueblo de San Ildefonso supply wells	644 µg/L, below NM groundwater standard of 750 µg/L	Naturally occurring
Total arsenic	Pueblo de San Ildefonso and Buckman supply wells	Up to 17 µg/L at Pueblo de San Ildefonso and 11.5 µg/L at Buckman Well field, above EPA MCL of 10 µg/L	Naturally occurring

10. Buckman Well Field

In 2010, we sampled three wells in the City of Santa Fe's Buckman Well Field (Tables 5-24 and 5-25). As in past samples, these wells contain natural uranium below the NM groundwater standard of 30 µg/L.

The water in some of these wells has high TDS, so concentrations of several chemicals including chloride are near or above NM groundwater standards or EPA health advisory levels. Naturally occurring metals such as arsenic and boron are also high in some wells.

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A. INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) monitors the quality of surface water, including storm water, and stream sediment in northern New Mexico to evaluate the potential environmental effects of Laboratory operations on affected watersheds. The Laboratory collects and analyzes samples for a variety of constituents, including radionuclides and inorganic and organic chemicals. In this chapter, the effects of Laboratory operations on surface water and stream sediment are evaluated geographically and over time. Additionally, the sampling results are compared with standards and screening criteria established to identify potential contaminants and to protect human health and the aquatic environment.

Annual monitoring of sediment sampled from selected locations at and near LANL has occurred since 1969, as part of the U.S. Department of Energy (DOE) Environmental Protection Program (DOE 2008). This currently includes sampling of active stream channels, overbank sediment on floodplains, and other settings, and is intended to evaluate possible changes in contaminant concentrations at specific locations over time. More detailed evaluations of contaminants in sediment across LANL have indicated that they do not currently pose risks to human health or ecosystems (e.g., LANL 2004; LANL 2005; LANL 2006a; LANL 2009a; LANL 2009b; LANL 2009c; LANL 2009d; LANL 2011a; LANL 2011b). Ongoing monitoring is designed to confirm that contaminant concentrations are not increasing due to changing conditions in the watersheds or, alternatively, to identify such changes if they occur. An additional objective of this monitoring is to evaluate the effects of sediment transport mitigation activities that have been undertaken in the Los Alamos Canyon watershed (LANL 2008a, 2008b). Sediment monitoring in 2010 occurred following the annual summer monsoon season, and this work is described in a sampling and analysis plan (LANL 2010a).

Surface water monitoring and assessments at the Laboratory in 2010 occurred under several tasks. The annual Interim Facility-Wide Groundwater Monitoring Plan (IFWGMP) (LANL 2009e, LANL 2010b) includes monitoring of base flow or persistent surface water in main drainages and some tributary channels for an extensive list of constituents. These plans are prepared following the March 1, 2005, Compliance Order on Consent (the Consent Order) with the New Mexico Environment Department (NMED). Extensive sampling of storm water occurred in Los Alamos and Pueblo Canyons under a plan to monitor the effectiveness of sediment transport mitigation activities (LANL 2009f). Sampling of snowmelt runoff and storm water at gaging stations occurred as part of the Laboratory's environmental surveillance activities. Sampling of base flow along the Rio Grande at two locations occurred under an agreement with the City and County of Santa Fe and the Buckman Direct Diversion (BDD) Project. Storm water sampling at other locations to monitor industrial activities occurred under the Multi-Sector General Permit (MSGP) with the U.S. Environmental Protection Agency (EPA). Two locations that are included in an Individual Permit (IP) with the EPA were sampled in 2010. Storm water sampling also occurred in 2010 as part of a special study to evaluate background and baseline concentrations of polychlorinated biphenyls (PCBs), metals, and gross alpha radiation in and near the Laboratory (LANL 2009g).

B. HYDROLOGIC SETTING

Laboratory lands contain parts or all of seven primary watersheds that drain directly into the Rio Grande, each defined by a master canyon (Figure 6-1). Listed from north to south, the master canyons for these watersheds are Los Alamos, Sandia, Mortandad, Pajarito, Water, Ancho, and Chaquehui Canyons. Each of these watersheds includes tributary canyons of various sizes. Los Alamos, Pajarito, and Water Canyons have their headwaters west of the Laboratory in the eastern Jemez Mountains (the Sierra de los Valles), mostly within the Santa Fe National Forest, while the remainder head on the Pajarito Plateau. Only the Ancho Canyon watershed is entirely located on Laboratory land.

Canyons that drain Laboratory property are generally dry for most of the year, and no perennial surface water (i.e., water that is present all year) extends completely across Laboratory land in any canyon. Approximately three miles of canyon in the western part of the Laboratory have streams that are naturally perennial and fed by springs. These perennial segments are located in Water Canyon, Cañon de Valle (a major tributary to Water Canyon), and Pajarito Canyon and its tributaries. Approximately four miles of canyon on Laboratory land have perennial streams created by discharges of sanitary effluent from wastewater treatment plants (WWTPs) in Pueblo and Sandia Canyons. Spring-fed perennial stream segments are also located in lower Ancho and Chaquehui Canyons on Laboratory land near the Rio Grande, as well as in other canyons upstream and downstream from the Laboratory.

The remaining stream channels are dry for varying lengths of time. The driest segments flow only after local precipitation events or during snowmelt periods, and flow in these streams is ephemeral. Other stream segments sometimes have alluvial groundwater that discharges into the stream bed and/or experience extensive snowmelt runoff and are considered intermittent. Intermittent streams may flow for several weeks to a year or longer.

To aid in water quality interpretation, we consider three basic types of stream flow. At times, the flow might represent a combination of several of these flow types:

- Base flow—persistent stream flow but not necessarily perennial water. This type of flow is generally present for periods of weeks or longer. The water source may be springs, effluent discharge, or alluvial groundwater that emerges along stream beds.
- Snowmelt runoff—flowing water present because of melting snow. This type of water may be present for up to a month or more and in some years may not be present at all.
- Storm water runoff—flowing water present in response to rainfall. These flow events are generally very short-lived, with flows lasting from less than an hour to—rarely—several days.

Because base flow and snowmelt runoff can be present for extended periods of time, they may be available for potentially longer-term exposures, such as when wildlife uses them for watering. Storm water runoff may provide a short-term water source for wildlife, particularly when it collects in bedrock pools or other local depressions, and water quality will improve at these locations over time as the suspended sediment settles out. Storm water runoff in particular is capable of transporting Laboratory-derived constituents associated with sediment particles off site and possibly into the Rio Grande.

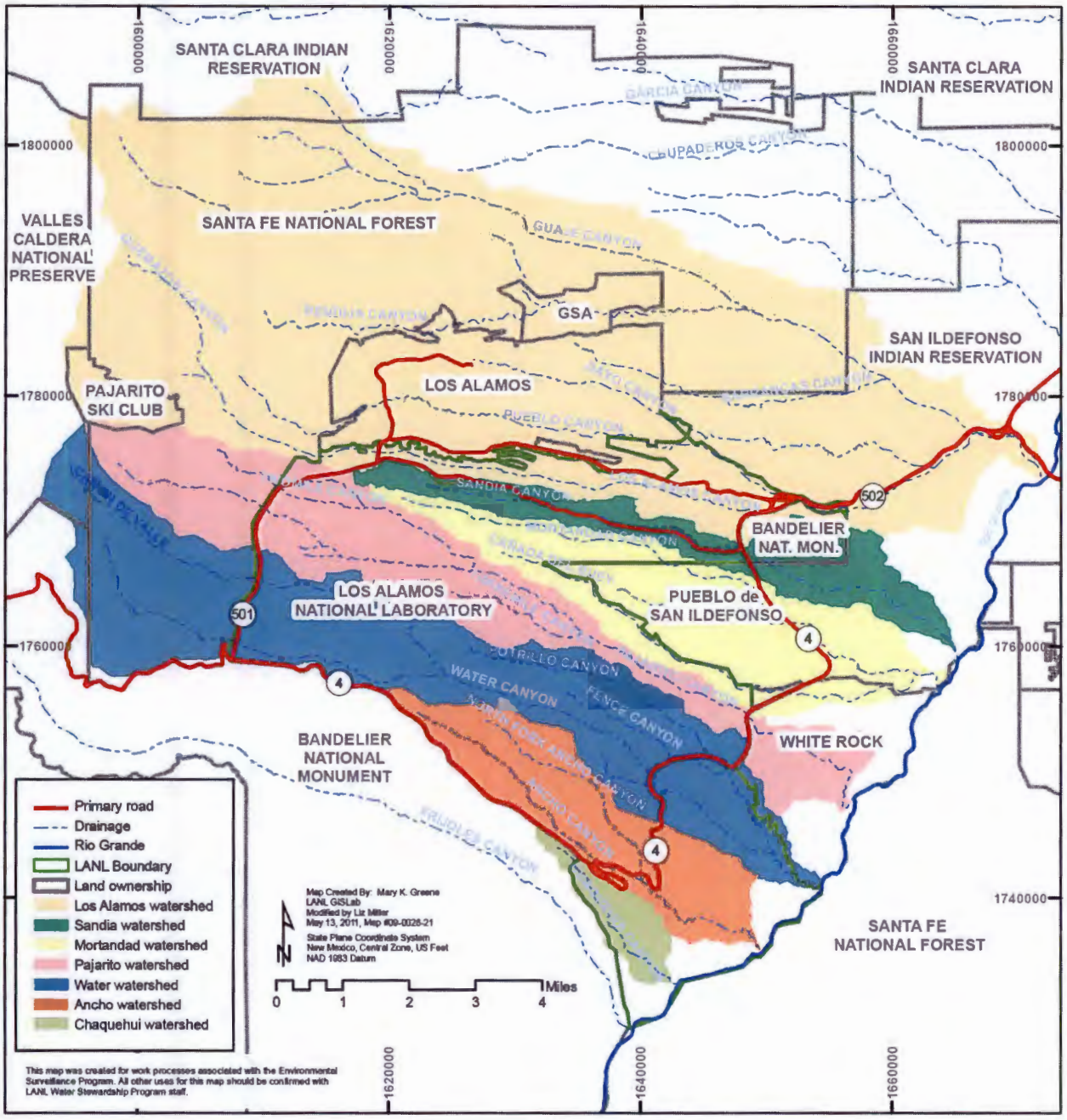

Figure 6-1 Primary watersheds at Los Alamos National Laboratory

The largest storm water runoff events in and near LANL in 2010 occurred in the Los Alamos Canyon watershed. On August 16, stream gages in Acid, DP, and Pueblo Canyons recorded peak discharges greater than 100 cubic feet per second (cfs). The largest discharge at LANL, 315 cfs, was measured at gaging station E039.1 in DP Canyon (LANL 2011c). DP Canyon receives runoff from large areas of pavement and buildings in the Los Alamos town site, and as a result has relatively frequent runoff events during the summer monsoon season. Larger discharges occurred in Los Alamos Canyon near the Rio Grande, at gaging station E109.9, with a maximum estimated discharge of about 779 cfs on August 23. The larger discharges near the Rio Grande resulted from runoff from Guaje Canyon, a major tributary to Los Alamos Canyon north of LANL.

None of the streams within the Laboratory boundary average more than one cfs of flow annually, and it is unusual for the combined mean daily flow leaving LANL to be greater than 10 cfs. This occurred once in 2010, on August 16, with a total estimated mean daily flow of 14 cfs leaving LANL in Los Alamos and Pueblo Canyons. Guaje Canyon also flowed on August 16, resulting in a total estimated mean daily flow into the Rio Grande of 25 cfs from the Los Alamos Canyon watershed. In comparison, the average daily flow in the Rio Grande at Otowi Bridge on August 16 was 1,060 cfs, or approximately 45 times higher than the flow in lower Los Alamos Canyon and 75 times higher than the flow from LANL.

In 2010, snowmelt runoff only crossed the eastern Laboratory boundary in Los Alamos Canyon, estimated at about 185 acre-feet (ac-ft) at gage E050, below the Los Alamos Canyon weir. Continuous flow occurred here for 48 days in April and May. Total storm water runoff at downstream gages in the canyons leaving the Laboratory is estimated at about 42 ac-ft, approximately 92% of this occurring in Los Alamos and Pueblo Canyons and 7% in Cañada del Buey above White Rock. Small events also occurred in Ancho, Potrillo, and Sandia Canyons. In addition, approximately 4 ac-ft of effluent released from the Los Alamos County WWTP is estimated to have passed the eastern LANL boundary in Pueblo Canyon. Figure 6-2 shows the estimated storm water runoff volume at LANL from June through October and the seasonal precipitation since 1995, indicating that the total storm water runoff in 2010 was relatively low.

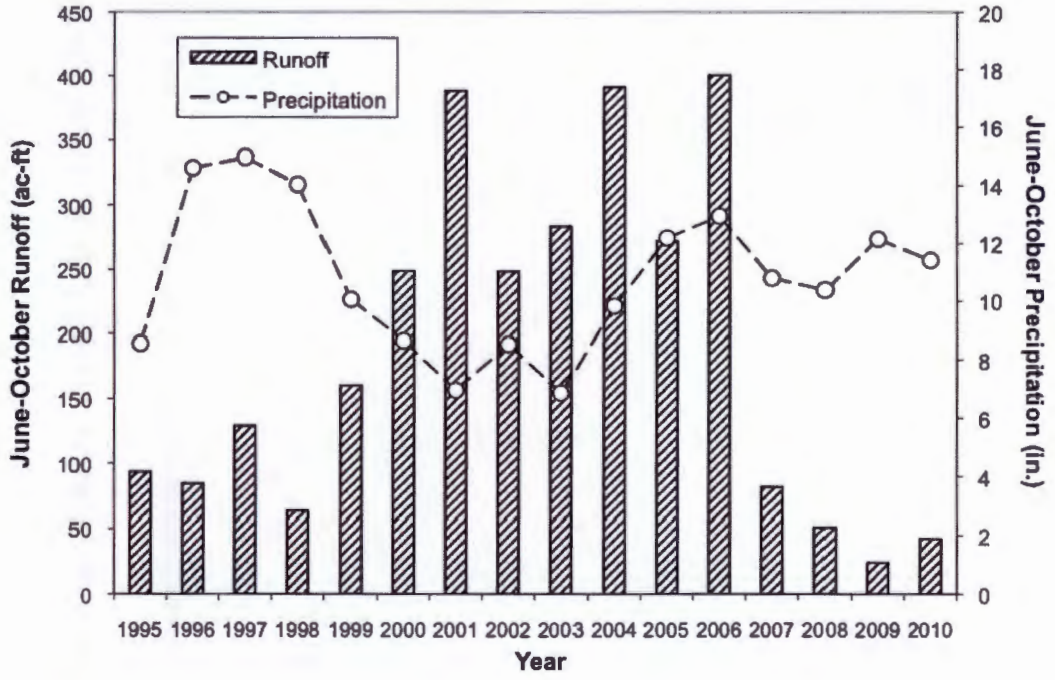

Figure 6-2 Estimated storm water runoff volume in LANL canyons (Pueblo Canyon to Ancho Canyon) and precipitation at TA-6 during the months of June through October from 1995 through 2010

C. SURFACE WATER AND SEDIMENT STANDARDS AND SCREENING LEVELS

This section discusses surface water quality standards and screening levels used to evaluate monitoring data from surface water and sediments. These standards and screening levels are summarized in Table 6-1.

Table 6-1

Application of Surface Water and Sediment Standards and Screening Levels to Monitoring Data

Media and Analyte Type	Standard	Screening Level	Reference	Notes
Surface Water, Radionuclides and Radioactivity	New Mexico gross alpha, radium-226 + radium-228, and tritium water quality standard for surface water		NMWQCC (2008)	Based on the protection of livestock watering for radium-226, radium-228, tritium, and gross alpha radiation. NMWQCC standards are not specific about exposure frequency or duration, and single sample results are compared with numeric criteria. The gross alpha standard excludes alpha radiation from source, special nuclear, and byproduct material regulated by the Atomic Energy Act. NMWQCC standards do not apply on Pueblo land or lands slated for land transfer from DOE. For samples from those locations, the standards are applied as screening levels in this report.
		Biota Concentration Guides (BCGs)	2002, 2004)	Surface water is generally present sporadically or is not available for long-term access and does not provide persistent drinking water. The actual exposure pathway is to plants and animals and not to humans. Perennial water BCGs are used for samples collected from designated perennial stream segments, and terrestrial water BCGs are applied to all other locations. BCGs are obtained from RESRAD-BIOTA 1.5 and are based on 1 rad/day exposure limit for aquatic animals and 0.1 rad day for riparian or terrestrial animals.
Surface Water, Non-radionuclides	New Mexico water quality standards for surface water		NMWQCC (2008)	Single sample results are compared with applicable segment-specific water quality standards. Standards for livestock watering, wildlife habitat, and acute and chronic aquatic life criteria apply to all stream segments, excluding samples from Pueblo land or lands slated for land transfer from DOE. At those locations, the standards are applied as screening levels in this report. Standards for human health criteria, including PCBs, apply to all stream segments.
Sediment, Radionuclides	None	BCGs	DOE (2002, 2004)	Dose limit to biota is the same as for surface water. Individual results are compared with BCGs obtained from RESRAD-BIOTA 1.5.
		Background	Ryti et al. (1998) or McLin and Lyons (2002)	Results from samples from the Pajarito Plateau are compared with plateau-specific background levels to identify potential contaminants. Results from samples along the Rio Grande and from Cochiti Reservoir are compared with background levels specific to major rivers and reservoirs within the Rio Grande drainage system.
Sediment, Non-radionuclides	None	Background	Ryti et al. (1998)	Results for inorganic chemicals from Pajarito Plateau stations are compared with plateau-specific background levels to identify potential contaminants. There are no established background levels for organic chemicals on or off the Pajarito Plateau, and all detected organic chemicals are considered as potential contaminants.

1. New Mexico Surface Water Standards

The New Mexico Water Quality Control Commission (NMWQCC) establishes surface water standards for New Mexico in its Standards for Interstate and Intrastate Surface Waters, presented in New Mexico Administrative Code (NMAC) 20.6.4.1 through 20.6.4.901 (NMWQCC 2008). New Mexico's surface water standards are intended to protect water quality through a three-step process: (1) designating uses for rivers, streams, lakes, and other surface waters, (2) setting criteria to protect those uses, and (3) establishing anti-degradation provisions to preserve water quality. On a triennial basis, surface water standards are reviewed and revised by the NMWQQC and approved by the EPA. The current standards were approved by EPA on January 14, 2011, and can be found on the New Mexico Environment Department's Web site at http://www.nmcpr.state.nm.us/nmac/parts/title20/20.006.0004.htm. These differ in certain regards from standards that are applicable to the period described in this report (2010). For example, both acute and chronic criteria for aquatic life were applicable to ephemeral and intermittent waters at LANL in 2010, whereas only acute criteria are applicable in 2011. New Mexico water quality standards do not apply to surface waters on Native American lands, and in this report we use these standards as screening levels for comparison with surface water data from Pueblo de San Ildefonso land.

New Mexico surface waters are divided into "classified" or "unclassified" water segments and are described as ephemeral, intermittent, or perennial. Unclassified surface waters are regulated as "ephemeral," "intermittent," or "perennial" and have differing designated uses and must meet use-specific water quality criteria. Classified surface waters, have segment-specific designated uses that may be an attainable or an existing use (e.g., livestock watering, wildlife habitat, aquatic life, secondary contact). To protect and sustain designated uses, the NMWQCC sets general numeric criteria applicable to all surface waters and use-specific water quality criteria that apply to stream-specific segments. Some of the standards are for total concentrations, which are compared with data from non-filtered surface water samples. Other standards are for dissolved concentrations, which are compared with data from filtered samples.

The NMWQCC has classified all stream segments and set segment-specific designated uses for all surface waters within Laboratory boundaries (Figure 6-3, Table 6-2, and NMWQCC 2008). Only four stream segments at LANL are classified as perennial, with designated uses of coldwater aquatic life, livestock watering, wildlife habitat, and secondary contact (NMAC 20.6.4.126). Three of the designated perennial segments at LANL are spring-fed (Cañon de Valle, Pajarito Canyon, and Water Canyon), and the fourth is supplied by treated sanitary effluent (Sandia Canyon). The majority of the Laboratory's remaining stream segments are classified as ephemeral or intermittent, with designated uses of limited aquatic life, livestock watering, wildlife habitat, and secondary contact (Figure 6-3, Table 6-2, and NMAC 20.6.4.128; NMWQCC 2008). Under the NMWQCC regulations that were effective in 2010, both acute and chronic aquatic life criteria apply to all classified stream segments at LANL. Human health criteria also apply to these stream segments. The part of Pueblo Canyon which is on LANL land, and which receives sanitary effluent discharges from the Los Alamos County WWTP, is excluded from NMAC 20.6.4.128 because it is scheduled for land transfer. Pueblo Canyon is instead considered an unclassified ephemeral or intermittent stream under NMAC 20.6.4.97 and 20.6.4.98, and has designated uses of livestock watering, wildlife habitat, aquatic life (the intermittent portion) or limited aquatic life (the ephemeral portion), and secondary contact (Figure 6-3, Table 6-2, and NMAC 20.6.4.98). Only the acute aquatic life criteria, not the chronic criteria, apply to ephemeral parts of Pueblo Canyon. For samples collected from ephemeral stream segments outside the LANL boundary, chronic aquatic life criteria also do not apply. For these samples and those from Pueblo Canyon, we compare results with the chronic criteria as a screening level for simplicity and consistency with comparable samples from LANL land outside Pueblo Canyon. Human health criteria also apply to all of Pueblo Canyon and canyons outside the LANL boundary.

Surface water within the Laboratory is not a source of drinking water, municipal, industrial, or irrigation water. As described above, the NMWQCC standards do not protect surface waters within the Laboratory for drinking water. However, wildlife may use surface waters within the Laboratory and standards are set at levels to protect wildlife habitat. Stream flow may also extend beyond the LANL boundary (i.e., onto Pueblo de San Ildefonso land).

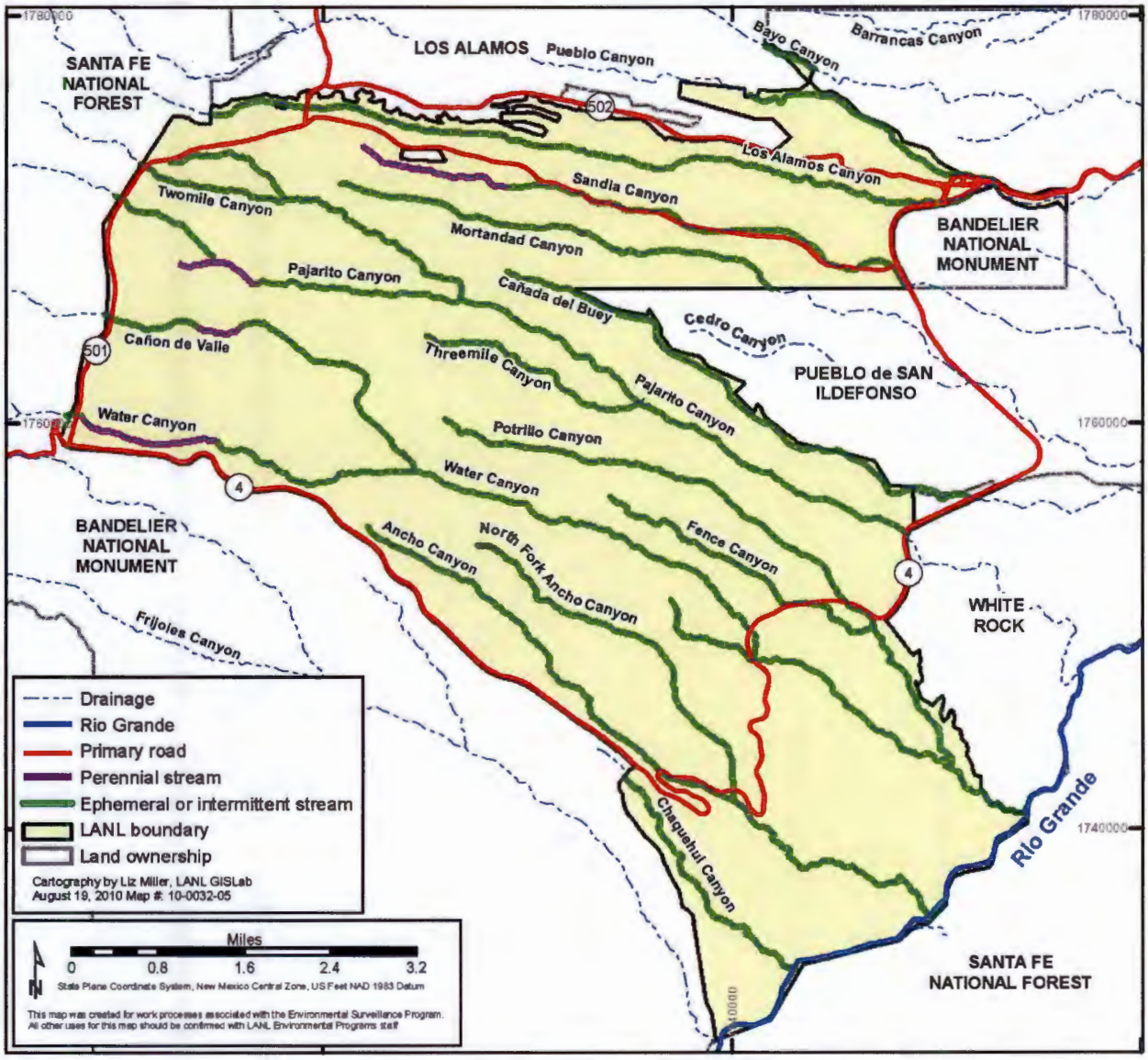

Figure 6-3 **Major drainages within Los Alamos National Laboratory land, showing designated stream segments**

Table 6-2
NMWQCC Designated Uses for LANL Surface Waters

Stream Segments	Designated Uses[a]	Description of Associated Users[a]
Designated perennial segments on LANL property, including parts of Cañon de Valle, Pajarito Canyon, Water Canyon, and Sandia Canyon. See Figure 6-3 and NMWQCC 2008	Livestock watering	Horses, cows, etc.
	Wildlife habitat	Deer, elk, mice, etc.
	Secondary contact	Recreational or other water use in which human contact with the water may occur with minimal probability for ingesting the water. Examples include fishing, wading, and boating.
	Coldwater aquatic life	Fish, aquatic invertebrates, etc.
Non-perennial segments on LANL property and all of Pueblo Canyon[b]	Livestock watering	Horses, cows, etc.
	Wildlife habitat	Deer, elk, mice, etc.
	Secondary contact	Recreational or other water use in which human contact with the water may occur with minimal probability for ingesting the water. Examples include fishing, wading, and boating.
	Limited aquatic life	Aquatic invertebrates, etc.

[a] Designated use indicates that the stream segment is protected for these uses. However, livestock are not legally grazed on Laboratory lands.

[b] One additional criterion applies to non-perennial segments on LANL property for acute total ammonia that doesn't apply in Pueblo Canyon.

Water in the Rio Grande in the vicinity of LANL is also classified by the NMWQCC and has segment-specific designated uses. Designated uses are irrigation, livestock watering, wildlife habitat, marginal coldwater aquatic life, primary contact, and warmwater aquatic life (NMAC 20.6.4.114; NMWQCC 2008).

Hardness-dependent aquatic life numeric criteria are calculated using a water hardness value of 100 mg $CaCO_3$/L (EPA 2006). For evaluating the potential impact of chronic exposure to surface water constituents on aquatic life in perennial stream segments, the Laboratory uses the protocol employed by NMED for assessing standards attainment in New Mexico (NMED 2011).

2. Radionuclides in Surface Water

DOE Order 5400.5 prescribes total dose limits associated with exposure to radionuclides in environmental media. Because of the limited extent of stream flow, there are no drinking water systems on the Pajarito Plateau that rely on surface water supplies. The emphasis of the radiological assessment of surface water is, therefore, on potential exposures to aquatic organisms. For protection of biota, concentrations of radionuclides in surface water are compared with the DOE BCGs (DOE 2002, 2004), with site-specific modifications by McNaughton et al. (2008). For screening purposes, single sample results are first compared with BCGs to identify if radionuclides at a location pose a potential risk to biota. Following DOE guidance (DOE 2003), final evaluations of potential risk at these locations use annual time-weighted radionuclide content of the water rather than individual sample results. For water samples from in or near designated perennial stream segments, we use BCGs for aquatic or riparian animals for our evaluation, and for samples from ephemeral or intermittent segments, we use BCGs for terrestrial animals.

Surface water analytical results for gross alpha radiation, radium isotopes, and tritium are also compared with the NMWQCC standards for protection of livestock watering use, which is a designated use for surface water within the Laboratory boundary. (We note that there are no livestock at the Laboratory except for some feral cows grazing at low elevations near the west bank of the Rio Grande.) NMWQCC standards are not specific about exposure frequency or duration. Therefore, for screening purposes, single sample results are compared with numeric criteria for these analytes. It should be noted that the gross alpha standard does not apply to source, special nuclear, or byproduct material regulated by DOE under the Atomic Energy Act, and the gross alpha radiation data discussed in this chapter were not adjusted to remove these sources of radioactivity.

3. Sediment

There are no standards for sediment. Sediment data from the Pajarito Plateau are instead compared with established plateau-specific background concentrations of inorganic chemicals or radionuclides that are naturally occurring or result from atmospheric fallout (Ryti et al. 1998; McDonald et al. 2003). Results above background values are considered to represent potential contaminants. Radionuclide data from regional sediment stations are compared with background levels established for major drainages of the area: the Rio Grande, the Rio Chama, and the Jemez River (McLin and Lyons 2002; McLin 2004). There are no established background levels for organic chemicals, and all detected results are considered to represent possible contamination.

D. SAMPLING LOCATIONS AND METHODS

1. On-Site and Perimeter Monitoring Locations

Surface water and sediment are sampled in all major canyons that cross current or former Laboratory lands, and are also sampled along some short tributary drainages. Stream channel sediment is sampled to evaluate the potential accumulation of contaminants in the aquatic environment (DOE 1991) and to evaluate trends over time. LANL collects surface water samples across the Pajarito Plateau within and near the Laboratory as part of several programs and to meet different regulatory requirements. This includes an emphasis on monitoring close to and downstream of potential Laboratory contaminant sources, such as at the downstream Laboratory boundary or NM 4. These samples include base flow grab samples from locations where effluent discharges or natural springs maintain stream flow and storm water samples collected using automated samplers.

Figure 6-4 shows surface water locations sampled in 2010 as part of the Environmental Surveillance Program and as part of a task to monitor the effectiveness of sediment transport mitigation measures in the Los Alamos Canyon watershed. These are mostly at stream gages, and also include grab samples at a sediment detention basin in upper Los Alamos Canyon. Figure 6-5 shows surface water locations sampled as part of the IFWGMP and in support of the BDD Project. These are entirely grab samples. Figure 6-6 shows locations sampled under the MSGP, which are from automated storm water samplers located close to LANL facilities. Also included on Figure 6-6 are two storm water sample locations at site-monitoring areas (SMAs). These samples are generally not representative of surface water along major drainages. Figure 6-7 shows locations of storm water samples collected in 2010 as part of a baseline PCB, metals, and gross alpha study.

Seven of the surface water sampling locations at the Laboratory in 2010 were situated within or very close to designated perennial stream segments, as discussed in Chapter C.1 and shown on Figure 6-3. These locations are in the south fork of Sandia Canyon ("Sandia right fork at power plant," gage E121), Sandia Canyon below the wetland (gage E123), middle Sandia Canyon at the terminus of persistent base flow, Pajarito Canyon below North Anchor East basin, Cañon de Valle below Material Disposal Area (MDA) P (now removed) (gage E256), Water Canyon above NM 501 (gage E252), and Water Canyon between NM 501 and Cañon de Valle ("between E252 and Water at Beta").

Sediment stations on the Pajarito Plateau and vicinity in 2010 (Figure 6-8) were located within approximately 8 km of the Laboratory's boundary, with the majority located within the Laboratory's boundary. Many of the annual sediment sampling stations on the Pajarito Plateau are located within canyons to monitor sediment in the active channel related to past and/or present effluent discharges. In accordance with the Consent Order, LANL has completed extensive evaluations of sediment, including both active channel and floodplain sediment deposits, in most canyons affected by Laboratory activities (LANL 2004, 2006a, 2009a, 2009b, 2009c, 2009d, 2011a, 2011b; Reneau et al., 2004). These evaluations complement the active channel sampling at these annual sediment stations. Figure 6-8 shows active channel locations from Consent Order investigations in 2010 in Ancho, Chaquehui, Fence, Indio, Potrillo, and Water Canyons that are included in the data set examined in this report.

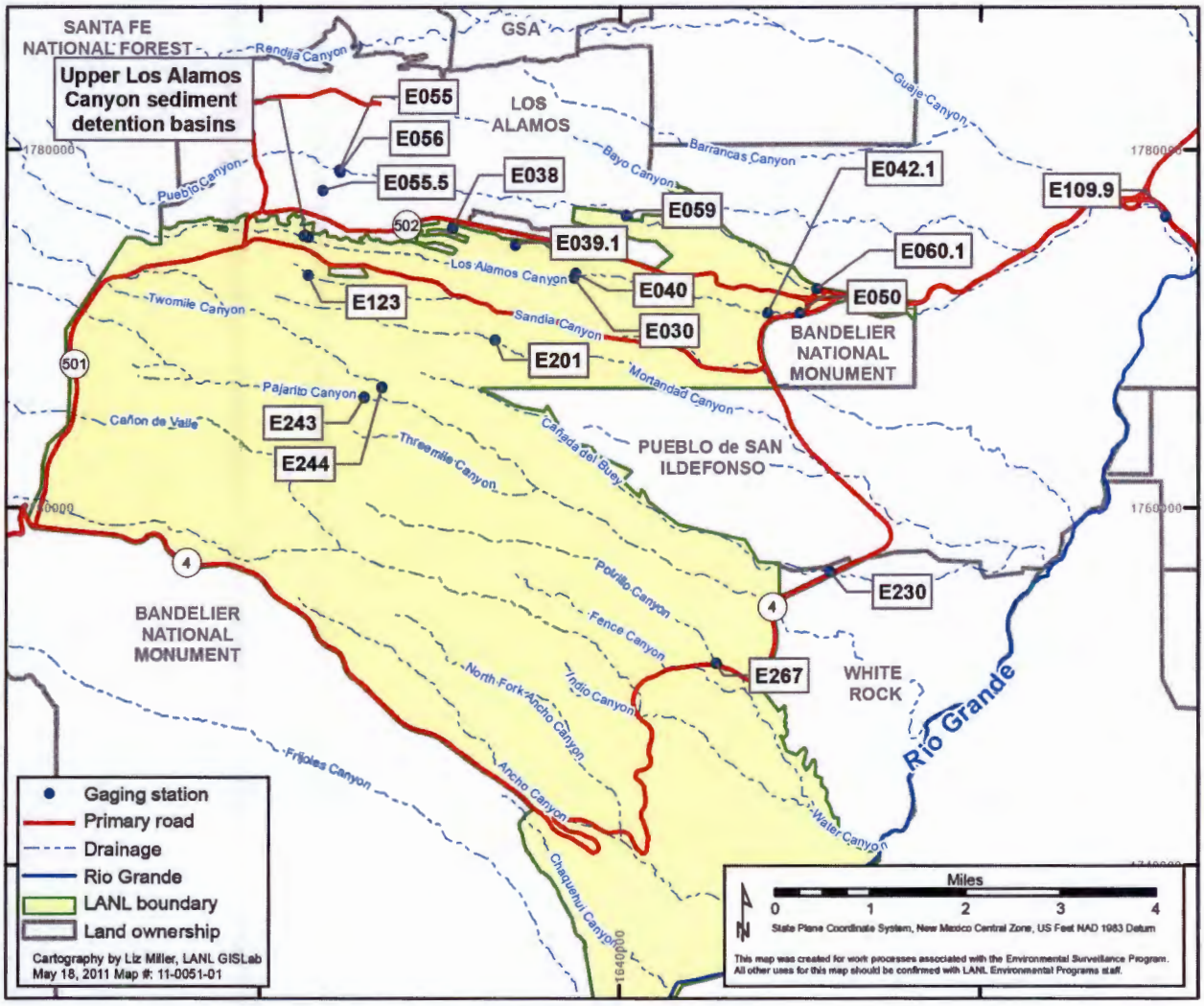

Figure 6-4 **Surface water locations sampled in 2010 as part of the Environmental Surveillance Program and the Los Alamos and Pueblo Canyons monitoring plan**

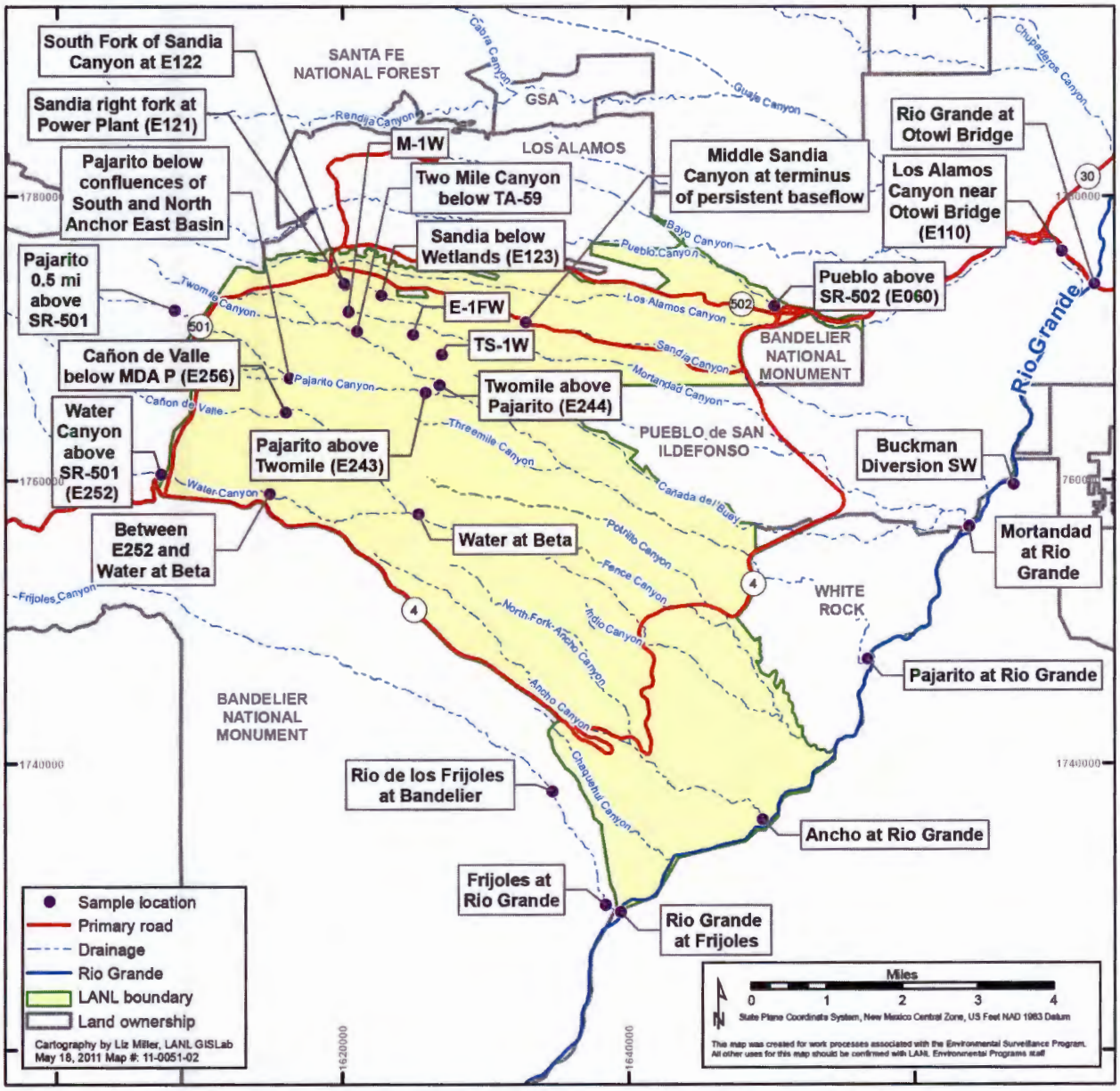

Figure 6-5 **Surface water locations sampled in 2010 as part of the IFWGMP and in support of the BDD project**

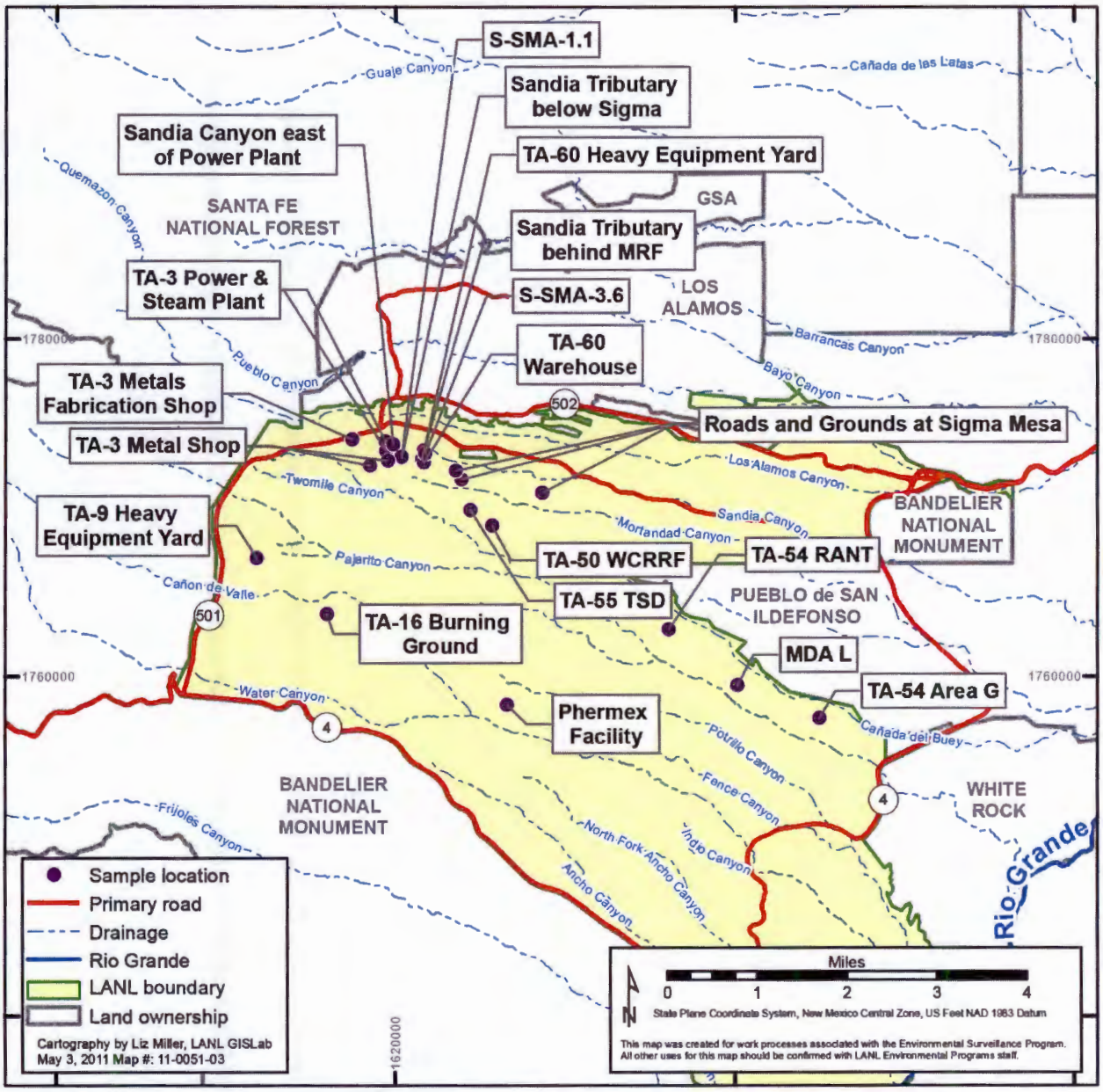

Figure 6-6 Surface water locations sampled in 2010 under the MSGP and at IP SMAs

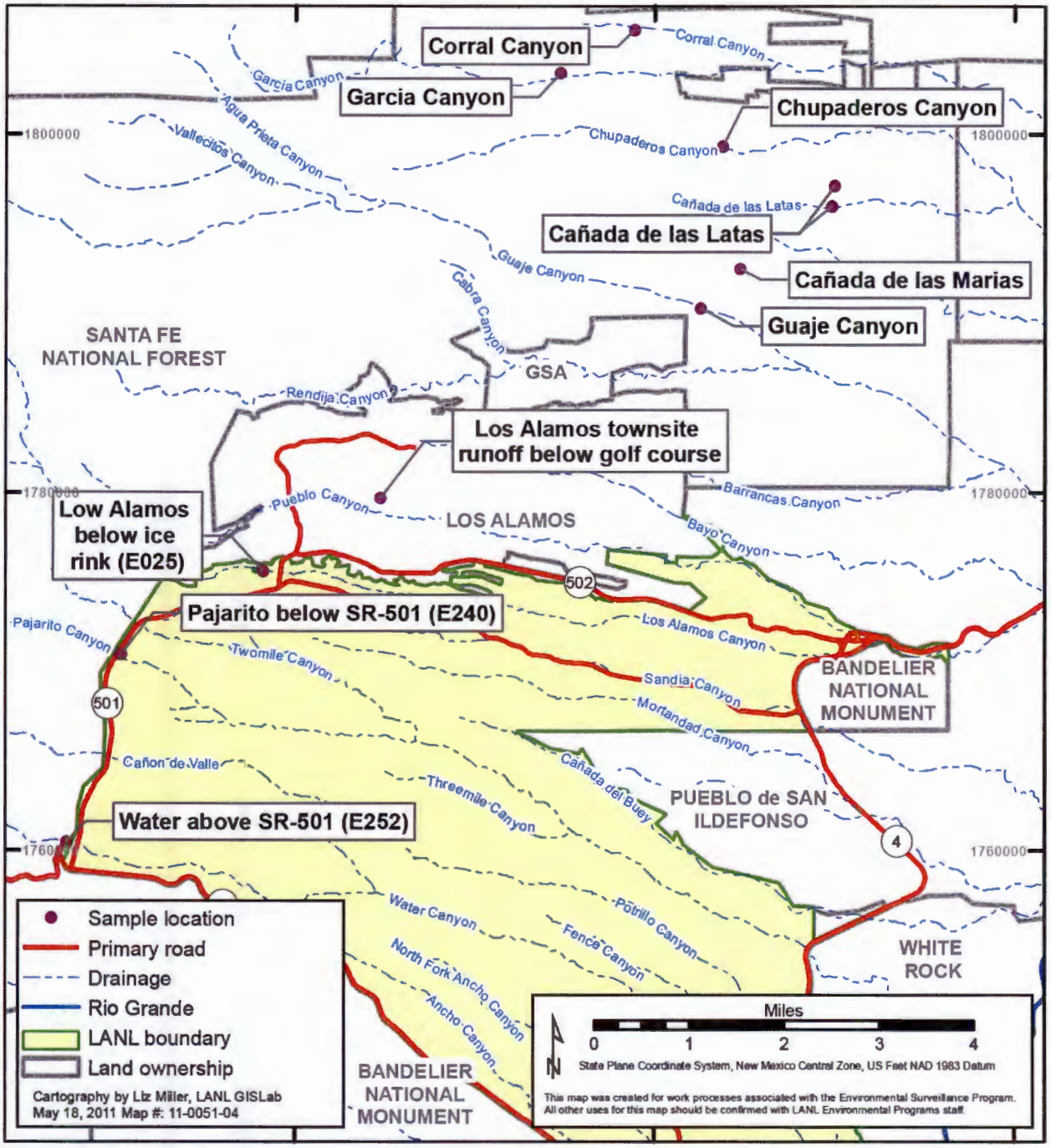

Figure 6-7 **Surface water locations sampled in 2010 as part of a baseline PCB, metals, and gross alpha radiation study**

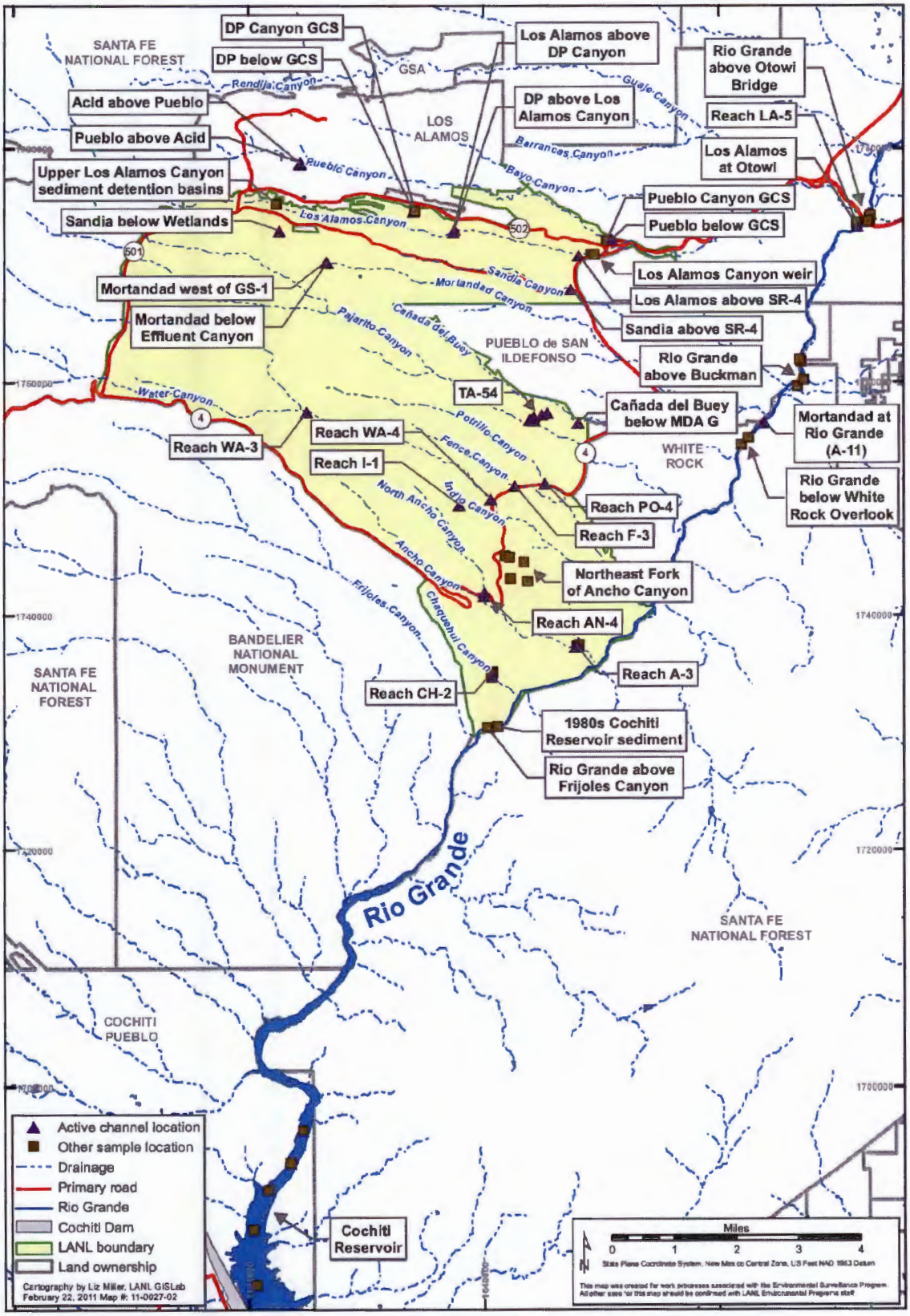

Figure 6-8 Sediment locations sampled in 2010 within and in the vicinity of LANL

Additionally, surface water and sediment were sampled at several locations on Pueblo de San Ildefonso lands in canyons draining the Laboratory. DOE entered into a memorandum of understanding with the Pueblo de San Ildefonso and the Bureau of Indian Affairs in 1987 to conduct environmental sampling on Pueblo land. The drainages that pass from LANL onto Pueblo de San Ildefonso land are Bayo, Los Alamos, Mortandad, Pueblo, and Sandia Canyons and Cañada del Buey.

In 2010, we collected sediment samples from dry stream beds on the Pajarito Plateau to a depth of 2 to 37 cm, depending on the thickness of the uppermost sediment layer. For flowing streams, samples were collected from near the edge of the main channel. Locations outside the main stream channel were also sampled to variable depths in hand-dug holes, up to 65 cm deep in the sediment retention basins above the Los Alamos weir. Additional samples of older fine-grained sediment were collected in Ancho and Chaquehui Canyons and from hand-dug holes and stream banks to depths of up to 86 cm to evaluate PCB congeners.

2. Regional Monitoring Locations

Regional base flow and sediment sampling stations for 2010 were located along a 19-km long stretch of the Rio Grande, extending from immediately upriver of Otowi Bridge and Los Alamos Canyon to near Frijoles Canyon, downriver of all canyons draining LANL. Samples from upriver stations reflect baseline concentrations and provide a basis for evaluating potential Laboratory impacts to the Rio Grande. In 2010, we collected sediment samples from four areas along the Rio Grande, one area upgradient from the Laboratory (above Otowi Bridge), and three areas down gradient (above Buckman, below the White Rock Overlook, and between Chaquehui and Frijoles Canyons; Figure 6-8). Deposits of fine-grained sediment along the Rio Grande were sampled from the sides of shallow hand-dug holes to depths of up to 58 cm, after identifying the probable base of the 2010 sediment. Sediment samples were collected from Cochiti Reservoir using a clam shell (Ponar) grab sampler. Samples were also collected near the Rio Grande from a hand-dug hole in an area near Frijoles Canyon where sediment was deposited during high water conditions in Cochiti Reservoir in the 1980s (Figure 6-8). These latter samples extended to a depth of 75 cm and provide a comparison of modern sediment with conditions existing several decades ago. In addition, in 2010 LANL collected paired surface water samples from the Rio Grande (above Otowi Bridge and above Buckman; Figure 6-5) in three sampling events and two other Rio Grande samples (above Otowi Bridge and at Frijoles Canyon).

3. Surface Water Sampling Procedures

The procedures for surface water sampling depend on the type of stream flow and location. Grab samples of base flow and snowmelt runoff are collected from free-flowing streams near the bank. The grab samples are either filtered or left unfiltered and preserved in the field. Stream gages, located mostly in canyon bottoms, are equipped with automated ISCO samplers that are activated at the start of significant storm water runoff events. Typically, the automated samplers collect water from the first 30 minutes of the runoff event to sample water near the leading edge of flood bores, also called the "first flush." This is the seventh year that the first flush of storm water has been sampled at many stations, and it is a significant change from previous years (2003 and earlier) when samples were collected over a two-hour period. Higher concentrations occur in the first flush compared with the average concentration during a flow event because suspended sediment concentration is highest near the flood bore (Malmon et al. 2004, 2007). As a result, these post-2003 data are not directly comparable to data from previous years. Beginning in 2010, LANL also collected multiple storm water samples through hydrographs at many gages to evaluate variations in suspended sediment and contaminant concentrations during individual runoff events. All storm water samples are filtered and preserved in LANL's storm water operations facility because filtering highly sediment-laden waters in the field is difficult. These samples are then shipped to commercial analytical laboratories without compositing or splitting the samples.

E. SAMPLING RESULTS BY CONSTITUENTS

The supplemental data tables on the included compact disk present all the 2010 watershed-related surface water and sediment analytical results. The tables present radiological results in sequence for each of these

media and then present the results for major water quality analytes and inorganic and organic chemicals. Samples are analyzed for gross alpha and gross beta radiation and selected radionuclides (americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, uranium-234, uranium-235/236, uranium-238, tritium, cobalt-60, potassium-40, neptunium-237, radium-226, radium-228, and sodium-22). The tables also list the total propagated one-sigma analytical uncertainty and the analysis-specific minimum detectable activity, where available. For most radionuclide measurements, a detection is an analytical result that does not include an analytical laboratory (or in some cases, secondary validation) qualifier code of X or U (indicating not detected). The tables and their contents are as follows:

- Table S6-1 -- presents the results of radiochemical analyses of surface water for 2010.
- Table S6-2 -- presents the results of radiochemical analyses of sediment.
- Table S6-3 -- presents the concentrations of major chemical constituents in surface water.
- Tables S6-4 and S6-5 -- present results of inorganic chemical analyses for surface water and sediment, respectively.
- Table S6-6 -- presents the number and type of organic chemical analyses performed on surface water samples.
- Table S6-7 -- presents all detected organic chemical results in surface water.
- Tables S6-8 and S6-9 --present summaries of organic chemical analyses of sediment samples.
- Table S6-10 -- presents results of particle size analyses of the sediment samples.

Particle size analyses were obtained on all sediment samples because particle size distribution can have a strong effect on contaminant concentrations, and particle size data are useful in understanding differences in chemical and radionuclide concentrations between samples. Many contaminants released into the environment tend to preferentially adsorb onto the smallest particles (e.g., silt and clay), and contaminant concentrations will be highest where the finest-grained sediment is deposited. For example, coarse-grained sediment deposited in an active stream channel can have much lower contaminant concentrations than fine-grained sediment deposited on an adjacent floodplain during the same runoff event.

Qualifier codes are shown in some tables to provide additional information on analytical results that are not detections; in some cases, for example, the analyte was found in the laboratory blank, or there were other analytical issues. The tables show two categories of qualifier codes: those from the analytical laboratory and those from secondary validation (Tables S5-5, S5-6, and S5-7).

Of the more than 100 analytes reported in sediment and surface water within the Laboratory, most are at concentrations below standards or screening levels. However, every major watershed has some impact from Laboratory operations. The following sections present a Laboratory-wide overview of surface water and sediment quality and then discuss the key findings in more detail on a watershed-by-watershed basis. It should be noted that analytical results that are above standards or screening levels can be derived from a variety of sources including Laboratory releases, runoff from developed areas such as the Los Alamos town site, naturally occurring radionuclides and chemicals, or "false positives" from analytical laboratories. It is not always possible to identify specific sources, and results above standards or screening levels are considered to represent potential Laboratory impacts unless the evidence is compelling for non-LANL sources.

1. Radionuclides and Radioactivity in Surface Water and Sediment

a. Surface water

During 2010, the Laboratory obtained analytical data on radionuclides and/or radioactivity from 211 surface water samples at 71 locations on the Pajarito Plateau. At some locations, multiple samples were collected during single runoff events to evaluate how concentrations of sediment and potential contaminants varied through events. An additional eight samples were collected at three locations along the Rio Grande.

Table 6-3 presents a summary of results for Pajarito Plateau samples from 2010 that exceed standards or that have known sources at Laboratory sites. No results exceeded applicable BCGs in these samples.

Table 6-3
Summary of Results for Select Radionuclides and Radioactivity in Non-Filtered Surface Water Samples from the Pajarito Plateau in 2010

Analyte	Standard or Guide (pCi/L)[a]	Percentage of Samples with Detected Results Above Standard or Guide	Master Watersheds with Detected Results Above Standard or Guide	Notes
Gross alpha radiation	15 (lw)	56%	Los Alamos, Mortandad, Pajarito, Sandia, and Water Canyons, and several non-LANL canyons	NMWQCC impaired listing for many canyons; above standard in non-LANL affected stream segments, including three highest results from 2010 (481 to 1,090 pCi/L), indicating elevated local background
Americium-241	438 (aa) 1,460 (ra) 202,000 (ta)	0%	None	Maximum result (6.91 pCi/L), from Los Alamos Canyon below a former outfall at TA-21, is 0.003% of terrestrial BCG
Cesium-137	20,000 (sr)	0%	None	Maximum result (283 pCi/L), from Mortandad Canyon below the TA-50 RLWTF[b] outfall, is 1.4% of LANL-specific BCG
Plutonium-238	176 (aa) 551 (ra) 189,000 (ta)	0%	None	Maximum result (33.1 pCi/L), from Mortandad Canyon below the TA-50 RLWTF outfall, is 0.02% of terrestrial BCG
Plutonium-239/240	187 (aa) 622 (ra) 201,000 (ta)	0%	None	Maximum result (150 pCi/L), from Acid Canyon below former TA-1 and TA-45 outfalls, is 0.08% of terrestrial BCG
Radium-226 + Radium-228	30 (lw)	2%	Corral Canyon	Single result above standard (37.8 pCi/L), from background area
Strontium-90	30,000 (sr)	0%	None	Maximum result (137 pCi/L), from DP Canyon below a former outfall at TA-21, is 0.5% of LANL-specific BCG
Uranium-234	202 (aa) 684 (ra) 405,000 (ta)	0%	None	Maximum result (18.9 pCi/L), from Los Alamos Canyon near the Rio Grande, is 0.005% of terrestrial BCG; may represent natural background
Uranium-235/236	218 (aa) 737 (ra) 420,000 (ta)	0%	None	Maximum result (1.54 pCi/L), from Pueblo Canyon above the WWTP, is 0.0004% of terrestrial BCG; may represent natural background
Uranium-238	224 (aa) 757 (ra) 406,000 (ta)	0%	None	Maximum result (20.4 pCi/L), from Los Alamos Canyon near the Rio Grande, is 0.005% of terrestrial BCG; may represent natural background

[a] aa = BCG for aquatic animal; lw = livestock watering standard ; ra = BCG for riparian animal; sr = LANL-specific site-representative BCG; ta = BCG for terrestrial animal.

[b] RLWTF = Radioactive Liquid Waste Treatment Facility.

Consistent with previous years, many surface water samples in 2010 had gross alpha radiation levels above the NMWQCC surface water standard of 15 pCi/L for livestock watering. Of the 114 non-filtered storm water samples analyzed from the Pajarito Plateau for gross alpha radiation, 56% exceeded 15 pCi/L, including background sample sites with no upstream releases of radionuclides from Laboratory activities. For example, the three highest concentrations, 481 to 1,090 pCi/L, were measured in storm water samples collected from Corral Canyon, Garcia Canyon, and Cañada de las Marias on Santa Fe National Forest land north of Los Alamos. The analytical results from 2010 support earlier conclusions that the majority of the alpha radiation in surface water on the plateau is due to the decay of naturally occurring isotopes in sediment and soil from uncontaminated areas carried in storm water runoff and that Laboratory impacts are relatively small (e.g., Gallaher 2007). Naturally occurring radionuclides that are alpha emitters include isotopes of radium,

thorium, and uranium. As noted previously, livestock watering does not occur at the Laboratory except for some feral cows near the Rio Grande.

One surface water sample collected in 2010 had the sum of radium-226 and radium-228 above the livestock watering standard of 30 pCi/L. This was a storm water sample collected from Corral Canyon, a background area on Santa Fe National Forest land north of Los Alamos, with 37.8 pCi/L radium-226 and radium-228.

Gross alpha radioactivity is a general screening measurement of limited value in assessing radiological hazards because this measurement does not identify or quantify specific alpha emitters in water samples. Therefore, gross alpha radiation results are not discussed in detail in this report. The naturally occurring radium isotopes are also not discussed further. Instead, this report focuses on specific individual radionuclides identified in LANL waste streams from prior work.

The maximum concentrations of americium-241, cesium-137, plutonium-238, plutonium-239/240, and strontium-90 in surface water samples in 2010 were measured in storm water during the summer monsoon season at different locations in Acid, DP, Los Alamos, and Mortandad canyons, downstream from facilities that have released radioactive effluents. These results are summarized in Table 6-3 and discussed in Sections F.1 and F.3. All of these results are consistent with prior data from these canyons. In contrast, the highest concentration of tritium was measured in the Rio Grande above Otowi Bridge, upriver of LANL sources and indicating a source in regional atmospheric fallout. The highest concentrations of uranium-234, uranium-235/236, and uranium-238 were measured in storm water samples from Los Alamos and Pueblo Canyons, a watershed where there was relatively little use of uranium at Laboratory facilities. The close relationships in these samples of uranium isotope concentrations to suspended sediment concentrations, with no difference between different sample locations, supports a natural origin for this uranium (LANL 2011c).

b. Sediment

Analytical data on radionuclides in sediment were obtained from 60 samples in 2010 as part of the annual surveillance program, including 30 samples from canyons draining the Pajarito Plateau, 20 samples from banks, bars, and slackwater areas along the Rio Grande, and 10 samples from Cochiti Reservoir sediment. The Pajarito Plateau samples were mostly from active channel locations that are typically dominated by coarse-grained sediment and also included fine-grained sediment at several locations. The Rio Grande and Cochiti Reservoir samples were all fine-grained sediment.

Eight radionuclides were measured at concentrations greater than the LANL sediment background values in the 2010 environmental surveillance samples from the Pajarito Plateau, in Acid, Los Alamos, and Mortandad canyons. A summary of sediment results for Pajarito Plateau from 2010 that exceed background values is presented in Table 6-4, and these results are discussed further in Sections F.1 and F.3. Note that the percentage of samples with results above background values is biased high because of the tailoring of analytical suites to known contaminants in each watershed in the annual surveillance samples. In addition to the Pajarito Plateau samples, four of the five samples collected from the bottom of Cochiti Reservoir had plutonium-239/240 concentrations above the regional reservoir background of McLin and Lyons (2002). No sediment results from 2010 were greater than BCGs. These results are all consistent with previous sampling events (e.g. Reneau and Kuyumjian 2009; Reneau et al., 2010).

Table 6-4
Summary of Results for Select Radionuclides in Pajarito Plateau Sediment Samples from 2010

Analyte	Sediment Background Value (pCi/g*)	Percentage of Samples with Detected Results Above Background Value	Master Watersheds with Detected Results Above Background Value	Notes
Americium-241	0.040	36%	Los Alamos, Mortandad, and Pajarito Canyons	Maximum result (0.876 pCi/g) is from the Mortandad Canyon stream channel below the TA-50 RLWTF
Cesium-137	0.90	25%	Los Alamos and Mortandad Canyons	Maximum result (5.65 pCi/g) is from the Mortandad Canyon stream channel below the TA-50 RLWTF
Plutonium-238	0.006	29%	Los Alamos, Mortandad, Pajarito, and Water Canyons	Maximum result (0.43 pCi/g) is from the Mortandad Canyon stream channel below the TA-50 RLWTF
Plutonium-239/240	0.068	47%	Los Alamos, Mortandad, and Pajarito Canyons	Maximum result (7.43 pCi/g) is from the Acid Canyon stream channel below former outfalls at TA-1 and TA-45
Strontium-90	1.04	4%	Los Alamos Canyon	Single result above background (1.13 pCi/g) is from the sediment retention basins above the Los Alamos Canyon weir, below a former wastewater treatment facility at TA-21
Uranium-234	2.59	5%	Los Alamos Canyon	Maximum result (21.7 pCi/g) is from the upper Los Alamos Canyon sediment detention basins, below SWMU 01-001(f)
Uranium-235/236	0.20	5%	Los Alamos Canyon	Maximum result (1.7 pCi/g) is from the upper Los Alamos Canyon sediment detention basins, below SWMU 01-001(f)
Uranium-238	2.29	5%	Los Alamos Canyon	Maximum result (24.5 pCi/g) is from the upper Los Alamos Canyon sediment detention basins, below SWMU 01-001(f)

*pCi/g = Picocuries per gram.

2. Inorganic Chemicals in Surface Water and Sediment

a. Surface Water

During 2010, the Laboratory obtained analytical data on metals and other inorganic chemicals from 173 surface water samples at 74 locations on the Pajarito Plateau. At some locations, multiple samples were collected during single runoff events to evaluate how concentrations of sediment and potential contaminants varied through events. An additional eight samples were collected at three locations along the Rio Grande. These data were compared with various standards and screening levels, as discussed in Section C.3. Some of these screening levels are for dissolved constituents, which are compared with filtered sample results, and some are for totals, which are compared with non-filtered sample results. A total of eight inorganic chemicals had maximum concentrations above screening levels. Under the Clean Water Act §303(d) list, the NMWQCC listed parts of one or more canyons within or near LANL as impaired for six metals: aluminum, arsenic, copper, mercury, silver, and zinc (NMWQCC 2010). These metals are discussed below, along with other inorganic chemicals that have results above standards or screening levels. Table 6-5 presents a summary of results and their significance for these inorganic chemicals.

Table 6-5
Summary of Results for Select Inorganic Chemicals in Surface Water Samples from the Pajarito Plateau in 2010

Metal	Sample Preparation	Standard (µg/L)*	Percentage of Samples with Detected Results Above Standard*	Master Watersheds with Detected Results Above Standards	Notes
Aluminum	Filtered	750 (aa) 87 (ca)	30% (aa) 80% (ca)	Ancho, Los Alamos, Mortandad, Pajarito, Sandia, and Water canyons and several non-LANL canyons	NMWQCC impaired listing for many canyons; above standards in non-LANL affected stream segments, indicating elevated local background; maximum result (14,000 µg/L) is from Effluent Canyon below TA-46
Arsenic	Filtered	9 (hh)	2% (hh)	Los Alamos and Sandia canyons	NMWQCC impaired listing in Ten Site Canyon, but no results above standard in this canyon; elevated arsenic probably derived from natural sources and runoff from developed areas; maximum result (29.3 µg/L) is from Los Alamos Canyon near the Rio Grande
Cadmium	Filtered	2.0 (aa) 0.25 (ca)	2% (ca)	Chupaderos and Los Alamos canyons	Single result above standard (1.1 µg/L) from LANL in DP Canyon above TA-21, which receives runoff from Los Alamos town site; also one result above the standard (used a screening level) from a background area
Chromium	Filtered	570 (aa) 74 (ca)	1% (ca)	Mortandad Canyon	Single result above standard (146 µg/L) from Effluent Canyon below TA-46, a known source for chromium
Copper	Filtered	13.4 (aa) 9.0 (ca)	3% (aa) 5% (ca)	Mortandad and Sandia canyons	NMWQCC impaired listing for many canyons; results above standards are from sites that receive runoff from developed areas; maximum result (15.6 µg/L) is from the upper part of Mortandad Canyon below TA-3
Mercury	Non-filtered	0.77 (wh)	1% (wh)	Los Alamos Canyon	NMWQCC impaired listing for several canyons; single results above standard from two locations; maximum result (1 µg/L) is from the south fork of Acid Canyon
Selenium	Non-filtered	5.0 (wh and ca)	2% (wh and ca)	Mortandad and Sandia canyons	Single results above standard from two locations; maximum result (15.3 µg/L) is from upper Sandia Canyon
Silver	Filtered	3.2 (aa)	0%	none	NMWQCC impaired listing in Ten Site Canyon, but no results above standard at any location
Zinc	Filtered	117 (aa) 118 (ca)	2% (aa) 2% (ca)	Los Alamos and Sandia canyons	NMWQCC impaired listing for several canyons; single results above standard from two locations that receive runoff from developed areas; maximum result (246 µg/L) is from DP Canyon below TA-21

* aa = acute aquatic life standard; ca = chronic aquatic life standard; hh = human health standard; wh = wildlife habitat standard.

The screening level for aluminum is based on aluminum dissolved in the water column, and filtered surface water samples collected on the Pajarito Plateau in 2010 commonly contained aluminum concentrations above the acute aquatic life standard of 750 µg/L and the chronic aquatic life standard of 87 µg/L. However, most or all of this aluminum may be naturally occurring (e.g., Reneau et al., 2010). For example, Water Canyon above NM 501, upstream from Laboratory operations, had 4,900 and 381 µg/L aluminum in two samples collected in 2010. Similarly, a sample from the perennial stream in Frijoles Canyon in Bandelier National Monument had 922 µg/L aluminum. Aluminum is a natural component of soil and is not known to be derived from Laboratory operations in any significant quantity. The NMED Surface Water Quality Bureau

has also noted that "the large number of exceedances" for aluminum on the Pajarito Plateau "may reflect natural sources associated with the geology of the region" and that aluminum also exceeds 750 µg/L in other parts of the Jemez area (NMED 2009).

The screening level for arsenic is based on arsenic dissolved in the water column. Two filtered surface water samples collected on the Pajarito Plateau in 2010 had arsenic above the human health standard. The highest concentration was measured in Los Alamos Canyon near the Rio Grande. The absence of arsenic above the standard in the Los Alamos Canyon watershed closer to LANL sources indicates that this arsenic is probably derived from natural sources. The other sample, in the north fork of Sandia Canyon (gage E122) below developed areas at LANL's TA-3, had arsenic <5% above the standard. Ten Site Canyon is listed as impaired for arsenic by the NMWQCC, but arsenic was not detected in the single filtered surface water sample collected from this canyon in 2010.

The screening level for copper is based on copper dissolved in the water column, and six filtered surface water samples from the Pajarito Plateau in 2010 had copper results above aquatic life standards. These results are from the watersheds of Mortandad and Sandia canyons from sites that receive runoff from developed areas. No results from a designated perennial stream segment on the Pajarito Plateau contained copper concentrations above the chronic aquatic life standard. The sources of copper in LANL watersheds have not been thoroughly evaluated, but its spatial distribution indicates copper is at least partly derived from runoff from developed areas.

The screening level for mercury is based on total mercury. Two non-filtered surface water samples collected from the Pajarito Plateau in 2010 contained detected mercury concentrations above the wildlife habitat standard. The highest result was from a sample collected from the south fork of Acid Canyon (gage E055.5). Three other samples from this location in 2010 had mercury below the standard, and results from 2009 were also below the standard. The other result above the standard was from Los Alamos Canyon above DP Canyon (gage E040). Three other samples from this location in 2010 also had mercury below the standard. These two canyons are listed as impaired for mercury by the NMWQCC, and the results indicate relatively infrequent exceedances of standards in these canyons.

The screening level for silver is based on silver dissolved in the water column, and no filtered surface water samples collected from the Pajarito Plateau in 2010 contained detected silver concentrations above standards. Although Ten Site Canyon is listed as impaired for silver by the NMWQCC, silver concentrations in this canyon are below the standard.

The screening level for zinc is based on zinc dissolved in the water column. Two of the filtered surface water samples collected from the Pajarito Plateau in 2010 had detected results above aquatic life standards. The highest zinc concentration was from DP Canyon below the grade-control structure (GCS) (gage E039.1), and three other samples from this location in 2010 had zinc concentrations below the standards. The other result above the standards was from an SMA in Sandia Canyon, which includes runoff from developed areas at TA-3. Although Acid, Los Alamos, and Ten Site canyons are listed as impaired for zinc by the NMWQCC, the 2010 surface water data did not indicate any concerns with zinc in these canyons.

In addition to the metals discussed above, three other metals, cadmium, chromium, and selenium, exceeded a standard in surface water samples. The screening level for cadmium is based on cadmium dissolved in the water column. Two filtered surface water samples collected on the Pajarito Plateau in 2010 had cadmium results above the chronic aquatic life standard. These results are from the watersheds of Chupaderos and Los Alamos canyons. The highest value was obtained from DP Canyon above TA-21 (gage E038), a location that receives runoff from urban areas in the Los Alamos town site. The second result is from a background area in Chupaderos Canyon on Santa Fe National Forest land north of Los Alamos. These results indicate that the source of the cadmium is a combination of urban runoff and naturally occurring soils.

The screening level for chromium is based on chromium dissolved in the water column. One filtered surface water sample collected on the Pajarito Plateau in 2010 had chromium above the chronic aquatic life standard. This result was from a base flow sample collected from the upper part of Effluent Canyon below TA-46

(reach E-1FW). TA-46 is a known source for chromium at the Laboratory (LANL 2006a). A second sample from this location in 2010 had chromium below the standard.

The screening level for selenium is based on total recoverable selenium. Two non-filtered surface water samples collected from the Pajarito Plateau in 2010 contained detected selenium above standards. The highest result was from a sample collected from the north fork of Sandia Canyon (gage E122). Two other samples from this location in 2010 had selenium below the standards, and results from 2009 were also below the standards. The other result above the standards was from Cañada del Buey above NM 4. Two other samples from this location in 2010 and others in 2009 also had selenium below the standards.

b. Sediment

For metals and other inorganic chemicals in sediment, analytical data were obtained from 29 samples collected on the Pajarito Plateau in 2010 as part of the annual surveillance program. These samples were mostly from active channel locations that are typically dominated by coarse-grained sediment and also included fine-grained sediment at several locations. In addition, 10 other active channel samples were collected as part of sediment investigations in the Ancho, Chaquehui, and Water canyon watersheds and are included in the data set examined here. Table 6-6 presents a summary of results for inorganic chemicals in Pajarito Plateau sediment samples from 2010 that exceed background values.

Table 6-6
Summary of Results for Select Inorganic Chemicals in Pajarito Plateau Sediment Samples from 2010

Analyte	Sediment Background Value (mg/kg)	Percentage of Samples with Detected Results Above Background Value	Master Watersheds with Detected Results Above Background Value	Notes
Antimony	0.83	8%	Los Alamos, Sandia, and Pajarito canyons	Maximum result (3.63 mg/kg) is from the MDA G-7 drainage at TA-54
Barium	127	3%	Los Alamos Canyon	Single result above background (182 mg/kg) is from lower Los Alamos Canyon and probably represents naturally occurring barium
Cadmium	0.4	5%	Los Alamos and Mortandad canyons	Maximum result (0.803 mg/kg) is from the Acid Canyon stream channel below former outfalls at TA-1 and TA-45 and the Los Alamos town site
Calcium	4,420	5%	Los Alamos Canyon	Both results above background (7280 and 8700 mg/kg) are from lower Los Alamos Canyon and probably represent naturally occurring calcium
Chromium	10.5	13%	Los Alamos, Mortandad, and Sandia canyons	Maximum result (67.1 mg/kg) is from the Sandia Canyon stream channel below the TA-3 power plant
Cobalt	4.73	8%	Los Alamos and Mortandad Canyons	Maximum result (7.04 mg/kg) is from the Cañada del Buey stream channel and probably represents naturally occurring cobalt
Copper	11.2	10%	Los Alamos Canyon	Maximum result (13.8 mg/kg) is from the sediment retention basins above the Los Alamos Canyon weir, below several LANL TAs and the Los Alamos town site
Iron	13,800	3%	Mortandad Canyon	Single result above background (21,200 mg/kg) is from the Cañada del Buey stream channel and probably represents naturally occurring iron
Lead	19.7	13%	Los Alamos Canyon	Maximum result (53.4 mg/kg) is from the Acid Canyon stream channel below former outfalls at TA-1 and TA-45 and the Los Alamos town site
Magnesium	2,370	5%	Los Alamos Canyon	Both results above background (2,420 and 3,250 mg/kg) are from lower Los Alamos Canyon, and probably represent naturally occurring magnesium

Table 6-6 (continued)

Analyte	Sediment Background Value (mg/kg)	Percentage of Samples with Detected Results Above Background Value	Master Watersheds with Detected Results Above Background Value	Notes
Manganese	543	3%	Los Alamos Canyon	Single result above background (655 mg/kg) is from the Acid Canyon stream channel below former outfalls at TA-1 and TA-45 and the Los Alamos town site
Mercury	0.1	3%	Sandia Canyon	Single result above background (0.105 mg/kg) is from the Sandia Canyon stream channel below the TA-3 power plant
Selenium	0.3	3%	Los Alamos Canyon	Single result above background (0.795 mg/kg) is from the sediment retention basins above the Los Alamos Canyon weir, below several LANL TAs and the Los Alamos town site
Silver	1	3%	Sandia Canyon	Single result above background (1.64 mg/kg) is from the Sandia Canyon stream channel below the TA-3 power plant
Vanadium	19.7	10%	Los Alamos and Mortandad canyons	Maximum result (37 mg/kg) is from the Cañada del Buey stream channel and probably represents naturally occurring vanadium
Zinc	60.2	16%	Los Alamos, Mortandad, and Sandia canyons	Maximum result (105 mg/kg) is from the sediment retention basins above the Los Alamos Canyon weir, below several LANL TAs and the Los Alamos town site

In 2010, 16 metals and other inorganic chemicals were detected in sediment at concentrations above the LANL sediment background values. Maximum results for these inorganic chemicals were obtained at six different locations in Acid, Los Alamos, Pajarito, and Sandia canyons and Cañada del Buey. Several of these results probably indicate background variability. For example, the highest concentrations of cobalt, iron, and vanadium were measured in a coarse-grained active channel sample from Cañada del Buey. These elements are all elevated in black magnetite-rich sands that are common on the Pajarito Plateau (Reneau et al., 1998a), and the presence of black sands in this sample was noted in the field. The highest concentrations of barium, calcium, and magnesium were measured in a fine-grained sample from lower Los Alamos Canyon near the Rio Grande, and these are not recognized as contaminants upstream. Instead, the source of these constituents was probably floods emanating from Guaje Canyon, where geologic units are different than on the Pajarito Plateau at LANL.

Other results for inorganic chemicals in sediment samples are consistent with known contamination at LANL. The maximum results for chromium, mercury, and silver were measured in an active channel sample from upper Sandia Canyon, below the TA-3 power plant, and are consistent with previous results (e.g., LANL 2009c). The maximum result for antimony came from a sample collected from a small drainage below MDA G at TA-54 within the Pajarito Canyon watershed, which is consistent with results from prior surveillance sediment samples (e.g., Reneau et al., 2010). The maximum results for cadmium, lead, and manganese were obtained from an active channel sample in Acid Canyon, where these metals have been previously identified as above background concentrations (LANL 2004). The maximum concentrations of copper, selenium, and zinc were obtained from fine-grained sediments deposited above the Los Alamos Canyon weir. Copper and zinc have been previously detected above background concentrations at this site (LANL 2008b). The Acid Canyon and Los Alamos Canyon weir locations both receive runoff from both present or former LANL TAs and the Los Alamos town site, and the metals detected above background concentrations at these locations may have both LANL and town site sources.

3. Organic Chemicals in Surface Water and Sediment

a. Surface Water

During 2010, the Laboratory obtained analytical data on organic chemicals from 185 surface water samples at 61 locations on the Pajarito Plateau. At some locations, multiple samples were collected during single runoff events to evaluate how concentrations of sediment and potential contaminants varied through events. An additional eight samples were collected at three locations along the Rio Grande. The analyses included the following suites: dioxins and furans, explosive compounds, pesticides, PCBs, semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). These data were compared with various screening levels, as discussed in Section C.3. Under the federal Clean Water Act §303(d) list, the NMWQCC has listed parts of several canyons within or near LANL as impaired for PCBs (NMWQCC 2010). A summary of results for organic chemicals exceeding standards is presented in Table 6-7, and results from all organic chemical analyses in surface water are discussed below.

Table 6-7
Summary of Results for Organic Chemicals in Non-Filtered Surface Water Samples from the Pajarito Plateau in 2010

Analyte and Method	Standard (µg/L) *	Percentage of Samples with Detected Results Above Standard *	Master Watersheds with Detected Results Above Standard	Notes
PCBs by Aroclor Method	0.00064 (hh) 0.014 (wh)	5% (hh) 5% (wh)	Sandia Canyon	Arolcor-1260 detected in one sample from a small drainage in the upper Sandia Canyon watershed, at 0.095 µg/L
PCBs by Congener Method	0.00064 (hh) 0.014 (wh)	82% (hh) 57% (wh)	Los Alamos, Mortandad, Pajarito, and Sandia canyons, and several non-LANL-affected canyons	Maximum result, 15.1 µg/L, from upper Los Canyon sediment detention basin below SWMU 01-001(f); human health standard exceeded in background areas north of Los Alamos associated with atmospheric fallout and also in areas receiving runoff from Los Alamos town site and other developed areas

*hh = Human health standard; wh = wildlife habitat standard.

Analyses for dioxins and furans were obtained from 47 non-filtered surface water samples collected at 18 locations on the Pajarito Plateau in 2010. One or more dioxin or furan congeners were detected in 40 of these samples from 15 locations in Acid, DP, Effluent, Los Alamos, Pajarito, Pueblo, and Twomile canyons. Maximum results for different congeners were obtained from four locations: Los Alamos Canyon above the weir (gage E042.1), the south fork of Acid Canyon (gage E055.5), Pueblo Canyon above Acid Canyon (gage E056), and upper Effluent Canyon (reach E-1FW). None of these results were above standards.

For explosive compounds, analyses were obtained from 16 non-filtered storm water samples collected at 11 locations on the Pajarito Plateau in 2010. A total of eight different explosive compounds were detected at five locations in Cañon de Valle, Pajarito Canyon, and Water Canyon. The highest concentrations of each were measured in Cañon de Valle below MDA P, downstream from a high-explosive machining facility at TA-16. None of these results were above standards.

For pesticides, analyses were obtained from six non-filtered surface water samples collected at two locations along the Rio Grande in 2010. No pesticides were detected in these samples.

For PCBs, analyses were obtained in 2010 using both the Aroclor method (EPA method 8082) and the congener method (EPA method 1668A). Aroclor analyses were obtained from 22 non-filtered surface water samples collected at 15 locations on the Pajarito Plateau, and Aroclor-1260 was detected in one of these samples from Sandia Canyon. Aroclor analyses were also obtained from three samples at two locations along the Rio Grande, but no Aroclors were detected in these samples.

PCB congener analyses were obtained from 108 non-filtered surface water samples collected at 37 locations on the Pajarito Plateau. Of these samples, 104 samples from 35 locations, including samples from background areas, had detected PCBs. PCB congener analyses were also obtained from six samples at two locations along the Rio Grande, and PCBs were detected in one of these samples, collected upriver from canyons draining the Laboratory. Most of the Pajarito Plateau samples, 82%, had total detected PCB concentrations above the human health standard of 0.00064 µg/L, including locations that receive runoff from the Los Alamos town site and other developed areas. Most of these samples, 57%, were also above the wildlife habitat standard of 0.014 µg/L. For example, a sample collected from Pueblo Canyon above Acid Canyon, which receives runoff from the Los Alamos town site, had 0.225 µg/L PCBs, and a sample from Cañada de los Latas, on Santa Fe National Forest land north of Los Alamos, had 0.0133 µg/L PCBs. The source of PCBs in background areas is atmospheric fallout. The highest concentrations of PCB congeners were measured in Los Alamos Canyon, below known Laboratory sources of PCBs, and these results are discussed later in section F.1.

For SVOCs, analyses were obtained from 23 non-filtered surface water samples collected at 19 locations on the Pajarito Plateau in 2010. Six samples were also collected from two locations along the Rio Grande. Single SVOCs were detected in three samples from three different locations on the Pajarito Plateau in Cañon de Valle, Mortandad Canyon, and Pajarito Canyon. None of these results were above standards.

For VOCs, analyses were obtained from 36 non-filtered surface water samples collected at 22 locations on the Pajarito Plateau in 2010 and from an additional eight samples from three locations along the Rio Grande. Five VOCs were detected in one or more samples from three locations, all in Sandia Canyon. None of these results were above standards.

b. Sediment

For organic chemicals in sediment, analytical data were obtained from 44 samples collected on the Pajarito Plateau in 2010 as part of the annual surveillance program. These samples were mostly from active channel locations that are typically dominated by coarse-grained sediment but also included fine-grained sediment at several locations. In addition, 10 other active channel samples were collected as part of sediment investigations in the Ancho, Chaquehui, and Water Canyon watersheds, and are included in the data set examined here. Table 6-8 presents a summary of results for detected organic chemicals in Pajarito Plateau sediment samples from 2010.

Table 6-8
Summary of Results for Organic Chemicals in Pajarito Plateau Sediment Samples from 2010

Analyte and Method	Percentage of Samples with Detected Results	Master Watersheds with Detected Results	Notes
Dioxin and Furan Congeners	100%	Los Alamos and Pajarito canyons	Highest concentrations were obtained from the sediment retention basins above the Los Alamos Canyon weir
PCBs by Aroclor Method	18%	Los Alamos and Sandia canyons	Highest concentrations, 22.3 mg/kg Aroclor-1254 and 10.8 mg/kg Aroclor-1260, were obtained from the upper Los Alamos Canyon sediment detention basins
PCBs by Congener Method	100%	Ancho, Chaquehui, and Los Alamos canyons	Maximum result for total PCB congeners, 0.105 mg/kg, was obtained from the sediment retention basins above the Los Alamos Canyon weir

In 2010, as part of the annual surveillance program, we obtained analytical data on dioxins and furans in sediment from nine samples: five from the Los Alamos Canyon weir and four from small drainages below MDA G at TA-54. Dioxin and furan congeners were detected in each sample, and maximum concentrations were measured in fine-grained samples collected at the weir.

We obtained analytical data on PCBs in sediment by the Aroclor method (EPA method 8082) from 18 samples in 2010 as part of the annual surveillance program. These samples were all collected from canyons

draining the Pajarito Plateau and were mostly active channel locations that are typically dominated by coarse-grained sediment. We also obtained analytical data on PCBs by the Aroclor method from 10 other active channel samples collected as part of sediment investigations in the Ancho, Chaquehui, and Water Canyon watersheds that are included in the data set examined here. Aroclor-1254 and Aroclor-1260 were both detected in the same five samples, four from Los Alamos Canyon and one from Sandia Canyon. Maximum concentrations for both Aroclors were from a fine-grained sample collected from the upper Los Alamos Canyon sediment detention basins, where a PCB cleanup recently occurred (LANL 2010c).

Also as part of the annual surveillance program in 2010, we obtained analytical data for PCB congeners in sediment using EPA method 1668A on 56 fine-grained samples, including 26 samples from the Pajarito Plateau, 20 samples from along the Rio Grande, and 10 samples from Cochiti reservoir sediment. PCB congeners were detected in all samples, with the highest concentrations obtained from the sediment retention basins above the Los Alamos Canyon weir. We obtained these data to evaluate congener "fingerprints," PCB sources, and spatial and temporal variations in PCB concentration, and they are discussed further in Sections F.1, F.6, F.7, and G.3.

In 2010, we also obtained analytical data on explosive compounds from the 10 active channel samples in the Ancho, Chaquehui, and Water canyon watersheds mentioned above. No explosive compounds were detected in these samples.

F. CANYON-SPECIFIC RESULTS

1. Los Alamos Canyon (includes Acid, Barrancas, Bayo, DP, Guaje, Pueblo, and Rendija Canyons)

Los Alamos Canyon has a large drainage area that heads in the Sierra de los Valles, with a stream channel length of about 17 mi (27 km). The total drainage area is about 61 mi^2 (157 km^2), of which 54% is located within Guaje Canyon and its tributaries (including Barrancas and Rendija Canyons). The Laboratory has used land in the Los Alamos Canyon watershed continuously since the early 1940s, with operations conducted in the watersheds of several tributary canyons (Acid, Bayo, DP, and Pueblo canyons). Several of the canyons within the watershed also receive urban runoff from the Los Alamos town site, and lower Pueblo Canyon receives treated sanitary municipal wastewater from the Los Alamos County WWTP.

Historical releases of radioactive liquid effluents into Acid, DP, and Los Alamos Canyons have introduced americium-241, cesium-137, plutonium-238, plutonium-239/240, and strontium-90, among other radionuclides, into the canyon bottoms. Most of these radionuclides bind to stream sediment and persist at concentrations well above atmospheric fallout levels. Cesium-137 and plutonium-239/240 are the most important radionuclides in the Los Alamos Canyon watershed from the perspective of potential human health risk, although concentrations are low enough that they do not pose an unacceptable risk to recreational users of the canyons (LANL 2004; LANL 2005). The main source for cesium-137 was discharges into DP Canyon from a treatment facility at TA-21 between 1952 and 1986. The main source for plutonium-239/240 was discharges into Acid Canyon from former TA-1 and former TA-45, located within the current Los Alamos town site, between 1945 and 1964. These radionuclides and other contaminants have been transported by floods down these canyons, off-site across Pueblo de San Ildefonso land, and to the Rio Grande near Otowi Bridge (Graf 1994, 1996; Reneau et al., 1998b; LANL 2004). Plutonium-239/240 from historic Acid Canyon discharges has been traced in sediment more than 55 km to lower Cochiti Reservoir (Gallaher and Efurd 2002).

PCBs have also been released into the Los Alamos Canyon watershed from multiple sources, with their spatial distribution indicating both Laboratory and Los Alamos town site sources. The transport of PCBs in storm water is of particular concern in this watershed because the standard for PCBs in water is very low (0.00064 µg/L, the NMED human health standard), and most samples are higher than the standard. In the last 10 years, the Laboratory has taken a series of measures to reduce potential human health and ecological risk and storm water transport of contaminants in the Los Alamos Canyon watershed. In the last two years, this work has included construction of GCSs along the main stream channels in lower Pueblo Canyon and in

DP Canyon (LANL 2010d; LANL 2010e) and excavation of PCB-contaminated sediment and soils in upper Los Alamos Canyon below SWMU 01-001(f) (also referred to as Hillside 140 or LA-SMA-2) (LANL 2010c). In addition, in March 2011, approximately 1,500 willows were planted in the area above the Pueblo Canyon GCS to both improve habitat and aid in slowing floodwaters.

Results of sediment sampling in the Pueblo Canyon watershed show that plutonium-239/240 concentrations in sediment transported by floods are much less at present than concentrations during the period of active releases of radioactive effluent into Acid Canyon. Figure 6-9 shows variations in plutonium-239/240 concentration in active channel sediment in lower Pueblo Canyon between ca. 1950 and 2010, extending the record presented previously (LANL 2004; Reneau et al., 2004; Reneau et al., 2010) with data from more recent surveillance sediment samples. As shown in the previous studies, plutonium-239/240 concentrations were much higher prior to 1965 and since that time have shown no distinct trends. The year-to-year variations seen in these samples may be due at least in part to variability in silt and clay percentages, as there are strong relations between sediment particle size and contaminant concentration (LANL 2004; Reneau et al., 2004).

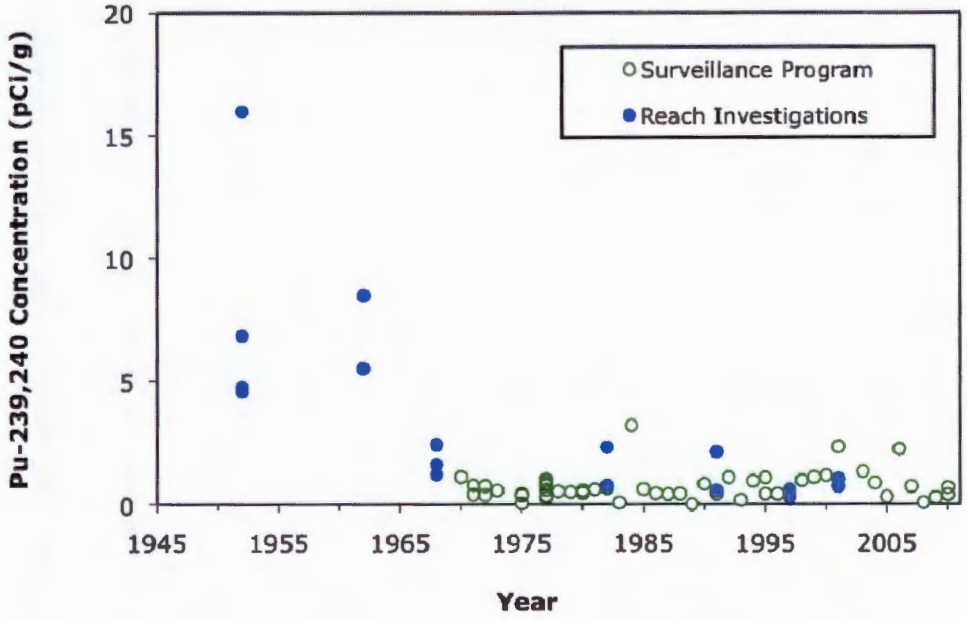

Figure 6-9 Variations in plutonium-239/240 concentration over time in active channel sediment in lower Pueblo Canyon; all results are detects, and most are above the background value of 0.068 pCi/g.

In lower Acid Canyon, analyses of active channel sediment samples show an overall decrease in plutonium-239/240 concentrations between 1970 and 2010 (Figure 6-10, modified from Reneau et al., 2010), with inter-year and intra-year variability also seen. The plutonium-239/240 concentration measured here in 2010, 7.43 pCi/g, is higher than that measured in the previous four years, but within the range measured over the last 10 years (1.41 to 12.5 pCi/g). Plutonium-239/240 concentrations in the active stream channel decrease downstream, measured at 0.662 and 0.382 pCi/g in lower Pueblo Canyon above and below the GCS, respectively, and 0.0979 pCi/g in lower Los Alamos Canyon near the Rio Grande.

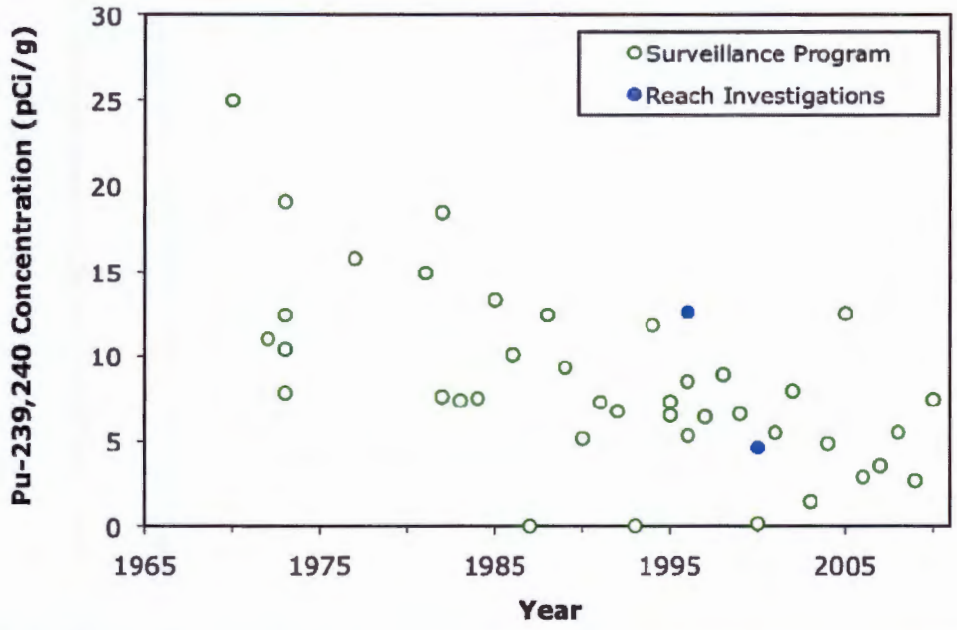

Figure 6-10 Variations in plutonium-239/240 concentration over time in active channel sediment in lower Acid Canyon; most values are detects and are above the background value of 0.068 pCi/g.

In two areas, samples of fine-grained sediment were collected in 2010 for radionuclide analysis for comparison with nearby coarse-grained samples. In Pueblo Canyon above the GCS, plutonium-239/240 concentrations were higher in the fine-grained sediment, consistent with results of previous studies (LANL 2004; Reneau et al., 2004). In contrast, in lower Los Alamos Canyon near the Rio Grande, plutonium-239/240 was measured at 0.0931 and 0.124 pCi/g in fine-grained sediment, similar to the measurement of 0.0979 pCi/g in a coarse-grained active channel sample. The sampled sediment in this part of Los Alamos Canyon probably includes mixtures of sediment derived from Guaje Canyon as well as upper Los Alamos Canyon, on LANL land, and Pueblo Canyon. These mixtures of sediment likely obscure the relationships between particle size and contaminant concentrations that are seen elsewhere.

Plutonium analyses were obtained from 53 storm water samples collected in the Los Alamos Canyon watershed in 2010. Figure 6-11 shows the spatial variations in plutonium-239/240 concentrations in this watershed. The highest plutonium-239/240 concentration, 150 pCi/L, was measured in the south fork of Acid Canyon (gage E055.5), close to the original Manhattan Project outfalls. Concentrations decreased downstream, measured at up to 44 pCi/L in Pueblo Canyon and 5 pCi/L in Los Alamos Canyon near the Rio Grande. In Los Alamos Canyon above NM 4, plutonium-239,240 concentrations were measured at up to 19 pCi/L, being similar above and below the confluence with DP Canyon (Figure 6-11). Concentrations were much lower in DP Canyon, supporting prior data that the primary source of plutonium-239,240 in upper Los Alamos Canyon was upstream from DP Canyon (LANL 2004). Plutonium-239,240 concentrations in storm water samples from gages in lower Pueblo Canyon (E060 and E060.1) are shown in Figure 6-12 and indicate that results from 2010 are within the range measured in previous years.

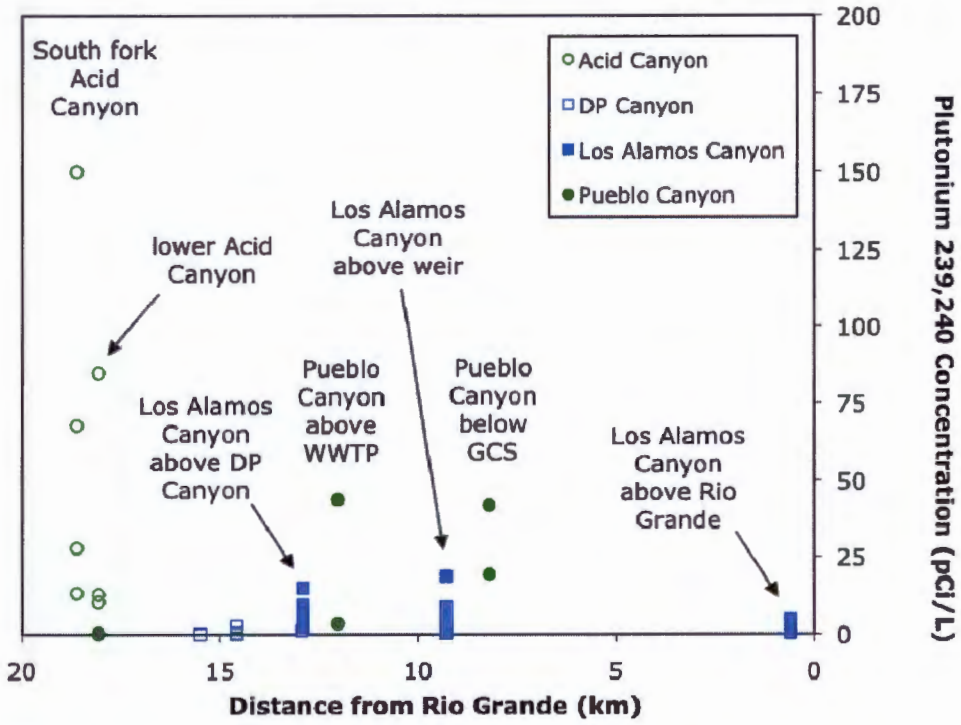

Figure 6-11 **Spatial variations in plutonium-239/240 concentrations in non-filtered storm water samples from the Los Alamos Canyon watershed in 2010; all results over 0.03 pCi/L are detects**

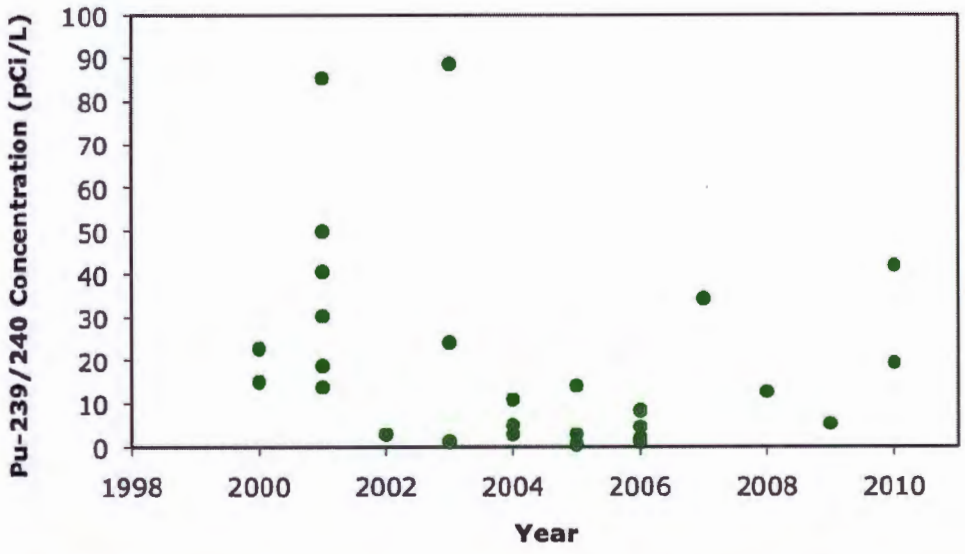

Figure 6-12 **Variations in plutonium-239/240 concentration over time in non-filtered surface water samples in lower Pueblo Canyon (gages E060 and E060.1); all values are detects.**

Results of sediment sampling in Los Alamos Canyon show that cesium-137 concentrations in sediment transported by recent floods are much less than concentrations during the period of active releases of radioactive effluent into DP Canyon. Figure 6-13 plots cesium-137 concentrations in samples from the active channel of lower DP Canyon since 1971 and shows that concentrations have been relatively low and constant

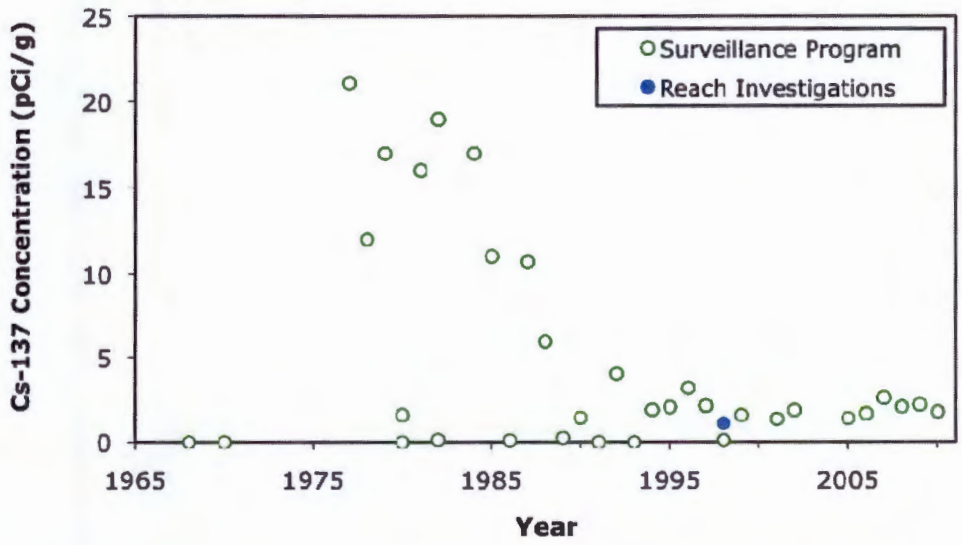

Figure 6-13 Variations in cesium-137 concentration over time in active channel sediment in lower DP Canyon; most values are detects and are above the background value of 0.9 pCi/g.

since about 1989. Downstream, samples from the active stream channel in Los Alamos Canyon above NM 4 and near the Rio Grande in 2010 had cesium-137 concentrations below the background value of 0.9 pCi/g, consistent with the findings from 2008 and 2009.

In 2010, analyses were also obtained for cesium-137 and other radionuclides in coarse-grained active channel sediment closer to the source, immediately upstream and downstream of the newly constructed GCS below the former outfall for the radioactive liquid waste treatment facility at TA-21. Cesium-137 concentrations in both samples were below the sediment background value, indicating that sediment deposited above the GCS and also transported past it was largely derived from upstream of the former outfall. These data also indicate that sediment analyzed from lower DP Canyon, where cesium-137 is above the background value, is derived from erosion of sediment in the lower canyon, below the GCS.

Cesium-137 analyses were obtained from 40 storm water samples collected in the Los Alamos Canyon watershed in 2010, and spatial variations in cesium-137 concentrations are shown in Figure 6-14. Most results are below detection limits, and cesium-137 was only detected in lower DP Canyon and in Los Alamos Canyon above the weir. The highest concentrations are from the gage above the weir (E042.1), indicating that the cesium-137 transported in storm water is mostly derived from erosion of stream banks between DP Canyon and the weir, which is consistent with inferences from previous investigations (e.g., LANL 2004; Malmon et al., 2005).

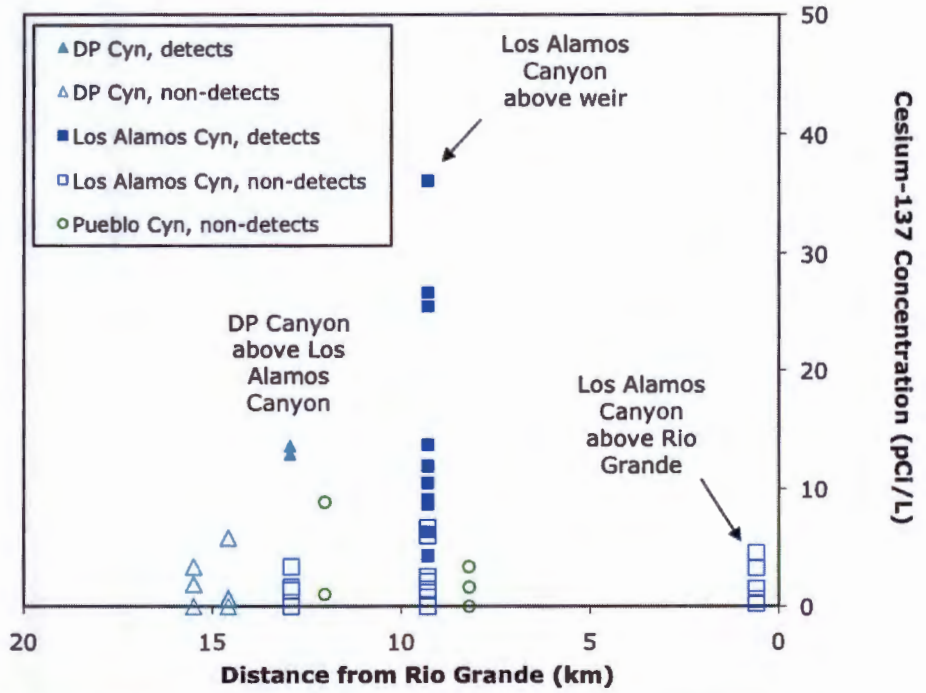

Figure 6-14 Spatial variations in cesium-137 concentrations in non-filtered storm water samples from the Los Alamos Canyon watershed in 2010

The highest concentrations of americium-241 in surface water at LANL in 2010 were also obtained from Los Alamos Canyon above the weir, on the same day as the maximum cesium-137 at that station (August 16). This americium-241 has the same source as the cesium-137, a former TA-21 outfall into DP Canyon. As shown in Figure 6-15, concentrations in storm water at this location in 2010 were within the range measured in previous years, and the maximum result was lower than in most years.

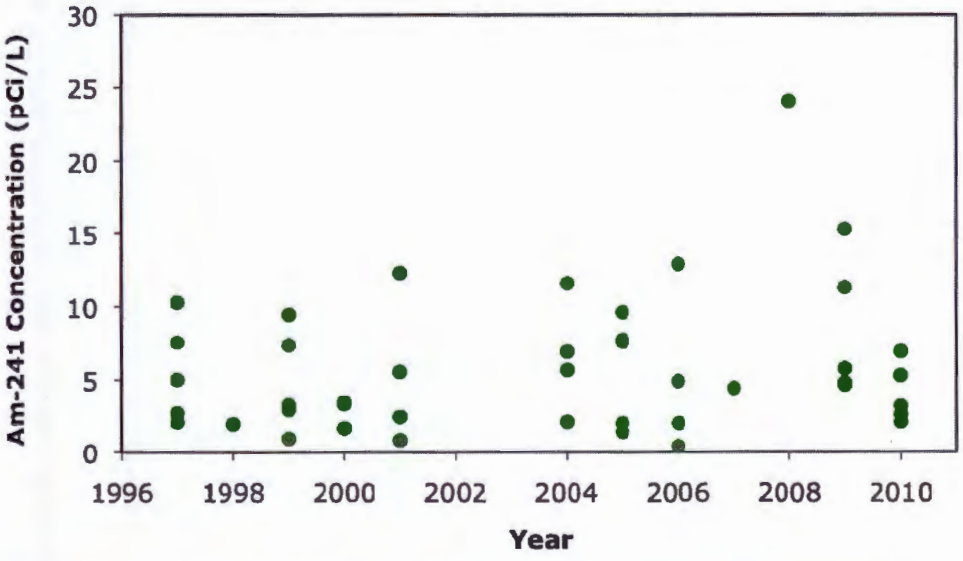

Figure 6-15 Variations in americium-241 concentration over time in non-filtered storm water samples at gages above Los Alamos Canyon weir (E042 and E042.1); all values are detects.

The highest concentration of strontium-90 in surface water at LANL in 2010 was measured in a storm water sample collected from DP Canyon below the GCS on July 22. The strontium-90 has the same source as the americium-241 and cesium-137 but is more soluble and therefore has different geochemical behavior. Figure 6-16 shows its spatial distribution in the Los Alamos Canyon watershed in 2010.

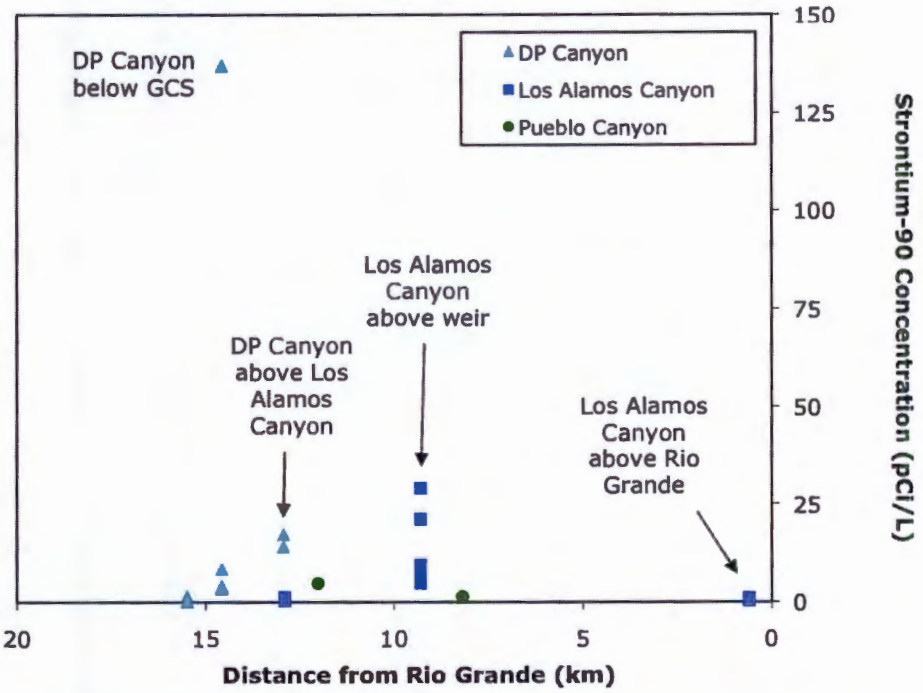

Figure 6-16 Spatial variations in strontium-90 concentrations in non-filtered storm water samples from the Los Alamos Canyon watershed in 2010; all results above 0.5 pCi/L are detects.

The highest concentrations of uranium-234, uranium-235/236, and uranium-238 in the 2010 surveillance program sediment samples were measured in a fine-grained sediment sample from upper Los Alamos Canyon, in the upper Los Alamos Canyon sediment detention basin below SWMU 01-001(f). These results are consistent with known activities at this SWMU and prior data from the site (LANL 2010f).

Five metals in surface water samples from the Los Alamos Canyon watershed had results above standards in 2010: aluminum, arsenic, cadmium, mercury, and zinc. The aluminum results probably represent background conditions, as discussed in Section E.2.a. A single result for arsenic is above the human health standard of 9 µg/L, 29.3 µg/L from Los Alamos Canyon near the Rio Grande (gage E109.9) on August 23. Arsenic has not been identified as a contaminant in surface water at LANL upstream in this watershed, and this result probably represents naturally occurring arsenic associated with geologic units present in the lower watershed. A single result for cadmium is above the acute aquatic life standard of 0.25 µg/L: 1.1 µg/L from DP Canyon above TA-21 (gage E038) on July 22. Cadmium has been identified as a contaminant in urban runoff (Breault and Granato 2000), and runoff from the Los Alamos town site into the head of DP Canyon may be the source of this cadmium. Zinc also has a single result above the acute aquatic life standard of 117 µg/L and the chronic aquatic life standard of 118 µg/L, collected from DP Canyon below the GCS (gage E039.1) on July 21. Zinc is also a common contaminant in urban runoff, and runoff from the Los Alamos town site may also be the source of this zinc.

Two results for mercury in the Los Alamos Canyon watershed in 2010 were above the wildlife habitat standard of 0.77 µg/L, one from Los Alamos Canyon above DP Canyon (gage E030; 0.85 µg/L on August 5) and one from the south fork of Acid Canyon (gage E055.5; 1.0 µg/L, also on August 5). At both sites, three additional samples had mercury concentrations below the standard. Mercury has been previously identified as

a contaminant in both areas, derived from LANL sites (LANL 2004; Reneau et al., 2010). However, the low concentrations and low frequency of results above the standard indicates there is relatively little impact from mercury in this watershed.

In sediment, there were 13 inorganic chemicals measured above background values in the Los Alamos Canyon watershed in 2010. As discussed in Section E.2.b, three of these (barium, calcium, and magnesium) were only above background values in lower Los Alamos Canyon near the Rio Grande and probably represent natural background, associated with runoff events from Guaje Canyon where bedrock units differ from the Pajarito Plateau at LANL. Chromium, cobalt, copper, and vanadium are also elevated here and may also represent natural background conditions or runoff from developed areas, as discussed below.

Six metals were measured above background values in fine-grained samples from the sediment detention basins above the Los Alamos Canyon weir. Two of these, antimony and chromium, had not been previously measured above background here, and the maximum concentrations of two others, lead and zinc, were higher than previous sample results from the weir (LANL 2008b). The other two metals, copper and selenium, were within the range of previous measurements. All six of these metals have recognized sources in urban runoff (e.g., Breault and Granato 2000; Callender and Rice 2000; Walker et al., 1999), and runoff from the Los Alamos town site into the head of DP Canyon may be an important source. Zinc was also measured above the background value in an active channel sample below the DP Canyon GCS.

Contaminant concentrations in sediment are often strongly related to particle size distribution, and comparisons of analytical data with silt and clay content of samples are often useful in understanding variability between samples. Figures 6-17 and 6-18 present data on lead and zinc at the weir and demonstrate that for a given particle size lead and zinc concentrations in some of the recent samples (representing sediment deposited in 2009 and 2010) are higher than previous samples (sediment deposited between original construction of the weir in June 2000 and its excavation in May 2009). Although the cause of these increases is not certain, they may result from continued transport of lead and zinc, along with other contaminants, from roads and other developed areas within the Los Alamos town site.

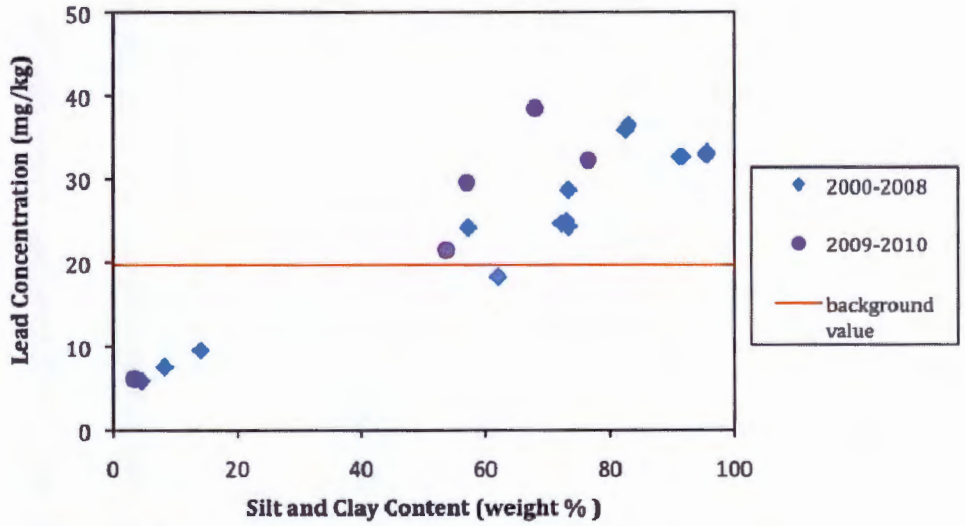

Figure 6-17 Variations in lead concentration in sediment samples from the Los Alamos Canyon weir as a function of silt and clay content

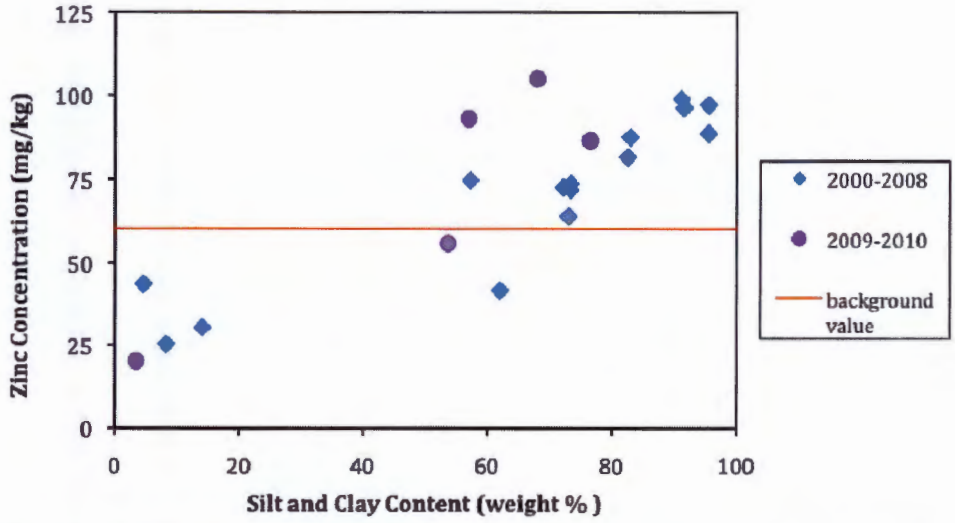

Figure 6-18 Variations in zinc concentration in sediment samples from the Los Alamos Canyon weir as a function of silt and clay content

Five metals were measured above background values in an active channel sample from lower Acid Canyon, and three of these (cadmium, lead, and manganese) had their highest concentrations in the 2010 surveillance samples from this location. Cobalt and vanadium were also elevated in this sample. Previous sediment data from upstream in Acid Canyon indicate that this cadmium, and possibly the lead, were probably derived from past releases into the south fork of Acid Canyon from Laboratory outfalls at TA-1 or TA-45, whereas the other metals probably have sources in urban runoff or naturally occurring soils (LANL 2004)

PCBs were analyzed in surface water samples in the Los Alamos Canyon watershed in 2010 using both the Aroclor method (one sample) and the congener method (74 samples). The Aroclor analyses consisted of one base flow sample from Pueblo Canyon below the Los Alamos County WWTP and had no detected PCBs. The congener analyses included 68 storm water samples, five snowmelt runoff samples, and one base flow sample. All but one sample had detected PCB congeners, including nine samples from background areas in Guaje and Los Alamos canyons and three samples from a site receiving runoff from the Los Alamos town site (a "baseline" area). Baseline samples had up to 0.225 µg/L of PCBs in Pueblo Canyon above Acid Canyon, and background samples had up to 0.0168 µg/L in Los Alamos Canyon above the skating rink. PCB concentrations in snowmelt runoff were much lower than in storm water runoff, with a maximum of 0.00865 µg/L measured in Los Alamos Canyon on April 21. The single base flow sample, derived from effluent releases from the Los Alamos County WWTP in Pueblo Canyon, also had low concentrations of PCBs, measured at 0.000168 µg/L on January 13.

Total detected congeners for all storm water samples from the Los Alamos Canyon watershed are plotted in Figure 6-19, excluding the maximum result (which is discussed below). The highest concentration in the watershed, 15.1 µg/L, was measured in Los Alamos Canyon at the western sediment detention basin in upper Los Alamos Canyon, on July 26. The same day, water in the lower basin had 1.01 µg/L PCBs, and surface water below the lower basin had 0.545 µg/L PCBs. These decreases are consistent with sediment settling out in the ponds. Along the main Los Alamos Canyon stream channel, total PCBs on LANL property were up to 1.96 µg/L, above the weir on August 16. In Pueblo Canyon, total PCB concentrations were measured up to 0.352 µg/L, above the WWTP on August 5. Concentrations were lower in Acid Canyon, DP Canyon, and lower Los Alamos Canyon near the Rio Grande (Figure 6-19). Concentrations in these areas are also less than in Pueblo Canyon above Acid Canyon, a baseline area receiving runoff from the Los Alamos town site. These data support earlier conclusions that Los Alamos Canyon on LANL property includes the most important PCB sources in the watershed, that concentrations decrease greatly downstream from the sources, and that storm water runoff is more important than snowmelt runoff or base flow in the transport of PCBs. PCBs in storm water in the Los Alamos Canyon watershed in 2010 are discussed further in LANL (2011c).

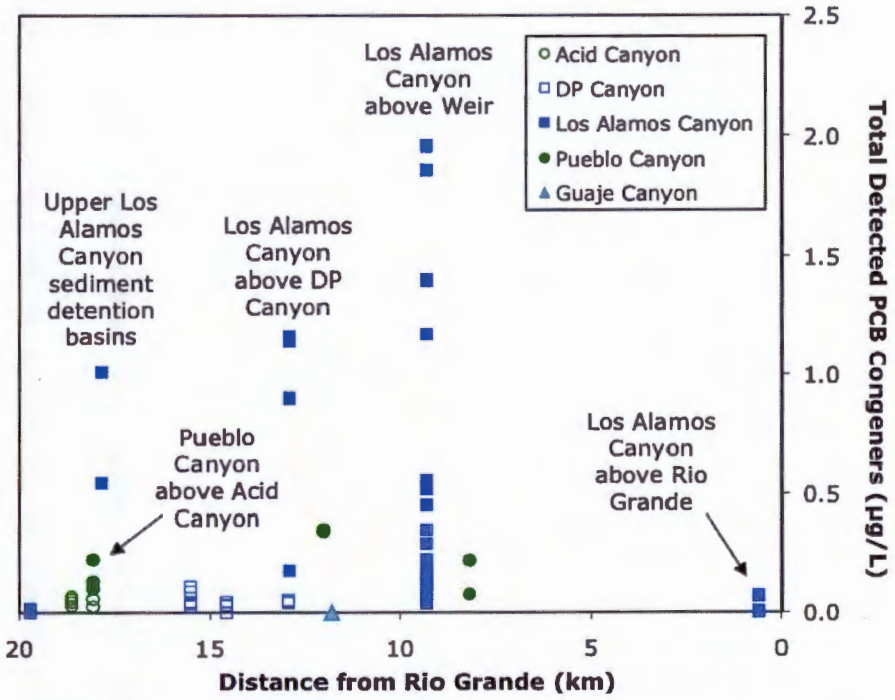

Figure 6-19 Spatial variations in total detected PCB congener concentrations in non-filtered storm water samples from the Los Alamos Canyon watershed in 2010, with the highest result, from upper Los Alamos Canyon sediment detention basins, excluded.

Using the Aroclor method, PCBs were detected in sediment at four locations in the Los Alamos Canyon watershed in 2010, all in Los Alamos Canyon above NM 4. Both Aroclor-1254 and Aroclor-1260 were detected in each of these samples. The highest concentration of detected Aroclors (sum of Aroclor-1254 and Aroclor-1260) was in a fine-grained sample from the western sediment detention basin in upper Los Alamos Canyon, at 33.1 mg/kg. Concentrations were lower in coarse-grained sediment in this same basin, 7.5 mg/kg, and much lower in coarse-grained active channel sediment downstream (0.0394 and 0.0079 mg/kg above DP Canyon and above the weir, respectively). Aroclors were not detected in the samples from Acid, DP, or Pueblo Canyons, or Los Alamos Canyon near the Rio Grande. These results are consistent with earlier sediment data which indicated that Los Alamos Canyon above DP Canyon was the most important source area for PCBs in this watershed (e.g., LANL 2008a; Reneau et al., 2010). These results are also consistent with the storm water data from 2010 discussed previously.

PCB congeners from sediment or water samples can be grouped together into 10 homologs, based on the number of chlorine atoms on the biphenyl rings, which allows visual comparison of similarities or differences between samples or groups of samples. The designations for the 10 homologs range from monochlorobiphenyl (or monoCB, with a single chlorine atom) to decachlorobiphenyl (or decaCB, with 10 chlorine atoms). Figure 6-20 shows average homolog percentages in sediment in each of the four areas in DP, Los Alamos, and Pueblo canyons that were sampled in 2010. Figure 6-20 also shows the average from the canyon bottom below SWMU 01-001(f) for comparison (the latter from Reneau et al., 2010). As found with data from 2009 (Reneau et al., 2010), the congener signatures in lower Pueblo Canyon, lower Los Alamos Canyon (reach LA-5), and Los Alamos Canyon above the weir are very similar, and cannot be distinguished. The 2010 data also indicate that PCB congener signatures are essentially the same in DP Canyon. However, these areas all have different signatures than SWMU 01-001(f), indicating that this site is not a major source for the PCBs found farther downstream in Los Alamos Canyon.

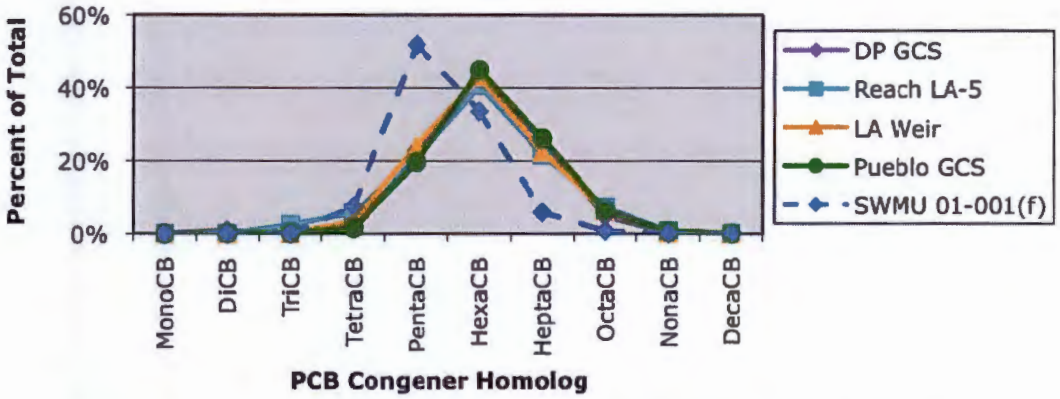

Figure 6-20 Average values for PCB congener homologs from sediment samples collected in DP, Los Alamos, and Pueblo canyons in 2010 and prior data from sediment samples below SWMU 01-001(f).

PCB congener data from surface water samples in the Los Alamos Canyon watershed generally indicate similar homolog signatures to sediment samples, and also show variability related to different sources for runoff and associated sediment between different events. As an example, Figure 6-21 shows average values for PCB homologs from 2010 snowmelt runoff below the Los Alamos Canyon weir (gage E050) and in lower Los Alamos Canyon near the Rio Grande (gage E109.9), and storm water runoff in two events in lower Los Alamos Canyon. Snowmelt runoff at the two locations and one of the storm water runoff events (on September 22) have the same signature, essentially the same as found in sediment at the weir (Figure 6-21). In contrast, the other storm water event on August 15 has a much different signature, associated with runoff from Guaje Canyon.

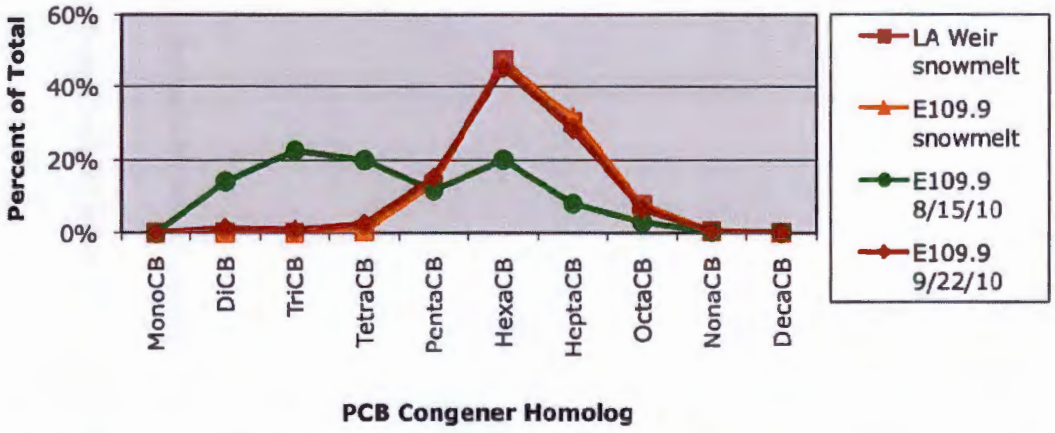

Figure 6-21 Average values for PCB congener homologs from surface water samples collected in lower Los Alamos Canyon in 2010 and snowmelt runoff at Los Alamos Canyon weir

In 2010, dioxin and furan analyses were included in the analytical suite for sediment at the Los Alamos Canyon weir to follow up on an increase in their concentrations that resulted from erosion of SWMU 21-027(a) below a potable water line break at TA-21 in 2008 (Reneau and Kuyumjian 2009). Figure 6-22 shows variations in the concentration of total tetrachlorodibenzodioxin (TCDD) a function of sediment age and silt and clay content, and Figure 6-23 shows variations in total tetrachlorodibenzofuran (TCDF) concentration. These figures show that for a given silt and clay content concentrations of both TCDD and TCDF in sediment deposited in 2009 and 2010 were much less than in 2008 and that the effects of the erosion at SWMU 21-027(a) were short-lived.

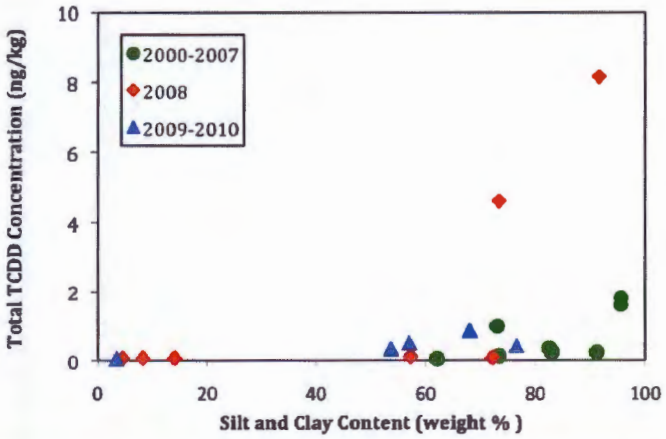

Figure 6-22 **Variations in total TCDD concentration in sediment behind the Los Alamos Canyon weir as a function of sediment age and silt and clay content**

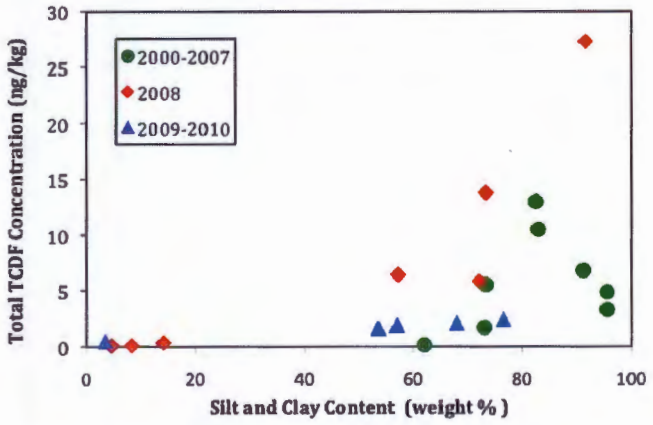

Figure 6-23 **Variations in total TCDF concentration in sediment behind the Los Alamos Canyon weir as a function of sediment age and silt and clay content**

Data on sediment volumes in the basins behind the Los Alamos Canyon weir (LANL 2011d) can be combined with data on contaminant concentrations to estimate the total inventory, or mass, of contaminants that have been deposited here since it was excavated and modified in May 2009. In 2009 and 2010, we estimate that about 0.02 kg of PCBs were deposited behind the weir, or about 0.01 kg/yr. For comparison, we previously estimated that an average of about 0.02 kg/yr of PCBs were deposited there from 2000 through 2008 (Reneau et al., 2010). As discussed in Section G.3, this is much less than the PCB flux in the Rio Grande past Otowi Bridge, above Los Alamos Canyon.

2. Sandia Canyon

Sandia Canyon heads on the Pajarito Plateau within TA-3 and has a total drainage area of about 5.5 mi^2 (14 km^2) and a channel length of about 11 mi (18 km). This relatively small watershed extends eastward across the central part of the Laboratory and crosses Bandelier National Monument and Pueblo de San Ildefonso land before ending at the Rio Grande. Effluent discharges from a sanitary WWTP, supplemented by releases from a steam plant, create perennial flow conditions along a 2-mile reach below TA-3. Surface flow rarely extends past the Laboratory boundary, and only two small runoff events were recorded at the E125 gage above NM 4 in 2010, with an estimated peak discharge of 1.6 cfs on August 15.

Two contaminants that have been of concern in Sandia Canyon are chromium and PCBs. Chromium, discharged in water from the TA-3 power plant from 1956 to 1972, has been the focus of extensive ongoing investigations related to groundwater contamination (LANL 2009c). PCBs were released from a former transformer storage area at TA-3 and were the target of remediation activities involving excavation of soil near the source (LANL 2001). Contaminant concentrations in sediment deposits decrease downstream from TA-3, and relatively low levels of contaminants are present above NM 4, adjacent to the eastern Laboratory boundary (LANL 2009c).

Five metals in surface water samples from the Sandia Canyon watershed had results above screening levels in 2010: aluminum, arsenic, copper, selenium, and zinc. The aluminum results probably represent background conditions, as discussed in Section E.2.a. The result for selenium, 15.3 µg/L from a non-filtered base flow sample from the south fork of Sandia Canyon (gage E122) on May 7, was the highest at LANL in 2010, exceeding the wildlife habitat and chronic aquatic life standards of 5.0 µg/L. Arsenic and copper were both elevated in the filtered sample from this location collected on the same day. Arsenic was slightly above the human health standard of 9 µg/L, at 9.39 µg/L, and copper was slightly above the chronic aquatic life standard of 9 µg/L, at 9.09 µg/L. The source of this water is an outfall at TA-3 (03A-199), which discharges cooling water from the Laboratory Data Communications Center. Samples collected on two other days from this location in 2010, on February 1 and November 9, were below the standards for arsenic, copper, and selenium. Results from 2009 were also below the standard for arsenic and selenium, but copper was elevated here in one sample in 2009, at 32.8 µg/L.

A storm water sample collected from S-SMA-3.6 in the upper Sandia Canyon watershed on October 20 had results above standards for copper and zinc. This site receives runoff from developed areas, and the results for copper and zinc are within the range measured in 2009 for storm water samples in upper Sandia Canyon.

PCBs were detected in one out of 19 surface water samples analyzed from the Sandia Canyon watershed in 2010 by the Aroclor method. Aroclor-1260 was measured at 0.095 µg/L in a storm water sample collected from a small drainage below the Sigma Building at TA-3 on May 14, which is above the human health standard of 0.00064 µg/L and the wildlife habitat standard of 0.014 µg/L. Using the congener method, PCBs were also analyzed in four base flow samples and two storm water samples from the Sandia Canyon watershed. PCBs were detected in all six samples, at concentrations of 0.00164 to 0.797 µg/L. The highest concentration was measured on October 2 in a storm water sample collected from the main Sandia Canyon stream channel below the wetland (gage E123).

Active channel sediment collected from Sandia Canyon below the wetland in 2010 had five metals detected above sediment background values: antimony, chromium, mercury, silver, and zinc. All of these metals except antimony have been previously identified as contaminants in this part of Sandia Canyon (e.g., LANL 2009c), and antimony is only slightly above the background value (0.94 mg/kg vs. 0.83 mg/kg). The results for chromium, mercury, and silver were the highest measured in the 2010 surveillance sediment data set, although they were within the range previously measured at this location. Concentrations in sediment at this location have varied widely, as shown for chromium in Figure 6-24. The variations may, in part, reflect variations in particle size between samples (e.g., the anomalously high concentration measured in 2003), but also, in part, different source areas. For example, a short distance up canyon from the sample site is a side drainage from the Los Alamos County landfill that has an active alluvial fan, and years with relatively low chromium and silver concentration may include a larger percentage of sediment from this source. Low concentrations of PCBs were also detected in the active channel below the wetland in 2009, at similar concentrations to recent years (0.0637 mg/kg Aroclor-1254 and 0.062 Aroclor-1260). Figure 6-25 shows variations in the concentrations of detected PCBs in active channel samples at and near this location since 1998, indicating generally higher values from 1998 to 2005 than from the last five years (2006 to 2010). No radionuclides were detected above background values at this location in 2009.

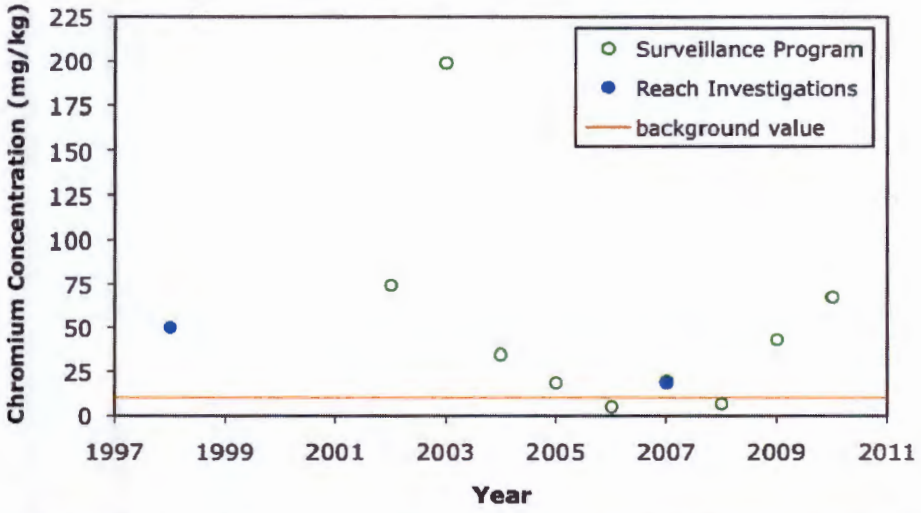

Figure 6-24 **Variations in chromium concentration over time in the active stream channel of Sandia Canyon below the wetland**

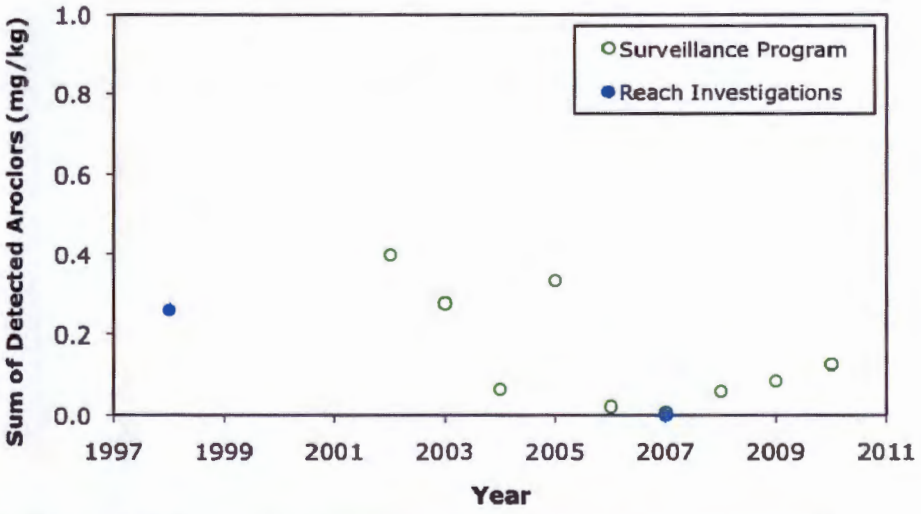

Figure 6-25 **Variations in PCB concentration over time in the active stream channel of Sandia Canyon below the wetland; values are the sum of detected Aroclors**

3. Mortandad Canyon (includes Cañada del Buey and Effluent, Pratt, and Ten Site Canyons)

Mortandad Canyon heads on the Pajarito Plateau in the main Laboratory complex at TA-3 and crosses Pueblo de San Ildefonso land before reaching the confluence with the Rio Grande. It has a total drainage area of about 10 mi^2 (27 km^2) and a main channel length of about 10 mi (16 km). Mortandad Canyon receives treated water discharged into Effluent Canyon from the TA-50 RLWTF. No runoff events have crossed the Laboratory boundary in Mortandad Canyon proper since a stream gage was installed in 1993, and the only reported event that crossed the boundary occurred in 1952 (LANL 2006a). The Mortandad Canyon sediment traps are located approximately two miles upstream of the Laboratory's eastern boundary, and in most years, including 2010, runoff events have not extended past the sediment traps.

Cañada del Buey is a major tributary that heads in TA-63 and passes through the town of White Rock and Pueblo de San Ildefonso land before joining Mortandad Canyon near the Rio Grande. It has a drainage area

of about 4 mi^2 (11 km^2) and a main channel length of about 8 mi (13 km). Runoff events have crossed the Laboratory boundary in Cañada del Buey every year since a gage (E230) was established above NM 4 in 1994, although in most years flow has not been recorded at the next upstream station (E225), indicating that the runoff originates in the lower part of the watershed. The lower part of Cañada del Buey receives treated sanitary wastewater from a Los Alamos County WWTP near the White Rock Overlook, which flows into Mortandad Canyon and the Rio Grande.

The highest concentrations of two radionuclides in surface water samples collected in 2010, cesium-137 and plutonium-238, were measured in a storm water sample collected on August 16 from the stream channel in Mortandad Canyon above Ten Site Canyon (gage E201). Figures 6-26 and 6-27 show time series plots for cesium-137 and plutonium-238 at E201 and E202 (located near the Ten Site Canyon confluence) from 2005 to 2010, indicating that results from 2010 are within the ranges measured in recent years in this part of Mortandad Canyon.

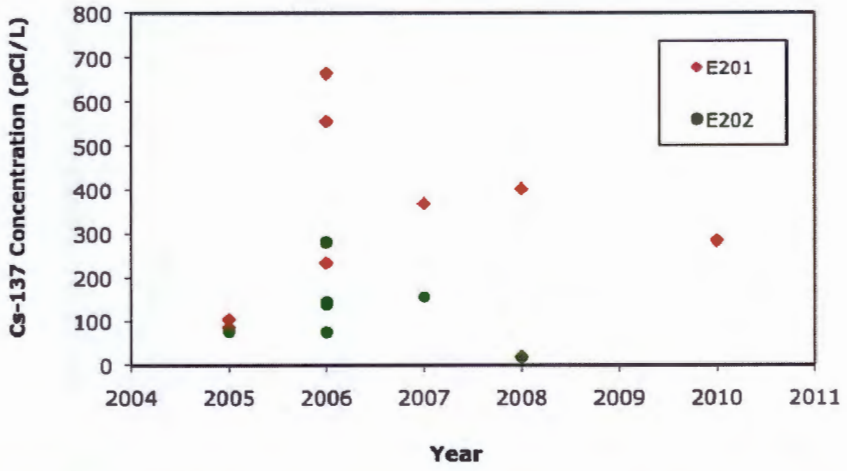

Figure 6-26 **Variations in cesium-137 concentration over time in non-filtered storm water samples in Mortandad Canyon above the sediment traps (gages E201 and E202); all values are detects.**

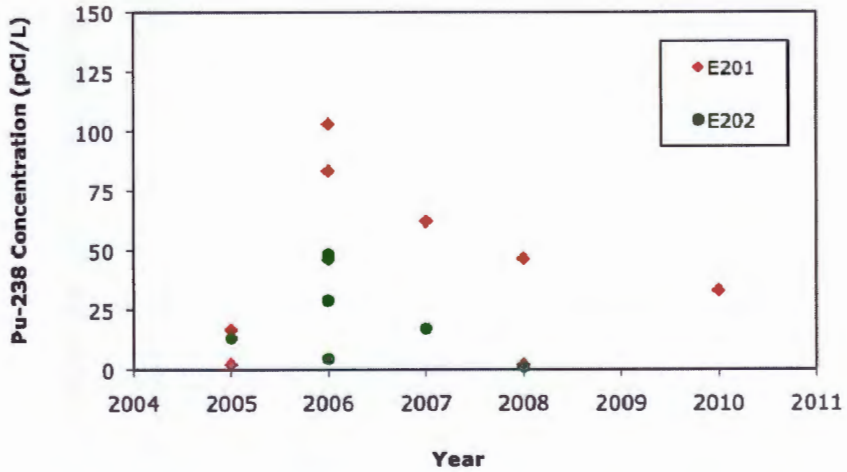

Figure 6-27 **Variations in plutonium-238 concentration over time in non-filtered storm water samples in Mortandad Canyon above the sediment traps (gages E201 and E202); all values are detects.**

Stream sediment in Mortandad Canyon downstream of Effluent Canyon to near regional well R-28 (1 km above the eastern LANL boundary) contains above-background concentrations of radionuclides, with concentrations decreasing to at or near background levels at the Laboratory boundary (LANL 2006a). Cesium-137 is the most important radionuclide in Mortandad Canyon from the perspective of potential human health risk (LANL 2006a). Cesium-137 concentrations in sediment transported by recent floods are much less than concentrations measured during the period of peak releases of radioactive effluent from the RLWTF into Effluent Canyon prior to 1980. Figure 6-28 plots cesium-137 concentrations in samples from the active channel of Mortandad Canyon below Effluent Canyon since 1972 (updated from LANL 2006a and Reneau et al., 2010) and shows that concentrations have been relatively low and constant since about 1983. Similar trends are present for other radionuclides in Mortandad Canyon (LANL 2006a).

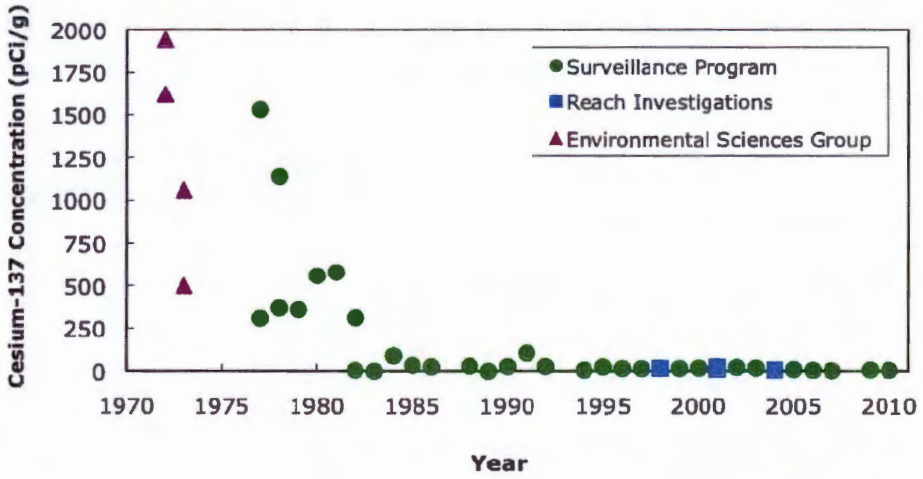

Figure 6-28 Variations in cesium-137 concentration over time in active channel sediment in Mortandad Canyon below Effluent Canyon; most values are detects and are above the background value of 0.9 pCi/g.

Sediment samples have been collected from small drainages below MDA G in the Cañada del Buey watershed since 1982 and have been generally above background levels for radionuclides. In 2010, only the MDA G-8 drainage was sampled because there was no evidence of flow at other stations. Americium-241, plutonium-238, and plutonium-239,240 were all measured above background values at this location, with concentrations of 0.116, 0.197, and 0.318 pCi/g, respectively. Results for 2010 were within the range measured in previous years. None of these radionuclides were detected above background levels downstream in the active channel of Cañada del Buey.

Four metals in surface water samples from the Mortandad Canyon watershed had results that were above standards in 2010: aluminum, chromium, copper, and selenium. The aluminum results probably represent background conditions, as discussed in Section E.2.a. The single result for chromium above standards at LANL in 2010 (146 µg/L from reach E-1FW on February 2, above the chronic aquatic life standard of 74 µg/L) was from upper Effluent Canyon below TA-46, a known source of chromium (LANL 2006a). A second sample from this location, collected on November 11, had chromium below the standard. Chromium was also slightly above the standard in one of two samples collected here in 2009, at 75.4 µg/L, but not in three samples from 2008. Four results for copper were above the chronic aquatic life standard of 9 µg/L, and two were also above the acute aquatic life standard (13.4 µg/L). The highest result, 15.6 µg/L from the upper part of Mortandad Canyon (reach M-1W), is from a location that receives runoff from a large developed area in TA-3, and the presence of copper here is consistent with urban runoff. A copper result of 11.4 µg/L from lower Mortandad Canyon near the Rio Grande, below the community of White Rock, may also be due to urban runoff. The other two copper results above standards from the Mortandad Canyon watershed in 2010 were from reach E-1FW (10.4 and 14.1 µg/L), and these elevated results could be either associated with releases from TA-46 or runoff from developed areas. The single result for selenium above standards in the

Mortandad Canyon watershed in 2010 (5.6 µg/L vs. the wildlife habitat and chronic aquatic life standards of 5.0 µg/L) was collected in Cañada del Buey above NM 4 on August 15 and may represent naturally occurring selenium since there are no known releases of selenium in this watershed (LANL 2009d).

In sediment, six metals from the Mortandad Canyon watershed in 2010 had results above background values in a sample from the Cañada del Buey stream channel below MDA G: cadmium, chromium, cobalt, iron, vanadium, and zinc. Field observations recorded the presence of naturally occurring black, magnetite-rich sands in this sample, and many heavy metals are known to be elevated in black sands on the Pajarito Plateau (Reneau et al., 1998b). Therefore, these elevated results probably represent natural mineralogic variations and not Laboratory releases.

4. Pajarito Canyon (includes Twomile and Threemile Canyons)

Pajarito Canyon heads in the Sierra de los Valles in the Santa Fe National Forest and crosses the central part of the Laboratory before passing through the community of White Rock east of NM 4. It has a total drainage area of about 13 mi^2 (33 km^2) and a main channel length of about 15 mi (24 km). Major tributary canyons include Twomile Canyon, which also heads in the Sierra de los Valles, and Threemile Canyon, which heads on the Pajarito Plateau. The Pajarito Canyon watershed includes a variety of active and inactive Laboratory sites (summarized in LANL 2009b). In 2010, there was no recorded runoff at the E250 stream gage in Pajarito Canyon above NM 4. Because of this, there were no surface water or sediment samples collected at E250 or downstream in 2010.

In 2010, aluminum and PCBs, by the congener method, were the only chemicals in surface water samples from the Pajarito Canyon watershed that exceeded standards. The aluminum results probably represent background conditions, as discussed in Section E.2.a. The PCB congeners probably include a combination of Laboratory and non-Laboratory (atmospheric fallout) sources. The highest concentrations of total detected PCB congeners in the Pajarito Canyon watershed were measured in Twomile Canyon above Pajarito Canyon (gage E244), above the wildlife habitat standard of 0.014 µg/L in both samples, at 0.0662 and 0.0716 µg/L. One sample from Pajarito Canyon below Twomile Canyon (gage E244), was below the wildlife habitat standard but above the human health standard of 0.00064 µg/L, at 0.012 µg/L. Four samples were collected from a background area near NM 501 (gage E240), and three of these results were above the human health standard, at 0.00189 to 0.00528 µg/L.

In sediment samples from the Pajarito Canyon watershed, three radionuclides (americium-241, plutonium-238, and plutonium-239/240) and one metal (antimony) were detected above background values in 2010. These samples were all collected from small drainages below MDA G at TA-54, and the maximum result for each was from the MDA G-7 drainage. The result for antimony, 3.63 mg/kg, was the highest concentration measured in the 2010 surveillance sediment data set, and this location also had the highest result for antimony in 2009. Results for the radionuclides have been lower in recent years than in previous years, and americium-241 results from 1999 to 2010 are shown in Figure 6-29 as an example. In contrast, antimony has in general increased since 2006, as shown in Figure 6-30. The reason for this increase in antimony concentrations in the MDA G-7 drainage is not known.

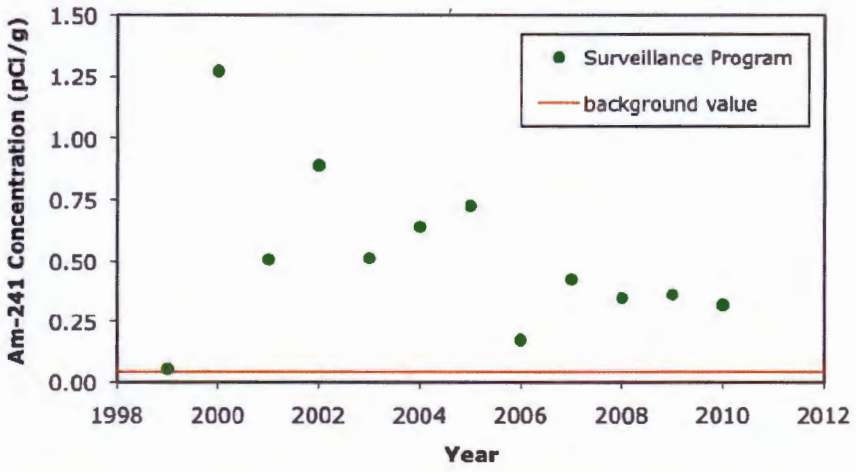

Figure 6-29 **Variations in americium-241 concentration over time in sediment in the MDA G-7 drainage in the Pajarito Canyon watershed; all values above 0.06 pCi/g are detects.**

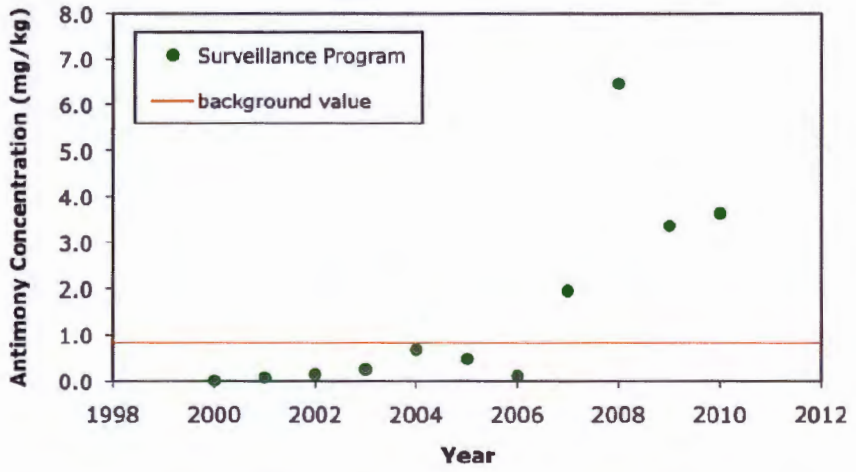

Figure 6-30 **Variations in antimony concentration over time in sediment in the MDA G-7 drainage in the Pajarito Canyon watershed; all values above 0.26 mg/kg are detects.**

Analyses for dioxin and furan congeners were also obtained from the MDA G sediment samples in 2010, which is the first year these analyses have been conducted here. Dioxin and furan congeners were detected in each sample, and the highest concentrations for each were also from the MDA G-7 drainage. These concentrations are lower than previous results from Pueblo Canyon, which receives urban runoff from the Los Alamos town site (LANL 2005).

5. Water Canyon (includes Cañon de Valle and Fence, Indio, and Potrillo Canyons)

Water Canyon heads in the Sierra de los Valles in the Santa Fe National Forest and extends across the southern portion of the Laboratory to the Rio Grande. It has a total drainage area of about 19 mi^2 (49 km^2) and a main channel length of about 14 mi (23 km). Cañon de Valle is a major tributary that also heads in the Sierra de los Valles. The Water Canyon watershed also includes the shorter canyons of Fence, Indio, and Potrillo Canyons that head on the Pajarito Plateau within LANL. Explosives development and testing and

other activities take place in this part of the Laboratory, and elevated concentrations of uranium isotopes, barium, silver, the high-explosive (HE) compounds HMX and RDX, along with other analytes have previously been measured in sediment and surface water in the watershed (LANL 2006b). Cañon de Valle has been the subject of focused Laboratory investigations to address barium and HE contamination in surface water and groundwater (LANL 2003; LANL 2006c), and the Laboratory implemented corrective measures for the canyon in 2009 and 2010 that included construction of a permeable reactive barrier within the alluvium (LANL 2010g).

One chemical, aluminum, had results above the standard in surface water samples from the Water Canyon watershed in 2010. The aluminum results probably represent background conditions, as discussed in Section E.2.a.

The highest concentrations of RDX, HMX, and other HE compounds in surface water at the Laboratory in 2010 were measured in non-filtered base flow samples from Cañon de Valle below MDA P (gage E256) in TA-16, in an area where development of explosive compounds has occurred. These results are consistent with previous years. A time series of RDX concentrations in Cañon de Valle below MDA P is presented in Figure 6-31. The figure shows that the results from 2010 are within the range measured in recent years. The data presented in Figure 6-31 also indicate that concentrations in base flow are typically higher than in storm water, indicating that the RDX is not primarily associated with sediment particles.

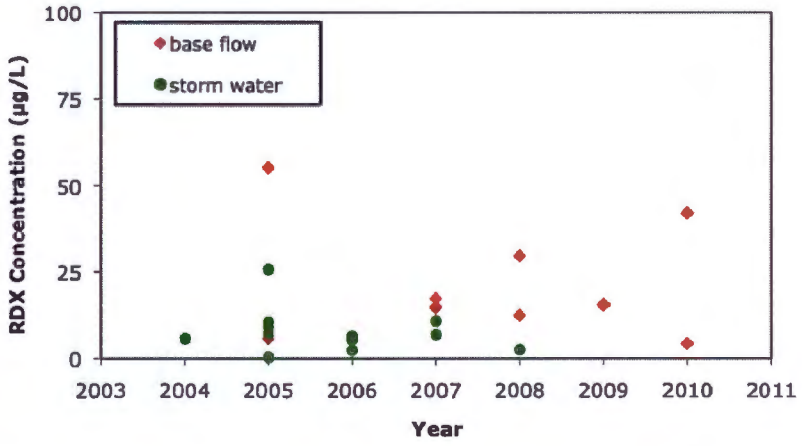

Figure 6-31 Time series of RDX concentrations in surface water samples from Cañon de Valle below MDA P (gage E256); all values are detects.

Five samples of active channel sediment collected from the Water Canyon watershed in 2010 are included in the data set examined here. Within these samples, one radionuclide, plutonium-238, was detected above the sediment background value at one location in Indio Canyon. No Laboratory activities have occurred in Indio Canyon, and this result probably represents a background outlier (LANL 2011a). No metals had results above background values in these samples, and no explosive compounds or PCBs were detected.

6. Ancho Canyon

Ancho Canyon heads on the Pajarito Plateau in TA-49 and extends across the Laboratory to the Rio Grande. It has a total drainage area of about 7 mi^2 (17 km^2) and a main channel length of about 7 mi (12 km). Potential Laboratory sources of contamination in the Ancho Canyon watershed include MDA AB in TA-49, the site of underground testing from 1959 to 1961, and firing sites in the north fork of Ancho Canyon in TA-39 (LANL 2006b).

One chemical, aluminum, had results above the standard in surface water samples from the Ancho Canyon watershed in 2010. The aluminum results probably represent background conditions, as discussed in Section E.2.a.

Four samples of active channel sediment collected from the Ancho Canyon watershed in 2010 are included in the data set examined here. No inorganic chemicals or radionuclides were detected at concentrations above sediment background values in these samples, and no explosive compounds or PCBs were detected.

Ten samples of fine-grained sediment were collected from the Ancho Canyon watershed in 2010 for analyses of PCB congeners. These were collected to help evaluate anomalous PCB congener signatures that were measured in sediment samples downriver along the Rio Grande in 2009 (Reneau et al., 2010) and also to help define "background" PCBs derived from atmospheric deposition. These included five samples from the lower part of the main canyon (reach A-3), between LANL SWMUs and the Rio Grande, and five samples from a background area (the northeast fork of Ancho Canyon). PCB congeners were detected in all samples. The range of total detected PCB congener concentrations was similar in each area, 0.000115 to 0.000337 mg/kg in lower Ancho Canyon and 0.000101 to 0.000286 mg/kg in the northeast fork. The mixture of PCB congener homologs was also similar in each area, as shown in Figure 6-32, but differed from that in Chaquehui Canyon (reach CH-2) where concentrations were higher (as discussed in the next section). These data indicate that atmospheric fallout is the primary source for PCBs in sediment in lower Ancho Canyon and are consistent with other sediment data using the Aroclor method that also indicate little or no PCB contamination in lower Ancho Canyon sediment and no recognizable transport of PCBs to the Rio Grande in this canyon (LANL 2011a).

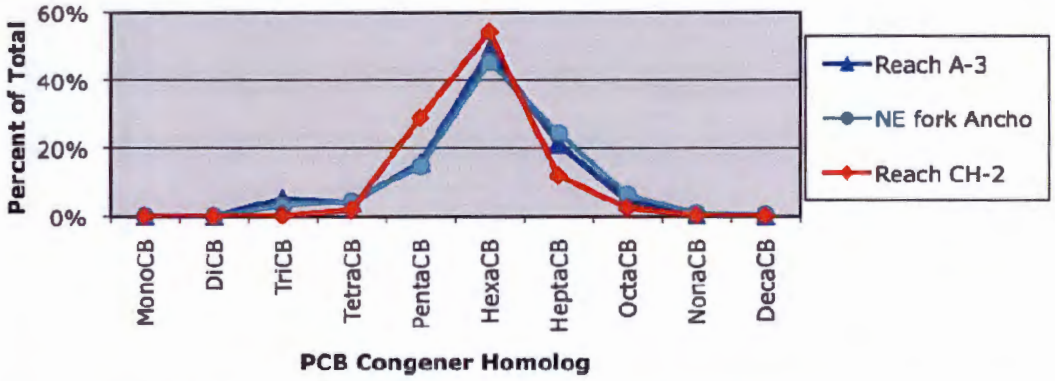

Figure 6-32 Average values for PCB congener homologs from sediment samples collected in Ancho and Chaquehui Canyons in 2010

7. Chaquehui Canyon

Chaquehui Canyon heads on the Pajarito Plateau near the Bandelier National Monument entrance station and extends across the Laboratory to the Rio Grande. It has the smallest of the primary watersheds at LANL, with a total drainage area of about 1.6 mi^2 (4 km^2) and a main channel length of about 3 mi (5 km). Potential Laboratory sources of contamination in the Chaquehui Canyon watershed are located at TA-33 and include firing sites and outfalls (LANL 2006b).

No surface water samples were collected in the Chaquehui Canyon watershed in 2010. One active channel sediment sample collected in 2010 is included in the data set examined here, and no inorganic chemical or radionuclide was detected at concentrations above sediment background values in this sample, In addition, no explosive compounds or PCBs were detected.

Five samples of fine-grained sediment were collected from lower Chaquehui Canyon (reach CH-2) in 2010 for analyses of PCB congeners. PCB congeners were detected in all samples. The maximum result for total detected PCB congeners, 0.00282 mg/kg, was higher than in the adjacent watershed of Ancho Canyon, and the PCB homolog signature was also different (Figure 6-32). These data are consistent other sediment data using the Aroclor method that also indicate LANL sources for PCBs in Chaquehui Canyon (LANL 2011a). However, these data also indicate that Chaquehui Canyon was not the source for anomalous PCB congener homolog signatures found downriver along the Rio Grande in 2009. Specifically, those samples were elevated

in the monochlorobiphenyl (monoCB) homolog (Reneau et al., 2010), and this homolog is not elevated in the Chaquehui Canyon samples.

G. POTENTIAL IMPACTS TO THE RIO GRANDE

In 2010, we assessed potential Laboratory impacts to the Rio Grande by comparing data from sediment and water samples collected upriver and downriver of LANL drainages and also comparing these data with analytical results obtained from canyons draining the Pajarito Plateau.

Natural stream flow and sediment loading in the Rio Grande are quite large compared with Los Alamos area streams. These factors reduce the possibility of identifying significant impacts from the Laboratory in the Rio Grande. Daily average flow in the Rio Grande at the Otowi gage in 2010 ranged from 407 to 4,580 cfs. In contrast, the maximum combined flow leaving LANL in 2010, on August 16, is estimated at 14 cfs. Similarly, the average annual amounts of suspended sediment and bed sediment passing the Otowi gaging station has been calculated to be 1,000 and 100 times, respectively, that contributed by Los Alamos Canyon (Graf 1994).

1. Surface Water Sampling Results

Surface water samples were collected from three locations along the Rio Grande in 2010 for analysis of inorganic and organic chemicals and radionuclides. These locations are upriver of Los Alamos Canyon and LANL at Otowi Bridge, at the planned surface water diversion site for Santa Fe at Buckman (at the mouth of Cañada Ancha, downriver from Los Alamos, Sandia, and Mortandad Canyons), and at the mouth of Frijoles Canyon in Bandelier National Monument (downriver from all canyons draining LANL). Three sets of paired samples were collected at Otowi Bridge and Buckman on the same days, and single samples were collected at Otowi Bridge and Frijoles Canyon in another sampling event.

Nine radionuclides were detected in the Rio Grande water samples in 2010: radium-226, radium-228, thorium-228, thorium-230, thorium-232, tritium, uranium-234, uranium-235/236, and uranium-238. Gross alpha and gross beta radiation were also detected in these samples. No screening levels were exceeded. All of these radionuclides are naturally occurring except for tritium, which is associated with atmospheric fallout. The highest concentrations for radium-226, thorium-228, thorium-232, tritium, and uranium-235/236 were measured at Otowi Bridge, upriver from LANL, demonstrating non-LANL sources. Although uranium-234 and uranium-238 were measured at higher concentrations at Buckman than at Otowi Bridge (maximums 6% to 20% higher on January 26), these differences are within measurement uncertainties and there was no runoff from Los Alamos Canyon during that month, and these results indicate naturally occurring uranium.

For organic chemicals, samples from the Rio Grande were analyzed for explosive compounds, pesticides, PCBs (by both the Aroclor and the congener methods), SVOCs, and VOCs. PCB congeners were detected in one sample, collected from Otowi Bridge on July 13, below the human health standard of 0.00064 µg/L at 0.0000385 µg/L. All other results were non-detects.

For inorganic chemicals, two results from the Rio Grande were above screening levels in 2010. A non-filtered sample collected at Otowi Bridge on May 10 had ammonia slightly above the chronic standard of 179 µg/L, at 184 µg/L. A filtered sample collected at Frijoles Canyon on September 29 had copper slightly above the chronic aquatic life standard of 9.0 µg/L, at 9.71 µg/L. These data indicate that water quality in the Rio Grande is good, with average values for these constituents being below chronic standards.

2. Sediment Sampling Results

In 2010, we collected sets of five sediment samples each for analysis of isotopic plutonium, gamma spectroscopy radionuclides, and PCB congeners from four areas along the Rio Grande. The four areas were as follows: (1) upriver from Otowi Bridge, which is upriver from Los Alamos Canyon and other LANL sources; (2) upriver from Buckman and the BDD Project surface water intake for the City and County of Santa Fe, which is downriver from Los Alamos Canyon; (3) below the White Rock Overlook, downriver from Sandia and Mortandad canyons; and (4) between Chaquehui and Frijoles canyons, downriver from all canyons

draining LANL. These samples included a similar range in geomorphic setting and particle size in each area, including low-water and high-water settings and coarse silt to very fine sand. Figures 6-33 and 6-34 show examples of the sample sites. In addition, we also collected five samples of sediment from the bottom of Cochiti Reservoir (Figure 6-35) and five samples of Cochiti Reservoir sediment deposited in the 1980s for the same analytical suite. Cochiti Reservoir had a higher water level than at present for several years in the mid-1980s, and deposits of sediment from this time period are preserved above the current reservoir level as far upriver as Ancho Canyon. We sampled the 1980s-vintage Cochiti Reservoir sediment at a location upriver from Frijoles Canyon and downriver from all LANL canyons (Figure 6-8), collecting a continuous sequence from the surface to a depth of 75 cm. The sediment from the 1980s had median particle size of fine to coarse silt, compared to the modern Cochiti Reservoir samples of fine silt to clay.

Figure 6-33 Photograph of sediment sampling area along the Rio Grande above Frijoles Canyon; November 11, 2010.

Figure 6-34 Photograph of sediment sampling area along the Rio Grande above Buckman; November 12, 2010.

Figure 6-35 Photographs of sediment sampling in Cochiti Reservoir; October 27, 2010.

In these samples, one radionuclide was detected above the sediment background concentrations of McLin and Lyons (2002) and McLin (2004). Plutonium-239/240 was detected at 0.0223 to 0.039 pCi/g in four of the samples collected from Cochiti Reservoir, above the regional reservoir background concentration of 0.0201 pCi/g but below the Pajarito Plateau sediment background value of 0.068 pCi/g. These results are consistent with previous data from Cochiti Reservoir obtained after the May 2000 Cerro Grande fire, as shown in Figure 6-36. Figure 6-36 also presents data from Abiquiu Reservoir obtained from 1995 to 2008. In comparison, plutonium-239/240 concentrations in the 1980s-vintage Cochiti Reservoir sediment are below the upper limit of background and are consistent with pre-fire data obtained in 1995 to 1999. (Figure 6-36).

PCB congener data were also obtained from the sediment samples, and are discussed further in Section G.3.

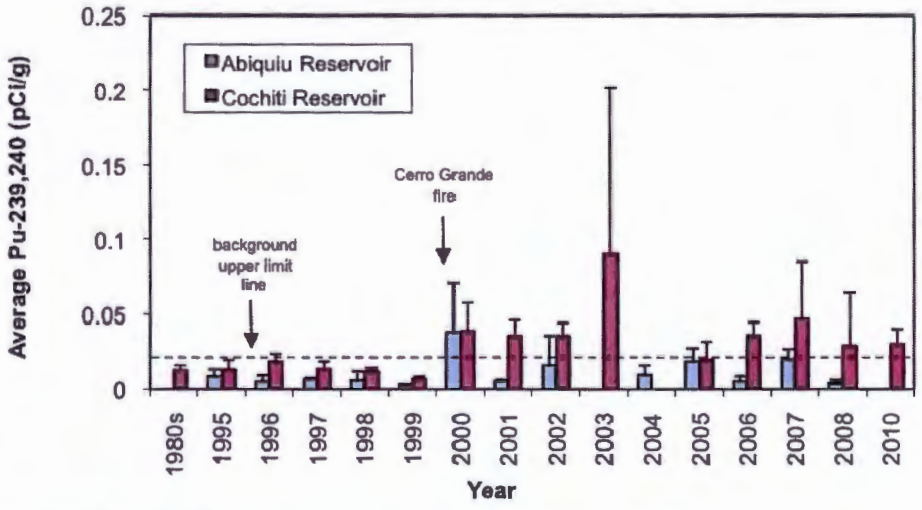

Figure 6-36 Plutonium 239/240 concentrations (mean + 1 standard deviation of 3-5 results) in Abiquiu and Cochiti Reservoir bottom sediment from the mid-1980s through 2010

3. PCBs in Sediment

a. PCB Concentrations and Sources

PCB congener data were obtained from 20 sediment samples along the Rio Grande in 2010, building on previous sampling events in 2008 and 2009 (Reneau and Kuyumjian 2009; Reneau et al., 2010). These were supplemented by five samples each from Cochiti Reservoir bottom sediment and from 1980s-vintage Cochiti Reservoir sediment. In addition to comparing PCB concentrations in samples collected from different locations, comparison of PCB congener "fingerprints" upriver and downriver from Los Alamos Canyon with congener data within the Los Alamos Canyon watershed allow further evaluation of potential Los Alamos contributions to PCBs along the Rio Grande.

Total detected PCB congener concentrations in Rio Grande sediment samples in 2010 are similar to concentrations measured in 2008 and 2009, though the ranges are greater. In the 2008 and 2009 sample areas, the average concentrations in each sampling area ranged from 0.000066 mg/kg (66 ng/kg) to 0.000090 mg/kg (90 ng/kg). In the four 2010 sample areas, average concentrations ranged from 47 ng/kg below the White Rock Overlook to 115 ng/kg above Frijoles Canyons. The average of 10 Rio Grande samples collected in 2010, 83 ng/kg, is similar to the averages in 2008 and 2009, 73 ng/kg and 76 ng/kg, respectively. The maximum concentration measured in 2010, 347 ng/kg from the sample area above Otowi Bridge, is higher than maximums from 2008 and 2009 (199 ng/kg and 208 ng/kg, respectively). Average concentrations in the Cochiti Reservoir bottom sediments, 115 ng/kg, were higher than in the Rio Grande sediments, although the maximum was less (220 ng/kg). Average PCB concentrations in the sediment samples in each area from 2008, 2009, and 2010, along with Cochiti Reservoir sediment from the 1980s and 2010, are shown in Figure 6-37.

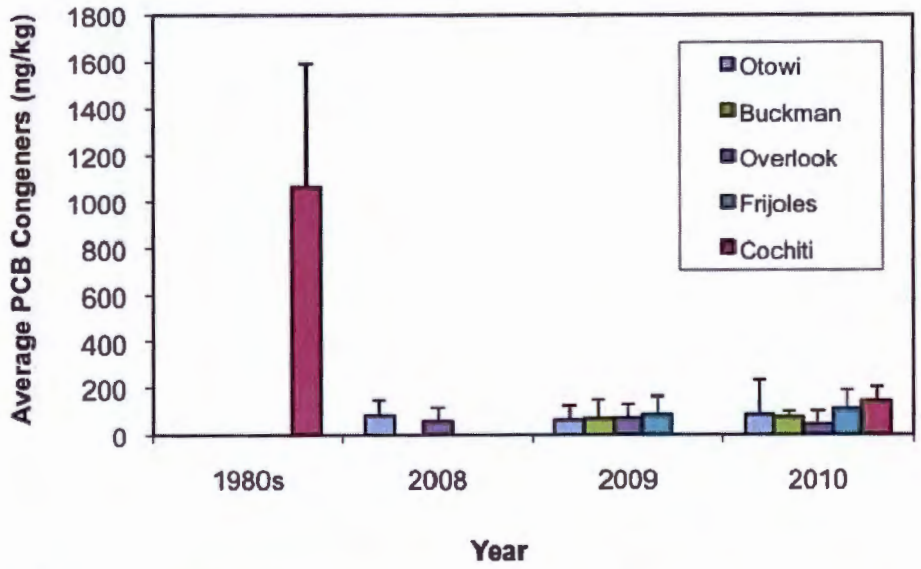

Figure 6-37 Total detected PCB congener concentrations (mean + 1 standard deviation of five results) in Rio Grande and Cochiti Reservoir sediment

Data from the 1980s-vintage Cochiti Reservoir sediments indicate that PCB concentrations were significantly higher at that time. Total detected PCB congeners in these samples ranged from 350 to 1,660 ng/kg, averaging 1,063 ng/kg (Figure 6-37). This decrease in PCB concentrations between the 1980s and present is consistent with the discontinuation of use of PCBs that began in 1979, when the U.S. Congress banned their production because of concerns about their toxicity and persistence in the environment.

The PCB congeners from each sample can be grouped together into 10 homologs, as discussed previously in Section F.1, which allows visual comparison of similarities or differences between samples or groups of samples. Compared with data from 2008 and 2009, the homolog signatures were much more variable in the 2010 sediment samples from along the Rio Grande, as shown in Figure 6-38. The variability is caused by

different sediment layers being associated with different runoff events that transport sediment from different sources with the upper Rio Grande watershed, and indicate large variability in PCB congener signatures in sources areas. Figure 6-38 also shows the congener signature from lower Los Alamos Canyon (reach LA-5) in 2010 and indicates that additions of PCBs from Los Alamos Canyon are not responsible for the differences in homologs between the Otowi Bridge sample area and downriver areas. For example, all downriver areas are elevated in triCB and tetraCB relative to Otowi Bridge, but the Los Alamos Canyon samples are not elevated in these homologs. The variability that exists in PCB congeners in the Rio Grande is also shown in Figure 6-39, which presents averages in 2008, 2009, and 2010 in samples from the Otowi Bridge area.

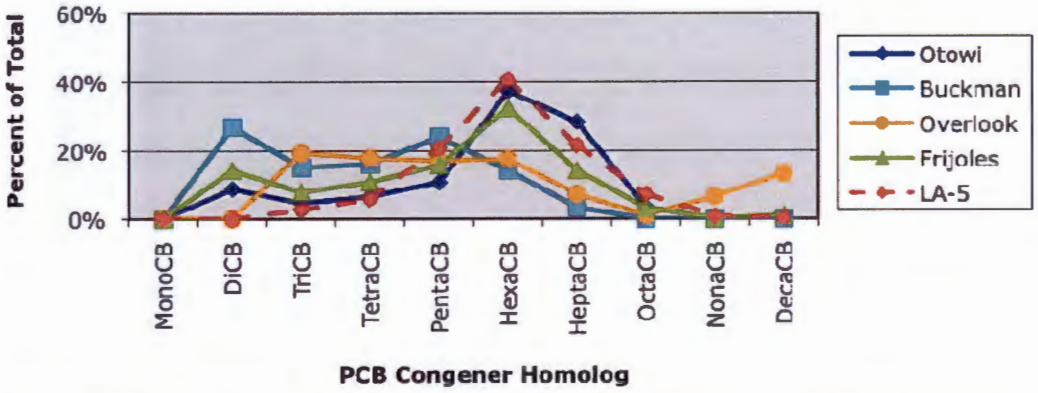

Figure 6-38 Average values for PCB congener homolog data from sediment samples collected along the Rio Grande and in lower Los Alamos Canyon in 2010

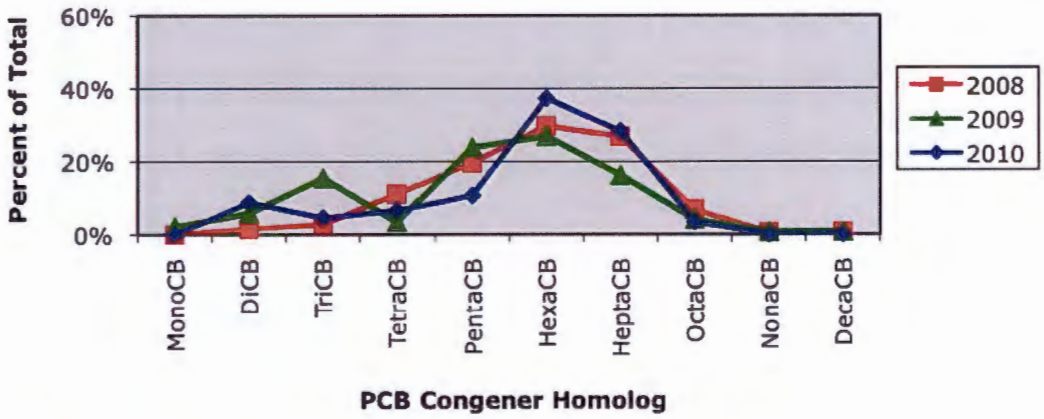

Figure 6-39 Average values for PCB congener homolog data from sediment samples collected along the Rio Grande near Otowi Bridge in 2008, 2009, and 2010.

PCB congener signatures also differ between sediment deposited along the Rio Grande and in Cochiti Reservoir, as shown in Figure 6-40. These Cochiti Reservoir sediment samples have a higher clay content than the sediment samples collected along the Rio Grande (average of 45% vs. 11% clay) and indicate that sources may also vary for sediment with differing particle size. Figure 40 also shows data on PCB congeners from the 1980s-vintage Cochiti Reservoir sediment, showing that PCB characteristics in the upper Rio Grande watershed were much different at that time.

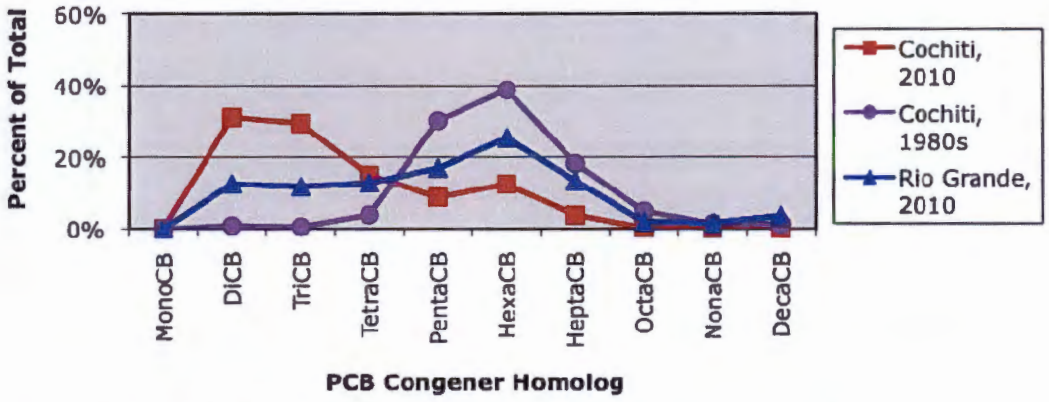

Figure 6-40 Average values for PCB congener homolog data from 2010 sediment samples from the Rio Grande and Cochiti Reservoir and from 1980s Cochiti Reservoir sediment.

b. PCB Flux

PCB congener data obtained from sediment samples along the Rio Grande, in combination with measurements of discharge and sediment flux at the Otowi Bridge gaging station made by the US Geological Survey (USGS), allow estimates to be made of the total mass of PCBs transported by the Rio Grande. These estimates can be compared with estimates of PCB flux at LANL, particularly in Los Alamos Canyon, which contains the main potential LANL sources of PCBs that could be transported to the Rio Grande.

Using data presented by the USGS (e.g., Stile 2011), the average annual flux of suspended sediment in the Rio Grande at Otowi Bridge was about 2,100,000 megagrams per year (Mg/yr)from 1948 to 2010 and was about 2,000,000 Mg/yr over the last 10 years (2001–2010). These are very similar to the value of 2,000,000 Mg/yr used in a previous study of plutonium along the Rio Grande, based on data from 1948 to 1985 (Graf 1994). Graf (1994) estimated that bedload sediment flux was much less, averaging about 300,000 Mg/yr or 14% of the suspended sediment flux and was a smaller component of the plutonium budget because of the inverse relation between contaminant concentrations and particle size. He estimated that only about 5% of the plutonium in the Rio Grande was associated with bedload sediment, and bedload can also be assumed to be a minor part of the PCB flux in the Rio Grande.

Suspended sediment flux in the Rio Grande in water year 2010 (WY2010) was below average, estimated as about 650,000 Mg (Stile 2011). Using this value and the average PCB concentration measured in Rio Grande sediment near Otowi Bridge in 2010 (90 ng/kg) provides an estimated flux of 0.06 kg of PCBs past Otowi Bridge in FY2010, similar to the estimate of 0.05 kg in FY2009 (Reneau et al., 2010). However, this may be an underestimate because of the sampling of coarser sediment that settled out of the river instead of the sediment that remained in suspension. For example, the sediment samples from this area in 2010 had an average of 6% clay, 45% silt, and 49% sand, whereas the five samples of Cochiti Reservoir sediment collected in 2010 averaged 45% clay, 55% silt, and <1% sand. Average PCB concentrations in Cochiti Reservoir sediment samples in 2010 were about 67% higher than average concentrations at Otowi Bridge. If we assume the average PCB concentration in suspended sediment is 50% higher than we measured at Otowi Bridge, the estimated PCB flux in WY2010 is increased to 0.09 kg.

Estimates of longer-term average PCB flux in the Rio Grande can also be made by combining our sediment data with the long-term average suspended sediment flux of 2,100,000 Mg/yr. Use of our average PCB concentration near Otowi Bridge of 80 ng/kg from 2008 to 2010 yields a PCB flux of 0.18 kg/yr, and using a 50% increase to adjust for particle size effects yields a PCB flux of 0.27 kg/yr.

The estimates of PCB flux in the Rio Grande can be compared with estimates of PCB flux in the Los Alamos Canyon watershed to evaluate the relative importance of Los Alamos Canyon as a PCB source for the Rio Grande. The only published estimate of suspended sediment yield from Los Alamos Canyon into the Rio Grande was made by Graf (1994), with an average of 2,000 Mg/yr. Combined with the average PCB

concentrations measured in fine-grained sediment samples in lower Los Alamos Canyon in 2009, 2,623 ng/kg (0.0026 mg/kg; Reneau et al., 2010), this yields an estimated PCB flux of 0.005 kg/yr. Because these samples included old floodplain sediment, they may not be representative of current concentrations. Instead, if we use the average PCB concentration in two fine-grained samples collected from lower Los Alamos Canyon in 2010 of 1,560 ng/kg, we obtain a lower estimate of 0.003 kg/yr. These values are 1–3% of the total estimated long-term flux in the Rio Grande. This small percentage is consistent with the absence of notable differences in PCB homolog signatures along the Rio Grande above and below Los Alamos Canyon, as found in a previous evaluation (Reneau et al., 2010). Enhanced sampling of storm water in lower Los Alamos Canyon at gaging station E109.9 and improved discharge estimates that began in 2010 (LANL 2011c) should result in improved estimates of PCB flux from Los Alamos Canyon into the Rio Grande.

The values presented above should be considered as preliminary estimates because of the small data set and the uncertainties and assumptions that went into these estimates. However, they provide a starting point for understanding the sources and fluxes of PCBs in the Rio Grande, and these estimates should be improved with additional data collection that is planned for 2011.

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A. INTRODUCTION

A soil monitoring program offers the most direct means of determining the concentrations (activities), distribution, and long-term trends of radionuclides and chemicals present around nuclear facilities (DOE 1991). Soil is an integrating medium that can account for contaminants released to the atmosphere, either directly in gaseous emissions, indirectly from re-suspension of contaminants, or through liquid effluents released to a stream that may be used for irrigation on farmlands. Consequently, soil contaminant data may provide information about potential pathways (e.g., soil ingestion, food ingestion, re-suspension into the air, and groundwater contamination) that could deliver radioactive materials or chemicals to humans and biota.

The overall soil surveillance program implemented by Los Alamos National Security, LLC (LANS), at the Los Alamos National Laboratory (LANL or the Laboratory) consists of the following:

1) An institutional component that monitors soil within and around the perimeter of LANL in accordance with US Department of Energy (DOE) Orders 450.1A (DOE 2003) and 5400.5 (DOE 1993);

2) A facility component that monitors soil (and sediment) within and around the perimeter of two Laboratory sites:

   - Principal radioactive waste disposal area (Area G) in accordance with DOE Orders 435.1 (DOE 1999a) and M 435.1-1 (DOE 1999b), and
   - Principal explosive test facility (Dual Axis Radiographic Hydrodynamic Test [DARHT]) in accordance with the Mitigation Action Plan (DOE 1996); and

3) A special studies component that investigates cases where there may be an absence of data concerning a localized (or potential) contaminant source that has the potential to impact human health and/or the environment as mandated from mitigation action plans, environmental surveillance program, or public concern.

The objectives of LANL's soil surveillance program are to determine the following:

1) Radionuclide and chemical concentrations in soil collected from potentially impacted areas (institution-wide, facility-specific, or potential source) and compared with the appropriate soil comparison levels (e.g., regional background levels, screening levels, and regulatory standards);

2) Concentration trends over time (i.e., whether radionuclide and/or chemical concentrations are increasing or decreasing); and

3) The committed effective dose equivalent from radionuclides potentially received by surrounding area residents and biota (see Chapter 3 for the potential radiation doses that individuals and biota may receive from exposure to soil), and risk to residents and biota from heavy metal and organic chemical exposures.

B. SOIL COMPARISON LEVELS

To evaluate potential Laboratory impacts from radionuclides and chemicals in soil, we first compare the analytical results of samples collected from the Laboratory's on-site and perimeter areas with regional statistical reference levels (RSRLs). Where the results exceed these regional background levels, we then compare the concentrations with human health screening levels (SLs) and, finally, if needed, with the appropriate regulatory standard, if available. A more detailed description of the levels and/or the standard used to evaluate the results of radionuclides and chemicals in soil are given below. An overall summary can be found in Table 7-1.

- Regional Statistical Reference Levels: RSRLs are the mean plus three standard deviations (= 99% confidence level) for radionuclides and chemicals in soil collected from background locations away from the influence of the Laboratory (> 9 miles) (DOE 1991) over at least the last five sampling periods. RSRLs, which represent natural and fallout levels, are calculated as additional data become available and can be found in the supplemental data tables of this report.
- Screening Levels: SLs for radionuclides are set below the DOE single-pathway dose constraint of 25 mrem/yr (DOE 1993, DOE 1999c) so that potential human health concerns may be identified in advance, i.e., a "yellow flag." If a radionuclide exceeds the SL, we investigate the basis for the higher amounts, check laboratory records, and reanalyze the sample, if possible, and/or resample the site to determine the possible cause for the higher than normal result. LANL developed SLs to identify radionuclides of potential human health concern on the basis of a 15-mrem/yr protective dose limit for several scenarios (residential or industrial) (LANL 2009) using the residual radioactive (RESRAD) computer model (Yu et al., 1995).

  For other chemicals (inorganic and organic), we compare concentrations to the New Mexico Environment Department (NMED) (residential or industrial) SLs that are set at a 10^{-5} risk level for carcinogens and a hazard quotient (HQ) of one for non-carcinogens (NMED 2006).

  To evaluate radionuclide and other chemicals in soil, the results from on-site areas are evaluated against industrial screening levels (ISLs), and perimeter areas are compared with residential screening levels (RSLs). The RSLs assume that families live at these locations on a year-round basis.
- Standard: If an SL for a radionuclide is exceeded, then a dose to a person is calculated using RESRAD and all of the measured radionuclide concentrations available for a given year. (These data are presented in Table S7-1.) The calculated dose is based on a residential scenario with soil ingestion, inhalation of suspended dust, external irradiation, and ingestion of homegrown fruits and vegetables as the exposure pathways. Unit conversions, input parameters, model and parameter assumptions, and the uncertainty analysis we used are presented in a report by Fresquez, Mullen, Ferenbaugh, and Perona (1996). This calculated dose is compared with the 25-mrem/yr DOE single-pathway dose constraint.

Table 7-1
Application of Soil Standards and Other Reference Levels to LANL Monitoring Data

Constituent	Sample Location	Standard	Screening Level (Scenario)	Background Level
Radionuclides	Perimeter	25 mrem/yr	15 mrem/yr (residential)	RSRL
	On-site, Area G, DARHT	25 mrem/yr	15 mrem/yr (industrial)	RSRL/BSRL[a]
Chemicals	Perimeter	na[b]	10^{-5} risk (residential) or HQ = 1	RSRL
	On-site, Area G, DARHT	na	10^{-5} risk (industrial) or HQ = 1	RSRL/BSRL[a]

[a] Baseline Statistical Reference Level. A discussion of these levels is provided in Section D.3.

[b] na = Not available

C. INSTITUTIONAL MONITORING

1. Monitoring Network

Institutional surface soil samples are collected from 17 on-site (LANL), 11 perimeter, and six regional (background) locations on a triennial basis (every third year) (Figure 7-1). The last comprehensive soil survey, which included the analysis of radionuclides, target analyte list (TAL) elements (mostly metals), polychlorinated biphenyls (PCBs), semi-volatile organic compounds (SVOCs), and high explosives (HEs), occurred in 2009 (Fresquez 2010). In general, all radionuclides and TAL elements were far below ISLs for on-site soils or far below RSLs for perimeter soils. Moreover, no HEs were detected above the reporting level of quantification in any soil collected from on-site, perimeter, or regional locations. And only trace amounts of a few PCB Aroclors (Aroclor 1254 and 1260) and SVOCs (aniline and fluoranthene) in soil from a few sites were detected; however, all levels were far below either ISLs or RSLs, and no increasing trends were evident. The next planned full-scale institutional soil assessment will occur in 2012.

Although the institutional soil sampling program was changed to a three-year sampling cycle, the Pueblo de San Ildefonso requested that we collect on an annual basis two perimeter soil samples for radionuclides and TAL elements on Pueblo lands that are downwind of Area G, the Laboratory's principal low-level radioactive waste disposal site. Area G, approximately 63 acres in size, is located in Technical Area (TA)-54 at the Laboratory's eastern boundary. Soil samples on Pueblo de San Ildefonso lands were collected in June 2010 from relatively level, open (unsheltered by trees or buildings), and rock-free areas. One sample, identified as "San Ildefonso," was collected across Cañada del Buey about one-half mile north of Area G, and the other sample, identified as "Tsankawi/PM-1," was collected just a little over two miles away and is also located north of Area G.

We compared soil sample (analysis) data from these two perimeter stations with RSRLs. These RSRLs are derived from samples collected from northern New Mexico background locations that surround the Laboratory in all major directions and from samples in which radionuclides and chemicals in the soil are primarily from natural sources or worldwide fallout events. These regional areas are located near Ojo Sarco, Dixon, and Borrego Mesa (near Santa Cruz dam) to the northeast; Rowe Mesa (near Pecos) to the southeast; Youngsville to the northwest; and Jemez Springs to the southwest. As required by the DOE, all locations are at similar elevations as LANL, are more than 20 miles away from the Laboratory, and are beyond the range of potential influence from normal Laboratory operations (> 9 miles) (DOE 1991).

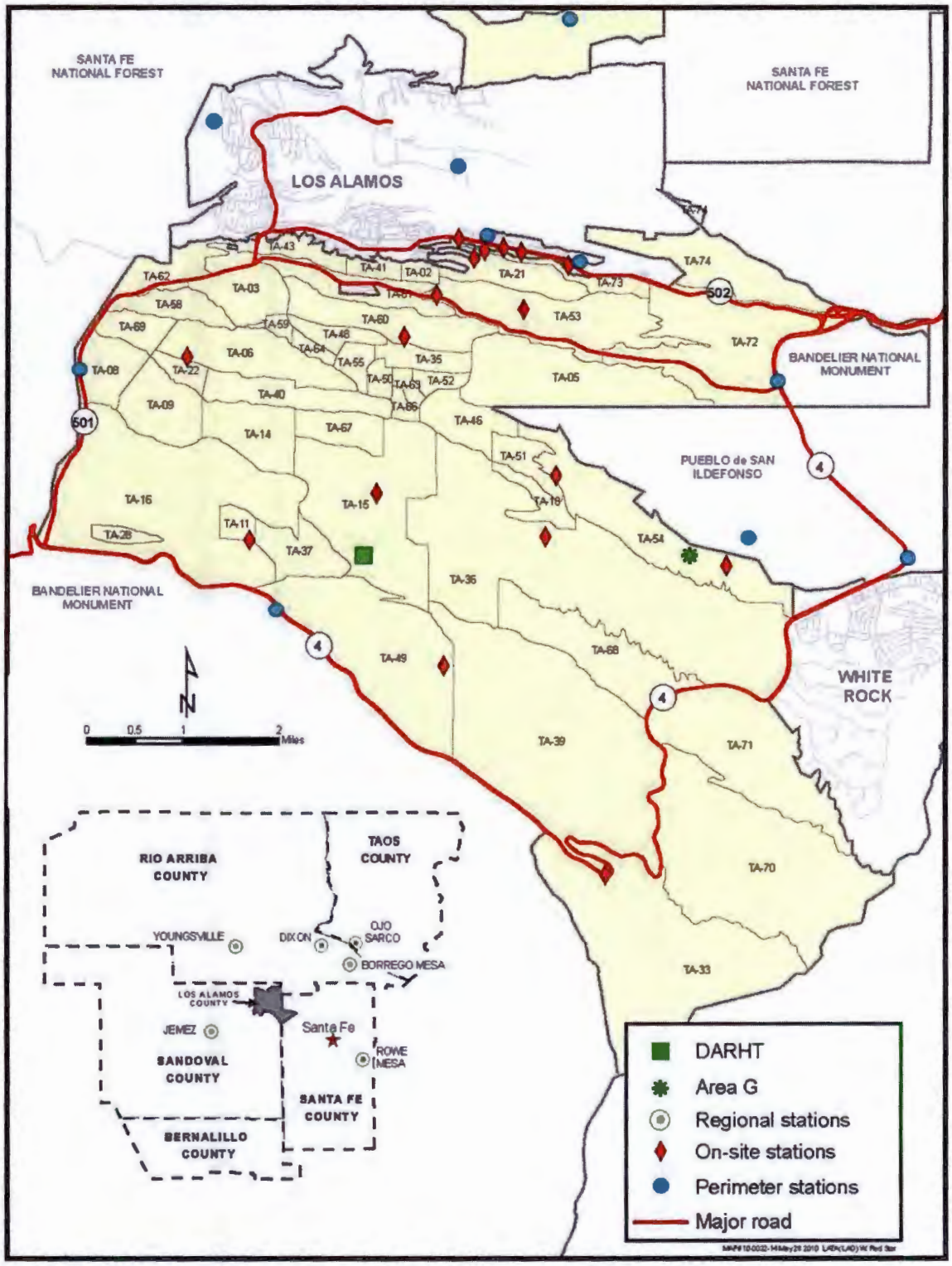

Figure 7-1 **On-site, perimeter, and regional soil sampling locations. The Otowi perimeter station is not shown but is about five miles east of LANL on State Route 502.**

2. Methods and Analysis

At each site, soil composite samples for radionuclides and TAL elements (mostly metals) were collected with a stainless steel soil ring 4 inches in diameter pushed 2 inches deep at the center and corners of a 33-ft by 33-ft square area. The five samples per site were combined and mixed thoroughly in a large Ziploc bag to form a composite sample. Composite samples were then placed in pre-labeled 500-mL polyethylene bottles, sealed with chain-of-custody tape, placed into individual Ziploc bags, and submitted to the LANL Sample Management Office. All samples were handled and shipped under full chain-of-custody procedures to ALS (formerly Paragon) Laboratory Group for analysis. These samples were analyzed for tritium, plutonium-238, plutonium-239/240, strontium-90, americium-241, cesium-137, uranium-234, uranium-235, and uranium-238 and for 23 TAL elements (aluminum, barium, beryllium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, zinc, antimony, arsenic, cadmium, lead, selenium, silver, thallium, and mercury). The results from these sample analyses are presented in supplemental Tables S7-1 and S7-2.

3. Radionuclides

All radionuclide (activity) concentrations in soil collected from the two perimeter areas on Pueblo de San Ildefonso lands downwind of Area G in 2010 were very low (pCi/g range), and most were either not detected or detected below the RSRLs (Table S7-1). A non-detected value is one in which the result is lower than three times the counting uncertainty and is not significantly different (α = 0.01, or 99% confidence level) from zero (Keith 1991; Corely et al., 1981) or less than the minimum detectable activity.

The only radionuclide that was detected in higher concentrations than the RSRL was plutonium-238 in the Pueblo de San Ildefonso soil location closest to Area G. The amount of plutonium-238 in soil from the "San Ildefonso" site, however, was just slightly above the RSRL and was far below the RSL. The long-term trend showed only normal variability along the RSRL line (Figure 7-2). Other radionuclides associated with Area G operations like tritium and plutonium-239/240 in the "San Ildefonso" soil sample were very similar to past years, are not increasing over time, and remain well below the RSL (Figures 7-3 and 7-4).

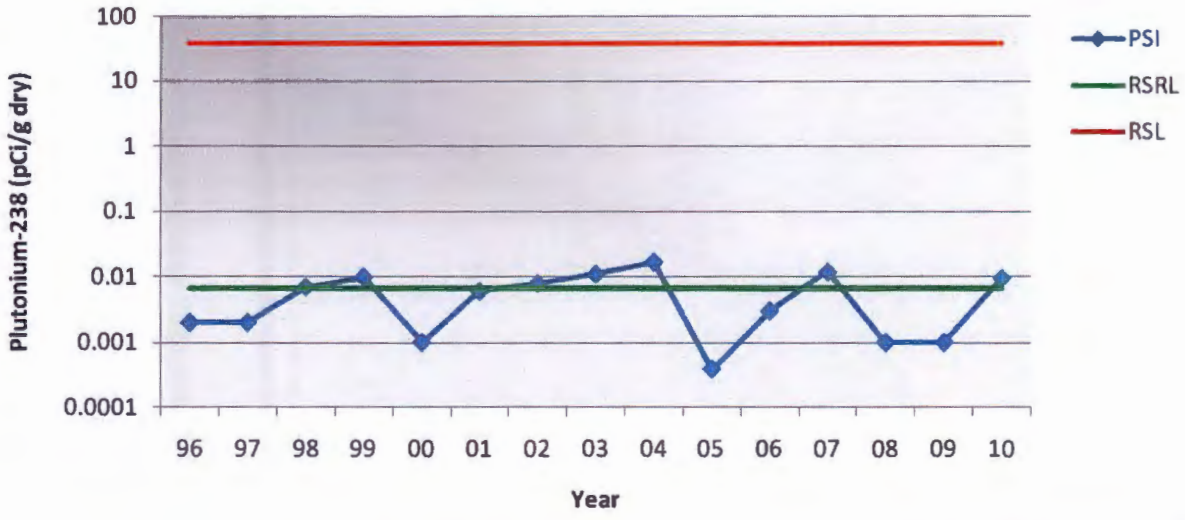

Figure 7-2 **Plutonium-238 (detectable and non-detectable) concentrations in soil samples collected from Pueblo de San Ildefonso (PSI) lands approximately one-half mile northeast of Area G from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the residential screening level (RSL).**

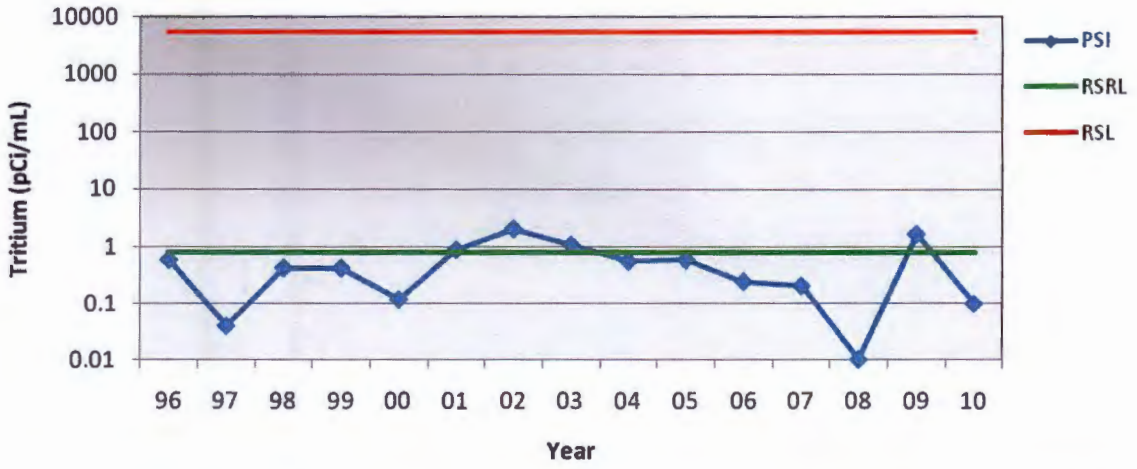

Figure 7-3 **Tritium (detectable and non-detectable) concentrations in soil samples collected from Pueblo de San Ildefonso (PSI) lands approximately one-half mile northeast of Area G from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the residential screening level (RSL).**

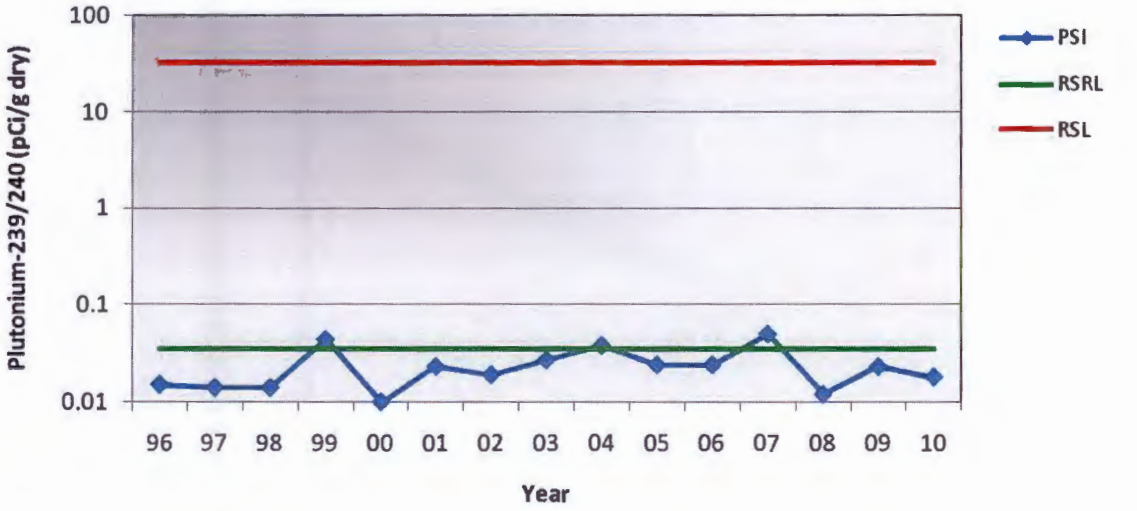

Figure 7-4 **Plutonium-239/240 (detectable and non-detectable) concentrations in soil samples collected from Pueblo de San Ildefonso (PSI) lands approximately one-half mile northeast of Area G from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the residential screening level (RSL).**

4. TAL Elements

Table S7-2 shows the results of the TAL element analyses in surface soil collected from the two perimeter sites located on Pueblo de San Ildefonso lands in 2010. All metal concentrations, with the exception of selenium, from these two areas, were either not detected or detected below RSRLs. The amounts of selenium, however, were just above the RSRL and far below RSLs.

5. TAL Elements: Follow-up of 2009 Results of Soil Manganese at Two Mile Mesa at TA-6

In 2009 we reported that manganese (3,600 mg/kg) in a soil sample collected from Two Mile Mesa at TA-6 site was far above the RSRL (766 mg/kg) (albeit far below the ISL of 48,400 mg/kg) and above the long-term average of 500 mg/kg (Fresquez 2010). To determine if there was a potential problem in the area, we re-sampled the site of interest in 2010. The 2010 results showed only normal concentrations (600 mg/kg) similar to past years (Table S7-2). Since there were no physical disturbances or any operations using manganese-

containing chemicals at or near the sample site, the high manganese level reported in 2009 was probably due to an analytical laboratory error.

D. FACILITY MONITORING

1. Monitoring Network for Area G at TA-54

The Laboratory conducts facility-specific soil monitoring on an annual basis at Area G (Lopez 2002). Area G is a 63-acre radioactive waste processing area located on the east end of Mesa del Buey at TA-54 (see Figure 7-1). Established in 1957, Area G is the Laboratory's primary low-level radioactive solid waste burial and storage site (Hansen et al., 1980; Soholt 1990). Tritium, plutonium, americium, uranium, and a variety of fission and activation products are the main radionuclides in waste materials disposed at Area G (DOE 1979).

Thirteen surface soil samples were collected in May 2010 at designated locations around the perimeter of Area G, and one surface soil sample (site #T3) was collected at the LANL/Pueblo of San Ildefonso boundary line approximately 800 ft northeast of Area G (Figure 7-5).

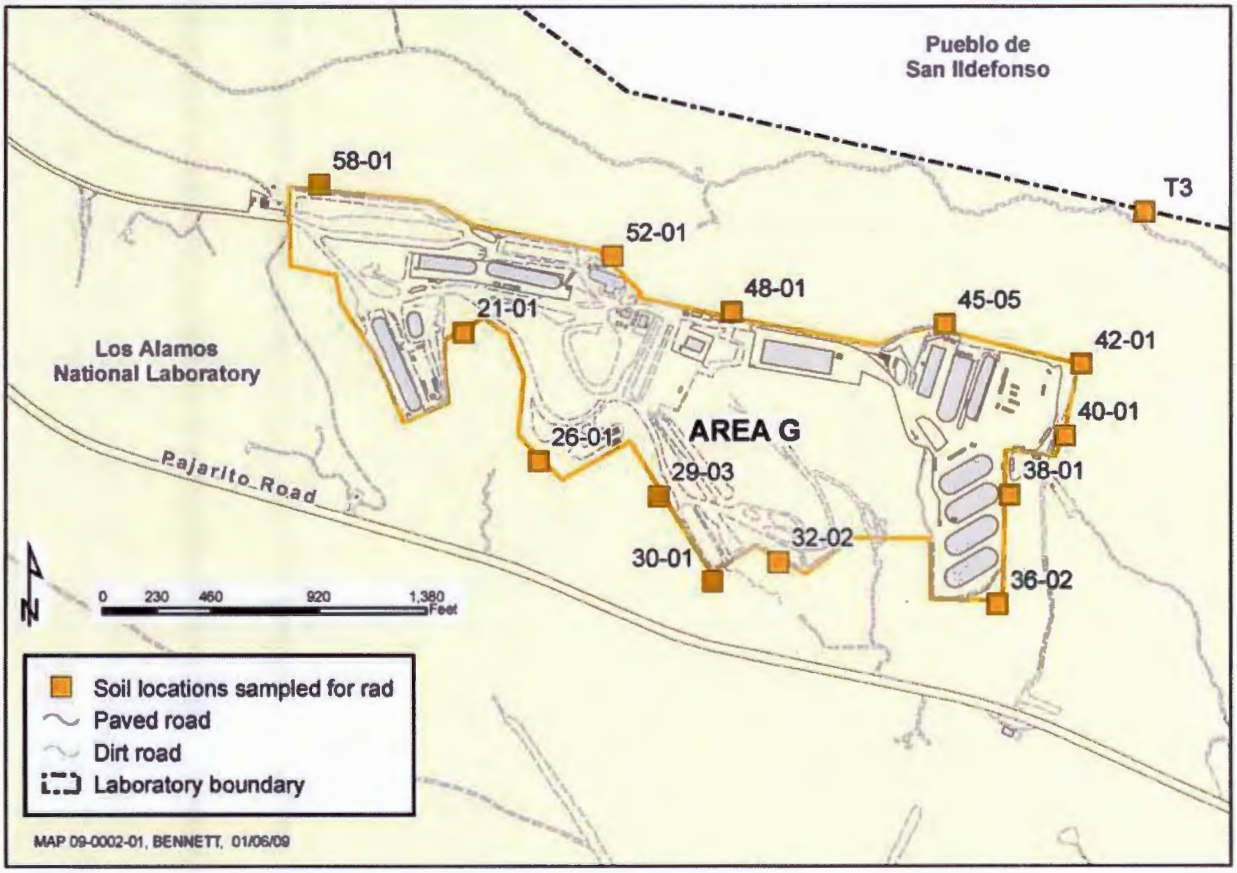

Figure 7-5 Locations of soil samples collected around Area G in 2010

All samples were analyzed by ALS for tritium, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. The results from these samples are presented in supplemental Table S7-3.

TAL elements were not analyzed in 2010 because previous sampling in 2006 showed no levels of concern. Results from that sampling period showed that most metals (478 out of 483 measurements) were similar to RSRLs (Fresquez 2007), and the few detected above RSRLs were far below the ISLs and no trends were evident.

2. Radionuclide Analytical Results for Area G

a. Perimeter Results

Tritium, americium-241, plutonium-238, and plutonium-239/240 were detected at concentrations above the RSRLs in several of the 13 soil samples collected around the perimeter of Area G in 2010 (Table S7-3).

Specifically, tritium was detected above the RSRL (0.80 pCi/mL) in 23% of the samples collected around Area G. The highest concentration (169 pCi/mL) occurred in the southern portion (around site #29-03) where the tritium shafts are located. Although these data are within the range of concentrations detected in past years, they are quite variable from year to year (Figure 7-6).

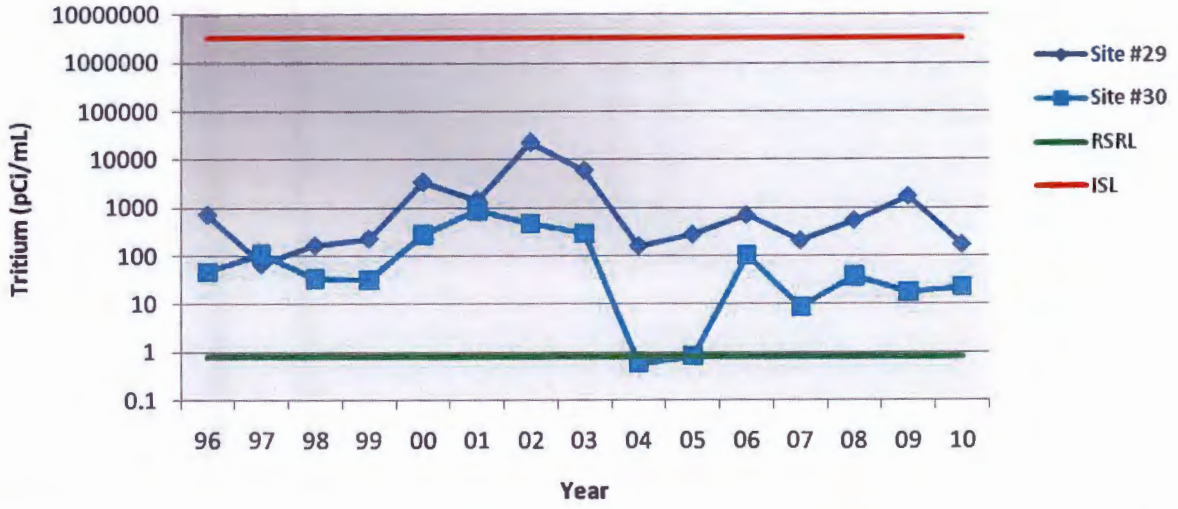

Figure 7-6 **Tritium concentrations in surface soil samples collected from the southern portions of Area G at TA-54 from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the industrial screening level (ISL). Note the logarithmic scale on the vertical axis.**

The degree of variability in tritium concentrations in surface soil from year to year may be influenced by engineering and environmental factors (Purtymun 1973; Abeele and Nyhan 1987; Vold 1997; Childs and Conrad 1999; Budd et al., 2004). Nonetheless, the concentrations of tritium in soil at Area G are far below the ISL of 3.2E06 pCi/mL (equivalent to 4.4E05 pCi/g at 12% moisture), and the migration of tritium from the Area G boundary at surface depths, is not extensive. In a 2003 study, the measurement of tritium in trees at the southern portion of Area G, starting from the perimeter fence line outward (approximately 33, 165, 330, 490, and 660 ft), showed that the concentrations of tritium decreased greatly with distance; and at about 330 ft away, the concentrations of tritium were similar to the RSRL (Fresquez et al., 2003).

More than 50% of the soil samples collected around the perimeter of Area G contain concentrations of americium-241, plutonium-238, and plutonium-239/240 greater than their respective RSRLs, particularly around the perimeter of the northern, northeastern, and eastern sections (Table S7-3). The highest concentrations of americium-241 (0.36 pCi/g dry at site #38-01), plutonium-238 (1.3 pCi/g dry at site #40-01), and plutonium-239/240 (1.7 pCi/g dry at site #38-01) were detected in soil samples located on the perimeter of the eastern side of Area G near the Transuranic Waste Inspection Project domes. Although the concentrations of these radionuclides in soil collected around the perimeter of Area G are higher than the RSRLs, all levels are still far below ISLs and, except for their high variability from year to year at some points, the concentrations are generally not increasing over time (Figures 7-7, 7-8, and 7-9).

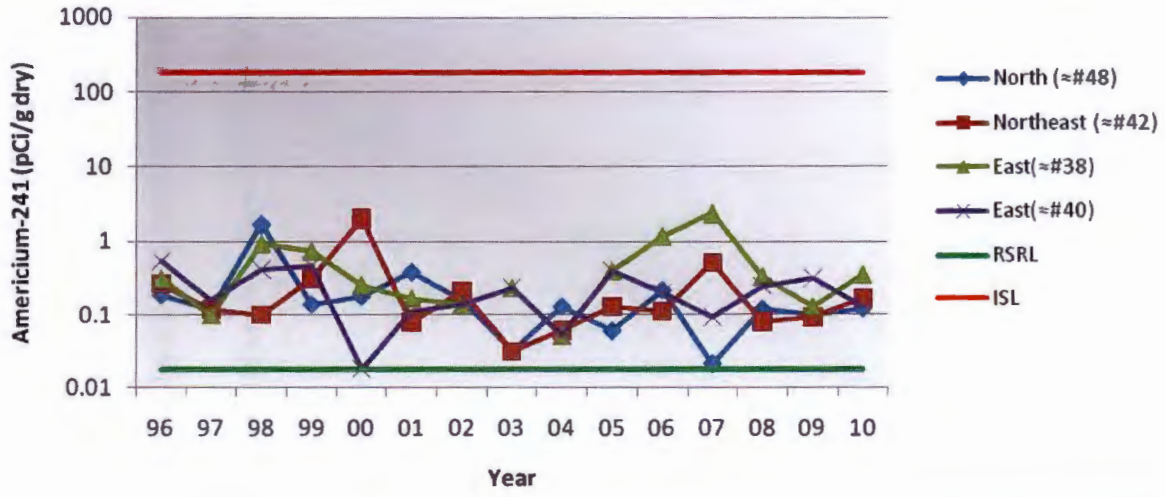

Figure 7-7 **Americium-241 concentrations in surface soils collected from the northern, northeastern, and eastern portions of Area G at TA-54 from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the industrial screening level (ISL). Note the logarithmic scale on the vertical axis.**

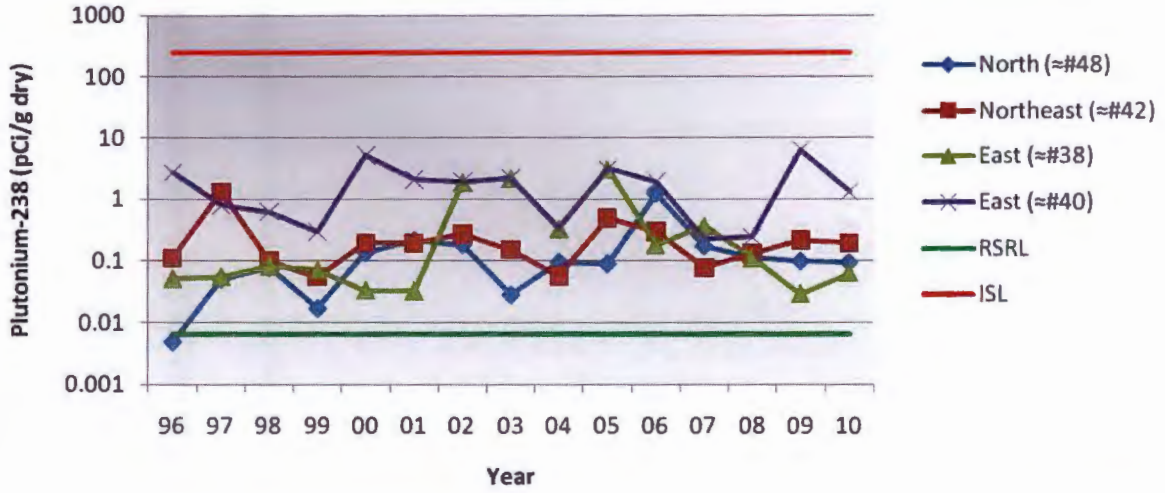

Figure 7-8 **Plutonium-238 concentrations in surface soils collected from the northern, northeastern, and eastern portions of Area G at TA-54 from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the industrial screening level (ISL). Note the logarithmic scale on the vertical axis.**

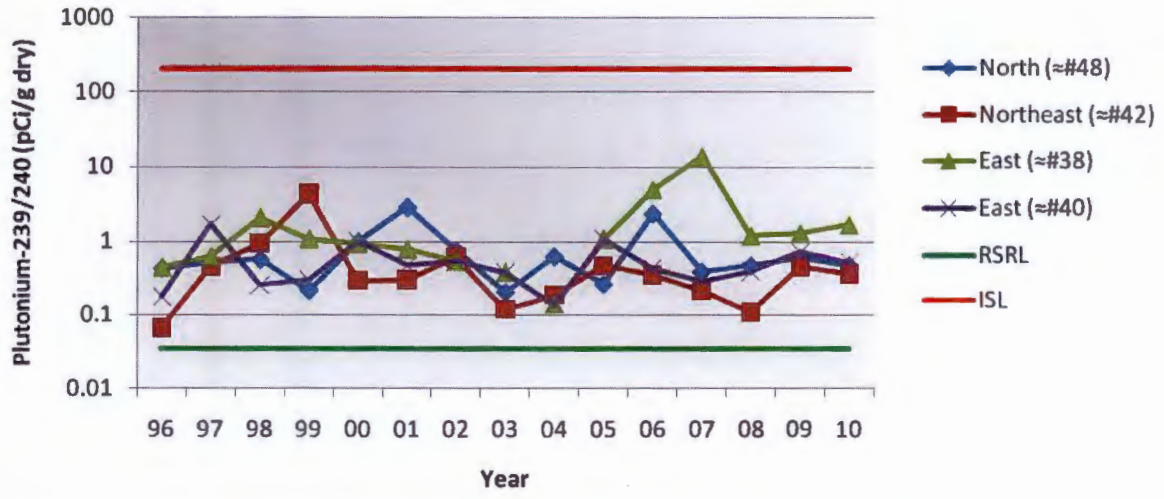

Figure 7-9 **Plutonium-239/240 concentrations in surface soils collected from the northern, northeastern, and eastern portions of Area G at TA-54 from 1996 through 2010 as compared with the regional statistical reference level (RSRL) and the industrial screening level (ISL). Note the logarithmic scale on the vertical axis.**

b. Results at the Pueblo de San Ildefonso Boundary

Plutonium-238 and plutonium-239/240 in a soil sample collected at the LANL/Pueblo de San Ildefonso boundary northeast and down gradient of Area G (Site #SI-T3) were detected at concentrations just above the RSRLs in 2010 (Table S7-3). However, the levels of these radionuclides were far below the RSLs and have generally remained stable over the five-year time period of study (Figures 7-10 and 7-11).

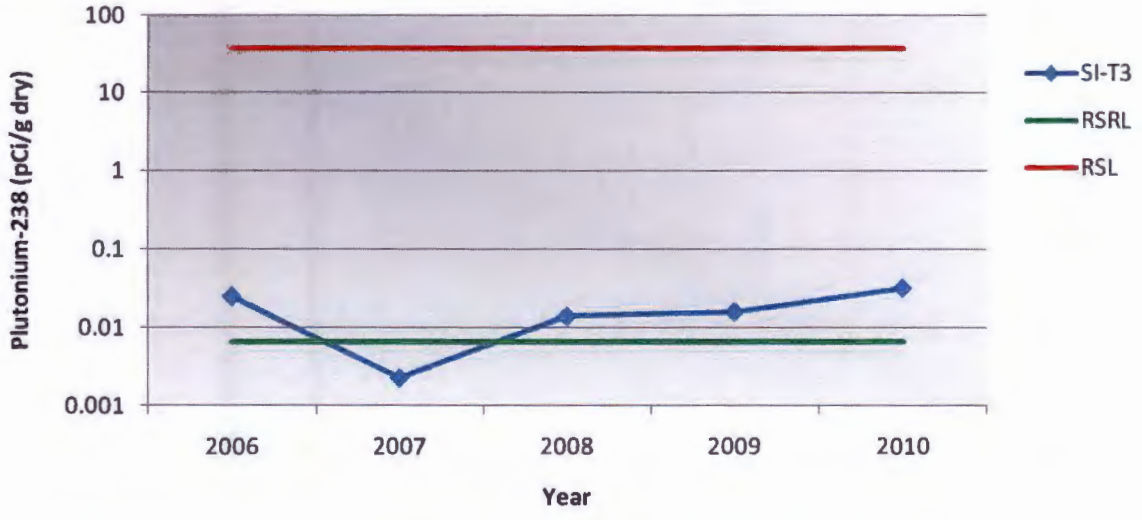

Figure 7-10 **Plutonium-238 (detectable and non-detectable) concentrations in surface soil collected from the LANL/Pueblo of San Ildefonso boundary (SI-T3) northeast of Area G at TA-54 from 2006 through 2010 as compared with the regional statistical reference level (RSRL) and the residential screening level (RSL). Note the logarithmic scale on the vertical axis.**

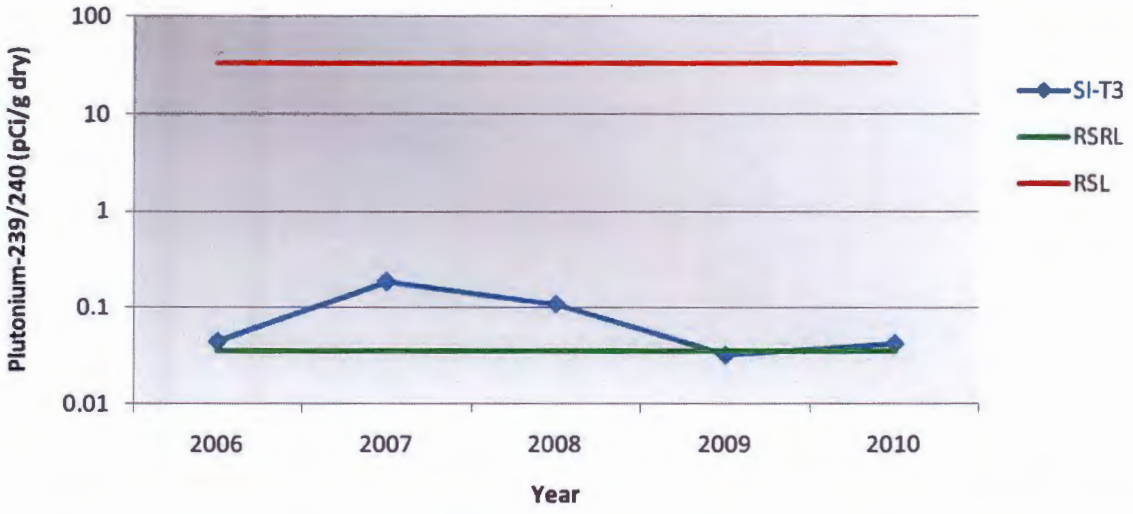

Figure 7-11 **Plutonium-239/240 (detectable and non-detectable) concentrations in surface soil collected from the LANL/Pueblo of San Ildefonso boundary (SI-T3) northeast of Area G at TA-54 from 2006 through 2010 as compared with the regional statistical reference level (RSRL) and the residential screening level (RSL). Note the logarithmic scale on the vertical axis.**

3. Monitoring Network for DARHT at TA-15

The Laboratory conducts facility-specific soil and sediment monitoring on an annual basis at DARHT (Nyhan et al., 2001). Approximately 20 acres in size, DARHT is located at R-Site (TA-15) at the Laboratory's southwestern side (see Figure 7-1). Activities at DARHT include the use of very intense X-rays to radiograph a full-scale non-nuclear mock-up of a nuclear weapon's primary during the late stages of the explosively driven implosion of the device (DOE 1995). Open-air detonations occurred from 2000 to 2006; detonations using foam mitigation were conducted from 2002 to 2006; and detonations within closed steel containment vessels were conducted starting in 2007 (three in fiscal year [FY] 2007, two in FY08, none in FY09, and four in FY10) (DOE 2009, 2010, 2011). Potential contaminants include radionuclides, beryllium (and other heavy metals), and organic chemicals like PCBs, SVOCs, and HEs.

Soil samples were collected in May 2010 on the north, east, south, and west sides (Figure 7-12) of the DARHT perimeter. An additional soil sample was collected about 23 meters north of the firing point (the firing point has since been paved). Sediment samples were collected on the north, east, south, and southwest sides. All soil and sediment samples were analyzed by the ALS for tritium, plutonium-238, plutonium-239/240, strontium-90, americium-241, cesium-137, uranium-234, uranium-235, uranium-238, TAL element, and HEs. The firing point sample was also analyzed for dioxin and furans by Cape Fear Analytical. Although not analyzed in 2010, PCBs and SVOCs were not detected in soil and sediment samples collected within and around the perimeter of the DARHT facility in 2007 (Fresquez 2008). (Note: We report on the analyses of vegetation, small mammals, bees, and birds collected around the DARHT facility in Chapter 8, Section B.4.b.)

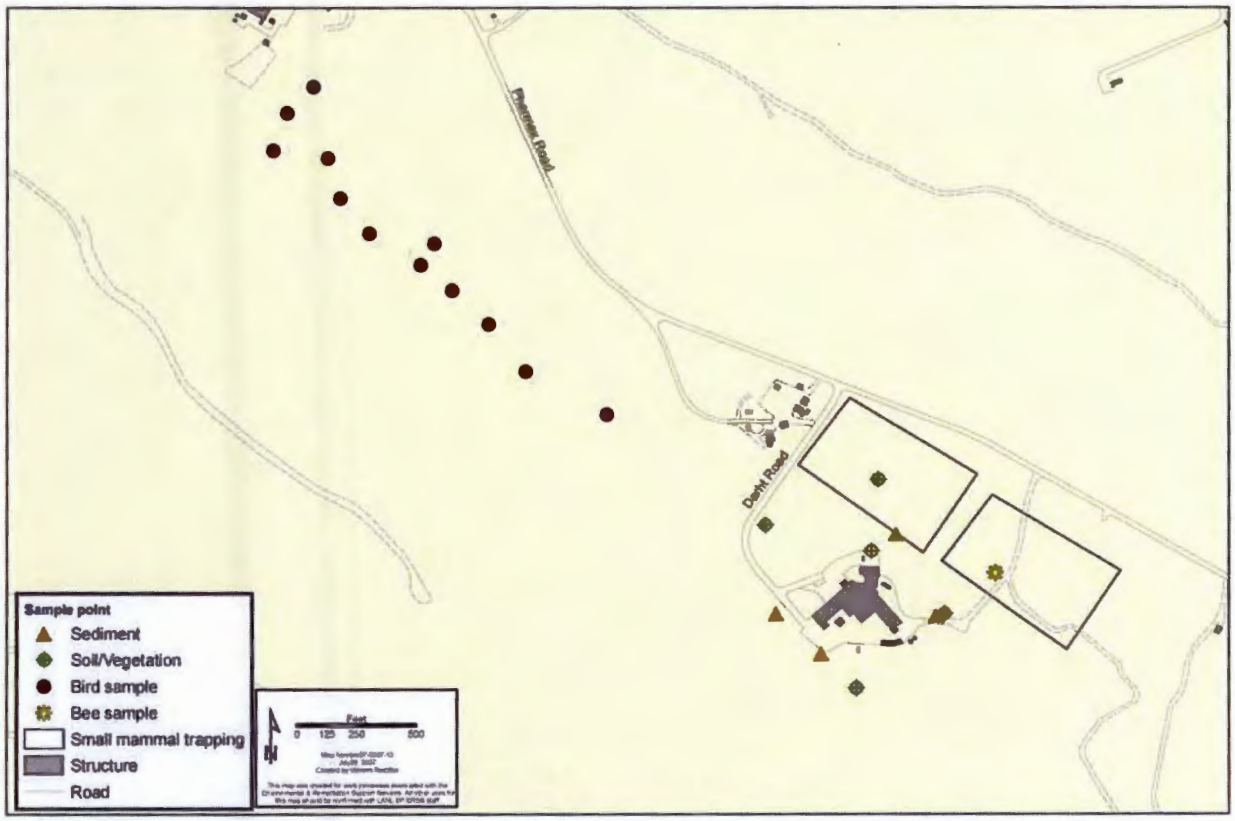

Figure 7-12 Soil, sediment, and biota sample locations at DARHT in 2010.

We compared the radionuclide and TAL element results in soil and sediment from the DARHT sampling to both RSRLs and BSRLs. The BSRLs are the concentrations of radionuclides and inorganic chemicals (mean plus three standard deviations) in soil and sediment collected from around the DARHT facility from 1996 through 1999 before the start-up of operations (Fresquez et al., 2001), per the DARHT Mitigation Action Plan (DOE 1996). Both reference levels are employed because the BSRLs for some elements may be biased as a result of changes in pre- and post-sampling locations and a change in analytical techniques. A comparison of BSRLs with RSRLs, for example, shows that some baseline radionuclide concentrations, such as cesium-137 from fallout, may be biased low and some baseline inorganic chemical concentrations, such as silver, may be biased high regardless of DARHT activities. Moreover, some TAL elements analyzed recently have no baseline levels at all. To accommodate parking spaces and storage areas within the DARHT complex after operations began, soil sampling locations had to be moved from within the fenced perimeter boundary (< 100 ft from the facility) to sites located outside the perimeter fence boundary (> 300 ft from the facility). This may have affected the concentrations of some radionuclides, particularly cesium-137 (fallout) because the pre-operation samples were collected in mostly disturbed soil and the post-operation start-up samples were collected in mostly undisturbed soil.

Higher amounts of fallout radionuclides would be expected in the undisturbed soil rather than the disturbed soil because of the mixing associated with disturbed soil. Moreover, the change in analytical techniques may have improved detection capabilities for some metals. The use of inductively coupled plasma mass spectrometry instrumentation to analyze post-operation start-up samples, for example, substantially decreased the detection limits of silver, from 2 to 0.2 mg/kg.

4. Radionuclide and Chemical Analytical Results for DARHT

Most radionuclides, with the exception of uranium isotopes, in soil and sediment collected from within and around the perimeter of the DARHT facility were either not detected or below the statistical reference levels

(Table S7-4). Uranium isotopes, but predominantly uranium-238, were detected above the BSRL in two of the five soil samples collected. The highest amount of uranium-238 was detected in a soil sample collected just north of the firing point (5.8 pCi/g dry); however, this amount was dramatically lower than some of the previous years, particularly in 2008 (55 pCi/g dry), and far below the ISL (Figure 7-13).

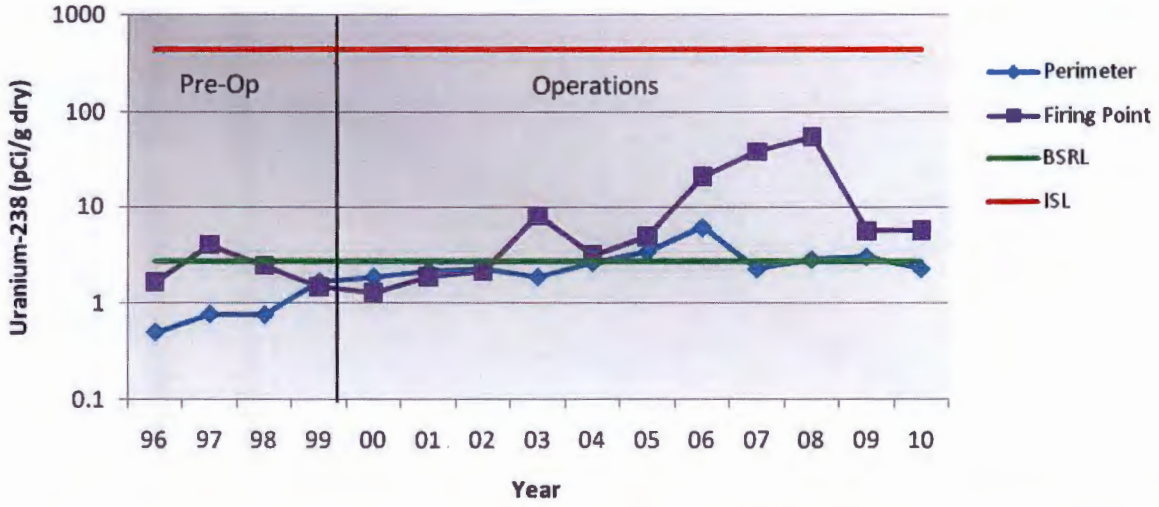

Figure 7-13 **Uranium-238 concentrations in surface soil collected within (near the firing point) and around the DARHT perimeter (north, west, south, and east side average) at TA-15 from 1996–1999 (pre-operations) to 2000–2010 (operations) as compared with the baseline statistical reference level (BSRL) and the industrial screening level (ISL). Note the logarithmic scale on the vertical axis.**

All of the TAL elements, including beryllium, in the soil and sediment samples collected within and around the DARHT facility were below both the statistical reference levels (Table S7-5). Beryllium, listed as a chemical of concern prior to the start-up of operations at DARHT (DOE 1995), was not detected in any of the soil or sediment samples above reference levels. Also, beryllium concentrations in soil over the 11-year operations period has been mostly below the BSRL, far below ISLs, and remains relatively stable over time (Figure 7-14).

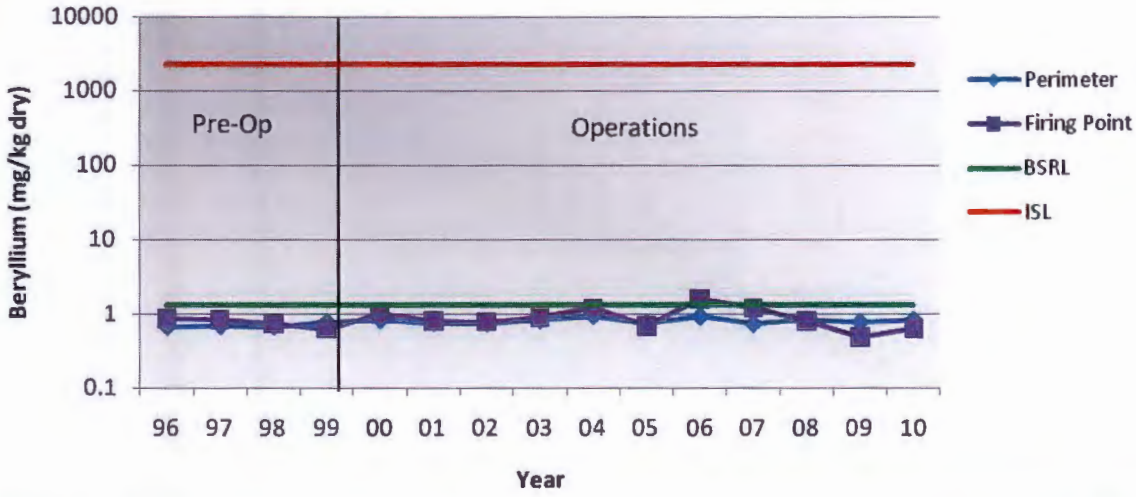

Figure 7-14 **Beryllium concentrations in soil collected within (near the firing point) and around the DARHT perimeter (north, west, south, and east side average) at TA-15 from 1996–1999 (pre-operations) to 2000–2010 (operations) as compared with the baseline statistical reference level (BSRL) and the industrial screening level (ISL)**

HEs were not detected in any of the soil or sediment samples collected within and around the perimeter of the DARHT facility, including the sample closest to the firing point (Table S7-6). Also, dioxin and furans were not detected above the limit of quantification (reporting limit) in the soil sample nearest the firing point (Table S7-7).

E. SPECIAL MONITORING STUDIES

1. Origin of Plutonium and Cesium-137 in Soil Samples Collected in High-Elevation Locations in New Mexico and Colorado

In 2008, the NMED collected five soil samples from high-elevation areas (11,099 to 12,476 ft) and analyzed them for cesium and plutonium activity (NMED 2008a); the goal of the study was to determine potential contaminants and their impacts to the watershed used for irrigation in the Embudo Valley (NMED 2007). Four samples were collected from the Sangre de Cristo Mountains of New Mexico (Cebolla, Puerto Nambe, and two from Trampas Lake), and one sample was collected from Rock Lake, Colorado. Results showed detectable concentrations of cesium-137 and plutonium-239/240 in the Trampas Lake samples in particular and concluded that the amounts were consistent with those measured at other high-elevation lakes in the Rocky Mountains (NMED 2008b). Normally, higher amounts of radionuclides from global fallout are detected at higher altitudes because of greater precipitation from rain and snow (Ulsh et al., 2000).

To determine the origin of the detectable concentrations of cesium-137 and plutonium-239/240 reported by the NMED, all five soil samples were provided to LANL to determine the distribution of isotopic ratios of the radionuclides in these samples. The isotopic ratios of these radionuclides vary, depending upon the origin of the radionuclides, and possible sources include LANL operations, fallout from nuclear tests at the Nevada Test Site (NTS), or from large thermonuclear tests conducted by the United States or the former Soviet Union. Cesium was analyzed by gamma-ray spectrometry and plutonium was analyzed by thermal ionization mass spectrometry. Based on the plutonium-240/plutonium-239 isotope ratio and cesium-137/plutonium-239,240 activity ratio measured for each sample, it was determined that all of the radionuclides present were from fallout from nuclear tests (LaMont et al., 2009; Steiner et al., 2010).

In the four samples from New Mexico, approximately 75% of the radionuclides were from global fallout from large thermonuclear atmospheric tests conducted by the United States and the former Soviet Union, and 25% of the radionuclides were from regional fallout from much smaller atmospheric nuclear tests conducted at the NTS. The sample from Colorado showed a much larger NTS fallout content at 78%, with only 22% of radionuclides coming from global fallout. The cesium-137/plutonium-239,240 ratios also demonstrated that fallout was the only source of radionuclides in these samples, and no measurable contribution to the plutonium concentration from LANL operations could be detected.

F. QUALITY ASSURANCE FOR THE SOIL, FOODSTUFFS, AND BIOTA MONITORING PROGRAM

1. Quality Assurance Program Development

The sampling team collects soil, foodstuffs, and biota (SFB) samples according to written, standard quality assurance and quality control procedures and protocols. These procedures and protocols are identified in the *LANL Quality Assurance Project Plan for the Soil, Foodstuffs, and Biota Monitoring Project* and in the following LANL standard operating procedures:

- Collection of Soil and Vegetation Samples for the Environmental Surveillance Program
- Sampling Soil and Vegetation at Facility Sites
- Analytical Chemistry Data Management and Review for Soil, Foodstuffs, and Biota
- Analytical Data Verification/Validation Process

These procedures, which are available on the LANL public website (http://www.lanl.gov/environment/all/qa.shtml), ensure that the collection, processing, and chemical analysis of samples, the validation and verification of data, and the tabulation of analytical results are conducted in a manner consistent from year to year. Locations and samples have unique identifiers to provide chain-of-custody control from the time of collection through analysis and reporting.

2. Field Sampling Quality Assurance

Overall quality of field sampling is maintained through the rigorous use of the carefully documented procedures, listed above, which govern all aspects of the sample-collection program.

The team collects all samples under full chain-of-custody procedures to minimize the chances of data transcription errors. Once collected, we hand-deliver the samples to the LANL Sample Management Office, which ships them via express mail directly to an external analytical laboratory under full chain-of-custody control. The project leader of the Soil, Foodstuffs, and Biota monitoring program tracks all samples. Upon receipt of data from the analytical laboratory (electronically and in hard copy), the completeness of the field-sample process and other variables are assessed. A quality assessment document is created, attached to the data packet, and provided to the project leader.

Field data completeness for SFB in 2010 was 99%.

3. Analytical Laboratory Quality Assessment

We had no analytical laboratory data quality issues related to the SFB sampling program during 2010. Detailed discussion of overall analytical laboratory quality performance is presented in Chapter 11. Analytical data completeness for all SFB sampling programs was 99% in 2010.

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A. FOODSTUFFS MONITORING

1. Introduction

A wide variety of wild and domestic crops, including vegetables, fruits, berries, nuts, and grains, are grown and/or harvested at many locations surrounding Los Alamos National Laboratory (LANL or the Laboratory). Also, many food products from domestic livestock (e.g., milk, eggs, and meat) and apiaries (honey) are available, and fishing and hunting for small and big game animals (e.g., rabbits, turkey, deer, and elk) on neighboring properties around LANL are a common occurrence.

Conceptually, these foodstuffs within and around LANL might become contaminated through air stack emissions and fugitive dust (inhalation by animals; deposition on plant surfaces), soil contamination sites (ingested and/or dermal contact by animals; splash and root uptake by plants), and storm and irrigation water exposures (ingested and/or dermal contact by animals; root uptake by plants). Elk and deer, for example, might graze through areas on LANL land or drink from water catchments that might contain radioactive and/or chemical contamination, and fish might be exposed to potential contaminants entering the Rio Grande from runoff discharging from the Cerro Grande and/or from the many canyons that cross Laboratory property. Please note, however, that the many years of data collected to date do not demonstrate LANL impacts above screening levels on these resources. Nonetheless, the ingestion of these foods might conceptually constitute an important exposure pathway by which radionuclides (Whicker and Schultz 1982) and other chemicals (Gough et al., 1979) might be taken in by humans (i.e., food web transfer).

The purpose of the foodstuff monitoring program is to determine whether Laboratory operations are affecting human health via the food chain. US Department of Energy (DOE) Orders 450.1A (DOE 2008) and 5400.5 (DOE 1993) define the framework and requirements for this monitoring program. We accomplish this effort through the following tasks:

1) Measuring radioactive and (other) chemical concentrations in foodstuffs on Laboratory land, if available, and from neighboring communities and comparing these results to regional background levels, screening levels, and, if available, standards;

2) Determining concentration trends over time; and

3) Providing data used to estimate potential dose from the consumption of the foodstuffs (see Chapter 3 for dose estimates to individuals from the ingestion of foodstuffs).

In general, as part of the soil/foodstuffs and biota program (see Chapters 7 and 8, respectively), we conduct sampling of major area resources on a three-year rotating schedule. The collection of Rio Grande–related samples (fish, crayfish, and benthic macroinvertebrates) was accomplished in 2008 (Fresquez et al., 2009) and surface soil/native vegetation related samples was completed in 2009 (Fresquez et al., 2010). This year, we present the results of agriculture-related samples (produce crops, goat milk, chicken eggs, and honey) collected from the neighboring communities surrounding the Laboratory. (Note: Other foodstuffs like wild edible plants, livestock, and small and large game animals are analyzed as they become available and an adequate number of samples can be submitted to the laboratory.)

Also, we present additional (follow-up) metal data on crayfish collected from the Rio Grande upstream and downstream of LANL; radionuclide, metal, and polychlorinated biphenyls (PCBs) in meat of two (road-killed) elk collected on LANL lands; and (follow-up) of metals and PCBs in meat of several (road-killed) deer that were collected along roads that cross LANL lands.

2. Foodstuffs Comparison Levels

Radionuclides and chemicals in foodstuffs potentially impacted by LANL operations are compared with regional statistical reference levels (RSRLs). RSRLs are the upper-level background concentration (mean plus three standard deviations = 99% confidence level) for radionuclides (both detected and nondetected values are used) and chemicals calculated from foodstuffs collected over the past five sampling events from regional locations away from the influence of the Laboratory (more than 9 miles away) (DOE 1991). The concentrations of radionuclides and chemicals in foodstuffs collected from regional background areas are the result of worldwide fallout and natural processes (e.g., elements in soil to plants to animals). (Note: In some cases where there are numerous detections above RSRLs and a large number of samples are collected from a defined population, a statistical test at the 0.05 probability level may be used to aid in comparisons.)

If any radionuclide/chemical concentration in a foodstuff exceeds the RSRL(s), we would then compare the concentration with screening levels (SLs). For radionuclides, the SLs in concentration units are based on 4% (= 1 mrem/yr) (LANL 2003) of the 25-mrem/yr DOE single-pathway constraint (DOE 1999) so that potential concerns may be identified in advance of the standard, i.e., a "yellow flag." If a radionuclide concentration exceeds an SL, the basis for that increase is investigated. For target analyte list (TAL) elements, with the exception of mercury in aquatic animals, there are no SLs for the majority of foodstuffs collected around LANL. The SL for mercury in aquatic animals, based on US Environmental Protection Agency (EPA) guidelines, is 0.30 mg/kg wet weight (parts per million) (EPA 2001). (Note: Although not SLs, per se, EPA guidelines for limited consumption of fish are based on the amounts of mercury, cadmium, selenium, and arsenic [EPA 2007]. They are presented as a range and as the concentrations increase, the number of fish that can be consumed decreases.) Similarly, for PCBs in fish, we use EPA guidelines for SLs; in this case, we would compare Toxicity Equivalent Quotients (TEQs), which are calculated from the 12 dioxin-like PCB compounds (Van den Berg et al., 2006) to the EPA risk-based consumption limits for human health (EPA 2007).

If radionuclides, mercury, or PCB concentrations exceed an SL, they would then be compared with the applicable action limit. In the case of radionuclides, a dose to a person would be calculated from all the radionuclides measured within a single pathway and compared with the 25-mrem/yr DOE single-pathway dose constraint (DOE 1999). In the case of mercury and PCBs, the concentrations would be compared with the Food and Drug Administration (FDA) action limits of 1 ppm (fish) and 3 ppm (for red meat and poultry), respectively (FDA 2000). Table 8-1 presents a summary of the RSRLs, SLs, and the standards used to evaluate the results of radionuclides, mercury, and PCBs in foodstuffs.

Table 8-1
Standards and Other Reference Levels Applied to Foodstuffs

Constituent	Media	Standard	Screening Level	Background Comparison Test or Level
Radionuclides	All foodstuffs	25 mrem/yr	1.0 mrem/yr	RSRLs
Mercury	Aquatic animals	FDA: 1 ppm (wet) in edible portion (complete consumption restrictions)	EPA: 0.30 ppm (wet) in edible portion	RSRLs
TAL Elements per EPA Risk-Based Consumption Limits of Edible Portions				
Mercury	Fish		0.029–1.9 ppm (wet)	RSRLs
Cadmium	Fish		0.088–5.6 ppm (wet)	
Selenium	Fish		1.5–94 ppm (wet)	
Arsenic	Fish		0.002–0.13 ppm (wet)	
Polychlorinated Biphenyls (PCBs)				
	Red meat and poultry	FDA (complete consumption restrictions). Total PCBs = 3 ppm		RSRLs
	Fish		EPA (limited consumption restrictions). Total PCBs = 0.0015–0.094 ppm or TEQs = 0.019–1.2 ppt from 12 dioxin-like PCB congeners	RSRLs

3. Crop (Produce) Monitoring

a. Monitoring Network

We collected more than 100 fruit and vegetable samples from on-site, perimeter, and regional background locations in the summer/fall of 2010 (Figure 8-1). The locations with respect to the Laboratory, number of samples collected, and potential transport pathway(s) were as follows:

- On-site (LANL): Technical Areas (TA) 3/16/21/35/36/46/52/54/61, 15 samples, downwind air pathway and storm water runoff pathway;
- Perimeter: Los Alamos town site, located north of LANL, 19 samples, downwind air pathway;
- Perimeter: White Rock/Pajarito Acres town sites, located southwest of LANL, 19 samples, downwind air pathway;
- Perimeter: Pueblo de San Ildefonso/El Rancho/Jacona/Nambé corridor, located along State Road 502 northeast of LANL, 23 samples, downwind air pathway;
- Perimeter: Algodones/Bernalillo/Corrales corridor, located along the Rio Grande basin south of LANL, 14 samples, water/irrigation pathway; and,
- Regional Background: Española/Velarde/Dixon/Alcalde/Santa Fe, 19 samples.

Approximately 15 on-site produce samples were collected from nine TAs located throughout the Laboratory. Most of the LANL samples were of fruit, but three samples were vegetables collected from the Otowi garden at TA-3 that is maintained by Laboratory volunteers. Similarly, more than 70 samples of fruits and vegetables were collected from perimeter communities located to the north, northeast, southeast, and south of the Laboratory and include crops irrigated with water from the Rio Grande.

Results obtained from the on-site and perimeter samples were compared with crop samples collected from regional (background) areas away from the Laboratory. Radionuclides and TAL elements detected in produce from background areas are the result of worldwide fallout and naturally occurring sources. This year, we collected 19 produce samples from the following regional areas: Alcalde, Dixon, Española, Santa Fe, and Velarde, New Mexico.

All samples, about two to three pounds each, were placed into Ziploc bags (Figure 8-2) and submitted to the LANL Sample Management Office (SMO) under chain-of-custody procedures where they were shipped to ALS Laboratory Group (formally Paragon Analytical) for the processing and analysis of tritium, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. In addition to these radionuclides, three samples representing a leafy vegetable crop (e.g., lettuce, cabbage), a root vegetable crop (e.g., radishes, garlic), and a fuzzy fruit crop (e.g., apricot) from each location, if available, were analyzed for strontium-90, cesium-137, americium-241, and 23 TAL elements (aluminum, barium, beryllium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, zinc, antimony, arsenic, cadmium, lead, selenium, silver, thallium, and mercury). Results for tritium are reported on a pCi/mL basis; results for the other radionuclides are reported on a pCi/g dry weight basis; and the results for the TAL elements are reported on a mg/kg (part per million) dry weight basis.

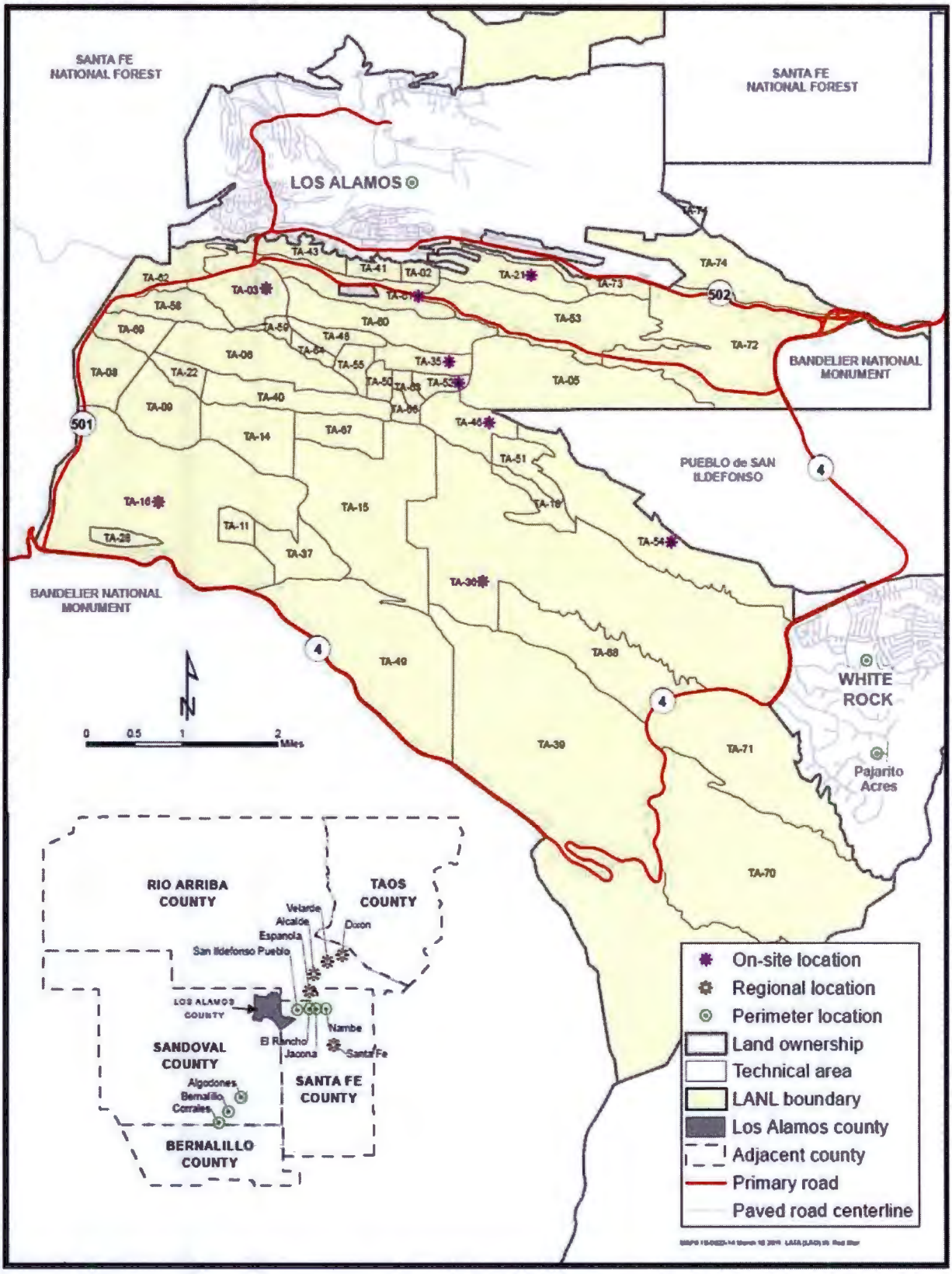

Figure 8-1 On-site, perimeter, and regional produce sampling locations

Figure 8-2 Collecting fruit samples from neighboring communities surrounding the Laboratory

b. Radionuclide Analytical Results

Radionuclide (activity) concentrations in produce collected from on-site, perimeter, and regional (background) locations during the 2010 growing season are presented in Table S8-1.

In general, all radionuclides in all produce samples, regardless of location, were very low (pCi range) and most were either not detected or detected below the RSRLs. A nondetected result is one in which the result is lower than the minimum detectable concentration and/or lower than three times the total propagated uncertainty (e.g., not significantly different from zero at the 0.01 probability level) (Keith 1991, Corely et al., 1981).

The few detected radionuclides in produce samples from on-site and perimeter areas that were higher than the RSRLs included tritium in a peach sample collected from the DP East facility at TA-21 (2.8 vs 0.56 pCi/mL); tritium in an apricot sample from the Area G waste disposal site at TA-54 (6.7 vs 0.56 pCi/mL); tritium in a grape sample from White Rock (1.0 vs 0.56 pCi/mL); tritium in a pear sample from Pajarito Acres (0.70 vs 0.56 pCi/mL); and uranium-234 (0.034 to 0.068 vs 0.030 pCi/g dry), uranium-235 (0.0019 to 0.0029 vs 0.017 pCi/g dry), and uranium-238 (0.027 to 0.058 vs 0.022 pCi/g dry) isotopes in five vegetable samples collected from the Jacona area, most from the same farm.

The higher tritium concentrations in the two fruit samples from LANL lands (DP East at TA-21 and Area G at TA-54) are a result of tritium processing work and waste disposal operations, respectively. The slightly higher tritium concentrations in two fruit samples collected from the White Rock/Pajarito Acres area are unknown; but the closest tritium source is from Area G at TA-54, which is located about one to three miles west and northwest of these communities. Based on only two detections out of the 19 samples, however, tritium in fruit and vegetables from these communities is not widespread, and the overall mean concentration (combining detectable and nondetectable values) is similar to past years (Figure 8-3).

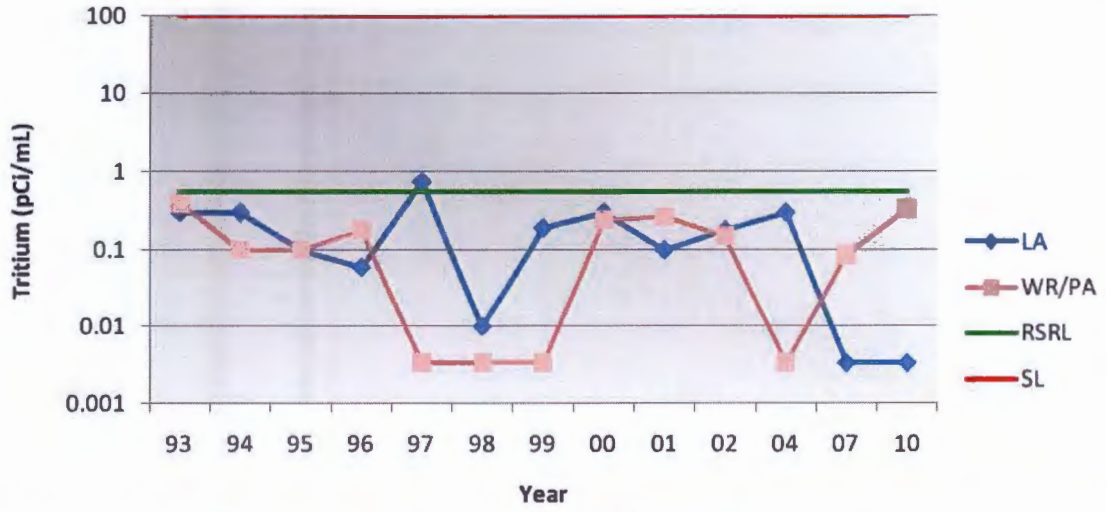

Figure 8-3 **Mean tritium concentrations in produce collected from the closest LANL neighbors, Los Alamos (LA) to the north and White Rock/Pajarito Acres (WR/PA) to the east, from 1993 through 2010 compared with the regional statistical reference level (RSRL) and the screening level (SL). Note the logarithmic scale on the vertical axis.**

As for the slightly higher uranium isotopes in vegetables from the Jacona area compared with the RSRLs, the uranium was naturally occurring (e.g., the uranium-234 and uranium-238 distribution was 1:1) and was probably a result of the water source used for irrigation. A high amount of naturally occurring uranium in stream and well waters in the general area of Jacona is well documented (Maassen and Bolivar 1979; McQuillan and Montes 1998; Hayes et al., 2000 and 2002).

Overall, the few detected tritium and uranium results in produce samples from on-site and some perimeter areas collected in 2010 were far below the SLs and do not pose a potential unacceptable dose to humans who may ingest these fruits and vegetables.

c. TAL Elements Analytical Results

Nearly all of the TAL elements in produce samples collected from on-site locations were below RSRLs (68 out of 69), and the few TAL elements that were higher than the RSRLs in produce samples collected from perimeter areas were probably a result of natural causes (Table S8-2). The type of crop, parent material (soil type), soil pH, tillage, irrigation source, and organic and inorganic fertilizer amendments that the gardener might add are all potential reasons the TAL elements differ from one place to another in perimeter farm land areas.

4. Goat Milk Monitoring

a. Monitoring Network

Milk from dairy cows and goats has been collected from 1994 to 1997 and from 1997 to present, respectively. The (cow) dairy, which was located approximately 25 miles (40 km) east of LANL, closed in 1998 and no detections of radionuclides or detections above regional background were ever made in those milk samples.

The collection of goat milk from the surrounding communities has continued—the milk is for private use and is not sold commercially. This year, we sampled (unprocessed) goat milk from a farm in the Pajarito Acres area (perimeter) and from a regional background farm located in Peña Blanca, New Mexico. Radionuclides in goat milk from regional background areas are due to worldwide fallout and to naturally occurring sources.

The goat milk samples were collected directly by the farmer, placed into labeled 1-L polyethylene bottles provided by the Laboratory, submitted under chain of custody to our SMO, and then to ALS for the analysis of tritium, cesium-137, strontium-90, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. All results are reported on a pCi/L basis.

b. Radionuclide Analytical Results

All radionuclides analyzed in goat milk from the Pajarito Acres area were not detected (Table S8-3). These data, including those from regional background, are unchanged from previous years.

5. Egg Monitoring

a. Monitoring Network

We collected two dozen (medium-sized) eggs each from farmers raising free-ranging chickens from the following perimeter areas: Los Alamos (North Mesa), Pajarito Acres, and Pueblo de San Ildefonso. Eggs from two regional background areas, Española and Peña Blanca, were also collected. All samples were submitted to ALS for the analysis of tritium, strontium-90, cesium-137, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. With the exception of tritium, which was reported in pCi/mL, all of the other radionuclides were converted from pCi/g ash to pCi/L by first multiplying the results by the ash/wet ratio of 0.0071 and then multiplying by the density of eggs (1,033 g/L).

b. Radionuclide Analytical Results

All radionuclides analyzed in eggs from the three perimeter sites around the Laboratory were either not detected or similar to RSRLs (Table S8-4). These data, including those from regional background, are similar to past years.

6. Honey Monitoring

a. Monitoring Network

We collected honey from bee hives located (1) east of Area G at TA-54, (2) Los Alamos town site, and (3) a regional background site near Pojoaque, New Mexico. We collected the honey from the hives at TA-54 and bought the perimeter and background honey directly from the producer. Approximately one quart of honey in glass jars was submitted under chain of custody to our SMO and then to ALS for the analysis of tritium, cesium-137, strontium-90, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. All results are reported on a pCi/L basis.

b. Radionuclide Analytical Results

The complete data set of radionuclides in honey from on-site, perimeter, and the regional location can be found in Table S8-5. All radionuclides analyzed for, with the exception of tritium at TA-54, in honey from all locations were either not detected or below RSRLs and similar to past years. Tritium in honey from TA-54 is from Area G operations and is not sold or consumed by the public; it is solely maintained as an experimental hive and shows that honey bees can be used as effective environmental monitors.

7. Crayfish Monitoring

a. Monitoring Network

Crayfish (crawfish, crawdads, or mudbugs) (*Orconectes* spp) samples were collected from the Rio Grande within two reaches relative to the location of LANL: upstream and downstream (Figure 8-4). Upstream (or background) samples were collected starting from the Otowi Bridge north to the Black Mesa area (about a three-mile stretch), and downstream samples were collected from the Los Alamos Canyon confluence south (about a one-mile stretch). Of the major drainages that cross LANL lands, the majority of LANL contaminants that may reach the Rio Grande are carried by storm water flow down Los Alamos Canyon (Gallaher and Efurd 2002; Reneau and Koch 2008; Fresquez et al., 2008). Note that other non-Laboratory sources may also contribute contaminants to the Los Alamos Canyon drainage; these include constituents in storm water carried from roads and grounds from the Los Alamos town site, treated effluent from the Los Alamos sewage treatment plant, atmospheric fallout of radionuclides, and some naturally occurring and anthropogenic materials in ash from the Cerro Grande Fire in May 2000 (Miranda 2009).

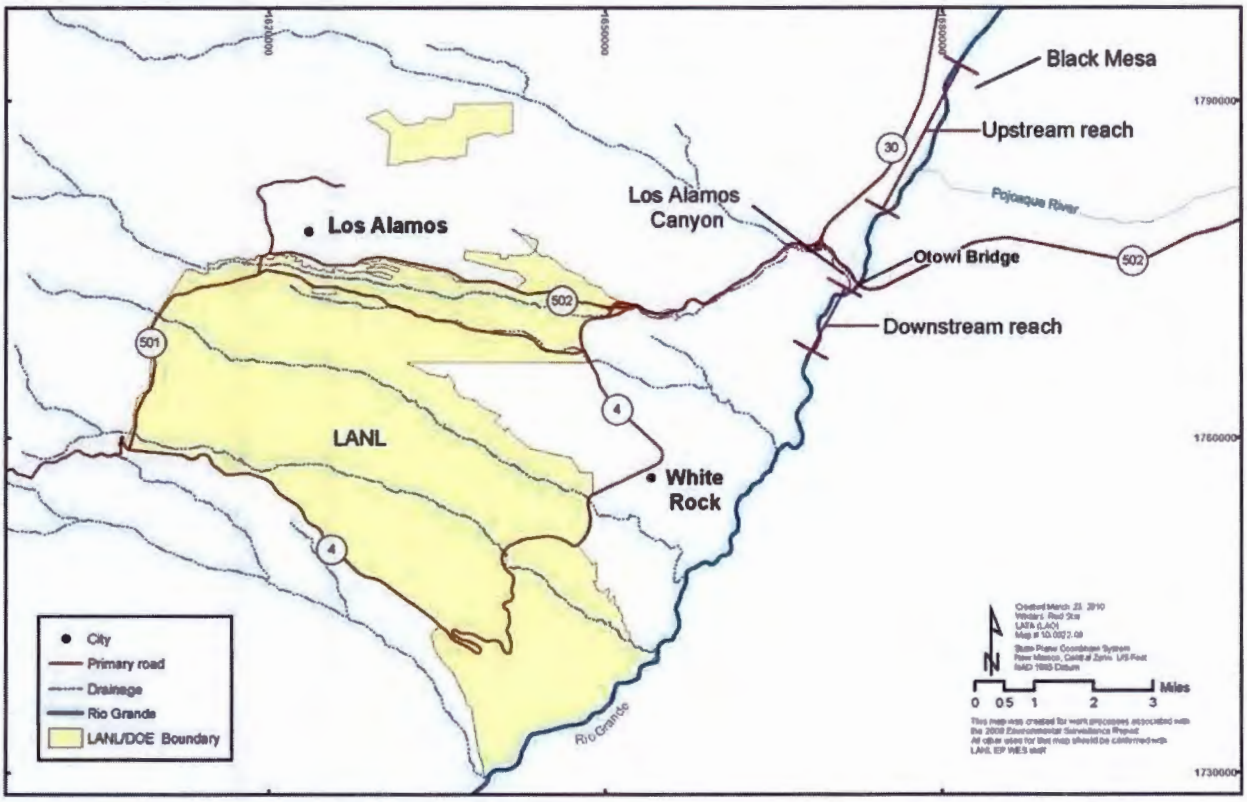

Figure 8-4 **Location of (crayfish) sampling reaches within the Rio Grande in relation to the location of LANL. The upstream reach is above the Otowi Bridge north to Black Mesa and the downstream reach starts below the Los Alamos Canyon confluence south.**

Last year, samples of whole body crayfish were analyzed for radionuclides, TAL elements, and PCB congeners. With the exception of some TAL elements (aluminum, barium, beryllium, chromium, cobalt, magnesium, vanadium, and arsenic), all of the other constituents measured in whole body crayfish from downstream reaches were similar to upstream reaches. The TAL element results, however, were based on only three samples from each reach.

This year, we collected more crayfish from upstream and downstream reaches to add to the database for a better evaluation of TAL elements. Also, some crayfish from both reaches were separated into edible (meat) and non-edible (head, gut, claws, and shell) portions to determine the differences in TAL element concentrations between the two parts and relative risk from the ingestion of only the meat portion.

b. Methods and Analysis

Within each reach, crayfish traps were randomly set with Purina Cajun World Crawfish Bait at the one-foot depth. Traps were checked every day for about two weeks (Figure 8-5).

Six crayfish from the upstream reach were collected; three of them were used for whole body analysis (Table S8-6), and the other three were analyzed for the edible portions (meat only) (Table S8-7). Two crayfish from the downstream reach were collected and divided: two edible and two non-edible portions were analyzed (Table S8-7). (Note: Whole body concentrations of these two downstream crayfish were estimated from the divided portions by multiplying the concentrations of each portion by the percentage of the total [edible = 13% and non-edible = 87%] and then summing the two. Results were added to Table S8-6).

All sample portions were weighed and placed into Ziploc bags, cooled to 4°C, and submitted under full chain-of-custody procedures to our SMO where they were then sent to ALS for TAL element analysis. These elements are reported on a wet weight basis in mg/kg.

Figure 8-5 Collection of crayfish samples from the Rio Grande

c. TAL Elements

Based on both 2009 and 2010 data, most of the TAL elements, including aluminum, barium, beryllium, chromium, cobalt, magnesium, vanadium, and arsenic, in whole body crayfish from upstream (n = 6) and downstream (n = 5) reaches were below the RSRLs (Table S8-6). The only TAL element in whole body crayfish from the downstream reach that was higher than the RSRL (and statistically as a group at the 0.05 probability level) was mercury. The differences in mercury concentrations in whole body crayfish collected from the two reaches, however, were small. Of the total, higher amounts were detected in the non-edible parts of crayfish from the downstream reach rather than the edible portions by a factor of nearly two (Table S8-7).

All TAL elements, including mercury, in the edible portions of crayfish collected from the downstream reach were similar to the edible portions collected from the upstream reach (< RSRLs) (Table S8-7). Also, all concentrations of mercury in the edible portion of crayfish collected from both reaches were an order of magnitude below the screening level of 0.30 mg/kg (EPA 2001). Mercury sources and contamination in fish inhabiting the Rio Grande upstream and downstream of LANL are well documented (see Foodstuffs and Biota related references); however, the amount of mercury in crayfish compared with bottom-feeding fish within these same reaches is an order of magnitude lower and does not appear to be a significant risk factor to humans if ingested.

8. Deer and Elk Monitoring

a. Monitoring Network

Since 1991, deer and elk have been routinely picked up as road kills along highways within and around LANL. We have analyzed samples from 26 deer and 43 elk from LANL, perimeter, and regional background sites from 1991 through 2010.

b. Elk

This year, two road killed elk on LANL property along Pajarito Road were collected: one within TA-36 and the other within TA-54. At each kill site, the muscle and bone from one of the front shoulders of the animal were collected for analysis of radionuclides and TAL elements. The muscles from these elk were also analyzed for PCB congeners. Samples were placed into the appropriate containers and submitted under chain-of-custody procedures to the SMO; samples were then submitted to ALS for the analysis of radionuclides and TAL elements and to Cape Fear Analytical Laboratory, Inc., for the analysis of PCB congeners.

i. Analysis

Radionuclides analyzed were tritium, strontium-90, cesium-137, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. Tritium concentration results are reported on a per mL of water basis. Results of the other radionuclides were reported in pCi/g dry weight after being converted from pCi/g ash weight. The 23 TAL elements listed earlier were also analyzed. These elements are reported on a mg/kg wet weight basis. PCBs were analyzed for 209 possible chlorinated structures or congeners and reported as pg/g (parts per trillion) wet weight basis. (Note: Because the bone tissue of deer and elk consist of both bone and bone marrow, the analytical chemist considered the material to be too heterogeneous to successfully achieve consistent results of TAL elements and PCBs; thus, bone tissue for TAL elements and for PCBs in elk and deer will be discontinued after this year and only the muscle portions will be analyzed.)

ii. Radionuclides

Most of the radionuclides that we analyzed for in both muscle and bone tissues from two elk collected on LANL lands were either not detected or below the RSRLs (Table S8-8). Only two radionuclides, uranium-234 and uranium-238, were detected in higher amounts than the RSRLs in muscle and/or bone tissue of the elk collected at TA-54. However, the amounts of uranium-234 and uranium-238 in tissues of elk were far below the SL of 0.56 and 0.50 pCi/g dry, respectively. Also, based on the uranium-234 and uranium-238 distribution (i.e., 1:1 ratio), the uranium was naturally occurring. These data agree with past results (Fresquez et al. 1999).

iii. TAL Elements

Results of TAL elements in muscle and bone tissues from two road-killed elk collected along Pajarito Road at TA-36 and TA-54 can be found in Table S8-9. Since this is the first time that TAL elements have been assessed in muscle and bone tissues of elk at LANL, we do not have a comparable data set from background elk, and an evaluation cannot be made at this time. These data are given at this time for future reference. However, since most of the radionuclide elements in muscle and bone from elk collected from LANL lands were not different from elk collected from regional background areas, the TAL elements are also not expected to be higher.

iv. Polychlorinated Biphenyls

PCB congeners, homologs, and totals in muscle tissues of road-kill elk collected alongside Pajarito Road at TA-36 and TA-54 can be found in Table S8-10. The amounts of PCBs in LANL elk muscle tissues from both elk were negligible.

c. Deer

Last year, one road-kill deer was collected along Pajarito Road within TA-46 and another road kill deer was collected along State Road 4 as it passes through the Pueblo of San Ildefonso property. All radionuclides in muscle and bone from these animals collected from these sites were similar to radionuclides in deer tissues collected from regional background sites. TAL elements and PCBs were also analyzed and reported in 2009, but there were no comparable datasets of TAL elements and PCBs from background deer to make an evaluation of any possible LANL contributions, if any. Data were given for future reference.

This year, we collected two deer from regional background areas and analyzed the muscle tissue for TAL elements and PCBs to compare with the deer collected in 2009; the analysis results are reported below. (Note: Because the bone tissue of deer and elk consist of both bone and bone marrow, the analytical chemist considered the material to be too heterogeneous to successfully achieve consistent results of TAL elements and PCBs; thus, bone tissue for TAL elements and for PCBs in elk and deer will be discontinued, and only the muscle portions will be analyzed in the future.)

i. TAL Elements

Results of TAL elements in muscle tissues from two road-kill deer collected in 2009 along State Road 4 and Pajarito Road as they pass through Pueblo of San Ildefonso and LANL lands, respectively, can be found in Table S8-11. Based on only two background deer, most TAL elements in deer collected from LANL and Pueblo de San Ildefonso lands were similar. We will continue to collect background deer as they become available.

ii. Polychlorinated Biphenyls

Total PCBs and homolog distributions in muscle tissues of a road-kill deer collected alongside Pajarito Road at TA-46 can be found in Table S8-12. The total amount of PCBs in the deer collected from LANL lands is at very low levels and is not higher than the RSRL. Similarly, the homolog distribution between the LANL deer and regional background appear to have the same general pattern, and both appear to possibly contain trace amounts of Aroclor 1242 and 1260, with more Aroclor 1242 detected than 1260 (Figure 8-6). We plan to continue to analyze deer tissues for PCBs to increase the amount of data to support a statistical assessment of the data.

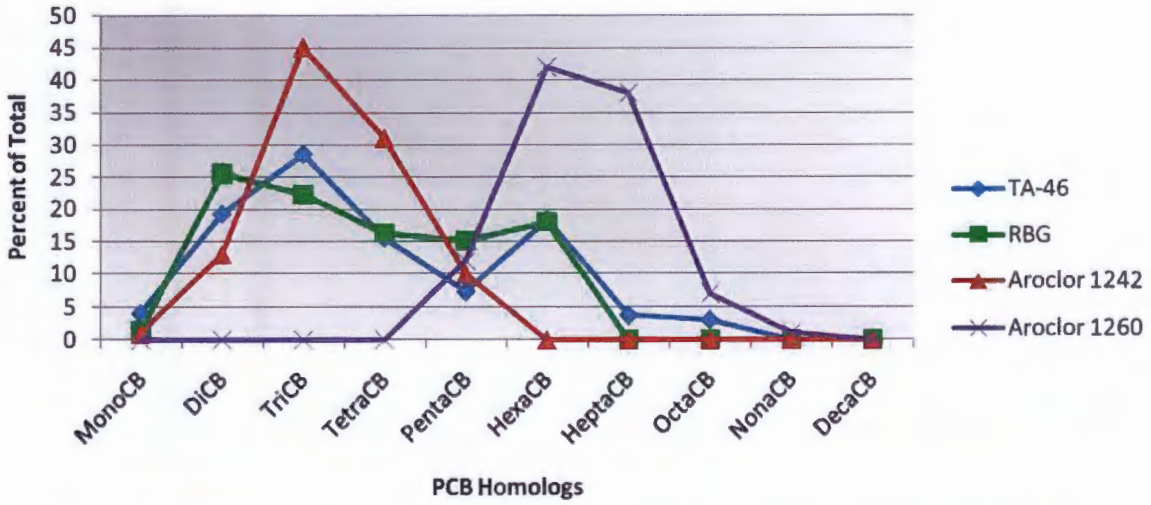

Figure 8-6 The PCB homolog distribution in muscle tissue of a road-kill deer collected alongside Pajarito Road at TA-46 in 2010 compared with regional background (RBG) and with Aroclor 1242 and 1260 formulations

B. BIOTA MONITORING

1. Introduction

DOE Orders 450.1A (DOE 2008) and 5400.5 (DOE 1993) define requirements for the monitoring of biota (plants and animals not normally ingested by humans) for the protection of ecosystems. Monitoring of biota, mostly in the form of facility-specific or site-specific studies, began in the 1970s with the Environmental Surveillance Program, while site-wide native vegetation monitoring started in 1994. Presently, in addition to native vegetation, we also monitor small mammals, amphibians, reptiles, birds, and bees within and around LANL on a systematic basis or for special studies. Detection of contaminants in biota may indicate that these animals may be entering contaminated areas (e.g., burrowing in waste burial grounds) or that material is

moving out of contaminated areas (e.g., blowing dust, transported soil/sediment via storm water, or food-chain transport).

The three objectives of the biota program are as follows:

1) Determine radionuclide and chemical concentrations in biota from on-site (LANL property) and perimeter areas and compare these results with regional (background) areas,

2) Determine concentration trends over time, and

3) Estimate potential radiation dose to plants and animals. (Chapter 3 presents the results of the 2010 biota dose assessments at LANL.)

2. Biota Comparison Levels

Like the foodstuffs data, radionuclides and chemical concentrations in biota from Laboratory areas are first compared with RSRLs. If the levels of potentially impacted areas are higher than the levels of non-impacted areas (RSRLs), then we would compare the concentrations with the SLs, if available, and then with the standards, if available. More information about comparison levels are summarized below and presented in Table 8-2:

- Regional background levels: RSRLs are the upper-level background concentrations (mean plus three standard deviations = 99% confidence level) for radionuclides and chemicals calculated from biota data collected over the past five sampling periods from regional locations away from the influence of the Laboratory (more than 9 miles away) (DOE 1991). RSRLs represent natural and fallout levels; they are calculated annually and presented in this report.
- Screening Levels: SLs are set below DOE dose standards so that potential concerns may be identified in advance, i.e., a "yellow flag." If a constituent exceeds an SL, then the reason for the higher levels is thoroughly investigated. For radionuclides in biota, SLs were set at 10% of the standard by the dose assessment team at the Laboratory to identify the potential contaminants of concern (McNaughton 2006). For chemicals, there are no SLs based on biota tissue concentrations. Instead, if a chemical in biota tissue exceeds the RSRL (or Baseline Statistical Reference Levels [BSRLs]), then the chemical concentrations in the soil at the place of collection are compared with ecological screening levels (ESLs) (LANL 2010). ESLs are derived from the literature and reflect the (highest) concentration of contaminants in the soil that are not expected to produce any adverse effects on selected biota receptors that commonly come into contact with soil or ingest biota that live in or on soil (i.e., they are the concentrations that are protective of ecological receptors under chronic exposure conditions).
- Standards: Based on the concentrations of radionuclides in biota, we calculate a dose and compare it with the 1-rad/day DOE dose standard for terrestrial plants and aquatic biota and 0.1 rad/day for terrestrial animals (DOE 2002).

Table 8-2
Standards and Other Reference Levels Applied to Biota

Constituent	Sample Location	Media	Standard	Screening Level	Background Level
Radionuclides	On site and perimeter	Terrestrial plants	1 rad/d	0.1 rad/d	RSRLs
	DARHT[a]	Terrestrial plants	1 rad/d	0.1 rad/d	RSRLs/BSRLs[b]
	On site and perimeter	Terrestrial animals	0.1 rad/d	0.01 rad/d	RSRLs
	DARHT	Terrestrial animals	0.1 rad/d	0.01 rad/d	BSRLs
Chemicals	On site and perimeter	Biota	na[c]	ESLs[d]	RSRLs
	DARHT	Biota	na	ESLs	RSRLs/BSRLs

[a] Dual Axis Radiographic Hydrodynamic Test Facility
[b] Baseline Statistical Reference Levels and a discussion of these levels can be found in Section 4.b.i.
[c] na = Not available
[d] Ecological Screening Levels are based on the concentration in the soil.

3. Institutional Monitoring

No wide-scale institutional monitoring of native vegetation was performed in 2010. Native understory (grasses and forbs) or overstory (trees) vegetation are collected on a triennial basis at the same time and at the same locations as the soil (17 on-site, 11 perimeter, and six regional locations) described in Chapter 7, Section C.1 (Figure 7-1). The next sampling period for the collection of native (understory) vegetation is in 2012. Past sampling shows that, in general, all radionuclide and TAL element concentrations in native understory and overstory vegetation sampled from Laboratory and perimeter areas are very low, and most concentrations are indistinguishable from regional background areas.

4. Facility Monitoring

a. Area G at TA-54

i. Monitoring Network

Native overstory vegetation (branches and needles) around Area G was collected at the same general locations as the soil samples described in Chapter 7, section D.1 (Figure 7-5). Radionuclides analyzed by the ALS included tritium, americium-241, plutonium-238, plutonium-239/240, uranium-234, uranium-235, and uranium-238. Results for tritium in vegetation are reported on a pCi/mL basis; results for the other radionuclides are reported on a pCi/g ash weight basis; and results for the TAL elements are reported on an mg/kg dry weight basis.

ii. Vegetation at Area G

With the exception of tritium, all of the other radionuclides in tree samples collected around the perimeter of Area G were mostly not detected or below the RSRLs (Table S8-13). Tritium, on the other hand, was detected above the RSRL in nearly 40% of the tree samples collected around the perimeter of Area G with the highest amounts (83 to 8,420 pCi/mL) occurring in trees growing in the southern sections near the tritium disposal shafts. All levels of tritium, however, are far below the SL, and despite the large variation in tritium concentrations from year to year, the concentrations are generally not increasing over time (Figure 8-7).

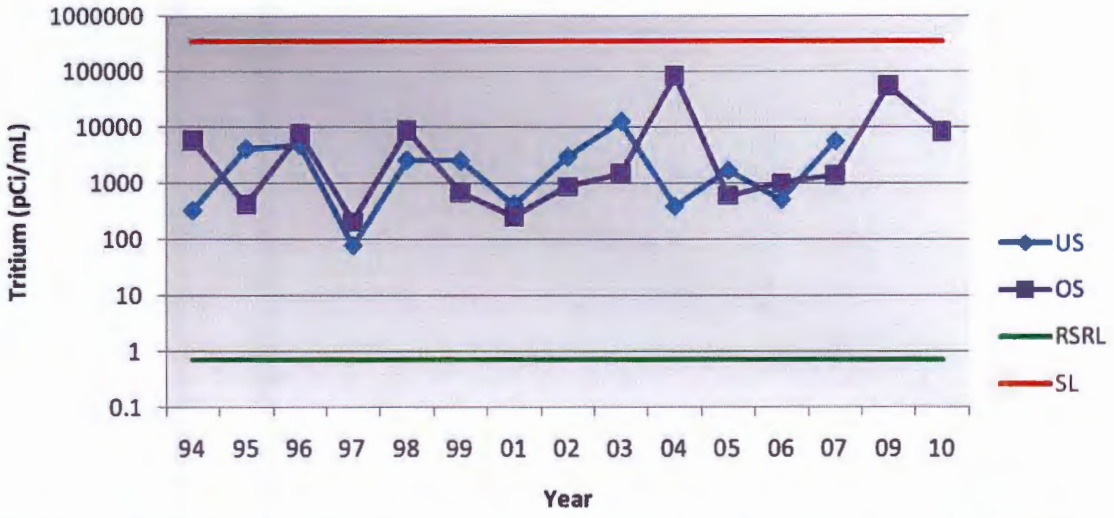

Figure 8-7 **Tritium in understory (US) and overstory (OS) vegetation collected from the south side of Area G at TA-54 from 1994 through 2010 compared with the regional statistical reference level (RSRL) and the screening level (SL). Note the logarithmic scale on the vertical axis.**

One other radionuclide that was detected above the RSRL in trees around Area G was plutonium-239/240; this sample was collected on the northwestern side of Area G (around site #58-01). These data, however, are far below the SL and do not pose an unacceptable dose to the tree.

b. Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility at TA-15

i. Monitoring Network

The Laboratory conducts facility-specific biota monitoring on an annual basis at the DARHT facility—the principal firing site at LANL—as required by the Mitigation Action Plan (MAP) resulting from the environmental impact statement for the construction and operation of the DARHT facility (DOE 1996). The history of operations at the site has included open air detonations from 2000–2006; detonations using foam mitigation from 2002–2006; and detonations within closed steel containment vessels starting in 2007 to present (three in fiscal year [FY] 2007, two in FY08, none in FY09, and four in FY10). Another factor that may influence the amount of potential contamination around the DARHT site (and cleanup) is that the firing point was paved with an asphalt surface in 2007.

The biota samples collected at DARHT include overstory vegetation (tree), field mice, bees, and birds (see Chapter 7, Figure 7-12, for sample locations). Vegetation, field mice, and bee samples are collected for chemical analysis, whereas birds are mostly collected (and released) for population, composition, and diversity estimates. Sometimes, however, birds are inadvertently caught on the field mice traps and, in these cases, the birds are used for contaminant analysis.

Overstory samples (branches plus needles) were collected on the north, south, west, and east sides of the DARHT perimeter and analyzed for radionuclides and TAL elements; small mammals, mostly deer mice (*Peromyscus* spp), were collected on the north and northeast side of the DARHT perimeter and analyzed for radionuclides and dioxin/furans; bee samples were collected from three hives located on the northeast side of the DARHT perimeter and analyzed for TAL elements; and bird samples were collected using 12 mist capture net traps spaced about 200 ft to 1600 ft outward from the west side of the DARHT facility. (Spacing of the nets was about 150 ft from one another.)

Vegetation, field mice, and bee samples were submitted to ALS where they were processed and analyzed for tritium, plutonium-238, plutonium-239/240, strontium-90, americium-241, cesium-137, uranium-234, uranium-235, uranium-238, and/or TAL elements. Results for tritium are reported on a pCi/mL basis; results for the other radionuclides are reported on a pCi/g ash weight basis; results for the TAL elements in vegetation are reported on an mg/kg dry weight basis; and results for the TAL elements in field mice and bees are reported on an mg/kg wet weight basis. Two field mouse samples were submitted to Cape Fear Analytical Laboratory and analyzed for dioxin/furans; results for dioxin/furans are reported on a pg/g (parts per trillion) wet weight basis.

Results of most of the biota chemical analysis were compared with BSRLs as per the MAP (DOE 1996). BSRLs are the upper-limit baseline data established over a four-year period (1996–1999) before the start-up of DARHT operations in 2000 (Nyhan et al., 2001). The BSRLs, at the three sigma level, are based on summaries provided by Fresquez et al. (2001) for vegetation, Haarmann (2001) for bees, and Bennett et al. (2001) for small mammals. Similarly, the population, composition, and diversity of birds collected from DARHT were compared with bird samples collected before the operation of the DARHT facility (Fresquez et al., 2007a). In cases where there are no BSRLs, then a comparison with RSRLs will be made.

ii. Vegetation at DARHT

All radionuclide concentrations analyzed for, including uranium-238, in overstory vegetation collected from around the perimeter of the DARHT facility were either not detected or detected below the BSRLs (or RSRLs when BSRL data were not available) (Table S8-14). In the past, uranium-238 was the only radionuclide most of the time to be detected in overstory vegetation around the DARHT facility (probably as a result of foliar deposition more than by root uptake), but since 2007 the concentrations have generally decreased from all sides of the DARHT perimeter. This general decrease in uranium-238 concentrations to BSRLs was probably due to the change in contaminant mitigation procedures from open and/or foam mitigation (2000–2006) to closed steel containment (vessel) mitigation starting in 2007 (Figure 8-8).

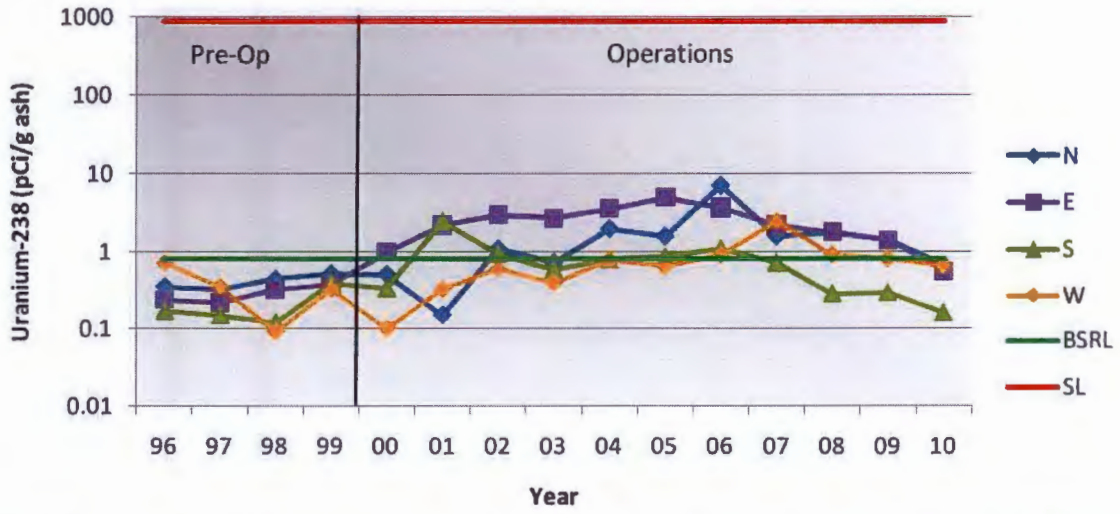

Figure 8-8 **Uranium-238 in overstory vegetation collected from the north (N), east (E), south (S), and west (W) sides of the DARHT facility at TA-15 from 1996–1999 (pre-operations) through 2000–2010 (during operations) compared with the baseline statistical reference level (BSRL) and the screening level (SL). Note the logarithmic scale on the vertical axis.**

The TAL element results, including metals like beryllium, in overstory vegetation collected from around the DARHT facility are summarized in Table S8-15. All of the metals were either not detected or below the BSRLs (or below the RSRLs).

iii. Small Mammals at DARHT

Most radionuclides analyzed for were either not detected or below the BSRLs in a composite field mouse sample (five mice per sample) collected from the north and northeast side of the DARHT facility (Table S8-16). Uranium-234, uranium-235, and uranium-238 concentrations were just slightly above their respective BSRLs, but the amounts were orders of magnitude below the SL.

The isotopic distribution of uranium-234 to uranium-238 in the field mouse sample collected from the north-northeast side of DARHT indicates the type of uranium is depleted uranium.

Using uranium-238 concentrations to model trends over time, the amounts, as seen with vegetation, exhibit an increase until the year 2007 and then decrease thereafter to the BSRL; this is concurrent with the change in detonation mitigation practices from open and/or foam-mitigated detonations during the 2000–2006 period to closed vessel containment starting in 2007 (Figure 8-9).

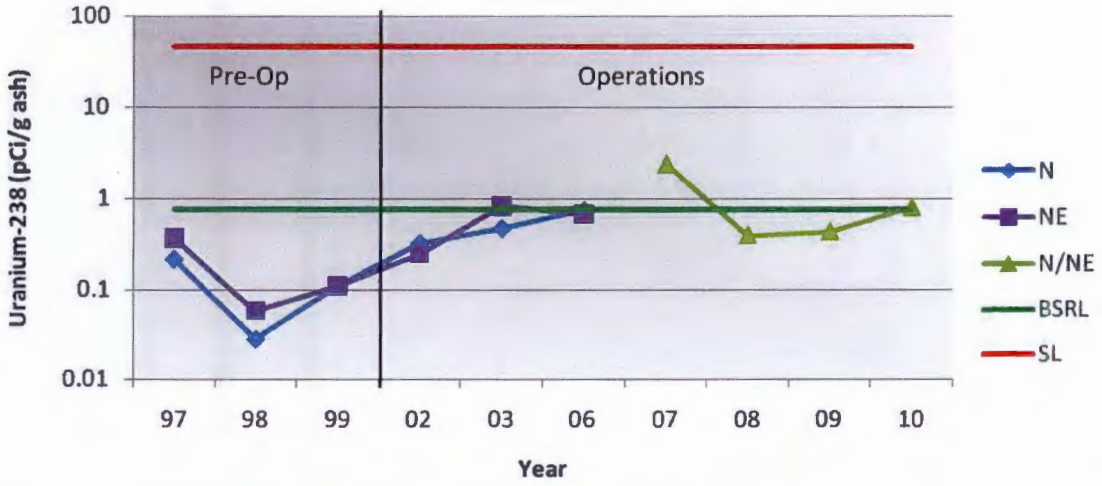

Figure 8-9 **Uranium-238 concentrations in (whole body) mice (n = 5) collected from the north (N) and northeast (NE) sides of the DARHT facility at TA-15 from 1997–1999 (pre-operations) through 2002–2010 (during operations) compared with the baseline statistical reference level (BSRL) and the screening level (SL). Note the logarithmic scale on the vertical axis.**

No TAL element analysis was conducted on the field mice in 2010. However, based on previous years, all TAL elements in field mice collected from the perimeter of the north and northeast sides of the DARHT facility were either not detected, were similar to RSRLs, or below ESLs. No trends were evident.

No detectable amounts of dioxin or furan chemicals in field mice samples were found that were above the limit of quantification (e.g., reporting limit); only trace amounts (greater than the minimum detectable level but less than the reporting limit) of hepta- and octachlorodibenzodioxins were estimated in one of the two field mice samples (Table S8-17). These data correlate well with the soil data reported in Table S7-7; no amounts of dioxin or furans were detected above the reporting level. (Note: No regional background data for dioxin and furans in field mice were collected prior to this year's report; however, background field mice were collected in March of 2011 for dioxin/furan analysis, and results will be reported next year.)

iv. Bees at DARHT

Radionuclide concentrations in bees from hives located on the northeastern perimeter of the DARHT facility were not analyzed this year; but based on previous years, no significantly higher amounts of radionuclide concentrations in bees from DARHT have been observed compared with BSRLs. In fact, the most prevalent radionuclide at DARHT, uranium-238, basically mimics the trends shown with other matrices, in that uranium-238 after an initial rise in 2005/2006 decreases to the BSRL (Figure 8-10). Again, this decrease may have been a result of the change in detonation mitigation practices from open and/or foam-mitigated detonations during the 2000–2006 periods to closed vessel containment starting in 2007.

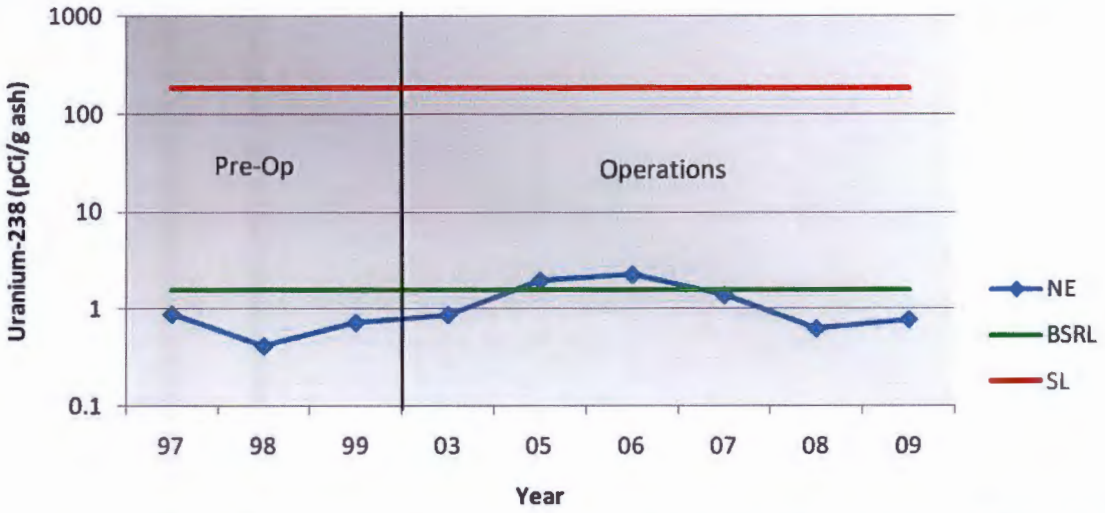

Figure 8-10 **Uranium-238 concentrations in bees collected from the northeast (NE) side of the DARHT facility at TA-15 from 1997–1999 (pre-operations) through 2003–2010 (during operations) compared with the baseline statistical reference level (BSRL) and the screening level (SL). Note the logarithmic scale on the vertical axis.**

Because we did not have a strong database for TAL elements from regional background sites to compare with DARHT bees, resources were diverted to analyze bees for metals from both sites in 2010. Most of the TAL elements in bee samples collected from hives northeast of the DARHT facility were similar to RSRLs (Table S8-18). The few TAL elements in bees that were higher than the RSRLs included aluminum, copper, vanadium, and lead. There are no ESLs listed for these elements in soil for bees, but the highest levels of these elements in soil around the grounds at DARHT (Table S7-5) are far below ESLs for other indicator biota receptors.

v. Birds at DARHT

Populations, composition, and the diversity of birds collected just west of the DARHT facility in 2010 compared with samples collected in 1999 (preoperational phase) are presented in Table S8-19. The purpose of the bird monitoring project is to determine the general ecological stress levels around the vicinity of DARHT that may be associated with facility operations (e.g., noise, disturbance, traffic, etc.). The number of birds, number of bird species, diversity, and evenness (distribution) collected in 2010 are similar to those collected before the start-up of operations at DARHT in 1999 (Figure 8-11); in general, there are a large number of birds and types of birds located in the vicinity of the DARHT complex. The most common bird species collected regardless of time periods were the chipping sparrow (*Spizella passerina*), Virginia's warbler (*Vermivora virginiae*), western tanager (*Piranga ludoviciana*), western bluebird (*Sialia mexicana*), and the broad-tailed hummingbird (*Selasphorus platycercus*).

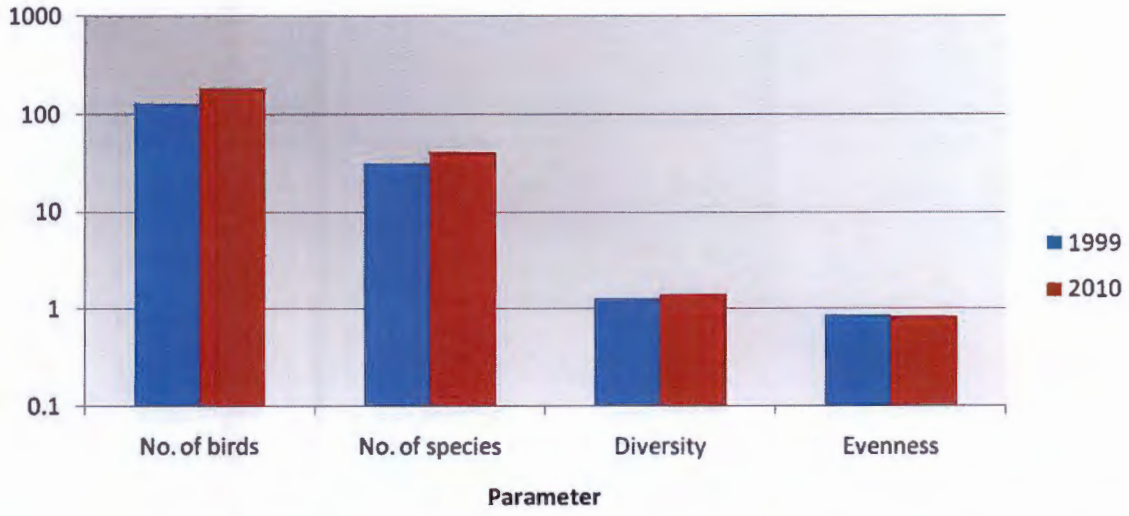

Figure 8-11 **Populations, number of species, diversity, and evenness of birds occurring before (1999) and during (2010) operations at DARHT. Note the logarithmic scale on the vertical axis.**

C. SPECIAL MONITORING STUDIES

In general, special studies are conducted when there is a lack of data concerning a contaminant that has the potential to impact human health and/or the environment. The following special studies were conducted in 2010 in support of Mitigation Action Plans and the Environmental Surveillance Program.

1. Radionuclide and Chemical Concentrations in Biota Collected from Water/Silt Retention Areas: Los Alamos Canyon Weir and the Pajarito Flood Control Retention Structure

In May 2000, a prescribed burn at Bandelier National Monument went out of control and burned nearly 43,000 acres of federal and pueblo land, including approximately 7,500 acres on LANL property. Because the Cerro Grande Fire burned substantial amounts of vegetative cover, the Laboratory became concerned about increased sediment (and potential contaminant) transport from LANL to off-site locations. As a preventive measure, the US Army Corps of Engineers constructed two large erosion control structures to control storm water and sediment runoff from burned areas. These structures consist of (1) a low-head, rock-filled gabion weir that lies across the streambed in Los Alamos Canyon near the junction of State Road 4 and State Road 502 and (2) a large cement flood retention structure located downstream of the confluence of Two-Mile and Pajarito canyons.

As part of the Special Environmental Analysis of actions taken in response to the Cerro Grande Fire at LANL (DOE 2000), the DOE identified various mitigation measures that must be implemented under the MAP as an extension of the fire suppression, erosion, and flood control actions. One of the tasks identified in the Plan Section 2.1.7, "Mitigation Action for Soil, Surface and Ground Water, and Biota," mandates the monitoring of soil, surface water, groundwater, and biota at areas of silt or water retention upstream (upgradient) of flood control structures, within silt retention basins, and within sediment traps to determine if there has been an increase in contaminant concentrations in these areas and to determine to what extent they impact the biota.

To this end, we collect native understory vegetation (grasses and forbs) and field mice (mostly deer mice, *Peromyscus* spp) in the areas upgradient of the Los Alamos Canyon Weir (LACW) and the Pajarito Canyon Flood Retention Structure (PCFRS). Native plants are monitored because they are the primary food source of biota, and field mice are monitored because they have the smallest home range of the mammals.

ALS analyzed the field mice (whole body) samples for radionuclides and TAL elements. PCBs (congeners, homologs, and totals) in whole body field mice were analyzed by Cape Fear Analytical Laboratory. The following two sections report the 2010 results of this monitoring.

a. Los Alamos Canyon Weir

The LACW structure was installed in 2001 and was partially excavated of sediments for the first time in 2009. The accumulated sediment was placed along the north slope of the LACW basin.

The concentrations of radionuclides and TAL elements in a composite understory vegetation sample that was collected on the upgradient side of the LACW can be found in Tables S8-20 and S8-21, respectively. As in previous years, radionuclides such as strontium-90, plutonium-238, plutonium-239/240, and americium-241 in vegetation growing behind the LACW were in higher concentrations than the RSRLs. With the exception of strontium-90, the actinides are not usually taken up very readily by plants, so the higher amounts of these radionuclides on vegetation on the upgradient side of the LACW may be due to either wind deposition or rain splash from the old or newly accumulating sediment. In either case, the concentrations of these particular radionuclides, including strontium-90, are still very far below the SLs and generally not increasing over the five-year time period (Figure 8-12). All TAL elements in understory vegetation were below the RSRLs.

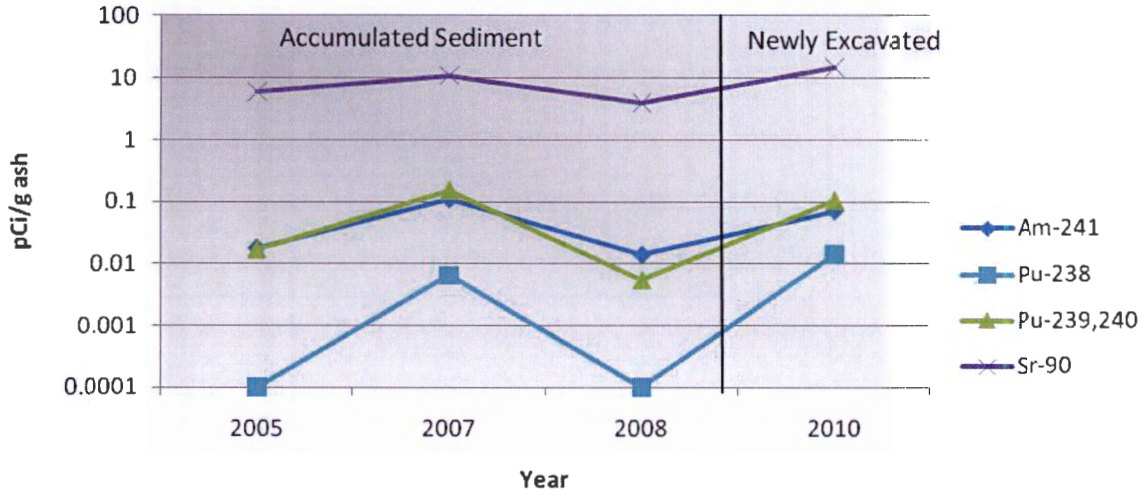

Figure 8-12 **Americium-241, plutonium-238, plutonium-239/240, and strontium-90 concentrations in understory vegetation collected on the upgradient side of the Los Alamos Canyon Weir from 2005 through 2010. Note the logarithmic scale on the vertical axis.**

Most concentrations of radionuclides analyzed for in a composite field mouse sample (n = 5) collected on the upgradient side of the LACW were either not detected or below the RSRLs (Table S8-22). The only radionuclides that were detected in higher concentrations than the RSRLs were americium-241 and plutonium-239/240. These data, particularly the americium-241 and plutonium-239/240 data, correlate well with the understory vegetation data and are basically similar to earlier results (regardless of excavation activities); all concentrations, however, are still far below the SLs (Figure 8-13).

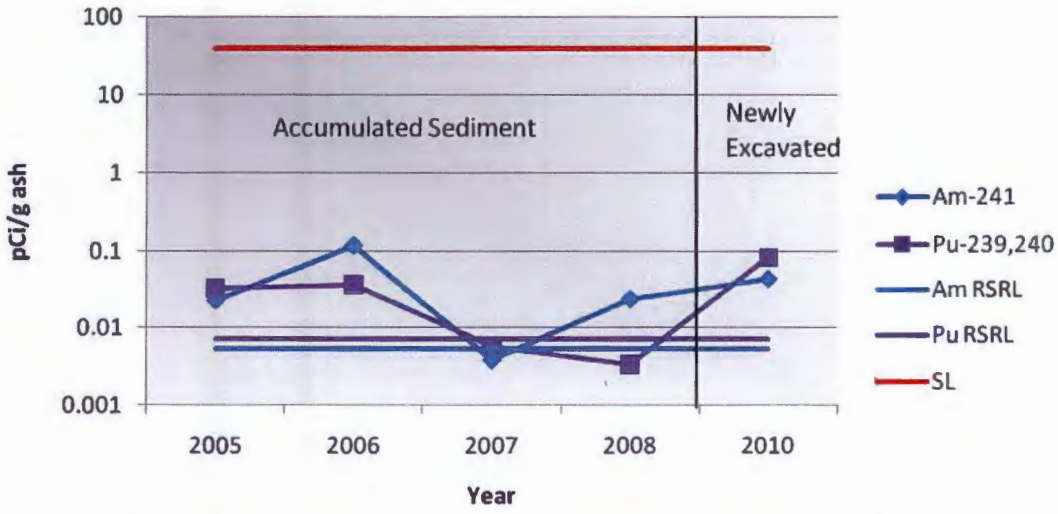

Figure 8-13 **Americium-241 and plutonium-239/240 concentrations in whole body field mice samples collected on the upgradient side of the Los Alamos Canyon Weir from 2005 through 2010. Note the logarithmic scale on the vertical axis.**

Results of the TAL elements in whole body field mice can be found in Table S8-23. Most TAL elements in field mice (n = 3) collected on the upgradient side of the LACW were lower than the RSRLs. The TAL elements in field mice collected from the upgradient side that were higher than the RSRLs were few (calcium, lead, and thallium) and not consistent within replications; in fact, the mean concentrations of these TAL elements were statistically similar ($p > 0.05$) to TAL elements in field mice collected from regional background locations (n = 9) (Fresquez 2009).

All concentrations of total PCBs in field mice (n = 3) collected from the upgradient side of the LACW were higher than the RSRL by one and two orders of magnitude (Table S8-24). Though there are no direct SLs for total PCBs in tissues, ESLs for PCBs in animals are derived from soil concentration levels from the study site. Based on the highest total PCB concentrations in surface sediments within the LACW in 2010 (0.11 mg/kg) (Reneau 2011), the level was below the ESL for field (deer) mice of 20 mg/kg for Aroclor 1260 (LANL 2010) and is not expected to significantly impact the field mice population.

The mean total PCBs in field mice collected around the LACW over a four-year period show that the levels are relatively similar in three of the four years and significantly decrease with distance from the LACW (Figure 8-14). Although the amounts of PCBs in field mice collected approximately 4.5 miles down gradient from the LACW were an order of magnitude lower than in field mice collected from areas around the LACW, the levels were still statistically higher ($p < 0.05$) than in field mice collected from regional background locations.

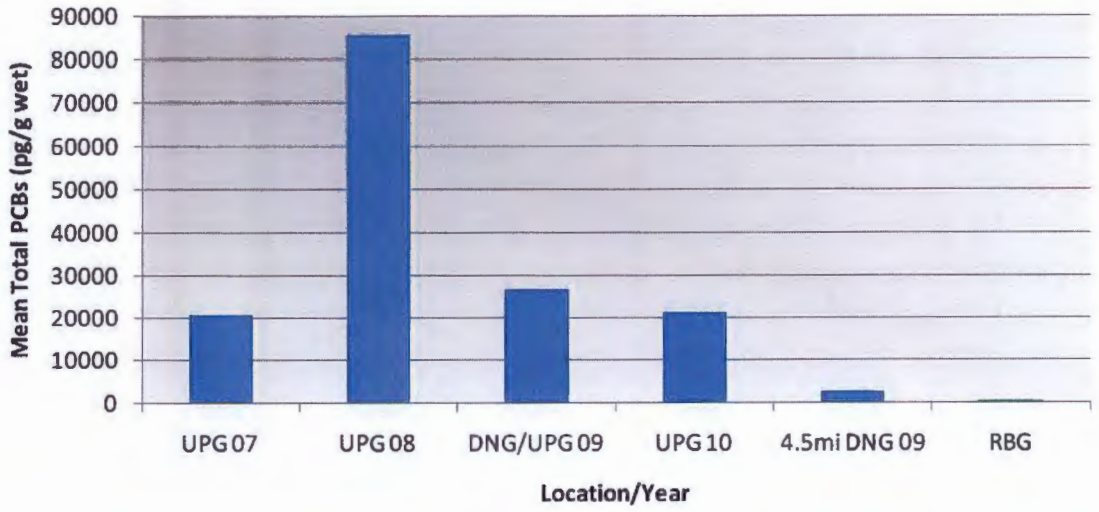

Figure 8-14 **Mean total PCB concentrations in whole body field mice collected on the upgradient (UPG) and down gradient (DNG) side from 2007 through 2010 of the Los Alamos Canyon Weir compared to the mean total regional background (RBG).**

A comparison of the mean PCB homolog distribution of field mice collected around the LACW from 2007 to 2010 shows that the patterns are mostly within the Aroclor 1260 profile formulation (Figure 8-15). Aroclor 1260 has been the most consistently detected PCB formulation in sediment collected upgradient of the LACW (Fresquez et al., 2007b; Reneau and Koch 2008).

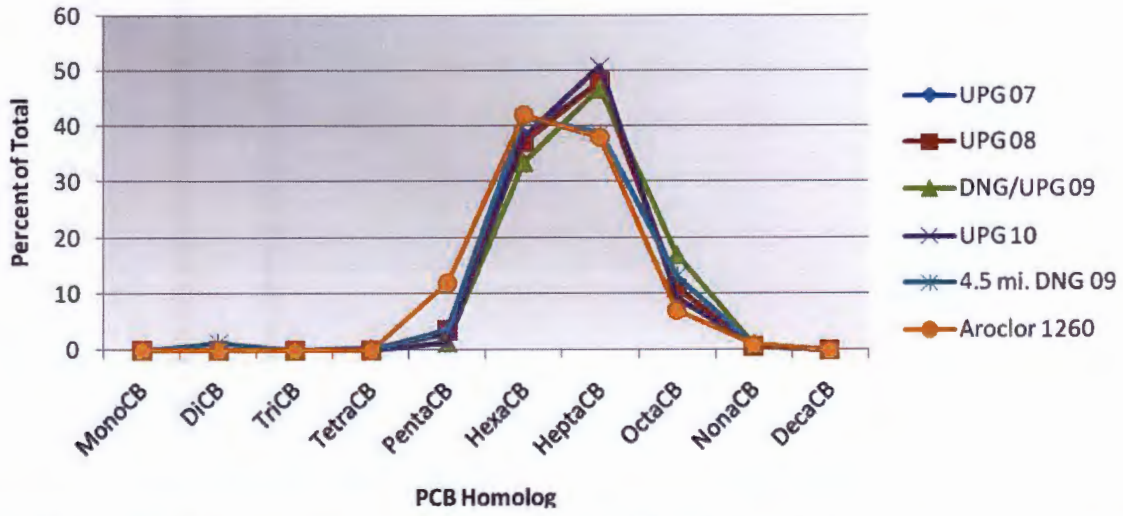

Figure 8-15 **Mean PCB homolog distribution for whole body field mice samples collected on the upgradient (UPG) and down gradient (DNG) side from 2007 through 2010 of the Los Alamos Canyon Weir compared with Aroclor 1260.**

b. Pajarito Canyon Flood Retention Structure

Concentrations of radionuclides, TAL elements, and PCBs in native understory vegetation (grasses and forbs) and field mice samples collected from within the silt retention area (upgradient side) of the PCFRS in 2010 are presented in Tables S8-25 through S8-29.

All of the radionuclides and most of the TAL elements analyzed for in a composite native understory sample collected on the upgradient side of the PCFRS were either not detected or were below the RSRLs (Table S8-25 and S8-26). The only TAL element in vegetation upgradient of the PCFRS that was higher than the

RSRL was antimony (4.2 mg/kg); but the levels were far below toxicity reference values (> 50 mg/kg to impact plant growth) (Gough et al., 1979). As a matter of record, the amounts of antimony in vegetation from the upgradient side of the PCFRS in past years ranged from undetected to 0.53 mg/kg; so the current concentration is unusually high, but will be watched.

All of the radionuclides in a composite field mouse sample (n = 5 subsamples) collected from the upgradient side of the PCFRS were similar to RSRLs (Table S8-27). Similarly, the only TAL element that was consistently higher along replications than the RSRL was barium—and as a group the mean was statistically higher ($p < 0.05$) in field mice from the PCFRS (n = 3) compared with background (n = 9) (Table S8-28). The levels of barium in tissue, however, were just slightly higher than the RSRL, and the highest soil concentration of barium encountered within the PCFRS basin (120 mg/kg) (Fresquez et al., 2008) was far below the ESLs for field mice (> 1800 mg/kg) (LANL 2010), and, thus, barium is not expected to be a significant concern.

There were virtually no PCBs detected in field mice (n = 3) from the upgradient side of the PCFRS in 2010 (Table S8-29); individual samples were all below the RSRL. And as a group, the mean total PCB level was statistically lower ($p < 0.05$) than in mice collected from regional background locations (n = 8). These data are far below the levels reported in past years (Figure 8-16).

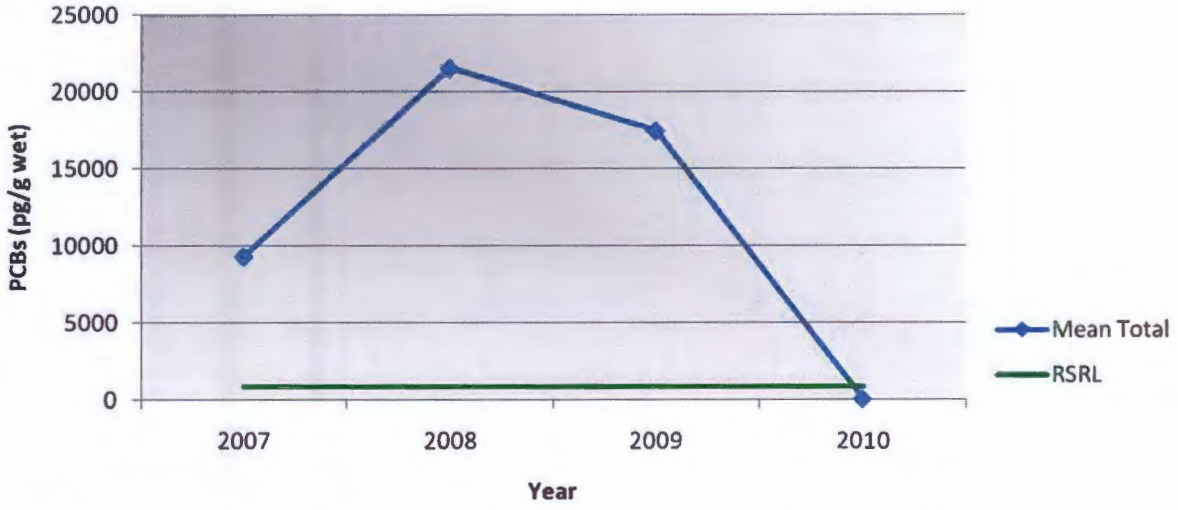

Figure 8-16 **Mean total PCB concentrations in whole body field mice samples collected on the upgradient side of the Pajarito Canyon Flood Retention Structure from 2007 through 2010 compared with the regional statistical reference level (green line).**

The mean PCB homolog distribution of field mice collected from the PCFRS throughout the years from 2007 to 2010 generally overlaps the distribution pattern of Aroclor 1260 (Figure 8-17). Trace amounts of Aroclor 1254 and Aroclor 1260 have been detected in sediment collected upgradient (Fresquez et al., 2009; Reneau and Koch 2008) and down gradient of the PCFRS in past years (LANL 2008).

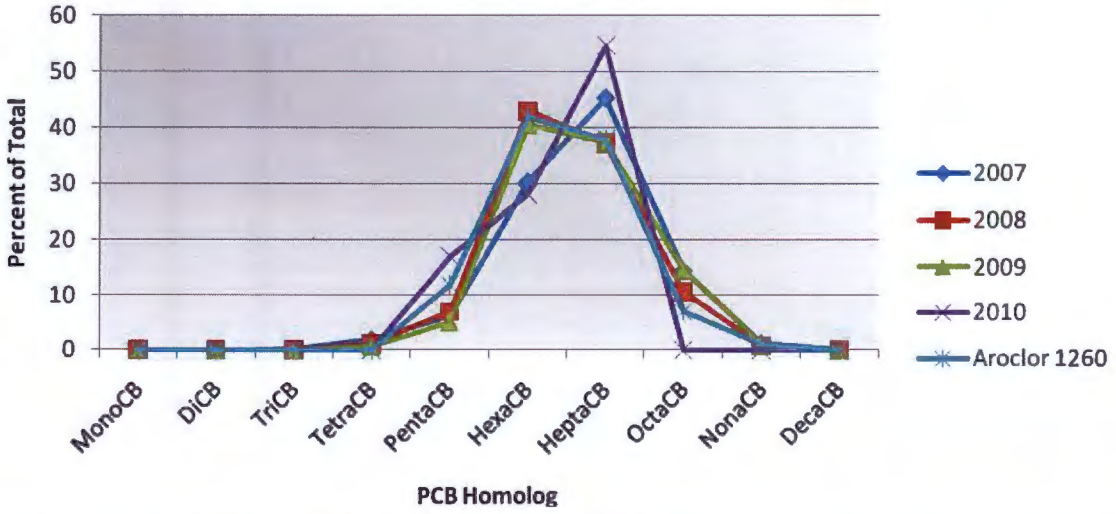

Figure 8-17 **Mean PCB homolog distribution of whole body field mice samples collected on the upgradient side of the Pajarito Canyon Flood Retention Structure from 2007 through and 2010 compared with Aroclor 1260.**

D. QUALITY ASSURANCE FOR THE SOIL, FOODSTUFFS AND BIOTA PROGRAM

This program uses the same quality assurance (QA) protocols described in Chapter 7 (QA program development, field sampling QA, analytical laboratory quality assessment, field data, analytical, and analytical laboratory quality assessment, and program audits) and also some of the same Standard Operating Procedures (SOPs) and analytical laboratories, plus the following SOPs:

- Produce sampling
- Fish sampling
- Game animal sampling
- Collection of crawfish in the Rio Grande
- Collection of macroinvertebrates in the Rio Grande
- Processing biota samples for analysis

These procedures, which are available on the LANL public website (http://www.lanl.gov/environment/all/qa.shtml), ensure that the collection, processing, and chemical analysis of samples, the validation and verification of data, and the tabulation of analytical results are conducted in a manner consistent from year to year. Locations and samples have unique identifiers to provide chain-of-custody control from the time of collection through analysis and reporting.

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A. INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is characterizing and remediating, as necessary, sites to ensure that past operations do not threaten human health or the environment. Corrective actions at the Laboratory are subject to the requirements of a Compliance Order on Consent (the Consent Order). The Environmental Programs (EP) Directorate is leading the site investigations with the objectives of (1) determining the nature (the origin, type, and amount of chemicals, either natural or man-made, that are present in the environment) and extent (the way a chemical is distributed in the environment) of contamination, and (2) identifying, evaluating, and implementing, where needed, remediation or other corrective measures to remove or mitigate the presence and/or migration of contaminants.

An investigation involves the collection and evaluation of data and information about the sites. The sites under investigation are designated as consolidated units, solid waste management units (SWMUs), or areas of concern (AOCs). Each investigation collects samples of the environmental medium of interest and the data are utilized to support site decisions. Corrective actions are complete at a site when LANL has demonstrated to the regulatory authority's satisfaction that the nature and extent of contamination are defined and the site poses no unacceptable risk or dose to humans, plants, and animals. Long-term stewardship activities, including surveillance and monitoring, might be implemented where contamination remains in place to ensure that there are no changes in potential risk/dose and concentrations.

1. Programs

The Corrective Action Program investigates consolidated units, SWMUs, and AOCs intermixed with active Laboratory operations as well as sites located within the Los Alamos town site (property currently owned by private citizens, businesses, or Los Alamos County) and property administered by the U.S. Forest Service (USFS), the National Park Service, and the U.S. Department of Energy (DOE). The Corrective Action Program also includes the canyons investigations, the groundwater monitoring program (implemented through the annual Interim Facility-Wide Groundwater Monitoring Plan), storm water and surface water monitoring, and the implementation of best management practices to minimize erosion.

The Technical Area (TA-) 21 Closure Program involves all of the sites associated with TA-21 and includes Material Disposal Areas (MDAs) A, B, T, U, and V; various process waste lines; a radioactive waste treatment system; and the Delta Prime (DP) Site Aggregate Area sumps, outfalls, leach fields, historic container storage areas, and other former facilities. The Laboratory received additional funding for environmental cleanup projects as part of the American Recovery and Reinvestment Act, which includes the decontamination and demolition of most of the buildings at TA-21, removal and disposal of waste from MDA B, and the installation of groundwater monitoring wells.

The TA-54 Closure Program involves all of the sites associated with TA-54 and includes MDAs G, H, and L. Activities involve periodic monitoring of the groundwater and vadose zone as well as the development and implementation of corrective measures for the MDAs.

2. Work Plans and Reports

The EP Directorate programs developed and/or revised 22 work plans and 37 reports, which were submitted to the New Mexico Environment Department (NMED) during 2010. A work plan proposes investigation activities designed to characterize SWMUs, AOCs, consolidated units, aggregate areas, and/or canyons.

Samples are collected from approved locations and depths and analyzed for some or all of the following analytical suites/analytes: target analyte list metals, cyanide, perchlorate, nitrate, volatile organic compounds (VOCs), semivolatile organic compounds, polychlorinated biphenyls (PCBs), dioxins and furans, explosive compounds, total petroleum hydrocarbons, isotopic uranium, americium-241, isotopic plutonium, gamma-emitting radionuclides, strontium-90, and tritium. The data are presented in an investigation report, which presents and evaluates the sampling results, and recommends additional investigation, remediation, monitoring, or no further action, as appropriate.

Tables 9-1 and 9-2 summarize the work plans and reports submitted and approved in 2010, the work plans and reports submitted prior to 2010 but approved in 2010, and the work plans and reports submitted in 2010 but not yet approved. Table 9-3 summarizes other reports, plans, and documents submitted in 2010. NMED granted Certificates of Completion for 34 SWMUs and AOCs in 2010 (Table 9-4). The remainder of this chapter presents summaries of the investigations for which activities were started, continued, and/or completed in 2010 and those investigations for which reports were submitted in 2010. Figures 9-1 and 9-2 show the locations where significant environmental characterization and/or remediation work was performed in 2010.

Table 9-1
Work Plans Submitted and/or Approved in 2010

Document Title	Date Submitted	Date Approved[a]	Status
Work Plan for Supplemental Soil Vapor Extraction Pilot Test Implementation/Reporting at Material Disposal Area G, Technical Area 54, Revision 1	1/11/2010	1/29/2010	The supplemental soil vapor extraction pilot test was conducted and a report provided
Lower Mortandad/Cedro Canyons Aggregate Area Investigation Work Plan, Revision 1	1/13/2010	1/22/2010	Conduct investigations and submit report in 2011
Hydrologic Testing Work Plan for Consolidated Unit 16-021(c)-99	2/1/2010	5/20/2010	Submitted a tracer test work plan and schedule for proposed pumping test
Investigation Work Plan for Twomile Canyon Aggregate Area[b]	2/1/2010	n/a[c]	Revised
Historical Investigation Report for Twomile Canyon Aggregate Area	2/1/2010	n/a	n/a
Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50	2/5/2010	n/a	Revised
Work Plan to Plug and Abandon the Existing Deep-Extraction Borehole as Part of the Supplemental Soil-Vapor Extraction Pilot Test at Material Disposal Area G	4/1/2010	4/19/2010	Borehole plugged and abandoned according to standard operating procedures
Long-Term Monitoring and Maintenance Plan for the Corrective Measures Implementation at Consolidated Unit 16-021(c)-99	4/23/2010	—[d]	Pending review by NMED in 2011
Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1	4/28/2010	5/11/2010	One groundwater well and three vapor wells installed
Sampling and Analysis Plan for Post-Remediation Borehole Drilling at Material Disposal Area B, Solid Waste Management Unit 21-015, Technical Area 21	4/28/2010	—	Pending review by NMED in 2011
Delta Prime East Building Footprints Letter Work Plan for Delta Prime Site Aggregate Area	5/11/2010	n/a	Revised
Investigation Work Plan for Twomile Canyon Aggregate Area, Revision 1	5/12/2010	6/3/2010	Investigation planned to be implemented in 2012
Delta Prime East Building Footprints Letter Work Plan for Delta Prime Site Aggregate Area, Revision 1	7/19/2010	7/26/2010	Investigation planned to be implemented in 2011
Investigation Work Plan for Lower Pajarito Canyon Aggregate Area	7/28/2010	n/a	Revised

Table 9-1 (continued)

Document Title	Date Submitted	Date Approved[a]	Status
Historical Investigation Report for Lower Pajarito Canyon Aggregate Area	7/28/2010	n/a	n/a
Phase II Investigation Work Plan for Sandia Canyon	7/30/2010	1/4/2011	Investigation planned to be implemented in 2011–2012
Investigation Work Plan for Upper Water Canyon Aggregate Area	8/31/2010	n/a	Revised
Historical Investigation Report for Upper Water Canyon Aggregate Area	8/31/2010	n/a	n/a
Investigation Work Plan for Starmer/Upper Pajarito Canyon Aggregate Area	9/30/2010	n/a	Revised in 2011
Historical Investigation Report for Starmer/Upper Pajarito Canyon Aggregate Area	9/30/2010	n/a	n/a
Historical Investigation Report for Frijoles Canyon Aggregate Area	10/12/2010	12/6/2010	No investigation required
Phase II Investigation Work Plan for Upper Los Alamos Canyon Aggregate Area	10/21/2010	—	Pending review by NMED in 2011
Investigation Work Plan for Chaquehui Canyon Aggregate Area, Revision 1	10/29/2010	—	Revised in 2011
Investigation Work Plan for Lower Pajarito Canyon Aggregate Area, Revision 1	11/19/2010	12/8/2010	Investigation planned to be implemented in 2011–2012
Phase II Investigation Work Plan for Upper Mortandad Canyon Aggregate Area	12/3/2010	—	Pending review by NMED in 2011
Phase II Investigation Work Plan for North Ancho Canyon Aggregate Area[b]	12/10/2010	—	Pending review by NMED in 2011
Work Plan for Determining Background Concentrations of Inorganic Chemicals in Bandelier Tuff Unit 4	12/15/2010	1/12/2011	Investigation planned to be implemented in 2011

[a] Work plans typically approved with modifications or directions.
[b] A stipulated penalty document for 2010 under the Consent Order.
[c] n/a = Not applicable.
[d] — = Approval not received or required.

Table 9-2
Reports Submitted and/or Approved in 2010

Document Title	Date Submitted	Date Approved[a]	Status
Supplemental Investigation Report for Consolidated Units 16-007(a)-99 and 16-008(a)-99	1/7/2010	2/16/2010	Conduct inspections of erosion controls in drainages and periodic collection of sediment samples from pond; monitor groundwater for two quarters
Investigation Report for North Ancho Canyon Aggregate Area, Revision 1	1/18/2010	1/28/2010	Phase II work plan submitted
Report for the Self-Implementation of On-Site Cleanup and Disposal of Polychlorinated Biphenyl Remediation for Consolidated Unit 21-003-99 and Solid Waste Management Unit 21-024(c)	1/29/2010	n/a[b]	Phase III work plan to be submitted
Investigation Report for Upper Los Alamos Canyon Aggregate Area, Revision 1	2/2/2010	4/21/2010	Phase II work plan submitted
Summary Report for the Corrective Measures Implementation at Consolidated Unit 16-021(c)-99[c]	3/1/2010	—[d]	Pending review by NMED in 2011

Table 9-2 (continued)

Document Title	Date Submitted	Date Approved[a]	Status
Results of Sediment Monitoring in the Pajarito Canyon Watershed	3/17/2010	6/3/2010	Monitoring of sediment continues
Phase II Investigation Report for Delta Prime Site Aggregate Area[c]	3/31/2010	n/a	Revised
Investigation Report for Upper Mortandad Canyon Aggregate Area, Revision 1	4/15/2010	6/4/2010	Phase II work plan submitted
Interim Measure Report for Solid Waste Management Unit 01-001(f) and Los Alamos Site Monitoring Area 2[c]	5/3/2010	—	Pending review by NMED in 2011
Investigation Report for Sites at Technical Area 49 Outside of the Nuclear Environmental Site Boundary[c]	5/18/2010	n/a	Revised
Investigation Report for Material Disposal Area B, Areas 9 and 10, Solid Waste Management Unit 21-015, Technical Area 21	5/26/2010	—	Pending review by NMED in 2011
Investigation Report for Sites at Technical Area 49 Inside of the Nuclear Environmental Site Boundary[c]	5/27/2010	n/a	Revised
Investigation Report for Upper Sandia Canyon Aggregate Area	6/1/2010	n/a	Revised
Soil Vapor Extraction Pilot Test Implementation/Reporting at Material Disposal Area G, Technical Area 54 (Summary Report)	6/1/2010	—	n/a
Completion Report for Pueblo Canyon Grade Control Structure[c]	6/3/2010	11/5/2010	Monitoring continues
Completion Report for Gage Stations E039.1 and E060.1[c]	6/3/2010	11/5/2010	Monitoring continues
Completion Report for DP Canyon Grade Control Structure[c]	6/3/2010	11/5/2010	Monitoring continues
Investigation Report for Threemile Canyon Aggregate Area	6/30/2010	n/a	Revised
Voluntary Corrective Action Completion Report for the Investigation and Remediation of Solid Waste Management Units 33-002(a-c) at Technical Area 33	7/30/2010	—	Revised
Addendum to the Summary Report for the Corrective Measures Implementation at Consolidated Unit 16-021(c)-99	8/30/2010	—	Pending review by NMED in 2011
Investigation Report for S-Site Aggregate Area	8/31/2010	n/a	Revised in 2011
Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed	8/31/2010	n/a	Revised
Investigation Report for Sites at Technical Area 49 Outside of the Nuclear Environmental Site Boundary, Revision 1	9/13/2010	11/12/2010	Phase II work plan to be submitted
Investigation Report for Sites at Technical Area 49 Inside of the Nuclear Environmental Site Boundary, Revision 1	9/14/2010	11/12/2010	Phase II work plan to be submitted
Supplemental Interim Measure Report for Solid Waste Management Unit 01-001(f)	9/29/2010	—	Pending review by NMED in 2011
Phase II Investigation Report for Delta Prime Site Aggregate Area, Revision 1	9/30/2010	—	Phase III work plan to be submitted
Phase II Investigation Report for Pueblo Canyon Aggregate Area[c]	9/30/2010	12/23/2010	Additional assessments planned to be completed in 2011
Corrective Measures Evaluation Report for Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Revision 1[c]	9/30/2010	—	Revised in 2011
Investigation Report for Upper Sandia Canyon Aggregate Area, Revision 1	10/1/2010	11/12/2010	Phase II work plan to be submitted
Remedy Completion Report for Upper Los Alamos Canyon Aggregate Area, Former Technical Area 32[c]	10/29/2010	—	Revised in 2011
Voluntary Corrective Action Completion Report for the Investigation and Remediation of Solid Waste Management Units 33-002(a-c) at Technical Area 33, Revision 1	10/29/2010	—	Revised in 2011
Interim Assessment to Report Storm Damage to Sediment Control Structures and Monitoring Stations in Los Alamos and Pueblo Canyons	10/29/2010	—	Pending review by NMED in 2011
Investigation Report for Threemile Canyon Aggregate Area, Revision 1	11/3/2010	12/8/2010	Phase II work plan to be submitted

Table 9-2 (continued)

Document Title	Date Submitted	Date Approved[a]	Status
Nest Box Monitoring Report for the Upper Pajarito Canyon Watershed, Revision 1	11/8/2010	1/14/2010	Additional monitoring required
Investigation Report for Upper Cañada del Buey Aggregate Area[c]	11/19/2010	—	Pending review by NMED in 2011
Corrective Measures Evaluation Report for Material Disposal Area G, Solid Waste Management Unit 54-013(b)-99, at Technical Area 54, Revision 2	11/30/2010	—	Pending review by NMED in 2011
Investigation Report for Potrillo and Fence Canyons	12/21/2010	—	Revised in 2011
Corrective Measures Evaluation Report for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54[c]	12/21/2010	—	Pending review by NMED in 2011

[a] Work plans typically approved with modifications or directions.
[b] n/a = Not applicable.
[c] A stipulated penalty document for 2010 under the Consent Order.
[d] — = Approval not received or required.

Table 9-3
Additional Plans and Reports Submitted in 2010

Document Title	Date Submitted
Periodic Monitoring Reports	
Pajarito Watershed	2/26/2010
White Rock Watershed	2/26/2010
Mortandad Watershed	2/26/2010
Sandia Watershed	2/26/2010
Water Canyon/Cañon de Valle Watershed	2/26/2010
Ancho Watershed	2/26/2010
Mortandad Watershed	5/25/2010
Sandia Watershed	5/25/2010
Los Alamos Watershed	5/25/2010
Pajarito Watershed	5/25/2010
Mortandad Watershed	8/19/2010
Sandia Watershed	8/19/2010
Pajarito Watershed	8/19/2010
Water Canyon/Cañon de Valle Watershed	8/19/2010
White Rock Watershed	8/19/2010
Ancho Watershed	8/19/2010
Mortandad Watershed	11/29/2010
Sandia Watershed	11/29/2010
Pajarito Watershed	11/29/2010
Groundwater Data Reviews	Monthly
Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54	Quarterly
Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54	Quarterly
Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21*	Quarterly

Table 9-3 (continued)

Document Title	Date Submitted
Periodic Monitoring Report for Vapor Sampling Activities at Material Disposal Area V, Consolidated Unit 21-018(a)-99, at Technical Area 21	Quarterly
Well Work Plans and Reports	
Completion Report for Regional Well R-40, Revision 1	1/19/2010
Fact Sheets for CdV-37-1i	1/21/2010
Hydrologic Testing Work Plan for Consolidated Unit 16-021(c)-99	2/1/2010
Completion Report for Well R-48	2/23/2010
Completion Report for Intermediate Aquifer Well R-47i	4/15/2010
Work Plan to Conduct Reliability Assessment of Multi-Screened West Bay Wells	5/27/2010
Work Plan for Replacement Well R-25r and Proposed Disposition of Scheduled Well R-47	6/15/2010
Technical Area 21 Groundwater and Vadose-Zone Monitoring Well Network Evaluation and Recommendations	7/1/2010
Los Alamos National Laboratory Site-Wide Monitoring Program Drinking Water Results for the City of Santa Fe Buckman Water Supply Wells	7/28/2010
Work Plan for Alternate Monitoring at the Buckman Well Field	7/30/2010
Drilling Work Plan for Intermediate Well R-55i	8/13/2010
Completion Report for Regional Aquifer Well R-37, Revision 1	8/30/2010
Completion Report for Intermediate Aquifer Well PCI-2, Revision 1	9/10/2010
Work Plan for Well R-61	10/15/2010
Work Plan for Well R-62	10/29/2010
Work Plan for Plug and Abandon Wells and Boreholes at Los Alamos National Laboratory	10/29/2010
Drilling Work Plan for Regional Aquifer Well R-56	2/1/2010
Notice of Demolition, Los Alamos National Laboratory Delta Prime Site, Building 21-155	2/1/2010
Material Disposal Area B Direct-Push Sampling Data Maps	2/4/2010
R-54 Fact Sheets	3/1/2010
Drilling Work Plan for Regional Aquifer Well R-57	3/4/2010
R-51 Fact Sheets	3/10/2010
Completion Report for Intermediate Aquifer Well R-27i	3/15/2010
Summary Report for Plugging and Abandonment of Test Wells TW-2, TW-2A, TW-2B	3/15/2010
R-50 Fact Sheets	3/15/2010
Work Plan to Plug and Abandon Well TW-4	3/25/2010
Fact Sheet TW-2Ar	4/1/2010
Fact Sheet R-29	4/12/2010
Drilling Work Plan for Perched-Intermediate Well CdV-16-4ip	4/27/2010
Fact Sheet R-53	4/27/2010
Summary Report for Plugging and Abandonment of Test Well-1 and Test Well-1A	4/27/2010
Completion Report for Intermediate Well CdV-37-1i	4/29/2010
Drilling Work Plan for Regional Aquifer Well R-55	5/3/2010
Fact Sheets for R-30	5/3/2010
Fact Sheets for R-52	5/3/2010
Notice of Demolition, Los Alamos National Laboratory Delta Prime Site, Buildings 21-213, 21-2, 21-3, 21-314, 21-4, 21-315, 21-1167, 21-5, and Demolition Resumption, Building 21-312	5/20/2010
Drilling Work Plan for Regional Aquifer Well R-60	6/1/2010

Table 9-3 (continued)

Document Title	Date Submitted
Completion Report for Regional Aquifer Well R-54	6/25/2010
Fact Sheets for R-57	6/25/2010
Completion Report for Regional Aquifer Well R-51	7/8/2010
Notice of Demolition, Los Alamos National Laboratory Delta Prime Site, Buildings 21-152 and 21-150	7/8/2010
Notice of Demolition, Los Alamos National Laboratory Delta Prime Site, Buildings 21-149 and 21-150	7/13/2010
Completion Report for Regional Aquifer Well R-50	7/13/2010
Summary Report for Plugging and Abandonment of TW-4	7/13/2010
Fact Sheets for R-3	7/21/2010
Completion Report for Intermediate TW-2Ar	7/21/2010
Fact Sheet for R-56	8/4/2010
Completion Report for Regional Aquifer Well R-29	8/5/2010
Completion Report for Regional Aquifer Well R-53	8/25/2010
Completion Report for Regional Aquifer Well R-30	8/25/2010
Completion Report for Regional Aquifer Well R-52	9/2/2010
Fact Sheets for CdV-16-4ip	9/17/2010
Fact Sheets for R-55	9/20/2010
Fourth Quarter Report, Fiscal Year 2010, Cleanup Activities at Material Disposal Area B, Solid Waste Management Unit 21-015	9/27/2010
Notice of Demolition, Los Alamos National Laboratory Delta Prime Site, Buildings 21-31, 21-212, 21-355, and 21-357	9/29/2010
Drilling Work Plan for Regional Well R-59	9/30/2010
Completion Report for Well R-57	11/5/2010
Fact Sheets for R-60	11/12/2010
Completion Report for Well R-3	11/18/2010
Completion Report for Regional Well R-56	12/14/2010
Progress Report for Cleanup Activities at Material Disposal Area B, Solid Waste Management Unit 21-015, Technical Area 21, First Quarter of Fiscal Year 2011	12/17/2010
Miscellaneous Reports/Plans	
Documentation of Borehole 16-608154 Abandonment	2/26/2010
Status of Inflatable Packer Systems and Assessment of Cross Flow in Monitoring Wells at Los Alamos National Laboratory	2/26/2010
Results of 2009 Sediment Monitoring in the Pajarito Canyon Watershed (Annual Update)	3/17/2010
Demolition Documentation Report for the Bayo Canyon Wastewater Treatment Plant, AOC 00-018(b)	4/13/2010
Documentation of Completion of Cross-Vane Structure Corrective Maintenance Actions In Pueblo Canyon	5/17/2010
Completion Documentation for Stream Bank Stabilization in the South Fork of Acid Canyon	4/23/2010
Baseline Geomorphic Conditions at Sediment Transport Mitigation Sites in Los Alamos/Pueblo Canyons Watershed	6/1/2010
Annual Inspection of Erosion Controls in Drainages to the 90s Line Pond at Technical Area 16	11/19/2010
Erosion Controls Associated with Fishladder Canyon [Solid Waste Management Unit 16-003(o)]	12/6/2010
General Facility Information (Annual Update)	3/31/2010
Interim Facility-Wide Groundwater Monitoring Plan (Annual Update)	6/29/2010
Groundwater Background Investigation Report, Revision 4	8/31/2010
Corrective Measure Study Progress Reports [16-021(c)-99 the 260 Outfall]	Monthly

*Periodic monitoring report for October to December 2009 is a stipulated penalty document for 2010 under the Consent Order.

Table 9-4
SWMUs and AOCs Granted Certificates of Completion in 2010

Site	Corrective Action Complete with Controls	Corrective Action Complete without Controls	Date Approved
SWMU 39-001(b)		X	4/6/2010
AOC 39-002(c)		X	4/6/2010
AOC 39-002(d)		X	4/6/2010
AOC 39-002(e)		X	4/6/2010
AOC 39-002(f)		X	4/6/2010
SWMU 39-005		X	4/6/2010
AOC 39-007(d)		X	4/6/2010
AOC 03-041		X	9/7/2010
AOC 48-002(e)		X	9/7/2010
SWMU 48-007(a)	X		9/7/2010
SWMU 48-007(d)	X		9/7/2010
SWMU 48-010	X		9/7/2010
AOC 48-012	X		9/7/2010
AOC 00-031(a)		X	9/10/2010
AOC 00-034(b)		X	9/10/2010
SWMU 01-001(t)		X	9/10/2010
SWMU 01-001(u)		X	9/10/2010
SWMU 01-006(o)		X	9/10/2010
SWMU 01-007(d)		X	9/10/2010
SWMU 01-007(e)		X	9/10/2010
AOC 01-003(c)		X	9/10/2010
AOC 01-006(g)		X	9/10/2010
SWMU 03-009(j)		X	9/10/2010
SWMU 32-001		X	9/10/2010
SWMU 41-001		X	9/10/2010
SWMU 01-001(b)	X		9/10/2010
SWMU 01-001(c)	X		9/10/2010
SWMU 01-001(e)	X		9/10/2010
SWMU 01-003(e)	X		9/10/2010
SWMU 01-006(d)	X		9/10/2010
SWMU 01-007(j)	X		9/10/2010
AOC 01-007(k)	X		9/10/2010
AOC 03-008(a)	X		9/10/2010
AOC 43-001(b2)	X		9/10/2010

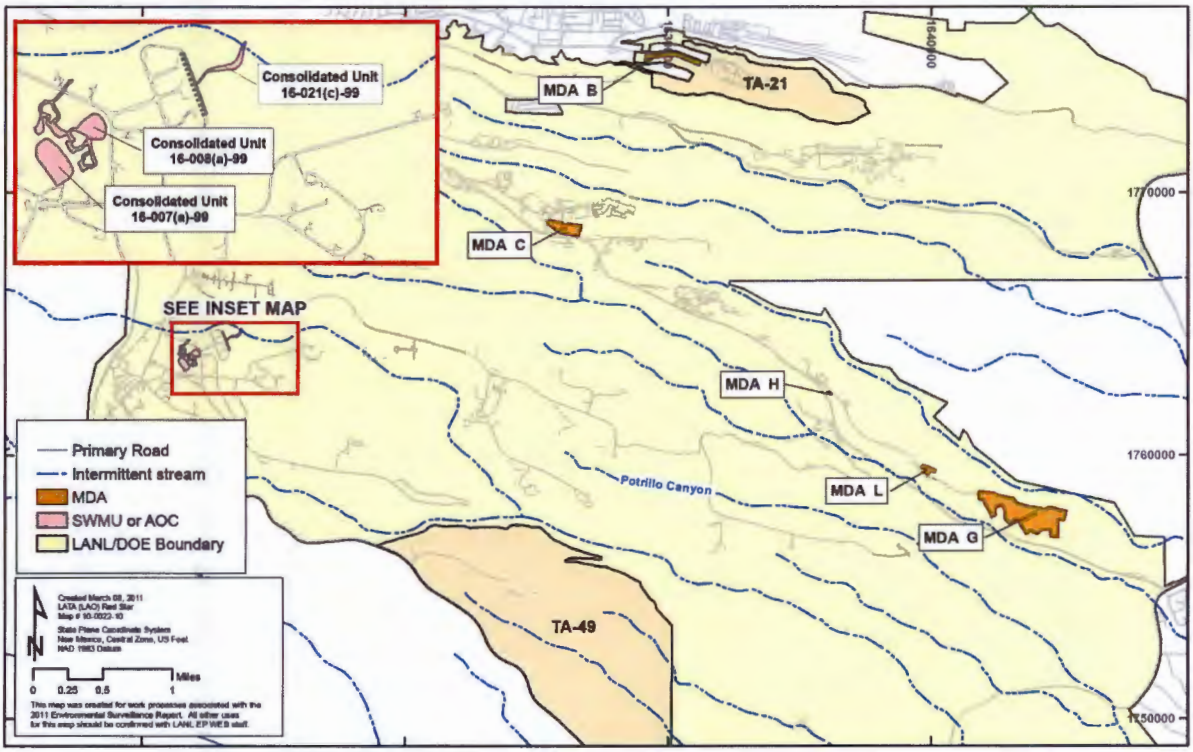

Figure 9-1 Location of MDAs and other SWMUs or AOCs where remediation and/or characterization work was performed in 2010.

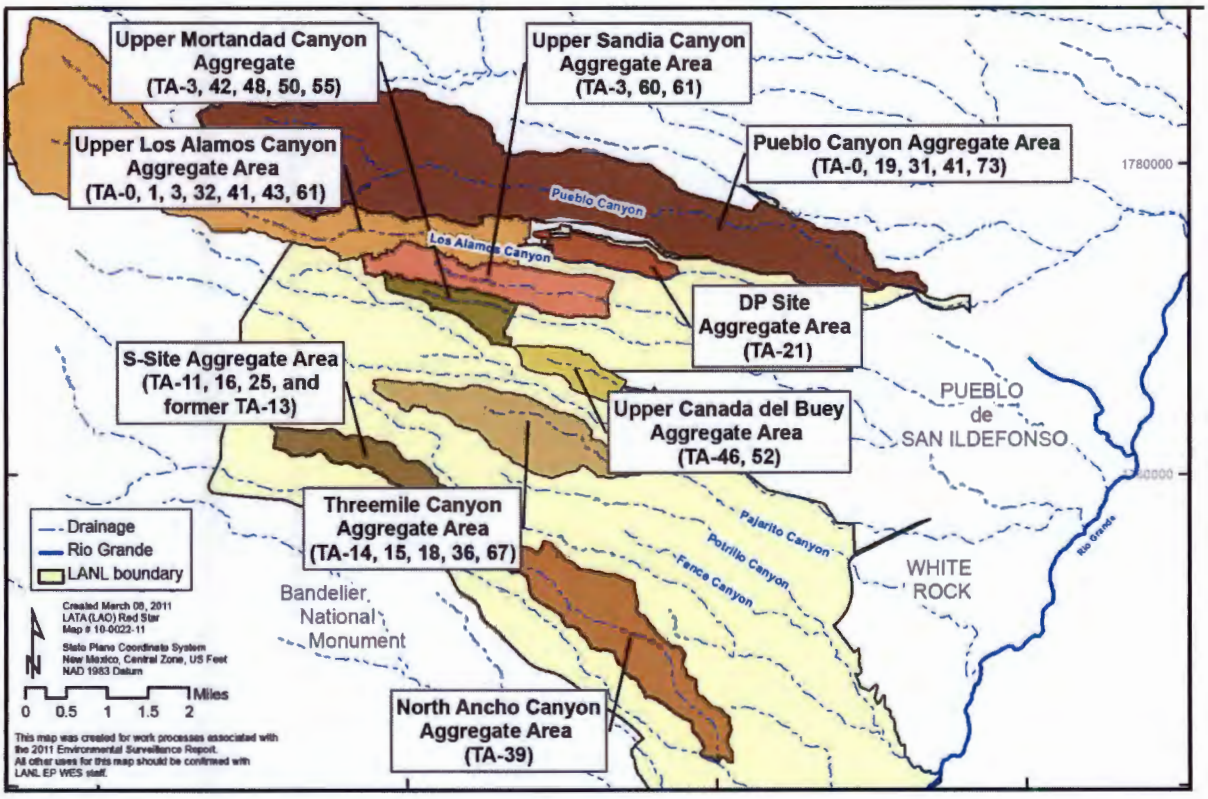

Figure 9-2 Location of canyons and aggregate areas where remediation and/or characterization work was performed in 2010

B. CORRECTIVE ACTIONS PROGRAM ACCOMPLISHMENTS

1. Upper Los Alamos Canyon Aggregate Area

a. Site Description and History

The Upper Los Alamos Canyon Aggregate Area is located within and south of the Los Alamos town site in TA-0, TA-1, TA-3, TA-32, TA-41, TA-43, and TA-61 and includes a total of 115 SWMUs and AOCs. Of the 115 sites in the Upper Los Alamos Canyon Aggregate Area, 47 sites underwent sampling in 2008–2009 and six sites were approved for delayed investigation pending cessation of operations. Sites include septic tanks and outfalls; sanitary waste lines and sewage treatment facilities; industrial waste lines, drains, and outfalls; storm drains and outfalls; soil contamination areas from Laboratory operations; landfills and surface disposal areas; transformer sites; and incinerators.

b. Remediation and Sampling Activities

A Phase II investigation work plan (LANL 2010a) was developed to complete the activities recommended in the investigation report (LANL 2010b). The primary activities at the 28 sites associated with the Phase II investigation are (1) surface and subsurface soil and tuff sampling and (2) excavation of soil and/or tuff in limited areas with elevated contaminant concentrations.

Accelerated corrective action (ACA) activities were conducted at former TA-32 in the Upper Los Alamos Canyon Aggregate Area for four sites in accordance with the ACA work plan approved by NMED (LANL 2009a; NMED 2010a). The objectives of the ACA were to (1) conduct limited soil removal and (2) collect samples to finalize the determination of the extent of contamination. Additional samples were collected and a total volume of approximately 5.5 yd^3 was excavated at one site.

Interim measure activities were conducted in the drainage downgradient of a former septic system, referred to as the Los Alamos Site Monitoring Area 2 (LA-SMA-2) drainage. The interim measure activities were implemented to mitigate contaminant migration to and within Los Alamos Canyon and included removal of contaminated environmental media from the downgradient drainage; installation of best management practices to prevent contaminants from the mesa top from migrating into the downgradient drainage; construction of surface water retention and sediment deposition basins in Los Alamos Canyon below the drainage; and characterization and disposal of waste generated during removal activities in accordance with applicable regulatory requirements (LANL 2010c).

A total of 594 yd^3 of PCB-contaminated media were removed from the outfall and drainage during the interim measure activities. At the base of the drainage, where a large body of sediment had accumulated, 2,290 yd^3 of PCB-contaminated sediment has been removed. Following the removal of contaminated sediment and rock, a total of 107 confirmation samples were collected from the site (LANL 2010c; LANL 2010d). Supplemental interim measure activities included additional removal of contaminated environmental media and collection of confirmation samples from the downgradient drainage; inspection of the two surface water retention and sediment deposition basins in Los Alamos Canyon below the drainage; and characterization and disposal of waste generated during removal activities in accordance with applicable regulatory requirements.

c. Conclusions and Recommendations

The results of the Upper Los Alamos Canyon Aggregate Area investigation were provided in an investigation report (LANL 2009b), which was revised in 2010 (LANL 2010b).

The data indicated the nature and extent of contamination are defined at three former TA-32 sites and no potential unacceptable risks or doses to human and ecological receptors from Laboratory releases are present (LANL 2010e). Sampling results show that the extent of contamination has not been defined at one site (LANL 2010e). Additional sampling will be implemented as part of the Phase II investigation of the Upper Los Alamos Canyon Aggregate Area. No further investigation or remediation activities are warranted at the other sites.

Implementation of the interim measures achieved the desired objectives of reducing the contaminant inventory in the drainage system below the former septic tank and controlling contaminant migration. Additional removal, stabilization, and sampling activities are recommended for the mesa-top portion of the site and will be implemented as part of the Phase II investigation for Upper Los Alamos Canyon Aggregate Area. A risk assessment to ensure no potential unacceptable risks are present will also be performed as part of the Phase II investigation.

NMED approved the report (NMED 2010b) and granted Certificates of Completion for 21 sites in the Upper Los Alamos Canyon Aggregate Area (NMED 2010c).

2. Upper Mortandad Canyon Aggregate Area

a. Site Description and History

The Upper Mortandad Canyon Aggregate Area is located in TA-3, former TA-42, TA-48, TA-50, and TA-55 and consists of 119 sites, 58 of which have been previously investigated and/or remediated and have been approved for no further action. The remaining SWMUs and AOCs were evaluated by the investigation.

b. Remediation and Sampling Activities

Thirty-one sites require additional sampling to define the extent of contamination. A Phase II investigation work plan (LANL 2010f) was developed and presents the proposed sampling and analyses needed to define the extent of contamination at each of the 31 sites.

c. Conclusions and Recommendations

The investigation report describing the sampling, analyses, and evaluation of the data was submitted (LANL 2009c) and revised in 2010 (LANL 2010g). The extent of contamination has not been defined at 31 sites. Additional sampling is needed to define the vertical and/or lateral extent of one or more chemicals of potential concern (COPCs) at each of these sites. NMED approved the revised report (NMED 2010d) and granted Certificates of Completion for six sites in the Upper Mortandad Canyon Aggregate Area (NMED 2010e).

3. North Ancho Canyon Aggregate Area

a. Site Description and History

The North Ancho Canyon Aggregate Area includes TA-39 and portions of TA-49. The aggregate area includes 44 individual SWMUs and AOCs. The 18 sites within TA-49 sites are addressed in separate work plans and investigation reports. The North Ancho Canyon Aggregate Area that encompasses TA-39 consists of 26 sites and is primarily composed of firing sites for testing of high explosives (HE), support facilities, and waste disposal areas. Active facilities include firing sites, storage areas, administrative offices, workshops, sewage disposal facilities, and supporting infrastructure. Inactive facilities include firing sites, storage areas, waste disposal areas, and sewage and chemical disposal facilities.

b. Remediation and Sampling Activities

Six sites require additional sampling to define the extent of contamination, one of which also requires additional remediation. A Phase II investigation work plan (LANL 2010h) was developed and describes the activities needed to complete the investigation and/or remediation of the remaining five SWMUs and one AOC. The Phase II investigation work plan also includes the abandonment of five shallow wells and 12 angled boreholes, and the final removal of remaining waste and contaminated media at two landfill sites.

c. Conclusions and Recommendations

The investigation report was completed and submitted in 2009 (LANL 2009d) and subsequently revised in 2010 (LANL 2010i). NMED approved the revised report (NMED 2010f) and granted Certificates of Completion for seven sites in the North Ancho Canyon Aggregate Area (NMED 2010g).

4. TA-49

a. Site Description and History

TA-49, also known as the Frijoles Mesa site, occupies approximately 1280 acres along the south-central boundary of the Laboratory and is located within the Ancho, North Ancho, and Water Canyon watersheds.

A period of intense experimental activity at TA-49 took place from late 1959 to mid-1961, during which hydronuclear and related experiments deposited significant amounts of plutonium, uranium, lead, and beryllium in underground shafts. These experiments were conducted in subsurface shafts located at MDA AB (Areas 2, 2A, and 2B) and Areas 1, 3, and 4. Facilities in Areas 5 and 10 were used to support the experiments at the test shaft areas. Uncontaminated materials generated at these facilities were deposited into a landfill and burn site in Area 6. Additionally, general site cleanups conducted in 1971 and 1984 resulted in the disposal of uncontaminated structure debris and materials into the Area 6 landfill and the creation of small landfills at Areas 5 and 10. Area 11 is the site of a former radiochemistry laboratory, associated leach field, and subsurface test-shot area. Area 12 includes the former Bottle House and Cable Pull Test Facility.

b. Remediation and Sampling Activities

The investigation of TA-49 was separated into two investigation work plans; one plan addressed the sampling of sites outside of the nuclear environmental site (NES) boundary (LANL 2008a) and the other work plan addressed the sampling of sites inside the NES boundary (LANL 2008b). The TA-49 sites outside the NES boundary consist of nine SWMUs and AOCs, two of which have been previously investigated and/or remediated and have been approved for no further action. The investigation of one AOC and one SWMU is deferred per Table IV-2 of the Consent Order; however, samples were collected around former transformer pads located within the AOC. The TA-49 sites inside the NES boundary consist of 11 SWMUs and AOCs, one of which has been approved for no further action. The surface investigation at one AOC is deferred per Table IV-2 of the Consent Order; however, subsurface samples from boreholes were collected within the AOC.

The investigation activities included collection of 2438 surface and shallow subsurface soil samples from 1,219 locations for gross-alpha and -beta radiological screening. Of these screening samples, 1,058 samples from 569 locations were submitted for laboratory analyses. In addition to the surface sampling, 144 soil and tuff samples were collected from 41 boreholes with a maximum depth of 192 ft below ground surface. Pore-gas samples were collected from at least one borehole at each area and analyzed for VOCs and tritium.

c. Conclusions and Recommendations

The investigation reports for outside and inside the NES boundary at TA-49 were submitted and subsequently revised in 2010 (LANL 2010j; LANL 2010k). Both revised reports were approved by NMED (NMED 2010h; NMED 2010i).

The extent of contamination has been defined at Area 5. These sites have been determined to pose no potential unacceptable risk or dose to human health or the environment. No further investigation or remediation activities are warranted at Area 5 (LANL 2010j). Certificates of Completion were requested for one AOC and one SWMU. Extent of contamination at Area 6 West is defined, but additional sampling is necessary to determine whether potential contamination from dioxins and furans is present.

The extent of contamination has not been defined at Area 1, MDA AB (Area 2, 2A, 2B), Area 3, Area 4, Area 10, Area 11, and Area 12 (LANL 2010k). Additional sampling is necessary to define the lateral and vertical extent of one or more contaminants at each of these sites. Phase II investigation work plans will be prepared to address the additional sampling and the required data analysis will be conducted to define extent at the sites inside and outside the NES boundary will be prepared. In addition, a separate work plan has been developed to address the inorganic background concentrations for Unit 4 of the Tshirege Member of the Bandelier Tuff (LANL 2010l).

The VOC pore-gas data were compared with screening values based on equilibrium partitioning of vapor with groundwater standards or screening levels to evaluate the potential for the reported VOC concentrations to result in contamination of groundwater. Pore-gas data indicate that VOCs in subsurface pore gas are not a

potential source of groundwater contamination. Tritium pore-gas data were compared with the groundwater maximum contaminant level (MCL) for tritium. For the most part, tritium activities in vapor samples were low. However, tritium activities in one borehole located at Area 12 exceeded the groundwater MCL for tritium and may represent a potential source of groundwater contamination. The Phase II investigation work plan for sites inside the NES boundary will propose that this borehole be re-sampled to confirm the results.

5. Upper Sandia Canyon Aggregate Area

a. Site Description and History

The Upper Sandia Canyon Aggregate Area is located in TA-3, TA-60, and TA-61 at the Laboratory. The Upper Sandia Canyon Aggregate Area includes only part of TA-3. Other parts of TA-3 are included in the Upper Los Alamos Canyon Aggregate Area, the Upper Mortandad Canyon Aggregate Area, and the Twomile Canyon Aggregate Area. The Upper Sandia Canyon Aggregate Area includes 180 SWMUs and AOCs, 91 of which have been previously investigated and/or remediated and have been approved for no further action. The remaining 89 SWMUs or AOCs were investigated in 2009–2010.

b. Remediation and Sampling Activities

Six hundred eight (608) surface samples, shallow subsurface samples (<10 ft below ground surface [bgs]), and deep subsurface samples (10 to 65 ft bgs) were collected from 256 locations and submitted for laboratory analyses. The sampling included drilling 56 boreholes to 10 to 61 ft bgs.

A septic tank was removed and confirmation samples were collected in accordance with the approved work plan (LANL 2008c; NMED 2008). The 6-in. inlet drainline to the septic tank was plugged with concrete and the outlet drainline to the seepage pit was removed.

c. Conclusions and Recommendations

The investigation report for the Upper Sandia Canyon Aggregate Area was submitted and subsequently revised in 2010 (LANL 2010m; LANL 2010n). The revised report was approved by NMED (NMED 2010j).

The nature and extent of contamination have been defined for 24 sites previously investigated or investigated during 2009. The nature and extent of contamination have not been defined for 41 sites. A total of 22 sites are proposed for delayed characterization pending decontamination and decommissioning (D&D) of certain buildings and structures within the aggregate area. Two additional sites are addressed under other regulatory programs and require no further action.

The 24 sites for which nature and extent are defined have been determined to pose no potential unacceptable risk or dose to human and ecological receptors from Laboratory releases. The Laboratory requested Certificates of Completion for the 24 sites in the Upper Sandia Canyon Aggregate Area.

A Phase II work plan to address the remaining 41 sites was developed and submitted to NMED in 2011 (LANL 2011a).

6. S-Site Aggregate Area

a. Site Description and History

The S-Site Aggregate Area consists of 105 SWMUs and AOCs in TA-11, former TA-13, TA-16, and TA-25. Thirty-seven sites have either been approved for no further action, are pending no further action, were addressed by other investigations, or were deferred from investigation pursuant to Table IV-2 of the Consent Order. The aggregate area has been subdivided into four subaggregates according to their location and operational histories: K-Site Subaggregate, P-Site Subaggregate, 300s Line Subaggregate, and V-Site Subaggregate.

i. K-Site Subaggregate

The TA-11 firing sites were constructed in 1944 for research on implosion symmetry using x-rays and the magnetic method. K-Site has also been home to photofission experiments, an air gun firing facility, a mortar impact area, a burning ground, laboratories, and storage buildings.

ii. P-Site Subaggregate

The subaggregate consists of inactive sites at TA-16 and former TA-13, which included a firing site, a firing site debris area, control bunkers, firing bunkers, storage buildings, purported burn pits, and a former wastewater treatment plant (WWTP). Former TA-13 was constructed in 1944 to support the HE portion of the Manhattan Project. Manhattan Project activities conducted included counter x-ray diagnostics of HE lens configurations, testing of initiator assemblies, and HE assembly and research in the magnetic method program. Because of its remote location, the area was also used to machine toxic or extremely sensitive explosives.

iii. 300s Line Subaggregate

The 300s Line Subaggregate consists of HE processing buildings along with their associated rest houses. Construction of the 300s Line began at the end of 1951 and was completed in 1953. The primary function of this facility was casting HE such as 2,4,6-trinitrotoluene, Composition B, and Baratol. In 1958, the 300s Line facility changed from casting HE to developing plastic-bonded explosives.

iv. V-Site Subaggregate

The V-Site Subaggregate is a historic site located at the eastern edge of the World War II–era complex. V-Site was used for the processing, machining, and casting of HE and included operations buildings, HE magazines, material storage buildings, and an assembly building.

b. Remediation and Sampling Activities

Sixty-eight SWMUs and AOCs are included in the investigation conducted in 2009–2010 (LANL 2007). Of these, three sites required no additional investigation and were proposed for no further investigation or remediation, two sites were sampled with nearby sites, and two sites were not sampled because of historic preservation constraints. The remaining 61 sites were sampled to determine the nature and extent of contamination. Additional locations were sampled in the drainages to determine if there is off-site transport of contaminants into Fishladder Canyon and Martin Spring Canyon.

A total of 3288 samples of soil, sediment, and rock samples from the surface, shallow subsurface, and deep subsurface were collected during the 2009-2010 investigations. Drilling operations included 26 boreholes at the V-Site Subaggregate, 10 boreholes at the 300s Line Subaggregate, and 12 boreholes at the P-Site Subaggregate to a maximum depth of 30 ft bgs (LANL 2007).

c. Conclusions and Recommendations

The investigation report for the S-Site Aggregate Area was submitted (LANL 2010o). The report was subsequently revised in early 2011 (LANL 2011b).

The extent of contamination has been defined at six sites. Human health and ecological risk assessments were performed for these sites. Five sites do not pose a potential unacceptable risk to human health and the environment and are recommended for corrective action complete. One site was found to pose potential unacceptable risk to human health, and corrective actions are recommended. Three sites were also recommended for corrective action complete on the basis that there is no history or evidence of releases of hazardous constituents.

The nature and extent of contamination have not been defined for 59 sites. Additional sampling is needed to define the lateral and/or vertical extent of contamination at each of these sites. The Laboratory will provide a Phase II investigation work plan to address the additional sampling required to complete the characterization of these sites.

The V-Site Courtyard Area is of historical significance because of its association with the Manhattan Project. In this area, the Trinity test device was assembled and tests of Fat Man and Little Boy weapon components were conducted. Historic preservation restrictions prohibit the Laboratory from sampling within this historically protected area, thereby preventing the determination of the nature and extent of contamination for the sites that lie within the V-Site Courtyard Area. However, the Courtyard Periphery Area has been found not to pose a potential unacceptable risk to human health (under the recreational scenario) and the environment (LANL 2010o; LANL 2011b).

7. Upper Cañada del Buey Aggregate Area

a. Site Description and History

The Upper Cañada del Buey Aggregate Area is located in TA-46 and TA-52 (which includes two sites associated with former TA-4 but now lie within the boundary of TA-52) and consists of 83 SWMUs and AOCs, 27 of which have been previously investigated and/or remediated and have been approved or recommended for no further action. The remaining 56 SWMUs or AOCs were addressed in the investigation. The sites include septic systems; outfalls and drainages; drain lines; stack emissions; potential soil contamination areas; surface impoundments; a landfill; storage areas; dry wells; a storage tank; and a surface disposal area.

b. Remediation and Sampling Activities

A total of 738 soil, sediment, and rock samples were collected from the surface, shallow subsurface, and deep subsurface. The sampling included 50 boreholes drilled to 10 to 26 ft bgs. Four inactive septic tanks were removed and confirmation samples were collected from each excavation following removal.

c. Conclusions and Recommendations

The investigation report was submitted to NMED in November 2010 (LANL 2010p).

The extent of contamination has been defined at six sites. Human health and ecological risk assessments were performed for four of these six sites. The human health risk-screening assessment results indicate no potential unacceptable risks from COPCs at the four sites evaluated. The ecological risk-screening assessment results indicate no potential unacceptable risks to any receptor at the evaluated sites. No COPCs were detected above background at one of the remaining two sites, and no COPCs were detected at depth intervals relevant to human health risk assessments at the other site.

The Laboratory recommended corrective actions complete without controls for the six sites for which the nature and extent of contamination have been defined. In addition, one site previously recommended for no further action was recommended for corrective actions complete with controls.

The extent of contamination has not been defined at 49 sites. Additional sampling is needed to define the vertical and/or lateral extent at each of these sites. The Laboratory will provide a Phase II investigation work plan to address the additional sampling required to complete characterization at these sites.

8. Pueblo Canyon Aggregate Area

a. Site Description and History

The Pueblo Canyon Aggregate Area (TA-0, TA-19, TA-31, TA-45, and TA-73) consists of 49 SWMUs and AOCs located within the watershed or sites that discharged directly to the canyon from the mesa top. These sites are located on former Laboratory property that is now part of the Los Alamos town site or in Pueblo Canyon. Transfer of the property on which these sites are located occurred historically either to Los Alamos County or to private landholders. Of the 49 sites, 19 were included in the Phase I investigation.

b. Remediation and Sampling Activities

Based on the results of Phase I characterization sampling, three SWMUs and three AOCs were recommended for additional sampling. The objectives of the Phase II investigation were to complete the characterization of the nature and extent of contamination at five sites and to complete the soil removal at one site.

The Phase II investigation included 31 surface and shallow subsurface samples collected from 18 locations at four sites and the drilling of 14 vertical boreholes and the collection of 28 samples at three sites. In addition, approximately 306 yd^3 of sediment, soil, and rock was excavated at one site. Confirmatory samples were collected and the excavation was backfilled with clean fill material delivered from off-site.

c. Conclusions and Recommendations

The Phase II investigation report was submitted to NMED in 2010 (LANL 2010q).

Based on the analytical results from the Phase I and Phase II investigations, the nature and extent of all COPCs are defined at the six sites. The human health risk-screening assessment results indicated no potential unacceptable risks at the six sites. The ecological risk-screening assessment results indicated no potential unacceptable risks to any receptor at the six sites. Additional evaluations are needed before corrective actions are completed.

9. Threemile Canyon Aggregate Area

a. Site Description and History

The Threemile Canyon Aggregate Area consists of sites within TA-14, TA-15, TA-18, TA-36, and TA-67. This aggregate area also includes sites associated with former TA-12 that lie within the boundaries of TA-15 and TA-67. The Threemile Canyon Aggregate Area includes 40 sites, 10 of which have been previously investigated and/or remediated and have been approved for no further action. Four sites have been deferred per Table IV-2 of the Consent Order. The remaining 26 sites were investigated in 2009–2010.

b. Remediation and Sampling Activities

A total of 764 surface and shallow subsurface soil, sediment, and rock samples were collected from 358 locations. Nine boreholes were drilled to depths ranging from 10–182.5 ft bgs.

Two septic tanks were removed during the 2009–2010 investigation. Following the removal of the septic tanks, confirmation samples were collected from each excavation.

c. Conclusions and Recommendations

The investigation report for the Threemile Canyon Aggregate Area was submitted and subsequently revised in 2010 (LANL 2010r; LANL 2010s). The revised report was approved by NMED (NMED 2010k).

The extent of contamination has not been defined at any of the 26 sites investigated. Additional sampling is needed to define the vertical and/or lateral extent of one or more contaminants at each of the sites. Remediation is recommended for six sites. The Laboratory will provide a Phase II investigation work plan to address the additional sampling required at the sites identified in this report.

10. Consolidated Units 16-007(a)-99 (30s Line) and 16-008(a)-99 (90s Line)

a. Site Description and History

TA-16 is located in the southwest corner of the Laboratory and covers approximately 2,410 acres (3.8 mi^2). Consolidated Units 16-007(a)-99 (the 30s Line) and 16-008(a)-99 (the 90s Line) are located near the western end of TA-16. These consolidated units consist of former HE processing buildings, former materials storage buildings, production facilities, sumps, drain lines, ponds, and outfall systems (drainages). Historically, the 30s Line and the 90s Line were used for HE processing operations, including electroplating and machining. The settling ponds were used to store wastewater generated in the nearby buildings during HE processing operations.

Consolidated Unit 16-007(a)-99 operated from 1944 to the early 1950s and Consolidated Unit 16-008(a)-99 operated from 1950 to 1970. The 90s Line Pond is all that remains of the 30s Line and 90s Line production facilities. Buildings associated with the discharge to the 30s Line Ponds were destroyed by burning. The buildings associated with the discharge to the 90s Line Pond were removed, which included the removal of sumps, blast shields, drain lines, earthen berms, and asphalt roadways.

b. Remediation and Sampling Activities

The following activities were completed in 2009 in accordance with the approved supplemental investigation work plan:

- A 300.5-ft borehole was drilled, logged, and sampled at the 90s Line; eight characterization samples were collected,
- HE and chromium VI contaminated soil was removed, and

- A groundwater-monitoring well (installed at the 90s Line Pond during the 2006–2007 ponds investigation) was developed for groundwater sampling. A transducer was installed to monitor water-level fluctuations on a continuous basis.

A total of 185 yd^3 of soil and tuff was excavated and removed at the 30s Line. Eight confirmation samples were collected from four locations within the excavated area. A total of 23 yd^3 of material was excavated at the 90s Line. Six confirmation samples were collected from three locations within the excavated area

c. Conclusions and Recommendations

A supplemental investigation report was submitted to NMED in 2010 (LANL 2010t) and approved (NMED 2010l).

Consolidated Units 16-007(a)-99 (the 30s Line) and 16-008(a)-99 (the 90s Line) have been characterized and remediated. Results of the drilling and sampling indicate the extent of contamination has been defined. The remediation of the HE-contaminated soil and tuff at the 30s Line and the chromium VI contaminated soil at the 90s Line were successfully completed. All established target cleanup levels for the HE and chromium VI remediation were met.

A groundwater-monitoring well was developed and will be sampled on a quarterly basis for one year as part of the groundwater monitoring in the Water Canyon/Cañon de Valle watershed, conducted under the annual Interim Facility-Wide Groundwater Monitoring Plan.

The Laboratory will continue to inspect erosion controls installed in the drainages to the 90s Line Pond and collect sediment samples from the 90s Line Pond.

11. Consolidated Unit 16-021(c)-99 (260 Outfall) Corrective Measures Implementation

a. Site Description and History

Building 16-260, located on the north side of TA-16, has been used for HE processing and machining since 1951. Wastewater from machining operations contained dissolved HE and may have contained entrained HE cuttings. At Building 16-260, wastewater treatment consisted of routing the water to 13 settling sumps for recovery of any entrained HE cuttings. From 1951 through 1996, the water from these sumps was discharged to the 260 Outfall, which drained into Cañon de Valle. As a result of the discharge, both the 260 Outfall and the drainage channel from the outfall were contaminated with HE and barium.

b. Remediation and Sampling Activities

The Laboratory implemented the corrective measure implementation (CMI) plan in 2009 and completed the plan's remediation and investigation actions in 2010. The CMI characterization and remediation activities included (1) removing the concrete trough outfall adjacent to building 16-260 at the 260 Outfall channel; (2) removing soil and sediment within the former settling pond within the 260 Outfall drainage channel; (3) replacing a low-permeability cap on the former settling pond; (4) removing soil and tuff from the 260 Outfall drainage channel; (5) sampling soil in the Sanitary Wastewater Systems Consolidation (SWSC) Cut of Cañon de Valle; (6) installing surge bed injection grouting within the former settling pond at the 260 Outfall channel; (7) installing carbon filter treatment systems of spring waters at SWSC and Burning Ground Springs in Cañon de Valle and modifying the existing carbon filter at Martin Spring in Martin Spring Canyon; and (8) installing a pilot permeable reactive barrier (PRB) for treatment of HE and barium in Cañon de Valle.

c. Conclusions and Recommendations

The CMI summary report and an addendum were completed and submitted in 2010 (LANL 2010u; LANL 2010v). The summary report presented most of the activities listed above, while the addendum reported the remaining activities, which included excavating soil and tuff and collecting a confirmation sample at the base of the cliff within the 260 Outfall drainage channel and re-sampling sediment for ecotoxicity at the SWSC Cut.

The removal activities and final confirmation sampling at the lower 260 Outfall drainage channel were conducted in April 2010. No potential unacceptable risks exist for the industrial, construction worker, and residential scenarios for the 260 Outfall drainage channel (LANL 2010v).

The SWSC Cut sediment toxicity testing of chironomids was completed in March 2010. The toxicity test results indicated no significant reductions in *Chironomus tentans* survival or growth occurred in the SWSC Cut sediment (LANL 2010v).

To confirm the effectiveness of the CMI characterization and remediation activities, the Laboratory submitted a CMI monitoring plan to NMED (LANL 2010w). The plan is designed to assess the performance of the four CMI treatment systems (a low-permeability cap, injection grouting of the surge bed, carbon filter treatment systems of spring waters, and PRB treatment system in Cañon de Valle) to determine whether the objectives of the treatment systems have been met, and to repair and/or adjust the treatment systems as necessary to ensure maximum effectiveness. The monitoring effectiveness will be evaluated following a one year period of activities.

The structural integrity of the low-permeability cap and surrounding stormwater control structures will be inspected and maintained. One alluvial well was installed in the vicinity of the former settling pond to monitor the performance of surge bed injection grouting within the former settling pond area. Treated spring water discharged from the carbon filter systems will be monitored to assess the performance of the carbon filter systems at SWSC, Burning Ground, and Martin Springs. Multiple upgradient and downgradient alluvial wells and vessel test ports will be monitored to test the effectiveness of the pilot PRB system and the effects of the system on the alluvial water in Cañon de Valle.

Data generated from the monitoring activities will assist the Laboratory and NMED in determining whether the goal of the CMI—to remediate HE and barium in the former settling pond within the 260 Outfall drainage channel and in the alluvial systems of Cañon de Valle and Martin Spring Canyon—has been met.

12. MDA C

a. Site Description and History

MDA C, an inactive 11.8-acre landfill, is located within TA-50 at the head of Ten Site Canyon. MDA C consists of seven disposal pits and 108 shafts; the depths of the pits range from 12 to 25 ft and the shafts range from 10 to 25 ft below the original ground surface. Shafts 98–107 are lined with 12-in.-thick concrete, while the rest of the pits and shafts are unlined. MDA C operated from May 1948 to April 1974 but received waste only intermittently from 1968 until it was decommissioned in 1974. Wastes disposed of at MDA C consisted of liquids, solids, and containerized gases generated from a broad range of nuclear energy research and development activities conducted at the Laboratory. These wastes included uncontaminated classified materials, metals, hazardous materials, and radioactively contaminated materials.

b. Remediation and Sampling Activities

The Laboratory developed a Phase III investigation work plan (LANL 2010x; LANL 2010y), which was subsequently approved by NMED (NMED 2010m). Phase III investigation activities will be conducted to better define the lateral and vertical extent of subsurface VOC and tritium pore gas contamination at MDA C, install two downgradient regional groundwater monitoring wells, and characterize background concentrations of inorganic chemicals detected in dacite rocks. The data collected during the Phase III investigation will be used to support future corrective action decisions for MDA C.

c. Conclusions and Recommendations

Regional aquifer well R-60 was installed downgradient of MDA C. The R-60 borehole was drilled to a total depth of 1418 ft bgs. The primary objective of the R-60 well is to provide hydrogeologic and groundwater data on the regional aquifer below the MDA. Secondary objectives were to collect drill-cutting samples, conduct borehole geophysical logging, and investigate potential perched groundwater zones.

Post-installation activities included well development, aquifer testing, surface completion, geodetic surveying, and installing a dedicated sampling system. Groundwater characterization samples will be collected from the completed well and results will be included in the appropriate periodic monitoring report.

In order to optimize the location, the second regional groundwater monitoring well proposed in the Phase III work plan will be sited and drilled following two rounds of sampling of the new deep vapor wells.

Three of the four new vapor monitoring wells have been installed. The fourth well will be located outside of the MDA C fence and will be installed in early 2011. The borehole cuttings for the two vapor monitoring wells located outside of the fenced area of MDA C will be used to characterize background concentrations of inorganic chemicals detected in dacite rocks. This work should be completed in 2011.

13. Los Alamos and Pueblo Canyons

a. Site Description and History

The portion of the canyon watershed investigated as the Los Alamos and Pueblo Canyons watershed includes Los Alamos, Pueblo, DP, and Acid Canyons (inclusive of the South Fork of Acid Canyon). The Los Alamos and Pueblo Canyons watershed heads on USFS land in the Sierra de los Valles west and northwest of the Laboratory. The watershed extends eastward from the headwaters across the Pajarito Plateau for approximately 30.4 km to the confluence with the Rio Grande.

The Los Alamos and Pueblo Canyons watershed includes several TAs (primarily TA-0, TA-1, TA-2, TA-21, TA-41, TA-45, TA-53, and TA-73) and non-Laboratory sources in the Los Alamos town site, such as roads and other paved areas, application of pesticides in headwater areas in the Santa Fe National Forest and within the town site, and atmospheric fallout of radionuclides. Regardless of the source(s), the contaminants have been dispersed down canyon in sediment, surface water, and alluvial groundwater. Many constituents found naturally or derived from anthropogenic sources were concentrated in ash during the Cerro Grande fire in May 2000 and also were dispersed down canyon.

b. Remediation and Sampling Activities

The geomorphic conditions were surveyed above and below sediment transport mitigation sites in the Los Alamos and Pueblo Canyon watersheds as specified in the approved monitoring plan (LANL 2009e; NMED 2010n). Surveys were conducted at all sediment transport mitigation sites specified in the plan and at the LA-SMA-2 retention basins. These surveys were repeated after the 2010 monsoon season and the results will be presented in a report to NMED in 2011. The report will include estimates of net sediment deposition in each area since the previous surveys and will evaluate if any unintended geomorphic changes have occurred, such as net sediment erosion.

c. Conclusions and Recommendations

Los Alamos and Pueblo Canyons were subject to a series of storm events in August 2010 that resulted in significant damage to some of the sediment control structures and gages installed as part of the mitigation project plan. An interim assessment was conducted to provide documentation of all bank and channel erosion, channel scour or undercutting, and deposition related to the sediment control structures; conduct an evaluation of any newly created flow paths; and determine any other changes that could affect the performance of the structures and monitoring stations. The interim assessment summarizes the impact of the storms and provides a schedule for repairing damages that require interim actions (LANL 2010z).

14. Pajarito Canyon

a. Site Description and History

Pajarito Canyon is located in the central part of the Laboratory. The canyon heads in the Santa Fe National Forest west of the Laboratory boundary and empties into the Rio Grande in White Rock Canyon. The main channel is approximately 14.8 miles long, and the watershed area is approximately 8 mi^2. In addition, Twomile and Threemile Canyons are major tributaries that join Pajarito Canyon and have watershed areas of 3.1 mi^2 and 1.7 mi^2, respectively. Sites within the Pajarito Canyon watershed are located at TA-3, TA-8, TA-9, TA-12, TA-15, TA-18, TA-23, TA-27, TA-48, TA-54, TA-55, TA-59, TA-64, and TA-69.

b. Remediation and Sampling Activities

The approved sampling and analysis plan specified that seven active stream channel samples would be collected each year in the Pajarito Canyon watershed, and up to an additional eight fine-grained sediment samples were identified as "contingency" samples to be collected in the event large floods occurred (LANL 2009f). Because no large floods occurred in 2010 in this watershed, the fine-grained contingency samples were not collected. In addition, because no flow was recorded at the E250 stream gage in Pajarito Canyon above NM 4, no samples were collected from the two active stream channel locations below E250. Also, there was insufficient sediment to sample at the lower retention pond in the MDA G-6 drainage. Therefore, a total of four active channel sediment samples were collected in the Pajarito Canyon watershed in 2010.

The bird nest box monitoring plan was revised (LANL 2010aa) and approved (NMED 2010o). Insects collected from occupied nest boxes were analyzed for key chemicals of potential ecological concern (COPECs), as allowed by available sample mass and target detection limits. These samples provide a comparison between reaches close to contaminant sources with relatively high COPEC concentrations. In addition, insect samples were collected from nest boxes on an adjacent mesa in TA-14, which serves as a local reference area. Insects from each reach were composited to increase sample mass before they are submitted to analytical laboratories.

The insects collected from bird nest boxes in the three reaches and the TA-14 reference area had sufficient mass for analyses of metals. In addition, there was sufficient sample mass to analyze the insects collected from one reach for PCBs.

c. Conclusions and Recommendations

The results of the 2010 sediment monitoring in the Pajarito Canyon Watershed are presented and discussed in Chapter 6.

The analytical data indicated elevated cadmium and lead in insects in one reach, which also has higher concentrations in sediment samples than the other reaches sampled for insects (LANL 2010bb). The concentrations of cadmium and lead in insects represent a potential for adverse ecological effects, and their distribution is consistent with a Laboratory source.

Other lines of evidence for evaluating risks to cavity-nesting birds include field measures of nest success. Such studies have not identified any potential for ecological risk in the Pajarito watershed. Overall, the weight-of-evidence indicates that COPECs in the Pajarito reaches do not pose a potential risk to population abundance or persistence and species diversity of avian ground invertivore feeding guild species (LANL 2010bb).

Submission of additional insect samples for analysis of metals, PCBs, and dioxins and furans is proposed. The Laboratory will submit insects collected in 2010 from nest boxes in the upper Pajarito Canyon watershed reaches for these analyses if sufficient sample mass is available (LANL 2010bb). These data and an evaluation of the associated field nest monitoring observations will be reported in 2011, if sufficient sample mass is available.

15. Potrillo and Fence Canyons

a. Site Description and History

Potrillo and Fence Canyons are located within the Water Canyon watershed. The Potrillo Canyon watershed heads on the Pajarito Plateau in TA-15. Potrillo Canyon extends approximately 7.0 mi to Water Canyon, approximately 1.0 mi above the Rio Grande. Fence Canyon is a major tributary to Potrillo Canyon that has its headwaters in TA-36. Its watershed extends approximately 4.0 mi to Potrillo Canyon. The combined watershed of Potrillo and Fence Canyons has a drainage area of 4.5 mi^2, of which 95% is on Laboratory land and 5% is on private land and Los Alamos County land in and adjacent to the community of White Rock.

Releases from SWMUs and AOCs within the Potrillo and Fence watershed have occurred as a result of dispersal from firing sites and related activities in TA-15 and TA-36. These canyons also receive stormwater runoff from roads, parking lots, and other developed areas in these TAs. Previous sampling results from

within these canyons indicated contamination from inorganic chemicals, organic chemicals, and radionuclides.

b. Remediation and Sampling Activities

The sediment investigations focus on characterizing the nature, extent, and concentrations of COPCs in post-1942 sediment deposits in a series of reaches in the Potrillo and Fence watershed. The scope of this investigation included characterization of seven reaches and two additional reaches requested by NMED. Sediment investigations in the Potrillo and Fence watershed included detailed geomorphic characterization and sediment sampling.

The surface water investigations include the presentation and summary of stormwater analyses obtained at one gaging station in Potrillo Canyon, E267, as part of the Laboratory's Environmental Surveillance Program. Stormwater samples have been collected from an additional gage in the Potrillo Canyon watershed, E269, along a tributary east of NM 4. Because this location is not downgradient of any SWMUs or AOCs, the E269 data are not evaluated for potential contamination, although they provide useful information on stormwater composition from a background location.

The investigations of potential shallow groundwater include observations from six boreholes drilled in Potrillo Canyon and one borehole drilled in Fence Canyon. Two of the Potrillo Canyon holes and the Fence Canyon borehole were completed as monitoring wells, but only the Fence Canyon borehole, FCO-1, has been maintained as a monitoring well. A transducer was installed in well FCO-1 in 2008 to measure any transient groundwater, but water levels have remained below the screen since the installation. No shallow groundwater has been observed, and therefore no groundwater samples have been collected from the Potrillo and Fence watershed. Because well FCO-1 has been dry since installation, it was removed from the Interim Facility-Wide Groundwater Monitoring Plan in 2010.

c. Conclusions and Recommendations

The investigation report was submitted to NMED in December 2010 (LANL 2010cc).

Sediment COPCs in Potrillo and Fence Canyons include 14 inorganic chemicals, 24 organic chemicals, and six radionuclides. These COPCs are derived from a variety of sources, including Laboratory SWMUs and AOCs and natural sources such as uncontaminated soil, sediment, and bedrock.

No persistent surface water occurs in Potrillo or Fence Canyons; therefore, surface water does not present potential ecological or human health risks, and no surface water COPCs were identified. Stormwater comparison values were exceeded by aluminum and by gross-alpha radiation in samples from Potrillo Canyon. However, the results represent natural background conditions.

The human health risk assessment for Potrillo and Fence Canyons indicates no unacceptable risks or doses from COPCs in sediment under a recreational scenario. The COPECs identified in the ecological risk screening assessment were compared with results from other watersheds where more detailed biota investigations have been conducted. This comparison indicated concentrations of COPECs in Potrillo and Fence Canyons are not likely to produce adverse ecological impacts, and no additional biota investigations, mitigation, or monitoring is required.

The conditions for sediment are likely to stay the same or improve because of decreases in contaminant concentrations after peak releases; therefore, no further monitoring of sediments is necessary. However, several firing sites in the watershed remain active, and additional releases are possible. SWMUs and AOCs present in the watershed will be characterized as part of the Potrillo and Fence Canyons Aggregate Area investigation. Potential contaminant transport will be monitored under the requirements of the National Pollutant Discharge Elimination System Individual Permit for Stormwater Discharges from certain SWMUs and AOCs at Los Alamos National Laboratory.

C. TA-54 CLOSURE PROGRAM ACCOMPLISHMENTS

1. MDA G

a. Site Description and History

MDA G is located in the east-central portion of the Laboratory at TA-54, Area G, on Mesita del Buey. MDA G is a decommissioned (removed from service) subsurface site established for disposition of low-level waste, certain radioactively contaminated infectious waste, asbestos-contaminated material, and PCBs. The MDA was also used for the retrievable storage of transuranic waste and consists of inactive subsurface units that include 32 pits, 194 shafts, and four trenches. When operations ceased, the remaining capacity of the pits, shafts, and trenches was backfilled with clean, crushed, compacted tuff, and the pits, shafts, and trenches were closed. The disposal shafts were capped with a concrete plug. Portions of the disposal units at MDA G are covered with concrete to allow ongoing waste management activities to be conducted on the surface at Area G. Surface runoff from the site is controlled and discharges into drainages to the north (towards Cañada del Buey) and the south (towards Pajarito Canyon).

b. Remediation and Sampling Activities

The Laboratory continues to monitor VOCs and tritium in subsurface pore gas at MDA G. The Laboratory reports these monitoring results in periodic monitoring reports.

Groundwater-quality monitoring is conducted in accordance with the annual Interim Facility-Wide Groundwater Monitoring Plan. This monitoring supports the corrective measures process for solid waste management units at TA-54, the Resource Conservation and Recovery Act permit for operating units within TA-54, and DOE regulations. The groundwater monitoring network for TA-54 includes both perched-intermediate and regional wells. The monitoring at TA-54 provides the basis for accurately describing the groundwater conditions beneath TA-54, including MDA G. The monitoring well network at MDA G includes new wells drilled in 2010 that are part of the overall effort to further characterize the groundwater conditions. The TA-54 monitoring network wells, including those specific to MDA G, will continue to be sampled on a quarterly basis, consistent with the Interim Facility-Wide Groundwater Monitoring Plan.

The Laboratory submitted a work plan for the implementation of a supplemental soil vapor extraction (SVE) pilot study (LANL 2009g; LANL 2010dd). NMED approved the work plan in early 2010 (NMED 2010p). The objectives of the supplemental pilot study were (1) to determine the capabilities and optimal design for a full-scale active SVE system at MDA G and (2) to further demonstrate that active SVE has the potential to be an effective part of remediation of hazardous constituents at MDA G. The 2010 SVE pilot test was designed to target the permeable zones identified in the Tshirege Member of the Bandelier Tuff, the contacts between the stratigraphic units, and any permeable layers in the geologic column. It was also designed to assess the ability of major stratigraphic units, such as the Cerro Toledo unit and Otowi Member, to act as either a barrier to contaminant migration or as an effective extraction interval.

c. Conclusions and Recommendations

Data from the groundwater monitoring network around TA-54 show sporadic detections of a variety of contaminants including, most notably, several VOCs. The temporal and spatial nature of the occurrences does not, however, clearly indicate the presence of a discernable plume or a source related to MDA G or other sources at TA-54. The results of the screening and evaluation of the groundwater data indicate that there is no compelling evidence for the presence of contamination from MDA G in wells downgradient of MDA G. The majority of the organic compounds that have been detected are generally associated with the first year of sampling following well completion or redevelopment. These organic compounds are not persistent after the first few rounds of sampling at a well, or they are detected only sporadically and near their respective detection limits.

The supplemental SVE pilot study report was submitted in 2010 (LANL 2010ee). The results of the 2010 SVE pilot test, as well as previous testing at MDAs G and L, further demonstrated that active SVE would be an effective remedial technology for removing VOCs from the subsurface at MDA G.

The Laboratory submitted a second revision of the corrective measure evaluation (CME) report to NMED in 2010 (LANL 2010ff). Technologies were first screened for applicability to MDA G and then combined into corrective measure alternatives. The alternatives were screened against balancing criteria and combined by source area into a recommended alternative. The recommended alternative includes constructing an evapotranspiration cover over the pits and shafts and constructing and operating a soil-vapor extraction system to achieve remedial action objectives. The recommended alternative assumes removing all existing surface structures, including concrete foundations and asphalt, before the selected remedy is implemented.

The recommended alternative meets the remedial action objectives. The remedy selected was based on the ability of the recommended alternative to (1) achieve cleanup objectives in a timely manner, (2) protect human and ecological receptors, (3) control or eliminate the sources of contaminants, (4) control migration of released contaminants, and (5) manage remediation waste in accordance with state and federal regulations.

2. MDA H

a. Site Description and History

MDA H is a 70 ft by 200 ft (0.3-acre) fenced area located within TA-54 on Mesita del Buey, a small mesa that lies between Pajarito Canyon and Cañada del Buey. The MDA consists of nine inactive vertical disposal shafts arranged in a line approximately 15 ft inside the southern fence. Each shaft is cylindrical with a diameter of 6 ft and a depth of 60 ft. When filled to within 6 ft of the surface, the space above the waste in Shafts 1 through 8 was capped with 3 ft of concrete, over which an additional 3 ft of crushed tuff was placed. The space above the waste in Shaft 9 was capped with 6 ft of concrete.

From May 1960 until August 1986, MDA H was the Laboratory's primary disposal area for classified, solid-form waste. Disposal of solid-form waste materials at MDA H was restricted to items or materials that were determined by authorized personnel to be both classified and no longer required for their intended use. Liquids were prohibited from disposal.

b. Remediation and Sampling Activities

The Laboratory continues to monitor VOCs and tritium in subsurface pore gas at MDA H. The Laboratory reports these monitoring results in periodic monitoring reports.

Groundwater monitoring at the Laboratory is currently conducted in accordance with the annual Interim Facility-Wide Groundwater Monitoring Plan. The monitoring at TA-54 provides the basis for accurately describing the groundwater conditions beneath TA-54, including MDA H. The groundwater monitoring network for TA-54 includes both perched-intermediate and regional wells. The monitoring well network at MDA H includes one new regional well, R-52, drilled in 2010, that is part of the overall effort to further characterize the groundwater conditions.

TA-54 monitoring network wells, including those specific to MDA H, will continue to be sampled on a quarterly basis, consistent with the annual Interim Facility-Wide Groundwater Monitoring Plan.

c. Conclusions and Recommendations

Data from the groundwater monitoring network at TA-54 show sporadic detections of a variety of potential contaminants, including several VOCs, general inorganic chemicals, trace metals, and tritium. The temporal and spatial nature of the occurrences does not, however, clearly indicate the presence of a discernable plume or a source related to MDA H.

In 2010, the Laboratory submitted a CME report for MDA H to NMED (LANL 2010gg). Technologies were screened for applicability to MDA H and then combined into corrective measure alternatives. The alternatives were screened against balancing criteria and combined by source area into a recommended alternative.

The recommended alternative includes constructing an evapotranspiration cover over the shafts and implementing institutional controls to prevent human intrusion. Implementation of the recommended alternative satisfies all remedial action objectives.

3. MDA L

a. Site Description and History

MDA L is located at TA-54 in the east-central portion of the Laboratory on Mesita del Buey, within an 1,100 ft by 3,000 ft (2.5-acre) fenced area known as Area L. MDA L is a decommissioned (removed from service) area established for disposing of nonradiological liquid chemical waste, including containerized and uncontainerized liquid wastes; bulk quantities of treated aqueous waste; batch-treated salt solutions; electroplating wastes, including precipitated heavy metals; and small-batch quantities of treated lithium hydride.

The MDA consists of one inactive subsurface disposal pit (Pit A); three inactive subsurface treatment and disposal impoundments (Impoundments B, C, and D); and 34 inactive disposal shafts (Shafts 1 through 34). When the shafts were filled to within approximately 3 ft of the surface, they were capped with a 3-ft concrete plug. Upon decommissioning, the pit and impoundments were filled and covered with clean, crushed, consolidated tuff.

b. Remediation and Sampling Activities

The Laboratory continues to monitor VOCs and tritium in subsurface pore gas at MDA L. The Laboratory reports these monitoring results in periodic monitoring reports.

Borehole 54-610786 was drilled and installed with a stainless-steel, pore-gas sampling system to measure the pore-gas plume at MDA L as a replacement for borehole 54-24244. The new borehole is located approximately 17 ft south of borehole 54-24244. Borehole 54-24244 was subsequently abandoned once borehole 54-610786 was completed.

c. Conclusions and Recommendations

The Laboratory submitted a revised CME report to NMED in 2010 (LANL 2010hh). Technologies were first screened for applicability to MDA L and then combined into corrective measure alternatives. The alternatives were screened against balancing criteria and combined by source area into a recommended alternative.

The recommended alternative includes constructing an engineered erosion-resistant vegetative cover over the pit, impoundments, and shafts and constructing and operating an SVE system to achieve remedial action objectives. The recommended alternative assumes removing all existing surface structures, including concrete foundations and asphalt before the selected remedy is implemented.

The recommended alternative meets the remedial action objectives. The remedy selected was based on the ability of the recommended alternative to (1) achieve cleanup objectives in a timely manner; (2) protect human and ecological receptors; (3) control or eliminate the sources of contaminants; (4) control migration of released contaminants; and (5) manage remediation waste in accordance with state and federal regulations. SVE also meets the preference for a remedy that uses treatment.

D. TA-21 CLOSURE PROGRAM ACCOMPLISHMENTS

1. DP Site Aggregate Area

a. Site Description and History

TA-21 is located on Delta Prime (DP) Mesa on the northern boundary of LANL and is immediately east-southeast of the Los Alamos town site. From 1945 to 1978, TA-21 was used primarily for plutonium research and metal production. Since 1978, various administrative and research activities have been conducted at TA-21. The DP Site Aggregate Area includes container storage areas, surface disposal areas, a PCB storage area, septic systems, sumps, drain lines, outfalls, a waste treatment laboratory, a sewage treatment plant, and seepage pits.

b. Remediation and Sampling Activities

Phase II investigation activities were conducted at 19 SWMUs, one AOC, and six consolidated units within the DP Site Aggregate Area. The objectives of the Phase II investigation were to define the nature and extent

of contamination and to determine whether the sites pose potential unacceptable risk or dose to human health or the environment.

The Phase II investigation activities included collecting 226 surface and subsurface soil and tuff samples from 175 locations to define the extent of contamination. Data from the samples collected during the Phase II investigation were combined with data presented in the Phase I investigation report that meet current Laboratory data-quality requirements. Two boreholes were drilled to a depth of 200 ft bgs in the area of diesel tank 21-57, which defined the extent of diesel contamination. Remediation activities at the PCB site removed all material contaminated with 1 mg/kg or greater of total PCBs within 10 ft bgs. Approximately 1,400 yd^3 of PCB-contaminated material were removed and a total of 300 confirmation samples were collected and analyzed for PCBs.

c. Conclusions and Recommendations

The Laboratory submitted the Phase II investigation report (LANL 2010ii) to NMED, which was subsequently revised (LANL 2010jj). The extent of contamination has been defined for 15 sites and has not been defined at 11 sites. The 11 sites at which extent was not defined will be addressed in a Phase III work plan.

Sixteen sites have been determined to pose no potential unacceptable risk or dose to human health or to the environment. Corrective actions are complete for 12 sites. Five sites within the DP Site Aggregate Area were determined to pose potential unacceptable risk or dose to human health, and one site also poses potential risk to ecological receptors. Limited soil removal and confirmation sampling will be conducted at these sites as part of Phase III.

2. American Recovery and Reinvestment Act At TA-21

a. Site Description and History

TA-21 is located on DP Mesa on the northern boundary of LANL and is immediately east-southeast of the Los Alamos town site. In 1945, plutonium research and metal production activities were transferred to the newly built facilities at TA-21.

b. Remediation and Sampling Activities

The Laboratory received $212 million for environmental cleanup projects as part of the American Recovery and Reinvestment Act of 2009. The Laboratory's Recovery Act projects include the following:

- Decontamination and demolition of 24 buildings at TA-21;
- Removal and remediation of early Laboratory waste from MDA B; and
- Installation of 16 groundwater monitoring wells.

c. Conclusions and Recommendations

The status of the Recovery Act projects as of January 2011 is as follows:

- The D&D and subsequent demolition of 24 buildings at TA-21 has been completed. The last building was demolished in December 2010.
- The excavation activities at the MDA B site commenced on June 30, 2010 (see below). The objective is to remediate the site to residential cleanup levels.
- The installation of 16 groundwater monitoring wells has been completed. The wells range in depth from 850 feet to 1,400 feet. Six existing wells were plugged and abandoned.

3. MDA B

a. Site Description and History

MDA B is an inactive subsurface disposal site that occupies approximately six acres. The site runs along the fence line on DP Road and is located about 1,600 ft east of the intersection of DP Road and Trinity Drive. MDA B consists of several disposal trenches approximately 300 ft long, 15 ft wide, and 12 ft deep and

includes at least one smaller, shallower trench on the eastern end of the site. From 1944 until it closed in 1948, MDA B received process wastes from operations within TA-21 at DP East and DP West. The wastes disposed of at MDA B were highly heterogeneous, primarily radioactively contaminated laboratory wastes and debris, and limited liquid chemical waste. MDA B will be completely excavated.

b. Remediation and Sampling Activities

Excavation activities at MDA B commenced on June 30, 2010. Remediation activities included the removal of an asphalt cover that was present over 75% of MDA B and removal of soil overburden from the east end of MDA B. MDA B was split into a grid of cells, each measuring 10 ft long by 10 ft wide. Remedial action progress through December 2010 included excavation of 201 grid cells. Excavation operations generally consisted of overburden removal, contaminated soil and waste removal, and confirmation sampling.

Seventeen confirmation samples were collected from the four enclosures. Additional excavation was conducted and additional confirmation samples were collected in locations where results exceeded residential soil screening levels (SSLs) for chemicals or residential screening action levels (SALs) for radionuclides. Approximately 7,265 yd^3 and 388 yd^3 of waste and overburden, respectively, have been removed from MDA B.

Eight air-monitoring network (AIRNET) stations are located along the northern boundary of MDA B. Each AIRNET station collects airborne radionuclides, such as plutonium, americium, and uranium, on a particulate filter and a water vapor sample (for measuring tritium) in a silica gel cartridge. The particulate filters and silica gel cartridges are changed every 2 weeks, and the sample media are sent to a commercial laboratory for analysis using U.S. Environmental Protection Agency (EPA) approved methods. Each calendar quarter, six or seven of the biweekly filters from a given station are assembled into a single composite sample and prepared for isotopic analysis by dissolution and radiochemical separation techniques. Annual emissions reporting and compliance evaluations for a station are based on the sum of the four quarterly composite samples (for particulate matter) and the sum of biweekly tritium analyses.

c. Conclusions and Recommendations

Nine exploratory trenches were excavated in 2010 to determine whether waste was present in Areas 9 and 10. The investigation activities concluded that no waste was buried in Areas 9 and 10 (LANL 2010kk). As a result, remediation and further investigation are not required for Areas 9 and 10 of MDA B, not only because no operational waste was found buried there, but because soil and fill in those areas do not contain contaminants that exceed residential screening levels.

The 17 confirmation samples collected from four of the enclosures had no detected concentrations of organic chemicals that exceeded residential SSLs (LANL 2010ll). Two of the seven confirmation samples from enclosure 3 had arsenic results exceeding residential SSLs, but all other inorganic and organic chemical results from those samples were below SSLs, and all the radionuclide results from those samples were below residential SALs (LANL 2010ll). One of three confirmation samples from enclosure 1 had plutonium-239/240 results that exceeded residential SALs; thus additional excavation was conducted and four additional confirmation samples were collected at various depths within that grid cell. None of the subsequent results exceeded the residential SSLs or SALs (LANL 2010ll). The SAL for plutonium-239/240 was also exceeded in the one confirmation sample collected from the bottom of the trench in enclosure 2. No additional tuff removal is planned because excavation in that trench has reached a depth at which continued excavation is impractical (LANL 2010ll). Three confirmation samples were collected from the trench in enclosure 7. The SAL for plutonium-239/240 was exceeded in the sample collected from the bottom of the enclosure 7 trench; excavation will continue to deeper levels (LANL 2010kk). No other confirmation sample results exceeded SSLs or SALs. No confirmation samples have been collected from the trench in enclosure 12 to date.

Air sampling along the northern boundary of MDA B indicated a maximum dose of 0.9 mrem to the public for 2010. These measurements are significantly lower than the EPA air pathway limit of 10 mrem per year.

E. QUALITY ASSURANCE PROGRAM

1. Quality Assurance Program Development

The EP Directorate's quality assurance objectives are to perform work in a quality manner while minimizing potential hazards to the environment, public, and workers. All work is performed by using approved instructions, procedures, and other appropriate means that implement regulatory or contractual requirements for technical standards, administrative controls, and other hazard controls. The LANL Quality Management Plan establishes the principles, requirements, and practices necessary to implement an effective quality assurance program.

The use of a graded approach in accordance with DOE Order 414.1C determines the scope, depth, and rigor of implementing the quality assurance criteria for a specific activity. Activities are managed through systems that are commensurate with the quality requirements, risk, and hazards involved in the activity. Such a selective approach allows the Laboratory to apply extensive controls to certain elements of activities and limited controls to others. The control measures applied to any particular activity are covered in documents such as procedures, statements of work, project-specific work plans, and procurement contracts associated with the activity.

2. Field Sampling Quality Assurance

Overall quality of sample collection activities is maintained through the rigorous use of carefully documented procedures that govern all aspects of these activities. These procedures are reviewed on a regular basis and updated as required to ensure up-to-date processes are used.

Soil, water, vapor, and biota samples are (1) collected under common EPA chain-of-custody procedures using field notebooks and sample collection logs and (2) prepared and stored in certified pre-cleaned sampling containers in a secure and clean area for shipment. The Laboratory delivers samples to analytical laboratories under full chain-of-custody, including secure FedEx shipment to all external vendors, and tracks the samples at all stages of their collection and analysis.

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A. INTRODUCTION

Subsurface vapor (pore gas) monitoring is currently implemented as part of corrective action investigations at Los Alamos National Laboratory (LANL). Vapor monitoring is conducted beneath and surrounding several historic material disposal areas (MDAs) at the Laboratory. The data collected from vapor monitoring wells is used to help characterize the nature and extent of volatile organic compounds (VOCs) and tritium in the vadose zone. Analysis of pore gas also assists in evaluating whether VOCs and tritium may be a potential threat to the groundwater.

Periodic monitoring of pore gas was required in 2010 by the New Mexico Environment Department (NMED) Order on Consent (Consent Order) at MDAs H, G, L, T, and V (Figure 10-1). The results of the pore gas sampling are provided in periodic monitoring reports (PMRs) submitted to the NMED on a quarterly or annual basis as required by the Consent Order. In addition, pore gas monitoring was conducted at MDA C for investigation purposes (Figure 10-1). The analytical data are also available on the online Risk Analysis, Communication, Evaluation and Reduction (RACER) Data Analysis Tool (http://www.racernm.com) and the Los Alamos National Laboratory's electronic public reading room (http://eprr.lanl.gov/oppie/service).

Because no regulatory criteria currently exist for vapor-phase contaminants in soil, LANL evaluates VOC pore gas data for the potential to contaminate groundwater above standards. A Tier I screening analysis is routinely presented in the vapor PMRs; the analysis evaluates the pore water concentration that would be in equilibrium with the maximum pore gas concentration of each VOC detected at a given site. The equilibrium relationship between pore gas and water concentrations is explained in the various PMRs for vapor sampling (LANL 2010a; LANL 2010b; LANL 2011c). The Tier I screening value (SV) is the ratio of the measured VOC pore gas concentration to the concentration corresponding to that VOC's groundwater standard; if the SV exceeds 1, the VOC may have the potential to impact groundwater. This Tier I screening process yields conservative SVs because the maximum vapor concentrations are located in the unsaturated zone several hundred feet above the regional groundwater at each of the MDAs. In addition, the screening evaluation does not account for aquifer dilution.

In the Corrective Measures Evaluation (CME) reports for MDAs G and L, a Tier II screening process was developed (LANL 2010d; LANL 2010e). The Tier II screening accounts for migration of VOCs through the unsaturated zone to the regional aquifer and subsequent dilution within the aquifer to provide a more realistic estimate of the potential impact that the vapor plume may ultimately have on groundwater. The calculated groundwater concentrations are compared with groundwater standards to produce a more realistic prediction of the potential for the vapor-phase VOCs to impact groundwater. Additional analysis was included in the CME reports for those constituents that exceeded the Tier II screening limits.

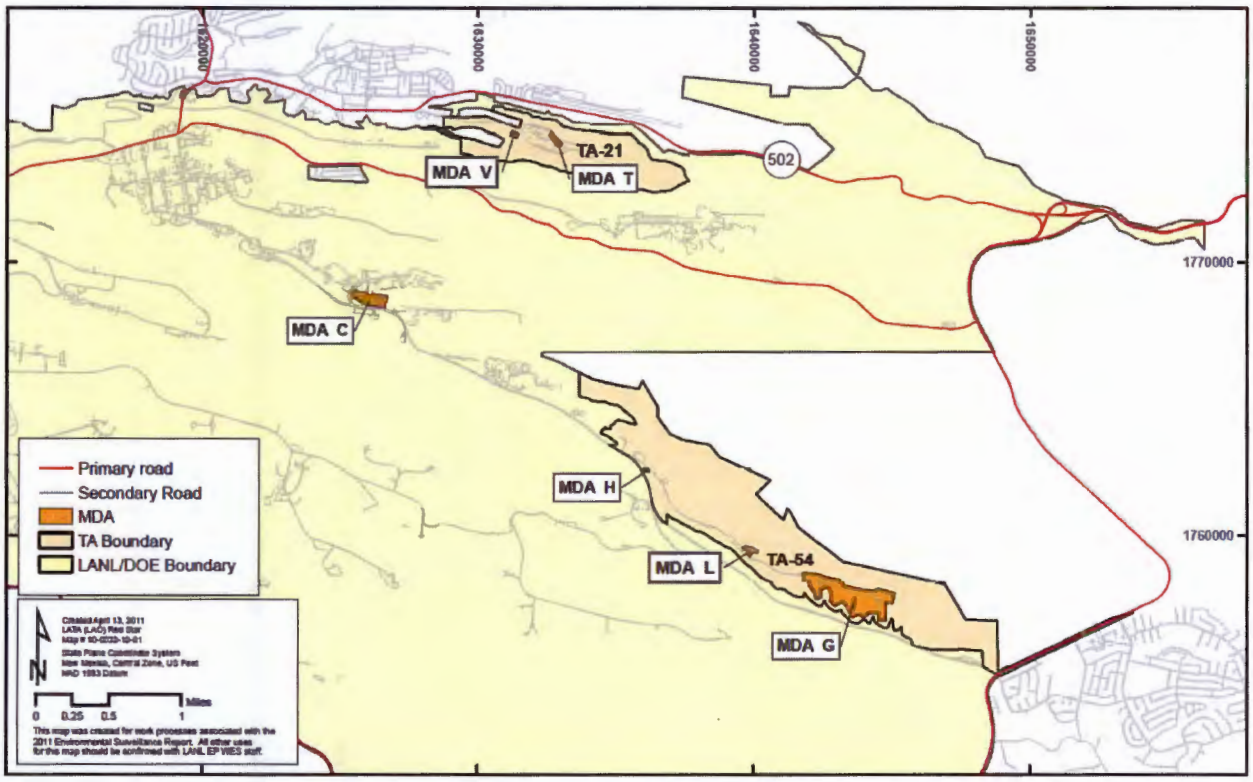

Figure 10-1 Location of MDAs where subsurface vapor monitoring was performed in 2010

B. FIELD SCREENING AND SAMPLING

Vapor monitoring during 2010 consisted of field screening and sample collection. Field screening included purging a specific sample interval, isolated at depth, within a vapor monitoring well with a gas monitor until pore gas concentrations stabilize, signifying that subsurface air was being collected. In addition to purging, VOC field screening included obtaining field measurements of organic vapors using a photoionization detector at MDAs H, L and G. A Breül and Krajer multi-gas analyzer was also used at MDA L and G that estimated several VOC concentrations at more wells and depths than were sampled and submitted for laboratory analysis.

Sample collection was carried out using one of three different sampling systems. VOC and tritium samples were collected with stainless steel tubing, down-hole packers, or a Flexible Liner Underground Technologies (FLUTe) sampling system. Each system is capable of isolating a specific depth interval from which pore gas is collected by applying a vacuum at the receiving end. VOC samples were collected in "SUMMA" canisters that capture and contain the air sample for transport to the analytical laboratory for analysis. Tritium samples were obtained by capturing subsurface water vapor in silica gel cartridges.

The analytical laboratory analyzed vapor samples according to U.S. Environmental Protection Agency (EPA) Method TO-15 for VOCs and EPA Method 906.0 for tritium.

C. FACILITY MONITORING

Table 10-1 includes the number of vapor monitoring wells, number of depth intervals sampled and/or field screened, type of sampling systems implemented, and the depth to groundwater at each MDA during the 2010 monitoring period. Vapor-monitoring wells and sampled depth intervals are determined by NMED-approved work plans.

Table 10-1
Vapor Monitoring Locations

Material Disposal Area	Number of Vapor Monitoring Wells	Number of Sampling Intervals	Type of Sampling System[a]	Approximate Depth to Groundwater[b] (ft bgs)
C	14	129	F/SS	1,182
G	21	39	SS/P	930
H	4	28	SS	1,040
L	25	86	SS/P	950
T	5	34	SS	1,300
V	1	9	SS/P	1,300

[a] SS = stainless steel, P = Packer, F = FLUTe

[b] Based on nearest groundwater monitoring well

VOC and tritium data analyses are discussed below and in other Laboratory reports available on the LANL public Website (http://www.lanl.gov/environment/all/reports.shtml/).

D. ANALYTIC DATA COMPARISON AND TRENDS

At MDAs G, H, and L vapor monitoring has been required for several years, and consequently a large data set exists. The data provide information on the nature and extent of subsurface VOC and tritium contamination. In 2010, contour views of the VOC vapor plumes under MDAs G and L were developed as part of the CME reports (LANL 2010d; LANL 2010e). At MDAs T and V, preliminary plots help to determine data trends. Data collection at MDA C has recently started; however, no comparison or trending was completed in 2010. Analyses of the data will be included in the Phase III investigation report for MDA C to be submitted to NMED in June 2011. Table 10-2 lists the VOCs for which the SVs exceeded 1 during 2010 for MDAs G, L, and T using the Tier I screening analysis. The maximum Tier I SVs calculated for these VOCs are also listed. Table 10-2 also indicates the VOCs at MDAs G and L that exceeded the more realistic Tier II screening analyses performed in the CME reports. SVs were not exceeded for VOCs at MDA H in 2010. Only tritium samples were collected at MDA V; thus, the Tier I screening evaluation does not apply.

Table 10-2
VOCs that Exceeded Tier I and Tier II Screening Values during 2010

Location	VOC	Maximum Pore Gas Concentration (µg/m³)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard (µg/m³)	Tier I Screening Value (unitless)
MDA G	Dichloroethane[1,1-]	35,000	5,750	6.1
	Dichloroethane[1,2-]	340	240	1.4
	Dichloroethene[1,1-]*	33,000	5,500	6
	Dichloroethene[cis-1,2-]	46,000	11,900	3.9
	Methylene chloride	1,900	650	2.9
	PCE*	220,000	3,600	61
	1,1,1-TCA*	720,000	42,300	17
	1,1,2-TCA	600	170	3.5
	TCE*	1,600,000	2,000	800

Table 10-2 (continued)

Location	VOC	Maximum Pore Gas Concentration (µg/m³)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard (µg/m³)	Tier I Screening Value (unitless)
MDA L	Benzene	4,400	1,140	3.86
	Carbon tetrachloride	19,000	5,500	3.45
	Chloroform	82,000	15,000	5.47
	Dichloroethane [1,1-]	94,000	5,750	16.4
	Dichloroethane [1,2-]*	740,000	240	3,083
	Dichloroethene [1,1-]*	130,000	5,500	23.6
	Dichloropropane [1,2-]*	400,000	600	666
	Dioxane [1,4-]	6,700	12.2	548
	Methylene chloride*	240,000	650	369
	PCE*	780,000	3,600	217
	1,1,1-TCA*	3,900,000	42,300	92.2
	1,1,2-TCA	2,100	170	12.4
	TCE*	1,300,000	2,000	650
MDA T	Methylene chloride	3,100	650	4.77
	PCE	3,700	3,600	1.03
	1,1,2-TCA	240	170	1.41

*Denotes the VOC exceeded the Tier II screening limits; analysis performed for MDAs G and L only.

Mass estimates of VOCs were also calculated for the CMEs at MDA G, H, and L in 2010 (LANL 2010d; LANL 2010e; LANL 2010f). The data used for these calculations are from 2009 and 2010. The following sections summarize these data as well as discuss data trends and comparisons.

1. MDA G

Figure 10-2 illustrates the 20 vapor monitoring wells sampled at MDA G during 2010. MDA G is currently sampled on an annual basis. Subsurface vapor monitoring data has been collected since 1985. Vapor monitoring data collected indicate VOCs are present in the subsurface. The screening evaluation identified nine VOCs above a Tier I SV of 1 and four VOCs that exceeded the more realistic Tier II screening limits at MDA G in 2010 (Table 10-2).

Trichloroethane-1,1,1 (TCA) and trichloroethene (TCE) are two VOCs of particular interest due to the consistency in detected concentrations and because their concentrations consistently exceed Tier II screening limits. As part of the MDA G CME (LANL 2010d) submitted to NMED in November 2010, contour views of the VOC plumes for both TCA and TCE were interpolated and are presented in Figures 10-3 and 10-4, respectively. These plots are based on data collected in August and September, 2009, because the 2010 data were not yet available for that evaluation. The extent of each VOC plume is defined by contour lines that represent multiples of (10 to 30 times) the TCA and TCE Tier I screening levels of 42,3000 µg/m³ and 2,000 µg/m³, respectively (Table 10-2). These contour lines reflect the extent of the different plumes in terms of their potential risk to groundwater rather than as absolute concentrations. An east-west cross section was developed for the same contaminants and presented in Figures 10-3 and 10-4. The concentration contours identified two plumes for TCA and three plumes for TCE at MDA G. The plumes are associated with disposal pits and shafts that contain wastes where VOCs are a secondary component of the waste, rather than a primary waste form. These areas are considered to be potentially ongoing sources of VOC vapors.

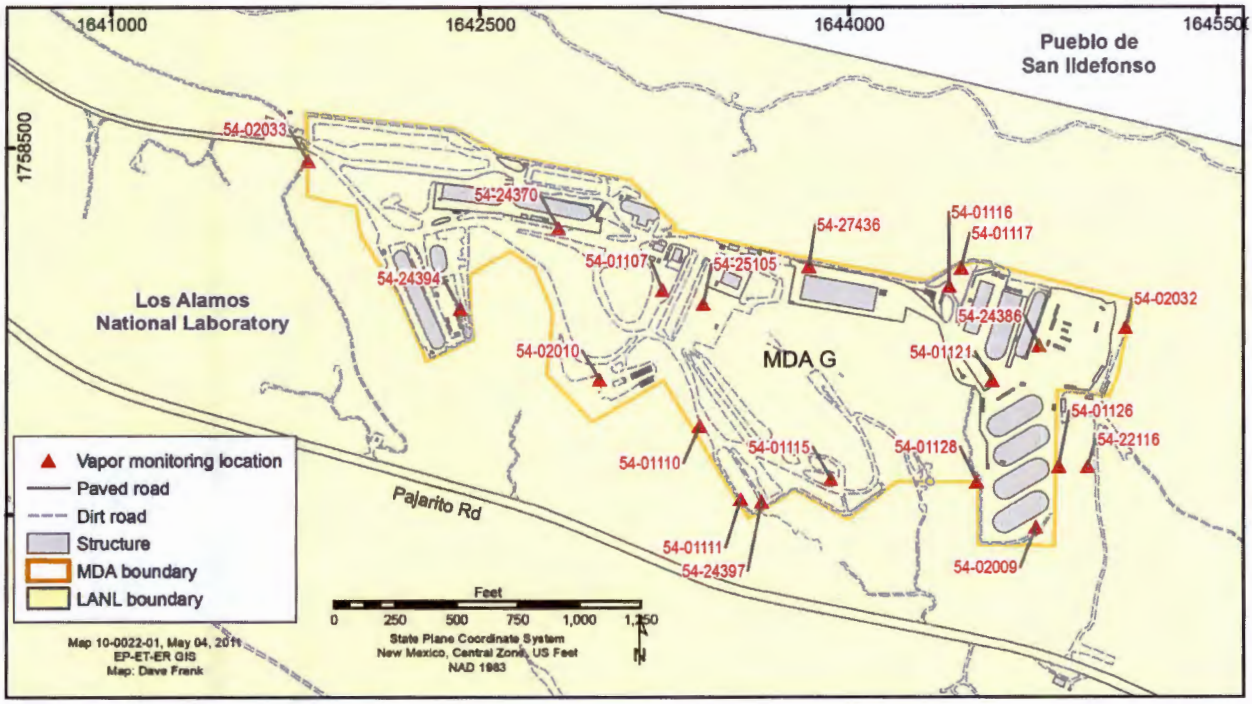

Figure 10-2 MDA G vapor monitoring wells

The estimated masses of TCA and TCE are 210 kg and 79 kg, respectively (LANL 2010g). These estimates are for mass contained within the areas defined by 10 times the respective Tier I SVs. These estimates account for mass in the vapor phase, dissolved phase, and adsorbed to solids. The analysis indicates the majority of the mass to be TCA. In addition, most of the mass is contained within the Bandelier Tuff as indicated by the vertical extent shown in Figures 10-3 and 10-4. However, there is uncertainty related to the long-term transport of VOC vapors to groundwater through the fractured basalts that are present beneath the tuff units at MDA G, and therefore, corrective measures related to VOCs were recommended as a precautionary measure in the MDA G CME (LANL 2010g).

Tritium activity is also detected in vapor samples collected at MDA G. MDA G contains the highest detected tritium activities in pore gas observed at Laboratory with a maximum in 2010 of 486,635,000 pCi/L. Reported activities have been similar during each annual sampling event, and the greatest activities are consistently reported in vapor monitoring well 54-01111 (Figure 10-2), which is located near the tritium disposal shafts in the south-central portion of MDA G.

2. MDA H

Figure 10-5 illustrates the four vapor monitoring wells sampled at MDA H during 2010. Vapor monitoring is currently conducted on a quarterly basis at MDA H. Subsurface vapor monitoring data has been collected since 2005. Vapor monitoring data indicate that VOC concentrations are low and frequently reported as not detected. No VOC concentrations exceeded Tier I screening values during 2010.

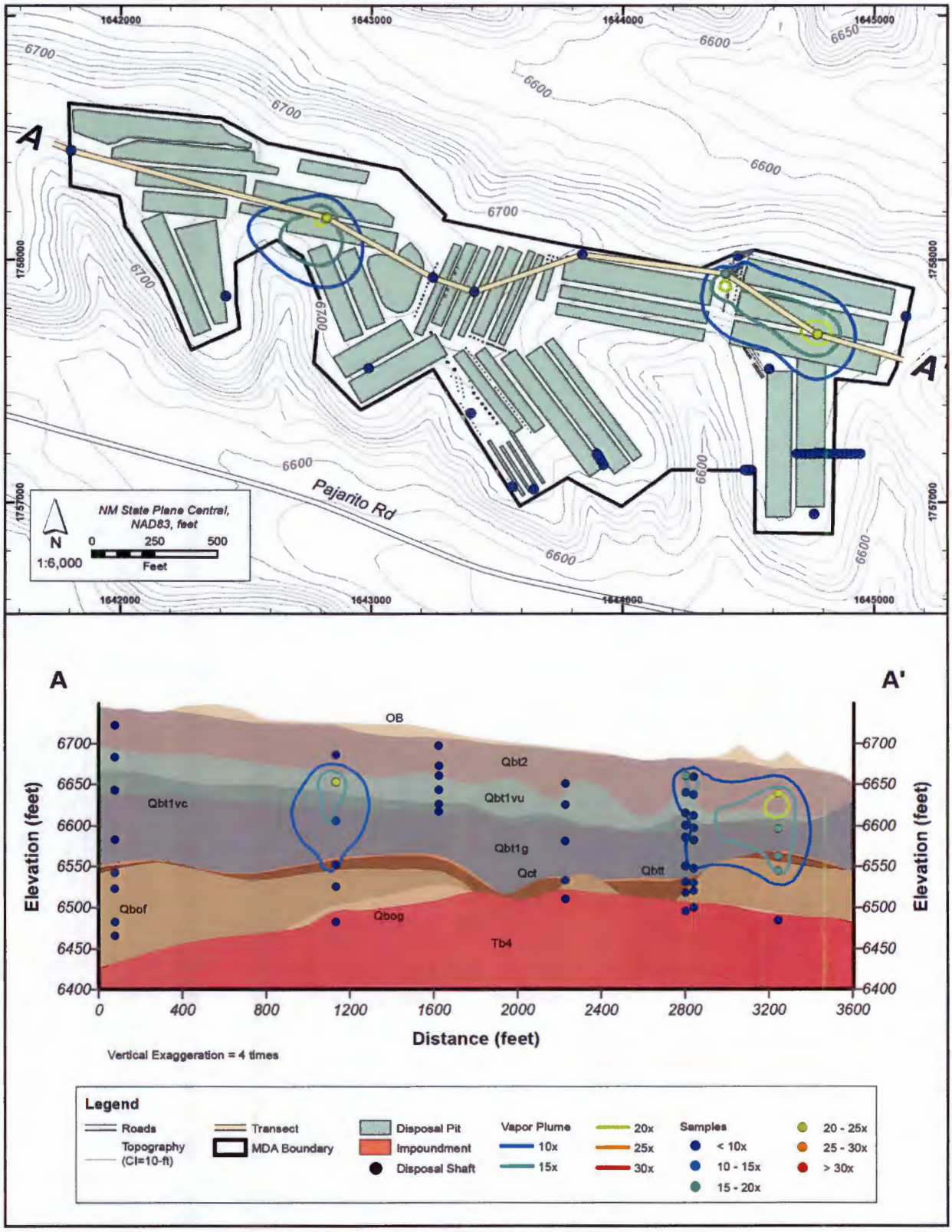

Figure 10-3 **Interpolated vapor plumes with cross section at MDA G for 1,1,1-TCA, based on 2009 data. Contour lines show concentration levels that are multiples of (10 to 30 times) the 1,1,1-TCA screening concentration.**

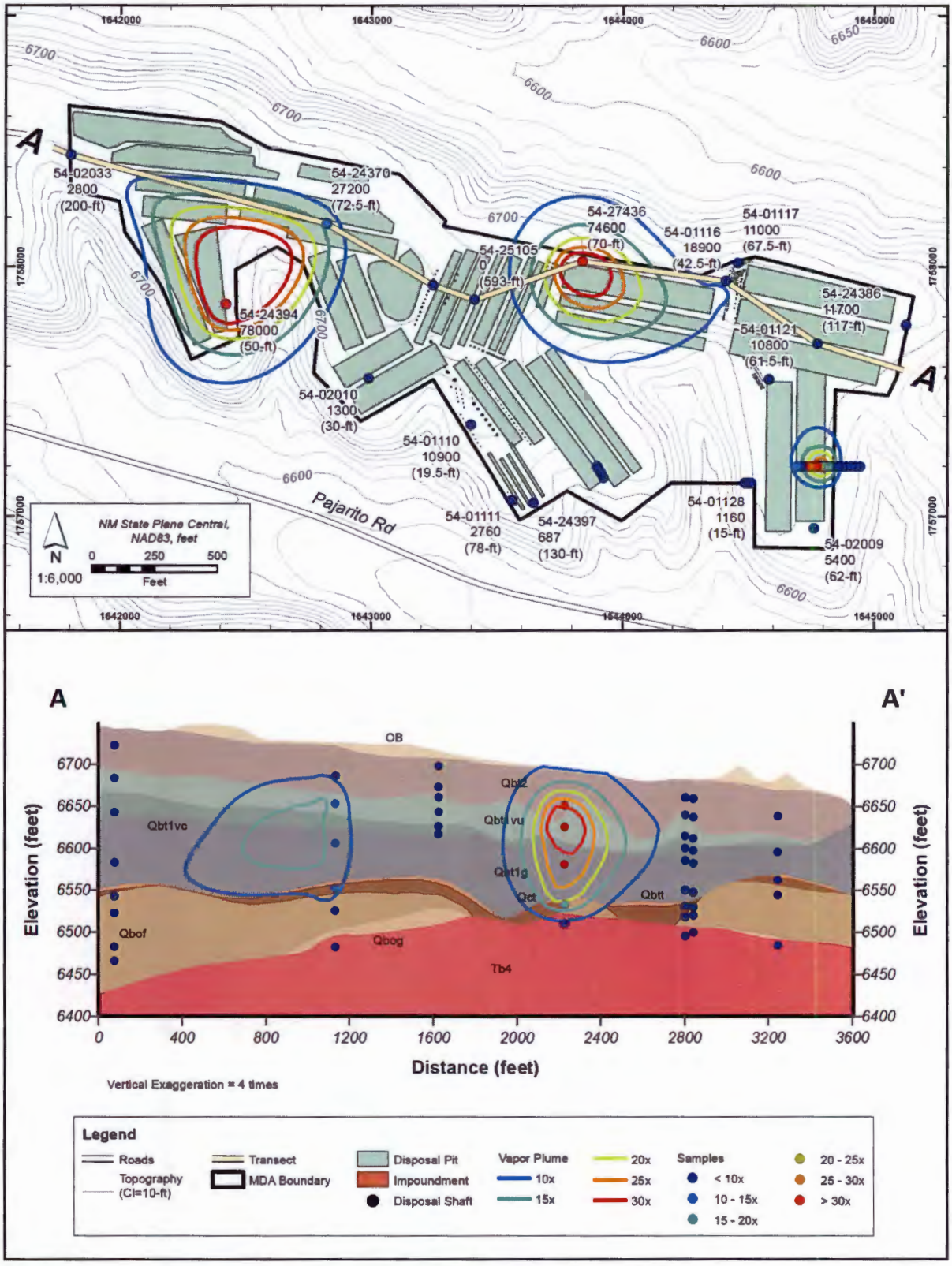

Figure 10-4 **Interpolated vapor plumes with cross section at MDA G for TCE, based on 2009 data. Contour lines show concentration levels that are multiples of (10 to 30 times) the TCE screening concentration.**

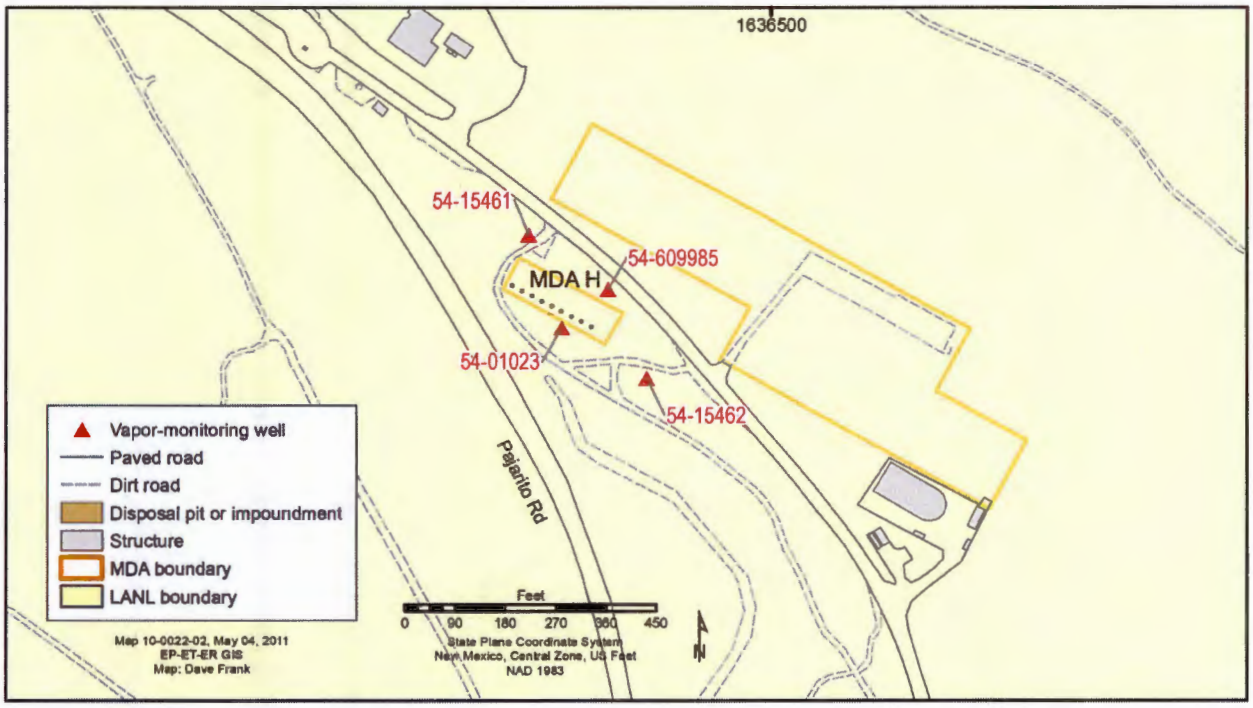

Figure 10-5 MDA H vapor monitoring wells

The MDA H CME (LANL 2010f) was submitted to NMED in December 2010. No VOC plume contours were created because reported VOC concentrations were very low or not detected, and no appreciable plume could be interpolated. Bulk estimates of VOC masses, however, were calculated based on an estimated volume of subsurface soil. The estimates were used to quantify the mass in the vapor phase, dissolved phase, and adsorbed to solids. The total VOC mass for all constituents detected at MDA H during vapor monitoring is estimated to be less than 2 kg; most of this mass is associated with alcohols and ketones (e.g., butanol and acetone) (LANL 2010f). Halogenated VOCs (e.g., TCA and TCE), which are generally of the most concern because of their potential to contaminate groundwater, comprise less than 5% of the total estimated mass (approximately 0.1 kg). This low estimate is consistent with the known sources of VOCs at MDA H, which does not include bulk chemical wastes. Based on the CME, VOCs measured in subsurface vapor at MDA H do not pose a potential threat to groundwater (LANL 2010f).

Tritium activity is also detected in vapor samples collected at MDA H. Reported activities are similar for each sampling event, and the greatest activities are consistently reported in vapor monitoring well 54-01023. The maximum activity reported during 2010 was 5,070,000 pCi/L in vapor monitoring well 54-01023.

3. MDA L

Figure 10-6 illustrates the 25 vapor monitoring wells sampled at MDA L during 2010. Vapor monitoring is currently conducted on a quarterly basis at MDA L. Subsurface vapor monitoring data has been collected since 1985. Vapor monitoring data show that MDA L contains the highest concentrations of VOCs in pore gas at the Laboratory. The screening evaluation identified 13 VOCs that exceeded a Tier I SV of 1 during 2010 and seven VOCs that exceeded the Tier II screening limits (Table 10-2). During 2010, six VOCs (1,2-dichloroethane, 1,2-dichloropropane, methylene chloride, tetrachloroethene [PCE], TCA, and TCE) were of particular interest due to the consistency in detected concentrations over time and because concentrations exceed Tier II limits. Vapor concentration data for each of the six VOCs were interpolated and are presented as contour plots in Figure 10-7 (LANL 2010e). The contour lines represent multiples of (50 times or 100 times) each constituent's Tier I screening level (see column 4 in Table 10-2 for the Tier I vapor screening level concentration of each VOC). These contour lines reflect the extent of the different plumes in terms of its potential risk to groundwater rather than as an absolute concentration. An east-west cross section for the

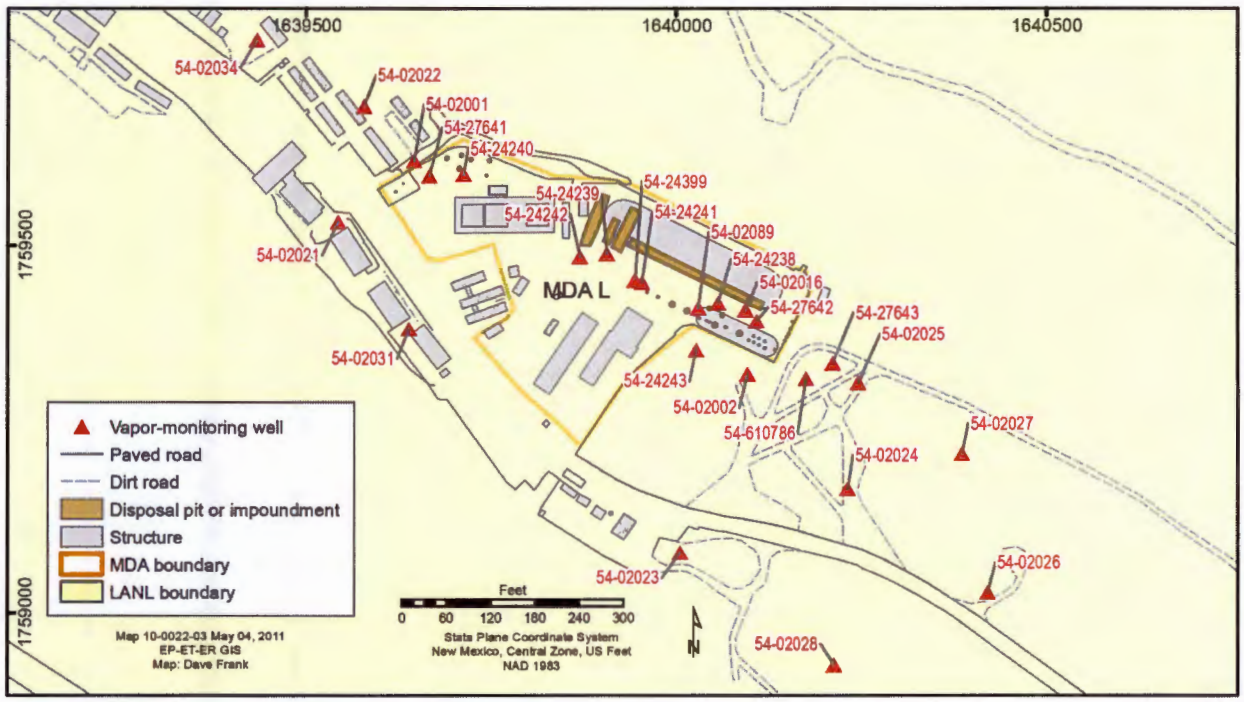

Figure 10-6 MDA L vapor monitoring wells

same VOCs is also presented in Figure 10-7. This cross section illustrates that the plumes are located within the upper 200 ft bgs; the regional aquifer is well below the plume at approximately 950 ft bgs. TCA and 1, 2-dichloroethane have the greatest lateral extent based on concentration contours representing 100 times their respective SVs (Figures 10-7). Additional information on the methodology used to develop contour views is available in Appendix B of the MDA L CME (LANL 2010e).

Mass estimates were calculated for TCA and TCE as part of the 2010 CME. The estimated masses of TCA and TCE are 428 kg and 245 kg, respectively. These two constituents are the dominant VOCs within the vapor plume at MDA L, making up more than 75% of the plume. Mass estimates were not calculated for the other four VOCs of interest. The estimated TCA and TCE contaminant masses are contained within areas defined by 10 times their respective SVs. Data for the TCA vapor plume at MDA L has been studied for over a decade, and the extent and concentrations within the plume are quite stable (Stauffer et al., 2005). However, because VOC concentrations substantially exceed Tier II screening limits at MDA L and because there is some uncertainty related to the transport of these vapors through the fractured basalts that are present beneath the tuff units at MDA L toward groundwater, corrective actions related to VOCs were recommended as a precautionary measure in the MDA L CME (LANL, 2010e).

Reported tritium activities in vapor samples collected at MDA L during 2010 were similar to previous year's data. Tritium is detected at various shallow depths in several vapor monitoring wells; however, most activities are relatively low compared to other sites (< 10,000 pCi/L). The highest tritium activities reported are in vapor monitoring well 54-24243 with a maximum activity reported in 2010 of 478,830 pCi/L.

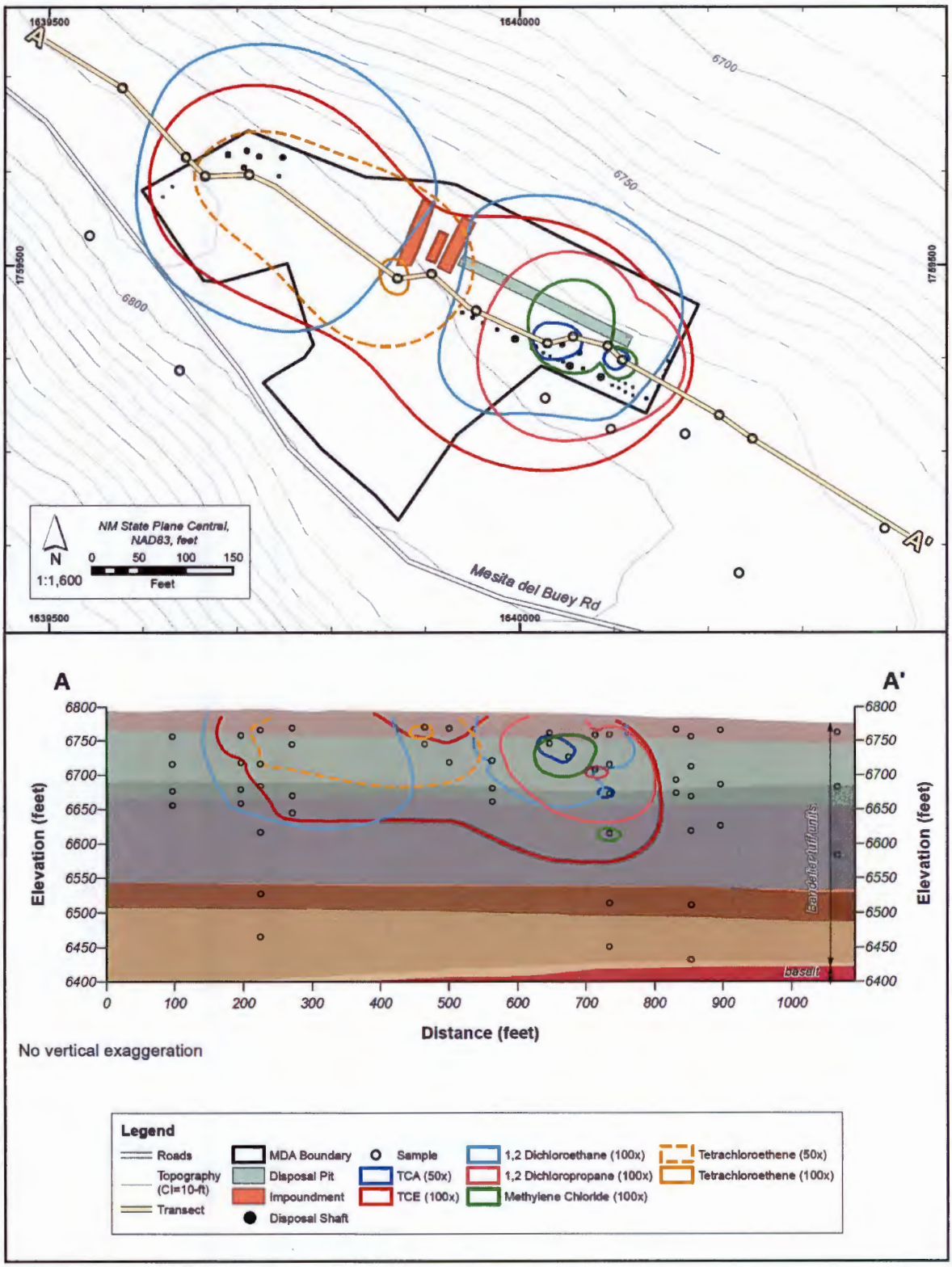

Figure 10-7 **Extent of VOC plume thresholds with cross section within the Bandelier Tuff at MDA L. VOCs include 1,2-dichloroethane; 1,2-dichloropropane; methylene chloride; PCE; TCA; and TCE. Contour lines show concentration levels that are multiples of (50 times or 100 times) each constituent's Tier I screening level.**

4. MDA T

Figure 10-8 illustrates the five vapor monitoring wells sampled at MDA T during 2010. Vapor monitoring is currently conducted on a quarterly basis at MDA T. Vapor monitoring data indicate that VOCs are present in the subsurface at MDA T. Three VOCs (methylene chloride, PCE, and 1,1,2-trichloroethane) exceed the Tier I screening values during 2010 (Table 10-2). PCE exceeds a Tier I SV of 1 in only one sample during 2010 while methylene chloride and 1,1,2-trichloroethane both exceeded an SV of 1 several times. The greatest Tier I SV reported at MDA T during 2010 was for methylene chloride with an SV of 4.77 (Table 10-2). Plots of concentrations versus depth are presented in the quarterly PMRs for the deeper vapor monitoring wells (locations 21-25262 and 21-607955) at MDA T to assist in evaluating trends. Plots for methylene chloride are presented in Figure 10-9. These plots indicate that methylene chloride concentrations consistently peak at a single depth; approximately 356 ft bgs in vapor monitoring well 21-607955 and 575 ft bgs in vapor monitoring well 21-25262. The data also indicate that concentrations decrease with depth. Current vapor data do not indicate a potential threat to groundwater; however, additional detailed data analysis and a Tier II screening analysis will be presented for the MDA T CME report.

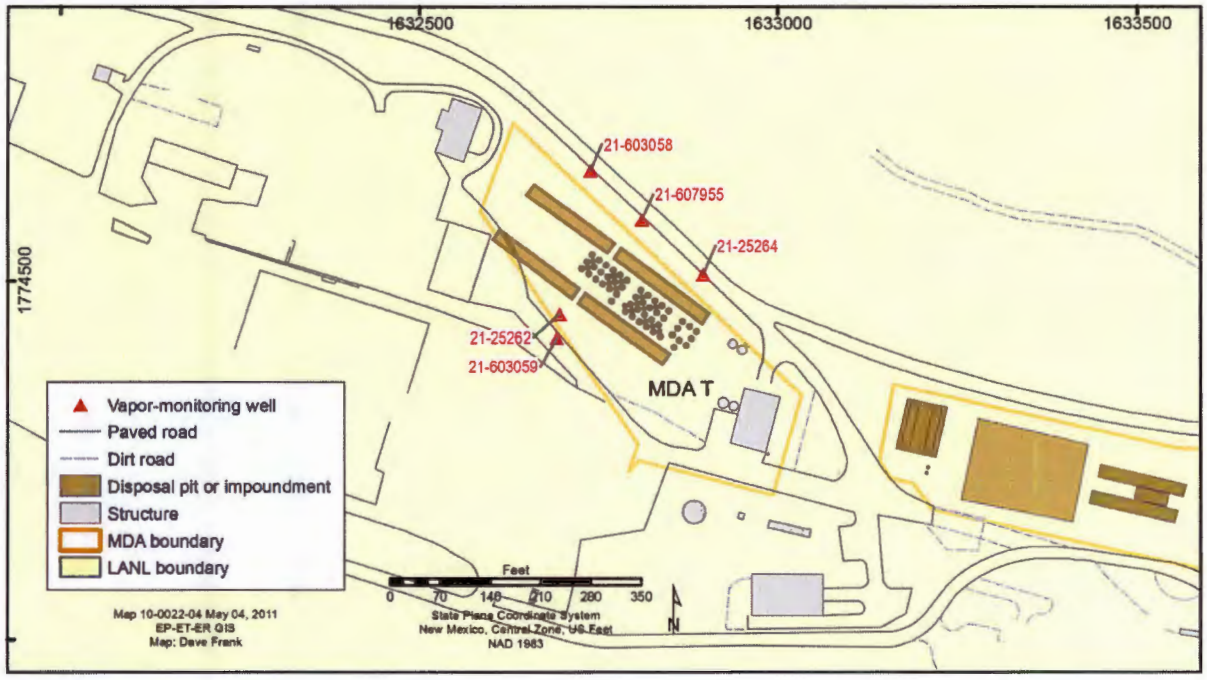

Figure 10-8 MDA T vapor monitoring wells

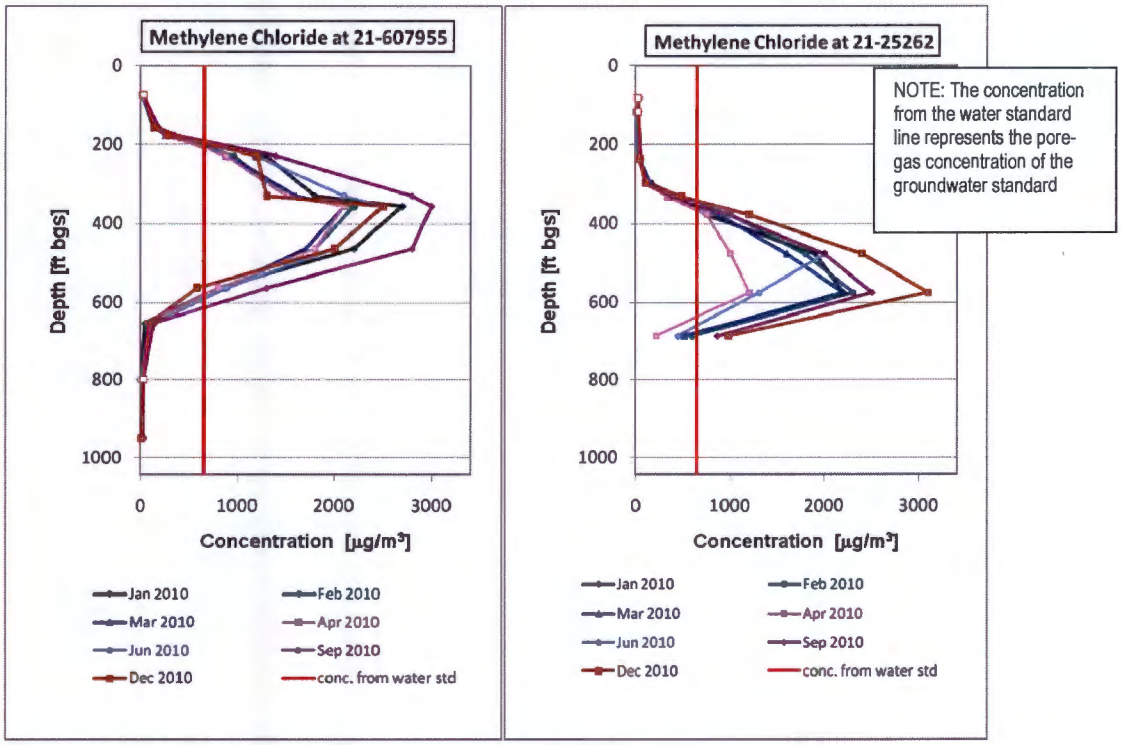

Figure 10-9 Vertical profiles of methylene chloride in vapor-monitoring wells 21-607955 and 21-25262 at MDA T

Tritium activity is detected in vapor samples collected at MDA T. Reported activities from each sampling event are similar, and the greatest activities are consistently reported in vapor monitoring well 21-25264. The maximum activity reported during 2010 was 191,460 pCi/L in vapor monitoring well 21-25264. Like methylene chloride, tritium activity peaks at a single depth (378 ft bgs) in vapor monitoring well 21-25262. In vapor monitoring well 21-607955, tritium activity generally peaks at a shallower depth of 156 ft bgs (Figure 10-10). Tritium data will be evaluated further in the MDA T CME report. In addition, results of monitoring for VOCs and tritium in nearby groundwater wells will be included in the CME report.

5. MDA V

LANL completed characterization and remediation activities at MDA V in 2005 related to potential contamination from both hazardous and radioactive chemicals. The activities included the removal of the absorption beds and contaminated soil. However, the extent of tritium in pore gas was not determined during characterization, thus continued monitoring for tritium in pore gas was required. A two part deep vapor monitoring well, 21-24524W and 21-24524S, collectively known as well 21-24524, were completed to assist in defining extent, and vapor monitoring has been ongoing for three years. Figure 10-11 illustrates the two wells sampled at MDA V and indicates where the absorption beds once existed. Figure 10-12 illustrates the last four quarters of tritium activity in pore gas in monitoring well 21-24524. The plot shows a consistent, prominent peak activity near 300 ft bgs. This peak may be attributed to the subsurface geologic feature known as the Tsankawi pumice bed. The higher permeability and porosity and lack of fractures in this bed compared with the units in the upper unsaturated zone may have created an effective geologic control on the downward transport of liquid following disposal operations at MDA V (LANL, 2011h).

Vapor monitoring for tritium continues on a quarterly basis. LANL requested and received certificates of completion from NMED for MDA V in 2010. Subsurface vapor monitoring is schedule to continue on a quarterly basis at vapor monitoring well 21-24524 until remediation activities are completed at nearby MDA B.

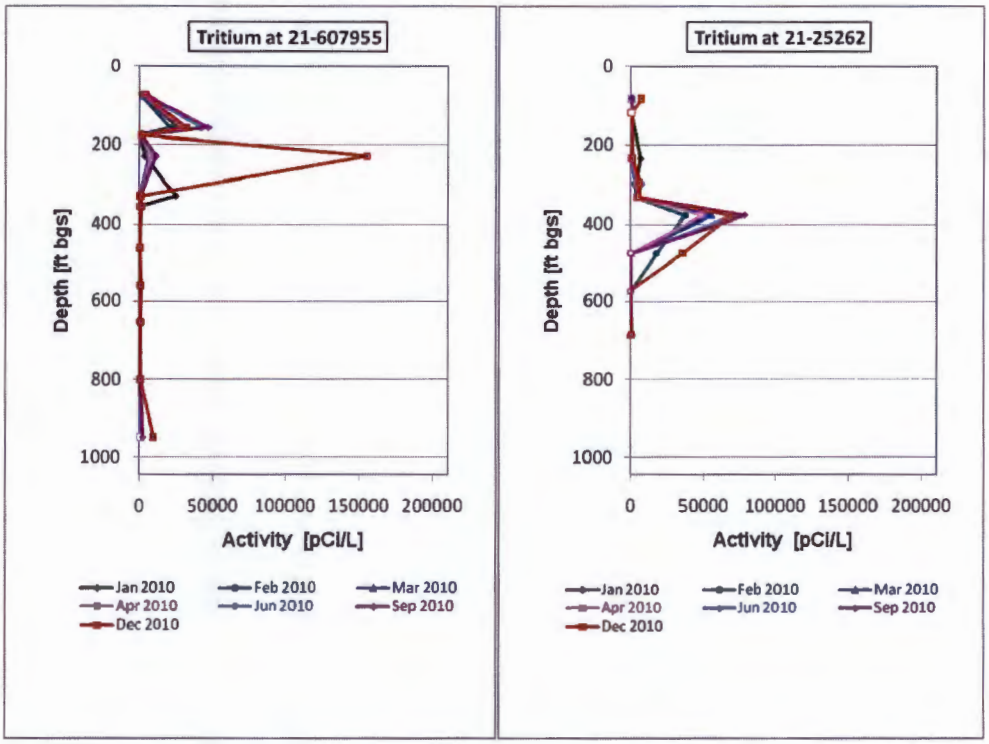

Figure 10-10 Vertical profiles of tritium in vapor-monitoring wells 21-607955 and 21-25262 at MDA T

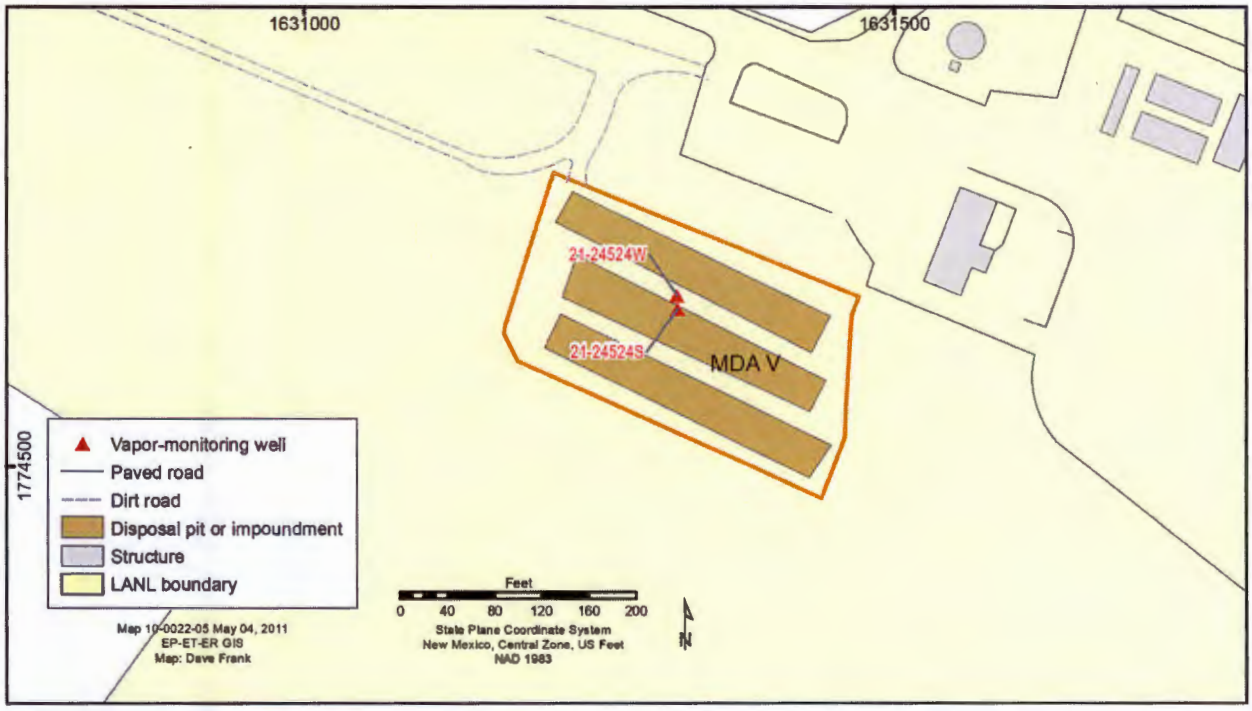

Figure 10-11 MDA V vapor monitoring wells

E. SUMMARY

Vapor (pore gas) monitoring is an important method for evaluating subsurface contamination of VOCs and tritium. Monitoring data has been used to determine the nature and extent of VOCs and the associated vapor plumes as well as to estimate masses of VOCs in the vadose zone. Similarly, monitoring data has been used to help determine the nature and extent of tritium contamination. These data have assisted in determining whether corrective measures are warranted at MDAs L and G to decrease subsurface vapor concentrations. In addition, analysis of subsurface VOC data from MDAs H and T indicate that VOCs do not pose a potential threat to groundwater; however, additional detailed data analyses will be presented for MDA T in the CME report. Because corrective actions have been completed at MDA V, LANL will request corrective action complete without controls for this site.

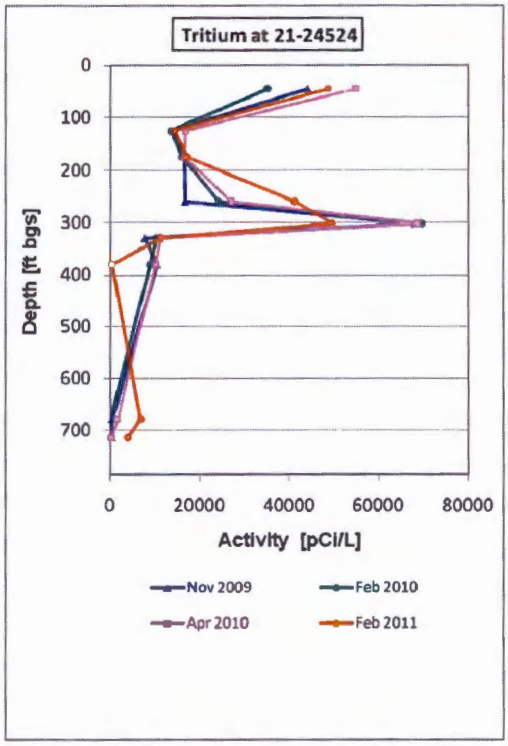

Figure 10-12 **Vertical profile of tritium vapor-port samples from vapor-monitoring wells 21-24524 and 21-24524S**

F. REFERENCES

LANL 2010a: "Periodic Monitoring Report for Vapor-Sampling Activities at Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Fourth Quarter Fiscal Year 2010," Los Alamos National Laboratory document LA-UR-10-7589 (November 2010).

LANL 2010b: "Sampling Activities at Material Disposal Area L, Solid Waste Management Unit 54-006, at Technical Area 54, Fourth Quarter Fiscal Year 2010," Los Alamos National Laboratory document LA-UR-10-8098 (2010).

LANL 2011c: "Sampling Activities at Material Disposal Area T, Consolidated Unit 21-016(a)-99, at Technical Area 21, July to September 2010," Los Alamos National Laboratory document LA-UR-11-0396 (2011).

LANL 2010d: "Corrective Measures Evaluation Report for Material Disposal Area G at Technical Area 54," Los Alamos National Laboratory document LA-UR-10-7868 (November 2010).

LANL 2010e: "Corrective Measures Evaluation Report for Material Disposal Area L at Technical Area 54," Los Alamos National Laboratory document LA-UR-10-6506 (2010).

LANL 2010f: "Corrective Measures Evaluation Report for Material Disposal Area H at Technical Area 54," Los Alamos National Laboratory document LA-UR-10-8097 (December 2010)

LANL 2010g: "Report for Supplemental Soil-Vapor Extraction Pilot Test at Material Disposal Area G, Technical Area 54," Los Alamos National Laboratory document LA-UR-10-3409 (May 2010)

LANL 2011h: "Supplemental Tritium Report for Material Disposal Area V," Los Alamos National Laboratory document LA-UR-11-8366 (January 2011)

Stauffer, P.H., K.H. Birdsell, M.S. Witkowski, and J.K. Hopkins, 2005. "Vadose Zone Transport of 1,1,1-Trichloroethane: Conceptual Model Validation through Numerical Simulation," *Vadose Zone Journal*, Vol. 4, pp. 760–773. (Stauffer et al. 2005, 090537)

A. INTRODUCTION

The 2010 environmental sampling incorporated a graded approach to quality assurance (QA) in accordance with DOE Order 414.1C, which determines the scope, depth, and rigor of implementing the QA criteria for a specific activity. To maximize effective resource use, this process promotes the selective application of QA and management controls based on the quality requirements, risk, and hazards associated with each activity. In this chapter, we present the analytical laboratories quality performance of LANL environmental data across all media. Overall, our analytical laboratories' performance meets our high quality standards.

All sampling, data reviews, and data package validations are conducted using standard operating procedures (SOPs), which are part of LANL's comprehensive QA program. The LANL quality program and SOPs may be viewed at http://www.lanl.gov/environment/all/qa.shtml. Completed chain-of-custody forms serve as the analytical request form and include the requester or owner, sample number, program code, date and time of sample collection, total number of bottles, list of analytes to be measured, bottle sizes, and preservatives for each analysis requested.

All analytical laboratory results undergo validation following the guidelines in the National Nuclear Security Administration (NNSA) Model Data Validation Procedure (NNSA 2006) and US EPA Contract Laboratory Program National Functional Guidelines for Data Review (EPA 2004, EPA 2005, EPA 2008). This process includes review of the data quality and the documentation's correctness and completeness. An independent DOE contractor, Analytical Quality Associates, Inc. (AQA), in Albuquerque, NM, performs the data validation and applies data qualifiers to the data according to LANL validation SOPs.

Field QA procedures and the quality plan documents were followed during 2010 sampling. Together, these plans and procedures describe or prescribe all the planned and systematic activities necessary to provide adequate confidence that sampling processes are performed satisfactorily.

The LANL data are available as part of the RACER database (http://www.racernm.com/) which contains all the air, surface water, sediment, soils, and groundwater analytical data received from our analytical laboratories. None of the data are censored or removed. If analytical results are inconsistent with prior data, LANL investigates the laboratory records, and the sample may be reanalyzed or the location resampled. Both the initial sample and the follow-up sample analyses are kept in the database and are available to the public. In some cases, comments are appended to the records to indicate existence of recognized analytical issues. The primary documentation of analytical issues for data from a given year is provided in this report.

See Supplemental Table S11-1 for the analytes and analytical methods used for analysis of air, surface water, soil, sediment, and groundwater samples during 2010. Tables S11-2, -3, and -4 present the laboratory qualifier codes, secondary validation flags, and validation reason codes.

B. QUALITY CONTROL FOR SAMPLES, DATA VALIDATION, AND ANALYTICAL RESULTS REVIEW

All samples are analyzed at analytical laboratories authorized by the LANL Analytical Services Statement of Work (SOW) for General Inorganic, Organic, Radiochemical, and Asbestos Analytical Laboratory Service. LANL requires all laboratories to produce legally, defensible data packages, which include the following types of quality control (QC) samples and data: instrument raw data, initial and continuing calibration verifications, method blanks, internal standards, laboratory duplicates, laboratory control samples (LCS), surrogate

samples, tracers, and matrix spike (MS) samples. The results from the laboratory QC samples are used to check the accuracy and precision of the analytical data. Field QC samples are also submitted along with environmental samples so that field and analytical laboratory contamination can be tracked and analytical laboratory performance can be assessed. Field QC samples collected include equipment blanks, field blanks, field duplicates, field trip blanks, and performance evaluation blanks.

LANL verifies and validates all analytical data used to support environmental activities to ensure they are defensible and of known quality. Analytical data packages sent to LANL by the analytical laboratories undergo a secondary validation review by AQA. When documentation or contract-compliance problems are identified during data validation, the analytical laboratory is contacted and attempts to resolve or clarify the related issues are established in Validation Corrective Action Reports submitted by AQA to LANL. The analytical laboratory reissues the corrected, modified documentation for re-validation. The majority of the issues of concern involve minor documentation and typographical errors, missing pages, and clarification of data results. Associated sample results are generally not affected. All 2010 Validation Corrective Action Reports are addressed and resolved appropriately by the analytical laboratory. AQA validated all of the 2010 data packages. Table S11-2 include the qualifiers and validation reason codes used to qualify the 2010 data.

After data validation by AQA, approximately 98% of all results are of good quality and are usable; AQA R-qualified (rejected) approximately 2% of the 2010 data. Overall, approximately 16% of the accepted results are qualified during data validation based on data quality issues such as surrogate, LCS, duplicates, tracer, and MS recoveries that do not meet specification; calibration of internal standards that are not met; or holding times that have expired. Less than 1% of the 2010 data are qualified as not detected (U) based on method blank and/or field blank contamination. The analytical laboratory assigned J qualifiers to approximately 2% of the data, indicating that the results represent a detection, but the value is estimated. The analytical laboratory confirmed 13% of the analytes as detected. Even after validation, 67% of the data are qualified as non-detect with no quality control issues. Table 11-1 displays the overall quality of the 2010 samples.

Table 11-1
Overall Quality of 2010 Samples

Qualifiers Affecting Quality Control	Percent of 2010 Data
U, U_LAB – qualified not detected by lab with No QC issues	67
J, J_LAB – qualified detected between method detection limit (MDL) and estimated quantitation limit (EQL)	2
NQ – Detected above the reporting limit with No QC issues	13
REJECTED in validation	2
Qualified as UJ [estimated non-detect] or J due to quality control issues discover in validation	16

Table 11-2 shows the percentage of data qualified based on AQA's secondary data validation of laboratory QC samples. Two percent of all 2010 data were qualified as Rejected (R).

Table 11-2
Routine Validation Summary for 2010 Data

QC Sample Type	Number of Analytes Qualified as Estimated (J)	Percent 2010 Data
Blanks	3,646	0.29
Holding Times	1,154	0.09
Initial Calibration Verifications or Continuing Calibration Verifications	1,982	0.16
Interference Check Samples	20	0.002
Internal Standards or Surrogates	740	0.06
Laboratory Control Samples	465	0.04
Laboratory Duplicates	3,317	0.27
Matrix Spike Samples	11,942	0.96
Serial Dilutions	228	0.02
Tracers (rad only)	352	0.03
QC Sample Type	**Number of Analytes Qualified as Rejected (R)**	**Percent 2010 Data**
Holding Times	218	0.02
Initial Calibration Verifications or Continuing Calibration Verifications	7,616	0.61
Internal Standards or Surrogates	3,210	0.27
Laboratory Control Samples	516	0.04
Laboratory Duplicates	38	0.003
Matrix Spike Samples	332	0.03
Spectra not match	11,427	0.91
Professional Judgment	50	0.004
Blank rejection	21	0.001

In addition to data validation, in order to determine the overall quality of the reported results, LANL performs data review of analytical results to assess and identify issues with data quality that require action. The data quality issues identified and addressed in 2010 include the following:

- LANL directed AQA to conduct a Data Package Assessment (DPA) for TestAmerica, Inc., St. Louis (TA-STL). The assessment included data package completeness, documentation of the analytical work performed, instrument calibration and calibration checks, method quality control, secondary reviews and quality assurance oversight, sample receiving and custody, holding times, use of appropriate methods, calculation review, and sample preparation. Ancillary records reviewed in support of the assessment include analyst proficiency training, standards preparation and traceability, calibrations not included in the data package, holding blanks, electronic files, laboratory performance evaluation samples, and any non-conformances and corrective actions associated with the report. This DPA included data packages that are assessed for organics, inorganics, and radiochemistry analyses. TA-STL worked closely with LANL and AQA to resolve the 109 issues noted in the DPA Report, as well as additional "validation time-saving" requests. TA-STL, LANL and AQA worked together to ensure that the corrective actions proposed adequately addressed all issues outlined in the DPA. Throughout the DPA reconciliation process, TA-STL exhibited a willingness to cooperate and an eagerness to resolve the issues. TA-STL submitted a comprehensive Corrective Action Plan (CAP) to LANL, and all 109 issues have been resolved.
- Elevated selenium results were obtained from soil samples. After review of the raw data, it was determined the analytical laboratory used a different mass for the Se on its instrumentation. LANL is in the process of working with the analytical laboratories to preclude non-detects above background.

- In 2010, LANL changed analytical laboratories from University of Miami to ARSL for low-level tritium analyses. Due to the minor differences in analytical methods at the two laboratories, the more recent data are not directly comparable to earlier values.
- Samples were improperly preserved with nitric acid for several samples collected for three wells. Samples displayed high nitrate (as nitrogen) results in contrast to low TDS concentrations. These issues have been resolved.
- LANL chromium results in groundwater showed an increasing Practical Quantitation Limits (PQL) and Method Detection Limits (MDL). This issue was brought to GEL Laboratories, which had identified the causes of the elevated chromium results in reported samples. Specifically, the equations that correct for isobaric polyatomic ion interferences for this element have not been revised at the same frequency as in the past. This is due to the elevation of GEL's current MDLs and PQLs from an MDL of 1 ppb and PQL of 3 ppb to revised values of 2.5 ppb and 10 ppb, respectively. While the frequency of the revision to the equation changed, the laboratory continued to comply with method requirements. GEL admitted to reporting LANL chromium samples with higher bias than what had been previously reported at or near the detection limit. The majority of the samples could not be reevaluated due to lack of availability of sample media and past holding times. The analytical lab performed re-digestion and reanalysis on only a few samples. GEL re-reported chromium results to LANL and these updated data are in the database.
- On July 12, 2006, LANL collected a groundwater sample from Buckman Well #1 as part of routine quarterly sampling conducted by LANL at three water-supply wells in the Buckman Well Field. The samples are sent to GEL Laboratories for radiochemistry analysis. GEL's data package indicated that they qualified a Pu-238 result from Buckman Well #1 as a detected analyte. However, following recent reviews of legacy data by LANL and further discussions with the analytical laboratory, GEL now concludes that Pu-238 was not present in the sample from Buckman Well #1. GEL found insufficient counts of alpha activity at the location of the spectrum that would be indicative of Pu-238. The original computer analysis of the results used the total number of counts, including background, within a specified "region of interest," but the analysis did not evaluate the data fully. Subsequent examination of the data by experts shows that the counts were the result of random processes and were not from Pu-238. Consequently, the results for the analysis of Pu-238 have been formally changed and flagged in the database as undetected. The updated flag is in RACER.
- The detection of several compounds in well samples was likely the result of analytical contamination rather than their presence in groundwater. Two Aroclor (PCB) compounds were found in a field duplicate from R-16 but not in the primary sample or any previous sample. Several PAH compounds (such as benzo(a)pyrene) were found in samples from MCOI-6, PCI-2, R-27, R-60 and R-55. In these cases, some compounds were found in a primary sample or field duplicate sample, but not both. The presence of diethylphthalate contamination in water samples was caused by contaminated sample bottles. The sample bottle supplier was changed to a supplier that provides higher quality certified 300 Series bottles.
- In 2010, we changed analytical laboratories for low-level tritium analyses. In August 2011 investigation revealed that results from the new provider (ARSL) were subject to calculation errors. At the time of this report, these data had not been corrected.

C. QUALIFICATION AND PERFORMANCE ASSESSMENT OF ANALYTICAL LABORATORIES

The Laboratory is responsible for acquiring analytical services that support environmental activities. The SOW for analytical services follows the Department of Energy (DOE) NNSA Service Center Model Statement of Work for Analytical Laboratories (NNSA 2010). The SOW provides the contract analytical laboratories the general QA guidelines and includes specific requirements and guidelines for analyzing air, surface water, groundwater, soil, and sediment samples.

In 2010, the majority of the analyses were performed by GEL Laboratories, Charleston, South Carolina; TestAmerica, Inc.- St. Louis, Earth City, Missouri; ALS Laboratory Group (formally Paragon), Fort Collins, Colorado; Southwest Research Institute, San Antonio, Texas; and American Radiation Services, Inc, Baton Rouge, Louisiana. Vista Analytical Laboratory in El Dorado Hills, California, is used as an additional laboratory to analyze samples for dioxins and furans.

Analytical laboratories undergo a pre-award assessment to evaluate their ability to perform the required analyses. The Laboratories must be certified by the National Environmental Laboratory Accreditation Program (NELAP) for the required analytical methods.

LANL requires analytical laboratories to participate in independent national performance evaluation (PE) programs. These PE studies address a majority of the parameters for which the analytical laboratories conduct analyses in different media. The laboratories participate in the Mixed Analyte Performance Evaluation Program (MAPEP), Water Study (WS), proficiency testing, and other pertinent programs offered by Environmental Resource Associates and state-sponsored certification programs as available for the analytical methods they conduct for LANL.

The vast majority of the results of these studies were within acceptance limits. Acceptance limits are the range of percent recoveries that indicate sufficient accuracy of the analyses and results in data not being qualified. If the results for an analyte or group of analytes did not pass, the laboratories implemented corrective actions and acceptable results are reported for 2010.

The 2010 performance evaluation programs at five analytical laboratories are summarized here:

- GEL Laboratories analyzed and reported results for PE samples in accordance with the NELAP requirements. These PE sample analyses resulted in the reporting of 129 analytes outside of the acceptance limits, out of 5,798 total PE results submitted (97.8% acceptable results). Eleven of the 129 are either reported as false negative or false positive results. The laboratory reported two consecutive Pu-238 failures due the ramifications of a worldwide shortage of the Pu-242 tracer, which resulted in a Priority I finding by the DOE Contract Analytical Program (DOECAP) audit team in 2011. However, only three out 8,000 Pu-238 results published by the lab for all its clients are affected. The laboratory has completed and submitted a corrective action for the Pu failures, and the finding was closed before the end of the audit. The laboratory has performed Pu-238 analyses with acceptable results since completion of the corrective action. Although the laboratory did not find an apparent cause for all of the 129 PE result failures, the laboratory investigated and addressed all of the failures. None of these failures affected Los Alamos samples.
- TestAmerica, Inc. - St. Louis analyzed and reported results for PE samples in accordance with the NELAP requirements. These PE sample analyses resulted in the reporting of 52 analytes outside of the acceptance limits, out of 3,043 total results submitted (98.3% acceptable results). Five of the 52 failures are either reported as false negative or false positive results. A failure of o-phosphate performance testing sample was also captured with the DOECAP audit. Although the laboratory did not find an apparent cause for all of the 52 PE result failures, the laboratory investigated and addressed all of the failures.
- ALS Laboratory Group analyzed and reported results for PE samples in accordance with NELAP requirements. These PE sample analyses resulted in the reporting of 37 analytes outside of the acceptance limits, out of 1,482 total results submitted (97.5% acceptable). Eight of the 37 failures are either reported as false negative or false positive results. Although the laboratory did not find an apparent cause for all of the 37 PE result failures, the laboratory investigated and addressed all of the failures.
- Southwest Research Institute analyzed and reported results for PE samples in accordance with NELAP requirements. These PE sample analyses resulted in the reporting of 12 analytes outside of the acceptance limits, out of 889 total results reported (92.7% acceptable). Three of the 12 failures are either reported as false negative or false positive results. Although the laboratory did not find an

apparent cause for all of the 12 PE result failures, the laboratory investigated and addressed all PE failures.

- American Radiation Services analyzed and reported results for PE samples in accordance with NELAP requirements. These PE sample analyses resulted in the reporting of seven analytes outside of the acceptance limits, out of 174 total results submitted (96.0% acceptable). A failure in radiochemistry due to a low bias observed in performance testing water samples for Am-241 was also captured in the DOECAP audit. The laboratory did not report any false negative or positive results. Although the laboratory did not find an apparent cause for all of the seven PE result failures, the laboratory investigated and addressed all PE failures.

There are no performance evaluation programs for the specialty analyses conducted at Vista Analytical Laboratory; therefore, performances on samples at Vista Analytical Laboratory are not assessed through performance evaluation programs.

All of the laboratories provided detailed analytical laboratory performance evaluation studies, investigation reports, and correction action plans to LANL for review. In addition, each laboratory conducts internal audits of their procedures, instrumentation and reporting practices on a regular basis. When issues are found, each laboratory documents the issues and performs and records corrective actions.

D. DEPARTMENT OF ENERGY CONTRACT ANALYTICAL PROGRAM AUDITS

The DOE Office of Environmental Management mandates participation in the DOE Contract Analytical Program (DOECAP; https://doecap.oro.doe.gov/). DOECAP is a consolidated, uniform program for conducting annual audits of commercial laboratories to eliminate audit redundancy by involving all DOE program line organizations and field elements, provide a pool of trained auditors sufficient to support consolidated audits, standardize terms and conditions of existing and proposed contracts to allow acceptance of consolidated audit results, and interface with state and federal regulatory agencies and other industry standard-setting groups, such as the National Environmental Laboratory Accreditation Conference. LANL requires participation in DOECAP for all major analytical providers. In 2010, DOECAP audits were conducted at five laboratory facilities which provide air, water, soil, and sediment data to LANL: GEL Laboratories; TestAmerica, Inc. - STL; ALS Laboratory Group; Southwest Research Institute, and American Radiation Services, Inc.

DOECAP audits result in *Findings and Observations* when there are items of concern that need to be addressed in the audit report. DOECAP audits found that the laboratories meet established requirements necessary to produce data of acceptable and documented quality through analytical operations that follow approved and technically sound methods. The corrective action plans resulting from the five audits, listed below, have been approved and are available from the DOECAP website.

- GEL Laboratories, April 27–29, 2010. There were seven findings and one observation identified. The findings were issued in the quality assurance area and involved the lack of defined protocol for production and use of control charts throughout the laboratory. All findings and observations were addressed and a corrective action plan has been accepted by DOECAP.
- TestAmerica, Inc. - STL, March 11–13, 2010. There were four findings and 15 observations identified. There were findings in organics due to lack of traceability for organic internal standards; in inorganics due to lack of root cause analysis associated with the corrective action for a failed o-phosphate performance testing sample; and in hazardous and radioactive materials management for lack of implementation of the eye protection requirements detailed in the laboratory safety documentation. A recurring finding from 2009 was the lack of defined acceptable uncertainty for daily balance check weights. All findings and observations were addressed and a corrective action plan was accepted by DOECAP.
- ALS, March 23–25, 2010. There were 10 findings and nine observations identified. Five findings were issued in quality assurance were poor document control practices, lack of document and record

review, and lack of designation for deputies for key management positions. A recurring finding from 2009 was the use of a thermometer that did not bracket the monitoring range required for the method in use. A finding was issued in radiochemistry for non-compliance with the laboratory's internal operating procedure. A finding was issued in Laboratory Information Management Systems (LIMs) due to lack of password maintenance. A finding was issued in hazardous and radioactive materials management for a continuing lack of attention by laboratory personnel to protective equipment requirements (lab coats and eye protection). All findings and observations were addressed and a corrective action plan was accepted by DOECAP.

- Southwest Research Institute, March 2–4, 2010. There were seven findings and eight observations. The findings identified in quality assurance involved lack of defined training requirements for each position, lack of gravimetric daily verification of pipettes, and improper logbook maintenance. A Priority 1 and a Priority 2 finding were issued in radiochemistry due to repeated performance testing failures. A new finding was issued in the LIMs due to lack of preservation of the original chromatogram when manual integration is performed. A finding was issued in hazardous and radioactive materials management for a safety shower that is located too far from the laboratory it is meant to service. All findings and observations were addressed and a corrective action plan was accepted by DOECAP.
- American Radiation Services, July 20–22, 2010. There were four findings and 4 observations identified. A finding was issued in quality assurance due to lack of periodic logbook review. A finding was issued in radiochemistry due to a low bias observed in performance testing water samples for Am-241. Two findings were issued in hazardous and radioactive materials management. A finding was issued for improper radiation scanning of samples upon receipt, and a finding was issued for lack of a policy or procedures for evaluation of waste brokering and Treatment, Storage and Disposal Facilities (TSDF) used by the laboratory. All findings and observations were addressed and a corrective action plan was accepted by DOECAP.

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A. INTRODUCTION

In this chapter, we present environmental topics at Los Alamos National Laboratory (LANL or the Laboratory) that are not strictly defined by media type or compliance program. In this year's report, we present (a) environmental monitoring and assessment information for geographical areas of interest to stakeholders and (b) Laboratory efforts at risk reduction.

Some environment subjects of interest to stakeholders do not fall into single environmental categories (water, sediments, air, foodstuffs, etc.), following the current organization of this report. One of these subjects of interest is the Rio Grande; another area is the Valles Caldera/Jemez Mountain region. LANL is not presenting new environmental monitoring projects or environmental assessments in this section, but rather summarizing environmental data presented in Chapters 5 through 8 of this report applicable to these regions and summarizing recent risk assessments for these two areas.

The DOE Order 450.1, Environmental Protection, establishes Department of Energy (DOE) sustainable environmental stewardship goals to reduce or eliminate environmental hazards. In this chapter, we present summary information on the environmental risk reduction efforts associated with Laboratory programs, including the environmental restoration program, groundwater program, surface water program, wildfire mitigation program, and the transuranic (TRU) waste management program.

B. MONITORING OF THE RIO GRANDE

1. Monitoring Information

Water quality, sediments, and biota/foodstuffs have been monitored for many years in and along the Rio Grande to assess LANL impacts. Annually, these data are presented in Chapters 5 through 8 of this report. Individual measurements are available in Supplemental tables of this report and on the RACER database (www.racerdat.com). Environmental samples may not be collected every year when contaminant values are not above standards and do not demonstrate an upward trend over time. When trends are identified, sample locations may change (e.g., sediments) to gain more information. Stations located along the Rio Grande above Los Alamos Canyon (e.g., Otowi Bridge and Abiquiu Reservoir) are considered upstream or background locations.

2. Water Quality in the Rio Grande

Surface water samples were collected from three locations along the Rio Grande in 2010: upriver of Los Alamos Canyon and LANL at Otowi Bridge, at the Buckman Direct Diversion (BDD) Project surface water diversion site (at the mouth of Cañada Ancha, downriver from Los Alamos, Sandia and Mortandad Canyons), and at the mouth of Frijoles Canyon in Bandelier National Monument (downriver from all canyons draining LANL) (see Figure 6-5).

Nine radionuclides were detected in the Rio Grande water samples: radium-226, radium-228, thorium-228, thorium-230, thorium-232, tritium, uranium-234, uranium-235/236, and uranium-238. As described in the report of the Buckman Direct Diversion Project Independent Peer Review (ChemRisk 2010), these are all natural, as demonstrated by their ratios and the consistency of the data upstream and downstream of LANL. Furthermore, as discussed in Chapter 3, the annual dose from these radionuclides is less than 0.1 mrem. As discussed in Chapter 3, doses less than 0.1 mrem cannot be distinguished from natural background radiation.

For inorganic chemicals, two results from the Rio Grande were above screening levels in 2010. A non-filtered sample collected at Otowi Bridge, above Los Alamos Canyon, had ammonia slightly above the New Mexico

Water Quality Control Commission (NMWQCC) chronic aquatic life standard of 179 µg/L, at 184 µg/L. A filtered sample collected at Frijoles Canyon had copper slightly above the NMWQCC chronic aquatic life standard of 9.0 µg/L, at 9.71 µg/L. These data indicate that water quality in the Rio Grande in the vicinity of the Laboratory is good, with average values for these constituents being below chronic aquatic life standards.

For organic chemicals, samples from the Rio Grande were analyzed for explosive compounds, pesticides, PCBs (by both the Aroclor and the congener methods), semi-volatile organic compounds (SVOCs), and volatile organic compounds (VOCs). PCB congeners were detected in one sample, collected from Otowi Bridge on July 13, below the NMWQCC human health standard of 0.00064 µg/L at 0.0000385 µg/L. All other results were non-detects.

3. Sediments in the Rio Grande

Past analyses and studies have detected radionuclides and other contaminants that have been transported by flood events down Los Alamos Canyon to the Rio Grande near Otowi Bridge (Graf 1994, 1996; Reneau et al., 1998; LANL 2004). Using sensitive isotopic analytical methods, we have traced plutonium-239/240 from historic Acid Canyon discharges in sediment more than 55 km to lower Cochiti Reservoir (Gallaher and Efurd 2002). However, the dose that might result from these radionuclides is much less than 0.1 mrem (see Chapter 3).

Natural stream flow and sediment loading in the Rio Grande are quite large compared with Los Alamos area streams. These factors limit impacts from the Laboratory in the Rio Grande. In 2010, we collected sets of five sediment samples each for analysis of isotopic plutonium, gamma spectroscopy radionuclides, and PCB congeners from five areas along the Rio Grande. The five areas were: (1) upriver from Otowi Bridge, which is upriver from all LANL sources; (2) upriver from Buckman and the BDD Project surface water intake for the City and County of Santa Fe; (3) below the White Rock Overlook, downriver from Los Alamos, Sandia and Mortandad canyons; (4) between Chaquehui and Frijoles Canyons, downriver from all canyons draining LANL, and the bottom of Cochiti Reservoir.

In four sediment samples collected at Cochiti in 2010, Pu-239/240 was detected above background. These results are consistent with previous data from Cochiti Reservoir (see Figure 6-36). Previous fish monitoring results demonstrate no difference in plutonium concentrations between fish caught in Abiquiu Reservoir, upriver of all LANL sources, and Cochiti Reservoir.

Total detected PCB congener concentrations in Rio Grande sediment samples in 2010 are similar to concentrations measured in 2008 and 2009. Data from the 1980s-vintage Cochiti Reservoir sediments indicate that PCB concentrations were significantly higher at that time. Total detected PCB congeners in 1980s samples ranged from 350 to 1660 ng/kg, averaging 1,063 ng/kg (Figure 6-37). This decrease in PCB concentrations between the 1980s and present is consistent with the discontinuation of use of PCBs that began in 1979, when the U.S. Congress banned their production because of concerns about their toxicity and persistence in the environment.

We estimate the long-term average PCB flux in the Rio Grande to be 0.27 kg/year, based on the average annual river flow past Otowi Bridge and average PCB concentrations in sediments near Otowi Bridge. A preliminary estimate of PCB flux in lower Los Alamos Canyon into the Rio Grande is 0.003 - 0.005 kg/yr, which is 1% to 3% of the total estimated long-term flux in the Rio Grande. These estimates support the conclusion based on PCB congener patterns that there is little LANL impact on PCBs in the river (see Chapter 6).

4. Crayfish in the Rio Grande

Crayfish (crawfish, crawdads, or mudbugs) (*Orconectes* spp.) samples were collected from the Rio Grande within two reaches relative to the location of LANL: upstream and downstream (see Figure 8-4). Upstream (or background) samples were collected starting from the Otowi Bridge north to the Black Mesa area (about a three-mile stretch) and downstream samples were collected from the Los Alamos Canyon confluence south (about a one-mile stretch). The samples were separated into edible (meat) and non-edible (claws, shell, etc.) portions and analyzed for target analyte list (TAL) elements.

All TAL elements, including mercury, in the edible portions of crayfish collected from the downstream reach were similar to the edible portions collected from the upstream reach (less than the regional statistical reference levels [RSRLs]) (Table S8-7). Also, all concentrations of mercury in the edible portion of crayfish collected from both reaches were an order of magnitude below the Environmental Protection Agency (EPA) screening level of 0.30 mg/kg (EPA 2001). Mercury sources and contamination in fish inhabiting the Rio Grande upstream and downstream of LANL are well documented (see Chapter 8); however, the amount of mercury in crayfish compared with the amount of mercury in bottom-feeding fish within these same reaches is an order of magnitude lower and does not appear to be a significant risk factor to humans if ingested.

5. Irrigation with Rio Grande Waters

In 2010, LANL sampled fruits and vegetables irrigated with Rio Grande water collected downstream (south) of the Laboratory. In general, contaminants in all produce samples were very low (pCi range) and most were either not detected or detected below the RSRLs.

6. Risk Assessments

Due to concern about potential LANL impacts to the Rio Grande, a number of risk assessments have been conducted over the past 10 years. Two areas of emphasis have been evaluated: LANL impacts to the Rio Grande following the May 2000 Cerro Grande fire and LANL impacts to the Rio Grande that may affect the BDD Project.

a. Cerro Grande Fire

An independent subcontractor, estimated the potential risk to the public from chemicals and radioactive materials released from the Cerro Grande fire in May 2000 (RAC 2002). They estimated the potential annual cancer risk to be less than 3 in 1 million for exposure to any LANL-derived chemical or radioactive material that may have been carried in the surface water and sediments to the Rio Grande and Cochiti Reservoir. This value is well below EPA target excess cancer risk level of one in 100,000 for environmental cleanup.

b. Buckman Direct Diversion Project

The City of Santa Fe and Santa Fe County completed the construction of the BDD Project in December 2010. The project accesses surface water from the Rio Grande and then treats and distributes these waters to the City and the County through their drinking water distribution systems.

The BDD Project hired an independent peer reviewer to prepare an independent risk assessment, regarding LANL contaminants, of potential exposure through the drinking water pathway, based on existing information, data, and studies. The risk assessment was published on December 3, 2010 and concluded that there is no health risk to people drinking BDD tap water (ChemRisk, 2010). The BDD Project began routine operations during 2011.

A discussion of Laboratory risk reduction activities related to the BDD Project is presented in Section D.d., below.

C. MONITORING IN THE JEMEZ MOUNTAINS AND VALLES CALDERA

This section provides the reader with a consolidated review of all LANL monitoring of areas west and southwest of the Laboratory, namely in the Valles Caldera, the Fenton Hill Site at Technical Area (TA-57), and in the Jemez River drainage. The Laboratory is not presenting new data or environmental assessments in this section, but instead summarizing the historical record of monitoring over a period of the last 35 years, from Environmental Surveillance Reports dating from 1980 and from reports on Fenton Hill as far back as 1973. This review was developed from Simmons (2011).

Since the 1970s, the Laboratory has been measuring the concentrations of chemical constituents in environmental media at locations west and southwest of the Laboratory, including surface water, ground water, soils, biota, and foodstuffs. Jemez Pueblo and a Jemez River location have served as regional (background) monitoring sites over this period of time because their distance from the Laboratory (>20 km) is such that they should not be affected by Laboratory operations.

Monitoring of surface water, well water, circulation-loop pond water, and vegetation at the Fenton Hill hot dry rock experimental site from 1973 to 1994 showed no long-term downstream effects to water quality or vegetation. Elevated concentrations of trace elements in vegetation receiving episodic discharge downstream of the ponds dissipated when discharges became less frequent and ended, with the completion of the hot dry rock project.

Thermal waters originate from the Valles Caldera geothermal region discharge in springs along the Jemez Fault at the Jemez River. The presence of higher arsenic, boron, fluoride, cadmium, and lithium at and downstream of these springs along the Jemez River can be attributed to geothermal sources. The higher concentrations are not evident below the confluence with the Rio Grande because of the higher discharge rate of the Rio Grande.

A very few sporadic detections of radionuclides have been measured in air, surface water, sediment, soil, and biota and foodstuffs over the period of record. The detections appear to be isolated instances and show no spatial or temporal trends. Above all, the detections cannot be attributed to Laboratory operations or influences. For this reason, the Jemez Pueblo and Jemez River locations remain as excellent background locations free of Laboratory influences.

D. RISK REDUCTION

The Laboratory is committed to reducing environmental hazards and the associated risk to people and the environment. In some cases the risk is directly related to dose, which results from actual exposure to a radiological or chemical hazard released from routine operations. The risk is reduced by keeping the dose as low as reasonably achievable (ALARA) through operational work practices. In other cases the risk depends on the probability of exposure in the future. For example, a contaminant in the regional aquifer may not currently be found in drinking water systems, but it may move over time and enter the drinking water systems. Another example of future risk is the potential for accidents from routine operations to release radioactive materials or chemicals into the environment.

The following are examples of where the Laboratory is working to reduce risks to the public and the environment.

1. TRU Waste Program

The TRU waste disposition program expedites the disposal of legacy transuranic waste to Waste Isolation Pilot Project (WIPP) in Carlsbad, NM. TRU waste processing facilities are located at TA-50 and TA-54. TA-54 Area G stores radioactively contaminated waste and other contaminated materials in aboveground storage.

As discussed in Chapter 3, the dose to the all-pathway maximally exposed individual (MEI) was about 1 mrem/yr in 2010. One method used to reduce both the current and prospective risk at Area G is to steadily reduce the inventory of transuranic waste by transporting drums of radioactive material to WIPP. The Laboratory shipped approximately 700 m^3 of TRU to WIPP in 2010. The DOE/LANL goal is to ship all legacy LANL TRU waste to WIPP by the end of 2015. After 2015, all newly generated TRU waste (~85 m^3 per year) will be shipped to WIPP within one year of generation.

The Site-Wide Environmental Impact Statement (DOE 2008) identifies the exposures to the public from potential accidents from Laboratory operations and facilities. The potential accidents having the greatest off-site consequences are postulated to occur at TRU processing (TA-50 and TA-54) and TRU storage facilities (TA-54). The Laboratory will begin design of a new TRU waste staging facility at TA-63 in 2011 to replace the existing facilities at TA-50 and TA-54. Final construction at TA-63 is to be completed in 2015. This facility will replace the buildings and fabric domes currently used to process TRU waste, and thus reduce the consequences from potential accidents.

2. Environmental Restoration

The objective of the Laboratory's environmental restoration program is to determine the types and extent (horizontal and vertical) of legacy environmental contamination (created prior to 1989), whether or not it

requires remediation, and what type of remediation is appropriate. The environmental restoration program requirements and schedule of work are defined in a Consent Order, signed by the Laboratory, DOE, and NMED in 2005. Approximately 2,100 sites were originally identified for evaluation (Figure 12-1). At the end of 2010, investigation work plans have been written for 99% of these sites. Sampling to determine the types and extent of contamination has been reported on approximately 64% of all sites. Approximately 40% of all sites have been approved by EPA and/or the New Mexico Environment Department (NMED) as corrective action complete, requiring no further remedial actions or ongoing monitoring.

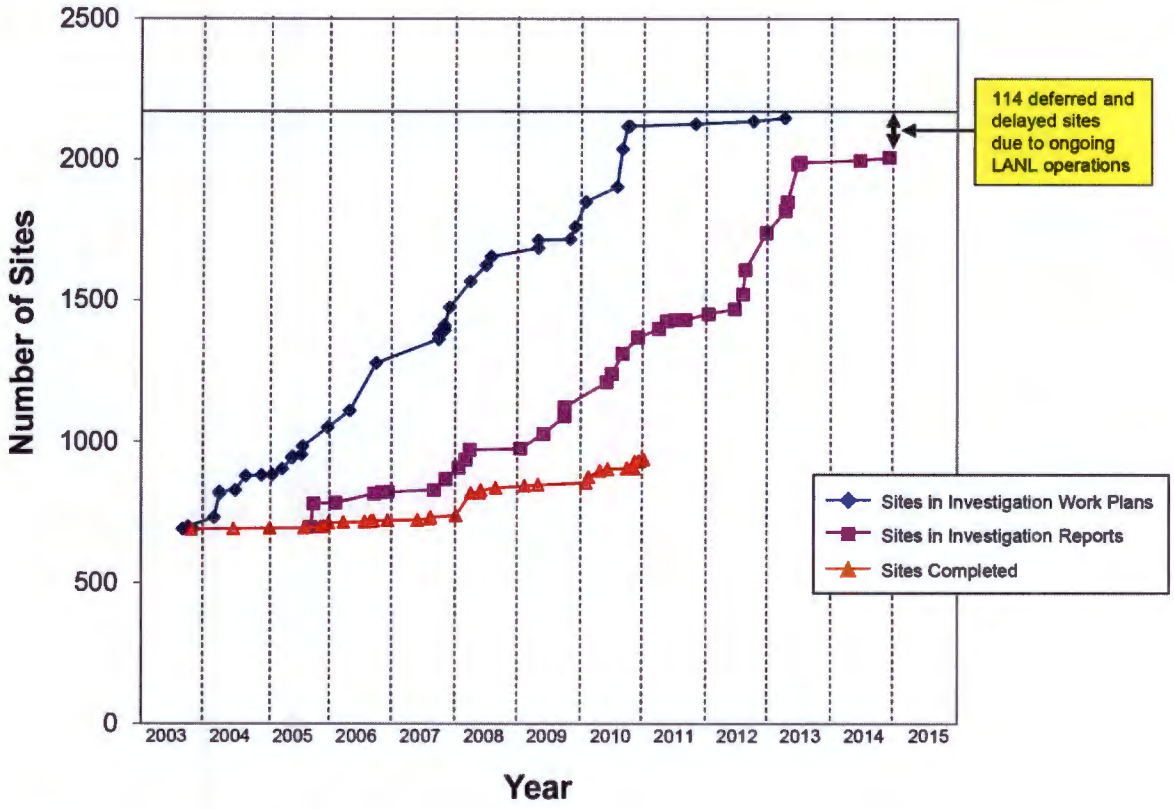
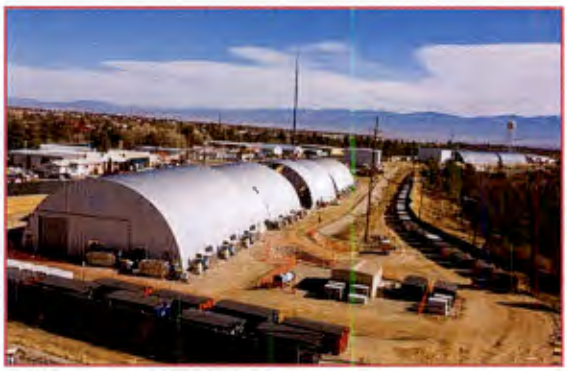


Figure 12-1 Consent Order Site Status

Chapter 9 provides information about all environmental investigation and cleanup activities in 2010. Major risk reduction activities conducted during 2010 included decontamination and decommissioning (D&D) and clean-up activities at TA-21.



TA-21 was the site of plutonium processing from 1945 to the early 1970s. It was also the site of a tritium processing and handling facility, and several material disposal areas (MDAs). The buildings at TA-21 were built as long ago as the 1940s and housed labs, offices and production facilities from the Manhattan Project and Cold War eras. Due to its location on the north side of Los Alamos canyon and its proximity to the Los Alamos townsite, TA-21 has been designated for future transfer to Los Alamos County. Prior to transfer to Los Alamos County, buildings, utilities, and MDAs must be demolished or remediated and the site must meet residential clean-up standards. The Laboratory received American Recovery and Reinvestment Act (ARRA) funding in 2009, and by the end of 2010, all TA-21 buildings, totaling more than 175,000 square feet, were demolished.

TA-21 MDA-B (Figure 4-3), was used from 1944-48 and is the Lab's oldest waste disposal site. MDA-B consists of a number of trenches that were dug to dispose of equipment, clothing and other waste. A great challenge in performing this work is that the inventories of hazardous and radioactive material at the TA-21 MDAs are not well characterized because few records of waste disposal exist from the 1940s and the Manhattan Project. To address those challenges and to ensure safety, the excavation of MDA-B has occurred inside large metal structures that resemble airplane hangars. These structures were built on the site and contain a number of safeguards, including dust and fire suppression systems and high efficiency particulate air (HEPA) filtering. In addition, the excavation has been monitored by closed circuit television cameras. The MDA B clean up was also conducted with ARRA funding. Approximately 50% of the excavation was completed by the end of 2010.

3. Groundwater

As discussed in Chapter 5, Groundwater Monitoring, Laboratory-derived impacts to groundwater have been detected in some monitoring wells. At present, there is no measurable LANL-derived contamination in the Los Alamos County or neighboring community's drinking water systems, but there may be a prospective risk because of the potential for contamination to migrate to the drinking water supply wells. For the past several years, efforts have been underway to evaluate groundwater quality and augment the current monitoring network to ensure monitoring activities will detect contamination in groundwater before it can affect the drinking water. These investigations will help determine the actions to reduce the prospective risk.

To characterize the extent of contamination in the groundwater, the Laboratory completed 14 intermediate or regional aquifer wells in 2010. Eleven wells were designed to monitor potential contamination from TA-54, TA-49 MDA AB, and TA-50 MDA C. One regional aquifer well was installed to further characterize chromium in Mortandad Canyon. The one intermediate well was installed to evaluate perched intermediate hydrologic properties in the vicinity of the TA-16 260 high explosives facility outfall. One regional aquifer well was installed in Los Alamos Canyon to monitor for potential contamination near the Los Alamos County municipal production well Otowi 1. Results of groundwater monitoring are found in Chapter 5.

4. Surface Water

The Laboratory has established a long term environmental stewardship goal of Zero Liquid Discharge (ZLD) from liquid effluent outfalls. The goal includes reducing the total number of outfalls and reducing the amount of water discharged from remaining outfalls. Reducing the LANL discharge of water into canyons will limit the driver of existing contaminants into downstream surface waters and downward movement into alluvial and intermediate waters and to the regional aquifer. This will reduce the long term risk of contamination to the regional aquifer and protects drinking water resources.

As part of the ZLD effort, the Laboratory is designing new concrete evaporation tanks at TA-52 to receive fully treated radioactive liquid effluent from the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF). These tanks are being constructed to reduce the volume of treated effluent being discharged through the National Pollutant Discharge Elimination System (NPDES) Outfall 051. The construction will also allow for passive evaporation of treated RLWTF effluent. The Laboratory submitted a Notice of Planned Change to EPA in May 2007 regarding the construction of the ZLD Tanks. The estimated completion for the date for the ZLD Tanks Project is March 28, 2012.

Additionally, the Laboratory eliminated discharges from NPDES Outfall 03A021 (TA-3 Chemistry and Metallurgy Research [CMR] Facility Cooling Tower), NPDES Outfall 03A130 (TA-11 Cooling Tower), and NPDES Outfall 03A185 (TA-15 DARHT Cooling Tower) in 2010. These actions were taken by LANL instead of adding new/additional treatment to meet new copper and zinc effluent limits that became effective on August 1, 2010. The TA-21 Steam Plant wastewater discharge (NPDES Outfall 02A129) has been eliminated a result of the facility closure and is currently undergoing D&D.

The BDD Project and the DOE signed a Memorandum of Understanding (MOU) in May 2010, documenting DOE/LANL continuing actions to assure protection of surface water accessed by the BDD Project. LANL upgraded an existing storm water monitoring system in lower Los Alamos Canyon near the Rio Grande. Through the use of remote telemetry, the monitoring system automatically notifies the BDDP

of storm water flows entering the Rio Grande through the use of remote telemetry. The BDDP can then temporarily discontinue water intake from the Rio Grande. Stormwater flows entered the Rio Grande from Los Alamos and Pueblo Canyons on two occasions and from Guaje Canyon on three occasions during 2010. In The system successfully notified the BDD Project in each case.

In addition, LANL completed construction in 2010 of two grade control structures in Pueblo and DP Canyons, both part of the Los Alamos Canyon watershed. These structures mitigate erosion processes during storm water runoff events to stabilize sediments and contaminants in place. Through the reduction of erosion in the canyon (known as headcutting), vegetative growth is enhanced and riparian areas are improved. The effectiveness of these projects will be measured and reported on an annual basis to NMED beginning in November 2011. In addition, 10,000 willows were planted in Pueblo Canyon during 2005 to 2009 to help slow flood waters and aid sediment deposition.

The MOU calls for funding five years of the storm water monitoring in lower Los Alamos Canyon, Rio Grande sampling at the BDD Project location, and one year of intensive measurements of BDD Project diverted water, sand return, and treated drinking water. Detailed sampling plans were under development during 2010. Reporting on these sampling efforts will occur in future editions of this report.

5. Wildland Fires

LANL is located in a fire-prone region and there will always be a high potential for wildfires. The Laboratory maintains a Wildland Fire Management Plan to protect the public and the environment from catastrophic wildfires. On an annual basis, the condition of the Laboratory forests is evaluated and mitigation actions are implemented. The locations of cultural resources and sensitive species habitats are also specifically identified for fire protection measures. These actions include tree thinning, maintenance of LANL fire roads, and erosion controls. During FY10, the Laboratory performed tree thinning operations on 380 acres of LANL property on the western Laboratory boundary on West Jemez Road, TA-49 along State Route 4, on the west side of State Route 4 adjacent to White Rock, and interior to LANL at TAs -39, -52, and -5. These mitigation actions were extremely important in minimizing the amount of LANL lands burned (only 2 acres of wild fires) during the 2011 Las Conchas fire (additional details to be presented in the 2011 report).

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General Formation of a Standard

Standards are created to protect a target group from a variety of contaminants in a given exposure pathway for a specific time frame. A target group may refer to the general public, animals, or a sensitive population like adolescents, the elderly, or asthmatics. Contaminants of concern are addressed by a governing body, such as the EPA, which takes into consideration occurrence in the environment, human exposure and risks of adverse health effects, available methods of detection, cost of implementation, geographic location, and public health. After a contaminant of concern has been identified, all exposure pathways are considered to determine the most probable instances and the need for regulation. Pathways of exposure include air, water, soil, biota, and foodstuffs that can be ingested, absorbed, or inhaled. Time of exposure is also an important factor in the formation of standards because prolonged exposure to low levels of a contaminant can have similar health effects as a short exposure to a high level of a contaminant.

Throughout this report, we compare concentrations of radioactive and chemical constituents in air and water samples with pertinent standards and guidelines in regulations of federal and state agencies. Los Alamos National Laboratory (LANL or the Laboratory) operations are conducted in accordance with directives for compliance with environmental standards. These directives are contained in Department of Energy (DOE) Orders 450.1, "Environmental Protection Program;" 5400.5, "Radiation Protection of the Public and the Environment;" and 231.1A, "Environmental Safety and Health Reporting."

Radiation Standards

DOE regulates radiation exposure to the public and the worker by limiting the radiation dose that can be received during routine Laboratory operations. Because some radionuclides remain in the body and result in exposure long after intake, DOE requires consideration of the dose commitment caused by inhalation, ingestion, or absorption of such radionuclides. This evaluation involves integrating the dose received from radionuclides over a standard period of time. For this report, 50-yr dose commitments were calculated using the EPA dose factors from Federal Guidance Report No. 13 (EPA 1999). The dose factors EPA adopted are based on the recommendations of Publication 30 of the International Commission on Radiological Protection (ICRP 1988).

In 1990, DOE issued Order 5400.5, which finalized the interim radiation protection standard for the public (NCRP 1987). Table A-1 lists currently applicable radiation protection standards, now referred to as public dose limits, for operations at the Laboratory. DOE's comprehensive public dose limit for radiation exposure limits the effective dose equivalent (EDE) that a member of the public can receive from DOE operations to 100 mrem per year. For one specific activity or pathway, DOE guidance specifies a "dose constraint" of 25 mrem

Table A-1
DOE Dose Limits
for External and Internal Exposures

Exposure pathway	Dose Equivalent[a] at Point of Maximum Probable Exposure
Exposure of Any Member of the Public[b]	
All Pathways	100 mrem/yr[c]
One Specific Pathway (dose constraint)	25 mrem/yr[d]
Air Pathway Only[e]	10 mrem/yr
Drinking Water	4 mrem/yr
Occupational Exposure[b]	
Stochastic Effects	5 rem/yr (TEDE)[f]
Nonstochastic Effects	
Lens of eye	15 rem/yr
Extremity	50 rem/yr
Skin of the whole body	50 rem/yr
Skin of the whole body	50 rem/yr
Embryo/Fetus of Declared Pregnant Worker	0.5 rem/gestation period

[a] Note: Refer to Glossary for definition.

[b] In keeping with DOE policy, exposures must be limited to as small a fraction of the respective annual dose limits as practicable. DOE's public dose limit applies to exposures from routine Laboratory operation, excluding contributions from cosmic, terrestrial, and global fallout; self-irradiation; and medical diagnostic sources of radiation. Routine operation means normal, planned operation and does not include actual or potential accidental or unplanned releases. Exposure limits for any member of the general public are taken from DOE Order 5400.5 (DOE 1990). Limits for occupational exposure are taken from 10 CFR 835, Occupational Radiation Protection.

[c] Under special circumstances and subject to approval by DOE, this limit on the EDE may be temporarily increased to 500 mrem/yr, provided the dose averaged over a lifetime does not exceed the principal limit of 100 mrem per year.

[d] Guidance (DOE 1999.)

[e] This level is from EPA's regulations issued under the Clean Air Act (40 CFR 61, Subpart H) (EPA 1989a).

[f] Refer to Glossary for definition.

per year (DOE 1999.) The public dose limits and the DOE occupational dose limits are based on recommendations in ICRP (1988) and the National Council on Radiation Protection and Measurements (NCRP 1987).

The EDE is the hypothetical whole-body dose that would result in the same risk of radiation-induced cancer or genetic disorder as a given exposure to an individual organ. It is the sum of the individual organ doses, weighted to account for the sensitivity of each organ to radiation-induced damage. The weighting factors are taken from the recommendations of the ICRP. The EDE includes doses from both internal and external exposure. External dose factors were obtained from Federal Guidance Report No. 12 (EPA 1993).

Radionuclide concentrations in water are compared with DOE's Derived Concentration Guides (DCGs) to evaluate potential impacts to members of the public. The DCGs for water are those concentrations in water that if consumed at a maximum rate of 730 liters per year, would give a dose of 100 mrem per year.

Table A-2 shows the DCGs. For comparison with drinking-water systems, the DCGs are multiplied by 0.04 to correspond with the EPA limit of 4 mrem per year.

In addition to DOE standards, in 1985 and 1989, the EPA established the National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities, 40 CFR 61, Subpart H. This regulation states that emissions of radionuclides to the ambient air from Department of Energy facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. DOE has adopted this dose limit (Table A-1). This dose is calculated at the location of a residence, school, business, or office. In addition, the regulation requires monitoring of all release points that can produce a dose of 0.1 mrem to a member of the public.

Table A-2

DOE's Derived Concentration Guides for Water[a]

Nuclide	DCGs for Water Ingestion in Uncontrolled Areas (pCi/L)	DCGs for Drinking Water Systems (pCi/L)[b]
^{3}H	2,000,000	80,000
^{7}Be	1,000,000	40,000
^{89}Sr	20,000	800
^{90}Sr	1,000	40
^{137}Cs	3,000	120
^{234}U	500	20
^{235}U	600	24
^{238}U	600	24
^{238}Pu	40	1.6
^{239}Pu	30	1.2
^{240}Pu	30	1.2
^{241}Am	30	1.2

[a] Guides for uncontrolled areas are based on DOE's public dose limit for the general public (DOE 1990). Guides apply to concentrations in excess of those occurring naturally or that are due to worldwide fallout.

[b] Drinking water DCGs are 4% of the DCGs for non-drinking water.

Nonradioactive Air Quality Standards

Table A-3 shows federal and state ambient air quality standards for nonradioactive pollutants.

National Pollutant Discharge Elimination System

The types of monitoring required under National Pollutant Discharge Elimination System (NPDES) and the limits established for sanitary and industrial outfalls can be found at http://int.lanl.gov/environment/h2o/cw_npdes.shtml.

Table A-3
National (40 CFR 50) and New Mexico (20.2.3 NMAC) Ambient Air Quality Standards

Pollutant	Averaging Time	Unit	New Mexico Standard	Federal Standards Primary	Federal Standards Secondary
Sulfur dioxide	Annual	ppm	0.02	0.030	
	24 hours	ppm	0.10	0.14	
	3 hours	ppm			0.5
Hydrogen sulfide	1 hour	ppm	0.010		
Total reduced sulfur	1/2 hour	ppm	0.003		
Total Suspended Particulates	Annual	$\mu g/m^3$	60		
	30 days	$\mu g/m^3$	90		
	7 days	$\mu g/m^3$	110		
	24 hours	$\mu g/m^3$	150		
PM-10[a]	Annual	$\mu g/m^3$		50	50
	24 hours	$\mu g/m^3$		150	150
PM-2.5[b]	Annual	$\mu g/m^3$		15	15
	24 hours	$\mu g/m^3$		65	65
Carbon monoxide	8 hours	ppm	8.7	9	
	1 hour	ppm	13.1	35	
Ozone	1 hour	ppm		0.12	0.12
	8 hours	ppm		0.08	0.08
Nitrogen dioxide	Annual	ppm	0.05	0.053	0.053
	24 hours	ppm	0.10		
Lead and lead compounds	*Calendar quarter*	$\mu g/m^3$		1.5	1.5

[a] Particles ≤10 µm in diameter.
[b] Particles ≤2.5 µm in diameter.

Drinking Water Standards

For chemical constituents in drinking water, regulations and standards are issued by the Environmental Protection Agency (EPA) and adopted by the New Mexico Environment Department (NMED) as part of the New Mexico Drinking Water Regulations (NMEIB 1995). To view the New Mexico Drinking Regulations go to http://www.nmenv.state.nm.us/Common/regs_idx.html. EPA's secondary drinking water standards, which are not included in the New Mexico Drinking Water Regulations and are not enforceable, relate to contaminants in drinking water that primarily affect aesthetic qualities associated with public acceptance of drinking water (EPA 1989b). There may be health effects associated with considerably higher concentrations of these contaminants.

Radioactivity in drinking water is regulated by EPA regulations contained in 40 CFR 141 (EPA 1989b) and New Mexico Drinking Water Regulations, Sections 206 and 207 (NMEIB 1995). These regulations provide that combined radium-226 and radium-228 may not exceed 5 pCi per liter. Gross alpha activity (including radium-226, but excluding radon and uranium) may not exceed 15 pCi per liter.

A screening level of 5 pCi per liter for gross alpha is established to determine when analysis specifically for radium isotopes is necessary. In this report, plutonium concentrations are compared with both the EPA gross alpha standard for drinking water and the DOE guides calculated for the DCGs applicable to drinking water (Table A-2).

For man-made beta- and photon-emitting radionuclides, EPA drinking water standards are limited to concentrations that would result in doses not exceeding 4 mrem per year, calculated according to a specified procedure. In addition, DOE Order 5400.5 requires that persons consuming water from DOE-operated

public water supplies do not receive an EDE greater than 4 mrem per year. DCGs for drinking water systems based on this requirement are in Table A-2.

Surface Water Standards

Concentrations of radionuclides in surface water samples may be compared with either the DOE DCGs (Table A-2) or the New Mexico Water Quality Control Commission (NMWQCC) stream standard, which references the state's radiation protection regulations. However, New Mexico radiation levels are in general two orders of magnitude greater than DOE's DCGs for public dose, so only the DCGs will be discussed here. The concentrations of nonradioactive constituents may be compared with the NMWQCC Livestock Watering and Wildlife Habitat stream standards (NMWQCC 1995) (http://www.nmenv.state.nm.us/NMED_regs/swqb/20_6_4_nmac.pdf). The NMWQCC groundwater standards can also be applied in cases where discharges may affect groundwater.

Soils

If contaminant concentrations in soil exceed regional statistical reference levels, the concentrations are first compared to screening levels. The screening level for soils is the concentration that would produce (a) a dose of 15 mrem or greater to an individual, (b) a carcinogen risk of 10^{-5}, or (c) a hazard quotient greater than 1. Screening levels for radionuclides are found in LANL 2005; screening levels for non-radionuclides are found in NMED 2006. If radionuclide concentrations in soil exceed the screening levels, then a dose to a person is calculated using RESRAD and all of the measured radionuclide concentrations available for a given year (these data are presented in Table S7-1). This calculated dose is compared to the 25-mrem/yr DOE single pathway dose standard (DOE 1999). Doses, risk, or hazard quotients are calculated using a conservative residential scenario given the measured contaminant soil concentration.

Foodstuffs

Federal standards exist for radionuclides and selected non-radionuclides (e.g. mercury and Polychlorinated Biphenyls (PCBs) in foodstuffs. Federal screening levels exist for selected non-radionuclides; LANL has selected screening levels for radionuclides. If contaminant concentrations in foodstuffs exceed regional statistical reference levels, the concentrations are compared to screening levels. LANL has established a screening level of 1 mrem/year for concentrations of individual radionuclides in individual foodstuffs (e.g. fish, crops, etc), assuming a residential scenario. EPA has established screening levels for mercury (EPA 2001) and PCBs (EPA 2007) in fish.

If contaminant concentrations in foodstuffs exceed screening levels, contaminant concentrations are compared against Food and Drug Administration (FDA) standards (FDA 2000). In the case of radionuclides, a dose to a person would be calculated from all the radionuclides measured and compared with the 25 mrem/yr DOE single-pathway dose constraint (DOE 1999).

Biota

If contaminant concentrations in biota exceed regional statistical reference levels, the concentrations are compared to screening levels. For radionuclides in biota, SLs were set at 10% of the standard by LANL to identify the potential contaminants of concern (McNaughton 2006). For chemicals, there are no SLs based on biota tissue concentrations. Instead, if a chemical in biota tissue exceeds the RSRL, then the chemical concentrations in the soil at the place of collection are compared with ecological screening levels (ESLs) (LANL 2008).

Based on the concentrations of radionuclides in biota, we calculate a dose and compare it with the 1-rad/day DOE dose standard for terrestrial plants and aquatic biota and 0.1-rad/day for terrestrial animals (DOE 2002).

References

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NMWQCC 1995: New Mexico Water Quality Control Commission, "State of New Mexico Water Quality Standards for Interstate and Intrastate Streams," Section 3-101.K (as amended through January 23, 1995).

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Throughout this report the US Customary (English) system of measurement has generally been used because those are the units in which most data and measurements are collected or measured. For units of radiation activity, exposure, and dose, US Customary Units (that is, curie [Ci], roentgen [R], rad, and rem) are retained as the primary measurement because current standards are written in terms of these units. The equivalent SI units are the becquerel (Bq), coulomb per kilogram (C/kg), gray (Gy), and sievert (Sv), respectively. Table B-1 presents conversion factors for converting US Customary Units into SI units.

Table B-2 presents prefixes used in this report to define fractions or multiples of the base units of measurements. Scientific notation is used in this report to express very large or very small numbers. Translating from scientific notation to a more traditional number requires moving the decimal point either left or right from the number. If the value given is 2.0×10^3, the decimal point should be moved three numbers (insert zeros if no numbers are given) to the right of its present location. The number would then read 2,000. If the value given is 2.0×10^{-5}, the decimal point should be moved five numbers to the left of its present location. The result would be 0.00002.

Table B-3 presents abbreviations for common measurements.

Table B-1
Approximate Conversion Factors for Selected US Customary Units

Multiply US Customary units	by	to Obtain SI (Metric) Unit
Fahrenheit (°F)	5/9 - 32	Celsius (°C)
inches (in.)	2.54	centimeters (cm)
cubic feet (ft^3)	0.028	cubic meters (m^3)
acres	.4047	hectares (ha)
ounces (oz)	28.3	grams (g)
pounds (lb)	0.453	kilograms (kg)
miles (mi)	1.61	kilometers (km)
gallons (gal.)	3.785	liters (L)
feet (ft)	0.305	meters (m)
parts per million (ppm)	1	micrograms per gram (µg/g)
parts per million (ppm)	1	milligrams per liter (mg/L)
square miles (mi^2)	2.59	square kilometers (km^2)
picocurie (pCi)	37	millibecquerel (mBq)
rad	0.01	gray (Gy)
millirem (mrem)	0.01	millisievert (mSv)

Table B-2
Prefixes Used with SI (Metric) Units

Prefix	Factor	Symbol
mega	1 000 000 or 10^6	M
kilo	1 000 or 10^3	k
centi	0.01 or 10^{-2}	c
milli	0.001 or 10^{-3}	m
micro	0.000001 or 10^{-6}	µ
nano	0.000000001 or 10^{-9}	n
pico	0.000000000001 or 10^{-12}	p
femto	0.000000000000001 or 10^{-15}	f
atto	0.000000000000000001 or 10^{-18}	a

DATA HANDLING OF RADIOCHEMICAL SAMPLES

Measurements of radiochemical samples require that analytical or instrumental backgrounds be subtracted to obtain net values. Thus, net values are sometimes obtained that are lower than the minimum detection limit of the analytical technique. Consequently, individual measurements can result in values of positive or negative numbers. Although a negative value does not represent a physical reality, a valid long-term average of many measurements can be obtained only if the very small and negative values are included in the population calculations (Gilbert 1975).

For individual measurements, uncertainties are reported as one standard deviation. The standard deviation is estimated from the propagated sources of analytical error.

Table B-3
Common Measurement Abbreviations and Measurement Symbols

Symbol	Abbreviation	Symbol	Abbreviation
aCi	attocurie	mrem	millirem
Bq	becquerel	mSv	millisievert
Btu	British thermal unit	nCi	nanocurie
Ci	curie	nCi/dry g	nanocurie per dry gram
cm^3/s	cubic centimeters per second	nCi/L	nanocurie per liter
cpm/L	counts per minute per liter	ng/m^3	nanogram per cubic meter
fCi/g	femtocurie per gram	pCi/dry g	picocurie per dry gram
ft	foot or feet	pCi/g	picocurie per gram
ft^3/min	cubic feet per minute	pCi/L	picocurie per liter
ft^3/s	cubic feet per second	pCi/m^3	picocurie per cubic meter
kg	kilogram	pCi/mL	picocurie per milliliter
kg/h	kilogram per hour	pg/g	picogram per gram
m^3/s	cubic meter per second	pg/m^3	picogram per cubic meter
µCi/L	microcurie per liter	PM_{10}	small particulate matter (less than 10 µm diameter)
µCi/mL	microcurie per milliliter	$PM_{2.5}$	small particulate matter (less than 2.5 µm diameter)
µg/g	microgram per gram	R	roentgen
$\mu g/m^3$	microgram per cubic meter	*s*, SD, or σ	standard deviation
mL	milliliter	sq ft (ft^2)	square feet
mm	millimeter	>	greater than
µm	micrometer	<	less than
µmho/cm	micro mho per centimeter	≥	greater than or equal to
mCi	millicurie	≤	less than or equal to
mg	milligram	±	plus or minus
mR	milliroentgen	~	approximately
mrad	millirad		

Standard deviations for the AIRNET station and group (off-site regional, off-site perimeter, and on-site) means are calculated using the standard equation:

$$s = (\Sigma (c_i - \bar{c})^2 / (N - 1))^{1/2}$$

where

c_i = sample i,

$\bar{c}$ = mean of samples from a given station or group, and

N = number of samples in the station or group.

This value is reported as one standard deviation (1*s*) for the station and group means.

REFERENCE

Gilbert 1975: R. O. Gilbert, "Recommendations Concerning the Computation and Reporting of Counting Statistics for the Nevada Applied Ecology Group," Battelle Pacific Northwest Laboratories report BNWL-B-368 (September 1975).

Locations of the technical areas (TAs) operated by the Laboratory in Los Alamos County are shown in Figure 1-2. The main programs conducted at each of the areas are listed in this Appendix.

Technical Area	Activities
TA-0 (Offsite Facilities)	This TA designation is assigned to structures leased by DOE that are located outside LANL's boundaries in the Los Alamos townsite and White Rock.
TA-2 (Omega Site or Omega West Reactor)	Omega West Reactor, an 8-MW nuclear research reactor, was located here. It was placed into a safe shutdown condition in 1993 and was removed from the nuclear facilities list. The reactor was decontaminated and decommissioned in 2002.
TA-3 (Core Area or South Mesa Site)	This TA is LANL's core scientific and administrative area, with approximately half of LANL's employees and total floor space. It is the location of a number of the LANL's Key Facilities, including the Chemistry and Metallurgy Research Building, the Sigma Complex, the Machine Shops, the Material Sciences Laboratory, and the Nicholas C. Metropolis Center for Modeling and Simulation.
TA-5 (Beta Site)	This TA is largely undeveloped. Located between East Jemez Road and the San Ildefonso Pueblo, it contains physical support facilities, an electrical substation, and test wells.
TA-6 (Two-Mile Mesa Site)	This TA, located in the northwestern part of LANL, is mostly undeveloped. It contains a meteorological tower, gas-cylinder-staging buildings, and aging vacant buildings that are awaiting demolition.
TA-8 (GT-Site [Anchor Site West])	This TA, located along West Jemez Road, is a testing site where nondestructive dynamic testing techniques are used for the purpose of ensuring the quality of materials in items ranging from test weapons components to high-pressure dies and molds. Techniques used include radiography, radioisotope techniques, ultrasonic and penetrant testing, and electromagnetic test methods.
TA-9 (Anchor Site East)	This TA is located on the western edge of LANL. Fabrication feasibility and the physical properties of explosives are explored at this TA, and new organic compounds are investigated for possible use as explosives.
TA-11 (K-Site)	This TA is used for testing explosives components and systems, including vibration analysis and drop-testing materials and components under a variety of extreme physical environments. Facilities are arranged so that testing may be controlled and observed remotely, allowing devices that contain explosives, radioactive materials, and nonhazardous materials to be safely tested and observed.
TA-14 (Q-Site)	This TA, located in the northwestern part of LANL, is one of 14 firing areas. Most operations are remotely controlled and involve detonations, certain types of high explosives machining, and permitted burning.
TA-15 (R-Site)	This TA, located in the central portion of LANL, is used for high explosives research, development, and testing, mainly through hydrodynamic testing and dynamic experimentation. TA-15 is the location of two firing sites, the Dual Axis Radiographic Hydrodynamic Test Facility, which has an intense high-resolution, dual-machine radiographic capability, and Building 306, a multipurpose facility where primary diagnostics are performed.
TA-16 (S-Site)	TA-16, in the western part of LANL, is the location of the Weapons Engineering Tritium Facility, a state-of-the-art tritium processing facility. The TA is also the location of high explosives research, development, and testing, and the High Explosives Wastewater Treatment Facility.
TA-18 (Pajarito Site)	This TA, located in Pajarito Canyon, is the location of the Los Alamos Critical Experiment Facility, a general-purpose nuclear experiments facility. It is the location of the Solution High-Energy Burst Assembly and is also used for teaching and training related to criticality safety and applications of radiation detection and instrumentation. All Security Category I and II materials and activities have been relocated to the Nevada Test Site.
TA-21 (DP-Site)	TA-21 is on the northern border of LANL, next to the Los Alamos townsite. In the western part of the TA is the former radioactive materials (including plutonium) processing facility that has been partially decontaminated and decommissioned. In the eastern part of the TA are the Tritium Systems Test Assembly and the Tritium Science and Fabrication Facility. Operations from both facilities have been transferred elsewhere as of the end of 2006.
TA-22 (TD-Site)	This TA, located in the northwestern portion of LANL, houses the Los Alamos Detonator Facility. Construction of a new Detonator Production Facility began in 2003. Research, development, and fabrication of high-energy detonators and related devices are conducted at this facility.
TA-28 (Magazine Area A)	TA-28, located near the southern edge of LANL, was an explosives storage area. The TA contains five empty storage magazines that are being decontaminated and decommissioned.
TA-33 (HP-Site)	TA-33 is a remotely-located TA at the southeastern boundary of LANL. The TA is used for experiments that require isolation, but do not require daily oversight. The National Radioastronomy Observatory's Very Long Baseline Array telescope is located at this TA.

Technical Area	Activities
TA-35 (Ten Site)	This TA, located in the north central portion of LANL, is used for nuclear safeguards research and development, primarily in the areas of lasers, physics, fusion, materials development, and biochemistry and physical chemistry research and development. The Target Fabrication Facility, located at this TA, conducts precision machining and target fabrication, polymer synthesis, and chemical and physical vapor deposition. Additional activities at TA-35 include research in reactor safety, optical science, and pulsed-power systems, as well as metallurgy, ceramic technology, and chemical plating. Additionally, there are some Biosafety Level 1 and 2 laboratories at TA-35.
TA-36 (Kappa Site)	TA-36, a remotely-located area in the eastern portion of LANL, has four active firing sites that support explosives testing. The sites are used for a wide variety of nonnuclear ordnance tests.
TA-37 (Magazine Area C)	This TA is used as an explosives storage area. It is located at the eastern perimeter of TA-16.
TA-39 (Ancho Canyon Site)	TA-39 is located at the bottom of Ancho Canyon. This TA is used to study the behavior of nonnuclear weapons (primarily by photographic techniques) and various phenomenological aspects of explosives.
TA-40 (DF Site)	TA-40, centrally located within LANL, is used for general testing of explosives or other materials and development of special detonators for initiating high explosives systems.
TA-41 (W Site)	TA-41, located in Los Alamos Canyon, is no longer actively used. Many buildings have been decontaminated and decommissioned; the remaining structures include historic properties.
TA-43 (the Bioscience Facilities, formerly called the Health Research Laboratory)	TA-43 is adjacent to the Los Alamos Medical Center at the northern border of LANL. Two facilities are located within this TA: the Bioscience Facilities (formerly called the Health Research Laboratory) and NNSA's local Site Office. The Bioscience Facilities have Biosafety Level 1 and 2 laboratories and are the focal point of bioscience and biotechnology at LANL. Research performed at the Bioscience Facilities includes structural, molecular, and cellular radiobiology; biophysics; radiobiology; biochemistry; and genetics.
TA-46 (WA Site)	TA-46, located between Pajarito Road and the San Ildefonso Pueblo, is one of LANL's basic research sites. Activities have focused on applied photochemistry operations and have included development of technologies for laser isotope separation and laser enhancement of chemical processes. The Sanitary Wastewater Systems Plant is also located within this TA.
TA-48 (Radiochemistry Site)	TA-48, located in the north central portion of LANL, supports research and development in nuclear and radiochemistry, geochemistry, production of medical radioisotopes, and chemical synthesis. Hot cells are used to produce medical radioisotopes.
TA-49 (Frijoles Mesa Site)	TA-49, located near Bandelier National Monument, is used as a training area and for outdoor tests on materials and equipment components that involve generating and receiving short bursts of high-energy, broad-spectrum microwaves. A fire support building and helipad located near the entrance to the TA are operated by the U.S. Forest Service.
TA-50 (Waste Management Site)	TA-50, located near the center of LANL, is the location of waste management facilities including the Radioactive Liquid Waste Treatment Facility and the Waste Characterization, Reduction, and Repackaging Facility. The Actinide Research and Technology Instruction Center is also located in this TA.
TA-51 (Environmental Research Site)	TA-51, located on Pajarito Road in the eastern portion of LANL, is used for research and experimental studies on the long-term impacts of radioactive materials on the environment. Various types of waste storage and coverings are studied at this TA.
TA-52 (Reactor Development Site)	TA-52 is located in the north central portion of LANL. A wide variety of theoretical and computational research and development activities related to nuclear reactor performance and safety, as well as to several environmental, safety, and health activities, are carried out at this TA.
TA-53 (Los Alamos Neutron Science Center)	TA-53, located in the northern portion of LANL, includes the LANSCE. LANSCE houses one of the largest research linear accelerators in the world and supports both basic and applied research programs. Basic research includes studies of subatomic and particle physics, atomic physics, neutrinos, and the chemistry of subatomic interactions. Applied research includes materials science studies that use neutron spallation and contributes to defense programs. LANSCE has also produced medical isotopes for the past 20 years.
TA-54 (Waste Disposal Site)	TA-54, located on the eastern border of LANL, is one of the largest TAs at LANL. Its primary function is management of solid radioactive and hazardous chemical wastes, including storage, treatment, decontamination, and disposal operations.
TA-55 (Plutonium Facility Complex Site)	TA-55, located in the center of LANL, is the location of the Plutonium Facility Complex and is the chosen location for the Chemistry and Metallurgy Research Building Replacement. The Plutonium Facility provides chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into many compounds and forms. The Chemistry and Metallurgy Research Building Replacement, currently under construction, will provide chemistry and metallurgy research, actinide chemistry, and materials characterization capabilities.

Technical Area	Activities
TA-57 (Fenton Hill Site)	TA-57 is located about 20 miles (32 kilometers) west of LANL on land administered by the U.S. Forest Service. The primary purpose of the TA is observation of astronomical events. TA-57 houses the Milagro Gamma Ray Observatory and a suite of optical telescopes. Drilling technology research is also performed in this TA.
TA-58 (Twomile North Site)	TA-58, located near LANL's northwest border on Twomile Mesa North, is a forested area reserved for future use because of its proximity to TA-3. The TA houses a few LANL-owned storage trailers and a temporary storage area.
TA-59 (Occupational Health Site)	This TA is located on the south side of Pajarito Road adjacent to TA-3. This is the location of staff who provide support services in health physics, risk management, industrial hygiene and safety, policy and program analysis, air quality, water quality and hydrology, hazardous and solid waste analysis, and radiation protection. The Medical Facility at TA-59 includes a clinical laboratory and provides bioassay sample analytical support.
TA-60 (Sigma Mesa)	TA-60 is located southeast of TA-3. The TA is primarily used for physical support and infrastructure activities. The Nevada Test Site Test Fabrication Facility and a test tower are also located here. Due to the moratorium on testing, these buildings have been placed in indefinite safe shutdown mode.
TA-61 (East Jemez Site)	TA-61, located in the northern portion of LANL, contains physical support and infrastructure facilities, including a sanitary landfill operated by Los Alamos County and sewer pump stations.
TA-62 (Northwest Site)	TA-62, located next to TA-3 and West Jemez Road in the northwest corner of LANL, serves as a forested buffer zone. This TA is reserved for future use.
TA-63 (Pajarito Service Area)	TA-63, located in the north central portion of LANL, contains physical support and infrastructure facilities. The facilities at this TA serve as localized storage and office space.
TA-64 (Central Guard Site)	This TA is located in the north central portion of LANL and provides offices and storage space.
TA-66 (Central Technical Support Site)	TA-66 is located on the southeast side of Pajarito Road in the center of LANL. The Advanced Technology Assessment Center, the only facility at this TA, provides office and technical space for technology transfer and other industrial partnership activities.
TA-67 (Pajarito Mesa Site)	TA-67 is a forested buffer zone located in the north central portion of LANL. No operations or facilities are currently located at the TA.
TA-68 (Water Canyon Site)	TA-68, located in the southern portion of LANL, is a testing area for dynamic experiments that also contains environmental study areas.
TA-69 (Anchor North Site)	TA-69, located in the northwestern corner of LANL, serves as a forested buffer area. The new Emergency Operations Center, completed in 2003, is located here.
TA-70 (Rio Grande Site)	TA-70 is located on the southeastern boundary of LANL and borders the Santa Fe National Forest. It is a forested TA that serves as a buffer zone.
TA-71 (Southeast Site)	TA-71 is located on the southeastern boundary of LANL and is adjacent to White Rock to the northeast. It is an undeveloped TA that serves as a buffer zone for the High Explosives Test Area.
TA-72 (East Entry Site)	TA-72, located along East Jemez Road on the northeastern boundary of LANL, is used by protective force personnel for required firearms training and practice purposes.
TA-73 (Airport Site)	TA-73 is located along the northern boundary of LANL, adjacent to Highway 502. The County of Los Alamos manages, operates, and maintains the community airport under a leasing arrangement with DOE. Use of the airport by private individuals is permitted with special restrictions.
TA-74 (Otowi Tract)	TA-74 is a forested area in the northeastern corner of LANL. A large portion of this TA has been conveyed to Los Alamos County or transferred to the Department of the Interior in trust for the Pueblo of San Ildefonso and is no longer part of LANL.

For more information on environmental topics at Los Alamos National Laboratory, access the following websites:

Environmental Surveillance reports and supplemental data tables	http://www.lanl.gov/environment/all/esr.shtml
Los Alamos National Laboratory web site	http://www.lanl.gov/
DOE/NNSA Los Alamos Site Office web site	http://www.doeal.gov/laso/default.aspx
Department of Energy web site	http://www.energy.gov/
LANL's air quality pages	http://www.lanl.gov/environment/air/index.shtml
LANL's water quality pages	http://www.lanl.gov/environment/h2o/index.shtml
LANL's waste pages	http://www.lanl.gov/environment/waste/index.shtml
LANL's biological resources pages	http://www.lanl.gov/environment/bio/index.shtml
LANL's risk reduction pages	http://www.lanl.gov/environment/risk/index.shtml
LANL's clean-up pages	http://www.lanl.gov/environment/cleanup/index.shtml
LANL's environmental database	http://www.lanl.gov/environment/all/racer.shtml
Comments and suggestions on this document	http://www.lanl.gov/environment/all/esr.shtml

activation products	Radioactive products generated as a result of neutrons and other subatomic particles interacting with materials such as air, construction materials, or impurities in cooling water. These activation products are usually distinguished, for reporting purposes, from fission products.
alpha particle	A positively charged particle (identical to the helium nucleus) composed of two protons and two neutrons that are emitted during decay of certain radioactive atoms. Alpha particles are stopped by several centimeters of air or a sheet of paper
ambient air	The surrounding atmosphere as it exists around people, plants, and structures. It is not considered to include the air immediately adjacent to emission sources.
AOC	Area of concern
aquifer	A saturated layer of rock or soil below the ground surface that can supply usable quantities of groundwater to wells and springs. Aquifers can be a source of water for domestic, agricultural, and industrial uses.
artesian well	A well in which the water rises above the top of the water-bearing bed.
background radiation	Ionizing radiation from sources other than the Laboratory. This radiation may include cosmic radiation; external radiation from naturally occurring radioactivity in the earth (terrestrial radiation), air, and water; internal radiation from naturally occurring radioactive elements in the human body; worldwide fallout; and radiation from medical diagnostic procedures.
beta particle	A negatively charged particle (identical to the electron) that is emitted during decay of certain radioactive atoms. Most beta particles are stopped by 0.6 cm of aluminum.
biota	The types of animal and plant life found in an area.
blank sample	A control sample that is identical, in principle, to the sample of interest, except that the substance being analyzed is absent. The measured value or signals in blanks for the analyte is believed to be caused by artifacts and should be subtracted from the measured value. This process yields a net amount of the substance in the sample.
blind sample	A control sample of known concentration in which the expected values of the constituent are unknown to the analyst.
CAA	Clean Air Act. The federal law that authorizes the Environmental Protection Agency (EPA) to set air quality standards and to assist state and local governments to develop and execute air pollution prevention and control programs.

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980. Also known as Superfund, this law authorizes the federal government to respond directly to releases of hazardous substances that may endanger health or the environment. The EPA is responsible for managing Superfund.
CFR	Code of Federal Regulations. A codification of all regulations developed and finalized by federal agencies in the Federal Register.
contamination	(1) Substances introduced into the environment as a result of people's activities, regardless of whether the concentration is a threat to health (see pollution). (2) The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.
controlled area	Any Laboratory area to which access is controlled to protect individuals from exposure to radiation and radioactive materials.
Ci	Curie. Unit of radioactivity. One Ci equals 3.70 × 1010 nuclear transformations per second.
cosmic radiation	High-energy particulate and electromagnetic radiations that originate outside the earth's atmosphere. Cosmic radiation is part of natural background radiation.
CWA	Clean Water Act. The federal law that authorizes the EPA to set standards designed to restore and maintain the chemical, physical, and biological integrity of the nation's waters.
DCG	Derived Concentration Guides. The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem. DCGs do not consider decay products when the parent radionuclide is the cause of the exposure (DCG values are presented in DOE Order 5400.5).
DOE	US Department of Energy. The federal agency that sponsors energy research and regulates nuclear materials used for weapons production. Los Alamos National Laboratory is managed by the NNSA, an agency within the DOE.
dose	A term denoting the quantity of radiation energy absorbed.
absorbed dose	The energy absorbed by matter from ionizing radiation per unit mass of irradiated material at the place of interest in that material. The absorbed dose is expressed in units of rad (or gray) (1 rad = 0.01 gray).
dose equivalent	The product of absorbed dose in rad (or gray) in tissue, a quality factor, and other modifying factors. Dose equivalent is expressed in units of rem (or sievert) (1 rem = 0.01 sievert).

TEDE	Total effective dose equivalent. The hypothetical whole-body dose that would give the same risk of cancer mortality and serious genetic disorder as a given exposure but that may be limited to a few organs. The effective dose equivalent is equal to the sum of individual organ doses, each weighted by degree of risk that the organ dose carries. For example, a 100-mrem dose to the lung, which has a weighting factor of 0.12, gives an effective dose that is equivalent to 100 × 0.12 = 12 mrem.
Maximum individual dose	The greatest dose commitment, considering all potential routes of exposure from a facility's operation, to an individual at or outside the Laboratory boundary where the highest dose rate occurs. It takes into account shielding and occupancy factors that would apply to a real individual.
population dose	The sum of the radiation doses to individuals of a population. It is expressed in units of person-rem. (For example, if 1,000 people each received a radiation dose of 1 rem, their population dose would be 1,000 person-rem.)
whole body dose	A radiation dose commitment that involves exposure of the entire body (as opposed to an organ dose that involves exposure to a single organ or set of organs).
effluent	A liquid waste discharged to the environment.
EIS	Environmental Impact Statement. A detailed report, required by federal law, on the significant environmental impacts that a proposed major federal action would have on the environment. An EIS must be prepared by a government agency when a major federal action that will have significant environmental impacts is planned.
emission	A gaseous waste discharged to the environment.
environmental compliance	The documentation that the Laboratory complies with the multiple federal and state environmental statutes, regulations, and permits that are designed to ensure environmental protection. This documentation is based on the results of the Laboratory's environmental monitoring and surveillance programs.
environmental monitoring	The sampling of contaminants in liquid effluents and gaseous emissions from Laboratory facilities, either by directly measuring or by collecting and analyzing samples in a laboratory.
environmental surveillance	The sampling of contaminants in air, water, sediments, soils, foodstuffs, and plants and animals, either by directly measuring or by collecting and analyzing samples in a laboratory.

EPA	Environmental Protection Agency. The federal agency responsible for enforcing environmental laws. Although state regulatory agencies may be authorized to administer some of this responsibility, EPA retains oversight authority to ensure protection of human health and the environment.
exposure	A measure of the ionization produced in air by x-ray or gamma ray radiation. (The unit of exposure is the roentgen.)
external radiation	Radiation originating from a source outside the body.
gallery	An underground collection basin for spring discharges.
gamma radiation	Short-wavelength electromagnetic radiation of nuclear origin that has no mass or charge. Because of its short wavelength (high energy), gamma radiation can cause ionization. Other electromagnetic radiation (such as microwaves, visible light, and radiowaves) has longer wavelengths (lower energy) and cannot cause ionization.
gross alpha	The total amount of measured alpha activity without identification of specific radionuclides.
gross beta	The total amount of measured beta activity without identification of specific radionuclides.
groundwater	Water found beneath the surface of the ground. Groundwater usually refers to a zone of complete water saturation containing no air.
half-life, radioactive	The time required for the activity of a radioactive substance to decrease to half its value by inherent radioactive decay. After two half-lives, one-fourth of the original activity remains (1/2 × 1/2), after three half-lives, one-eighth (1/2 × 1/2 × 1/2), and so on.
hazardous waste	Wastes exhibiting any of the following characteristics: ignitability, corrosivity, reactivity, or yielding toxic constituents in a leaching test. In addition, EPA has listed as hazardous other wastes that do not necessarily exhibit these characteristics. Although the legal definition of hazardous waste is complex, the term generally refers to any waste that EPA believes could pose a threat to human health and the environment if managed improperly. Resource Conservation and Recovery Act (RCRA) regulations set strict controls on the management of hazardous wastes.
hazardous waste constituent	The specific substance in a hazardous waste that makes it constituent hazardous and therefore subject to regulation under Subtitle C of RCRA.

HSWA	Hazardous and Solid Waste Amendments of 1984 to RCRA. These amendments to RCRA greatly expanded the scope of hazardous waste regulation. In HSWA, Congress directed EPA to take measures to further reduce the risks to human health and the environment caused by hazardous wastes.
hydrology	The science dealing with the properties, distribution, and circulation of natural water systems.
internal radiation	Radiation from a source within the body as a result of deposition of radionuclides in body tissues by processes such as ingestion, inhalation, or implantation. Potassium-40, a naturally occurring radionuclide, is a major source of internal radiation in living organisms. Also called self-irradiation.
ionizing radiation	Radiation possessing enough energy to remove electrons from the substances through which it passes. The primary contributors to ionizing radiation are radon, cosmic and terrestrial sources, and medical sources such as x-rays and other diagnostic exposures.
isotopes	Forms of an element having the same number of protons in their nuclei but differing in the number of neutrons. Isotopes of an element have similar chemical behaviors but can have different nuclear behaviors.
long-lived isotope	A radionuclide that decays at such a slow rate that a quantity of it will exist for an extended period (half-life is greater than three years).
short-lived isotope	A radionuclide that decays so rapidly that a given quantity is transformed almost completely into decay products within a short period (half-life is two days or less).
LANS	Los Alamos National Security. The limited liability corporation that took over management of LANL in June 2006.
LASO	Los Alamos Site Office. The Los Alamos office of the DOE's NNSA.
LLW	Low-level radioactive waste. Radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct material (as defined in section 11e.(2) of the *Atomic Energy Act of 1954*, as amended), or naturally occurring radioactive material.
MCL	Maximum contaminant level. Maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system (see Appendix A and Table A-6). The MCLs are specified by the EPA.
MDA	Material disposal area.

MEI	Maximally exposed individual. The average exposure to the population in general will always be less than to one person or subset of persons because of where they live, what they do, and their individual habits. To try to estimate the dose to the MEI, one tries to find that population subgroup (and more specifically, the one individual) that potentially has the highest exposure, intake, etc. This becomes the MEI.
mixed waste	Waste that contains a hazardous waste component regulated under Subtitle C of the RCRA and a radioactive component consisting of source, special nuclear, or byproduct material regulated under the federal Atomic Energy Act (AEA).
mrem	Millirem. See definition of rem. The dose equivalent that is one-thousandth of a rem.
NEPA	National Environmental Policy Act. This federal legislation, passed in 1969, requires federal agencies to evaluate the impacts of their proposed actions on the environment before decision making. One provision of NEPA requires the preparation of an EIS by federal agencies when major actions significantly affecting the quality of the human environment are proposed.
NESHAP	National Emission Standards for Hazardous Air Pollutants. These standards are found in the CAA; they set limits for such pollutants as beryllium and radionuclides.
NNSA	National Nuclear Security Agency. An agency within the DOE that is responsible for national security through the military application of nuclear energy.
nonhazardous waste	Chemical waste regulated under the Solid Waste Act, Toxic Substances Control Act, and other regulations, including asbestos, PCB, infectious wastes, and other materials that are controlled for reasons of health, safety, and security.
NPDES	National Pollutant Discharge Elimination System. This federal program, under the Clean Water Act, requires permits for discharges into surface waterways.
nuclide	A species of atom characterized by the constitution of its nucleus. The nuclear constitution is specified by the number of protons, number of neutrons, and energy content—or alternately, by the atomic number, mass number, and atomic mass. To be a distinct nuclide, the atom must be capable of existing for a measurable length of time.
outfall	The location where wastewater is released from a point source into a receiving body of water.

PCB	Polychlorinated biphenyls. A family of organic compounds used since 1926 in electric transformers, lubricants, carbonless copy paper, adhesives, and caulking compounds. PCBs are extremely persistent in the environment because they do not break down into new and less harmful chemicals. PCBs are stored in the fatty tissues of humans and animals through the bioaccumulation process. EPA banned the use of PCBs, with limited exceptions, in 1976.
PDL	Public Dose Limit. The new term for Radiation Protection Standards, a standard for external and internal exposure to radioactivity as defined in DOE Order 5400.5 (see Appendix A and Table A-1).
PE Curie	One PE curie is the quantity of transuranic material that has the same radiation inhalation hazard as one curie of Pu-239.The PE curie is described in Appendix B of http://www.wipp.energy.gov/library/wac/CH-WAC.pdf.
perched groundwater	A groundwater body above a slow-permeability rock or soil layer that is separated from an underlying main body of groundwater by a vadose zone.
person-rem	A quantity used to describe the radiological dose to a population. Population doses are calculated according to sectors, and all people in a sector are assumed to get the same dose. The number of person-rem is calculated by summing the modeled dose to all receptors in all sectors. Therefore, person-rem is the sum of the number of people times the dose they receive.
pH	A measure of the hydrogen ion concentration in an aqueous solution. Acidic solutions have a pH less than 7, basic solutions have a pH greater than 7, and neutral solutions have a pH of 7.
pollution	Levels of contamination that may be objectionable (perhaps because of a threat to health [see contamination]).
point source	An identifiable and confined discharge point for one or more water pollutants, such as a pipe, channel, vessel, or ditch.
ppb	Parts per billion. A unit measure of concentration equivalent to the weight/volume ratio expressed as µg/L or ng/mL. Also used to express the weight/weight ratio as ng/g or µg/kg.
ppm	Parts per million. A unit measure of concentration equivalent to the weight/volume ratio expressed as mg/L. Also used to express the weight/weight ratio as µg/g or mg/kg.
QA	Quality assurance. Any action in environmental monitoring to ensure the reliability of monitoring and measurement data. Aspects of quality assurance include procedures, interlaboratory comparison studies, evaluations, and documentation.

QC	Quality control. The routine application of procedures within environmental monitoring to obtain the required standards of performance in monitoring and measurement processes. QC procedures include calibration of instruments, control charts, and analysis of replicate and duplicate samples.
rad	Radiation absorbed dose. The rad is a unit for measuring energy absorbed in any material. Absorbed dose results from energy being deposited by the radiation. It is defined for any material. It applies to all types of radiation and does not take into account the potential effect that different types of radiation have on the body. 1 rad = 1,000 millirad (mrad)
radionuclide	An unstable nuclide capable of spontaneous transformation into other nuclides through changes in its nuclear configuration or energy level. This transformation is accompanied by the emission of photons or particles.
RCRA	Resource Conservation and Recovery Act of 1976. RCRA is an amendment to the first federal solid waste legislation, the Solid Waste Disposal Act of 1965. In RCRA, Congress established initial directives and guidelines for EPA to regulate hazardous wastes.
release	Any discharge to the environment. Environment is broadly defined as water, land, or ambient air.
rem	Roentgen equivalent man. The rem is a unit for measuring dose equivalence. It is the most commonly used unit and pertains only to people. The rem takes into account the energy absorbed (dose) and the biological effect on the body (quality factor) from the different types of radiation. rem = rad × quality factor 1 rem = 1,000 millirem (mrem)
SAL	Screening Action Level. A defined contaminant level that if exceeded in a sample requires further action.
SARA	Superfund Amendments and Reauthorization Act of 1986. This act modifies and reauthorizes CERCLA. Title III of this act is known as the Emergency Planning and Community Right-to-Know Act of 1986.
saturated zone	Rock or soil where the pores are completely filled with water, and no air is present.

SWMU	Solid waste management unit. Any discernible site at which solid wastes have been placed at any time, regardless of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically released, such as waste tanks, septic tanks, firing sites, burn pits, sumps, landfills (material disposal areas), outfall areas, canyons around LANL, and contaminated areas resulting from leaking product storage tanks (including petroleum).
terrestrial radiation	Radiation emitted by naturally occurring radionuclides such as internal radiation source; the natural decay chains of uranium-235, uranium-238, or thorium-232; or cosmic-ray-induced radionuclides in the soil.
TLD	Thermoluminescent dosimeter. A material (the Laboratory uses lithium fluoride) that emits a light signal when heated to approximately 300°C. This light is proportional to the amount of radiation (dose) to which the dosimeter was exposed.
TRU	Transuranic waste. Waste contaminated with long-lived transuranic elements in concentrations within a specified range established by DOE, EPA, and Nuclear Regulatory Agency. These are elements shown above uranium on the chemistry periodic table, such as plutonium, americium, and neptunium, that have activities greater than 100 nanocuries per gram.
TSCA	Toxic Substances Control Act. TSCA is intended to provide protection from substances manufactured, processed, distributed, or used in the United States. A mechanism is required by the act for screening new substances before they enter the marketplace and for testing existing substances that are suspected of creating health hazards. Specific regulations may also be promulgated under this act for controlling substances found to be detrimental to human health or to the environment.
tuff	Rock formed from compacted volcanic ash fragments.
uncontrolled area	An area beyond the boundaries of a controlled area (see controlled area in this glossary).
unsaturated zone	See vadose zone in this glossary.
UST	Underground storage tank. A stationary device, constructed primarily of nonearthen material, designed to contain petroleum products or hazardous materials. In a UST, 10% or more of the volume of the tank system is below the surface of the ground.
vadose zone	The partially saturated or unsaturated region above the water table that does not yield water for wells. Water in the vadose zone is held to rock or soil particles by capillary forces and much of the pore space is filled with air.

water table	The water level surface below the ground at which the unsaturated zone ends and the saturated zone begins. It is the level to which a well that is screened in the unconfined aquifer would fill with water.
watershed	The region draining into a river, a river system, or a body of water.
wetland	A lowland area, such as a marsh or swamp, that is inundated or saturated by surface water or groundwater sufficient to support hydrophytic vegetation typically adapted for life in saturated soils.
wind rose	A diagram that shows the frequency and intensity of wind from different directions at a particular place.
worldwide fallout	Radioactive debris from atmospheric weapons tests that has been deposited on the earth's surface after being airborne and cycling around the earth.

Ac-ft	acre-feet
ACA	accelerated corrective action
AIRNET	Ambient Air Monitoring Network
ALARA	as low as reasonably achievable
AOC	area of concern
AQA	Analytical Quality Associates
ARRA	American Recovery and Reinvestment Act
AST	aboveground storage tank
BCG	Biota Concentration Guides
BDD	Buckman Direct Diversion Project
BMP	Best Management Practice
BOD	biological oxygen demand
BSRL	baseline statistical reference level
C&T	(Land) Conveyance and Transfer Project
CAA	Clean Air Act
CEM	Certified Energy Manager
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGP	Construction General Permit
Ci	curie
CME	corrective measure evaluation
CMI	corrective measure implementation
CMR	Chemistry and Metallurgy Research Facility
CMRR	Chemistry and Metallurgy Research Replacement Facility
COE	United States Army Corps of Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Consent Order	New Mexico Environment Department Compliance Order on Consent
COPC	chemical of potential concern
CWA	Clean Water Act
CY	calendar year
D&D	decontamination and decommissioning
DAC	derived air concentration

DARHT	Dual Axis Radiographic Hydrotest Facility
DCG	derived concentration guide
DOE	Department of Energy
DOECAP	Department of Energy Contract Analytical Program
DP	Delta Prime site
DPA	Data Package Assessment
DRO	diesel-range organic compound
DPRNET	Direct Penetrating Radiation Monitoring Network
DU	depleted uranium
EDE	effective dose equivalent
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP	Environmental Programs Directorate
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	environment, safety, & health
ESH&Q	Environment, Safety, Health, and Quality Directorate
ESL	ecological screening level
ESPC	Energy Savings Performance Contract
EU	enriched uranium
FCRS	Flood Control Retention Structure
FDA	Food and Drug Administration
FFCA	Federal Facility Compliance Agreement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOD	Facility Operations Directorate
FY	fiscal year
GEL	General Environmental Laboratory
GHG	greenhouse gas
GMAP	gaseous mixed air activation products
GSAF	Generator Set-Aside Fee
GSA	General Services Administration

HAP	hazardous air pollutant
HE	high explosive
HEWTF	High Explosive Wastewater Treatment Facility
HPSB	High Performance Sustainable Building
HQ	hazard quotient
HSWA	Hazardous and Solid Waste Amendments
HT	elemental tritium
HTO	tritium oxide
IFWGMP	Interim Facility-Wide Groundwater Monitoring Plan
IP	Individual Permit
ISL	industrial screening level
ISM	Integrated Safety Management
ISO	International Standards Organization
JIT	just in time
LACW	Los Alamos Canyon Weir
LANL	Los Alamos National Laboratory (or the Laboratory)
LANS	Los Alamos National Security, LLC
LANSCE	Los Alamos Neutron Science Center (TA-53)
LASO	Los Alamos Site Office
LC/MS/MS	liquid chromatography/mass spectrometry/mass spectrometry
LCS	laboratory control sample
LEED	Leadership in Energy and Environmental Design
LLW	low-level waste
MAP	Mitigation Action Plan
MAPEP	Mixed-Analyte Performance Evaluation Program
MCL	maximum contaminant level
MDA	material disposal area
MDL	method detection limit
MEI	maximally exposed individual
MLLW	mixed low-level waste

MOU	memorandum of understanding
MREM	millirem
MS	matrix spike
MSGP	Multi-Sector General Permit
NCRP	National Council on Radiation Protection
NELAP	National Environmental Laboratory Accreditation Program
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NISC	Nonproliferation and International Security Center
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NNSA	National Nuclear Security Administration
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRDA	natural resources damage assessment
NSSB	National Security Sciences Building
NSR	New Source Review
NTS	Nevada Test Site
NTU	nephelometric turbidity units
ODS	Ozone-depleting substances
ORP	oxidation-reduction potential
P2	Pollution Prevention Program
PA/CA	performance assessment/composite analysis
PCB	polychlorinated biphenyls
PCFRS	Pajarito Canyon Flood Retention Structure
PE	performance evaluation
PM	particulate matter
ppb	parts per billion
PQL	Practical Quantitation Limit

PRS	Potential Release Site
PSTB	Petroleum Storage Tank Bureau
P/VAP	particulate/vapor activation products
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
R&D	research and development
RAMP	Roof Assessment Management Program
RCRA	Resource Conservation and Recovery Act
RDX	research department explosive (cyclonite)
RLUOB	Radiological Laboratory/Utility/Office Building
RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
RSL	residential screening level
RSRL	regional statistical reference level
RWMB	Radioactive Waste Management Basis
SAL	screening action level
SDPPP	Site Discharge Pollution Prevention Plan
SDWA	Safe Drinking Water Act
SERF	Sanitary Effluent Reclamation Facility
SFB	soil, foodstuffs, and biota
SL	screening level
SMA	Site Monitoring Area
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SPCC	Spill Prevention Control and Countermeasures
SR	State Road
SSL	soil screening level
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWEIS	Site-Wide Environmental Impact Statement

SWPPP	Storm Water Pollution Prevention Plan
SWMU	solid waste management unit
SWWS	Sanitary Wastewater Systems Plant
TA	Technical Area
TAL	target analyte list
TCDD	tetrachlorodibenzodioxin
TCDF	tetrachlorodibenzofuran
TCE	trichloroethylene
TDS	total dissolved solids
TEQ	toxicity equivalent quotient
TLD	thermoluminescent dosimeter
TNT	trinitrotoluene
TOC	total organic carbon
TRC	total residual chlorine
TRU	transuranic
TSCA	Toxic Substances Control Act
TSDF	treatment, storage, or disposal facility
UI	Utilities and Infrastructure Facilities
USFS	United States Forest Service
USGS	United States Geological Survey
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Project
WWTP	wastewater treatment plant
WY	water year
ZLD	Zero Liquid Discharge

Actinium	Ac	Erbium	Er
Aluminum	Al	Europium	Eu
Americium	Am	Fermium	Fm
Argon	Ar	Fluorine	F
Antimony	Sb	Francium	Fr
Arsenic	As	Gadolinium	Gd
Astatine	At	Gallium	Ga
Barium	Ba	Germanium	Ge
Berkelium	Bk	Gold	Au
Beryllium	Be	Hafnium	Hf
Bicarbonate	HCO_3	Helium	He
Bismuth	Bi	Holmium	Ho
Boron	B	Hydrogen	H
Bromine	Br	Hydrogen oxide	H_2O
Cadmium	Cd	Indium	In
Calcium	Ca	Iodine	I
Californium	Cf	Iridium	Ir
Carbon	C	Iron	Fe
Cerium	Ce	Krypton	Kr
Cesium	Cs	Lanthanum	La
Chlorine	Cl	Lawrencium	Lr (Lw)
Chromium	Cr	Lead	Pb
Cobalt	Co	Lithium	Li
Copper	Cu	Lithium fluoride	LiF
Curium	Cm	Lutetium	Lu
Cyanide	CN	Magnesium	Mg
Carbonate	CO_3	Manganese	Mn
Dysprosium	Dy	Mendelevium	Md
Einsteinium	Es	Mercury	Hg

Molybdenum	Mo	Samarium	Sm
Neodymium	Nd	Scandium	Sc
Neon	Ne	Selenium	Se
Neptunium	Np	Silicon	Si
Nickel	Ni	Silver	Ag
Niobium	Nb	Sodium	Na
Nitrate (as Nitrogen)	NO_3-N	Strontium	Sr
Nitrite (as Nitrogen)	NO_2-N	Sulfate	SO_4
Nitrogen	N	Sulfite	SO_3
Nitrogen dioxide	NO_2	Sulfur	S
Nobelium	No	Tantalum	Ta
Osmium	Os	Technetium	Tc
Oxygen	O	Tellurium	Te
Palladium	Pd	Terbium	Tb
Phosphorus	P	Thallium	Tl
Phosphate (as Phosphorus)	PO_4-P	Thorium	Th
Platinum	Pt	Thulium	Tm
Plutonium	Pu	Tin	Sn
Polonium	Po	Titanium	Ti
Potassium	K	Tritiated water	HTO
Praseodymium	Pr	Tritium	^3H
Promethium	Pm	Tungsten	W
Protactinium	Pa	Uranium	U
Radium	Ra	Vanadium	V
Radon	Rn	Xenon	Xe
Rhenium	Re	Ytterbium	Yb
Rhodium	Rh	Yttrium	Y
Rubidium	Rb	Zinc	Zn
Ruthenium	Ru	Zirconium	Zr

In the Report "Environmental Surveillance at Los Alamos During 2009," a number of errors were introduced during the final compositing of the report. These errors have been corrected in the on-line version http://int.lanl.gov/environment/all/esr.shtml. In the printed copies of the report, the following errors are found.

1. Chapter 1, page 40, Table 1-2, 2 corrections – both in the middle column: 1,6057 should be 1,605, and 4,882 should be 5,551.

2. Chapter 3, page 87 Figure 3-3: The caption of the figure should be "Los Alamos County radiation background compared with average US background. Los Alamos County-specific background doses have not been determined for potassium-40, medical/dental exposures, man-made radiation, and global fallout and are assumed to be the same as the US average in this figure."

3. Chapter 5, page 148, Figure 5-10 should read, "Bis(2-ethylhexyl)phthalate concentration history for intermediate well MCOI-6. Nondetects are reported at the practical quantitation limit (PQL) of about 11 µg/L; the MDL is about 2.2 µg/L. The EPA MCL is 6 µg/L."
   Chapter 5, page 150, Figure 5-16 should read, "Figure 5-16. Bis(2-ethylhexyl)phthalate concentration history for intermediate groundwater well TA-53i. The EPA MCL is 6 µg/L."

4. Chapter 6, pages 214 and 215, D.1 heading should be "On-Site and Perimeter Monitoring Locations," and D.2 should be "Regional Monitoring Locations."

5. Chapter 8, page 281, Table 8-1 should read, "Standards and Other Reference Levels Applied to Foodstuffs"
   Chapter 8, page 288, Table 8-2 should read, "Standards and Other Reference Levels Applied to Biota"
   Chapter 8, page 291, Figure 8-9, The unit measurements should read "Uranium-238 (pCi/g ash)"
   Chapter 8, page 292, Figure 8-10, The unit measurements should read "Uranium-238 (pCi/g ash)"

The following Los Alamos National Laboratory organizations perform environmental surveillance, ensure environmental compliance, and provide environmental data for this report:

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Water Quality and RCRA Group (Luciana Vigil-Holterman and Robert Beers, Coordinators)
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Previous reports in this series are LA-14427-ENV, LA-13775-ENV, LA 13861 ENV, LA-13979-ENV, LA-14085 ENV, LA-14162-ENV, LA 14239 ENV, LA-14304-ENV, LA-14341-ENV, LA-14369-ENV, LA 14407 ENV, and LA-14427-ENV.

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An on-line survey form for providing comments, suggestions, and other input on this report is available at http://www.lanl.gov/environment/all/esr.shtml

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Date: March 22, 2011
Refer To: ENV-RCRA-11-0040
LAUR: 11-00269, 11-01005

Mr. William C. Olson, Bureau Chief
Ground Water Quality Bureau
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Harold Runnels Building, Room N2250
1190 St. Francis Drive
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Santa Fe, NM 87502

Dear Mr. Olson:

SUBJECT: TA-50 RLWTF ANNUAL REPORTS FOR 2008 AND 2009

Please find enclosed the following Los Alamos National Laboratory reports:

- *Radioactive Liquid Waste Treatment Facility Annual Report for 2008* (LA-UR-11-00269)
- *Radioactive Liquid Waste Treatment Facility Annual Report for 2009* (LA-UR-11-01005)

These reports are being provided to your agency as supporting documentation for Los Alamos National Laboratory's Groundwater Discharge Permit Application (DP-1132) for the Radioactive Liquid Waste Treatment Facility (RLWTF) at Technical Area (TA)-50.

The RLWTF annual reports for 2008 and 2009 contain summary information about flows, concentrations, and quantities received and discharged at the TA-50 and TA-53 radioactive liquid waste treatment facilities. The facility at TA-50 operates two different treatment processes for low-level radioactive liquid waste and transuranic radioactive liquid waste. The two processes are discussed separately throughout the report as though they were each a separate facility.

: 00066

Please contact me at 505-667-7969 if you have questions.

Sincerely,

Robert Beers
Water Quality and RCRA Group

BB/lm

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Hugh McGovern, TA-55 RLW, w/o enc., E518
Pete Worland, TA-55-RLW, w/o enc., E518
Chris Del Signore, TA-55-RLW, w/o enc., E518
ENV-RCRA File, w/enc., K490
IRM-RMMSO, w/enc., A150

LA-UR-11-00269

Approved for public release;
distribution is unlimited.

Title:	Radioactive Liquid Waste Treatment Facility Annual Report for 2008
Author(s):	J.C. Del Signore R.L. Watkins
Intended for:	TA55 Radioactive Liquid Waste December 2010

Los Alamos
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Form 836 (7/06)

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Acronyms and Abbreviations

AE-Ci	americium-241-equivalent curie
Ci	curie (3.7×10^{10} disintegrations per second)
COD	chemical oxygen demand
CY	calendar year
DCG	derived concentration guidelines
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
IX	ion exchange
Kg	kilogram
L	liter
LANL	Los Alamos National Laboratory
MDL	method detection limit
meq/L	milliequivalents per liter
mg/L	milligram per liter
mrem	millirem (10^{-3} rem)
nCi/L	nanocuries per liter (10^{-9} curies per liter)
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
pCi/L	picocuries per liter (10^{-12} curies per liter)
RLW	radioactive liquid waste(s)
RLWCS	radioactive liquid waste collection system
RLWTF	radioactive liquid waste treatment facility
RO	reverse osmosis
SVOC	semi-volatile organic chemical(s)
TA	technical area
TDS	total dissolved solids
TSS	total suspended solids
TUF	tubular ultrafilter
VOC	volatile organic chemical(s)
µS/cm	microSiemens per centimeter
µg/L	microgram per liter

1. Overview of Facilities and Operations

There are two Radioactive Liquid Waste Treatment Facilities (RLWTF) at the Los Alamos National Laboratory, one each at TA53 and TA50. The RLW facility at TA50, however, contains two different treatment processes, each treating a different radioactive liquid waste (RLW) stream. These two processes are discussed separately throughout this report as though they were each a facility.

1.1 TA50 RLWTF for Low-Level RLW

The low-level RLW facility at TA50 receives and treats low-level RLW from more than 1000 generating points. RLW are sent from generator facilities to TA50 via truck or by underground pipe. The underground collection system that has about four miles of double-walled pipes that are tied to 25 buildings at six Technical Areas at LANL.

The low-level RLW facility is the only facility that discharges water to the environment. Treated waters are discharged through an outfall in Mortandad Canyon. One state and two federal agencies monitor the quality of these treated waters.

Primary structures at the TA50 RLWTF for the treatment of low-level RLW are Building 50-01, 50-02, 50-90, 50-248, and a trailer-based evaporator. These structures, with a combined area of approximately 55,000 square feet, house process equipment, operations support areas, analytical laboratories, and offices. The facility has a main treatment process (MTP) with five unit operations, and a secondary treatment process consisting of two unit operations for the treatment of wastes generated by the MTP. The facility has been designated a Hazard Category 3 nuclear facility, and has Management Level 3 and Level 4 quality assurance requirements.

The TA50 RLWTF was constructed in 1963. Because of its age, and because of changing regulations, the facility has undergone significant modifications. The infusion of capital into the TA50 facility for repairs and upgrades has exceeded $20 million since 1997, including projects for stack consolidation, repair of tanks and equipment, and the installation of new processes in 1999 and 2002 to address more stringent discharge standards.

1.2 TA50 RLWTF for Transuranic RLW

The transuranic facility receives and treats an acid waste stream and a caustic waste stream from the plutonium facility at TA55. These two streams are transferred to TA50 via two underground double-walled collection pipes. Treated transuranic waters are sent to the low-level evaporator for further treatment.

The transuranic RLW process was designed and installed in 1982, and brought online in 1983. Structures consist of a valve station at Building 50-201, two influent storage tanks in Building 50-66, and the treatment process within Room 60 of Building 50-01. This facility is part of the Hazard Category 3 nuclear facility at TA50, and has Management Level 2 and Level 3 quality assurance requirements.

1.3 TA53 Facility

The facility at TA53 treats RLW from accelerator research at the Los Alamos Neutron Science Center through water storage, to allow radioisotope decay, and solar evaporation. The TA53 facility started operation in December 1999, and is categorized as a radiological facility.

Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan center. The RLW is pumped from these lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945 at the east end of TA53. The tanks allow decay of radioisotopes created by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one of two solar evaporator basins, each with a capacity of 125,000 gallons.

2. Operations Summary for 2008

2.1 Flows

Table 2-1 summarizes influent and effluent volumes for the RLW facilities.

Table 2-1
Radioactive Liquid Waste Flows During 2008

Facility	Influent (liters)	Effluent (liters)
Low-level RLW	5,295,640	5,298,930
Transuranic RLW	3,064	2,900
TA-53	203,370	257,170

Low-level RLW: The TA50 RLWTF received 5,495,600 liters of influent during 2008, and discharged 5,298,900 liters to Mortandad Canyon. Influent included 82,940 liters of water transported from six generators via truck. Water flows were up 19% from the preceding year, and halted a trend since 2001 of declining influent volumes. Influent and effluent volumes are detailed by month in Table 2-2.

The influent brought with it 0.89 curie of alpha radioactivity and 0.06 curie of beta activity in 748 grams of radioactive material. Uranium-238 accounted for nearly all of the radioactive mass, while plutonium and americium accounted for nearly all of the radioactivity. Effluent contained just 0.06 curie in one gram of radioactive material. Approximately 99.7% of the radioactivity in the effluent was due to tritium, which cannot be removed by RLWTF processes.

Nearly 1,900 kilograms of chemicals entered the plant with the influent in the form of suspended solids (32 kilograms) and dissolved solids (1,860 kilograms). After treatment, a total of 1,720 kilograms of chemicals of were discharged into Mortandad Canyon in the form of dissolved solids, of which 57% was sodium and chloride, the constituents of table salt.

Transuranic RLW: Influent for the year consisted of 3,064 liters of caustic waste. Acid waste influent could not be received because the acid waste influent tank had been filled in late 2007. Transuranic effluent consisted of a single discharge of 2,900 liters to the tanks in Building 50-248. This effluent resulted from rinsing and flushing Room 60 piping and equipment, not from the treatment of transuranic RLW.

TA53 RLWTF: The TA53 facility received 203,370 liters of influent during 2008, and discharged 257,570 liters to the evaporation ponds. Influent included 20,280 liters trucked to TA53 in addition to water from accelerator research. Because effluent was so much larger than influent volume, storage tanks were at 50% of capacity at year's end, versus 70% of capacity twelve months earlier.

Table 2-2
Low-level RLW Flow Summary During 2008

Date	Influent (Liters)	No. of Discharges	Effluent (Liters)
Jan-08	413,079	5	365,700
Feb-08	316,112	3	224,300
Mar-08	366,447	5	374,500
Apr-08	360,415	4	298,400
May-08	573,343	8	590,230
Jun-08	484,957	6	445,900
Jul-08	593,620	8	595,200
Aug-08	783,094	8	597,700
Sep-08	497,371	9	680,900
Oct-08	452,947	5	373,800
Nov-08	303,310	7	525,500
Dec-08	350,946	3	226,800
Total	5,495,641	71	5,298,930

2.2 Effluent Quality: Low-level RLW

Three agencies monitor the quality of treated waters discharged from the TA50 RLWTF into Mortandad Canyon. The United States Department of Energy (DOE) regulates discharges of radioactive materials via Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE, 01/17/93). The United States Environmental Protection Agency (USEPA) regulates 18 parameters via NPDES permit number NM0028355 (EPA, 06/08/07). LANL also has voluntary commitments (a) to the New Mexico Environment Department (NMED) to meet groundwater standards for fluoride, nitrate-nitrogen and total dissolved solids, (b) to the NMED to meet a proposed discharge standard for perchlorates, and (c) to the DOE to limit tritium to the drinking water standard.

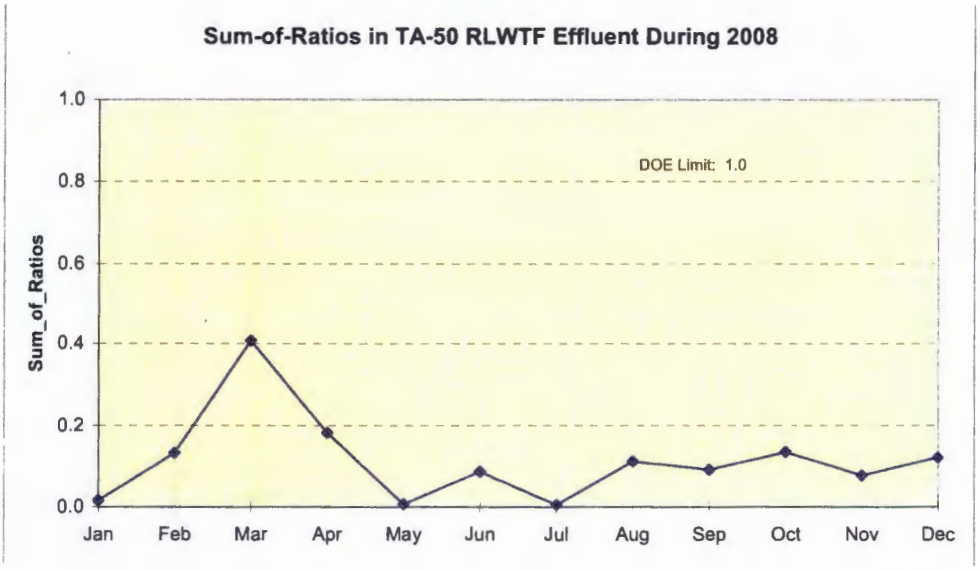
During calendar year 2008, TA50 RLWTF effluent:

- met all DOE standards set forth in Order 5400.5 for radiological discharges;
- was in compliance with all NPDES water quality parameters; and
- met four of five voluntary standards.

DOE: Effluent radiological quality during 2008 is illustrated in Figure 2-1, a plot of sum-of-ratios for each month. The average sum-of-ratios for the year was 0.10, or ten percent of the DOE discharge standard. RLWTF effluent has been compliant with the standard for 106 of the past 108 consecutive months[1].

[1] The monthly sum-of-ratios for discharge of radionuclides was 1.28 in January 2002 and 1.19 in February 2002, versus the DOE Guideline of 1.0.

Figure 2-1



EPA: Table 2-3 summarizes effluent quality versus NPDES discharge limits. The table lists regulated parameters, their discharge standards, and the maximum and average concentration of each parameter in monthly composite samples of effluent during 2008. Except for COD, annual average discharge concentrations were less than one percent of the discharge standard for those regulated parameters with numeric discharge standards. Average COD concentration was 25% of its discharge standard. RLWTF effluent has been compliant with NPDES discharge standards for the past 108 months.

Table 2-3
TA50 RLWTF Effluent During 2008 Compared To NPDES Standards

Regulated Parameter	Frequency	Units	Standard	Max.	Avg.
Cadmium	Annual	µg/L	Report	*	*
Copper	Monthly	µg/L	Report	32	12
Mercury	Annual	µg/L	Report	0.04	0.01
Nickel	Annual	µg/L	Report	10	5
PCBs	Annual	µg/L	Report	*	*
Perchlorate	Annual	µg/L	Report	2	0.2
Selenium	Annual	µg/L	Report	3.9	1.6
WET	Quarterly	%	Report	100%	83%
Zinc	Monthly	µg/L	Report	15	1.8
Chromium	Annual	µg/L	1,340	5.5	0.6
COD	Monthly	mg/L	125	73	32
Lead	Annual	µg/L	423	3	0.3
pH	Weekly	s.u.	6 - 9	7.8	6.8
Radium	Annual	pCi/L	30	*	*
Residual Chlorine	Weekly	µg/L	11	*	*
Suspended Solids	Monthly	mg/L	30	*	*
Toxic Organics	Monthly	µg/L	1,000	4	0.6

Data is from 12 monthly composite samples, except for PCBs, residual chlorine, and WET.
WET = whole effluent toxicity * Less than detection limit.

Voluntary: Table 2-4 summarizes effluent quality versus voluntary discharge standards. The table lists the voluntary discharge standards, and the maximum and average concentration of each parameter in weekly composite samples of effluent during 2008. Voluntary discharge standards were met for all weekly composite samples for dissolved solids, fluoride, nitrate-nitrogen, and tritium. Weekly composite results for perchlorate exceeded the voluntary discharge standard or 4 µg/L on five of 43 weeks, with a maximum value of 15 µg/L. The presence of perchlorate in RLWTF effluent was due to breakthrough of ion exchange resins before replacement resin could be installed. New resins were installed May-02, and perchlorate concentrations in effluent dropped immediately to less than the discharge standard .

Table 2-4
TA50 RLWTF Effluent During 2008 Compared To Voluntary Standards

	Agency	Units	Standard	Max.	Avg.
Dissolved Solids	NMED	mg/L	1,000	795	378
Fluoride	NMED	mg/L	1.6	1.3	0.6
Nitrate-Nitrogen	NMED	mg/L	10	9.9	3.9
Perchlorate	EPA	µg/L	4	15	1.6
Tritium	DOE	nCi/L	20	18	13

Data is from 43 weekly composite samples; no water was discharged during the other weeks of the year.

2.3 Production

Low-level RLW: Influent was received all 366 days of the year. The Main Treatment Plant operated on 124 days, and effluent was discharged on 71 occasions. Key process indicators for each of the unit operations were as follows:

- Clarifier sludge was not removed at any time during the year.
- The gravity filter was backwashed on four occasions (85,900 liters).
- Perchlorate ion exchange vessels were changed out on May 2nd.
- RO membranes were changed on August 19th; TUF membranes were not changed.

In the Secondary Treatment Plant, the vacuum filter (sludge processing) was not operated. Bottoms were not shipped for off site treatment and disposal, so that the inventory rose to 340,000 liters by the end of the year. The 100K influent tank was used to store bottoms. Two evaporator campaigns were conducted, one in May and one in December. A total of 100,450 gallons of reverse osmosis concentrate were fed to the evaporators; 31,500 gallons of bottoms and chemical cleaning solutions were generated.

Transuranic RLW: Influent was received on twelve occasions. In October, a small leak was discovered in the sludge holding tank, TK7. About 70% of the sludge inventory was transferred to the new sludge tank, and containment measures were installed in case TK7 developed new leaks. Startup assessments were attempted, but failed. As a result, treatment did not take place in Room 60.

TA53 RLWTF: Influent was trucked to the TA53 facility on three occasions from three different locations: TA16, TA48, and TA50 (RLWCS vault water). Discharges were made to the evaporation basins in May, June, and November.

2.4 Process and Facility Modifications

Process: Small ion exchange vessels were installed on a temporary and emergency basis after break-through was experienced on the perchlorate ion exchange vessels in April. The breakthrough resulted in the discharge of water, for five weeks, that exceeded the voluntary discharge standard of 4 µg/L for perchlorate. These temporary vessels were used until October, when replacement full-size vessels were procured and installed.

Facility: Work was nearly completed on upgrades to Room 60. Started in 2004, the Room 60 Upgrade Project is replacing corroded and leaking process pipes, the sludge storage tank, and the drum tumbler. Work also continued, albeit at very low levels, on the installation of a new pump house and influent storage facility. Started in 2000 after the Cerro Grande wildfire, this project is also nearing completion.

2.5 Wastes

The process waste backlog varied from 370 – 640 thousand liters during 2008. A small net reduction was achieved during the year: 519 thousand liters of process wastes at the end of the year, versus 566,000 liters on January 1st. At the end of the year, the backlog was comprised of 340,000 liters of bottoms, 133,000 liters of evaporator feed, 43,000 liters of low-level sludge, and 3100 liters of transuranic sludge.

A total of 98 cubic meters (20,500 kilograms) of packaged wastes were shipped from the TA50 RLWTF during 2008. Almost all of this was solid low-level radioactive waste. Shipments included 61 kilograms of mixed low-level wastes (a lead-lined safe). No chemical wastes or transuranic wastes were shipped during the year. Sixty percent of low-level wastes were generated during maintenance and construction projects, primarily the Room 60 Upgrades Project.

3. Radiological Nature of Low-level RLW

RLWTF influent and effluent samples are analyzed for thirty-seven (37) radionuclides which, from past experience, are possible in LANL radioactive liquid wastes. Alpha-emitting radionuclides are of most concern because of quantities (both mass and radioactivity) and safety basis impacts. For example, whereas three-fourths of a kilogram and 0.89 curie of alpha-emitting radionuclides were received in RLWTF influent during 2008, less than one gram and just 0.06 curie of beta-emitting radionuclides were received.

3.1 Influent Characteristics

As shown in Tables 3-1 and 3-2, fourteen radionuclides were detected in the RLWTF influent: seven alpha-emitting isotopes and seven beta-emitting isotopes.

Influent contained 0.89 curie of alpha-emitting radionuclides, and had an average concentration of 161 nCi/L. This concentration was about three times historical average concentrations (Del Signore, December 2006, p.25). Am-241, Pu-238, and Pu-239 comprised all but 0.7% of the alpha radioactivity.

Beta-emitting radionuclides had an average concentration of 11.5 nCi/L, and brought 0.06 curie. More than 99% of beta radioactivity was from tritium.

3.2 Effluent Characteristics

As shown in Tables 3-1 and 3-2, twelve radionuclides were detected in the RLWTF effluent: six alpha-emitting isotopes and six beta-emitting isotopes. Alpha-emitting radionuclides had an average effluent concentration of 3.7 pCi/L, and beta-emitting radionuclides an average concentration of 11.9 nCi/L.

3.3 Radionuclide Removal

Table 3-2 summarizes radioactivity (curies) into and out of the RLWTF for 2008 for all radioisotopes. In the table, "alpha gross" indicates direct analytical measurement of alpha activity by liquid scintillation counting, and "alpha sum" is the arithmetic sum of the concentrations of the nine alpha-emitting radionuclides by alpha spectroscopy. This double analysis of water samples provides an accuracy check for analytical results, and can indicate when re-analysis may be warranted.

Table 3-1
Radionuclide Analyses of RLWTF Influent and Effluent in 2008

Radionuclides Analyzed for in the RLWTF Influent and Effluent	Radionuclides Detected in RLWTF Influent	Radionuclides Detected in RLWTF Effluent
Alpha Particle Emitters (9)		
Am-241	X	X
Np-237		
Ra-226		
Pu-238, 239	X, X	X, X
Th-232	X	
U-234, 235, 238	X, X, X	X, X, X
Beta Particle Emitters (28)		
As-74		X
Be-7		
Ce-141	X	
Co-56, 57, 58, 60	X, X	
Cs-134, 137	X	X
Eu-152		
H-3	X	X
I-133		
Mn-52, 54		
Na-22		X
Ra-228		
Rb-83, 84	X	X
Sc-46, 48		
Se-75		
Sn-113		
Sr-85, 89, 90	X	X
V-48		
Y-88		
Zn-65		
37 Total	**14 Total**	**12 Total**

Table 3-3 shows the *mass* of alpha-emitting radionuclides in RLWTF influent and effluent during 2008. The table shows that 748 grams of alpha emitters were received in influent, and that 0.9 gram was discharged in treated water, a removal of 99.9%. The table also shows that uranium-238 comprised nearly all of the mass of these radionuclides in both influent and effluent.

A similar perspective is obtained by examining removal of alpha *radioactivity* during 2008 (Table 3-4). The RLWTF performed even better from this perspective, removing 99.998% of the radioactivity of the alpha emitters from the wastewater stream (0.89 curie in, versus 15 microcuries out).

Table 3-2
TA50 RLWTF Radionuclide Summary For 2008

	INFLUENT Avg (nCi/L)	Maxi-mum (nCi/L)	Mini-mum (nCi/L)	Total (Ci)	EFFLUENT Avg (pCi/L)	Maxi-mum (pCi/L)	Mini-mum (pCi/L)	Total (Ci)
Alpha Gross	160.8 E0	410 E0	56 E0	883 E-3	3.51 E0	9.7 E0	*	18.6 E-6
Alpha Sum	161.1 E0	320 E0	57 E0	885 E-3	3.69 E0	13 E0	*	19.6 E-6
Am-241	40.9 E0	180 E0	18 E0	225 E-3	1.50 E0	5.7 E0	*	7.93 E-6
As-74	*	*	*	*	22.7 E0	36 E0	*	120 E-6
Be-7	*	*	*	*	*	*	*	*
Ce-141	3.2 E-3	39 E-3	*	17.7 E-6	*	*	*	*
Co-56	*	*	*	*	*	*	*	*
Co-57	830 E-6	13 E-3	*	4.6 E-6	*	*	*	*
Co-58	4.4 E-3	69 E-3	*	24.2 E-6	*	*	*	*
Co-60	*	*	*	*	*	*	*	*
Cs-134	*	*	*	*	*	*	*	*
Cs-137	4.1 E-3	45 E-3	*	22.4 E-6	6.25 E0	15 E0	*	33.1 E-6
Eu-152	*	*	*	*	*	*	*	*
H-3	n.m.	n.m.	n.m.	n.m.	11.9 E3	14 E3	7.5 E3	62.9 E-3
I-133	*	*	*	*	*	*	*	*
Mn-52	*	*	*	*	*	*	*	*
Mn-54	*	*	*	*	*	*	*	*
Na-22	*	*	*	*	201 E-3	4.7 E0	*	1.07 E-6
Np-237	*	*	*	*	*	*	*	*
Pu-238	37.3 E0	65 E0	8.9 E0	205 E-3	550 E-3	4.0 E0	*	2.92 E-6
Pu-239	82.9 E0	240 E0	24 E0	455 E-3	820 E-3	3.3 E0	*	4.35 E-6
Ra-226	*	*	*	*	*	*	*	*
Ra-228	*	*	*	*	*	*	*	*
Rb-83	22.6 E-3	180 E-3	*	124 E-6	6.62 E0	45 E0	*	35.1 E-6
Rb-84	*	*	*	*	*	*	*	*
Sc-46	*	*	*	*	*	*	*	*
Sc-48	*	*	*	*	*	*	*	*
Se-75	*	*	*	*	*	*	*	*
Sn-113	*	*	*	*	*	*	*	*
Sr-85	17.4 E-3	120 E-3	*	95.4 E-6	636 E-3	4.6 E0	*	3.37 E-6
Sr-89	*	*	*	*	*	*	*	*
Sr-90	*	*	*	*	*	*	*	*
Th-232	117 E-6	770 E-6	*	642 E-9	*	*	*	*
U-234	63.0 E-3	310 E-3	*	346 E-6	766 E-3	5.1 E0	*	4.06 E-6
U-235	1.2 E-3	2.8 E-3	520 E-6	6.66 E-6	1.62 E-3	14 E-3	*	8.60 E-9
U-238	44.7 E-3	67 E-3	19 E-3	246 E-6	57.6 E-3	470 E-3	*	305 E-9
V-48	*	*	*	*	*	*	*	*
Y-88	*	*	*	*	*	*	*	*
Zn-65	*	*	*	*	*	*	*	*

Twelve influent samples and 12 effluent samples for each isotope.
* Less than Detection Limit n.m.: Not measured

Table 3-3
Mass of Alpha Radionuclides During 2008

Radionuclide	Influent (grams)	Effluent (grams)
Am-241	0.1	<0.001
Np-237	*	*
Ra-226	*	*
Pu-238	<0.1	<0.001
Pu-239	7.3	<0.001
Th-232	5.8	*
U-234	0.1	0.001
U-235	3.1	0.004
U-238	731.2	0.908
Totals	**747.6**	**0.913**

* Less than Detection Limit

Removal of beta-emitting radioisotopes is also depicted in Table 3-4. Approximately one-third of non-tritium beta activity was removed during 2008 (0.29 millicurie in; 0.19 millicurie out). Tritium quantities entering and leaving the plant were the same (63 millicuries). This is because tritium is present *as* water, and the RLWTF is not equipped to treat or remove tritium. Although treatment for and removal of beta-emitting radioisotopes was not as effective as for alpha-emitting radioisotopes, the quantities encountered were smaller. Specifically, influent contained just 63 millicuries of beta activity, versus 886 millicuries of alpha activity.

Table 3-4
Removal of Radioactivity From RLWTF Influent During 2008

Month	Influent (mCi)	Effluent (mCi)	%Removed
Alpha radioactivity	886	0.015	99.998
Beta radioactivity*	0.29	0.19	33.2
Tritium (beta)	63	63	0

* Non-tritium beta

3.4 Regulatory Performance

DOE Order 5400.5, "Radiation Protection of the Public and the Environment," defines discharge standards, referred to as Derived Concentration Guidelines (DCGs), for all radionuclides discharged from DOE facilities. The concentration of each radionuclide divided by its particular DCG value results in a ratio. For waters containing more than one radionuclide, a ratio is to be found for each radionuclide, and these ratios are to be summed. To be in compliance with Order 5400.5, the sum of the ratios cannot exceed 1.0.

Table 3-5 provides flow-weighted sum-of-the-ratios for individual isotopes, and shows that the average for all of 2008 was 0.10. Americium accounted for half of the sum of the ratios in the RLWTF effluent during 2008, and ^{238}Pu and ^{239}Pu accounted for most of the rest.

Table 3-5
TA-50 RLWTF Effluent During 2008 Compared With DOE Order 5400.5

Radioactive Isotopes *	Mean Concentration (picoCi/L)	DCG 5400.5 (picoCi/L)	Percent Of DCG
Am-241	1.50 E0	30	5.0
As-74	22.7 E0	40,000	<0.1
Cs-137	6.25 E0	3,000	0.2
H-3	11.9 E3	2,000,000	0.6
Na-22	201 E-3	10,000	<0.1
Pu-238	550 E-3	40	1.4
Pu-239	820 E-3	30	2.7
Rb-83	6.62 E0	20,000	<0.1
Sr-85	636 E-3	70,000	<0.1
U-234	766 E-3	500	0.2
U-235	1.62 E-3	600	<0.1
U-238	57.6 E-3	600	<0.1
Sum of Ratios = 0.102			

* Other isotopes were not detected in RLWTF effluent.

3.5 Graphs of Radiological Data

Figures 3-1 and 3-2 chart concentrations in RLWTF influent and effluent for each month of 2008 for alpha-emitting isotopes (i.e., sum of the concentration of the nine alpha radionuclides listed in Table 3-1). Note that the ordinate of Figure 3-1 is scaled in nanocuries per liter while Figure 3-2 is scaled in picocuries per liter, a factor of one thousand. Examination of these graphs shows the following:

- The decontamination factor for alpha radioisotopes was four orders of magnitude (i.e., 10,000) or more. This was also indicated in Table 3-4.

- Effluent concentrations averaged less than 15 pCi/L, the EPA drinking water standard, every month of the year, and less than 4 pCi/L for ten months.

- Influent concentrations surged during March, April, and May 2008. No particular isotope was the cause, as ^{238}Pu, ^{239}Pu, and ^{241}Am concentration each increased from the annual average. No generator was identified as the source of the spike.

Figure 3-1
Alpha-Emitting Isotopes in RLWTF Influent During 2008

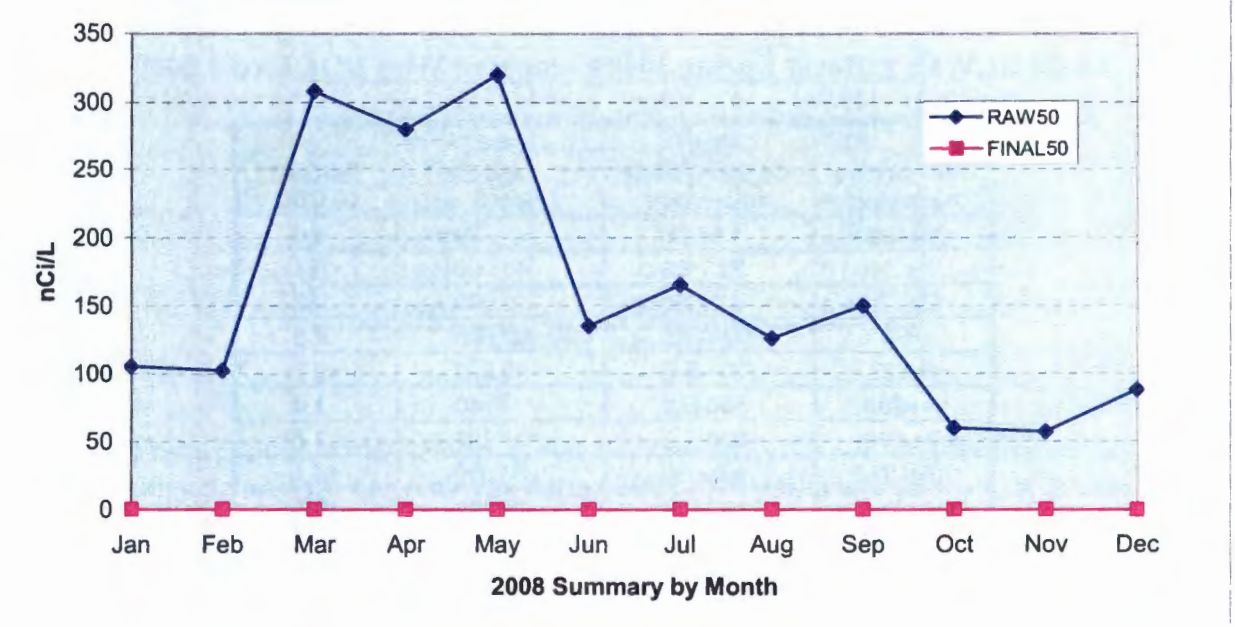


Figure 3-2
Alpha-Emitting Isotopes in RLWTF Effluent During 2008

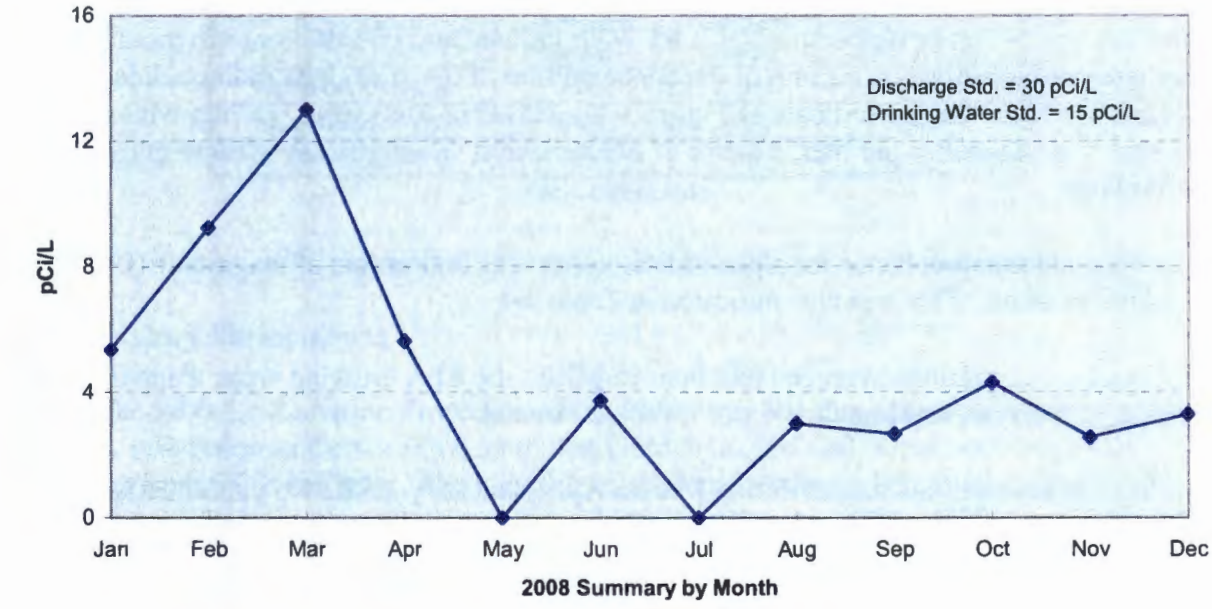
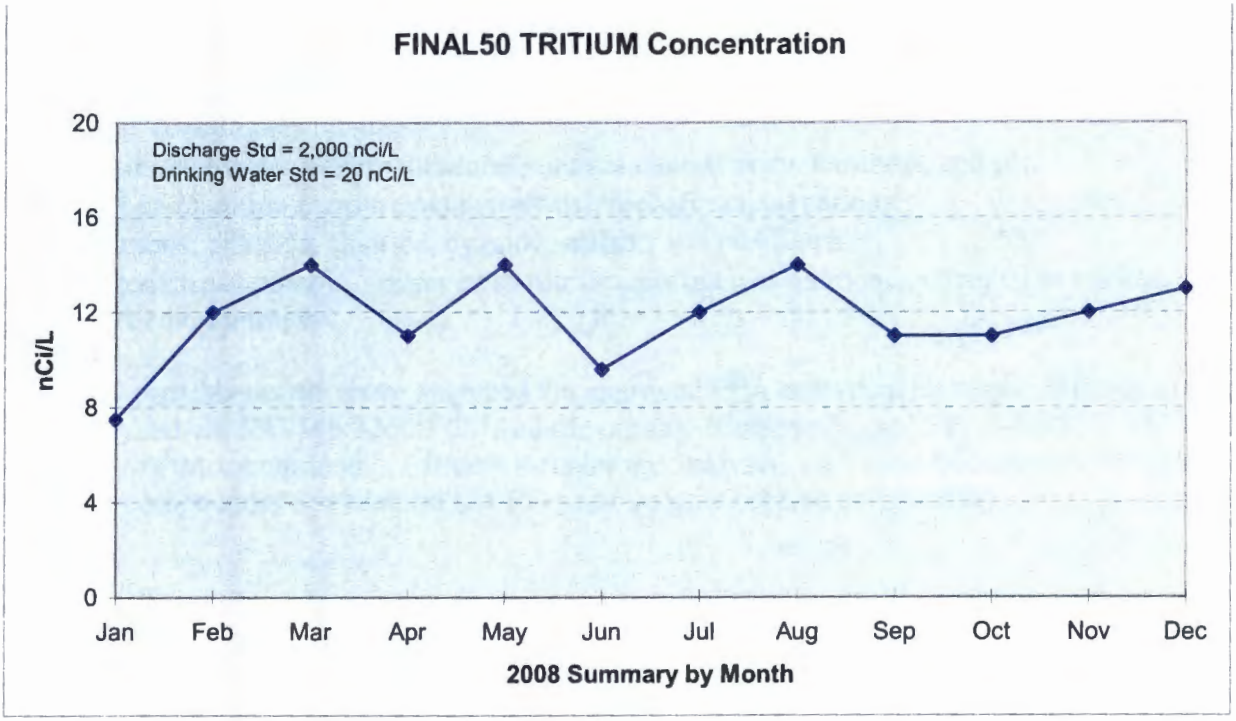


Figure 3-3 charts average concentrations, in nanocuries per liter, of tritium by month in RLWTF effluent. Tritium was the only significant beta-emitting radionuclide in RLWTF effluent, accounting for 99.7% of the total beta activity discharged during 2008.

Figure 3-3
Tritium in RLWTF Effluent During 2008



4. Non-Radiological Nature of Low-level RLW

RLWTF influent and effluent are analyzed for both inorganic and organic constituents, most of which are present in tap water. Influent samples are analyzed for 42 inorganic water quality parameters, and for 131 volatile and semi-volatile organic compounds. Effluent samples are analyzed for the same 42 inorganic parameters, and for 86 volatile and semi-volatile organic compounds.

Inorganic constituents included:

- conventional water quality measures, such as conductivity, hardness, and pH.
- a total of 25 cation measurements (metals), including total cations.
- five anions: chloride, fluoride, cyanide, sulfate, and perchlorate.
- nitrogen measurements – nitrogen as nitrates, nitrogen as ammonia, nitrogen as nitrites, and total Kjedahl nitrogen.

Organic constituents are those analyzed via approved EPA analytical methods. Influent samples are analyzed via SW-846:8260B (70 volatile organic compounds) and SW-846:8270C (61 semi-volatile organic compounds). Effluent samples are analyzed via Method 624 for (32 volatile organic compounds) and Method 625 (54 semi-volatile organic compounds).

4.1 Influent Characteristics

As shown in Table 4-1, all 42 inorganic parameters were detected in the RLWTF influent in 2008. Table 4-1 also shows, however, that seventeen of these were reported at less than the analytical detection limit for at least one month during the year. On average, in fact, six inorganic parameters were reported each month at less than the analytical detection limit. Average influent concentration of all inorganic chemicals for the entire year was 345 mg/L.

As shown in Table 4-5, the total mass of inorganic chemicals entering the RLWTF was nearly 1900 kilograms, of which sulfate and sodium totaled 826 kilograms (44%). This was quite different from radioactive contaminants, which had a combined influent mass of less than one kilogram.

Influent was also analyzed for volatile and semi-volatile organic compounds (Table 4-2 and 4-3). Twelve samples were collected during 2008, and each were analyzed for 131 organic compounds. Of these analyses, 72 (5%) were determined to exceed minimum detection level. Annual average influent concentration was 0.74 mg/L volatile organic compounds and 0.05 mg/L semi-volatile organic compounds. Total mass of organic compounds received with the influent was 4.2 kilograms, 93% of which was acetone.

Table 4-1
TA50 RLWTF Inorganic Chemical Summary For 2008

	RAW Average	Maxi-mum	Mini-mum	Total In (Kg)	FINAL Average	Maxi-mum	Mini-mum	Total Out (Kg)
ALKALINITY-MO**	78.2 E0	306 E0	18. E0	430 E0	192 E0	454 E0	29 E0	1.02 E3
ALKALINITY-P**	27.4 E0	226 E0	*	151 E0	*	*	*	*
ALUMINUM	565 E-3	1.30 E0	*	3.11 E0	4.38 E-3	12 E-3	*	23.2 E-3
AMMONIA-N	7.50 E0	12.3 E0	1.53 E0	41.2 E0	4.12 E0	8.1 E0	1.3 E0	21.8 E0
ARSENIC	6.82 E-3	30 E-3	*	37.5 E-3	3.57 E-3	30 E-3	*	18.9 E-3
BARIUM	31.8 E-3	61 E-3	10. E-3	175 E-3	47.4 E-6	260 E-6	*	251 E-6
BERYLLIUM	3.20 E-3	20 E-3	*	17.6 E-3	*	*	*	*
BORON	81.5 E-3	400 E-3	*	448 E-3	129 E-3	700 E-3	*	684 E-3
CADMIUM	1.96 E-3	15 E-3	*	10.8 E-3	*	*	*	*
CALCIUM	11.4 E0	21 E0	5.3 E0	62.9 E0	310 E-3	1.9 E0	*	1.64 E0
CHLORIDE	24.5 E0	53 E0	15.4 E0	135 E0	52.3 E0	114 E0	5.4 E0	277 E0
COBALT	1.46 E-3	4. E-3	*	8.04 E-3	*	*	*	*
COD	71.6 E0	144 E0	*	393 E0	32.4 E0	73 E0	*	172 E0
CONDUCTIVITY**	529 E0	1.1 E3	250 E0	2.91 E3	608 E0	1.2 E3	98 E0	3.22 E3
COPPER	10.4 E0	140 E0	500 E-6	57.0 E0	11.9 E-3	32 E-3	20 E-6	62.9 E-3
CYANIDE	20.3 E-3	280 E-3	*	112 E-3	892 E-6	9 E-3	*	4.73 E-3
FLUORIDE	769 E-3	1.68 E0	220 E-3	4.23 E0	535 E-3	1.2 E0	*	2.83 E0
HARDNESS**	41.8 E0	64.4 E0	21.1 E0	230 E0	1.47 E0	6.39 E0	207 E-3	7.79 E0
IRON	2.78 E0	11 E0	*	15.3 E0	9.52 E-3	30 E-3	*	50.5 E-3
LEAD	252 E-3	1.25 E0	70 E-3	1.39 E0	278 E-6	2.9 E-3	*	1.47 E-3
MAGNESIUM	3.22 E0	5 E0	1.9 E0	17.7 E0	169 E-3	400 E-3	20 E-3	893 E-3
MERCURY	4.88 E-3	8.6 E-3	2.4 E-3	26.8 E-3	5.91 E-6	36 E-6	*	31.3 E-6
NICKEL	350 E-3	1.2 E0	60 E-3	1.92 E0	5.46 E-3	10 E-3	*	28.9 E-3
NITRATE-N	12.4 E0	21.6 E0	6 E0	67.9 E0	3.75 E0	8.84 E0	100 E-3	19.9 E0
NITRITE-N	618 E-3	1.42 E0	*	3.40 E0	2.28 E0	6.2 E0	*	12.1 E0
PERCHLORATE	411 E-3	1.3 E0	12 E-3	2.26 E0	193 E-6	1.95 E-3	*	1.03 E-3
pH	6.92 E0	10.9 E0	3.9 E0	38.0 E0	6.81 E0	7.81 E0	*	36.1 E0
PHOSPHORUS	1.79 E0	2.43 E0	130 E-3	9.86 E0	173 E-3	2.0 E0	20 E-3	914 E-3
POTASSIUM	4.71 E0	16. E0	400 E-3	25.9 E0	3.06 E0	13 E0	90 E-3	16.2 E0
SELENIUM	201 E-6	3.5 E-3	*	1.11 E-3	1.60 E-3	3.9 E-3	*	8.48 E-3
SILICON	25.2 E0	31. E0	18 E0	139 E0	8.49 E0	16 E0	1.1 E0	45.0 E0
SILVER	23.7 E-3	250 E-3	*	128 E-3	487 E-6	5.0 E-3	*	2.58 E-3
SODIUM	70.4 E0	205 E0	23 E0	387 E0	132 E0	250 E0	18 E0	697 E0
SULFATE	79.9 E0	411 E0	9.1 E0	439 E0	9.38 E0	28 E0	1.1 E0	49.7 E0
TDS	339 E0	700 E0	190 E0	1.86 E3	325 E0	657 E0	56 E0	1.72 E3
TKN	9.77 E0	15 E0	3.9 E0	53.7 E0	4.52 E0	8.7 E0	1.3 E0	23.9 E0
TOTAL CATIONS**	4.49 E0	12 E0	2.2 E0	24.6 E0	5.15 E0	12 E0	1.0 E0	27.3 E0
TOTAL CHROMIUM	52.2 E-3	170 E-3	*	287 E-3	631 E-6	5.5 E-3	*	3.34 E-3
TOXIC ORGANICS	*	*	*	*	587 E-6	4.03 E-3	*	3.11 E-3
TSS	5.77 E0	14 E0	*	31.7 E0	*	*	*	*
URANIUM	132 E-3	200 E-3	56 E-3	729 E-3	172 E-6	1.4 E-3	*	909 E-6
VANADIUM	15.5 E-3	37 E-3	*	85 E-3	814 E-6	7.0 E-3	*	4.32 E-3
ZINC	209 E-3	370 E-3	90 E-3	1.15 E0	1.82 E-3	15 E-3	*	9.63 E-3

Twelve influent samples and 12 effluent samples for each mineral.
* Less than Detection Limit n.m.: Not measured
**Units: All figures in mg/L except:
Alkalinities and hardness as mg CaCO3/L; Conductivity as uS/cm; Total Cations as meq/L.

Table 4-2
VOC Detected in RLWTF Influent During 2008

Volatile Organic Compound	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
1,1,2-Trichloroethane	1	0.32	0.32
1,1-Dichloroethane	1	0.07	0.07
1,2,4-Trimethylbenzene	1	0.07	0.07
1,2-Dichloroethane	1	0.98	0.98
1-Propylbenzene	1	0.07	0.07
2-Butanone	1	1.30	1.30
2-Chlorotoluene	1	0.12	0.12
2-Hexanone	1	2.30	2.30
4-Chlorotoluene	1	0.13	0.13
4-Isopropyltoluene	1	0.17	0.17
Acetone	10	4.90	3,200
Benzene	1	0.06	0.06
Bromodichloromethane	1	0.14	0.14
Bromoform	1	1.10	1.10
Carbon Disulfide	1	0.26	0.26
Chlorodibromomethane	1	0.75	0.75
Chloroform	1	0.25	0.25
Chloromethane	1	0.41	0.41
Iodomethane	1	4.20	4.20
Methylene Chloride	8	2.30	22
Tert-Butylbenzene	1	0.19	0.19
Toluene	3	0.11	0.35
Total Detects **	40		

* out of 726 total analyses

Table 4-3
SVOC Detected in RLWTF Influent During 2008

Semi-Volatile Organic Compound	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
2-Nitrophenol	3	1.4	4.3
Benzoic Acid	1	7.7	7.7
Bis(2-Ethylhexyl)Phthalate	12	9.6	100.0
Butylbenzylphthalate	2	1.2	2.3
Di-n-Butylphthalate	3	1.3	1.8
Di-n-Octyl Phthalate	1	4.3	4.3
Diethyl Phthalate	2	1.1	1.6
Dimethyl Phthalate	1	3.6	3.6
n-Nitroso-Di-n-Propylamine	4	9.7	70.0
n-Nitrosodimethylamine	1	10.0	10.0
Pyridine	2	8.1	11.0
Total Detects *	32		

* out of 840 total analyses

4.2 Effluent Characteristics

As shown in Table 4-1, 37 of the 42 inorganic parameters were detected in the RLWTF effluent; beryllium, cadmium, cobalt, phenolphthalein alkalinity, and suspended solids were not detected in any of the 12 monthly composite samples. Table 4-1 also shows that 26 parameters were reported at less than the analytical detection limit for at least one month during the year. On average, in fact, 15 inorganic parameters were reported each month at less than the analytical detection limit. Average effluent concentration of all inorganic chemicals for the entire year was 325 mg/L.

As shown in Table 4-5, the total mass of minerals leaving the RLWTF was 1720 kilograms, of which 974 kilograms (57%) were sodium and chloride. This, too, was quite different from radioactive contaminants, which had a combined effluent mass of just six grams.

Effluent was also analyzed for volatile and semi-volatile organic compounds (Table 4-4). A total of 12 samples were collected during 2008, and each were analyzed for 86 organic compounds. Of these analyses, just four (0.4%) were found to exceed minimum detection level. Annual average effluent concentration was 0.0006 mg/L organic compounds. Total mass of organic compounds discharged with effluent was three grams.

Table 4-4
Organics Detected in RLWTF Effluent During 2008

Compound	Suite	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
Chloroform	VOC	2	1.3	4.0
Chlorobenzene	VOC	1	1.2	1.2
Chrysene	SVOC	1	1.2	1.2
Total Detects *		4		

* out of 1032 total analyses

4.3 Removal of Non-Radiological Constituents

Table 4-1 provides a summary of concentrations and quantities of inorganic chemicals received by (influent) and discharged from (effluent) the RLWTF during 2008. The information shows that 1892 kilograms of inorganic chemicals entered the facility in the form of suspended solids (32 kilograms) and dissolved solids (1860 kilograms). This quantity is similar to quantities received in recent years. As shown in the final column of Table 4-1, the total amount of inorganic chemicals leaving the facility with the effluent in 2008 was 1720 kilograms, all of it in the form of dissolved solids.

Nine inorganic chemicals comprised the majority (~84%) of these non-radiological constituents; they are summarized in Table 4-5, along with percent removed from the RLWTF influent. The variation shown for removal percentages reflect whether the chemical is insoluble in water (e.g.,

Table 4-5
Removal of Major Inorganic Minerals From RLWTF Influent During 2008

Mineral	Mass in Influent (Kgs)	Mass in Effluent (Kgs)	Percent Removed
Sulfate	439	50	89
Sodium	387	697	-80
Nitrate	301	89	71
Silicon	139	45	68
Chloride	135	277	-105
Calcium	63	2	97
Copper	57	0	100
Ammonia	50	26	47
Potassium	26	16	38
Subtotal	1597	1202	25
Total Solids *	1892	1720	9

* Total Dissolved Solids + Total Suspended Solids

97% removal of calcium), soluble (e.g., 71% removal of nitrate), or required in the treatment process[2] (i.e., sodium and chloride, where effluent quantity exceeded influent quantity).

In contrast to these variable removal percentages, more than 99.9% of organic compounds were removed before treated water was discharged to Mortandad Canyon. Influent brought 4.2 kilograms of semi-volatile and volatile organic compounds to the RLWTF, but just three grams were present in effluent.

4.4 Regulatory Performance

Eighteen parameters in the effluent from the RLWTF were regulated by the National Pollutant Discharge Elimination System in compliance with the Federal Clean Water Act (EPA, 06-08-2007). Reporting is required for all of these; eight have discharge standards. LANL also has a voluntary commitment with the New Mexico Environment Department to discharge effluent from the TA-50 RLWTF below groundwater standards set by the New Mexico Water Quality Control Commission (NMED, 04-20-2008) for three water quality parameters: fluoride, nitrogen-as-nitrate, and total dissolved solids. Table 4-6 identifies these regulated parameters. The table also shows sampling frequency required for each, and their regulatory limits.

[2] The RLWTF is a water treatment facility, and chemicals are added to several of the treatment steps. For example, lime can be added to soften the water, ferric sulfate to precipitate radionuclides, and sodium hydroxide to adjust pH. Other chemicals, such as sodium metabisulfite can be used to clean the ultrafiltration and reverse osmosis membranes.

During calendar year 2008, TA50 RLWTF effluent, for the ninth consecutive year, was in compliance with all NPDES water quality parameters. TA50 effluent also met NMED ground water standards for fluoride, nitrate, and TDS every week of the year, and has now met these voluntary standards for all but two weeks over the last nine years [3].

Finally, although the RLWTF is not required to meet EPA drinking water standards, a comparison of average annual effluent concentrations shows that effluent would have met 17 of the 18 inorganic and radioactive national primary drinking water standards published at 40 CFR Part 141, and would have met all eleven secondary drinking water standards published at Part 143. Effluent exceeded the standard for nitrite-as-nitrogen, 2.06 vs. 1.0 mg/L.

Table 4-6
NPDES and NMED Regulated Parameters

Parameter	Sampling Frequency	Units	Average	Daily Max
NPDES Parameters (18)				
Chemical Oxygen Demand	M	mg/L	125	125
Flow	CR	----	Report	Report
Perchlorate	Y		Report	Report
pH	W	s.u.	6 – 9	6 – 9
Radium 226 + Radium 228	Y	pCi/L	30	30
Total Cadmium	Y	µg/L	Report	Report
Total Chromium	Y	µg/L	Report	Report
Total Copper	M	µg/L	Report	Report
Total Lead	Y	µg/L	423	524
Total Mercury	Y	µg/L	Report	Report
Total Nickel	Y	µg/L	Report	Report
Total PCBs	Y	µg/L	Report	Report
Total Residual Chlorine	W	µg/L	----	11
Total Selenium	Y	µg/L	Report	Report
Total Suspended Solids	M	mg/L	30	45
Total Toxic Organics	M	µg/L	1,000	1,000
Total Zinc	M	µg/L	Report	Report
Whole Effluent Toxicity	Q	%	Report	Report
NMED Parameters (3)				
Fluoride	WC	mg/L	1.6	
Nitrogen-as-Nitrate	WC	mg/L	10	
Total Dissolved Solids	WC	mg/L	1,000	

Sampling frequencies:
W: weekly grab sample
M: monthly grab sample
Q: quarterly grab sample
Y: yearly grab sample
CR: continuous record
WC: weekly composite sample

[3] Two weekly composite samples of RLWTF effluent slightly exceeded the groundwater standard for fluoride during 2003. Sample values of 2.07 mg/L (January 3rd) and 1.64 mg/L (March 25th) were obtained, versus the groundwater standard of 1.6 mg/L. (Watkins and Worland, March 2004, p. 30.)

4.5 Graphs of Non-Radiological Data

The following series of graphs highlight important information about non-radiological components of the TA50 RLWTF influent and effluent. Although influent and effluent are analyzed for 42 non-radioactive parameters, just six have been chosen for display in this report. Each figure plots concentration in RLWTF influent and effluent by month during 2008.

Figures 4-1 and 4-2 show total dissolved solids and total suspended solids in RLWTF influent and effluent during 2008. These two parameters provide summary information about water purity since they represent all contaminants present. Both parameters also have regulatory discharge limits – 1000 mg/L for TDS and 30 mg/L for TSS. In the RLWTF treatment process, the gravity filter and ultrafilter remove essentially all suspended solids. Reverse osmosis removes varying percentages of dissolved solids, depending upon particle mass and size.

The TDS graph shows that influent was generally received at concentrations below the discharge standard of 1000 mg/L. This did not guarantee compliance with the discharge standard, however, because chemicals were added in various treatment steps. The TSS graph shows that influent was also generally received at concentrations below the discharge standard, 30 mg/L in this case. The graph shows the absence of suspended solids in RLWTF effluent.

Figure 4-1
Dissolved Solids in RLWTF Waters During 2008

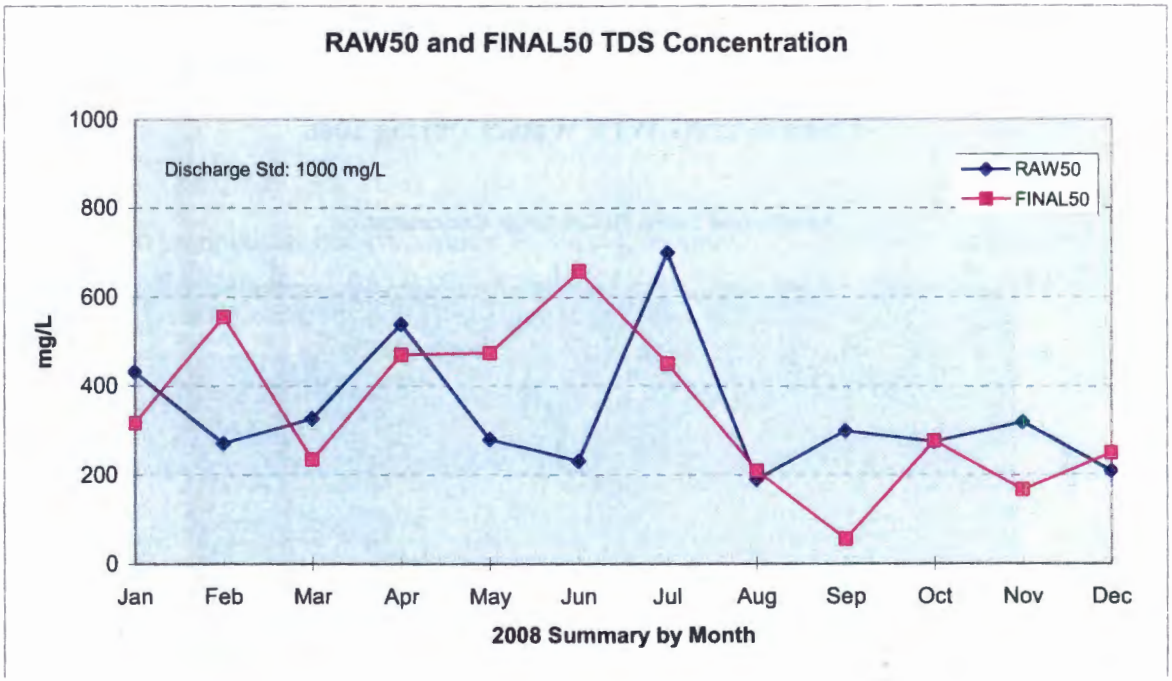


Figure 4-2
Suspended Solids in RLWTF Waters During 2008

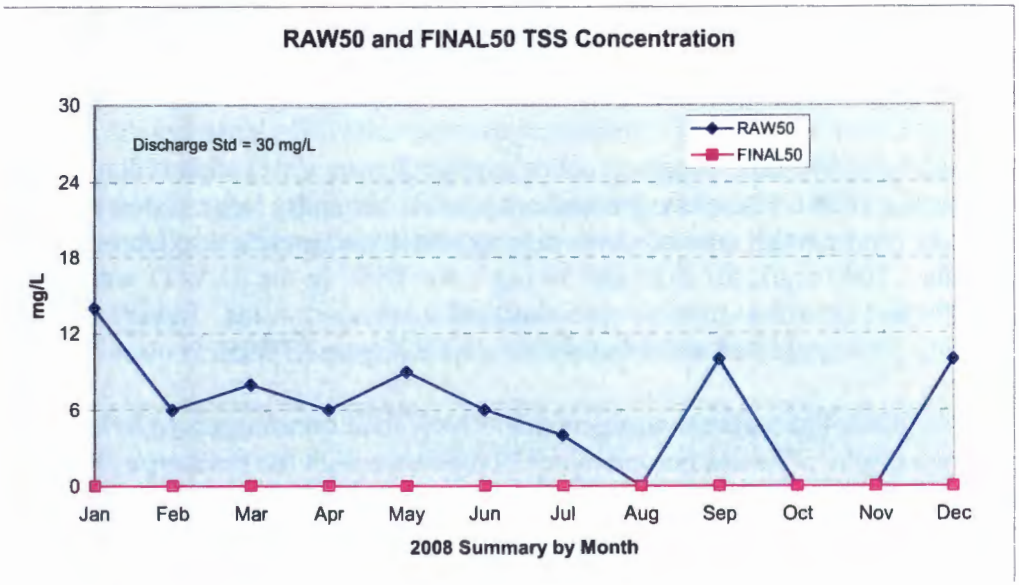


Figure 4-3 shows concentrations of calcium in RLWTF influent and effluent during 2008. Calcium, not a regulated parameter, is an insoluble element. Calcium was received in influent in concentrations ranging from 5 - 20 mg/L, but was nearly absent from plant effluent. The graph illustrates the effect of the RLWTF treatment process on insoluble elements; few insoluble elements make it to the outfall.

Figure 4-3
Calcium in RLWTF Waters During 2008

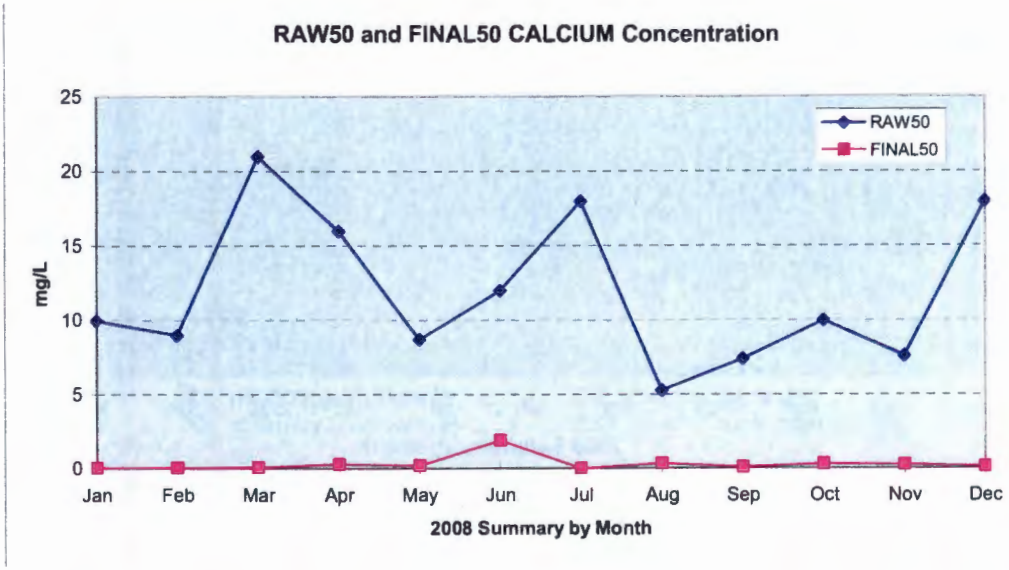
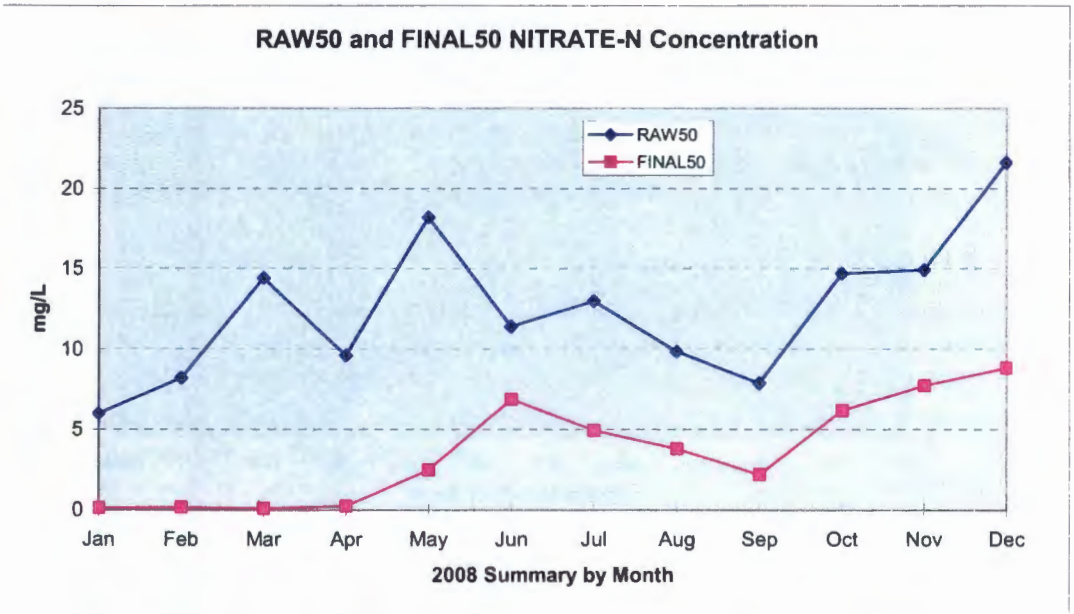


Figure 4-4 shows concentrations of nitrate-as-nitrogen in RLWTF influent and effluent during 2008. Nitrate, a regulated parameter, is soluble in water. Nitrate was received in influent in concentrations ranging from 5 - 20 mg/L, similar to calcium concentrations, but was almost always present in effluent. The graph illustrates the effect of the RLWTF treatment process on soluble chemicals; only a percentage of the chemical is removed in the treatment process.

Figure 4-4
Nitrate-as-Nitrogen in RLWTF Waters During 2008



Other nitrogen compounds behave similar to nitrate, as shown in Table 4-7. Table 4-7 presents average concentrations for nitrogen compounds for the year. In 2008, both influent and effluent concentrations were similar to historical concentrations.

Table 4-7
Nitrogen Compounds in RLWTF Waters During 2008

	Influent*	Effluent*
Total Kjedahl Nitrogen	9.8	4.5
Nitrogen-as-Ammonia	7.5	4.1
Nitrogen-as-Nitrate	12.4	3.8
Nitrogen-as-Nitrite	0.6	2.3
All Nitrogen	30.3	14.7

* Average concentration for 2008, in mg/L.

Figures 4-5 and 4-6 show sodium and copper concentrations in RLWTF influent and effluent during 2008. The sodium graph shows effluent concentrations were higher than influent concentrations, which reflects the fact that sodium is one of the water treatment chemicals used at the plant. The copper graph was selected to demonstrate that influent water quality can vary appreciably. The graph shows that copper influent concentration during April was about 70 times higher than copper concentrations for the remainder of the year. Such unanticipated influent perturbations can pose significant water treatment challenges.

Figure 4-5
Sodium in RLWTF Waters During 2008

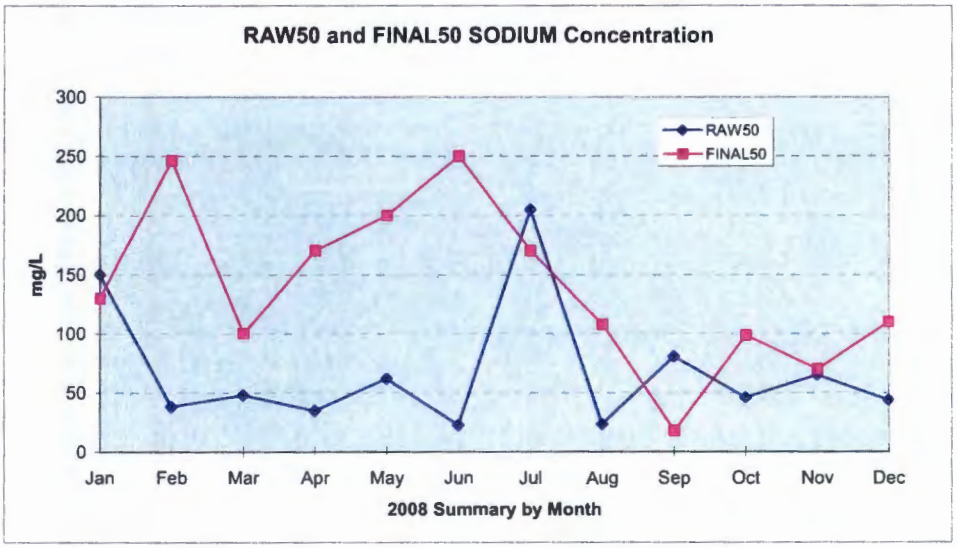
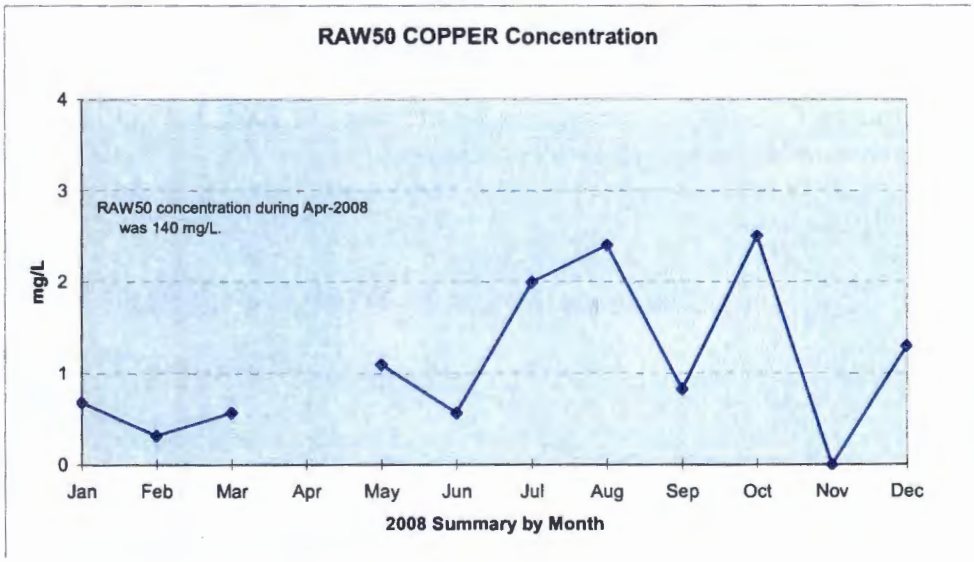


Figure 4-6
Copper in RLWTF Influent During 2008



5. Other RLW Operations in 2008

Chapters 2 through 4 of this annual report discussed the treatment of low-level radioactive liquid wastes at the TA50 RLWTF. This chapter discusses the other RLW operations.

5.1 Low-Level Influent Collection System

A system of underground piping connects generators of low-level radioactive liquid waste to the TA50 RLWTF. The system has about four miles of double-walled pipes that direct water flow, by gravity, from 25 buildings in six Technical Areas to the influent tanks in Building 50-02.

The system has 62 underground vaults installed at piping junctions and other strategic locations. Outer pipes terminate at each of these vaults to provide an indication of leaks in the inner piping; water from the annulus would collect in the vault sump. Each vault sump is equipped with an alarm to detect the presence of water in the sump.

A system of vault inspections and water sampling was instituted in the fourth quarter of 2007. This inspection program was expanded in 2008 to include alarm repairs and de-watering of vaults. During 2008, 184 total inspections were made, an average of three per vault, and all 62 vaults were inspected at least once. All vaults that contained water were de-watered at least once. Table 5-1 summarizes these activities.

Thirteen vaults were known to contain water by the end of the year, versus 16 at the start. In addition, sampling had confirmed that water found in vaults was due to infiltration of groundwater, not to collection system leakage. At the end of December 2008, ten alarms were in need of repair.

Table 5-1
Low-Level RLW Collection System Activities During 2008

	Q1	Q2	Q3	Q4	Totals
Inspections:					
No. vaults inspected during the quarter	37	24	64	16	141
No. vault inspections during the quarter	37	46	83	18	184
Water:					
No. of samples collected	27	19	17	12	75
No. vaults dewatered during the quarter	21	13	20	7	61
Status (end of quarter):					
No. vaults in alarm or inhibited	15	6	8	14	--
No. vaults with water	6	1	2	13	--
No. alarms needing repair	--	--	10	10	--

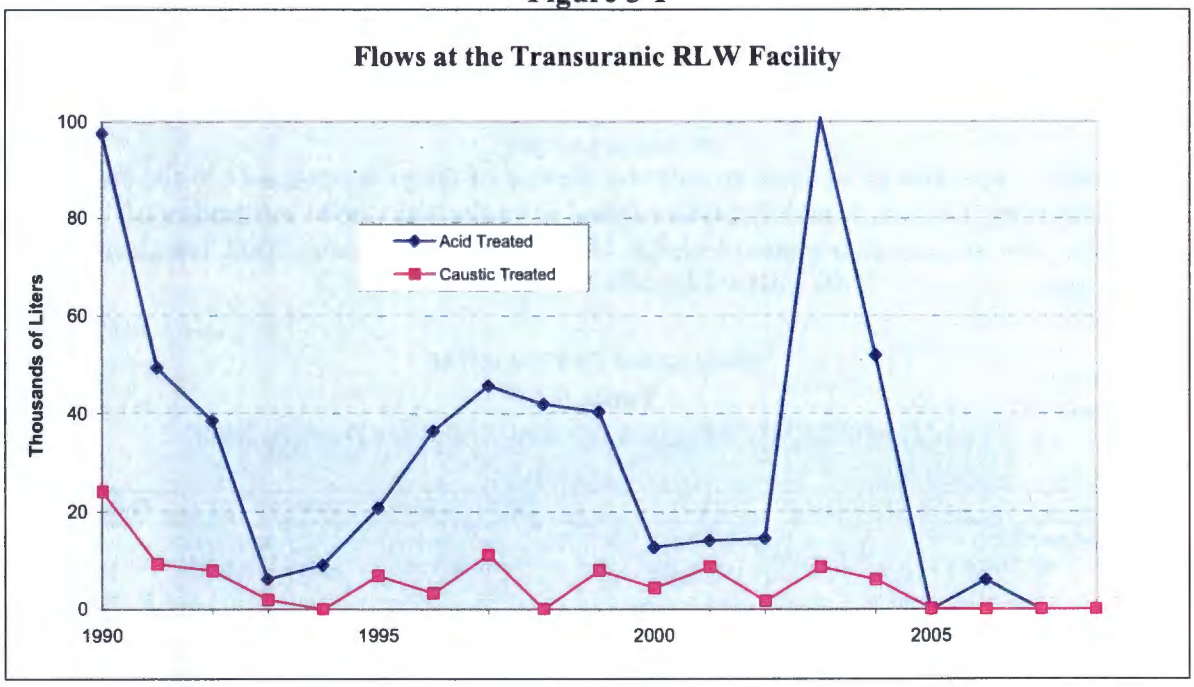
5.2 Transuranic RLW Facility

Two events limited transuranic RLW operations during 2008: the discovery in September 2003 that the influent storage tank for caustic waste was leaking, and the shutdown of Room 60 in July 2004 due to deteriorating equipment and vessels.

Installation of the new caustic waste tank was completed in February 2007, and the receipt of acid and caustic wastes resumed shortly thereafter. A total of 3,060 liters of caustic waste (12 transfers) were received during 2008. There were no transfers of acid waste during 2008.

Room 60 repairs proceeded throughout 2008, nearly to completion. A Management Self Assessment late in the year concluded that conditions were not yet adequate for the resumption of operations. Figure 5-1 reflects the fact that no waste was treated during 2008, and also provides an historical perspective for volumes of transuranic RLW treated in Room 60.

Figure 5-1



5.3 TA53 RLW Facility

The TA53 RLWTF treats radioactive liquid waste from accelerator research at the Los Alamos Neutron Science Center. The treatment process consists of wastewater storage to allow short-lived radioisotope decay, followed by solar evaporation. Three flows are of importance.

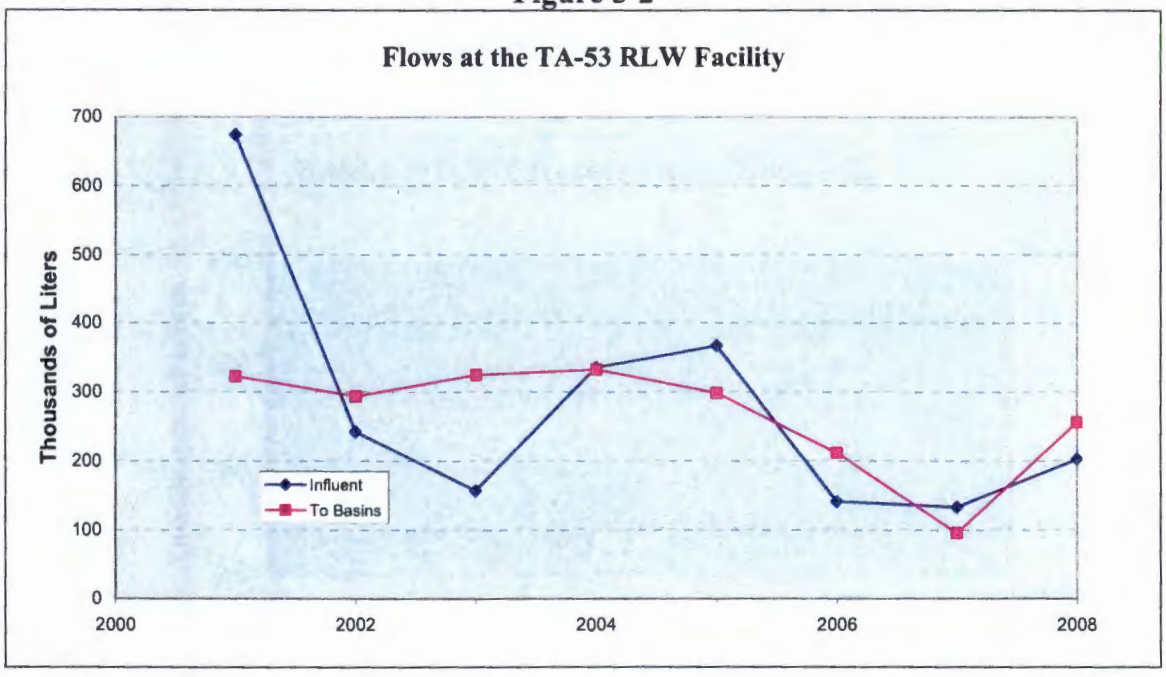
- Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan Center. The RLW is pumped from the lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945. A total of 183,090 liters of RLW were transferred from the lift stations to the RLWTF during 2008.

- Tritiated waters are occasionally trucked to the TA53 influent tanks. During 2008, 20,280 liters were trucked to the basins from TA16 and TA48. These trucked wastewaters met the waste acceptance criteria for the TA53 RLWTF. This additional trucked quantity raised total influent volume for the year to 203,370 liters.

- After aging in the influent tanks, the RLW is pumped to the evaporator basins. During 2008, three discharges occurred, totaling 257,170 liters.

Figure 5-2 provides historical perspective for RLW flows at the TA53 facility. The graph shows that flows in 2008 were low, but not atypical of flows since the facility went into operation in December 1999. There is no conclusive trend to the flows, however, and they remain well below the evaporative capacity (1.4 million liters per year) of the basins.

Figure 5-2



6. Wastes and Secondary Liquids

RLW treatment processes generate process streams that require further processing and solid wastes that must be packaged and disposed. The disposition of both requires resources that include materials, labor, and dollars (e.g., disposal fees).

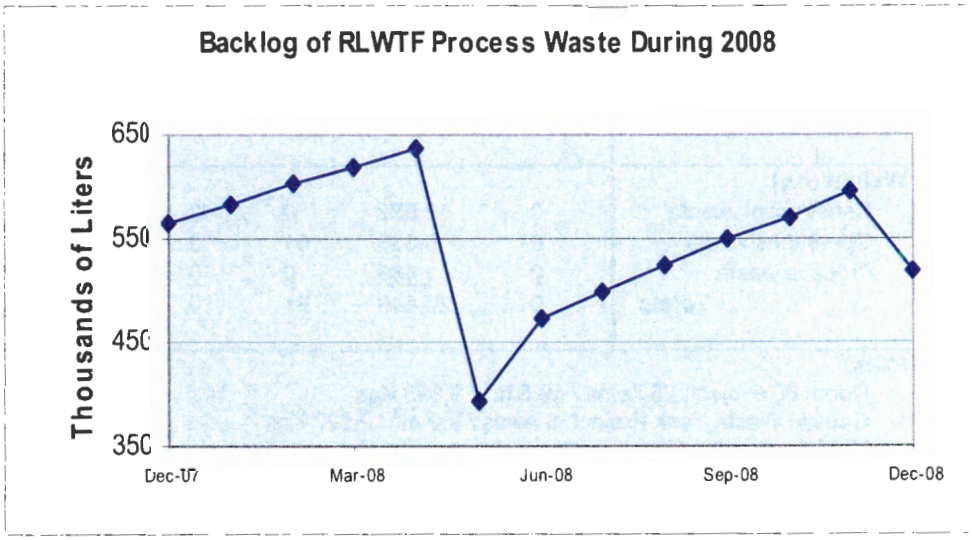
6.1 Process Wastes

The treatment of radioactive liquid wastes at TA50 generates four secondary process waste streams:

- Low-level sludge is de-watered, then packaged for disposal as a solid low-level radioactive waste.
- Transuranic sludge is solidified using cement, then packaged for disposal as a solid transuranic waste.
- Evaporator feed is evaporated to reduce its volume. Feed consists of reverse osmosis concentrate from the low-level treatment process, and treated water from the transuranic treatment process.
- Evaporator bottoms are solidified by a Subcontractor for disposal as a solid low-level radioactive waste.

The process waste backlog (i.e., volume), is an indicator of process status. Backlog, shown in Figure 6-1, varied from 370 – 640 thousand liters during 2008. Periods of sharp reduction, evident in May and December, coincide with evaporator campaigns.

Figure 6-1



6.2 Packaged Wastes

Wastes to be disposed are packaged in accordance with DOE, EPA, and DOT requirements, then transported to an authorized disposal site. During 2008, the TA50 RLWTF shipped 98 cubic meters (20,500 kilograms) of packaged wastes, as summarized in Table 6-1. These packaged wastes can be broadly grouped as wastes stemming from treatment operations, wastes from major construction projects, and process wastes.

Operations Wastes: Operations wastes result from both day-to-day water treatment activities and from facility and equipment repairs and modifications. A typical quantity, 32 cubic meters weighing 6,397 kilograms, were generated at the TA50 RLWTF during 2008. Operations wastes consisted of compactible and other trash generated in radiation control areas at the RLWTF. Compactible trash includes paper, discarded plastic sample vials and bottles, protective gloves, and similar materials needed for day-to-day activities. Other trash included empty containers, process consumables such as spent filter cartridges, and waste from repairs and modifications such as piping and worn pumps and motors.

Table 6-1
Packaged Wastes Shipped From the TA50 RLWTF During 2008

	Chem	LLW	MLLW	TRU	Totals
No. Items:					
Construction waste	0	32	0	0	32
Operations waste	0	26	1	0	27
Process waste	0	9	0	0	9
Totals	0	67	1	0	68
Volume (m^3):					
Construction waste	0	63.4	0	0	63.4
Operations waste	0	32.3	0.1	0	32.4
Process waste	0	1.9	0	0	1.9
Totals	0	97.6	0.1	0	97.7
Weight (Kg):					
Construction waste	0	12,622	0	0	12,622
Operations waste	0	6,335	61	0	6,397
Process waste	0	1,488	0	0	1,488
Totals	0	20,446	61	0	20,507

Notes:
Room 60 Project: 26 items / 49.6 m^3 / 9,395 Kgs
Caustic Waste Tank Project: 5 items / 9.0 m^3 / 2,527 Kgs
MLLW was a lead-lined safe from the chemical laboratories.

Construction Waste: Solid wastes were generated (a) during the installation of a replacement caustic waste storage tank in WM-66 and (b) during the replacement of equipment and piping in Room 60. Such wastes take the form of used protective equipment and clothing, dismantled equipment and project-related debris or soils. During 2008, construction wastes totaled 63 cubic meters, and accounted for two-thirds of the solid wastes shipped from the TA50 RLWTF. The Room 60 project generated 49.6 cubic meters and 9,395 kilograms of this non-routine waste; residual waste from the caustic waste tank project totaled 9.0 cubic meters and 2,527 kilograms of waste.

Packaged Process Wastes: During 2008, nine drums containing 1,448 kilograms of low-level sludge were shipped for disposal as LLW at Area G. No drums of solidified transuranic sludge were shipped from TA50 during 2008. Evaporator bottoms are collected in tankers, then shipped offsite for drying and disposal as solid low-level radioactive wastes. While bottoms were generated during 2008, none were shipped.

7. References

Much of the information presented in this Annual Report come from the RLWTF process control system, RS View, which automatically records temperatures, flow rates, flow totals, pressures, tank levels, and similar readings of process conditions. Another large segment of the information presented in graphs and tables in this Annual Report comes from analytical data results for water samples. The below list of references points to a third major data source used in compiling the Annual Report – published reports that are cited within the text of the Annual Report.

Del Signore, J.C., December 2006. "Material-at-Risk Calculations for the Radioactive Liquid Waste Treatment Facility", LA-UR-06-8731.

Del Signore, J.C., 01-06-2009. "Low-level RLW Influent During 2008", memo to File, Los Alamos, NM.

Department of Energy, 01-17-1993. "Radiation Protection of the Public and the Environment", Order 5400.5, Change 1, Washington, DC.

Environmental Protection Agency, 01-30-1991. "National Secondary Drinking Water Regulations". 40CFR Part 143.

Environmental Protection Agency, 01-22-2001. "National Primary Drinking Water Regulations: Maximum Contaminant Levels and Maximum Residual Disinfectant Levels". 40CFR Part 141, Subpart G.

Environmental Protection Agency, 06-08-2007. "Authorization to Discharge Under the National Pollution Discharge Elimination System", NPDES Permit No. NM0028355, Dallas, TX.

New Mexico Environment Department, 04-26-2008. "New Mexico Water Quality Control Commission Regulations", 20.6.2.3103 New Mexico Administrative Code.

Watkins, R.L. and Worland, V.P., March 2004. "RLWTF Annual Report for 2003", LA-CP-04-0314, Los Alamos, NM.

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Author(s):	J.C. Del Signore R.L. Watkins
Intended for:	TA55 Radioactive Liquid Waste February 2011

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Acronyms and Abbreviations

AE-Ci	americium-241-equivalent curie
Ci	curie (3.7×10^{10} disintegrations per second)
COD	chemical oxygen demand
CY	calendar year
DCG	derived concentration guidelines
DOE	United States Department of Energy
EPA	United States Environmental Protection Agency
IX	ion exchange
Kg	kilogram
L	liter
LANL	Los Alamos National Laboratory
MDL	method detection limit
meq/L	milliequivalents per liter
mg/L	milligram per liter
mrem	millirem (10^{-3} rem)
nCi/L	nanocuries per liter (10^{-9} curies per liter)
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
pCi/L	picocuries per liter (10^{-12} curies per liter)
RLW	radioactive liquid waste(s)
RLWCS	radioactive liquid waste collection system
RLWTF	radioactive liquid waste treatment facility
RO	reverse osmosis
SVOC	semi-volatile organic chemical(s)
TA	technical area
TDS	total dissolved solids
TSS	total suspended solids
TUF	tubular ultrafilter
VOC	volatile organic chemical(s)
µS/cm	microSiemens per centimeter
µg/L	microgram per liter

1. Overview of Facilities and Operations

There are two Radioactive Liquid Waste Treatment Facilities (RLWTF) at the Los Alamos National Laboratory, one each at TA53 and TA50. The RLW facility at TA50, however, contains two different treatment processes, each treating a different radioactive liquid waste (RLW) stream. These two processes are discussed separately in this report as though they were each a facility.

1.1 TA50 RLWTF for Low-Level RLW

The low-level RLW facility at TA50 receives and treats low-level RLW from more than 1000 generating points. RLW are sent from generator facilities to TA50 via truck or by underground pipe. The underground collection system has about four miles of double-walled pipes that are tied to 25 buildings at six Technical Areas at LANL.

The low-level RLW facility is the only facility that discharges treated water to the environment through an outfall in Mortandad Canyon. One state and two federal agencies monitor the quality of these treated waters.

Primary structures at the TA50 RLWTF for the treatment of low-level RLW are Building 50-01, 50-02, 50-90, 50-248, and a trailer-based evaporator. These structures, with a combined area of approximately 55,000 square feet, house process equipment, operations support areas, analytical laboratories, and offices. The facility has a main treatment process (MTP) with five unit operations, and a secondary treatment process consisting of two unit operations for the treatment of wastes generated by the MTP. The facility has been designated a Hazard Category 3 nuclear facility, and has Management Level 3 and Level 4 quality assurance requirements.

The TA50 RLWTF was constructed in 1963. Because of its age, and because of changing regulations, the facility has undergone significant modifications. The infusion of capital into the TA50 facility for repairs and upgrades has exceeded $20 million since 1997, including projects for stack consolidation, repair of tanks and equipment, and the installation of new processes in 1999 and 2002 to address more stringent discharge standards.

1.2 TA50 RLWTF for Transuranic RLW

The transuranic facility receives and treats an acid waste stream and a caustic waste stream from the plutonium facility at TA55. These two streams are transferred to TA50 via two underground double-walled collection pipes. Treated transuranic waters are sent to the low-level evaporator for further treatment.

Structures for transuranic RLW consist of a valve station at Building 50-201, two influent storage tanks in Building 50-66, and the treatment process within Room 60 of Building 50-01. This facility is part of the Hazard Category 3 nuclear facility at TA50, and has Management Level 2 and Level 3 quality assurance requirements.

The transuranic RLW process was designed and installed in 1982, and brought online in 1983. The process has not been modified since installation, but equipment repairs and upgrades exceeding $20 million have been necessary. Most recently, the caustic waste influent tank was replaced (2007), and piping and equipment in Room 60 were replaced. The latter project required more than four years, and was completed in late 2009.

1.3 TA53 Facility

The facility at TA53 treats RLW from accelerator research at the Los Alamos Neutron Science Center through water storage, to allow radioisotope decay, and solar evaporation. The TA53 facility started operation in December 1999, and is categorized as a radiological facility.

Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan center. The RLW is pumped from these lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945 at the east end of TA53. The tanks allow decay of radioisotopes created by the LANSCE accelerator beam, most of which have short half-lives. After aging, the RLW is pumped to one of two evaporator basins, each with a capacity of 125,000 gallons.

2. Operations Summary for 2009

2.1 Flows

Table 2-1 summarizes influent and effluent volumes for the RLW facilities during 2009.

Table 2-1
Radioactive Liquid Waste Flows During 2009

Facility	Influent (liters)	Effluent (liters)
Low-level RLW	4,544,388	4,401,900
Transuranic RLW	2,916	7,535
TA-53	448,410	379,600

Low-level RLW: The TA50 RLWTF received 4,544,400 liters of influent during 2009, and discharged 4,401,900 liters to Mortandad Canyon. Influent included 59,600 liters of water transported from four generators via truck. Water flows were down 17% from the preceding year, but nearly the same as in 2007. Influent and effluent volumes are detailed by month in Table 2-2.

The influent brought with it 0.58 curie of alpha radioactivity and 0.07 curie of beta activity in 542 grams of radioactive material. Uranium-238 accounted for nearly all of the radioactive mass, while plutonium and americium accounted for nearly all of the radioactivity. Effluent contained just 0.06 curie in one gram of radioactive material. Approximately 99.7% of the radioactivity in the effluent was due to tritium, which cannot be removed by RLWTF processes.

Approximately 1050 kilograms of chemicals entered the plant with the influent in the form of suspended solids (49 kilograms) and dissolved solids (1,000 kilograms). After treatment, a total of 1050 kilograms of chemicals of were discharged into Mortandad Canyon in the form of dissolved solids, of which 40% was sodium.

Transuranic RLW: Influent for the year consisted of 2916 liters of waste in three transfers from TA55. While no influent was treated, 7535 liters of effluent were sent to the tanks in Building 50-248. Effluent came from rinsing and flushing Room 60 piping and equipment, and from the calibration of tank level probes; effluent was not the result of treating of transuranic RLW.

TA53 RLWTF: The TA53 facility received 448,410 liters of influent during 2009, and discharged 379,600 liters to the evaporation basins. Influent included 158,130 liters trucked to TA53 from other locales, in addition to water from accelerator research. Because influent was so much larger than effluent volume, storage tanks were at 70% of capacity at year's end, versus 50% of capacity twelve months earlier.

Table 2-2
TA50 Low-level RLW Flow Summary During 2009

Date	Influent (Liters)	No. of Discharges	Discharged (Liters)
Jan-09	365,691	4	299,300
Feb-09	285,860	4	301,100
Mar-09	419,858	7	524,300
Apr-09	456,239	5	372,400
May-09	368,572	5	377,400
Jun-09	383,284	5	343,900
Jul-09	485,445	6	440,500
Aug-09	363,910	6	453,300
Sep-09	364,317	6	458,000
Oct-09	313,725	4	303,500
Nov-09	389,370	3	226,900
Dec-09	348,117	4	301,300
Total	4,544,388	59	4,401,900

2.2 Effluent Quality: Low-level RLW

Three agencies monitor the quality of treated waters discharged from the TA50 RLWTF into Mortandad Canyon. The United States Department of Energy (DOE) regulates discharges of radioactive materials via Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE, 01/17/93). The United States Environmental Protection Agency (USEPA) regulates 18 parameters via NPDES permit number NM0028355 (EPA, 06/08/07). LANL also has voluntary commitments (a) to the New Mexico Environment Department (NMED) to meet groundwater standards for fluoride, nitrate-nitrogen and total dissolved solids, (b) to the NMED to meet a proposed discharge standard for perchlorates, and (c) to the DOE to limit tritium to the drinking water standard.

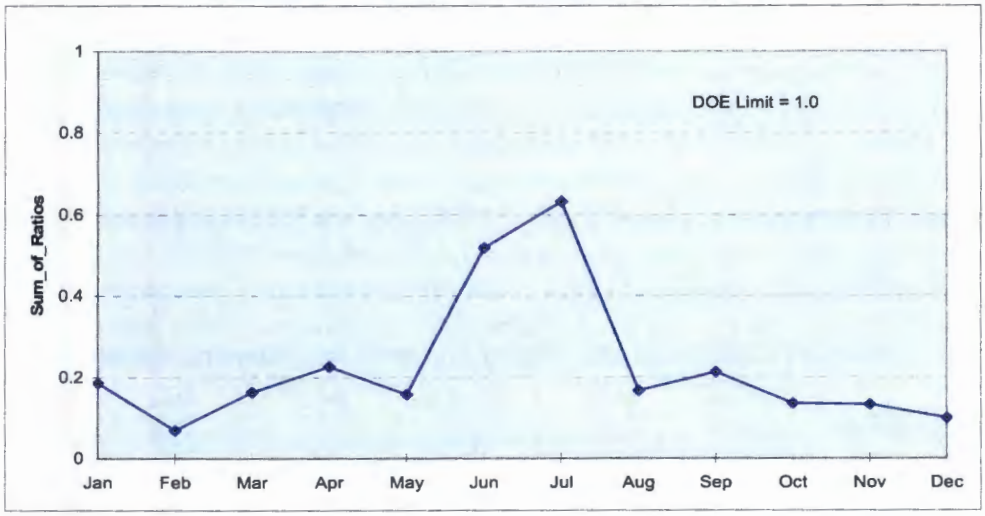
During calendar year 2009, TA50 RLWTF effluent:

- met all DOE standards set forth in Order 5400.5 for radiological discharges;
- met all NPDES discharge standards except for one analysis for pH.
- met all voluntary standards exept for one weekly measurement for nitrate.

DOE: Effluent radiological quality during 2009 is illustrated in Figure 2-1, a plot of sum-of-ratios for each month. The average sum-of-ratios for the year was 0.24, or approximately one-fourth of the DOE discharge standard. RLWTF effluent has been compliant with the standard for 118 of the past 120 consecutive months[1].

[1] The monthly sum-of-ratios for discharge of radionuclides was 1.28 in January 2002 and 1.19 in February 2002, versus the DOE Guideline of 1.0.

Figure 2-1
Sum-of-Ratios in RLWTF Effluent During 2009



EPA: Table 2-3 summarizes effluent quality versus NPDES discharge limits. The table lists regulated parameters, their discharge standards, and the maximum and average concentration of each parameter in monthly composite samples of effluent during 2009. Although monthly composite sample results met discharge limits, a sample taken during a discharge on 02-04-2009 was measured with a pH value of 5.7 standard units, versus the acceptable range of 6.0-9.0 units. This discharge snapped a string of 109 consecutive months without an NPDES violation.

Table 2-3
TA50 RLWTF Effluent During 2008 Compared To NPDES Standards

Regulated Parameter	Frequency	Units	Standard	Max.	Avg.
Cadmium	Annual	µg/L	Report	0.24	0.06
Copper	Monthly	µg/L	Report	87	33
Mercury	Annual	µg/L	Report	0.04	0.004
Nickel	Annual	µg/L	Report	66	25
PCBs	Annual	µg/L	Report	*	*
Perchlorate	Annual	µg/L	Report	*	*
Selenium	Annual	µg/L	Report	8.0	1.6
WET	Quarterly	%	Report	100%	75%
Zinc	Monthly	µg/L	Report	25	13
Chromium	Annual	µg/L	1,340	4.7	0.8
COD	Monthly	mg/L	125	39	18
Lead	Annual	µg/L	423	5.5	1.9
pH	Weekly	s.u.	6 - 9	8.2	7.3
Radium	Annual	pCi/L	30	*	*
Residual Chlorine	Weekly	µg/L	11	*	*
Suspended Solids	Monthly	mg/L	30	*	*
Toxic Organics	Monthly	µg/L	1,000	18	1.5

Data is from 12 monthly composite samples, except for PCBs, residual chlorine, and WET.
WET = whole effluent toxicity * Less than detection limit.

Voluntary: Table 2-4 summarizes effluent quality versus voluntary discharge standards. The table lists the voluntary discharge standards, and the maximum and average concentration of each parameter in weekly composite samples of effluent during 2009. Voluntary discharge standards were met for all weekly composite samples for dissolved solids, fluoride, perchlorate, and tritium (180 total analyses). Weekly composite results for nitrate-nitrogen met the voluntary discharge standard of 10 mg/L for 43 of 45 weeks. Discharge concentrations of 12.9 and 12.8 mg/L were measured for the weeks ending 10-04-2009 and 11-22-2009, respectively.

Table 2-4
TA50 RLWTF Effluent During 2009 Compared To Voluntary Standards

	Agency	Units	Standard	#>Std.	Max.	Avg.
Dissolved Solids	NMED	mg/L	1,000	0	558	232
Fluoride	NMED	mg/L	1.6	0	0.55	0.17
Nitrate-Nitrogen	NMED	mg/L	10	2	12.9	6.2
Perchlorate	EPA	µg/L	4	0	1.95	0.05
Tritium	DOE	nCi/L	20	0	20	16

Data is from 45 weekly composite samples; no water was discharged during the other weeks of the year.

2.3 Production

Low-level RLW: Influent was received all 365 days of the year. The Main Treatment Plant operated on 140 days, and effluent was discharged on 59 occasions. Key process indicators for each of the unit operations were as follows:

- Clarifier sludge was not removed at any time during the year.
- The gravity filter was backwashed twice (107,050 liters).
- Perchlorate ion exchange vessels were not changed the entire year.
- RO membranes were changed on six occasions; TUF membranes were not changed.

In the Secondary Treatment Plant, the vacuum filter (sludge processing) was not operated. Bottoms were not shipped for off site treatment and disposal. It was necessary to continue to store evaporator bottoms in the 100K influent tank.

Three evaporator campaigns were conducted, one each in June, July, and August. A total of 134,410 gallons of reverse osmosis concentrate and bottoms were fed to the evaporator; 50,770 gallons of bottoms and chemical cleaning solutions were generated. Evaporator campaigns of July and August were used to concentrate evaporator bottoms in addition to reverse osmosis concentrate. The need to re-concentrate was created by the four-year drought in shipping bottoms for off-site treatment and disposal. Without this further concentration, there would have been no storage tanks available for either RO concentrate or evaporator bottoms, and RLW treatment would have had to be suspended. Re-concentration of evaporator bottoms came at a high cost. Higher downtime, increased filter bag changes, increased fouling, more frequent chemical cleaning, and increased pump wear and maintenance all resulted.

RLWCS: A total of 208 vault inspections were conducted during 2009, an average of three per vault. Water discovered in vaults was sampled and analyzed for radioactivity, then de-watered. Sampling confirmed that water found in the vaults was due to the infiltration of groundwater, not to collection system leakage. At the end of the year, ten vaults were suspected to contain water, and 16 alarms were in need of repair.

Transuranic RLW: Influent was received on just three occasions, and no treatment took place in Room 60. Despite this, the year 2009 was marked by a number of significant successes. The Room 60 Upgrades Project, started in 2004, drew to a close. Equipment installation and testing, and instrument calibration, were completed. The Contractor Readiness Assessment was successfully completed, and pre-start assessment findings were closed. On December 14, the DOE authorized the restart of Room 60 operations.

TA53 RLWTF: Influent volume was higher than normal, largely because 158,000 liters were trucked to the evaporation basins from other technical areas. Discharges were made to the evaporation basins in February, July (twice), and November.

2.4 Process and Facility Modifications

Process: There were no major process modifications during 2009.

Facility: Work was completed on upgrades to Room 60. Started in 2004, the Room 60 Upgrade Project has replaced corroded and leaking process pipes, the sludge storage tank, and a small pressure filter. Work also continued, albeit at low levels, on the installation of a new pump house and influent storage facility. Started in 2000 after the Cerro Grande wildfire, this project neared completion during 2009.

2.5 Wastes

The process waste backlog varied from 400 – 600 thousand liters during 2009. A small net reduction was achieved during the year: 494 thousand liters of process wastes at the end of the year, versus 519,000 liters on January 1st. At the end of the year, the backlog was comprised of 312,000 liters of bottoms, 135,000 liters of evaporator feed, 44,000 liters of low-level sludge, and 3100 liters of transuranic sludge.

A total of 55 cubic meters (13,880 kilograms) of packaged wastes were shipped from the TA50 RLWTF during 2009. Almost all of this was solid low-level radioactive waste. Shipments included 869 kilograms of chemical wastes generated during closeout of the Room 60 Upgrades Project, and during a plant-wide chemical cleanout campaign. Approximately 3500 kilograms of low-level waste were generated during two maintenance and construction projects, the Room 60 Upgrades Project and the influent storage project. Another 9500 kilograms of solid low-level waste were generated by RLWTF operations. No process wastes (e.g., sludge) were shipped during 2009.

3. Radiological Nature of Low-level RLW

RLWTF influent and effluent samples are analyzed for thirty-seven (37) radionuclides which, from past experience, are possible in LANL radioactive liquid wastes[2]. These radionuclides are categorized by primary method of decay as either alpha-emitting or beta-emitting isotopes. Alpha-emitting radionuclides are of most concern because of quantities (both mass and radioactivity) and safety basis impacts.

3.1 Influent Characteristics

As shown in Tables 3-1 and 3-2, nineteen radionuclides were detected in the RLWTF influent: eight alpha-emitting isotopes and eleven beta-emitting isotopes.

Influent contained 0.58 curie of alpha-emitting radionuclides, and had an average concentration of 127 nCi/L. This concentration was about twice the historical average alpha concentration (Del Signore, December 2006, p.25). Am-241, Pu-238, and Pu-239 comprised 99.9% of the alpha radioactivity.

Beta-emitting radionuclides had an average concentration of 14.2 nCi/L, and brought 0.065 curie. More than 98% of beta radioactivity was from tritium.

3.2 Effluent Characteristics

As shown in Tables 3-1 and 3-2, nineteen radionuclides were detected in the RLWTF effluent: seven alpha-emitting isotopes and twelve beta-emitting isotopes. Alpha-emitting radionuclides had an average effluent concentration of 7.7 pCi/L, and beta-emitting radionuclides an average concentration of 14.6 nCi/L. Less than one-tenth of a millicurie of alpha radioactivity was discharged to Mortandad Canyon in the effluent.

3.3 Radionuclide Removal

Table 3-2 summarizes radioactivity (curies) into and out of the RLWTF for 2009 for all radioisotopes. In the table, "alpha gross" indicates direct analytical measurement of alpha activity by liquid scintillation counting, and "alpha sum" is the arithmetic sum of the concentrations of the nine alpha-emitting radionuclides by alpha spectroscopy. This double analysis of water samples provides an accuracy check for analytical results, and can indicate when re-analysis may be warranted.

[2] Non-routine isotopes are also detected during evaluation of spectrographic data.

Table 3-1
Radionuclide Analyses of RLWTF Influent and Effluent in CY 2009

Radionuclides Analyzed for in the RLWTF Influent and Effluent	Radionuclides Detected in RLWTF Influent	Radionuclides Detected in RLWTF Effluent
Alpha Particle Emitters (9)		
Am-241	X	X
Np-237		
Pu-238, 239	X, X	X, X
Ra-226	X	
Th-232	X	X
U-234, 235, 238	X, X, X	X, X, X
Beta Particle Emitters (28)		
As-74	X	X
Be-7		
Ce-141	X	
Co-56, 57, 58, 60	X	X
Cs-134, 137	X	X,X
Eu-152		
H-3	X	X
I-133		X
Mn-52, 54		
Na-22		X
Ra-228	X	X
Rb-83, 84	X	X,X
Sc-46, 48		
Se-75	X	
Sn-113		
Sr-85, 89, 90	X,X,X	X
V-48		
Y-88		
Zn-65		X
37 Total	**19 Total**	**19 Total ***

* Nb-95 was also detected in the effluent, in December 2009.

Table 3-3 shows the *mass* of alpha-emitting radionuclides in RLWTF influent and effluent during 2009. The table shows that 542 grams of alpha emitters were received in influent, and that 0.9 gram was discharged in treated water, a removal of 99.9%. The table also shows that uranium-238 comprised nearly all of the mass of these radionuclides in both influent and effluent.

A similar perspective is obtained by examining removal of alpha *radioactivity* during 2009 (Table 3-4). The RLWTF performed even better from this perspective, removing 99.994% of the radioactivity of the alpha emitters from the wastewater stream (0.58 curie in, versus 34 microcuries out).

TABLE 3-2
TA-50 RLWTF Radionuclide Summary For 2009

	RAW Avg (nCi/L)	Maximum (nCi/L)	Minimum (nCi/L)	Total (Ci)	FINAL Avg (pCi/L)	Maximum (pCi/L)	Minimum (pCi/L)	Total (Ci)
Alpha Gross	1.28E+02	4.80E+02	3.10E+01	5.79E-01	7.29E+00	1.90E+01	3.00E+00	3.21E-05
Alpha Sum	1.27E+02	4.49E+02	2.36E+01	5.78E-01	7.66E+00	1.96E+01	2.73E+00	3.37E-05
Am-241	2.06E+01	9.90E+01	4.80E+00	9.35E-02	2.72E+00	9.00E+00	*	1.20E-05
As-74	1.54E-02	7.90E-02	*	7.01E-05	7.12E+00	3.70E+01	*	3.13E-05
Be-7	*	*	*	*	*	*	*	*
Ce-141	9.63E-03	8.10E-02	*	4.38E-05	*	*	*	*
Co-56	*	*	*	*	*	*	*	*
Co-57	*	*	*	*	7.91E-02	7.60E-01	*	3.48E-07
Co-58	1.20E-03	1.40E-02	*	5.45E-06	*	*	*	*
Co-60	*	*	*	*	*	*	*	*
Cs-134	*	*	*	*	8.76E-02	1.70E+00	*	3.86E-07
Cs-137	6.44E-03	2.30E-02	*	2.92E-05	1.47E+00	8.10E+00	*	6.47E-06
Eu-152	*	*	*	*	*	*	*	*
H-3	*	*	*	*	1.46E+04	1.80E+04	1.10E+04	6.43E-02
I-133	*	*	*	*	3.34E-01	2.80E+00	*	1.47E-06
Mn-52	*	*	*	*	*	*	*	*
Mn-54	*	*	*	*	*	*	*	*
Na-22	*	*	*	*	1.87E-01	1.80E+00	*	8.24E-07
Nb-95	*	*	*	*	1.29E-01	2.50E+00	2.50E+00	5.67E-07
Np-237	*	*	*	*	*	*	*	*
Pu-238	4.63E+01	2.30E+02	2.80E+00	2.10E-01	1.81E+00	9.50E+00	*	7.98E-06
Pu-239	6.02E+01	1.50E+02	1.60E+01	2.74E-01	2.70E+00	7.50E+00	9.90E-01	1.19E-05
Ra-226	2.55E-03	3.70E-02	*	1.16E-05	*	*	*	*
Ra-228	5.16E-03	4.30E-02	*	2.34E-05	*	*	*	*
Rb-83	7.97E-03	9.90E-02	*	3.62E-05	6.11E+00	3.90E+01	*	2.69E-05
Rb-84	*	*	*	*	9.43E-01	4.20E+00	*	4.15E-06
Sc-46	*	*	*	*	*	*	*	*
Sc-48	*	*	*	*	*	*	*	*
Se-75	1.10E-03	1.10E-02	*	5.02E-06	*	*	*	*
Sn-113	*	*	*	*	*	*	*	*
Sr-85	2.91E-02	1.80E-01	*	1.32E-04	2.56E+00	7.80E+00	*	1.13E-05
Sr-89	1.84E-02	1.00E-01	*	8.35E-05	*	*	*	*
Sr-90	1.31E-02	1.30E-01	*	5.93E-05	*	*	*	*
Th-232	2.62E-04	1.10E-03	*	1.19E-06	2.50E-03	2.40E-02	*	1.10E-08
U-234	3.18E-02	9.00E-02	*	1.44E-04	3.54E-01	2.40E+00	*	1.56E-06
U-235	1.15E-03	3.00E-03	*	5.20E-06	5.83E-04	6.50E-03	*	2.57E-09
U-238	3.88E-02	1.30E-01	2.70E-03	1.76E-04	6.11E-02	2.60E-01	*	2.69E-07
V-48	*	*	*	*	*	*	*	*
Y-88	*	*	*	*	*	*	*	*
Zn-65	*	*	*	*	3.72E-01	4.40E+00	*	1.64E-06

Twelve influent samples and 12 effluent samples for each isotope.
* Less than Detection Limit n.m.: Not measured

Table 3-3
Mass of Alpha Emitting Radionuclides During 2009

Radionuclide	Influent (grams)	Effluent (grams)
Am-241	<0.1	<0.001
Np-237	*	*
Ra-226	<0.1	*
Pu-238	<0.1	<0.001
Pu-239	4.4	<0.001
Th-232	10.8	0.100
U-234	<0.1	<0.001
U-235	2.4	0.001
U-238	524	0.800
Totals	**542**	**0.902**

* Less than Detection Limit

Removal of beta-emitting radioisotopes is also depicted in Table 3-4. Approximately 80% of non-tritium beta activity was removed during 2009 (0.42 millicurie in; 0.085 millicurie out). Tritium quantities entering and leaving the plant were the same (64 millicuries). This is because tritium is present *as* water, and the RLWTF is not equipped to treat or remove tritium.

Table 3-4
Removal of Radioactivity From RLWTF Influent During 2009

Month	Influent (mCi)	Effluent (mCi)	%Removed
Alpha radioactivity	578	0.034	99.994
Beta radioactivity*	0.42	0.085	79.6
Tritium (beta)	64	64	0

* Non-tritium beta

3.4 Regulatory Performance

In 1990 DOE issued Order 5400.5, "Radiation Protection of the Public and the Environment," which revised Derived Concentration Guidelines (DCGs) for all radionuclides discharged from DOE facilities. The concentration of each radionuclide divided by its particular DCG value results in a ratio. For waters containing more than one radionuclide, a ratio is to be found for each radionuclide, and these ratios are to be summed. To be in compliance with Order 5400.5, the sum of the ratios cannot exceed 1.0.

Table 3-5 provides flow-weighted sum-of-the-ratios for individual isotopes, and shows that the average for all of 2009 was 0.24. Americium, ^{238}Pu, and ^{239}Pu accounted for nearly all of the sum of the ratios in the RLWTF effluent; tritium accounted for about 1%.

Table 3-5
TA-50 RLWTF Effluent During 2009 Compared With DOE Order 5400.5

Radioactive Isotopes	Mean Concentration (picoCi/L)	DCG 5400.5 (picoCi/L)	Percent Of DCG
Am-241	2.7	30	**9.1**
As-74	7.1	40,000	<0.1
Co-57	0.1	100,000	<0.1
Cs-134	0.1	2,000	<0.1
Cs-137	1.5	3,000	<0.1
H-3	14,600	2,000,000	**0.7**
I-133	0.3	10,000	<0.1
Na-22	0.2	10,000	<0.1
Nb-95	0.1	65,000	<0.1
Pu-238	1.8	40	**4.5**
Pu-239	2.7	30	**9.0**
Rb-83	6.1	20,000	<0.1
Rb-84	0.9	10,000	<0.1
Sr-85	2.6	70,000	<0.1
Th-232	<0.1	50	<0.1
U-234	0.35	500	<0.1
U-235	<0.1	600	<0.1
U-238	0.1	600	<0.1
Zn-65	0.4	9,000	<0.1
Sum of Ratios = 0.236			

* Other isotopes were not detected in RLWTF effluent.

3.5 Graphs of Radiological Data

Figures 3-1 and 3-2 chart concentrations in RLWTF influent and effluent for each month of 2009 for alpha-emitting isotopes (i.e., sum of the concentration of the nine alpha radionuclides listed in Table 3-3). Note that the ordinate of Figure 3-1 is scaled in nanocuries per liter while Figure 3-2 is scaled in picocuries per liter, a factor of one thousand. Examination of these graphs shows the following:

- The decontamination factor for alpha radioisotopes was four orders of magnitude (i.e., 10,000) or more. This was also indicated in Table 3-4.

- Effluent concentrations averaged less than 15 pCi/L, the EPA drinking water standard, for ten months.

Figure 3-1
Alpha-Emitting Isotopes in RLWTF Influent During 2009

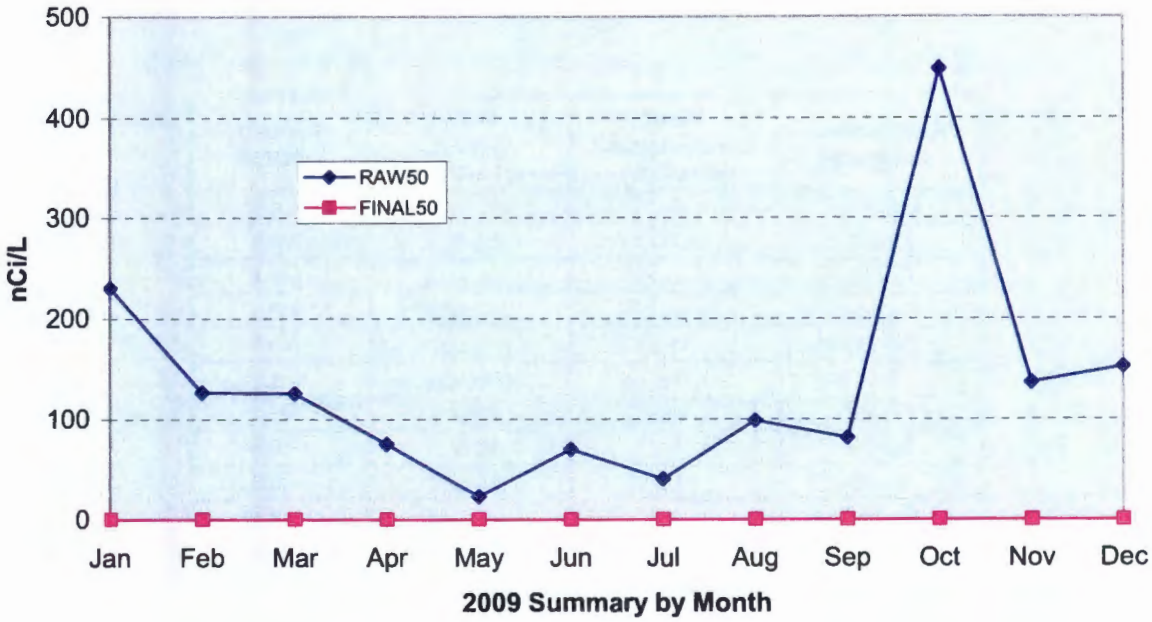
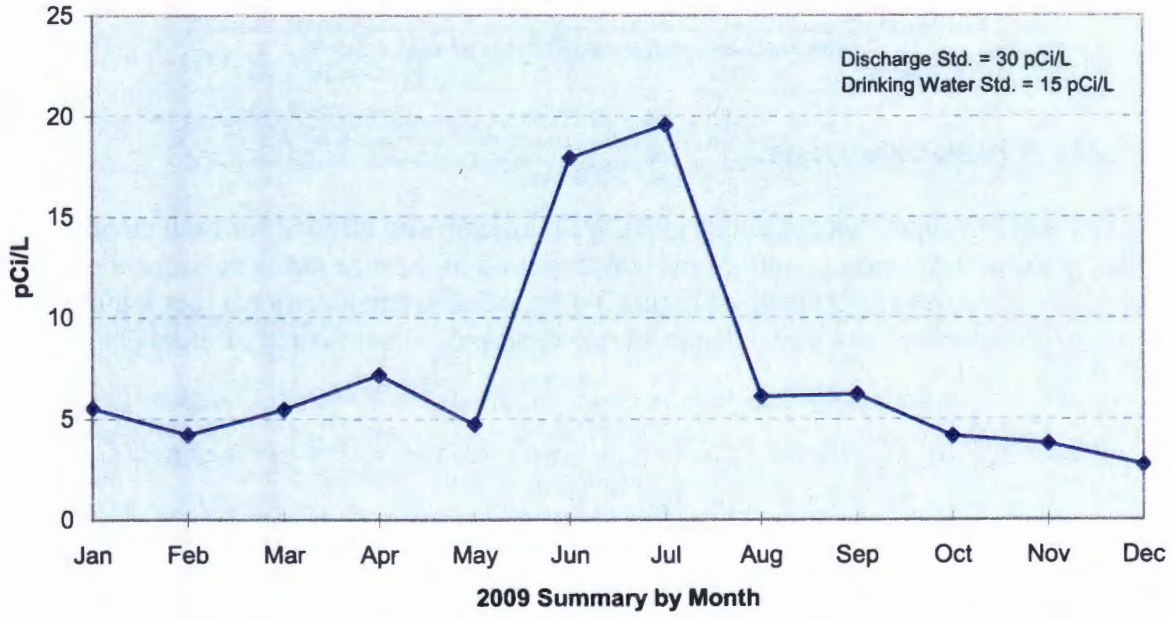


Figure 3-2
Alpha-Emitting Isotopes in RLWTF Effluent During 2009

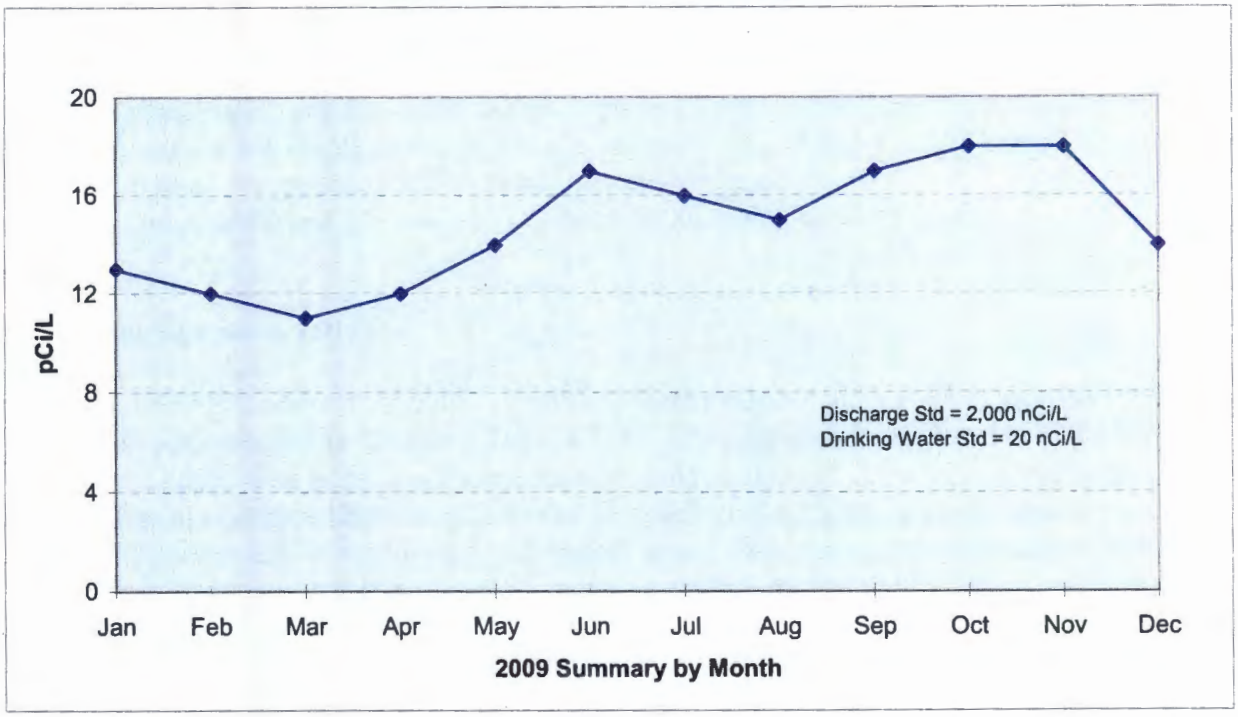


- Influent concentrations surged in October 2009. No particular isotope was the cause, as ^{238}Pu, ^{239}Pu, and ^{241}Am concentration each increased from the annual average. No generator was identified as the source of the spike.

- Effluent concentrations were high, though safely within the discharge standard, during June and July 2009. Abnormal fouling of reverse osmosis membranes occurred during these two months. Membranes had to be changed on three occasions over a seven-week period.

Figure 3-3 charts average concentrations, in nanocuries per liter, of tritium by month in RLWTF effluent. Tritium was the only significant beta-emitting radionuclide in RLWTF effluent, accounting for 99.8% of the total beta activity discharged during 2009. All discharges to the environment were below the EPA drinking water standard.

Figure 3-3
Tritium in RLWTF Effluent During 2009



4. Non-Radiological Nature of Low-level RLW

RLWTF influent and effluent are analyzed for both inorganic and organic constituents, many of which are present in tap water. Influent samples are analyzed for 40 inorganic water quality parameters, and for 130 volatile and semi-volatile organic compounds. Effluent samples are analyzed for the same 40 inorganic parameters, and for 86 volatile and semi-volatile organic compounds.

Inorganic constituents included:

- seven conventional water quality measures, such as conductivity, hardness, and pH
- a total of 24 cation measurements (metals)
- five anions: chloride, fluoride, cyanide, sulfate, and perchlorate
- four nitrogen measurements – nitrogen as ammonia, nitrogen as nitrates, nitrogen as nitrites, and total Kjedahl nitrogen.

Organic constituents are also analyzed via approved EPA analytical methods. Influent samples are analyzed via SW-846:8260B (69 volatile organic compounds) and SW-846:8270C (61 semi-volatile organic compounds). Effluent samples are analyzed via Method 624 for (32 volatile organic compounds) and Method 625 (54 semi-volatile organic compounds).

4.1 Influent Characteristics

Twelve monthly composite samples of influent were analyzed during 2009, each for 40 different inorganic parameters. As shown in Table 4-1, all 40 parameters were detected in the RLWTF influent in 2009. The table also shows, however, that sixteen of these were reported at less than the analytical detection limit for at least one month during the year. On average, in fact, seven inorganic parameters were reported each month at less than the analytical detection limit. Average influent concentration of all inorganic chemicals for the entire year was 232 mg/L.

As shown in Table 4-5, the total mass of inorganic chemicals entering the RLWTF was 1044 kilograms, of which nitrate totaled 220 kilograms (21%). This was quite different from radioactive contaminants, which had a combined influent mass of less than one kilogram.

Influent was also analyzed for volatile and semi-volatile organic compounds (Tables 4-2 and 4-3). Nine samples were collected during 2009, and each were analyzed for 130 organic compounds. Of these analyses, 46 (4%) were determined to exceed minimum detection level. Annual average influent concentration was 0.05 mg/L volatile organic compounds and 0.04 mg/L semi-volatile organic compounds. Total mass of organic compounds estimated to have been received with the influent for the year was 445 grams, 88% of which was comprised of three chemicals (acetone, Bis(2-Ethylhexyl)Phthalate, and methylene chloride).

Table 4-1
TA50 RLWTF Inorganic Summary For 2009

	RAW Average	Maxi-mum	Mini-mum	Total In (Kg)	FINAL Average	Maxi-mum	Mini-mum	Total Out (Kg)
ALKALINITY-MO**	3.93E+01	1.10E+02	*	1.78E+02	1.49E+02	2.70E+02	6.60E+01	6.55E+02
ALUMINUM	4.85E-01	8.10E-01	*	2.21E+00	6.30E-03	2.00E-02	*	2.77E-02
AMMONIA-N	9.62E+00	1.46E+01	5.90E+00	4.37E+01	5.46E+00	1.13E+01	1.50E+00	2.41E+01
ARSENIC	9.08E-04	5.50E-03	*	4.13E-03	1.95E-04	5.30E-04	*	8.58E-04
BARIUM	2.90E-02	6.00E-02	*	1.32E-01	1.41E-02	9.40E-02	*	6.20E-02
BERYLLIUM	1.21E-03	5.50E-03	*	5.52E-03	*	*	*	*
BORON	1.10E-01	4.50E-01	*	5.02E-01	8.31E-02	1.90E-01	*	3.66E-01
CADMIUM	6.49E-04	4.00E-03	*	2.95E-03	6.12E-05	2.40E-04	*	2.69E-04
CALCIUM	1.20E+01	2.70E+01	7.40E+00	5.44E+01	3.99E-01	1.00E+00	6.00E-02	1.76E+00
CHLORIDE	2.35E+01	3.40E+01	1.54E+01	1.07E+02	1.43E+01	2.80E+01	5.50E+00	6.31E+01
CHROMIUM	6.42E-02	3.00E-01	*	2.92E-01	8.22E-04	4.70E-03	*	3.62E-03
COBALT	9.69E-03	1.10E-01	*	4.40E-02	1.94E-01	2.80E+00	*	8.52E-01
COD	7.08E+01	2.23E+02	3.20E+01	3.22E+02	1.76E+01	3.90E+01	*	7.77E+01
CONDUCTIVITY**	3.42E+02	4.60E+02	2.80E+02	1.56E+03	4.38E+02	6.80E+02	1.90E+02	1.93E+03
COPPER	9.71E-01	4.30E+00	2.30E-01	4.41E+00	3.28E-02	8.70E-02	6.90E-03	1.45E-01
CYANIDE	6.44E-04	8.00E-03	*	2.93E-03	*	*	*	*
FLUORIDE	3.72E-01	8.40E-01	4.00E-02	1.69E+00	1.83E-01	1.10E+00	3.00E-02	8.04E-01
HARDNESS**	4.46E+01	8.72E+01	3.30E+01	2.03E+02	2.70E+00	1.21E+01	4.36E-01	1.19E+01
IRON	4.39E+00	1.20E+01	7.40E-01	2.00E+01	1.79E-02	6.10E-02	*	7.90E-02
LEAD	1.70E-01	3.00E-01	6.60E-02	7.73E-01	1.88E-03	5.50E-03	*	8.30E-03
MAGNESIUM	3.58E+00	4.80E+00	3.00E+00	1.63E+01	4.14E-01	2.90E+00	3.30E-02	1.82E+00
MERCURY	3.38E-03	7.90E-03	*	1.54E-02	4.37E-06	4.20E-05	*	1.92E-05
NICKEL	5.96E-01	3.90E+00	2.70E-02	2.71E+00	2.47E-02	6.60E-02	*	1.09E-01
NITRATE-N	1.09E+01	1.92E+01	5.50E+00	4.97E+01	6.69E+00	1.15E+01	2.70E+00	2.95E+01
NITRITE-N	3.59E-01	2.04E+00	*	1.63E+00	1.85E+00	5.30E+00	5.00E-02	8.15E+00
PERCHLORATE	2.12E-01	5.00E-01	8.00E-02	9.61E-01	*	*	*	*
PHOSPHORUS	1.77E+00	5.50E+00	6.40E-01	8.04E+00	1.15E-01	3.40E-01	3.00E-02	5.06E-01
POTASSIUM	4.53E+00	9.70E+00	3.00E-01	2.06E+01	2.97E+00	6.10E+00	2.60E-01	1.31E+01
SELENIUM	2.56E-02	2.10E-01	*	1.16E-01	1.60E-03	8.00E-03	4.00E-04	7.03E-03
SILICON	3.53E+01	7.20E+01	5.10E+00	1.60E+02	4.20E+00	2.90E+01	*	1.85E+01
SILVER	6.02E-04	5.20E-03	*	2.74E-03	4.14E-06	6.00E-05	*	1.82E-05
SODIUM	3.09E+01	4.70E+01	1.80E+01	1.40E+02	9.32E+01	1.90E+02	3.60E+01	4.10E+02
SULFATE	2.87E+01	8.60E+01	9.00E-01	1.30E+02	9.18E+00	2.10E+01	1.50E-01	4.04E+01
TDS	2.21E+02	2.72E+02	1.50E+02	1.00E+03	2.39E+02	3.63E+02	1.28E+02	1.05E+03
TKN	1.26E+01	1.90E+01	8.50E+00	5.73E+01	5.29E+00	8.80E+00	2.20E+00	2.33E+01
TOXIC ORGANICS	n.m.	n.m.	n.m.	n.m.	1.24E-03	1.81E-02	*	5.44E-03
TSS	10.8E+00	4.40E+01	*	4.89E+01	0.00E+00	1.70E+01	*	0.00E+00
URANIUM	1.17E-01	4.00E-01	8.00E-03	5.33E-01	1.82E-04	7.70E-04	*	8.02E-04
VANADIUM	7.14E-03	3.40E-02	*	3.24E-02	1.43E-04	2.10E-03	*	6.29E-04
ZINC	3.11E-01	5.00E-01	1.00E-01	1.41E+00	1.32E-02	2.50E-02	1.60E-03	5.82E-02
pH	5.95E+00	7.50E+00	3.40E+00	--	7.32E+00	8.15E+00	6.20E+00	--

Twelve influent composite samples and 12 effluent composite samples for each inorganic.
* Less than Detection Limit n.m.: Not measured
**Units: All figures in mg/L except:
Alkalinities and hardness as mg CaCO3/L; Conductivity as uS/cm; Total Cations as meq/L.

Table 4-2
VOC Detected in Samples of 2009 RLWTF Influent

Volatile Organic Compound	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
4-Methyl-2-Pentanone	1	5.8	5.8
Acetone	5	7.0	230
Benzene	1	0.94	0.94
Bromomethane	3	2.5	17
Chloroform	5	0.13	3.6
Chloromethane	2	0.23	3.3
Iodomethane	1	6.9	6.9
Methylene Chloride	8	0.12	40
Toluene	1	0.04	0.04
Total Detects *	27		

* nine samples; 549 total analyses during 2009

Table 4-3
SVOC Detected in RLWTF Influent During 2009

Semi-Volatile Organic Compound	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
2-Nitrophenol	1	1.4	1.4
3-Methylphenol & 4-Methylphenol	1	1.9	1.9
Benzoic Acid	3	5.7	14
Bis(2-Ethylhexyl)Phthalate	8	7.3	220
Diethylphthalate	3	1.2	2.0
Pyridine	3	6.7	11
Total Detects *	19		

* nine samples; 621 total analyses during 2009

4.2 Effluent Characteristics

Twelve monthly composite samples of effluent were analyzed during 2009, each for 40 different inorganic parameters. As shown in Table 4-1, 36 of the 40 inorganic parameters were detected in the RLWTF effluent; beryllium, cyanide, perchlorate, and suspended solids were not detected in any of the 12 monthly composite samples. Table 4-1 also shows that 20 parameters were reported at less than the analytical detection limit for at least one month during the year. On average, in fact, 11 inorganic parameters were reported each month at less than the analytical detection limit. Average effluent concentration of all inorganic chemicals for the entire year was 239 mg/L, nearly identical to the average influent concentration.

As shown in Table 4-5, the total mass of minerals leaving the RLWTF was 1050 kilograms, of which 410 kilograms (39%) was sodium. This, too, was quite different from radioactive contaminants, which had a combined effluent mass of less than one gram.

Effluent was also analyzed for volatile and semi-volatile organic compounds (Table 4-4). A total of 13 samples were collected during 2009, and each were analyzed for 86 organic compounds. Of these analyses, just 15 (1.3%) were found to exceed minimum detection level. Annual average effluent concentration was 0.0015 mg/L organic compounds. Total mass of organic compounds discharged with effluent was seven grams.

Table 4-4
Organic Compounds Detected in RLWTF Effluent During 2009

Compound	Suite	No. of Detects	Minimum (µg/L)	Maximum (µg/L)
Acenaphthene	SVOC	1	1.16	1.16
Acenaphthylene	SVOC	1	1.12	1.12
Anthracene	SVOC	1	1.19	1.19
Benzo(a)anthracene	SVOC	1	1.32	1.32
Benzo(a)pyrene	SVOC	1	1.26	1.26
Benzo(b)fluoranthene	SVOC	1	1.23	1.23
Benzo(g,h,i)perylene	SVOC	1	1.24	1.24
Benzo(k)fluoranthene	SVOC	1	1.28	1.28
Chloronaphthalene[2-]	SVOC	1	1.11	1.11
Chrysene	SVOC	1	1.25	1.25
Fluoranthene	SVOC	1	1.20	1.20
Fluorene	SVOC	1	1.18	1.18
Naphthalene	SVOC	1	0.99	0.99
Phenanthrene	SVOC	1	1.26	1.26
Pyrene	SVOC	1	1.27	1.27
Total Detects *		15		

* out of 1118 total analyses

4.3 Removal of Non-Radiological Constituents

Table 4-1 provides a summary of concentrations and quantities of inorganic chemicals received by (influent) and discharged from (effluent) the RLWTF during 2009. The information shows that 1050 kilograms of inorganic chemicals entered the facility in the form of suspended solids (49 kilograms) and dissolved solids (1000 kilograms). This quantity is similar to quantities received in recent years. As shown in the final column of Table 4-1, the total amount of inorganic chemicals leaving the facility with the effluent in 2009 was 1050 kilograms, all of it in the form of dissolved solids.

Eight inorganic chemicals comprised the majority (84%) of these non-radiological constituents; they are summarized in Table 4-5, along with percent removed from the RLWTF influent. The variation shown for removal percentages reflect whether the chemical is insoluble in water (e.g.,

Table 4-5
Removal of Major Inorganic Minerals From RLWTF Influent During 2009

Chemical	Mass in Influent (Kgs)	Mass in Effluent (Kgs)	Percent Removed
Nitrate	220	131	41
Silicon	160	19	88
Sodium	140	410	-193
Sulfate	130	40	69
Chloride	107	63	41
Calcium	54	2	97
Ammonia	53	2	97
Potassium	21	13	38
Subtotal	886	679	23
Total Solids *	1049	1050	--

* Total Dissolved Solids + Total Suspended Solids

97% removal of calcium), soluble (e.g., 41% removal of nitrate), or required in the treatment process[3] (i.e., sodium, where effluent quantity exceeded influent quantity).

In contrast to these variable removal percentages, more than 98.5% of organic compounds were removed before treated water was discharged to Mortandad Canyon. Influent brought 445 grams of semi-volatile and volatile organic compounds to the RLWTF, but just seven grams were present in effluent.

4.4 Regulatory Performance

Eighteen parameters in the effluent from the RLWTF were regulated by the National Pollutant Discharge Elimination System in compliance with the Federal Clean Water Act (EPA, 06-08-2007). Reporting was required for all of these; eight have discharge standards. LANL also has a voluntary commitment with the New Mexico Environment Department to discharge effluent from the TA-50 RLWTF below groundwater standards set by the New Mexico Water Quality Control Commission (NMED, 04-20-2008) for three water quality parameters: fluoride, nitrogen-as-nitrate, and total dissolved solids. Table 4-6 identifies these regulated parameters. The table also shows sampling frequency required for each, and their regulatory limits.

During calendar year 2009, TA50 RLWTF effluent met all NPDES discharges standards except for one analysis for pH. The compliance sample taken on 02-04-2009 was measured with a pH of 5.7 standard units, versus the acceptable range of 6.0-9.0 units. The remaining sample results,

[3] The RLWTF is a water treatment facility, and chemicals are added to several of the treatment steps. For example, lime can be added to soften the water, ferric sulfate to precipitate radionuclides, and sodium hydroxide to adjust pH. Other chemicals, such as sodium metabisulfite can be used to clean the ultrafiltration and reverse osmosis membranes.

133 analyses during 2009, were compliant with discharge standards. This discharge snapped a string of 109 consecutive months without an NPDES violation.

TA50 effluent also failed to meet one of the voluntary ground water standards. Combined nitrate-plus-nitrite concentration was measured at 12.9 mg/L for the week ending 10-04-2009, and at 12.8 mg/L for the week ending 11-22-2009. During 2009, the RLWTF met voluntary standards in 223 of 225 sample analyses.

Finally, although the RLWTF is not required to meet EPA drinking water standards, a comparison of average annual effluent concentrations shows that effluent would have met 17 of the 18 inorganic and radioactive national primary drinking water standards published at 40 CFR Part 141, and would have met all eleven secondary drinking water standards published at Part 143. Effluent exceeded the standard for nitrite-as-nitrogen, 1.76 vs. 1.0 mg/L.

Table 4-6
NPDES and NMED Regulated Parameters

Parameter	Sampling Frequency	Units	Average	Daily Max
NPDES Parameters (18)				
Chemical Oxygen Demand	M	mg/L	125	125
Flow	CR	----	Report	Report
Perchlorate	Y		Report	Report
pH	W	s.u.	6 – 9	6 – 9
Radium 226 + Radium 228	Y	pCi/L	30	30
Total Cadmium	Y	µg/L	Report	Report
Total Chromium	Y	µg/L	Report	Report
Total Copper	M	µg/L	Report	Report
Total Lead	Y	µg/L	423	524
Total Mercury	Y	µg/L	Report	Report
Total Nickel	Y	µg/L	Report	Report
Total PCBs	Y	µg/L	Report	Report
Total Residual Chlorine	W	µg/L	----	11
Total Selenium	Y	µg/L	Report	Report
Total Suspended Solids	M	mg/L	30	45
Total Toxic Organics	M	µg/L	1,000	1,000
Total Zinc	M	µg/L	Report	Report
Whole Effluent Toxicity	Q	%	Report	Report
NMED Parameters (4)				
Fluoride	WC	mg/L	1.6	
Nitrogen-as-Nitrate	WC	mg/L	10	
Perchlorate	WC	µg/L	4	
Total Dissolved Solids	WC	mg/L	1,000	

Sampling frequencies:
W: weekly grab sample
M: monthly grab sample
Q: quarterly grab sample
Y: yearly grab sample
CR: continuous record
WC: weekly composite sample

4.5 Graphs of Non-Radiological Data

The following series of graphs highlight important information about non-radiological components of the TA50 RLWTF influent and effluent. Although influent and effluent are analyzed for 40 non-radioactive parameters, just six have been chosen for display in this report. Each figure plots concentration in RLWTF influent and effluent by month during 2009.

Figures 4-1 and 4-2 show total dissolved solids and total suspended solids in RLWTF influent and effluent during 2009. These two parameters provide summary information about water purity since they represent all contaminants present. Both parameters also have regulatory discharge limits – 1000 mg/L for TDS and 30 mg/L for TSS. In the RLWTF treatment process, the gravity filter and ultrafilter remove essentially all suspended solids. Reverse osmosis removes varying percentages of dissolved solids, depending upon particle mass and size.

The TDS graph shows that influent was generally received at concentrations below the discharge standard of 1000 mg/L. This did not guarantee compliance with the discharge standard, however, because chemicals were added in various treatment steps. The graph demonstrates, however that TDS influent and effluent concentrations fairly consistent throughout the year, and that the two concentrations did not greatly vary from one another.

The TSS graph provides three pieces of information: (a) that influent was also generally received at concentrations below the discharge standard, 30 mg/L in this case; (b) that influent water quality can vary greatly, as shown for September and October, and (c) that there were, once again, no suspended solids in RLWTF effluent.

Figure 4-1
Dissolved Solids in RLWTF Waters During 2009

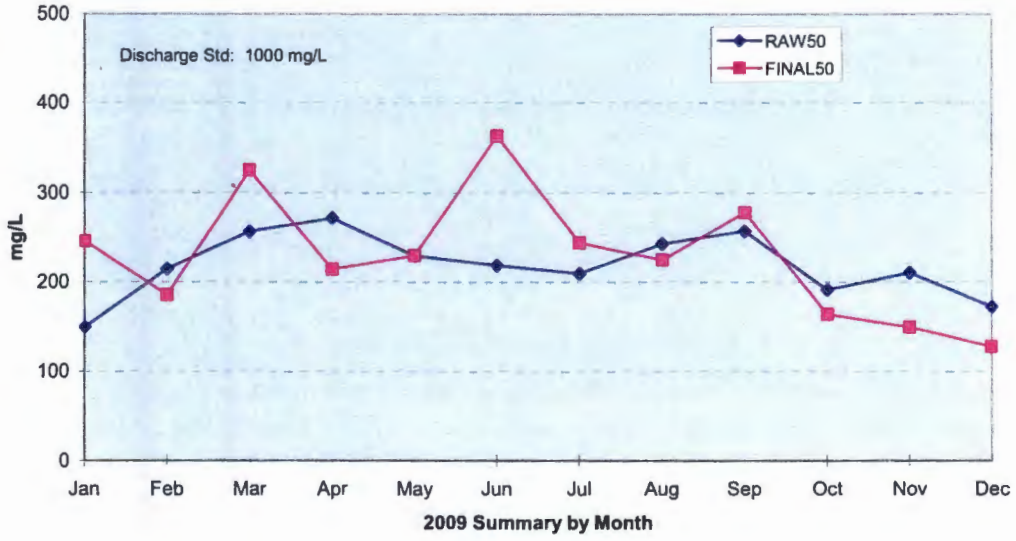


Figure 4-2
Suspended Solids in RLWTF Waters During 2009

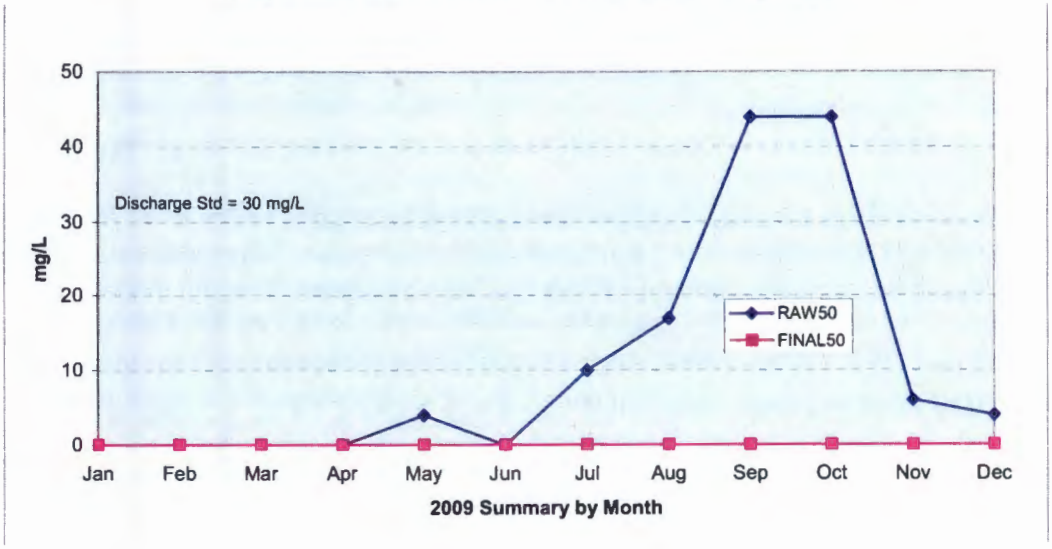


Figure 4-3 shows concentrations of calcium in RLWTF influent and effluent during 2009. Calcium, not a regulated parameter, is an insoluble element. Calcium was received in influent in concentrations ranging from 7 - 27 mg/L, but was nearly absent from plant effluent (97% removal). The graph illustrates the effect of the RLWTF treatment process on insoluble elements; few insoluble elements make it to the outfall.

Figure 4-3
Calcium in RLWTF Waters During 2009

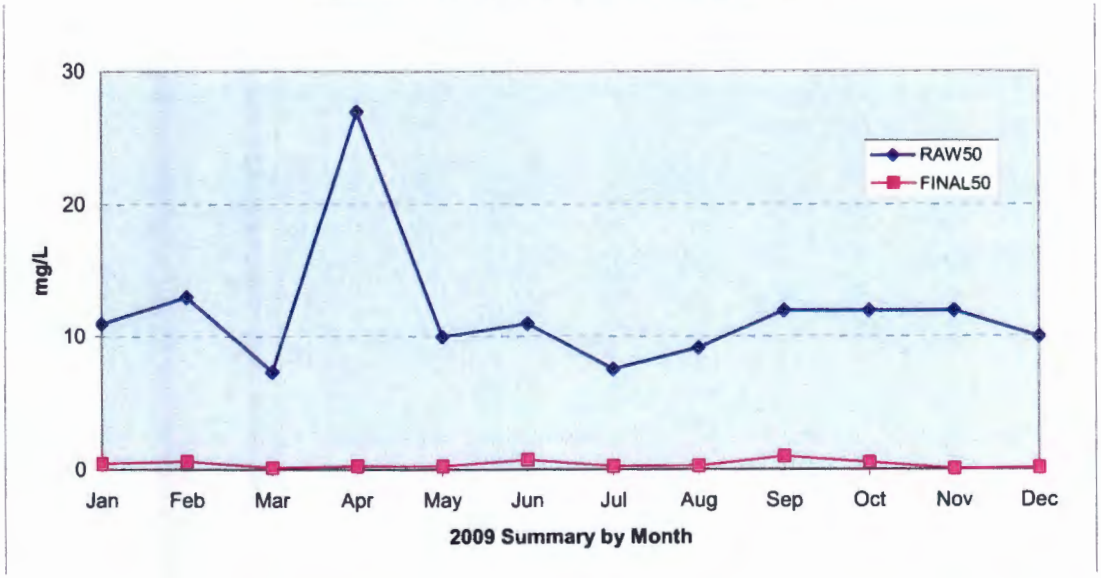
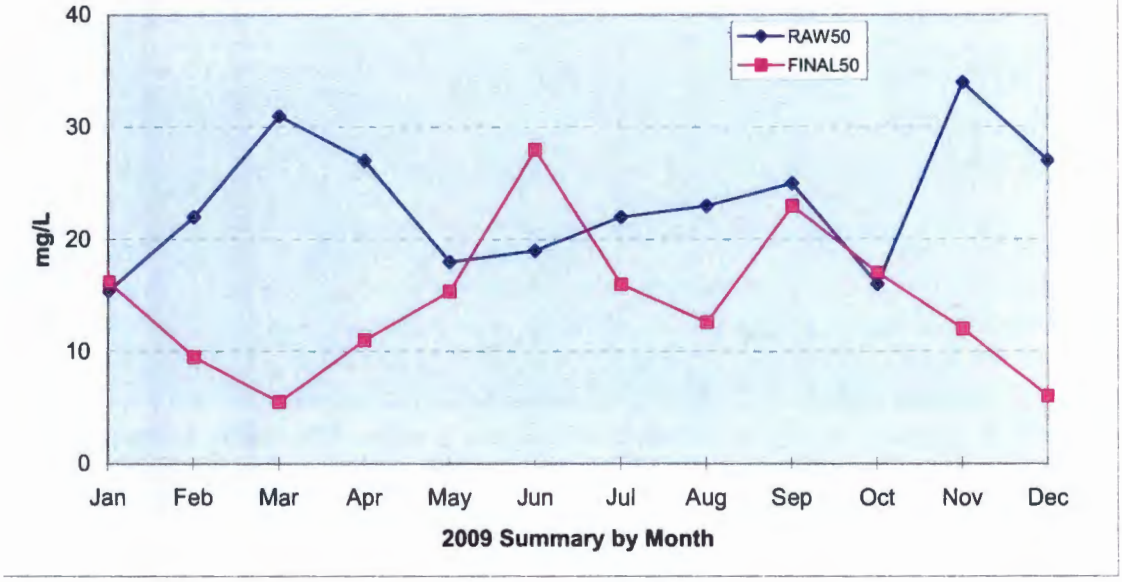


Figure 4-4 shows concentrations of chloride in RLWTF influent and effluent during 2009. Chloride, not a regulated parameter, is soluble in water. Chloride was received in influent in concentrations ranging from 15 - 34 mg/L, similar to calcium concentrations, but was also present in effluent, at concentrations ranging from 6 - 28 mg/L. The graph illustrates the effect of the RLWTF treatment process on soluble chemicals; only a percentage of the chemical is removed in the treatment process.

Figure 4-4
Chloride in RLWTF Waters During 2009



Nitrogen compounds behave similar to soluble compounds, as shown in Table 4-7. Table 4-7 presents average concentrations for nitrogen compounds for the year. In 2009, both influent and effluent concentrations were similar to historical concentrations.

Table 4-7
Nitrogen Compounds in RLWTF Waters During 2009

	Influent*	Effluent*
Total Kjedahl Nitrogen	12.6	5.3
Nitrogen-as-Ammonia	9.6	5.5
Nitrogen-as-Nitrate	10.9	6.7
Nitrogen-as-Nitrite	0.4	1.9
All Nitrogen	33.5	19.4

* Average concentration for 2009, in mg/L.

Figures 4-5 and 4-6 show sodium and perchlorate concentrations in RLWTF influent and effluent during 2009. The sodium graph shows effluent concentrations were higher than influent concentrations, which reflects the fact that sodium hydroxide is used to adjust pH of plant effluent. The perchlorate graph was selected to demonstrate that influent water quality can vary appreciably. The graph shows that perchlorate influent concentration, during three of the last four months, rose by a factor of three from typical concentrations received during the other nine months of the year. Such unanticipated influent perturbations can pose significant water treatment challenges.

Figure 4-5
Sodium in RLWTF Waters During 2009

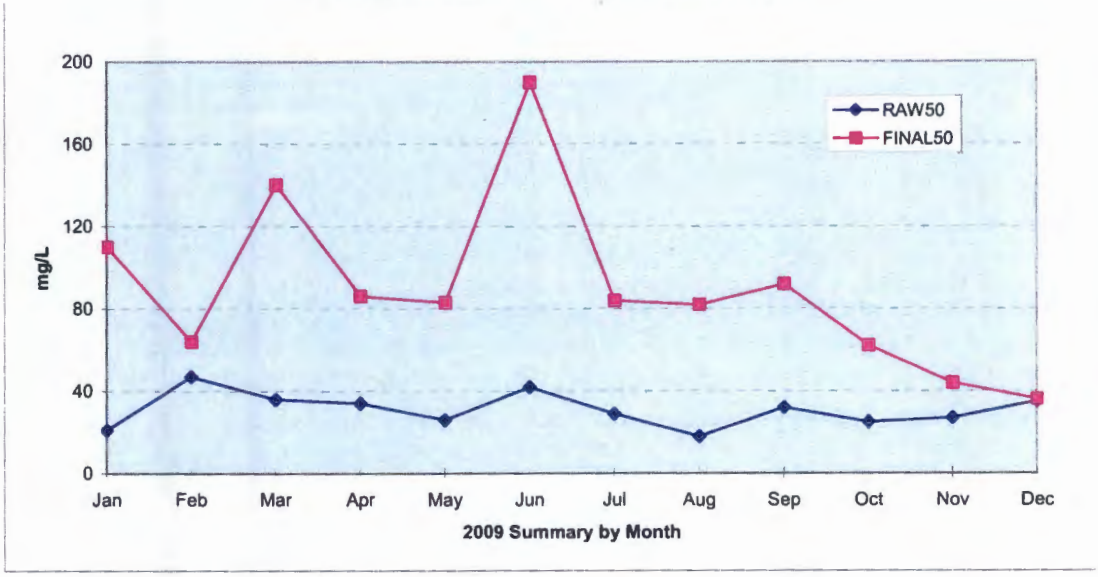
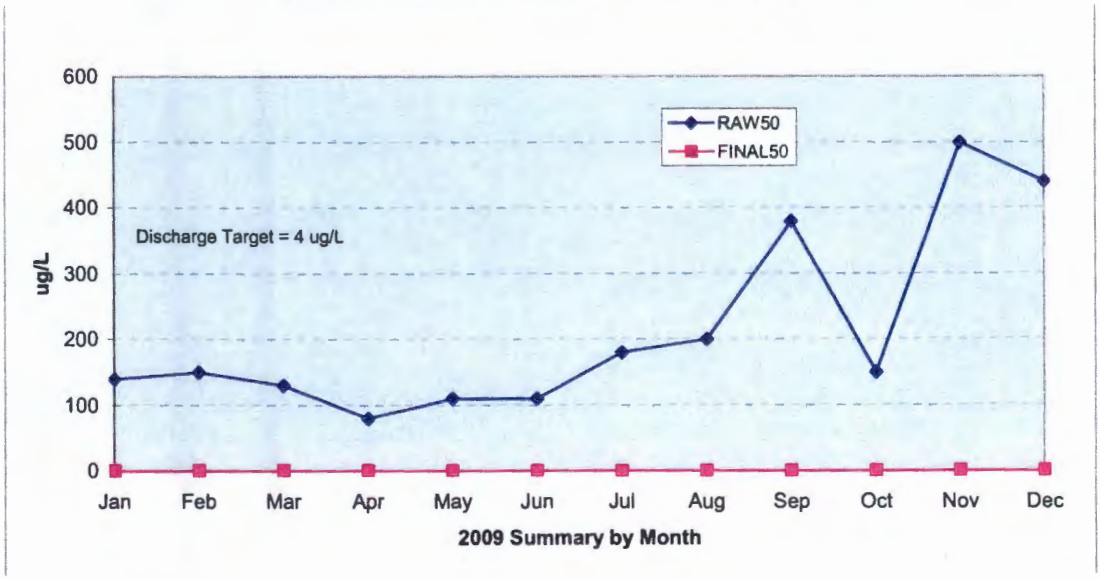


Figure 4-6
Perchlorate in RLWTF Waters During 2009



5. Other RLW Operations in 2009

Chapters 2 through 4 of this annual report discussed the treatment of low-level radioactive liquid wastes at the TA50 RLWTF. This chapter discusses the other RLW operations.

5.1 Low-Level Influent Collection System

A system of underground piping connects generators of low-level radioactive liquid waste to the TA50 RLWTF. The system has about four miles of double-walled pipes that direct water flow, by gravity, from 25 buildings in six Technical Areas to the influent tanks in Building 50-02.

The system has 62 underground vaults installed at piping junctions and other strategic locations. Outer pipes terminate at each of these vaults to provide an indication of leaks in the inner piping; water from the annulus would collect in the vault sump. Each vault sump is equipped with an alarm to detect the presence of water in the sump.

A system of vault inspections and water sampling was instituted in the fourth quarter of 2007. This inspection program was expanded the following year to include alarm repairs and de-watering of vaults. During 2009, 208 total inspections were made, an average of three per vault, and all but two vaults were inspected at least once[4].

Water discovered in vaults was sampled and analyzed for radioactivity, then de-watered. Sampling confirmed that water found in the vaults was due to the infiltration of groundwater, not to collection system leakage. Ten vaults were suspected to contain water at the end of the year, versus 13 at the start, and sixteen alarms were in need of repair. Table 5-1 summarizes these activities.

Table 5-1
Low-Level RLW Collection System Activities During 2009

	Q1	Q2	Q3	Q4	Totals
Inspections:					
No. vaults inspected during the quarter	63	37	20	31	151
No. vault inspections during the quarter	74	64	30	40	208
Water:					
No. of samples collected	50	48	31	19	148
No. vaults dewatered during the quarter	12	11	10	23	56
Status (end of quarter):					
No. vaults in alarm or inhibited	17	18	20	10	--
No. vaults with water	13	18	20	10	--
No. alarms needing repair	15	13	15	16	--

[4] Vaults PF-102 and PF-103 are located behind the TA55 security fence, and were not inspected during 2009.

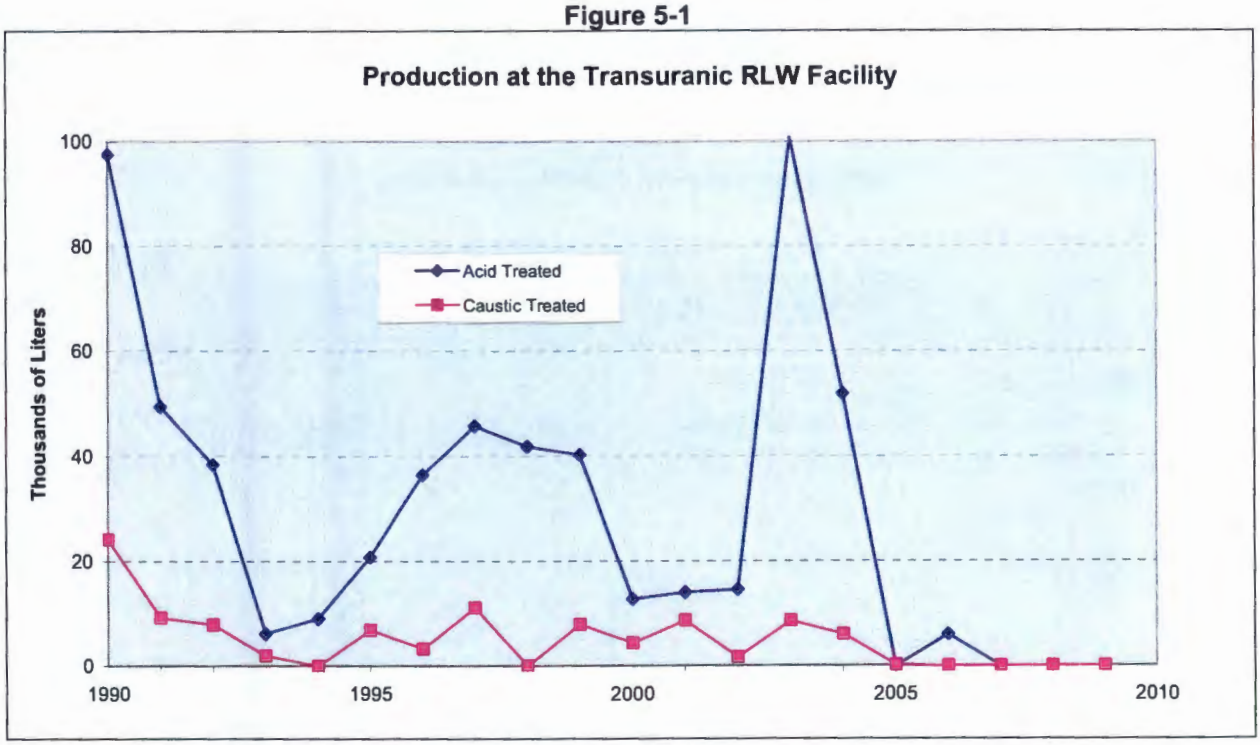
5.2 Transuranic RLW Process

The shutdown of Room 60 in July 2004 due to deteriorating equipment and vessels continued to impact transuranic RLW operations during 2009. The year was devoted to completion of the project to replace aging equipment and piping; the preparation of operating procedures; the calibration of tank level probes; personnel training; and the conduct of two readiness reviews in the latter half of the year.

As a result, transuranic production activities were limited in 2009. Waste were received from TA55 on just three occasions (2702 liters of acid waste and 214 liters of caustic waste), and no waste was treated in Room 60. There were four discharges of water from Rom 60 (7535 liters), but all of this effluent resulted from equipment flushes and tank calibration, not from the treatment of transuranic RLW. Figure 5-1 reflects the fact that no waste was treated during 2009, and also provides an historical perspective for volumes of transuranic RLW treated in Room 60.

The year culminated on a positive note, however. On December 14, following a successful Contractor Readiness Assessment and closure of pre-start findings, the DOE authorized the restart of Room 60 treatment operations. (DOE, 12-14-2009).

Figure 5-1



5.3 TA53 RLW Facility

The TA53 RLWTF treats radioactive liquid waste from accelerator research at the Los Alamos Neutron Science Center. The treatment process consists of wastewater storage to allow short-lived radioisotope decay, followed by solar evaporation. Three flows are of importance.

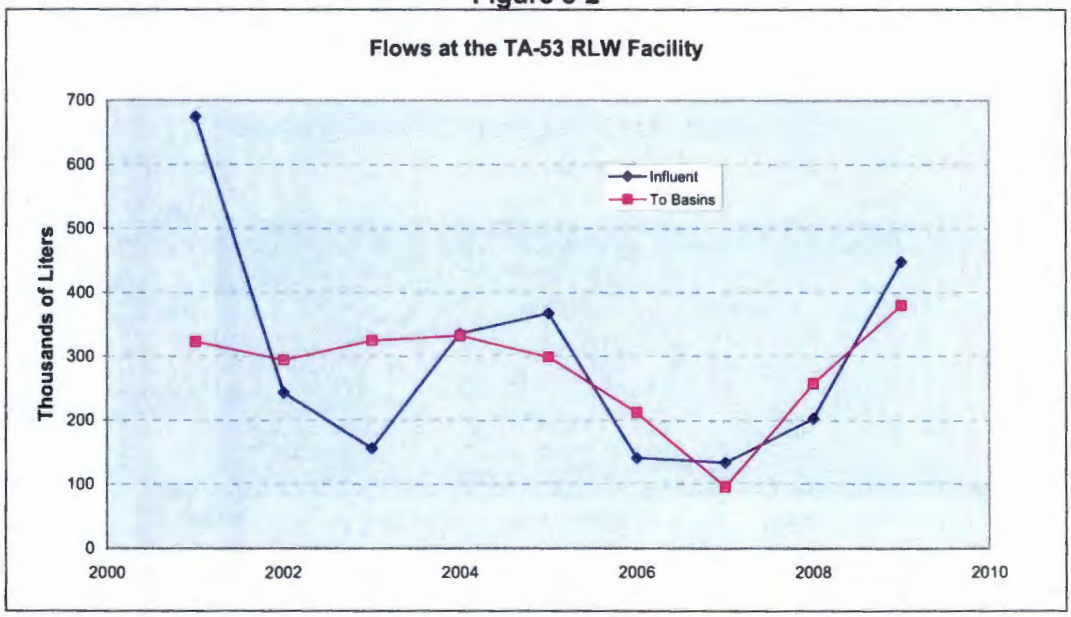
- Water flows by gravity into lift stations adjacent to Experimental Area A and the Lujan Center. The RLW is pumped from the lift stations through double-walled underground piping to one of three 30,000-gallon tanks inside Building 53-945. A total of 290,280 liters of RLW were transferred from the lift stations to the RLWTF during 2009.

- Tritiated waters are occasionally trucked to the TA53 influent tanks. A total of 158,130 liters were trucked to the basins from four technical areas. These trucked wastewaters met the waste acceptance criteria for the TA53 RLWTF. Most of the trucked water consisted of tritiated water from the TA50 RLWTF. The water had tritium concentrations of 21-22 nCi/L, versus the DOE discharge standard of 2,000 nanocuries per liter, and was not discharged at TA50 due to the desire to not discharge when tritium concentrations exceed the EPA drinking water standard of 20 nCi/L. This additional trucked quantity raised total influent volume for the year to 448,410 liters.

- After aging in the influent tanks, the RLW is pumped to the evaporator basins. During 2009, four discharges occurred, totaling 379,600 liters.

Figure 5-2 provides historical perspective for RLW flows at the TA53 facility. The graph shows that flows in 2009 were high, but not atypical of flows since the facility went into operation in December 1999. Flows remained well below the evaporative capacity of the basins (1.4 million liters per year).

Figure 5-2



6. Wastes and Secondary Liquids

RLW treatment processes generate process streams that require further processing and solid wastes that must be packaged and disposed. The disposition of both requires resources that include materials, labor, and dollars (e.g., disposal fees).

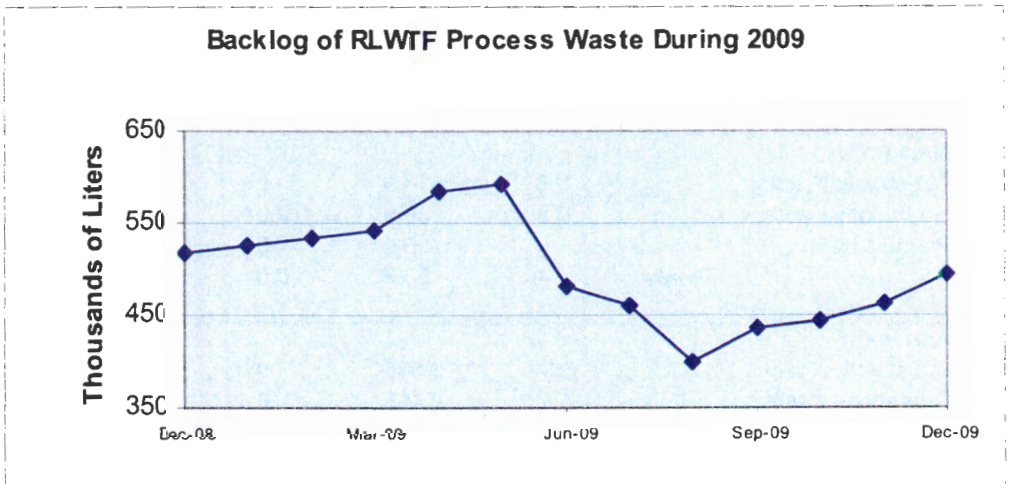
6.1 Process Wastes

The treatment of radioactive liquid wastes at TA50 generates four secondary process waste streams:

- Low-level sludge is de-watered, then packaged for disposal as a solid low-level radioactive waste.
- Transuranic sludge is solidified using cement, then packaged for disposal as a solid transuranic waste.
- Evaporator feed is evaporated to reduce its volume. Feed consists of reverse osmosis concentrate from the low-level treatment process, and treated water from the transuranic treatment process.
- Evaporator bottoms are solidified by a Subcontractor for disposal as a solid low-level radioactive waste.

The process waste backlog (i.e., volume), is an indicator of treatment status. Backlog, shown in Figure 6-1, varied from 400 – 600 thousand liters during 2009. The period of process waste volume reduction, from June through August, coincide with three evaporator campaigns.

Figure 6-1



The June evaporation campaign was a typical campaign that treated reverse osmosis concentrate, and reduced its volume by a factor of four. The July and August campaigns were required in order to further concentrate evaporator bottoms. Caused by a four-year drought in funding to treat and dispose of evaporator bottoms, this extraordinary re-evaporation step further concentrated bottoms volumes by a factor of two (i.e., total concentration of 8:1). Re-evaporation was not without consequences, however. Solids precipitated in all four tanks in Building 50-248.

The three evaporation campaigns during 2009 evaporated 83,400 gallons of reverse osmosis concentrate and re-evaporated 51,000 gallons of bottoms. The resultant volume of bottoms and chemical cleaning solutions totaled 50,800 gallons, a net volume reduction of 83,000 gallons.

6.2 Packaged Wastes

Wastes to be disposed are packaged in accordance with DOE, EPA, and DOT requirements, then transported to an authorized disposal site. During 2009, the TA50 RLWTF shipped 55 cubic meters (13,880 kilograms) of packaged wastes, as summarized in Table 6-1. These packaged wastes can be broadly grouped as wastes stemming from major construction projects, wastes from treatment operations, and process wastes.

Construction Wastes: During 2009, construction projects generated both chemical and low-level solid wastes. Construction chemical wastes totaled 0.6 cubic meter and 667 kilograms. These wastes were generated during closeout of the Room 60 Upgrades Project that led to the disposal

Table 6-1
Packaged Wastes Shipped From the TA50 RLWTF During 2009

	Chem	LLW	MLLW	TRU	Totals
No. Items:					
Construction debris	113	11	0	0	124
Operations waste	28	25	0	0	53
Process wastes	0	0	0	0	0
Totals	141	36	0	0	177
Volume (m^3):					
Construction debris	0.6	14.9	0	0	15.5
Operations waste	0.8	38.9	0.0	0	39.7
Process wastes	0	0.0	0	0	0.0
Totals	1.4	53.8	0.0	0	55.2
Weight (Kg):					
Construction debris	667	3,545	0	0	4,211
Operations waste	202	9,466	0	0	9,668
Process wastes	0	0	0	0	0
Totals	869	13,011	0	0	13,880

of 102 cans of epoxy, urethane, and paint (0.45 cubic meter / 470 kilograms) and 11 containers of sealant. Construction low-level wastes came from two construction projects. Four drums of contaminated soil (0.8 cubic meter, 1075 kgs) came from the tank farm project. The remainder came from the Room 60 Upgrades Project (14 cubic meters, 2470 kgs).

Operations Wastes: Operations wastes result from both day-to-day water treatment activities and from facility and equipment repairs and modifications. During 2009, operations generated 28 containers of chemical waste (0.8 cubic meter, 202 kgs) and 25 containers of low-level wastes. Most chemical wastes were generated during a plant-wide cleanout campaign that netted light bulbs, batteries, and spent chemicals. Low-level wastes included compactible and other trash generated in radiation control areas at the RLWTF (e.g., paper, discarded plastic sample vials and bottles, protective gloves) and spent ion exchange columns. The ion exchange columns, in fact, accounted for 4175 of the total 9466 kilograms of low-level waste.

Packaged Process Wastes: No process wastes were shipped for disposal during 2009.

7. References

Much of the information presented in this Annual Report come from the RLWTF process control system, RS View, which automatically records temperatures, flow rates, flow totals, pressures, tank levels, and similar readings of process conditions. Another large segment of the information presented in graphs and tables in this Annual Report comes from analytical data results for water samples. The below list of references points to a third major data source used in compiling the Annual Report – published reports that are cited within the text of the Annual Report.

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