

Stage 1 Abatement Plan Proposal

Former Santa Fe Generating Station (Santa Fe Well-S)

Santa Fe, Santa Fe County, New Mexico 87505



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ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-dichloroethene
bgs	below ground surface
CAF	Corrective Action Fund
COPCs	contaminants of potential concern
CSM	conceptual site model
CT	carbon tetrachloride
CVOC	chlorinated volatile organic compound
DO	dissolved oxygen
DP	Discharge Permit
DRO	diesel range organics
EDB	1,2-dibromoethane
EDC	1,2-dichloroethane
EPA	United States Environmental Protection Agency
ft	foot/feet
GWQB	Ground Water Quality Bureau, New Mexico Environment Department
HDP	high-density polyethylene
HEAL	Hall Environmental Analysis Laboratory
HgCl ₂	mercuric chloride
H ₂ SO ₄	sulfuric acid
INTERA	INTERA Incorporated
LNAPL	light non-aqueous phase liquid
Metric	Metric Corporation
MC	methyl chloride
MPS	Multiprobe System
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
ORP	oxidation reduction potential
OSE	Office of the State Engineer
PCE	tetrachloroethylene
PNM	Public Service Company of New Mexico

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PSTB	Petroleum Storage Tank Bureau, New Mexico Environment Department
QTa	Upper SFG Ancha Formation
Qst	Post-SFG Pleistocene age terrace deposits
S1AP	Stage 1 Abatement Plan
SFG	Santa Fe Group
SFGS	Santa Fe Generating Station
Site	former Santa Fe Generating Station (Facility # 1779; Release ID # 81)
SOP	standard operating procedure
SSHASP	Site-Specific Health and Safety Plan
TCE	trichloroethylene
Tts	Lithosome S, Tesuque Formation
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
WSW	water supply well

1.0 INTRODUCTION

INTERA Incorporated (INTERA) on behalf of Public Service Company of New Mexico (PNM) is submitting this revised Stage 1 Abatement Plan (S1AP) proposal for the former Santa Fe Generating Station (Santa Fe Well-S) (Site) in response to the New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) Abatement Plan Required letter dated March 25, 2019. In this letter, NMED GWQB requested that a S1AP proposal be submitted to address dissolved-phase chlorinated volatile organic compounds (CVOCs) and nitrate present in groundwater at the Site. The specific CVOCs identified in the GWQB letter include tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), vinyl chloride (VC), methylene chloride (MC), and carbon tetrachloride (CT). These six CVOCs and nitrate are considered the contaminants of potential concern (COPCs) for the Site. The Site is located in Santa Fe, New Mexico, approximately 1.5 miles southwest of downtown (**Figure 1**).

This S1AP proposal was prepared in accordance with provisions in New Mexico Administrative Code (NMAC) 20.6.2.4106 *Abatement Plan Proposal*, relevant regulations, and discussions in a meeting with INTERA, PNM, and NMED GWQB representatives on June 4, 2019. A S1AP proposal was submitted to NMED GWQB on July 10, 2019. Further discussions between INTERA, PNM, and Mr. Justin Ball (NMED GWQB) occurred on July 15; subsequently, the S1AP proposal was revised to include the sampling of all existing monitoring wells, except for off-site monitoring wells CSF-1 and OS-20, and a commitment including a proposed schedule, for follow-on investigation and abatement activities.

1.1 Purpose and Objectives of Stage 1 Abatement Plan

The purpose of this S1AP proposal is to present a plan for NMED GWQB review and approval to collect additional groundwater data necessary to support the planning of future abatement activities. The specific groundwater data proposed to be collected will aid in the identification of data gaps that exist in the estimation of the extent and magnitude of COPCs and will inform future decisions concerning proposed investigation activities that are addressed, in a general manner, in this proposal. As stated by the NMED GWQB personnel, the S1AP will be an iterative process, and, as new data is collected and evaluated, the S1AP will be modified to provide specific investigation activities relative to the data needed to ultimately define the nature, extent, and magnitude of the COPC impacts and develop a plan for abatement.

It is noteworthy that previous investigations have primarily been driven by petroleum hydrocarbon investigations; therefore, recent activities at the Site have focused on collecting data specific to petroleum hydrocarbons; however, select monitoring wells are sampled quarterly for nitrate as specified in the Site's NMED-approved discharge permit (DP-1202). This S1AP

proposal focuses on collecting data from all monitoring wells, both those that are and those wells that are not routinely sampled for the COPCs.

1.2 Stage 1 Abatement Plan Organization

This S1AP proposal is divided into seven sections. This section, Section 1.0, provides an introduction to the S1AP proposal; Section 2.0 reviews the Site background and includes a discussion of the Site history and investigation chronology; and Section 3.0 offers a detailed Site description including an overview of the regional and Site hydrogeology. Section 4.0 presents the proposed workplan for S1AP activities and presents a schedule for these activities. Section 5.0 discusses PNM's commitment to conduct future S1AP activities, Section 6.0 provides a tentative schedule for these activities, and Section 7.0 outlines the references used in preparing this S1AP proposal. Several supporting figures and tables are attached and referenced in their respective sections. Panel plots illustrating the spatial distribution of CVOC and nitrate concentration from 2004 to present are included as **Appendix A**, INTERA Standard Operating Procedures (SOPs) are included as **Appendix B**, copies of field forms are provided in **Appendix C**, and the Site-specific health and safety plan (SSHASP) is included as **Appendix D**.

2.0 BACKGROUND

2.1 Site History

The Site was formerly occupied by the PNM Santa Fe Generating Station (SFGS), which operated from circa 1949 through 1980. Construction of the SFGS power plant was initiated in 1949 and began operation in 1950; additional generating units were added in 1950 and 1951. The power plant operated using natural gas with fuel oil being used for start-up and for emergency generation (Metric, 1995b).

The power plant operated at full capacity until about 1962, when it was placed on and remained on stand-by status until 1973. In 1973, the power plant was reactivated to supplement power to Albuquerque during peak times until it was permanently taken out of service in 1980. The electrical substation at the Site began operations around the same time as the power plant and continues to operate today to distribute power to the City of Santa Fe. The service center was opened in 1953 and included fueling stations as well as equipment repairs. Fuels historically stored at the service center included regular gasoline, premium gasoline, unleaded gasoline, and diesel fuel. The service center ceased operation in 1985 (Metric, 1995a).

2.2 Site Investigation Chronology

The Santa Fe Well (also known as the Baca Street Well) was completed as a water supply well (WSW) within the Tesuque Formation in 1951 to provide the residents of Santa Fe with potable water (**Figure 2**). Originally, the well was operated by the Sangre de Cristo Water Company (aka PNM Water Services), which was a subsidiary of PNM. The City of Santa Fe assumed operation of the Santa Fe Well in July 2001. The Santa Fe Well was completed to a depth of 723 feet below ground surface (ft bgs) with perforated pipe (screened interval) extending from 200 to 723 ft bgs.

Contamination including dissolved-phase benzene, 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), and xylenes was first detected in the Santa Fe Well in October of 1988 and has been periodically detected in the Santa Fe Well since that time. Wellhead treatment was installed in 1989 so that water extracted from the Santa Fe Well would meet standards for public consumption (Metric, 1995a, 1995b). The Santa Fe Well has been removed from and returned to service on numerous occasions and was deactivated in August 2013 and has not operated since (OSE, 2018).

Investigations performed by PNM identified two releases on the Site: a CVOC release immediately east of the service center and a fuel oil release near the former power plant (Enhanced Solutions, 1996). Soil near the service center contained CVOCs, and soil near the power plant building contained fuel oil from a 1952 spill of approximately 84,000 gallons. No

gasoline constituents were noted during this investigation conducted in 1989 and 1990 (Metric, 1995b). PNM removed approximately 220 cubic yards of CVOC-contaminated soil near the former service center building in the early 1990s, and laboratory analysis from soil samples collected from the limits of the excavation confirmed that volatile organic compound (VOC) levels in soil were below the applicable standards at that time (NMED, 1992).

Numerous monitoring wells were installed at the Site between 1989 and 1997 to facilitate Site characterization efforts; however, the horizontal and vertical extent of the dissolved-phase petroleum hydrocarbon plume has not been delineated. Between 1998 and 2002, a bioremediation system continuously injected hydrogen peroxide into six monitoring wells (USTB-4, USTB-7, USTB-9, OS-13, OS-15, and PNM-1) to stimulate in-situ degradation of organic constituents (**Figure 3**) (PNM, 2002). In addition to the hydrogen peroxide, “Restore 375,” a proprietary bionutrient formulation, was injected periodically. The bionutrient formulation included ammonium chloride and mono- and di-basic sodium phosphate and is the likely source of the on-site nitrate plume. The injection of these substrates is discussed in detail in the *Groundwater Discharge Permit Application* (PNM, 1998) and the NMED-approved DP-1202 (NMED GWQB, 1999).

Between March and May 2018, field activities were completed to support further characterization of the extent of petroleum hydrocarbon contamination, both on- and off-site. These field activities were completed with oversight from the NMED Petroleum Storage Tank Bureau (PSTB) as part of the active investigation into the petroleum hydrocarbon plume and included locating, redeveloping, and installing a new surface completion at monitoring wells OS-18, OS-4A, and OS-4B and the drilling and installation of seven new monitoring wells (USTB-18 through USTB-23). Results from this investigation are summarized in the *Additional Site Investigation and Groundwater Monitoring Report* submitted by INTERA in September 2018 (INTERA, 2018a). Seventeen (17) additional wells (USTB-25 through USTB-36 and USTB-39 through USTB-43) were installed between August 2018 and April 2019, and one additional well (USTB-38) will be installed in July/August 2019. Data collected from these investigations will be valuable when developing the conceptual site model (CSM) as part of the S1AP Report. A more detailed summary of the Site investigation chronology is presented in **Table 1**.

In addition to potential contaminant sources located on-site, numerous off-site contaminant sources have been identified (NMEID, 1991; Metric, 1995b; Hawley and Swanson, 2016). INTERA recently furthered the assessment of off-site sources by reviewing historical aerial photographs and documents such as *Public Service Company of New Mexico Santa Fe Generating Station Settlement Agreement, Site Investigation, External Document, and Conferral Review*, completed by Metric Corporation (Metric) in July 1995. A deliverable summarizing the findings of the potential off-site sources was submitted to PSTB on November 14, 2018.

INTERA's review concluded that the presence of the railroad, bulk fuel facilities, underground storage tank (UST) facilities, and maintenance buildings east, southeast, and south of the Site may have contributed to the petroleum hydrocarbon contamination as well as the COPCs currently observed at the Site (INTERA, 2018b).

3.0 SITE DESCRIPTION

Several investigations have been conducted at the direction of the NMED PSTB and GWQB for the Site and Site vicinity. The hydrogeologic setting subsections below only serve to provide a brief summary of findings from these activities. A Site map illustrating the location of existing monitoring wells is provided as **Figure 3**. A table listing all these monitoring wells and their construction information is included as **Table 2**. Additional details pertaining to the geology and hydrogeology of the Site and vicinity can be found in Dr. John Hawley's report on the *Hydrogeologic Framework of the Public Service Company of New Mexico Santa Fe Generating Station Site and Surrounding Parts of Santa Fe, New Mexico with Emphasis on Hydrogeologic Controls on Contaminant Transport in the Vadose and Saturated Zones* (Hawley and Swanson, 2016).

3.1 Regional Geology

The Site is located on a broad, piedmont alluvial plain that slopes downward from the Santa Fe Range, which is located to the east of the Site, towards the Rio Grande, which is located to the west of the Site. Structurally, the Site is within the Santa Fe Embayment section of the Española Basin, one of several intermountain basins formed by the Rio Grande rift. Deposition within the basin occurred during the late Cenozoic in an alluvial fan/piedmont environment represented by the Santa Fe Group (SFG). The SFG consists of two units: the Lower SFG Tesuque Formation (Late Oligocene to Middle Miocene age) and Upper SFG Ancha Formation (Pliocene and Early Pleistocene) (Baldwin, 1963; Hawley and Swanson, 2016). The Tesuque Formation comprises most of the SFG in the vicinity of the Site, is believed to be over 2,000 ft thick, has a 10° to 15° westward tilt, is the predominant aquifer system in the area, and is the target of previous Site investigations (Hawley and Swanson, 2016).

The Tesuque Formation in the Site vicinity is referred to as Lithosome S (geologic map unit Tts; Smith, 2004; Koning et al., 2010). According to Hawley and Swanson (2016), "A lithosome is a body of sedimentary rock, exhibiting relatively uniform and distinctive lithologic character that intertongues with different sedimentary rock types." Most of Tts was deposited by fan distributaries on a low-gradient piedmont slope with the primary sediment source being the now-obliterated drainage basin near the site of the present Tesuque Creek-Santa Fe River headwaters. The basic sequencing of an alluvial fan system consists of irregularly stacked sequences of lenticular high-energy, distributary-channel deposits that are interbedded with more extensive, low-energy inter-channel (floodplain/sheet-flood) deposits. Tts is most coarse grained near the original fan axis near the present Santa Fe Range front. Near the Site, coarse-grained deposits are less abundant but still occur in a fining-upward sequence (Hawley and Swanson, 2016).

An angular unconformity exists between the Tesuque Formation (Early to Middle Miocene) and the overlying Ancha Formation (Pliocene and Early Pleistocene). This angular unconformity was formed on piedmont slopes throughout the Española Basin region after Tesuque Formation sedimentation ceased. Near the Site, the post-Tesuque erosion surface was formed by the establishment of the ancestral Rio Santa Fe. The Upper SFG Ancha Formation (Qta) is the youngest widespread basin-fill unit deposited on the post-Tesuque erosion surface (Hawley and Swanson, 2016). Post-SFG Pleistocene-age terrace deposits (Qst) cap remnants of the Ancha Formation between Cerrillos Road and the current Santa Fe River. The undeformed Pleistocene terrace deposits and Ancha Formation are typically less than 75 ft thick and almost entirely in the vadose zone.

3.2 Regional Hydrogeology

The Site and vicinity fall within the complex, basin-fill aquifer system of the Tesuque Formation (Tts). High hydraulic conductivity channel zones of varying thicknesses (15 to 1,000 ft) are present, as well as thinner, fine-grained, low-permeability interbeds. Estimated saturated hydraulic conductivity (K_{sat}) values range from 0.5 ft/day to 7 ft/day; although values greater than 10 ft/day are likely to be observed in coarse-grained channels (Hawley and Swanson, 2016). The regional flow direction is generally from east to west (Baldwin, 1963; Mourant, 1980; Johnson, 2009; JSAI, 2017); however, a cone of depression created by pumping from City of Santa Fe WSWs (including the Santa Fe Well) is depicted in regional groundwater potentiometric surface maps (Johnson, 2009; JSAI, 2017; JSAI, 2019). The size of the cone of depression is significantly less in JSAI's recent 2018 regional groundwater flow map (JSAI, 2019) when compared to the 2009 regional groundwater flow map developed by the New Mexico Bureau of Geology and Mineral Resources (Johnson, 2009). This apparent decrease in size of the cone of depression is likely due to the cessation of pumping at the Santa Fe Well in August 2013.

Due to years of groundwater pumping, the majority of the Ancha Formation (Qta) and Quaternary terrace-fill sequences have been dewatered within the Site vicinity. It is important to note that the K_{sat} for the Ancha Formation and valley-fill deposits are at least 20 times greater than the K_{sat} values observed in the Tesuque Formation. These higher conductivity deposits are a conduit for contaminant transport and recharge, and therefore play a large role in contaminant transport from historic releases, both on-site and off-site (Hawley and Swanson, 2016).

Water flow within the vadose zone of the Tts generally moves downward parallel to the bedding planes where the permeability is greatest; after water reaches the zone of saturation, water flows in the direction of the slope of the potentiometric surface, which is primarily westward and follows zones of higher conductivity (bedding planes) (Hawley and Swanson, 2016). Vertical

head gradients also exist and have changed depending on nearby pumping stresses. The dip of the beds within Tts results in the potentiometric surface of the uppermost water-bearing unit occurring within both low-conductivity and high-conductivity units at the Site (PNM, 2002).

3.3 Site Stratigraphy

The following discussion on Site stratigraphy is primarily based on lithologic information obtained from the roto sonic cores obtained from borings USTB-18, USTB-19, USTB-20, USTB-22, USTB-23, and USTB-24 (INTERA, 2018b) (**Figure 3**). Lithologic data obtained from these borings is being emphasized because roto sonic sampling methods produce continuous cores and lithologic data that are of higher quality relative to the lithologic data produced by the air and mud rotary drilling and sampling methods that were used to advance and log previous borings.

Borings from the roto sonic investigation were drilled to depths ranging from 280 ft bgs to 416 ft bgs and penetrated the Ancha (upper Pliocene to lower Pleistocene; Koning and Read, 2010) and Lithosome S of the Tesuque Formation (lower to middle Miocene; Koning and Read, 2010).

The Ancha Formation exists from ground surface to between approximately 24 and 36 ft bgs in borings USTB-18 through USTB-24 and consists of brown, mostly interbedded sandy gravel and gravelly sand. Granitic cobbles were common in the cores from this unit, and some thinner clay/silt lenses were observed. Reddish layers of the Tesuque Formation underlie the Ancha Formation. The Tesuque Formation consists of sand with varying amounts of gravel, silt, and clay interbedded with thinner clay lenses and layers. The sandy intervals in USTB-18 through USTB-24 are several feet to several tens of feet thick, while the clay units are less than 1 ft to approximately 10 ft thick. Given the thin nature of the clay units and the high potential for erosion of these units after deposition (Hawley and Swanson, 2016), clay units most likely do not extend laterally for significant distances.

Recently collected lithologic data from the newly installed wells will be evaluated to improve the understanding of the hydrogeologic framework and contaminant fate and transport pathways of the COPCs. These data will be included in the CSM presented in the S1AP Report.

3.4 Site Hydrogeology

The groundwater data that is currently available do not provide a reliable estimate of groundwater flow direction. Estimating the lateral groundwater flow direction at the Site has been a challenge because, as discussed below, overall groundwater flow appears to have a significant vertical component and some monitoring well screens are excessively long, resulting in water levels that are not representative of a single water-bearing unit. The monitoring wells that are being installed as part of the ongoing petroleum hydrocarbon investigation have much

shorter well screens, so the data collected from that investigation and the scope of work being proposed herein should afford a better estimate of groundwater flow.

Historical data indicates that vertical gradients at the Site have varied and appear to be influenced by pumping stresses in the regional aquifer. The monitoring well cluster (USTB-2, USTB-11, USTB-23, and USTB-15) immediately adjacent to the Santa Fe Well and the monitoring well cluster located approximately 400 ft to the east-southeast within the boundary of the Site (USTB-9, USTB-12, and USTB-13) have seen changes in the directional component of the vertical gradient (**Figure 4a** and **4b**). Between approximately 1992 and 1998, when the Santa Fe Well was not operational, there was an upward vertical flow component observed at these monitoring well clusters. Once pumping resumed, there was a shift to a downward vertical flow between the intermediate (USTB-11) and deep (USTB-15) monitoring wells, and between the shallow (USTB-2) and deep (USTB-15) monitoring wells. A downward vertical component was also observed between the shallow (USTB-2) and intermediate (USTB-11) monitoring wells and the newly installed deep monitoring well (USTB-23). Additionally, there has been a consistent upward flow component between the shallow (USTB-2) and intermediate (USTB-11) monitoring well, regardless of pumping at the Santa Fe Well; although the magnitude of the vertical gradient seems to increase during the times the Santa Fe Well was operational. Recent data also suggests an upward vertical gradient between the deep monitoring wells USTB-15 and USTB-23 (**Figure 4a**).

As seen on **Figure 4b**, all three monitoring wells at the monitoring well cluster within the Site boundary (USTB-9, USTB-12, and USTB-13) saw a shift in the directional component of the vertical gradient, from having an upward flow component to switching to a downward flow component once pumping resumed in 1998. Groundwater data for shallow monitoring well USTB-9 is sparse between 1998 and the present, and it is important to note that this monitoring well was used as an injection well as part of the bionutrient injection remediation system. Since the cessation of pumping at the Santa Fe Well in 2013, the magnitude of the downward vertical flow component has decreased. Depending on regional pumping stresses, there may be a reversal in the vertical flow direction in the future at both of these monitoring well clusters.

3.5 Surface Water Hydrology

The Acequia de los Pinos is oriented from east to west through the northern portion of the Site and flows seasonally. This unlined former irrigation channel likely serves as an area of hydraulic recharge and may serve as a transport mechanism for off-site contaminants (**Figure 3**). The Santa Fe River is located approximately 0.5 miles to the north of the Site (**Figure 2**). Due to the nature of the potential Site contaminant discharge, it is anticipated that neither of these surface waters have been impacted.

3.6 Water Wells

The locations of wells within one mile of the Site and in the Office of the State Engineer (OSE) database (OSE, 2019) are illustrated on **Figure 2**. **Figure 2** also illustrates the location of six active municipal WSWs (Ferguson, Alto Street, Torreon, Agua Fria, Osage, and St. Michaels) and two inactive WSWs (Santa Fe Well, and Hickox). As shown on **Figure 2**, The Agua Fria WSW, Torreon WSW, and Alto Street WSW are located approximately 0.5 miles to the northwest, north-northwest, and north, respectively. The Osage WSW is located approximately 1.0 miles due west of the Site, while the Ferguson WSW and Hickox WSW are located approximately 0.8 miles to the north-northeast and east, respectively. The St. Michaels WSW is greater than 1.0 miles from the Site. Further evaluation of the potential risk to these WSWs will be included in the S1AP Report.

3.7 Nature, Extent, and Magnitude of Contamination

The panel plots included in **Appendix A** illustrate the spatial distribution of CVOCs in groundwater from 2010 to 2018 and nitrate in groundwater from 2005 to 2018. These plots allow for a preliminary evaluation of the extent and magnitude of these contaminant plumes, and, when coupled with an evaluation of all historical data, identify data gaps with respect to estimating the extent of the CVOC and nitrate contaminant plumes. Once a more comprehensive data set is collected as part of the implementation of this S1AP, a more detailed evaluation of the nature, extent, and magnitude of contamination will be conducted and discussed in the first S1AP Quarterly Progress Report.

4.0 PROPOSED ABATEMENT ACTIVITIES

The following sections outline the methods used to implement the first S1AP groundwater monitoring event and the field quality control measures that will be used to assure the collection of representative data to meet the objectives of this S1AP proposal.

4.1 Groundwater Sampling Plan

The tasks included in the first proposed S1AP groundwater sampling event will involve measuring water levels, measuring field parameters, and collecting groundwater samples for laboratory analyses from the wells listed in **Table 2** and identified on **Figure 3**. All activities performed will follow the procedures detailed below and the SOPs included in **Appendix B**. All field data, measurements, and information will be recorded in the project logbook and/or on specific field forms which are included in **Appendix C**. The SSHASP for the first S1AP groundwater monitoring event conducted pursuant to the Site S1AP proposal is included as **Appendix D**. Details of these tasks are included below.

The depth to water, depth to light non-aqueous phase liquid (LNAPL) (as applicable), and total depth will be measured at all accessible monitoring wells (**Table 2** and **Figure 3**, maximum of 65 locations) using a properly decontaminated oil/water interface probe and in accordance with INTERA *SOP 9 – Monitor Well Gauging* (INTERA, 2017b) and INTERA *SOP 2-- Decontamination* (INTERA, 2017a). Between gauging at each monitoring well, the oil/water interface probe will be decontaminated with a Liquinox/tap water solution followed by a final distilled water rinse. Fluid level readings will be collected on the same day, if possible, and recorded on the monitoring well gauging field form provided in **Appendix C**. The diameter of the oil/water interface probe does not allow for fluid level measurement at three monitoring well locations (PNM-5, USTB-13, and USTB-15); a small-diameter water level meter will be used at these locations.

Groundwater samples will be collected from the 60 monitoring wells listed in **Table 2** and illustrated on **Figure 3** in accordance with INTERA *SOP 10-- Monitor Well Sampling for Groundwater* (INTERA, 2019). The groundwater monitoring wells will be purged a minimum of one saturated well-casing volume, using either a dedicated electric submersible pump or a Bennett pump (owned by PNM). Purging of one casing volume is a variance to SOP 10 (INTERA, 2019); however, this sampling protocol has been consistently implemented at the Site and provides representative data. In the event that a well is purged dry, the well will be sampled immediately after a sufficient volume of water has recharged into the well to fill sample containers. During purging activities, groundwater quality parameters (specific conductivity, temperature, and pH) will be monitored for stabilization using a YSI 556 multiprobe system

(MPS) water quality meter (or equivalent) and a flow-through cell. Although stabilization will not be required for dissolved oxygen (DO) and oxidation-reduction potential (ORP), these water quality parameters will be recorded on the groundwater sampling field form provided in **Appendix C**. Additionally, flow rates and purge volumes will be recorded on the field forms. Once a minimum of one casing volume has been removed and water quality parameter stabilization has been reached, a groundwater sample will be collected for the following:

- VOCs by United States Environmental Protection Agency (EPA) Method 8260B (14-day holding time); and,
- Nitrate dissolved by EPA Method 300.0 (48-hour holding time) and field filtered using a 0.45-micron disposable cartridge filter.

Groundwater samples collected for analysis of VOCs will be placed in 40-milliliter volatile organic analysis vials with zero headspace and preserved with mercuric chloride (HgCl_2). Groundwater samples collected for analysis of nitrate will be field filtered with a 0.45-micron filter and placed in 250-milliliter high-density polyethylene (HDP) bottles. All purged water will be transferred to on-site evaporation tanks.

The following field quality control samples will be collected:

- One field duplicate sample will be collected for every 10 primary samples (10%) and analyzed for the same parameters as the primary samples. The association of the field duplicate and the primary sample will be noted in the field book but will not be documented on the chain-of-custody form.
- An equipment rinsate sample will be collected every five (5) monitoring wells and analyzed for the same parameters as the primary samples. The equipment rinsate samples will be collected during decontamination of the submersible pump using deionized water. The sample identification will include “ER” with sequential numbering for each sample and the date (i.e., ER-101-20190729).
- One field blank will be collected for the sampling event and analyzed for the same parameters as the primary samples. The field blank will be collected by transferring deionized water to sample containers while in the field. The sample identification will include “FB” and the date.
- One trip blank will be retained for every 10 sample containers for VOCs by EPA 8260B.

After collection, all groundwater samples will be labeled and immediately packed in an ice-chilled cooler for transport to Hall Environmental Analysis Laboratory (HEAL) for analysis within their holding times. Samples will be recorded on a chain-of-custody form that will accompany the samples to the laboratory. Additionally, a sample control log will be filled out in

the field, a copy of which is provide in **Appendix C**. Proper chain-of-custody procedures will be adhered to during sample collection, transport, and delivery to HEAL.

4.2 Reporting

A S1AP Quarterly Progress Report will be submitted after the completion of the first S1AP groundwater monitoring event. The S1AP Report will summarize field activities, measurements, and laboratory analytical results (historical and present) associated with groundwater monitoring at the Site. This Report will also include an evaluation of groundwater flow direction and the nature, extent, and magnitude of dissolved-phase CVOC and nitrate contamination, identify data gaps, provide recommendations, and provide a plan for future S1AP activities.

5.0 FUTURE ABATEMENT ACTIVITIES

This section presents potential future abatement activities that may be included as part of the abatement process for the Site pursuant to NMAC 20.6.2.4106 *Abatement Plan Proposal*. PNM is committed to the abatement process and has identified Stage 1 Abatement activities (**Table 3**) that may be necessary to develop a detailed Final Site Investigation Report as specified in NMAC 20.6.2.4106. Stage 1 Abatement activities will be selected and implemented with the goal of collecting sufficient data that will support the selection and design of an effective abatement option. Data collection to define Site conditions is an iterative process; therefore, several of the Stage 1 Abatement activities included in **Table 3** may not be necessary, and other abatement activities not currently included in **Table 3** may be identified and added to the scope of work in the future.

6.0 SCHEDULE

The first S1AP groundwater sampling event will occur concurrent with the PSTB Corrective Action Fund (CAF) groundwater monitoring event which is anticipated to occur in September/October 2019. Groundwater sampling activities are anticipated to be completed in September/October 2019, and the 1st groundwater monitoring event and S1AP Quarterly Progress Report will be submitted in January 2020. A long-term schedule of proposed S1AP activities is included as **Table 3**. As the S1AP is modified to address future abatement activities, **Table 3** will be updated.

7.0 REFERENCES

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FIGURES

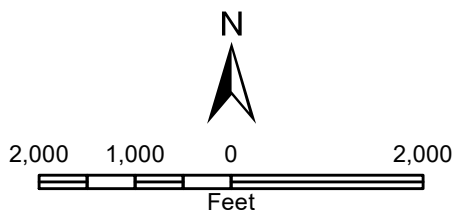
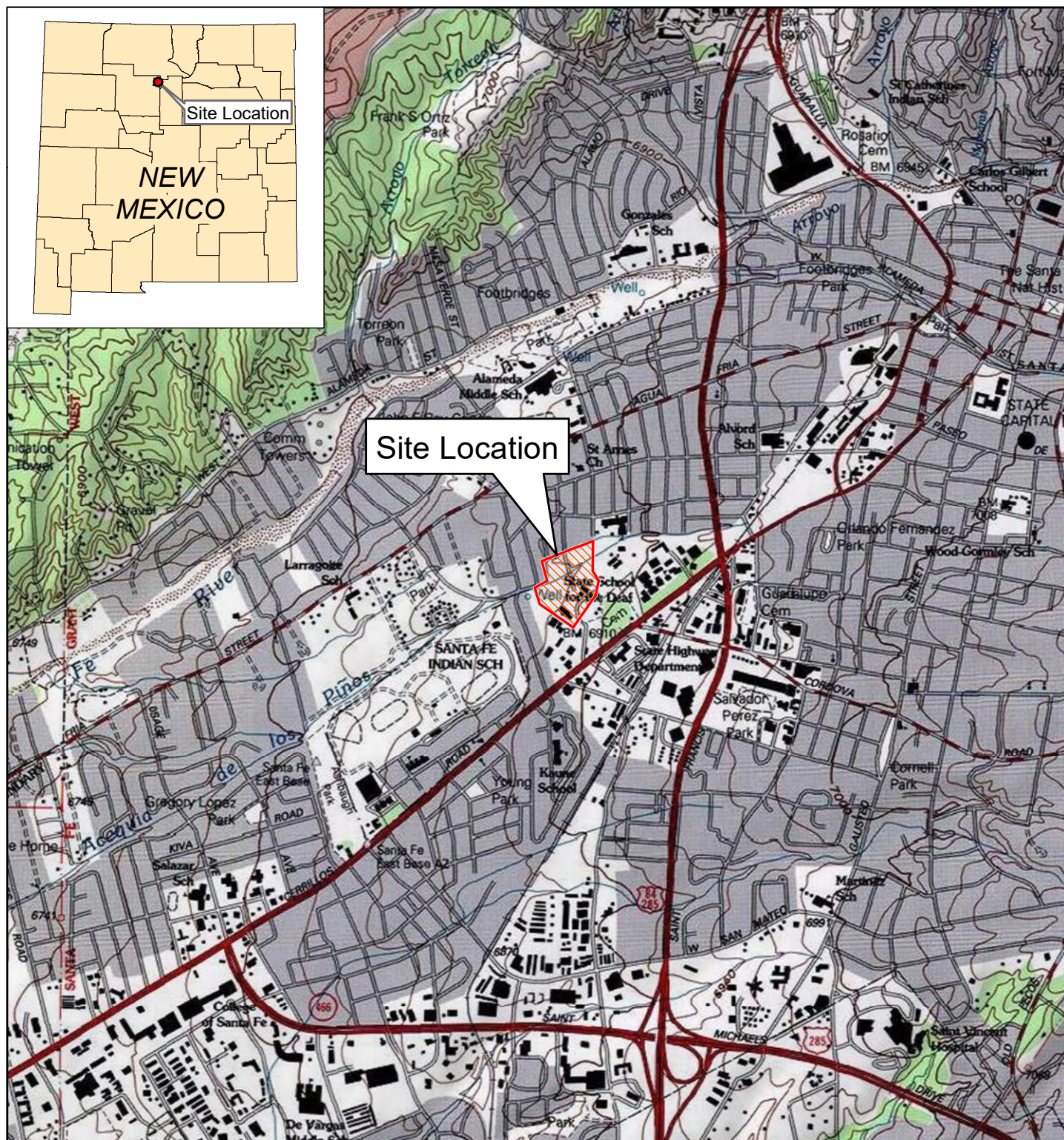
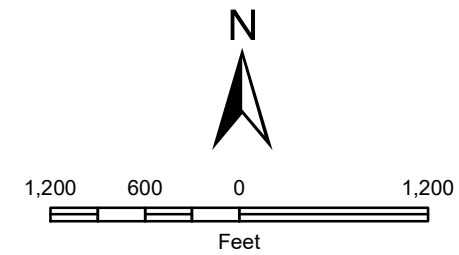
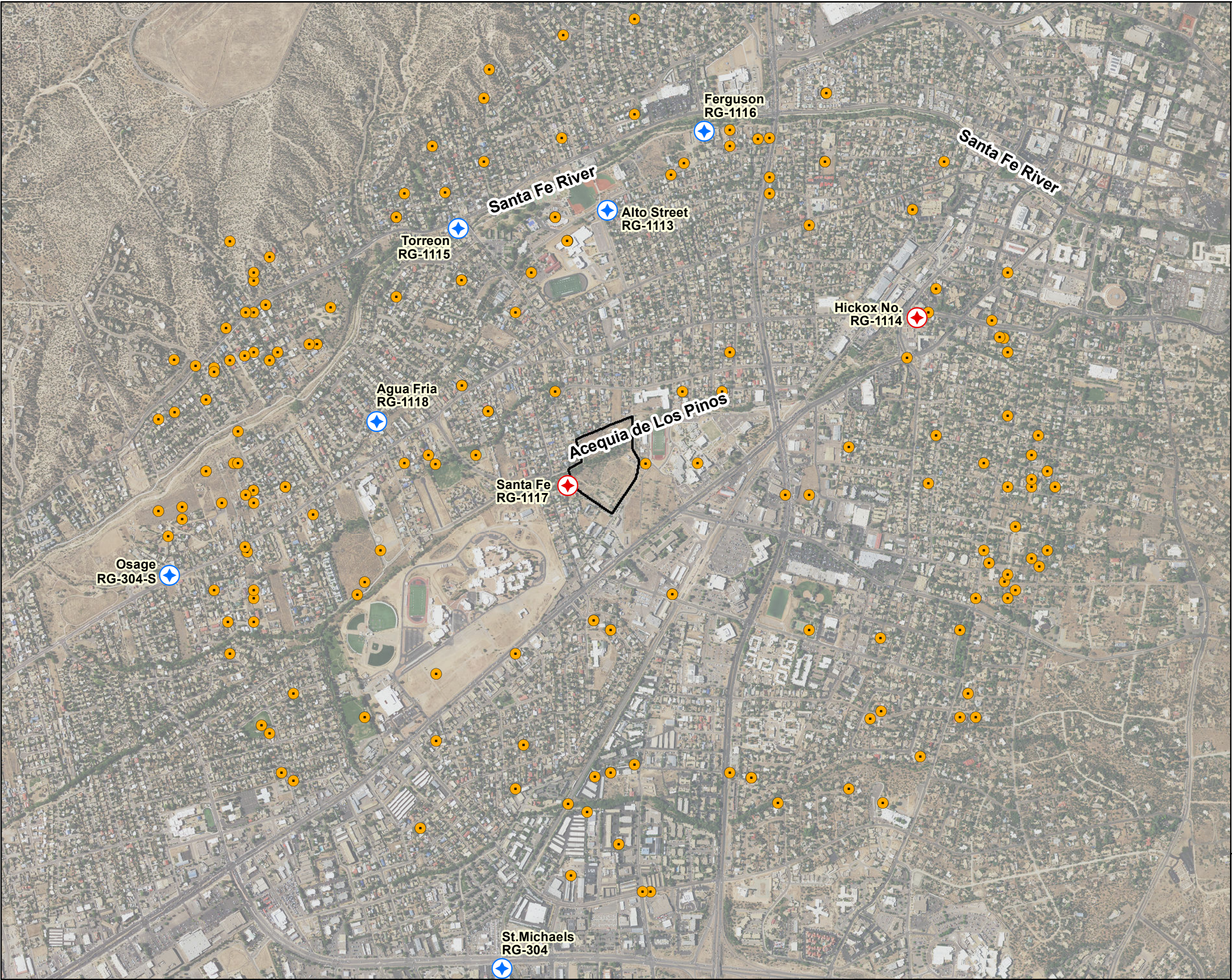


Figure 1
Site Location
 Stage 1 Abatement Plan Proposal
 Former Santa Fe Generating Station (Santa Fe Well-S)
 Santa Fe, Santa Fe County, New Mexico



Sources: Aerial – NAIP imagery, dated 2018;
Wells – OSE website, downloaded
February 2019

Legend

- Site Boundary
- Active WSW
- Inactive WSW
- OSE Well Location within 1 mile of Site

Figure 2
Site Vicinity
Stage 1 Abatement Plan Proposal
Former Santa Fe Generating Station
(Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

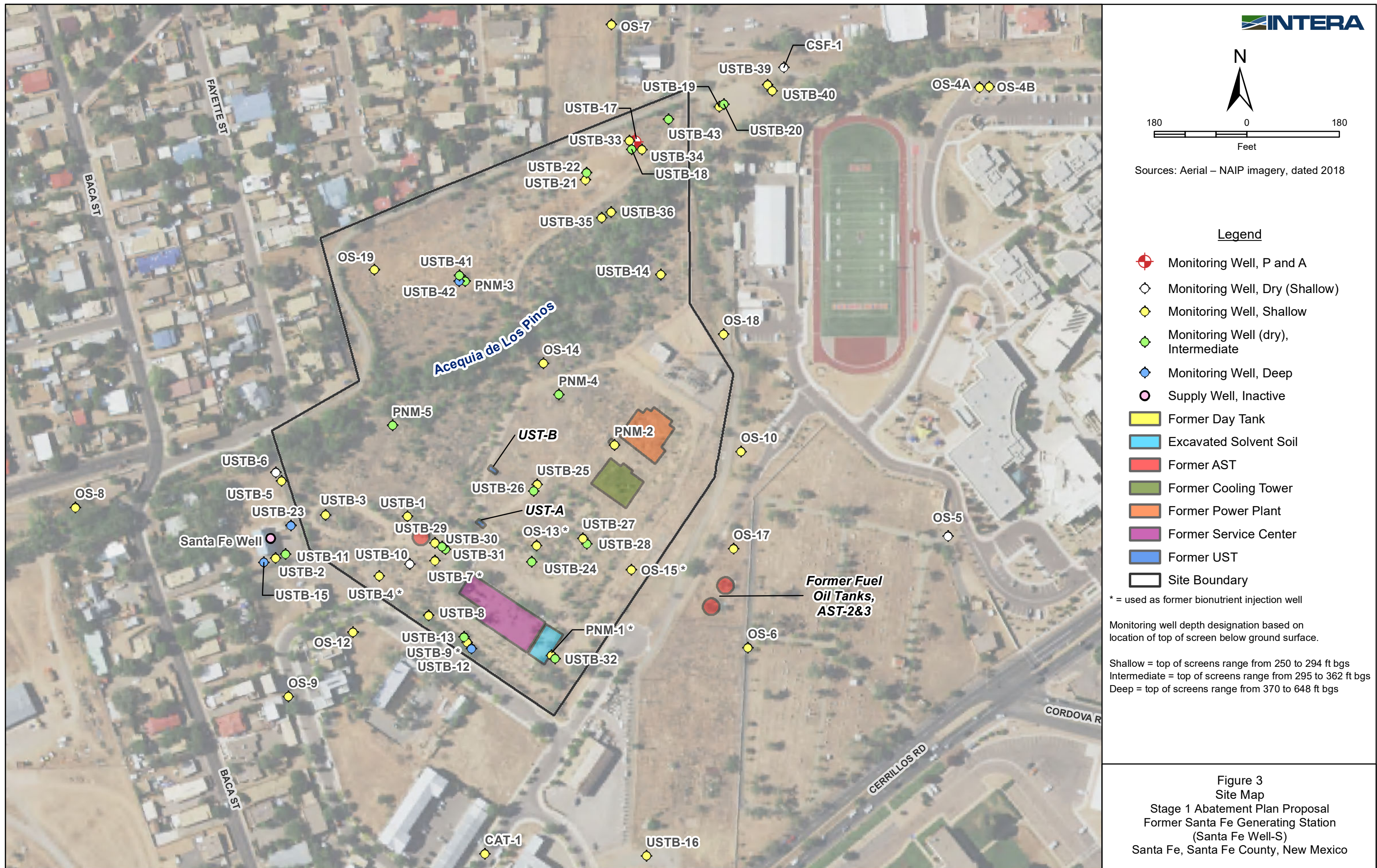


Figure 4a - Potentiometric Surface Elevations: USTB-2, USTB-11, USTB-15, and USTB-23

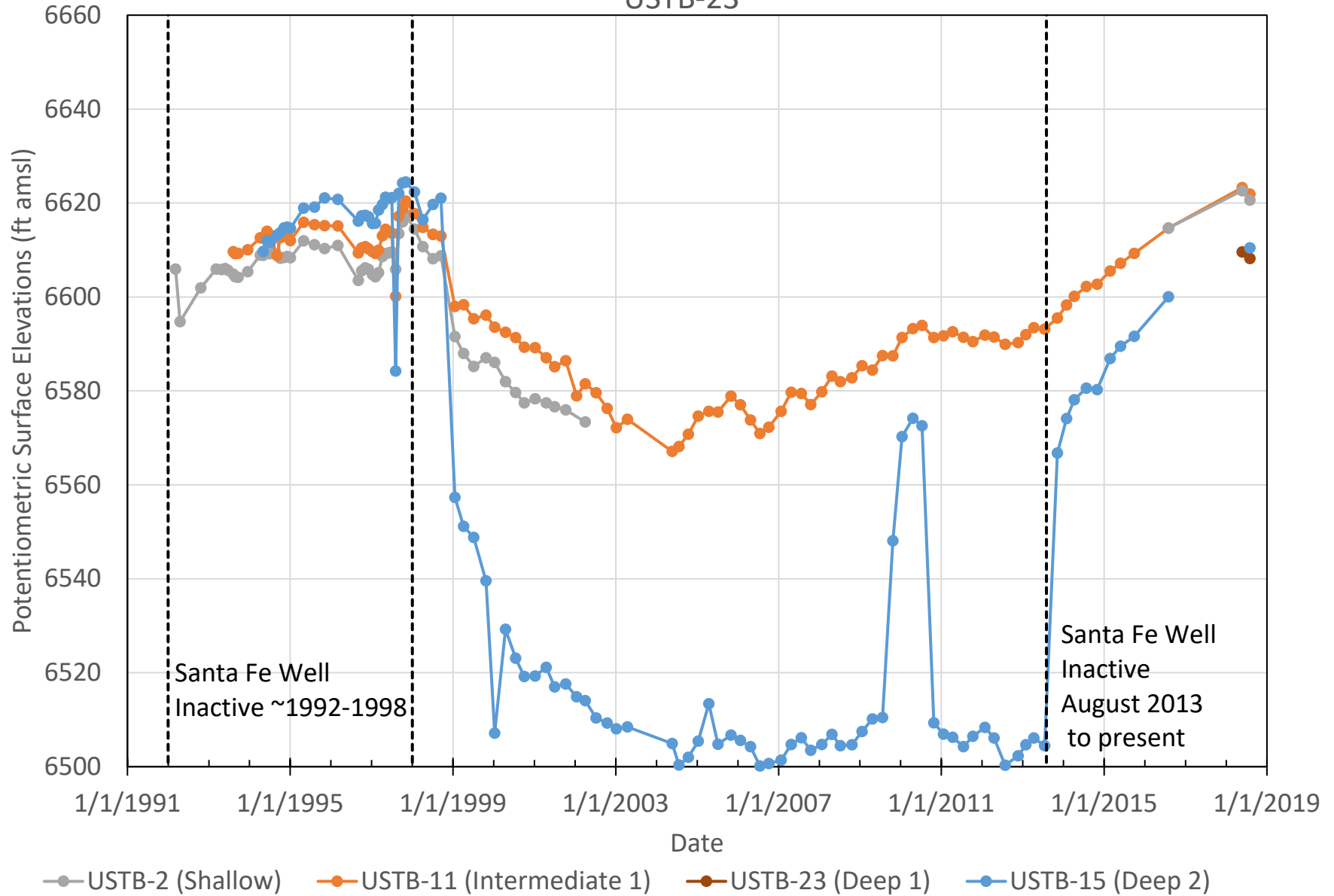
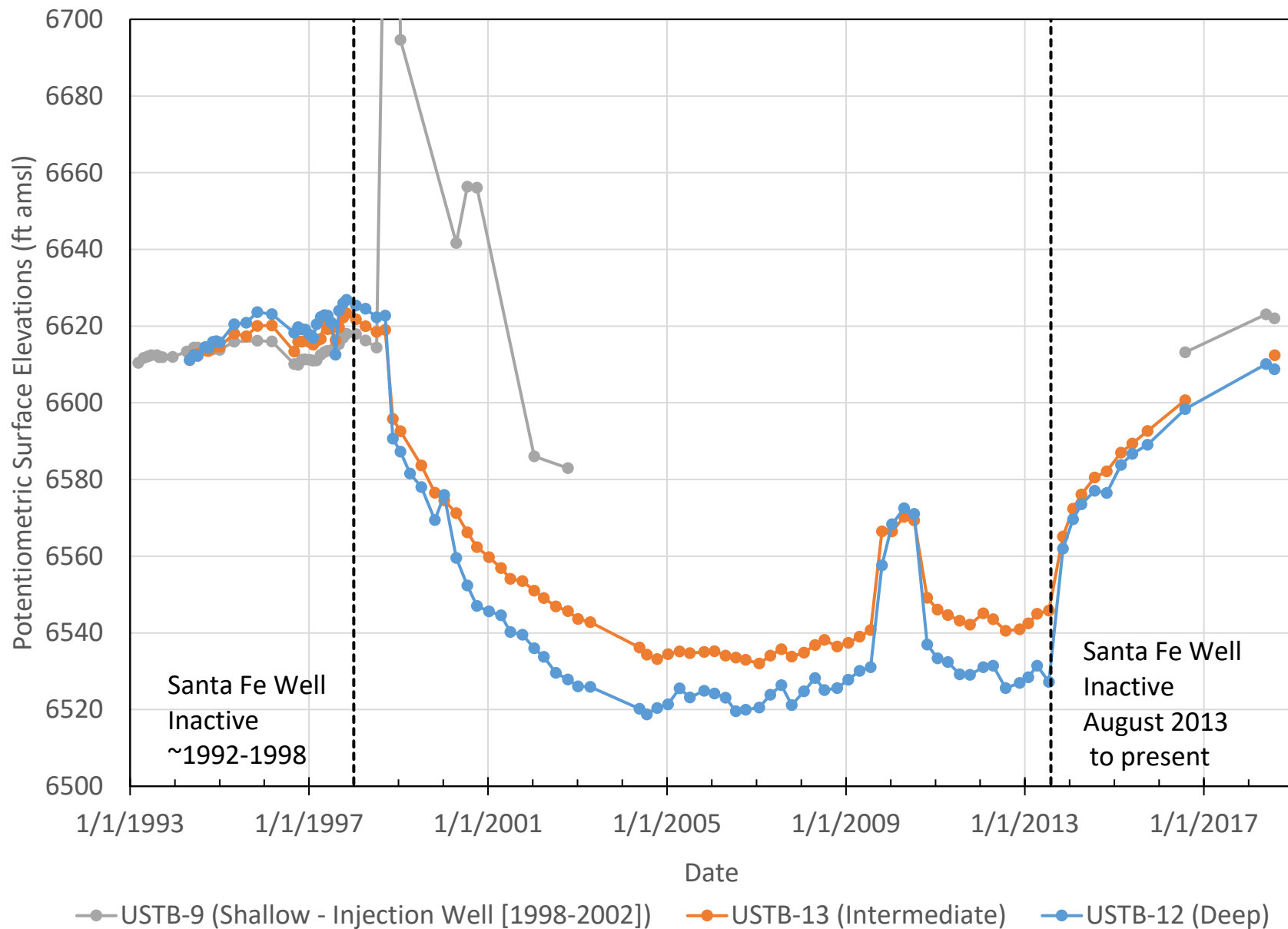


Figure 4b- Potentiometric Surface Elevations: USTB-9, USTB-12, and USTB-13



TABLES

TABLE 1
Site Investigation Chronology
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Date	Summary
1950 - 1980	Public Service Company of New Mexico (PNM, now PNM Resources) electric power generating station operational (NMED GWQB, 2000)
1951	Santa Fe Well (Baca St Well) was installed and turned on. The well does not contain an annular seal, which was typical for this time (NMED GWQB, 2000).
1952	Approximately 84,000 gallons of fuel oil leaked into the soil from a leaking underground pipe that was connected to one for the above-ground storage tanks (ASTs) at the power plant. It was reported that all of the fuel was missing from the one of the fuel oil tanks (PNM, 1995). The leak occurred in a portion of the pipeline connecting the fuel oil tank to the 18,000-gallon underground storage tank (UST) referred to as the "Day Tank" (Figure 3) (PNM, 1995). The leak was repaired but there was no investigation to determine the extent of the environmental damage (NMED GWQB, 2000).
1950s - 1970s	A 1,000-gallon tank was installed at the location noted as UST-A on Figure 3 . Later this tank was replaced in the same location by a 2,000-gallon tank. Both tanks are believed to have held gasoline. The location noted as UST-B may have held as many as three tanks (Figure 3). From the 1960s to 1970s, one or two 1,000- or 2,000-gallons USTs existed at this location; a 10,000-gallon UST was installed in 1979. The original tanks may have contained diesel at some time (not confirmed) but reportedly contained regular gasoline (Metric, 1995a).
1953 - 1985	A service center was operated within the southern portion of the property between 1953 and 1985 (Figure 2b). Five USTs containing gasoline were located at two different locations within the service center. The volumes of these USTs could not be identified and no soil contamination was identified down to 30 feet below the tank pits during UST removal in 1989 (NMED GWQB, 2000).
January 15, 1987	The 2,000-gallon UST was removed from location UST-A. No evidence for a release was found at the time the tank was removed. The 10,000-gallon UST was removed from location UST-B. No evidence of release was found during UST removal activities (Metric, 1995a).
October 1988	Benzene and ethylene dibromide (EDB) contamination discovered in the Santa Fe Well (NMED, 1994).
December 1988	The Santa Fe Well was shut down due to the presence of gasoline constituents in the water. The Sangre de Cristo Water Company (SDCW) installed a granulated activated carbon (GAC) wellhead treatment system and the well was returned to service in 1989 (Metric, 1995).
1989	Four monitoring wells (USTB-1 through USTB-4) were installed as part of the investigation into petroleum contamination found in the Santa Fe Well (Metric, 1995).
October 1989	Santa Fe Well returned to service with wellhead treatment consisting of GAC.
1989 - 1990	A subsurface soil investigation was conducted. Chlorinated solvents, predominantly tetrachloroethene (PCE), were found near the former service center building. PNM voluntarily removed and incinerated 220 cubic yards of contaminated soil (Figure 3). Laboratory analysis of soil samples from the limits of the excavation revealed that contaminant levels were below the United States Environmental Protection Agency (EPA) Toxicity Characteristic Leaching Procedure (TCLP) levels (Settlement Agreement, 1992).
January 31, 1991	A total of 38 potential off-site contamination sources were identified. Three possible sources have been designated as top priority and were addressed in the off-site investigation (NMEID, 1991).
1992	Monitoring wells OS-1 through OS-11 were installed.

TABLE 1
Site Investigation Chronology
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Date	Summary
April 1992	The Santa Fe Well was shut down again due to gasoline constituents detected in a nearby monitoring well. Monitoring well USTB-5 installed (Metric, 1995).
December 9, 1992	Settlement Agreement between PNM and the NMED signed.
1993	Monitoring wells OS-12, PNM-1, PNM-2, CAT-1, USTB-6 through USTB-9, USTB-10 (unknown but most likely drilled in this year), USTB-11, USTB-12 (unknown but most likely drilled in this year), and USTB-13 through USTB-17 were installed as part of the ongoing investigation (Metric, 2003).
April 1993	First Amendment signed. Required obligations of PNM and its successors.
April - June 1994	Monitoring wells OS-13 through OS-20 were installed as part of the ongoing investigation.
May 1995	The New Mexico Environment Department (NMED) sent a letter designating PNM as source of contamination.
July 1995	Second Amendment signed. PNM agreed to continue investigation despite disagreement with the NMED on source of contamination. Corrective Action Fund now available for reimbursement.
1996	The Santa Fe well was started on July 16 but was shut down August 27 due to excess sedimentation and not due to hydrocarbon contamination (PNM, 1998).
April 1996	Third Amendment signed. Provided payment to NMED by PNM for oversight activities.
October 1996	Fourth Amendment signed. Provided that PNM would pay \$1.22 million for aquifer testing, groundwater monitoring, and remediation of the Site.
1997	Wells CSF-1, CSF-2U, and CSF-2L were installed (Metric, 2003).
December 1997	As of the end of 1997, 33 monitoring wells had been completed (PNM, 2002).
October 5, 1998	The Santa Fe Well was returned to service with a wellhead treatment system. The wellhead treatment system consisted of acid metering to a lower pH, air stripping to remove volatile organic compounds (VOCs), the addition of flocculant, a settling basin, a multimedia sand filter and bag filters to remove suspended and dissolved solids, two GAC units in series for removal of any remaining sorbable organics, and chlorination and fluoridation prior to distribution to the Santa Fe municipal water supply (PNM, 2002).
July 2001	City of Santa Fe took over operation of SDCW company from PNM.
October 5, 1998 - March 1, 2002	Santa Fe Well wellhead treatment system and the Zone 2 bioremediation nutrient injection system operated continuously through this period. The injection system was shut down on 10/10/01 to assess the effectiveness, and in March 2002 the injection system was reactivated. Zone 2 is the predominant zone of hydrocarbon contaminations. Nutrient and hydrogen peroxide were injected into six on-site monitoring wells (USTB-4, USTB-7, USTB-9, OS-13, OS-15, and PNM-1) to stimulate in-situ degradation of organic constituents. The system injected a mixture of water and hydrogen peroxide at a continual flow rate of 20 gallons per minute (gpm) using the six injection wells. Injections were attempted into USTB-1 but were ceased due to low injection rates (PNM, 2002).
March 2002	The bioremediation nutrient injection system was turned off and the efficiency was evaluated. In March 2002, the system was reactivated. The date this system ceased operation could not be determined by INTERA.
August 26, 2003	Fifth Amendment to the Settlement Agreement between the NMED And PNM was signed. The amendment included the installation of two new monitoring wells PNM-3 and PNM-4, and one extraction well for consumption, PNM-5 (PNM, 2002).

TABLE 1
Site Investigation Chronology
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Date	Summary
November 19, 2012	The Santa Fe Well was shut down when a 50-60 gpm drop in the flow rate began to cause the well to cycle on and off in 30-minute intervals. PNM determined that the reduced flowrate in extraction well PNM-5 was causing excessive amounts of backpressure in the system. Once PNM-5 was shut down, the Santa Fe Well and associated wellhead treatment system were put back into service and operated normally (PNM, 2012).
August 2013	The Santa Fe Well (including PNM-5) went out of service due to the failure of the systems variable frequency drive (VFD). The VFD controls the operation of the booster pumps which pump treated water into the City's distribution system (PNM, 2015).
March through May 2018	Seven new monitoring wells were installed (USTB-18 through USTB-24) to further characterize the nature and extent of petroleum hydrocarbon contamination on- and off-site. Monitoring well OS-18 was located and recompleted.
August 2018 to present	Seventeen (17) new monitoring were installed (USTB-25 through USTB-36 and USTB-39 through USTB-43) to further characterize the nature, extent, and magnitude of the petroleum hydrocarbon contamination both on and off-site. Monitoring well OS-4A and OS-4B were located, uncovered, and recompleted and USTB-17 was plugged and abandoned (P&A). Installation of monitoring well USTB-38 is pending.
Present	The Santa Fe Well is still not operating.

TABLE 2
Monitoring Well Details
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Well	Date Installed	TOC Elevation (ft amsl)	Ground Surface Elevation (ft amsl)	Screen Length (ft)	Depth to top of screen (ft bgs)	Depth to bottom of screen (ft bgs)	Well Depth (ft bgs)	Borehole Depth (ft bgs)	Well Diameter (inches)	Pump Type	Depth to Water (ft btoc) (July/August 2018)	Fluid Level	Groundwater Sample	Comments
Existing Wells														
OS-1	Oct-92	6953.28	--	50	100	150	150	150	2	--	--	N	N	Survey data not updated
OS-2	Oct-92	6952.26	--	50	85	135	135	140	2	--	--	N	N	Survey data not updated
OS-3A	Oct-92	6944.63	--	40	123	163	163	163	2	--	--	N	N	Survey data not updated
OS-3B	Oct-92	6945.29	--	30	75	105	105	105	2	--	--	N	N	Survey data not updated
OS-4A	Oct-92	6901.42	--	50	235	285	285	290	2	--	NM	Y	Y	Survey data not updated
OS-4B	Oct-92	6902.06	--	50	275	325	325	330	2	--	NM	Y	Y	Survey data not updated
OS-6	Oct-92	6902.00	6902.84	50	270	320	320	320	2	--	286.79	Y	Y	
OS-7	Oct-92	6891.64	6891.74	100	252	352	352	360	2	--	262.42	Y	Y	
OS-8	Oct-92	6867.50	6867.76	100	252	352	352	360	2	--	243.96	Y	Y	
OS-9	Oct-92	6878.82	6879.31	80	260	340	340	343	2	--	258.00	Y	Y	
OS-10	Oct-92	6898.39	6898.47	100	257	357	357	360	2	--	289.72	Y	Y	
OS-11	Oct-92	--	--	30	115	145	145	150	2	--	--	N	N	Survey data not updated
OS-12	2/27/1993	6875.43	6875.54	40	260	305	305	320	4	--	258.72	Y	Y	
OS-13	Jun-94	6894.23	6891.70	40	267	307	312	332	4	--	271.25	Y	Y	Former bionutrient injection well
OS-14	Jun-94	6889.15	6886.84	40	260	300	305	340	4	--	264.84	Y	Y	
OS-15	Jun-94	6897.51	6895.07	40	264	304	304	320	4	--	284.52	Y	Y	Former bionutrient injection well
OS-16	Jun-94	6918.39	6918.81	40	294	334	339	355	4	--	313.33	Y	Y	
OS-17	Jun-94	6900.44	6898.87	40	275	315	320	330	4	--	291.37	Y	Y	
OS-18	Jun-94	6893.18	6891.72	50	265	315	315	320	4	--	286.75	Y	Y	
OS-19	Jun-94	6886.26	6884.19	40	262	302	307	320	4	--	254.29	Y	Y	
OS-20	Jun-94	6918.20	6918.64	40	290	330	335	340	4	--	269.46	Y	N	
PNM-1	10/4/1993	6893.75	6891.95	52	267	319	319	322	4	--	271.74	Y	Y	Former bionutrient injection well
PNM-2	10/13/93	6895.74	6893.53	50	270	320	320	325	4	--	281.21	Y	Y	
PNM-3	9/15/2003	6888.19	6886.23	110	298/338	328/418	418	435	4	Electric Submersible	269.25	Y	Y	TOC to north
PNM-4	9/15/2003	6890.60	6888.58	160	324/394	384/494	494	503	4	Electric Submersible	144.58	Y	Y	TOC to east
PNM-5	9/24/2003	6882.13	6881.75	135	296/356	346/441	441	451	4	Electric Submersible	267.34	Y	Y	Former extraction well (potable)
USTB-1	4/17/1989	6886.25	6884.48	50	260	310	310	315	4	--	264.04	Y	Y	

TABLE 2
Monitoring Well Details
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Well	Date Installed	TOC Elevation (ft amsl)	Ground Surface Elevation (ft amsl)	Screen Length (ft)	Depth to top of screen (ft bgs)	Depth to bottom of screen (ft bgs)	Well Depth (ft bgs)	Borehole Depth (ft bgs)	Well Diameter (inches)	Pump Type	Depth to Water (ft btoc) (July/August 2018)	Fluid Level	Groundwater Sample	Comments
USTB-2	4/20/1989	6877.83	6875.61	50	255	305	305	309	4	Electric Submersible	257.23	Y	Y	
USTB-3	4/27/1989	6881.53	6878.92	50	255	305	305	310	4	Electric Submersible	260.38	Y	Y	
USTB-4	8/10/1990	6884.50	6882.69	50	263	313	313	320	4	--	262.87	Y	Y	Former bionutrient injection well
USTB-5	3/7/1992	6877.72	6875.92	20	279	299	309	320	4	Electric Submersible	256.65	Y	Y	
USTB-7	1/12/1993	6889.41	6887.15	40	260	300	305	305	4	--	267.31	Y	Y	Former bionutrient injection well
USTB-8	2/4/1993	6884.22	6882.24	40	260	300	310	319	4	--	262.38	Y	Y	
USTB-9	3/3/1993	6884.70	6882.40	39	262	301	306	320	4	--	262.66	Y	Y	Former bionutrient injection well
USTB-11	Aug-93	6878.07	6875.87	35	345	380	382	390	4	Electric Submersible	256.14	Y	Y	
USTB-12	1994	6884.59	6882.45	20	480	500	505	505	4	--	275.85	Y	Y	
USTB-13	2/24/1993	6884.42	6882.43	20	362	382	385	385	4	Electric Submersible	271.99	Y	Y	Need water level meter; OWI does not fit in sounding tube
USTB-14	3/6/1993	6890.35	6891.83	40	270	310	315	315	4	Electric Submersible	281.51	Y	Y	
USTB-15	3/9/1993	6877.07	6874.87	20	480	500	505	505	4	Electric Submersible	266.59	Y	Y	Need water level meter; OWI does not fit in sounding tube
USTB-16	3/18/1993	--	--	30	271	301	311	311	4	--	--	Y	Y	Currently covered pending paving at Oddfellows Hall
USTB-18	3/18/2018	6896.49	6893.81	10	306	316	316.5	321	4	--	283.41	Y	Y	
USTB-19	4/17/2018	6896.64	6896.70	5	261	266	266	280	4	--	254.30	Y	Y	
USTB-20	4/11/2018	6896.61	6896.96	10	302	312	312	316	4	--	282.13	Y	Y	
USTB-21	4/5/2018	6891.70	6888.68	30	259	289	289	290	4	--	269.00	Y	Y	
USTB-22	3/28/2018	6895.80	6892.52	5	295	300	300	314	4	--	267.88	Y	Y	
USTB-23	5/7/2018	6871.88	6872.01	10	402	412	413	416	4	--	263.70	Y	Y	
USTB-24	4/29/2018	6890.43	6887.75	10	317	327	327	328	4	--	282.70	Y	Y	
USTB-25	11/9/2018	--	--	40	250	290	290.5	292	4	--	--	Y	Y	Not surveyed
USTB-26	10/31/2018	--	--	10	315	325	325.5	327	4	--	--	Y	Y	Not surveyed
USTB-27	10/20/2018	--	--	40	247.5	287.5	288	290	4	--	--	Y	Y	Not surveyed

TABLE 2
Monitoring Well Details
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Well	Date Installed	TOC Elevation (ft amsl)	Ground Surface Elevation (ft amsl)	Screen Length (ft)	Depth to top of screen (ft bgs)	Depth to bottom of screen (ft bgs)	Well Depth (ft bgs)	Borehole Depth (ft bgs)	Well Diameter (inches)	Pump Type	Depth to Water (ft btoc) (July/August 2018)	Fluid Level	Groundwater Sample	Comments
USTB-28	10/5/2018	--	--	10	317.1	327.1	327.4	329	4	--	--	Y	Y	Not surveyed
USTB-29	12/14/2018	--	--	40	246.5	286.5	286.85	287	4	--	--	Y	Y	Not surveyed
USTB-30	12/5/2018	--	--	10	316.65	326.65	327	330	4	--	--	Y	Y	Not surveyed
USTB-31	11/27/2018	--	--	10	356.5	366.5	366.85	369	4	--	--	Y	Y	Not surveyed
USTB-32	9/23/2018	--	--	10	344	354	354.35	361	4	--	--	Y	Y	Not surveyed
USTB-33	1/28/2019	--	--	30	245	275	275.35	282	4	--	--	Y	Y	Not surveyed
USTB-34	1/23/2019	--	--	10	280.65	290.65	291	300	4	--	--	Y	Y	Not surveyed
USTB-35	1/12/2019	--	--	2.5	286.65	289.15	289.5	330	4	--	--	Y	Y	Not surveyed
USTB-36	12/20/2018	--	--	35	249.5	284.5	285	302	4	--	--	Y	Y	Not surveyed
USTB-38	TBD	--	--	--	--	--	--	--	--	--	--	Y	Y	Not installed yet.
USTB-39	9/7/2018	--	--	10	246.1	256.1	256.5	257	4	--	--	Y	Y	Not surveyed
USTB-40	8/28/2018	--	--	30	270	300	300.35	319	4	--	--	Y	Y	Not surveyed
USTB-41	2/20/2019	--	--	10	319.65	329.65	330	332	4	--	--	Y	Y	Not surveyed
USTB-42	2/16/2019	--	--	10	370.15	380.15	380.5	420	4	--	--	Y	Y	Not surveyed
USTB-43	3/13/2019	--	--	9.1	307	316.1	316.45	318	4	--	--	Y	Y	Angle Well (24° off vertical)
CAT-1	7/7/1993	6890.57	6891.08	50	250	300	302	302	4	--	269.41	Y	N	Near Hickox Well
CSF-1	10/16/97	6895.22	6895.01	25	259	284	284	298	4	--	284.70	Y	N	On property owned by the NM School for the Deaf. Located approximately 100 ft east of the south end of Alicia Street
CSF-2U	10/10/97	6844.99	6845.13	20	534.4	554.4	554.4	680	2	--	226.46	Y	N	In Larragoite Park on the east side of Avenida Cristobal Colon Road. (COSF#2A and #2B) [2A]
CSF-2L	10/10/97	6844.88	6845.13	10	648.4	658.4	668	680	2	--	238.78	Y	N	In Larragoite Park on the east side of Avenida Cristobal Colon Road. (COSF#2A and #2B) [2B]
Plugged and Abandoned														
USTB-17	5/6/1993	6896.80	6894.08	40	255	295	295	300	4	--	286.50	--	--	Contains LNAPL
Water Supply Well														
Santa Fe Well (Baca Street Well)	8/6/1951	6870.90	--	523	200	723	725	1523	--	--	--	N	N	Survey data not updated
Dry														
USTB-6	2/27/1992	6877.87	6875.58	9	66	75	75	78	2	--	Dry	N	N	
USTB-10	--	6882.80	6880.34	10	125	135	138	138	4	--	Dry	N	N	Dry at 138.7 ft bgs

TABLE 2
Monitoring Well Details
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

Well	Date Installed	TOC Elevation (ft amsl)	Ground Surface Elevation (ft amsl)	Screen Length (ft)	Depth to top of screen (ft bgs)	Depth to bottom of screen (ft bgs)	Well Depth (ft bgs)	Borehole Depth (ft bgs)	Well Diameter (inches)	Pump Type	Depth to Water (ft btoc) (July/August 2018)	Fluid Level	Groundwater Sample	Comments
Not Located														
OS-5	Oct-92	--	--	40	245	285	285	290	2	--	Dry	Y	Y	Dry at 286 ft bgs; Survey data not updated

Notes:

amsl = above mean sea level

bgs = below ground surface

BTOC = below top of casing

CSF = City of Santa Fe

ft = foot/feet

LNAPL = light non-aqueous phase liquid

NM = not measured

NMDOT = New Mexico Department of Transportation

OWI = oil/water interface

TOC = top of casing

USTB = Underground Storage Tank Bureau (former name of PSTB - Petroleum Storage Tank Bureau)

-- = not known or not applicable

All wells unless otherwise noted surveyed by SW Mountain Surveyors in April and May 2018

TABLE 3
Proposed Stage 1 Abatement Plan Schedule
Former Santa Fe Generating Station (Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

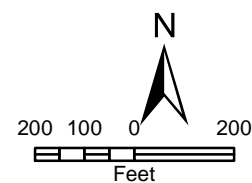
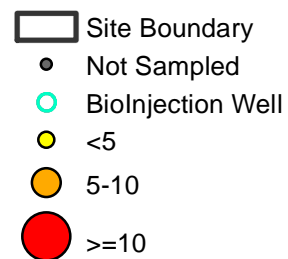
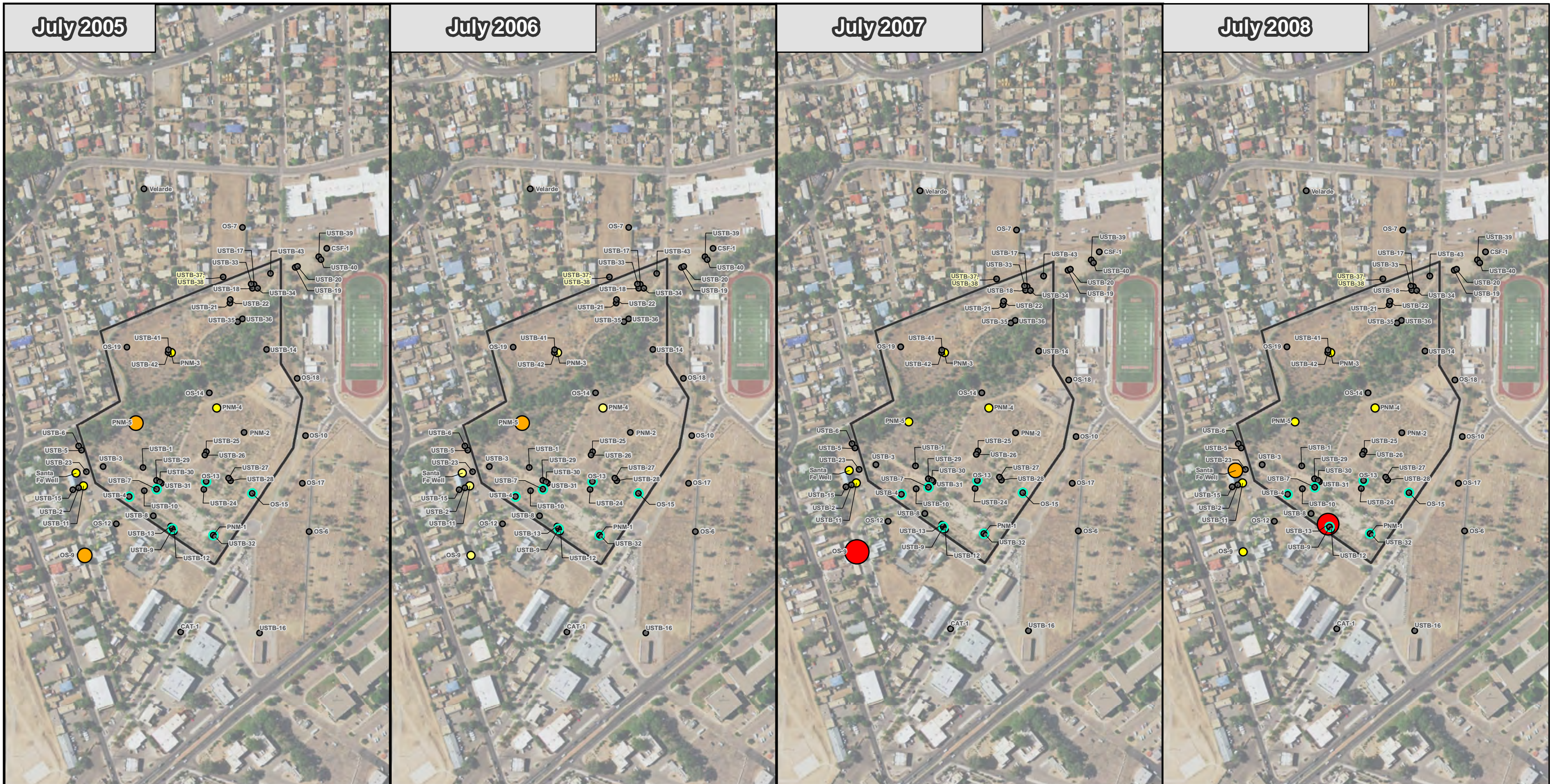
Task	Proposed Completion/Deliverable Date	Actual Completion Date	Status ¹
Response to GWQB Abatement Plan Required letter of 3/25/2019	July 29, 2019		IP
1 st Groundwater Monitoring Sampling Event	September 2019		NC
1 st Groundwater Monitoring Event and Quarterly Progress Report	January 2020		NC
S1AP Modification	January 2020		NC
Quarterly Progress Report	April 2020		NC
2 nd Groundwater Monitoring Sampling Event	March 2020		NC
2 nd Groundwater Monitoring Event, Passive Diffusion Bag Samplers/Alternative Sampling Method Evaluation, Conceptual Site Model Update, Data Gap Evaluation, and Quarterly Progress Report	July 2020		NC
S1AP Modification and Quarterly Progress Report	October 2020		NC
Quarterly Progress Report	January 2021		
Additional Site Characterization Field Activities (i.e., well installation, monitored natural attenuation evaluation, flow modeling, 3 rd groundwater sampling event)	January 2021 through March 2021		NC
Quarterly Progress Report	April 2021		
Quarterly Progress Report	July 2021		
4 th Groundwater Monitoring Sampling Event	September 2021		NC
Quarterly Progress Report	October 2021		NC
Additional Site Characterization Activities (i.e., well installation, monitored natural attenuation evaluation, flow modeling), 3 rd and 4 th Groundwater Monitoring Event Report [Final Site Investigation Report]	December 2021		NC

Notes:

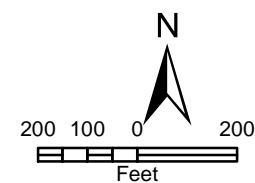
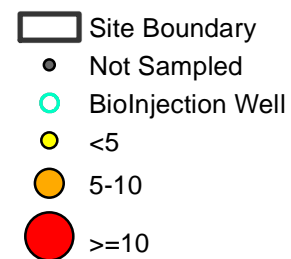
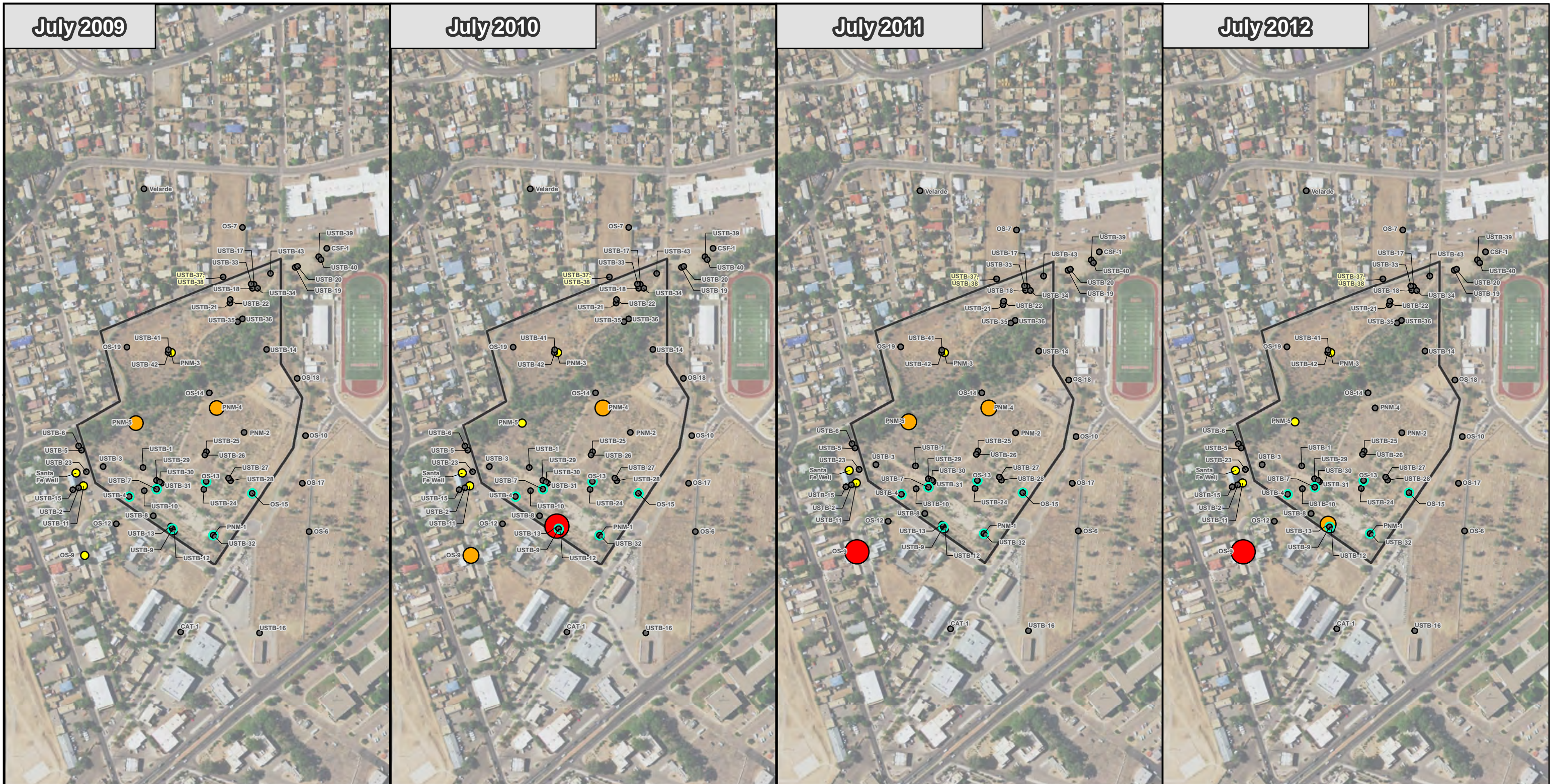
¹ C = Complete, UC = Unable to Complete, NN = Not Needed, NC = Not Complete, IP = In Process
The status will be updated in each Quarterly Progress Report.

APPENDIX A

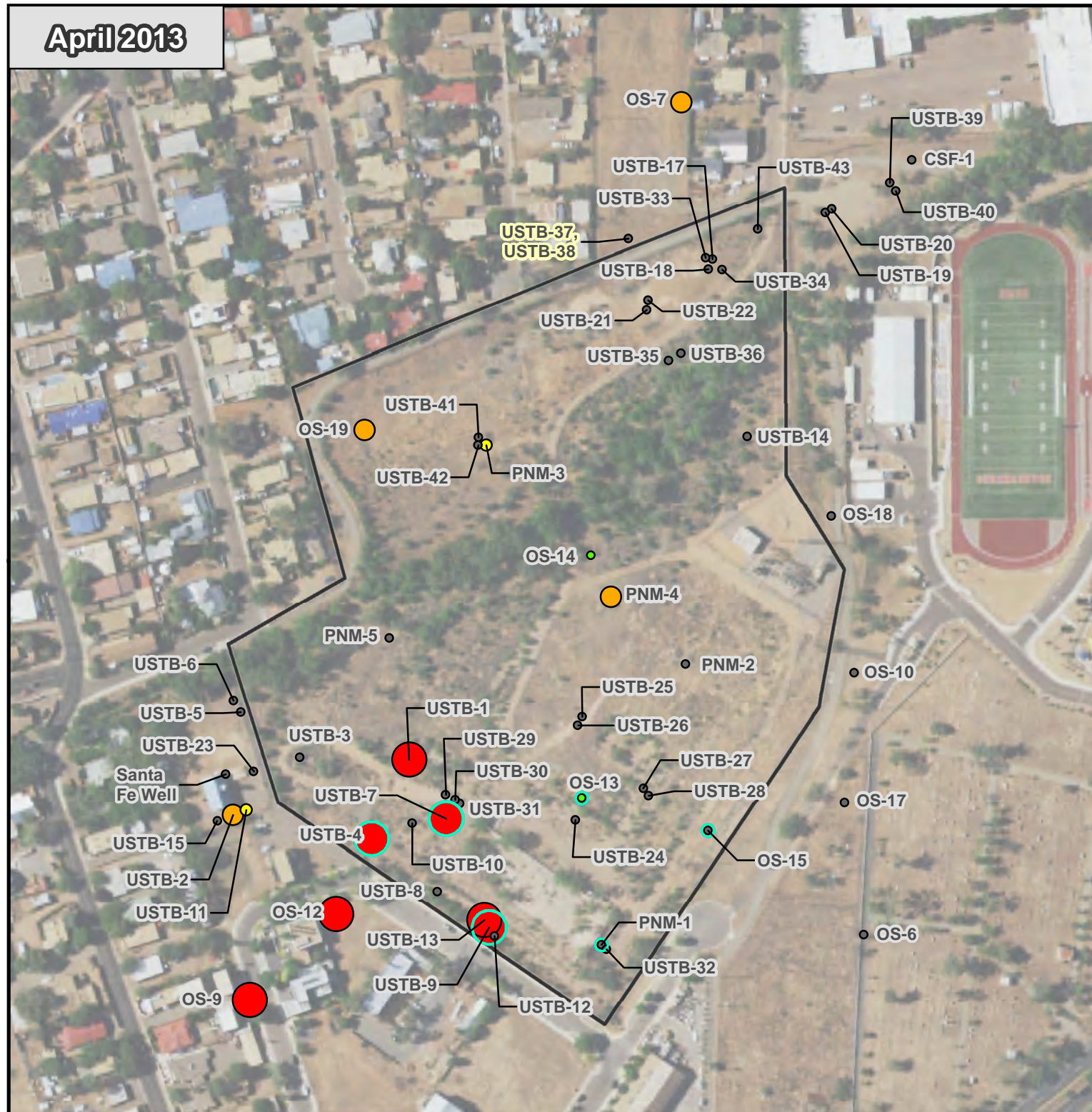
Panel Plots – CVOCs and Nitrate



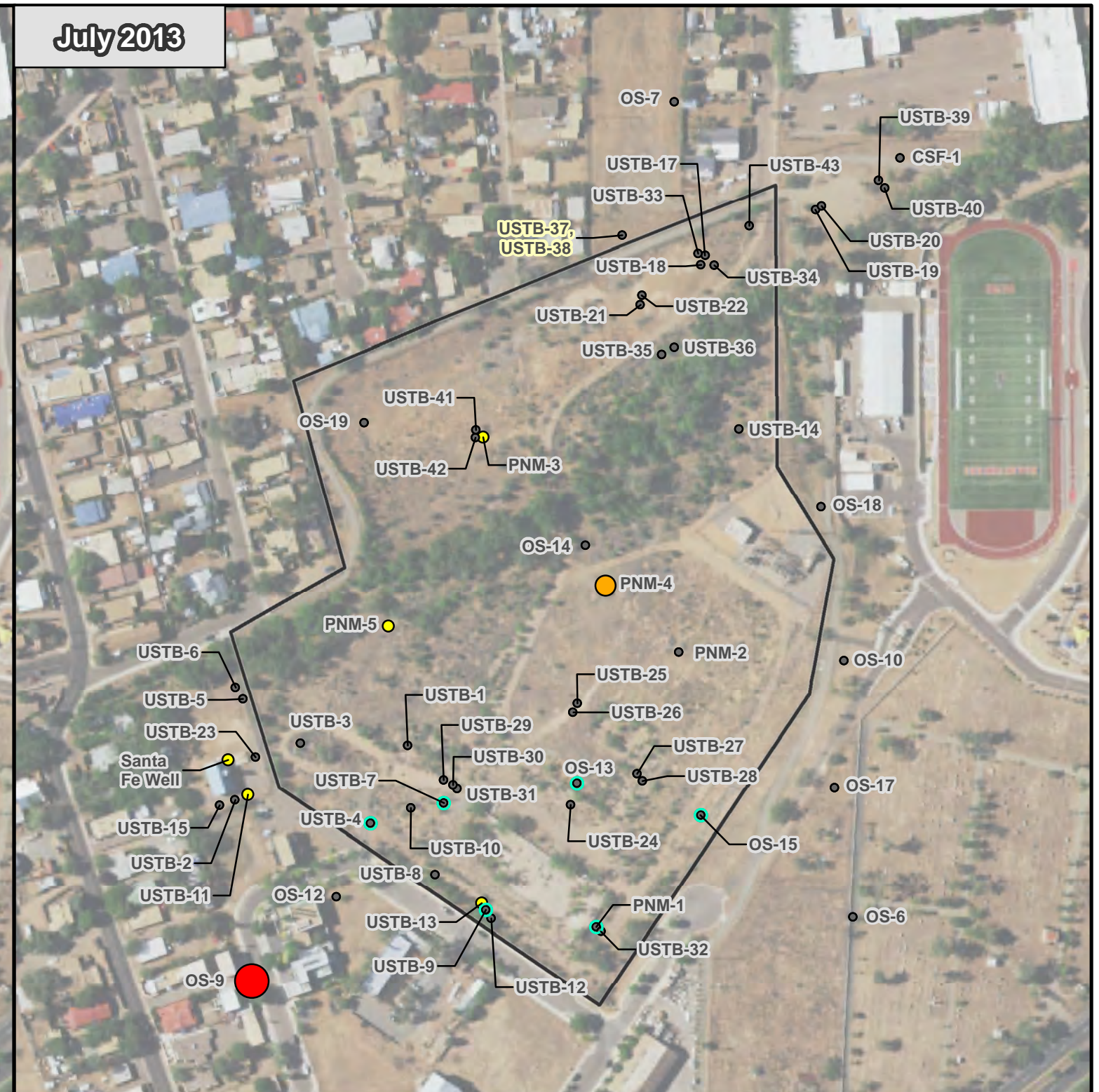
Nitrate Concentrations
2005, 2006, 2007, 2008
PNM



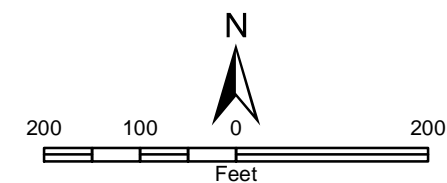
April 2013



July 2013



- Site Boundary
- Not Sampled
- BioInjection Well
- Non Detect
- <5
- 5-10
- >=10

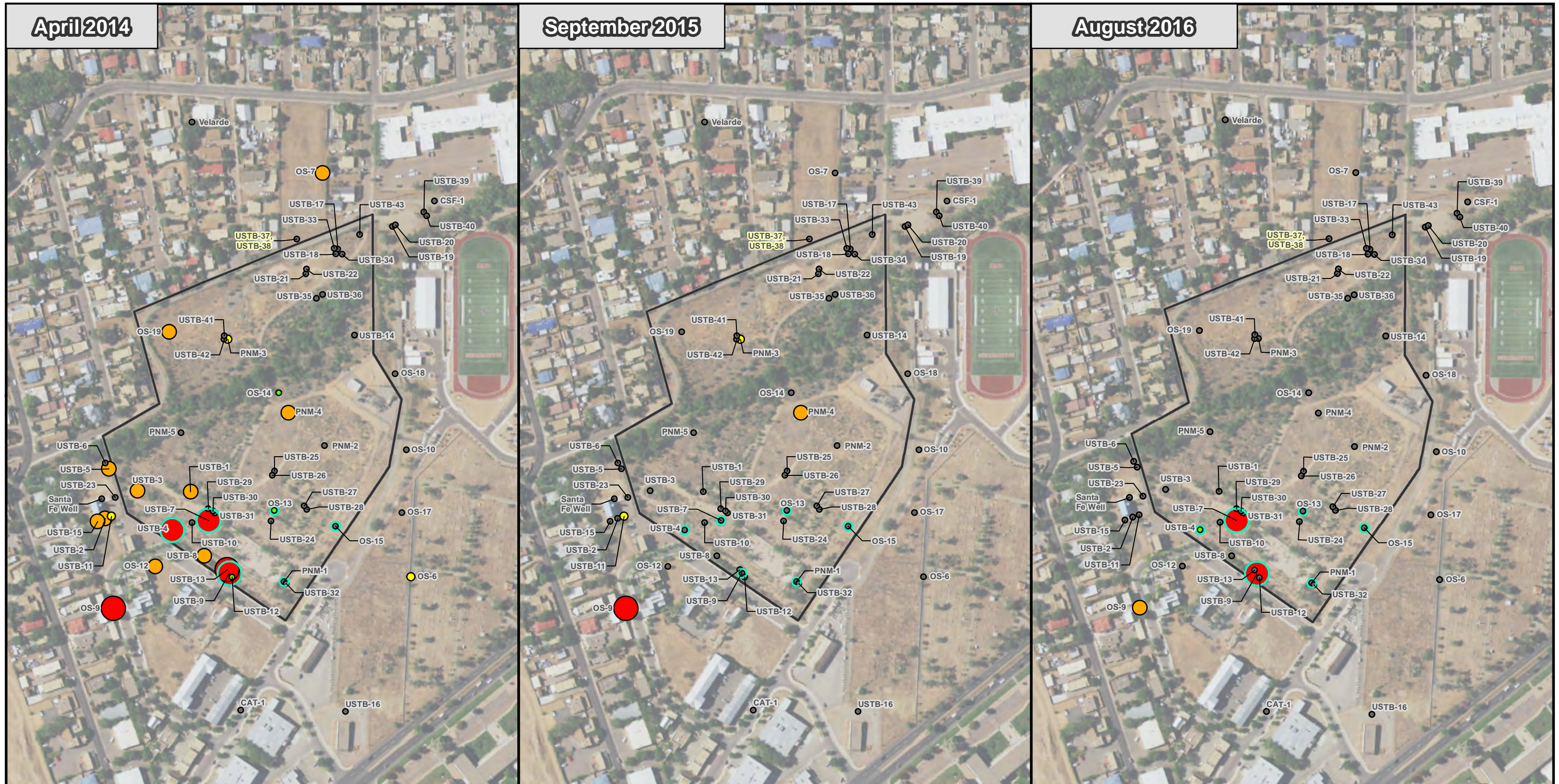


Nitrate Concentrations
2013
PNM

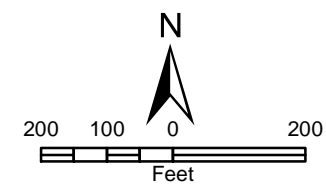
April 2014

September 2015

August 2016



- Site Boundary
- Not Sampled
- BioInjection Well
- Non Detect
- <5
- 5-10
- >=10

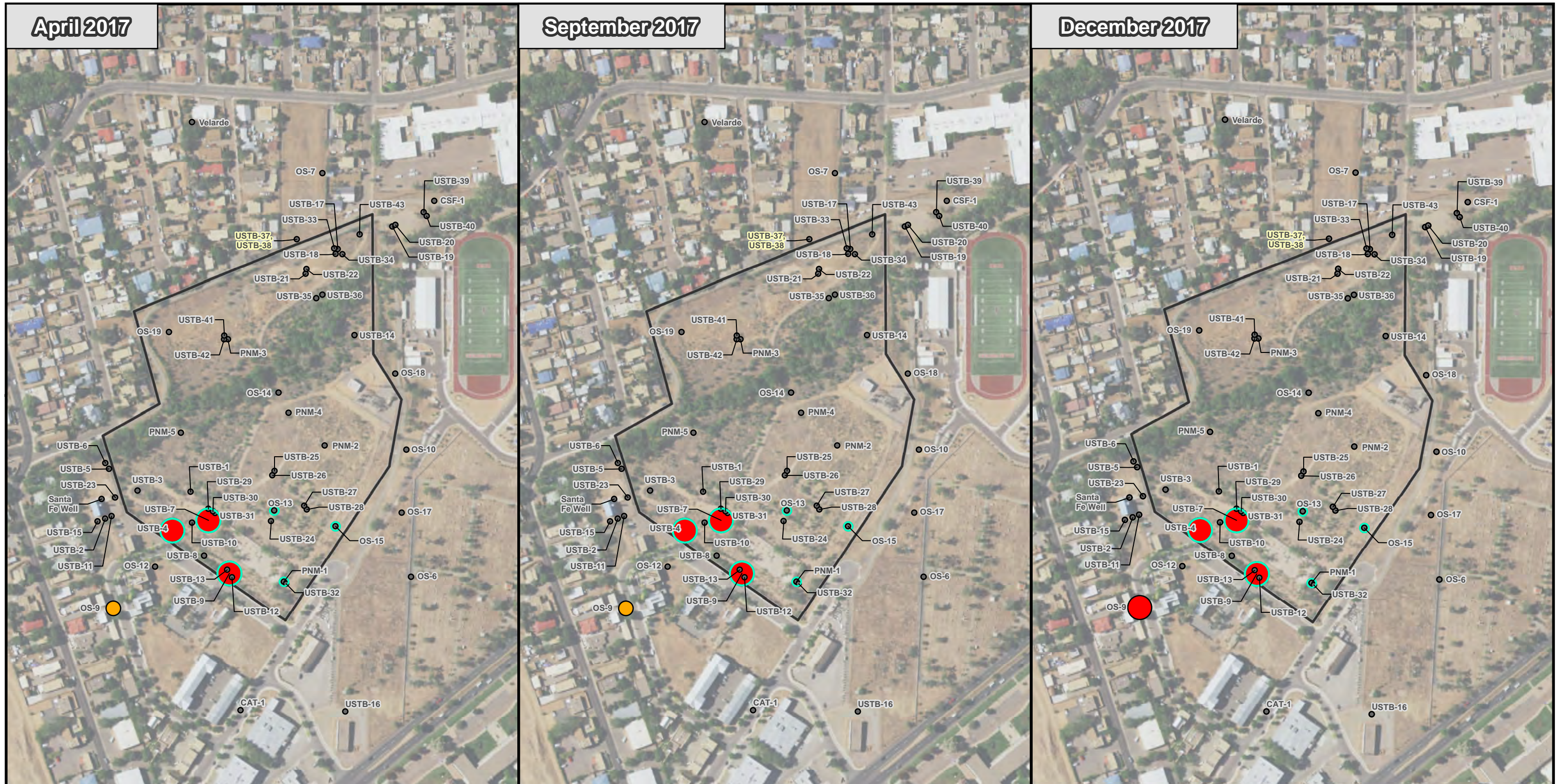


Nitrate Concentrations
2014, 2015, 2016
PNM

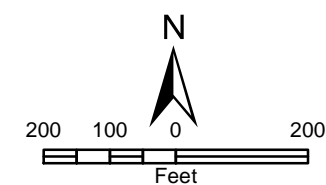
April 2017

September 2017

December 2017

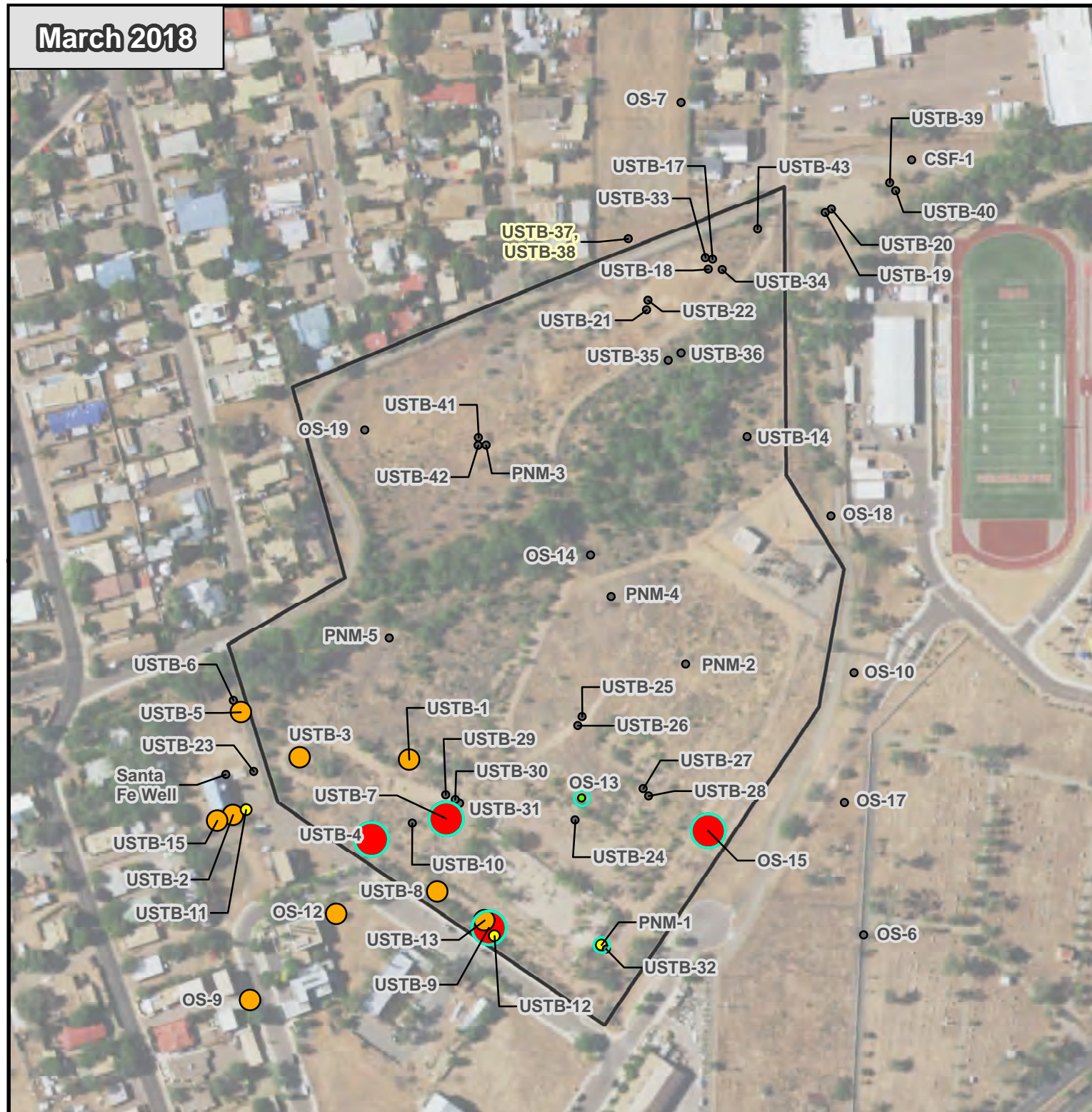


- Site Boundary
- BioInjection Well
- Not Sampled
- Non Detect
- <5
- 5-10
- >=10

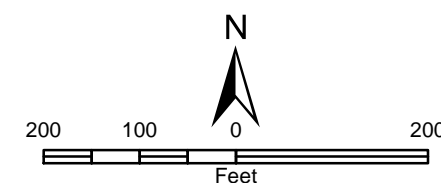
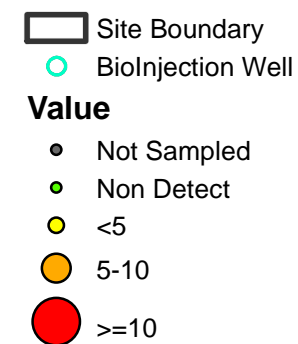
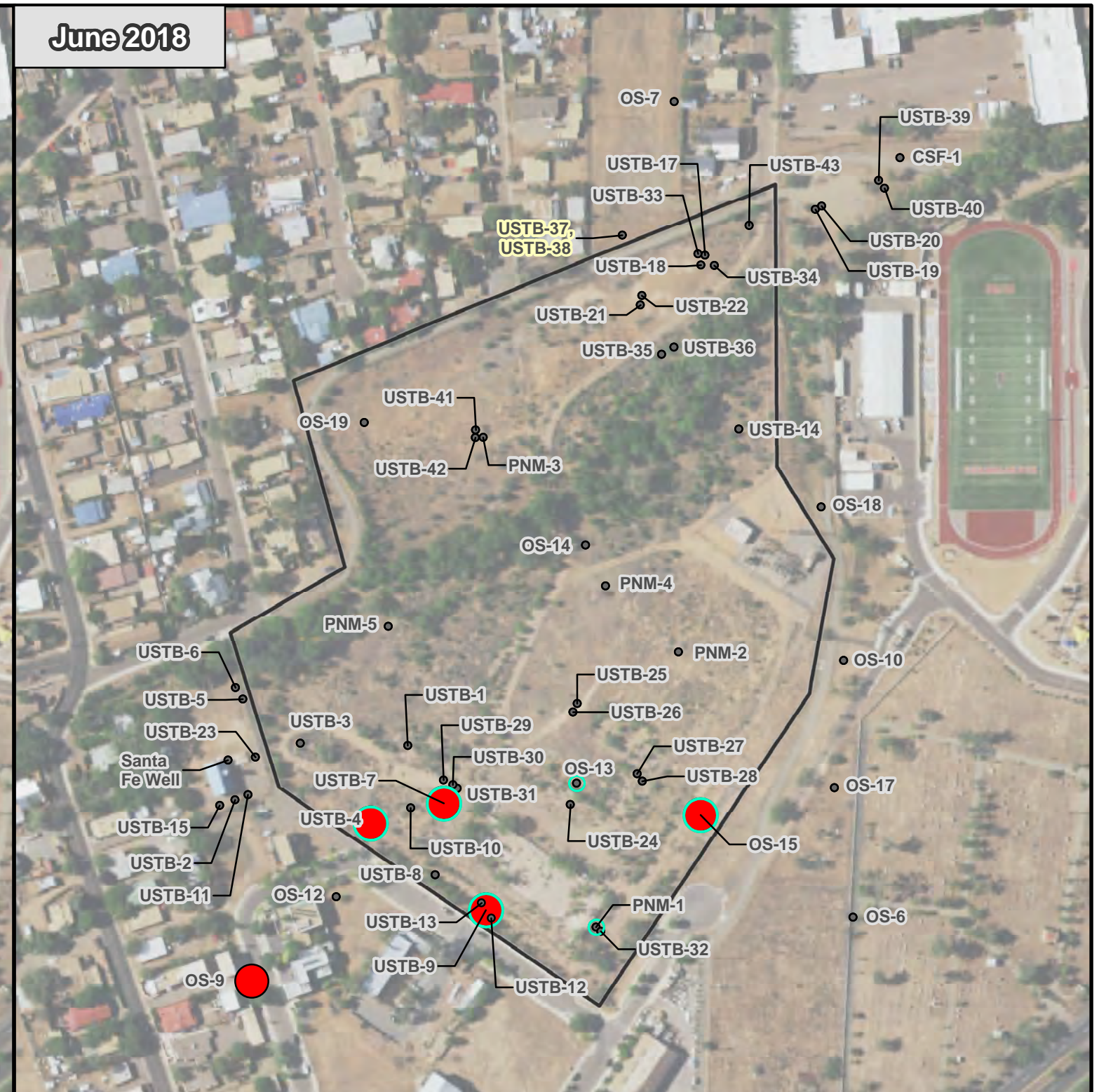


Nitrate Concentrations
2017
PNM

March 2018



June 2018



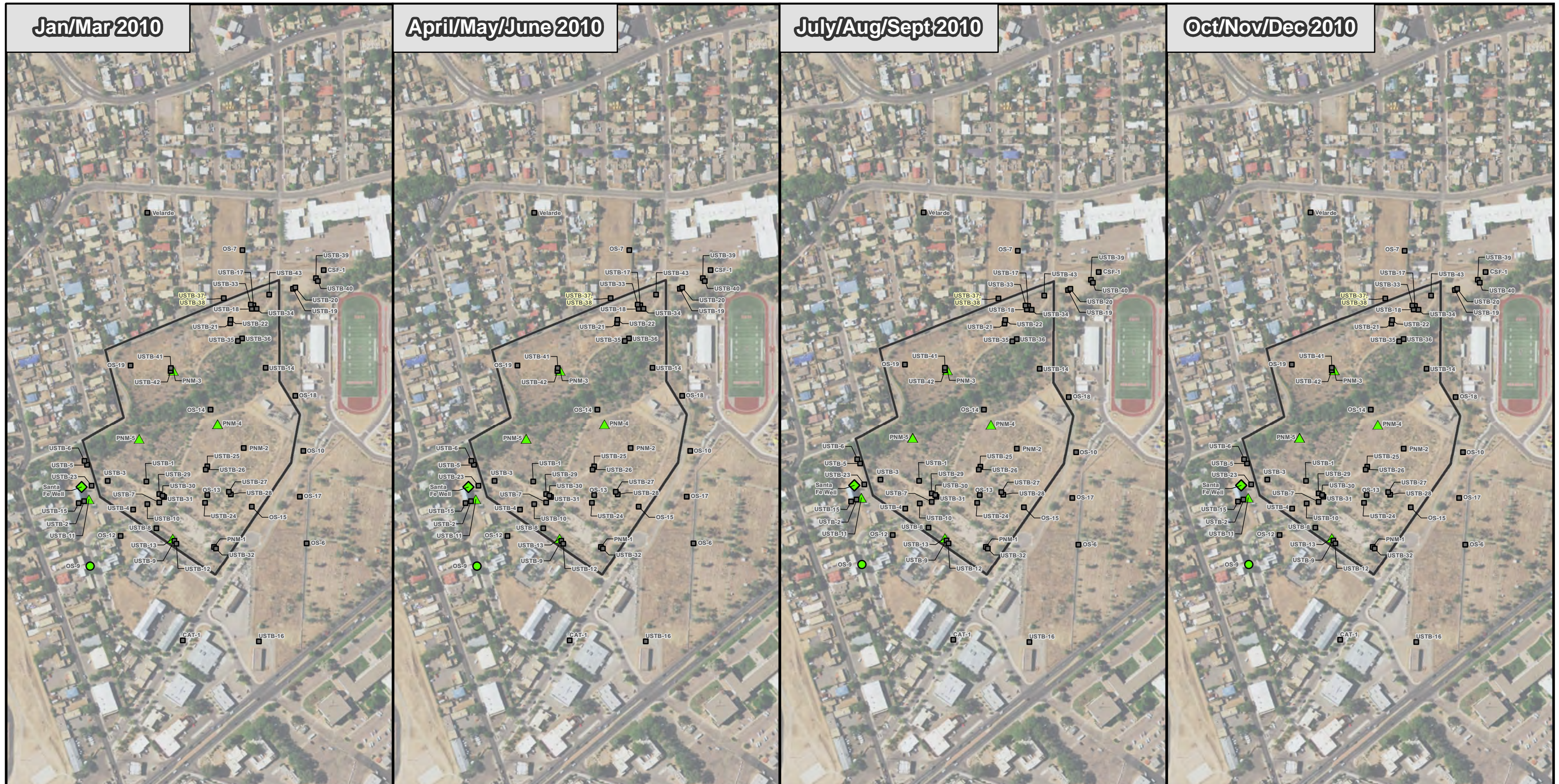
Nitrate Concentrations
2018
PNM

Jan/Mar 2010

April/May/June 2010

July/Aug/Sept 2010

Oct/Nov/Dec 2010



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

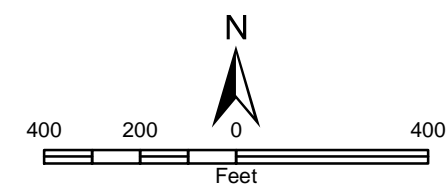
Non Detect
<1
≥1 - 5
≥5

Intermediate

Non Detect
<1
≥1 - 5
≥5

Deep

Non Detect
<1
≥1 - 5
≥5



PCE Concentrations
2010
PNM



Shallow

- Non Detect
- <1
- >=1 - 5
- >=5

Intermediate

- Non Detect
- <1
- >=1 - 5
- >=5

Deep

- Non Detect
- <1
- >=1 - 5
- >=5

Legend

- Proposed Monitoring Well
- Site Boundary
- Not Sampled

Scale

400 200 0 400

Feet

PCE Concentrations

2011

PNM

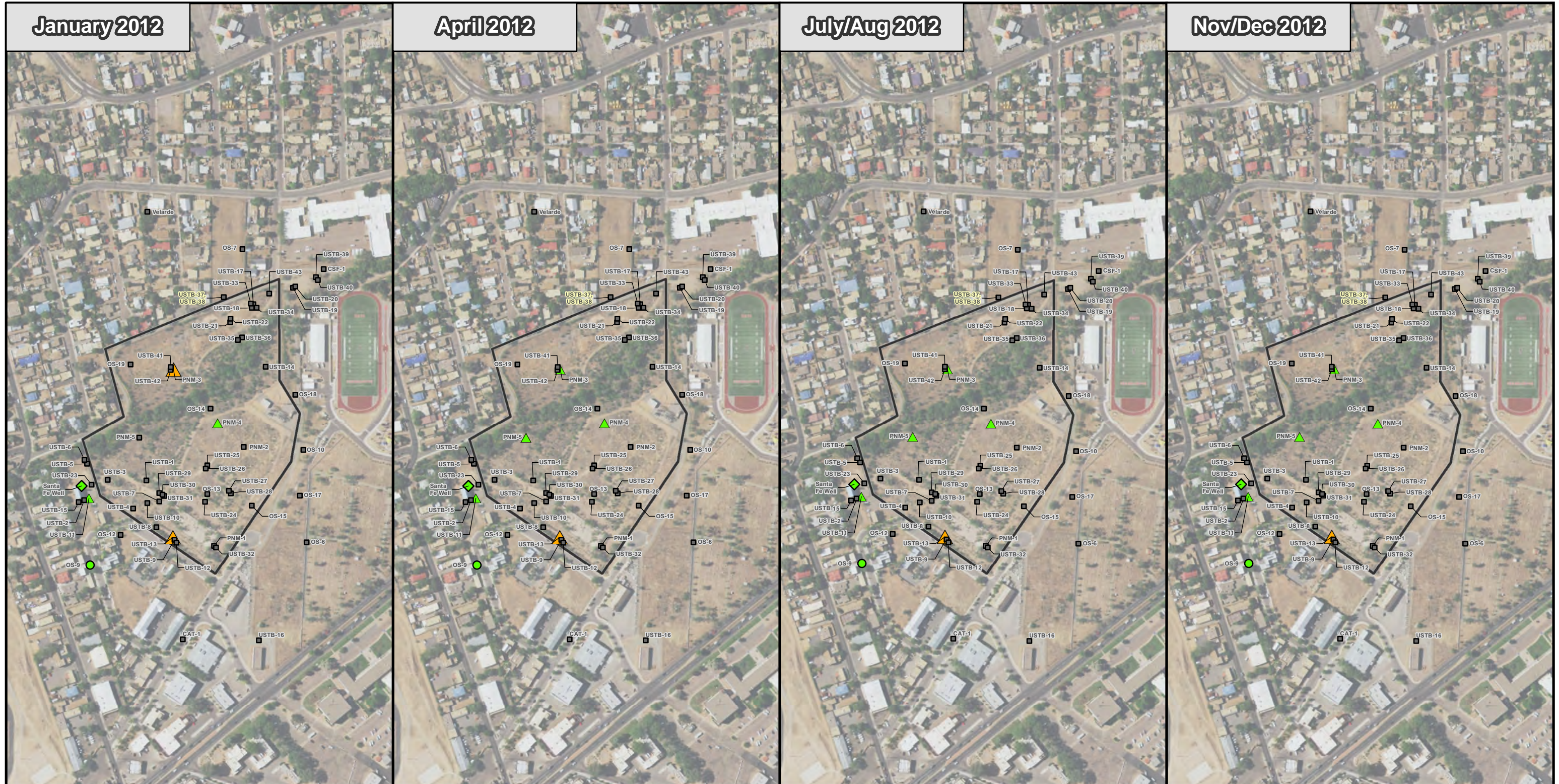
INTERA Source(s):

January 2012

April 2012

July/Aug 2012

Nov/Dec 2012



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

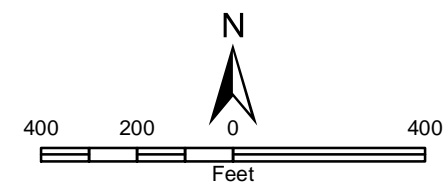
Non Detect
<1
>=1 - 5
>=5

Intermediate

Non Detect
<1
>=1 - 5
>=5

Deep

Non Detect
<1
>=1 - 5
>=5



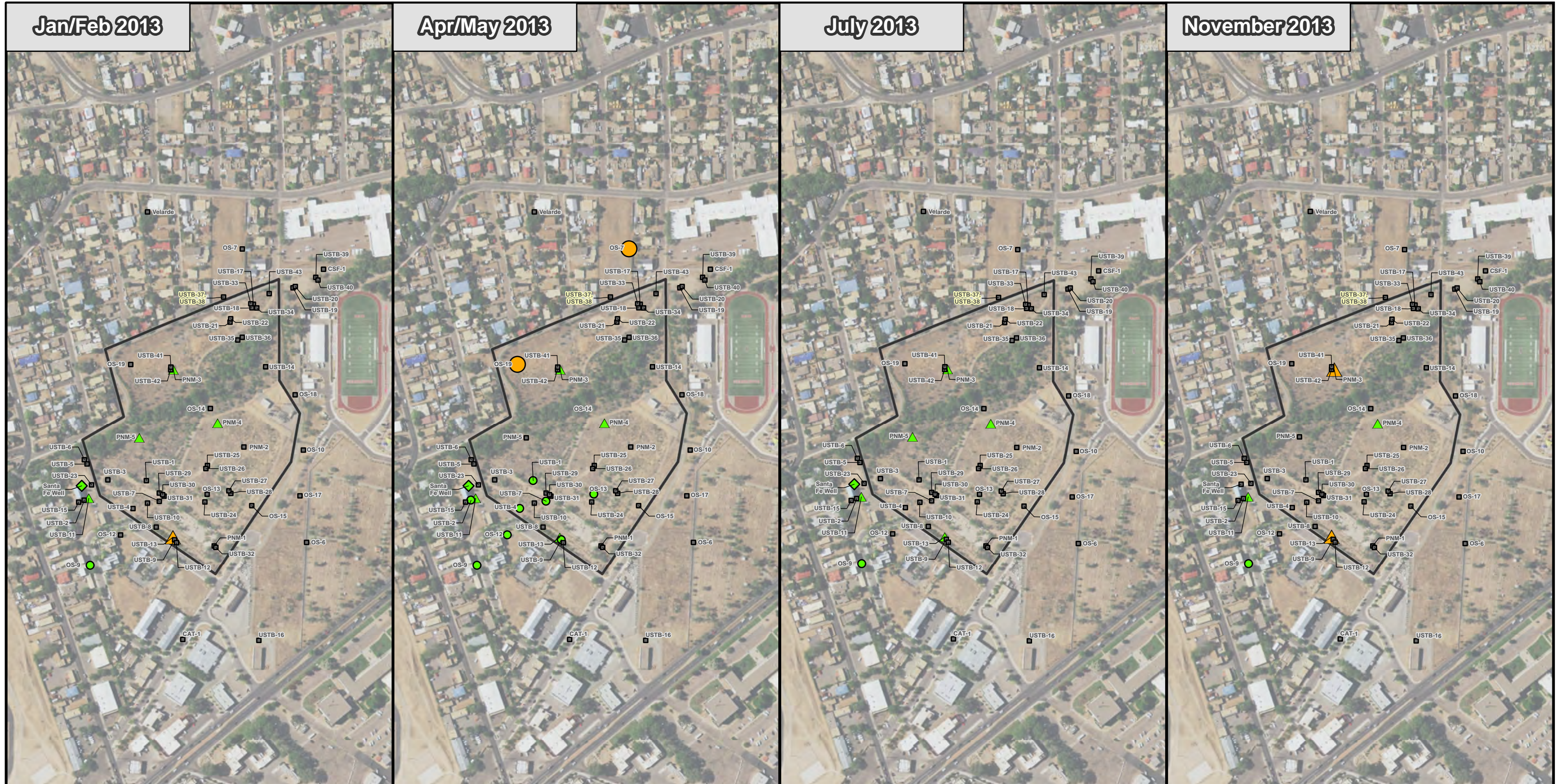
PCE Concentrations
2012
PNM

Jan/Feb 2013

Apr/May 2013

July 2013

November 2013



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

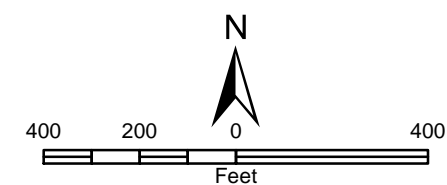
Non Detect
<1
≥1 - 5
≥5

Intermediate

Non Detect
<1
≥1 - 5
≥5

Deep

Non Detect
<1
≥1 - 5
≥5



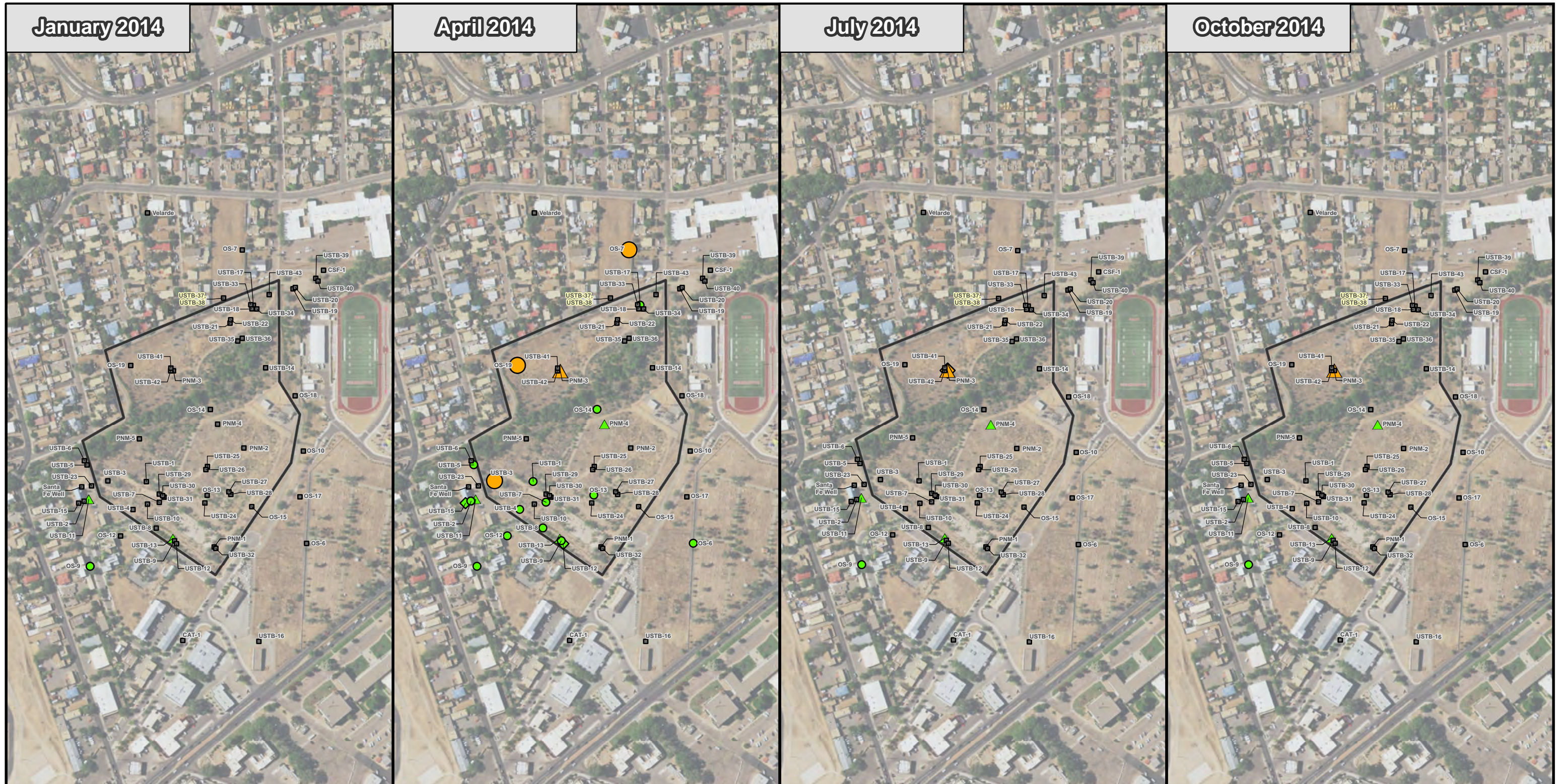
PCE Concentrations
2013
PNM

January 2014

April 2014

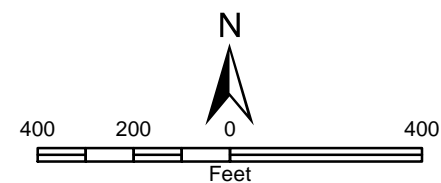
July 2014

October 2014



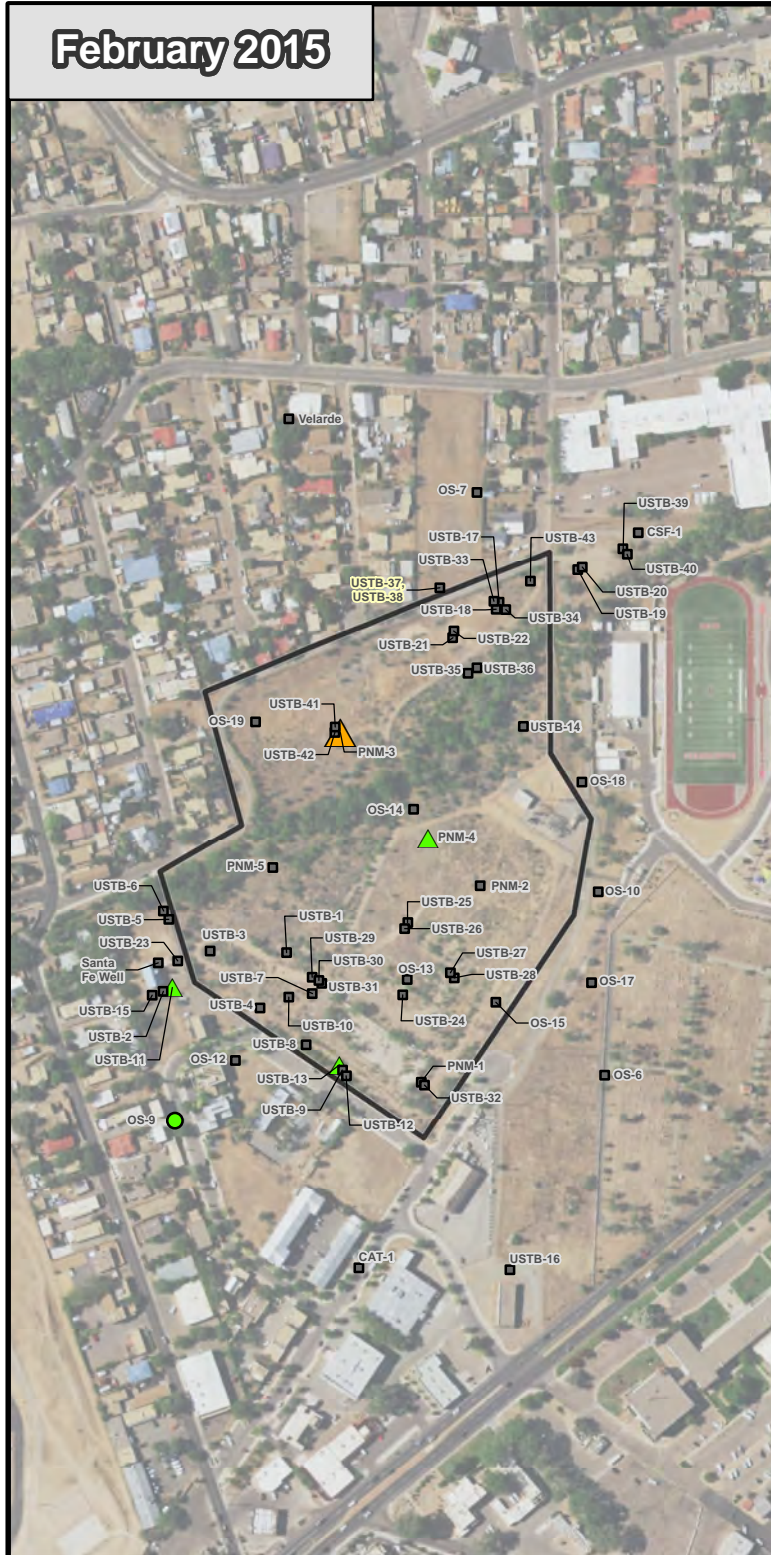
Proposed Monitoring Well
 Site Boundary
 Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <1	▲ <1	◆ <1
● >=1 - 5	▲ >=1 - 5	◆ >=1 - 5
● >=5	▲ >=5	◆ >=5

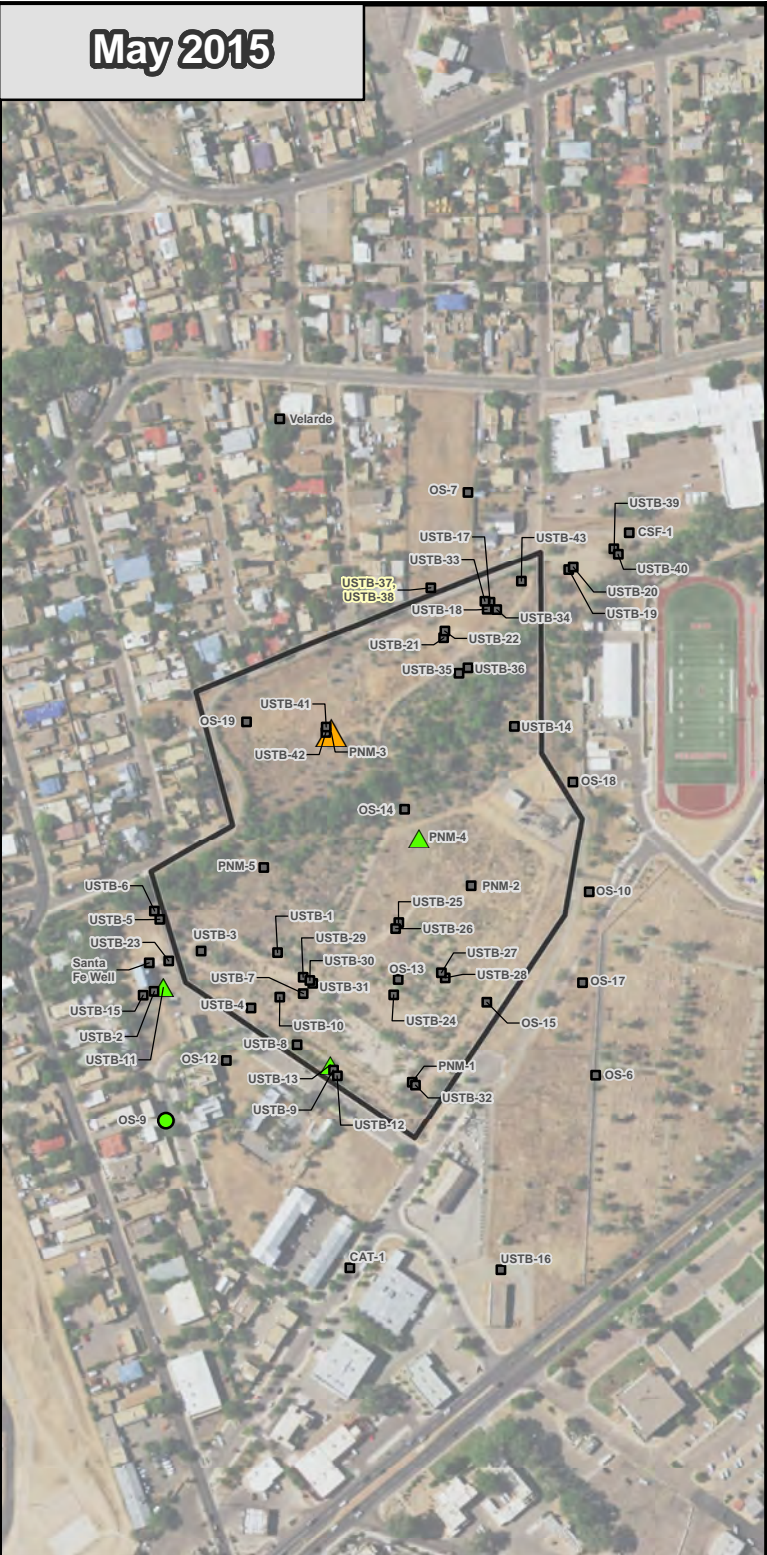


PCE Concentrations
 2014
 PNM

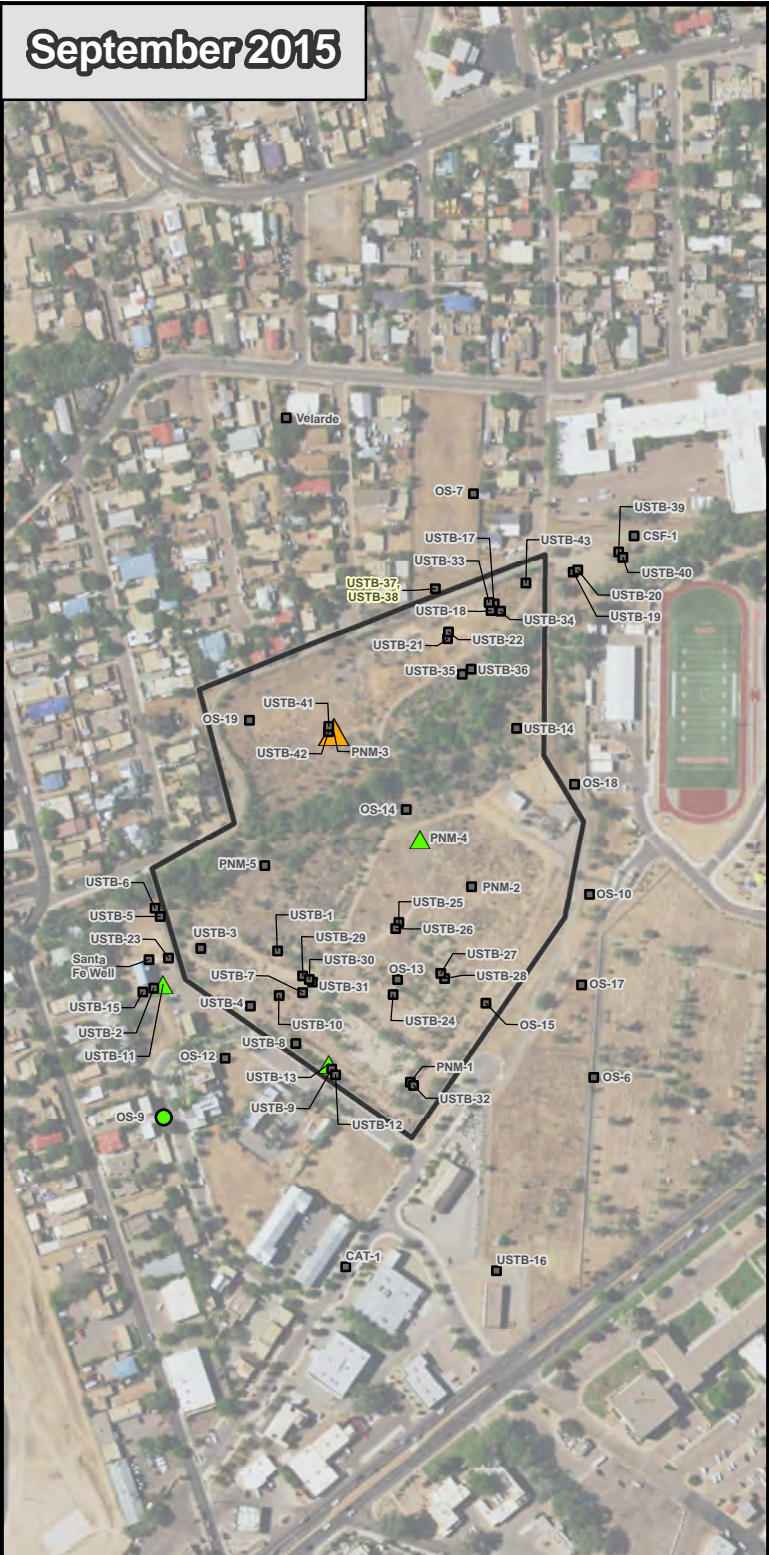
February 2015



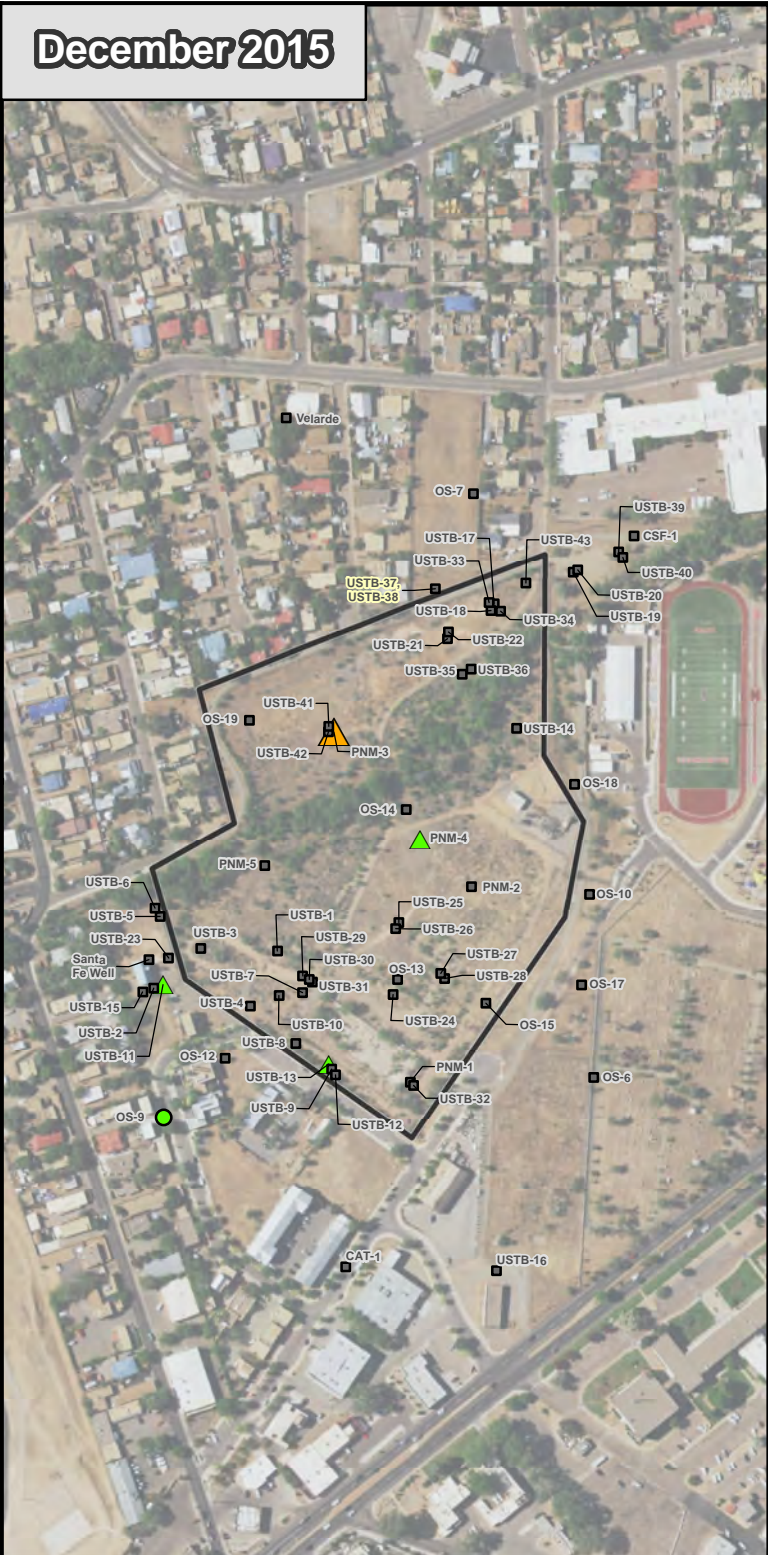
May 2015



September 2015

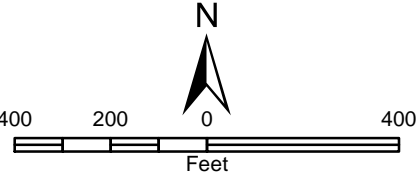


December 2015



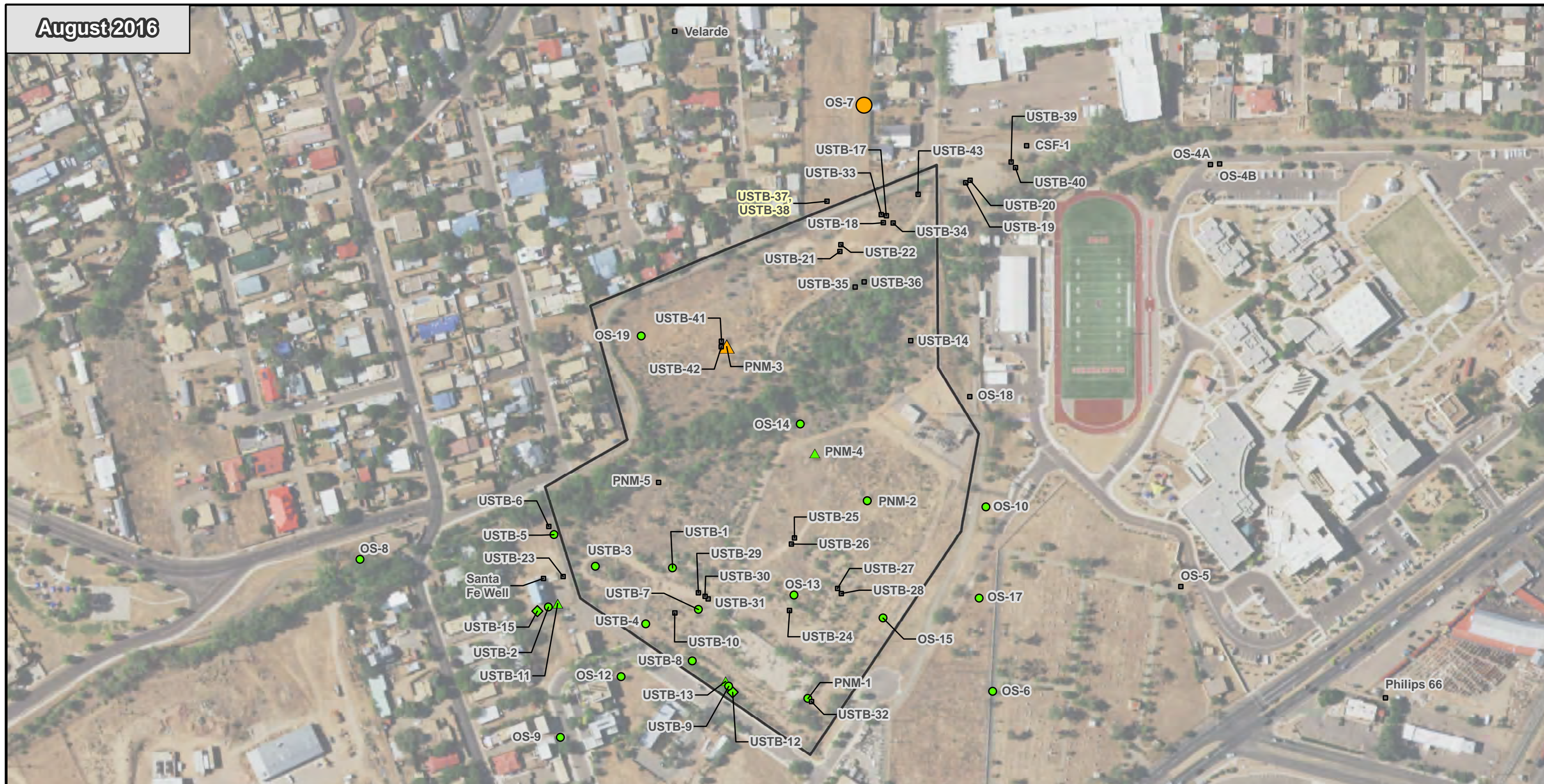
Proposed Monitoring Well
Site Boundary
Not Sampled

Shallow	Intermediate	Deep
Non Detect	Non Detect	Non Detect
<1	<1	<1
>=1 - 5	>=1 - 5	>=1 - 5
>=5	>=5	>=5



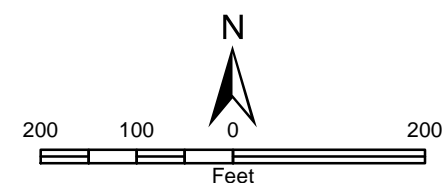
PCE Concentrations
2015
PNM

August 2016



Proposed Monitoring Well
Site Boundary
Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <1	▲ <1	◆ <1
● ≥1 - 5	▲ ≥1 - 5	◆ ≥1 - 5
● ≥5	▲ ≥5	◆ ≥5



PCE Concentrations
2016
PNM

May 2018

Velarde

OS-7

USTB-17

USTB-33

USTB-37, USTB-38

USTB-18

USTB-21

USTB-22

USTB-35

USTB-36

USTB-43

USTB-39

CSF-1

USTB-40

USTB-20

USTB-19

USTB-34

USTB-14

OS-18

USTB-41

OS-19

USTB-42

PNM-3

OS-14

PNM-4

PNM-5

USTB-6

USTB-5

USTB-23

Santa Fe Well

USTB-15

USTB-2

USTB-11

OS-12

USTB-3

USTB-1

USTB-29

USTB-30

USTB-31

USTB-7

USTB-4

USTB-10

USTB-8

USTB-13

USTB-9

USTB-12

PNM-1

USTB-32

OS-13

USTB-25

USTB-26

USTB-27

USTB-28

OS-15

OS-10

OS-17

OS-6

OS-9

July/August 2018

Velarde

Map labels include:

- USTB-1 through USTB-43
- OS-6 through OS-19
- PNM-1 through PNM-5
- CSF-1
- Santa Fe Well
- USTB-37, USTB-38 (highlighted in yellow)

A large red circle is positioned near USTB-43 and USTB-20, indicating a specific area of interest.

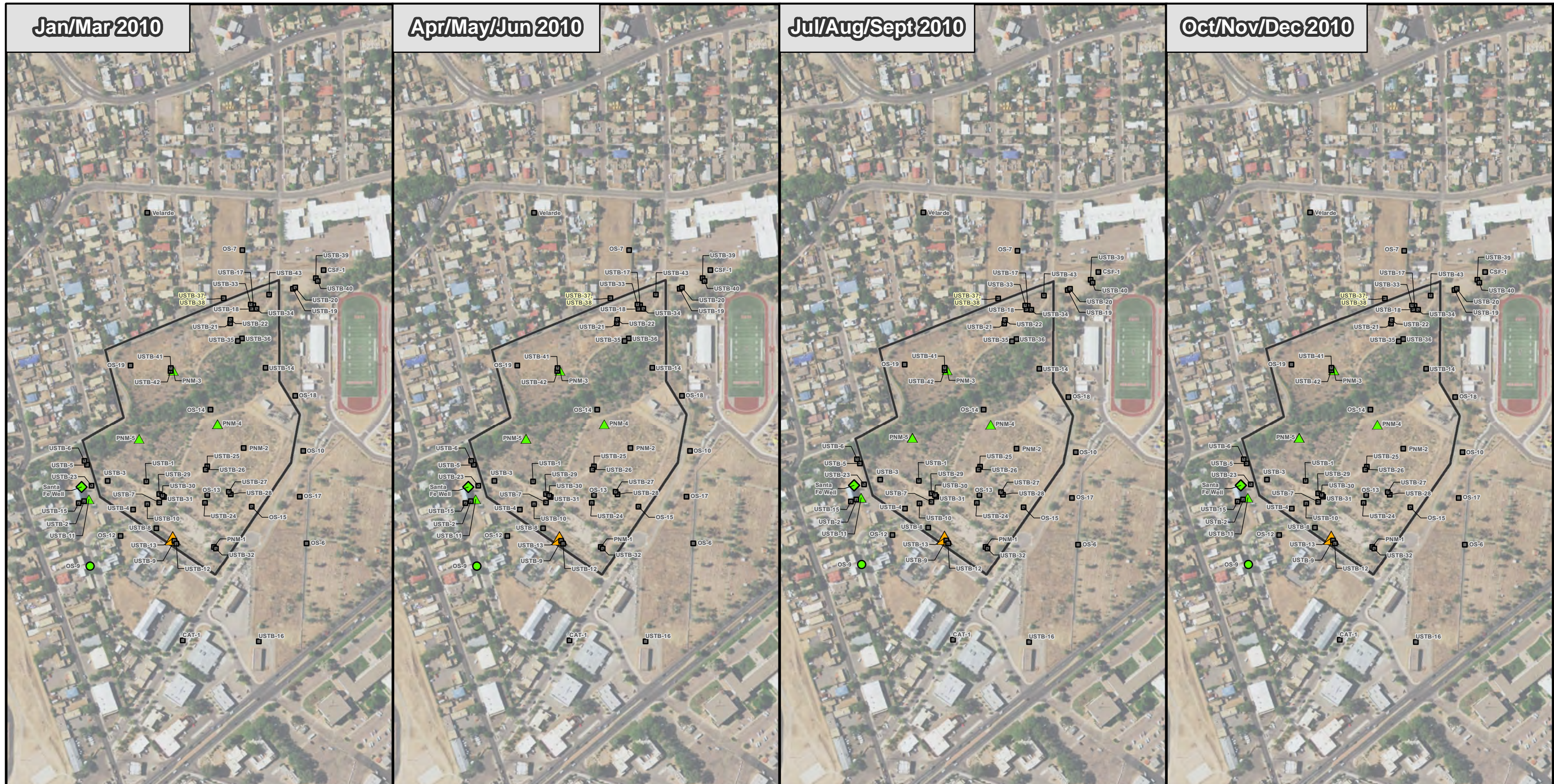
FILE: S:\ABQ\PNMRS.M001.S1AP\Graphics\MapDocs\CVOC\PCE\PCE_2018.mxd 5/20/2019

Jan/Mar 2010

Apr/May/Jun 2010

Jul/Aug/Sept 2010

Oct/Nov/Dec 2010



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

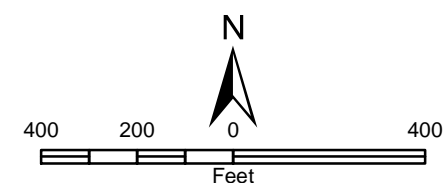
Non Detect
<1
<1 - 5
>1 - 5

Intermediate

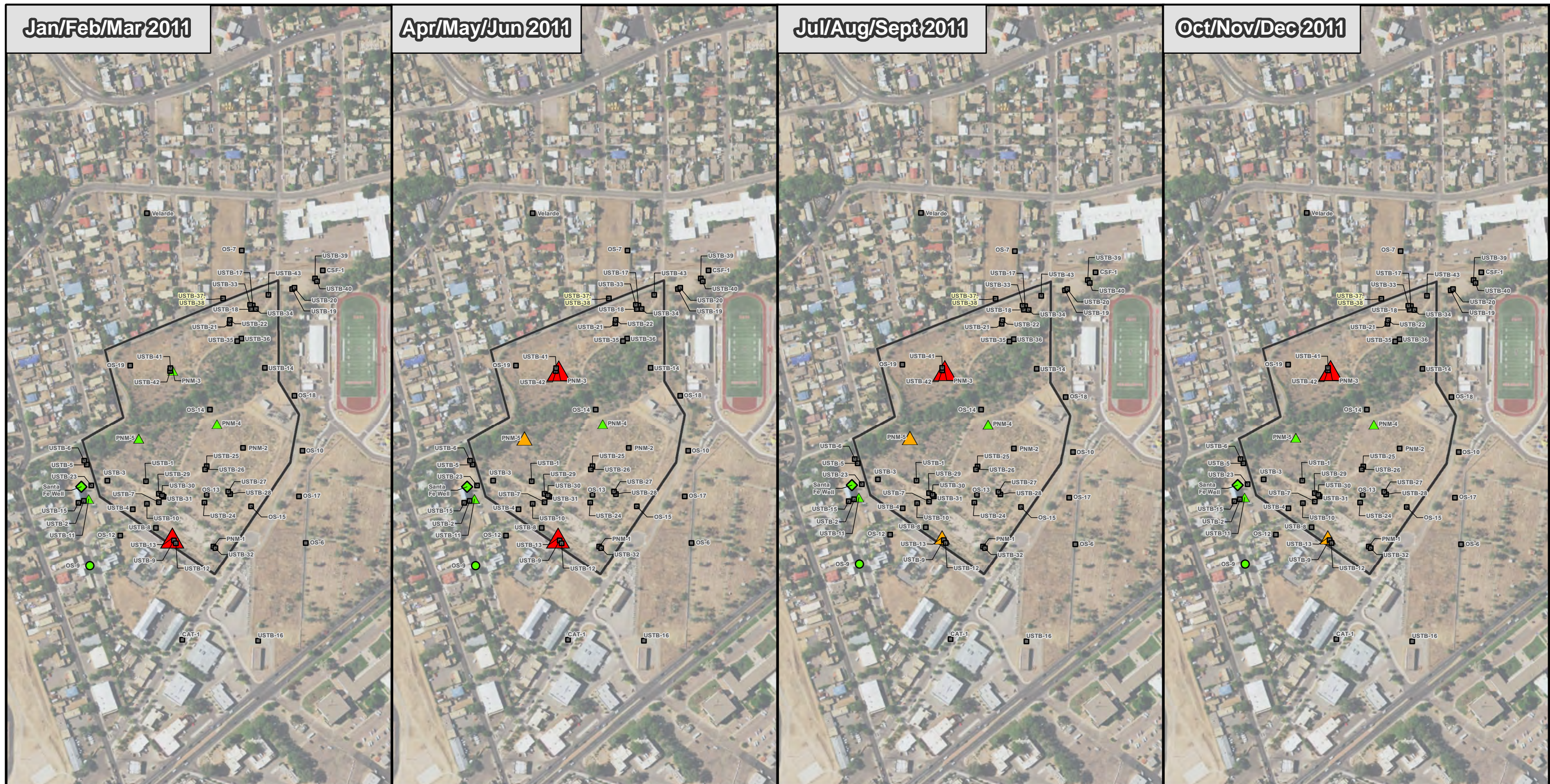
Non Detect
<1
<1 - 5
>1 - 5

Deep

Non Detect
<1
<1 - 5
>1 - 5



TCE Concentrations
2010
PNM



Source(s):

Proposed Monitoring Well

Site Boundary

Not Sampled

Shallow	Intermediate	Deep
Non Detect	Non Detect	Non Detect
<1	<1	<1
<=1 - 5	<=1 - 5	<=1 - 5
>=5	>=5	>=5

N

400 200 0 400

Feet

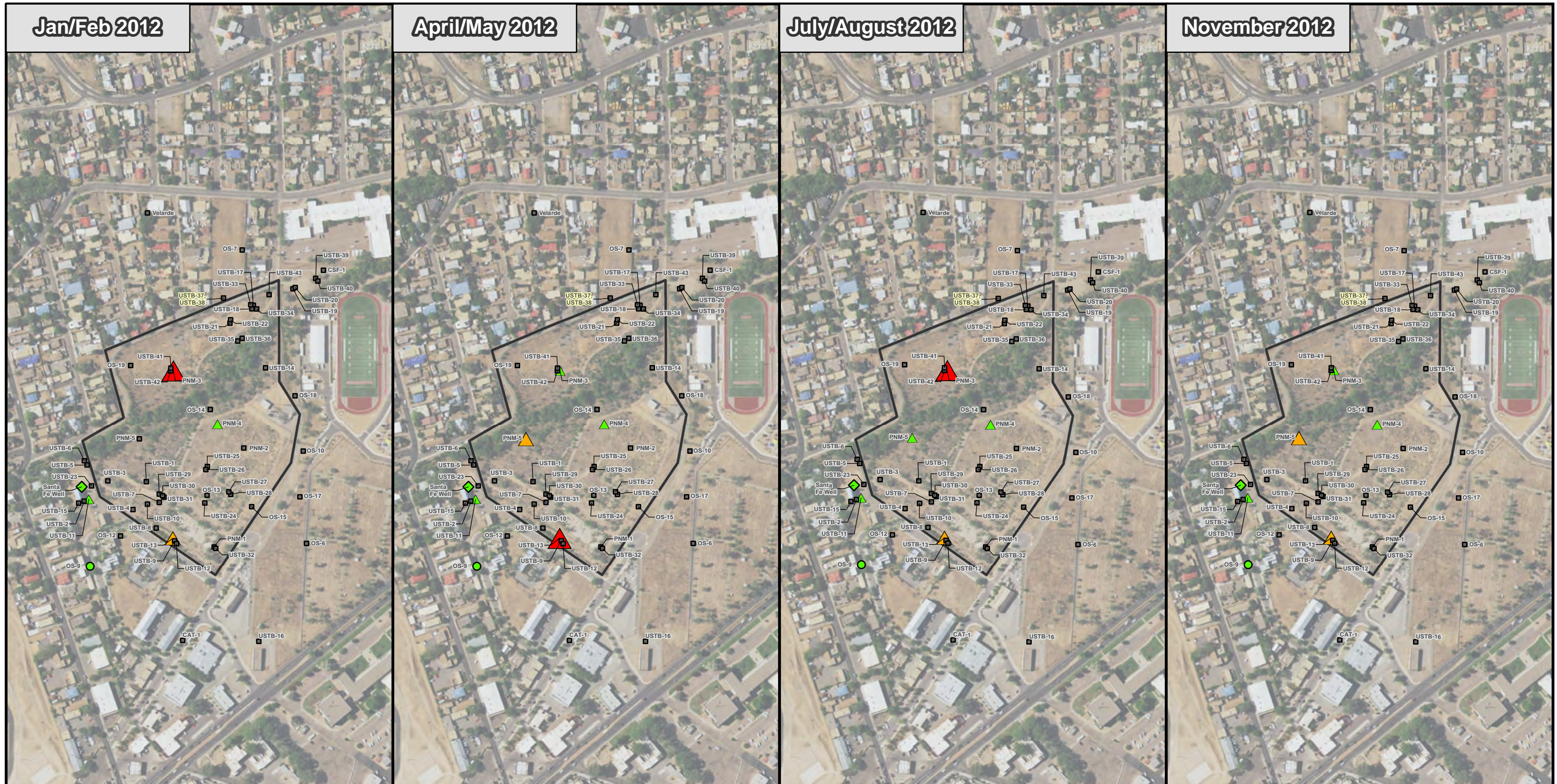
TCE Concentrations
2011
PNM

Jan/Feb 2012

April/May 2012

July/August 2012

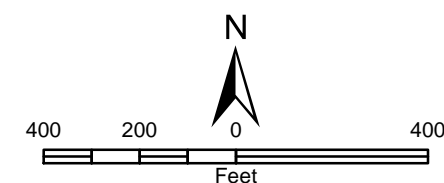
November 2012



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <1	▲ <1	◆ <1
● <=1 - 5	▲ <=1 - 5	◆ <=1 - 5
● >=5	▲ >=5	◆ >=5



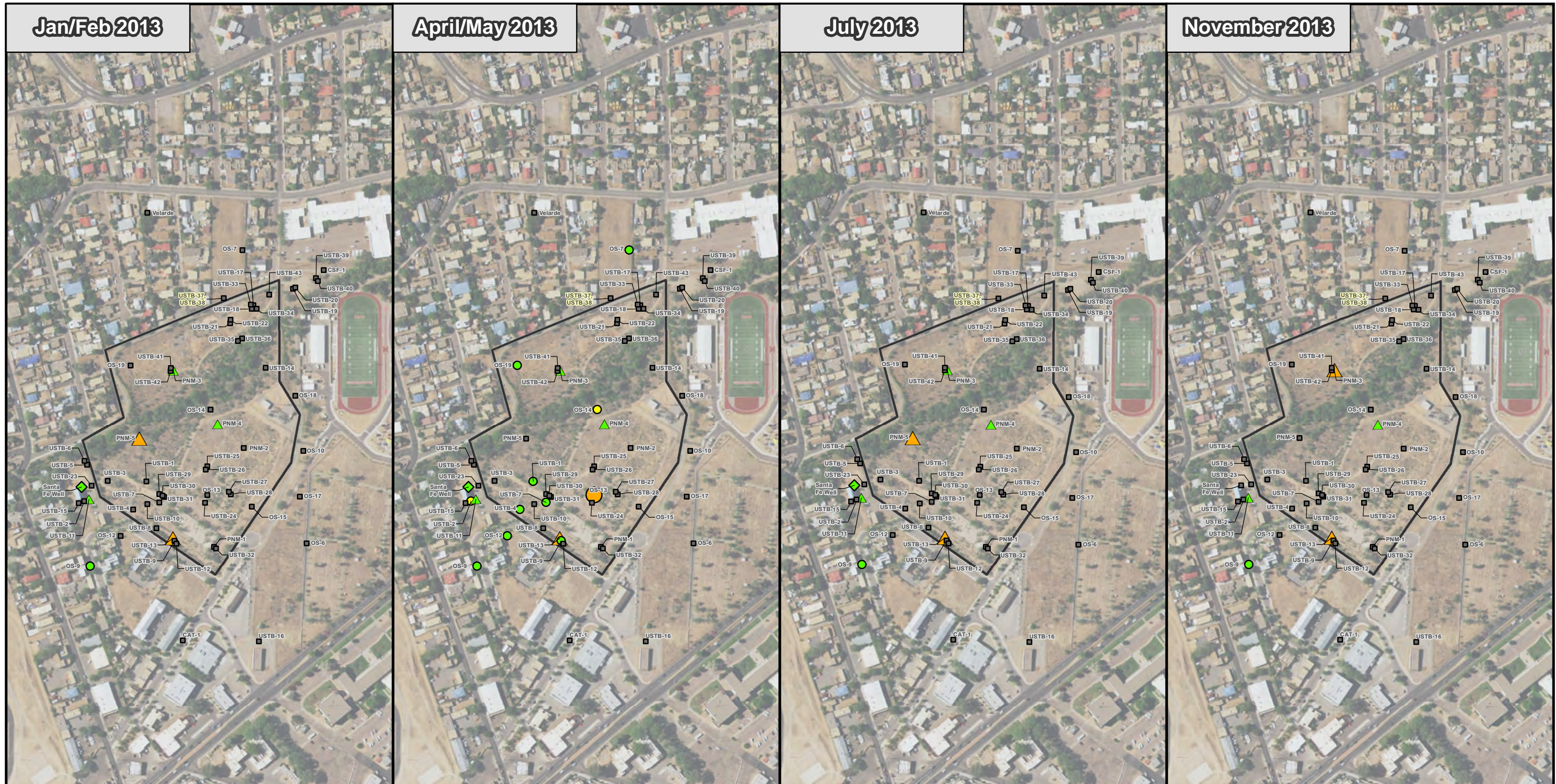
TCE Concentrations
2012
PNM

Jan/Feb 2013

April/May 2013

July 2013

November 2013



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

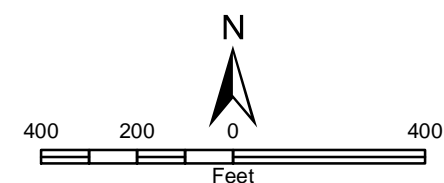
Non Detect
<1
<=1 - 5
>=5

Intermediate

Non Detect
<1
<=1 - 5
>=5

Deep

Non Detect
<1
<=1 - 5
>=5



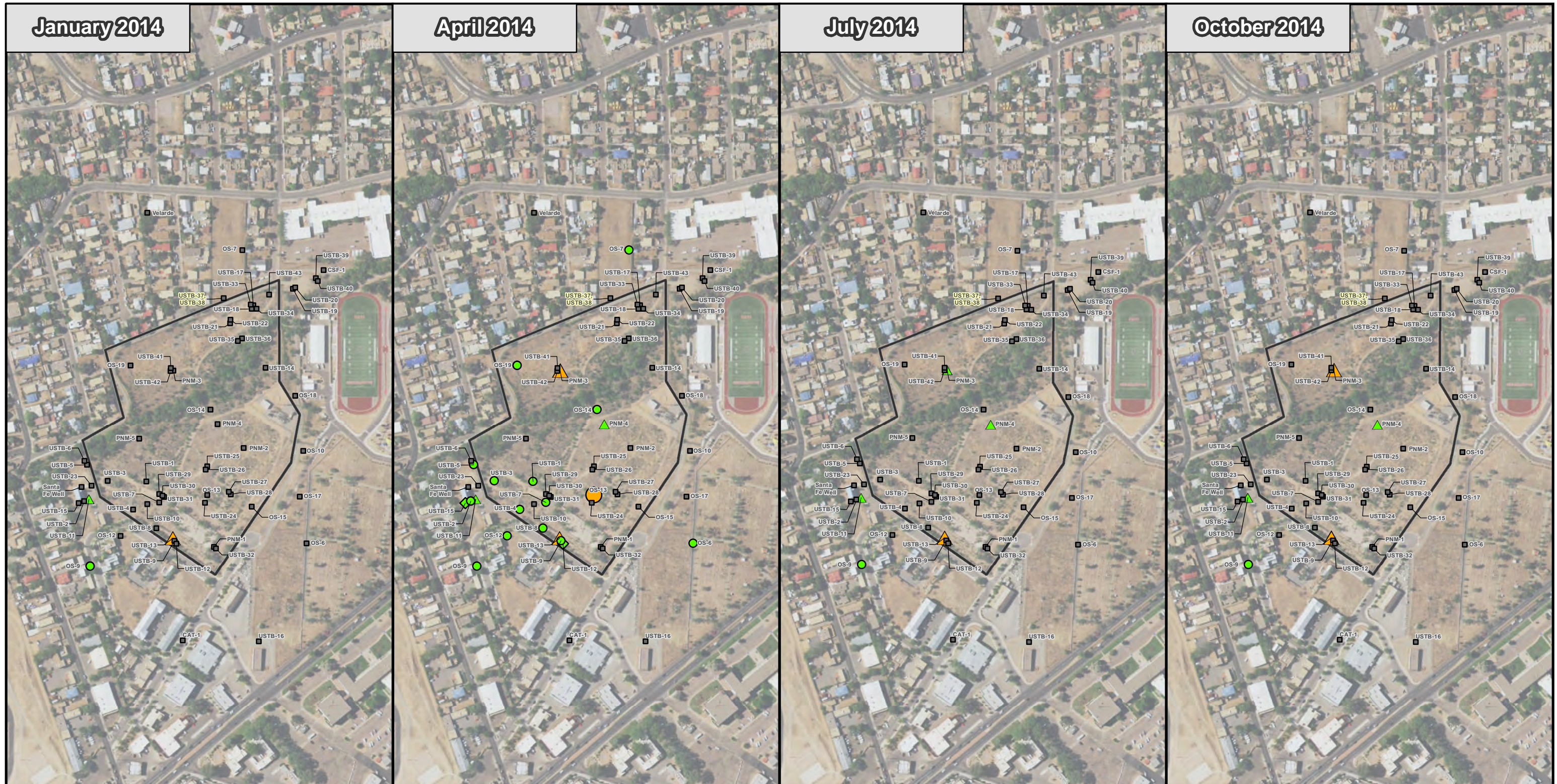
TCE Concentrations
2013
PNM

January 2014

April 2014

July 2014

October 2014



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

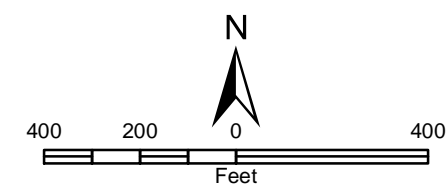
Non Detect
<1
<=1 - 5
>=5

Intermediate

Non Detect
<1
<=1 - 5
>=5

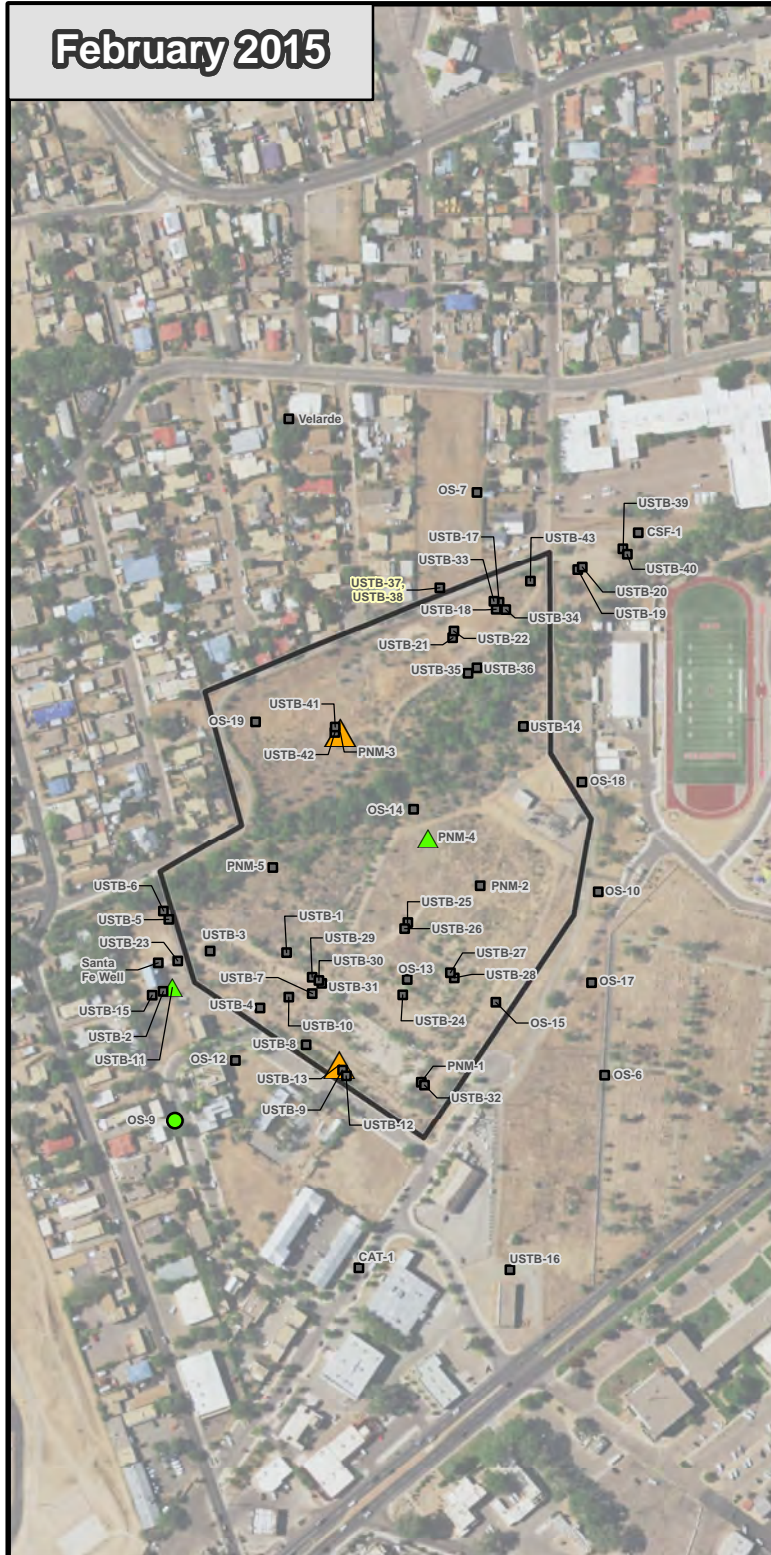
Deep

Non Detect
<1
<=1 - 5
>=5

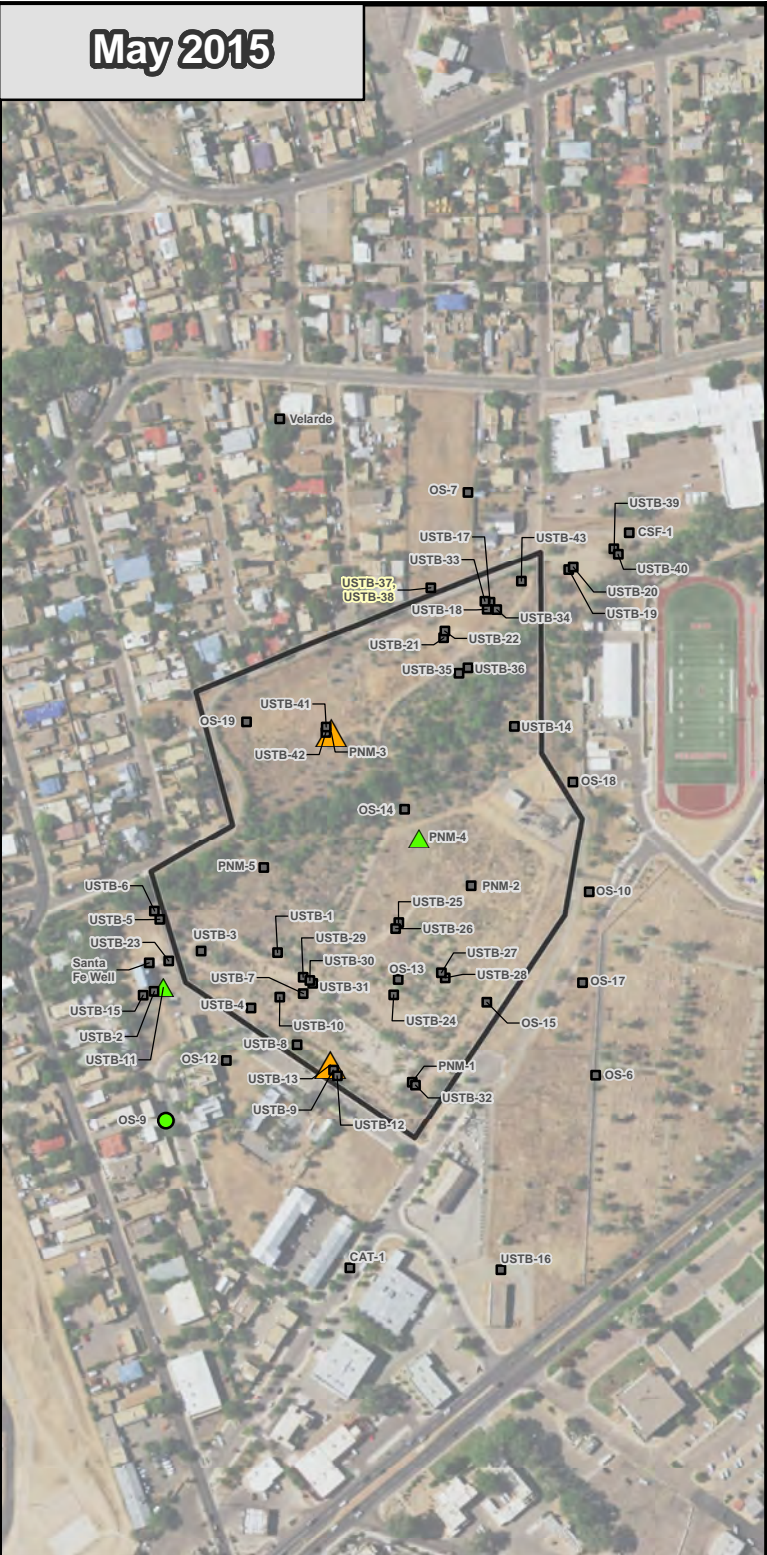


TCE Concentrations
2014
PNM

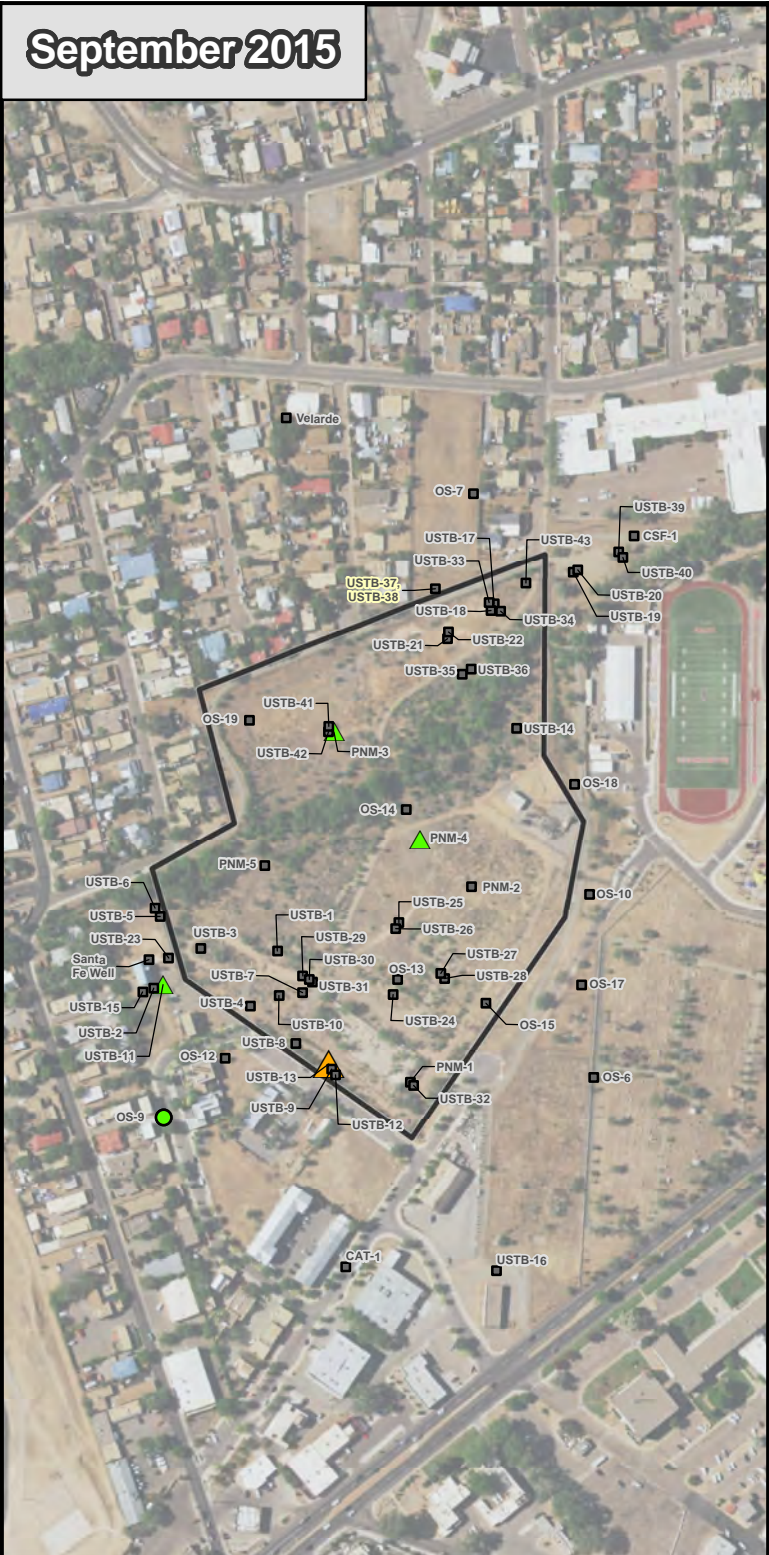
February 2015



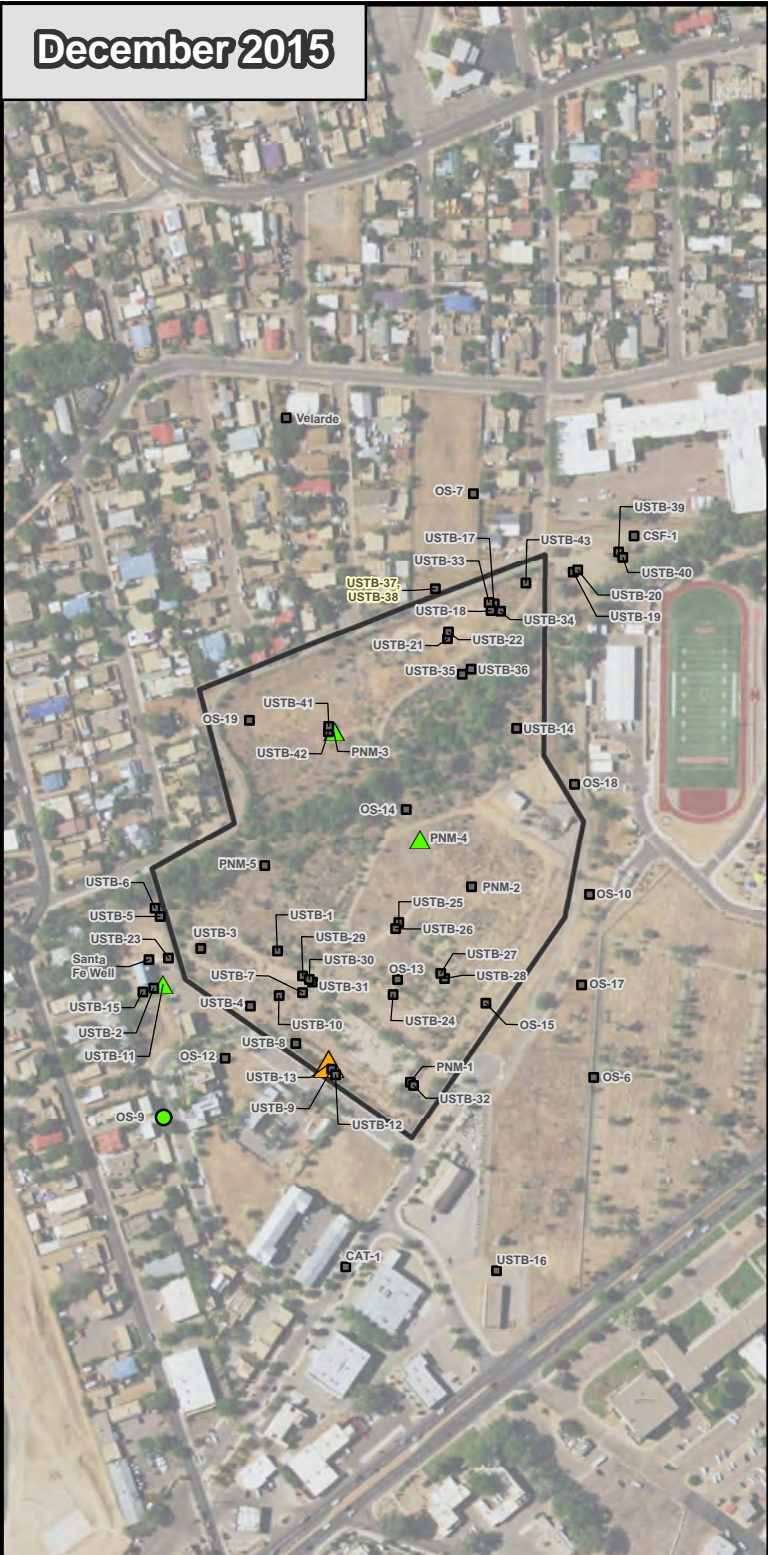
May 2015



September 2015

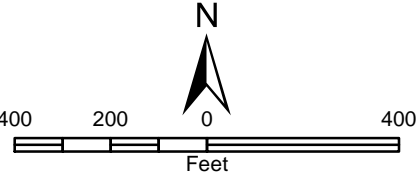


December 2015



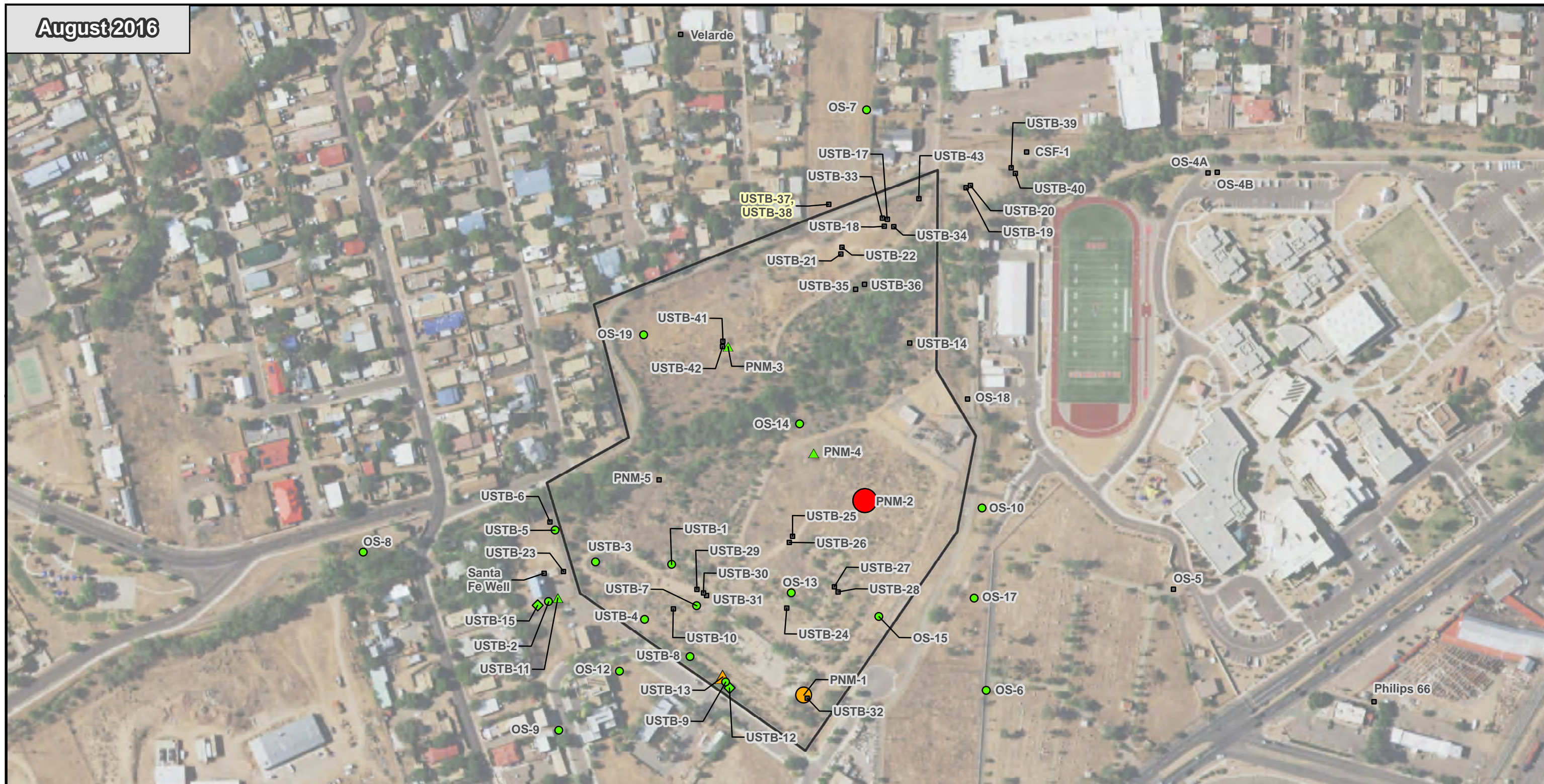
Proposed Monitoring Well
Site Boundary
Not Sampled

Shallow	Intermediate	Deep
Non Detect	Non Detect	Non Detect
<1	<1	<1
<=1 - 5	<=1 - 5	<=1 - 5
>=5	>=5	>=5



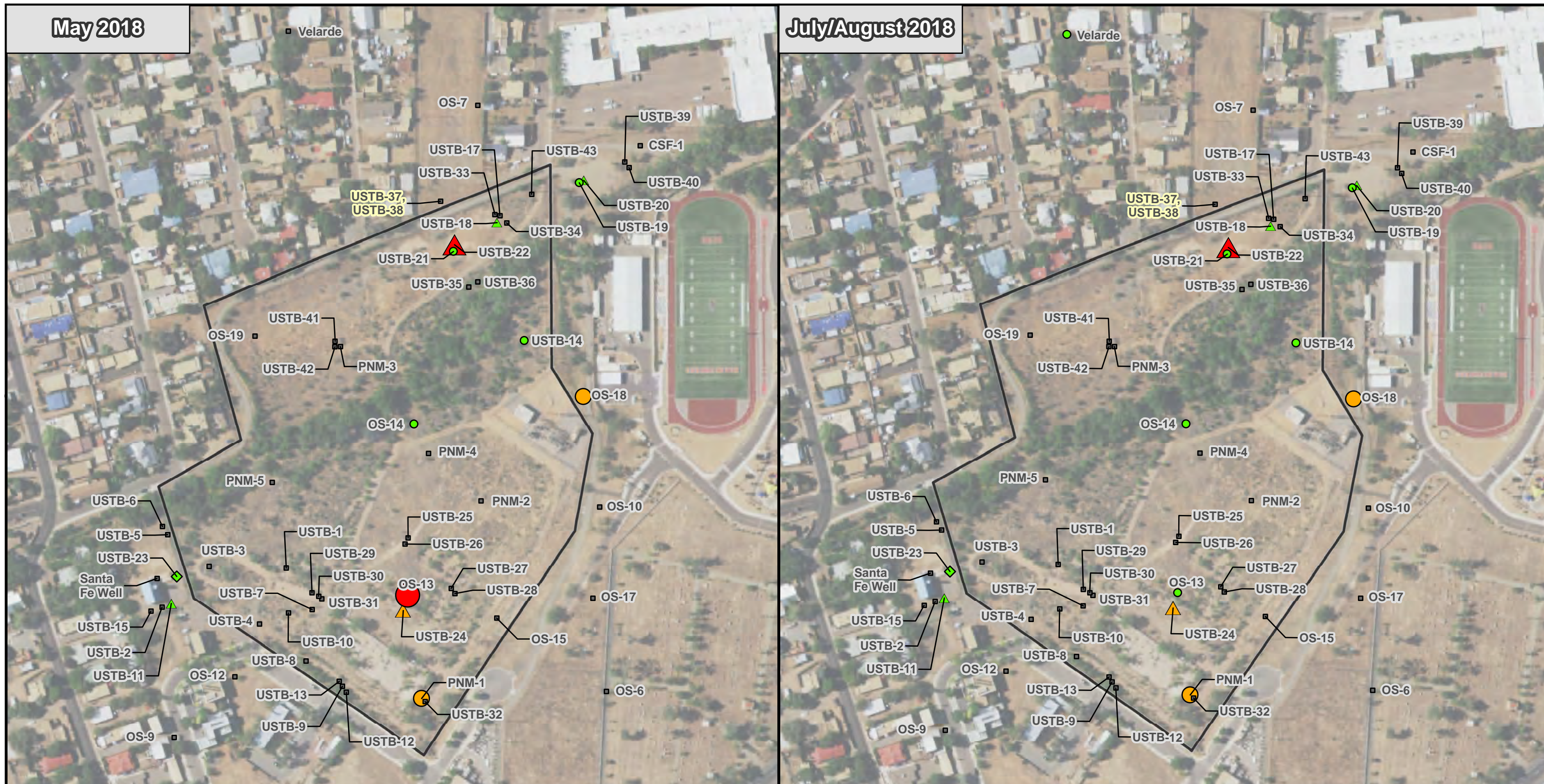
TCE Concentrations
2015
PNM

August 2016



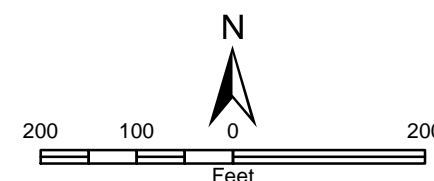
May 2018

July/August 2018



Proposed Monitoring Well
 Site Boundary
 Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <1	▲ <1	◆ <1
● <=1 - 5	▲ <=1 - 5	◆ <=1 - 5
● >=5	▲ >=5	◆ >=5



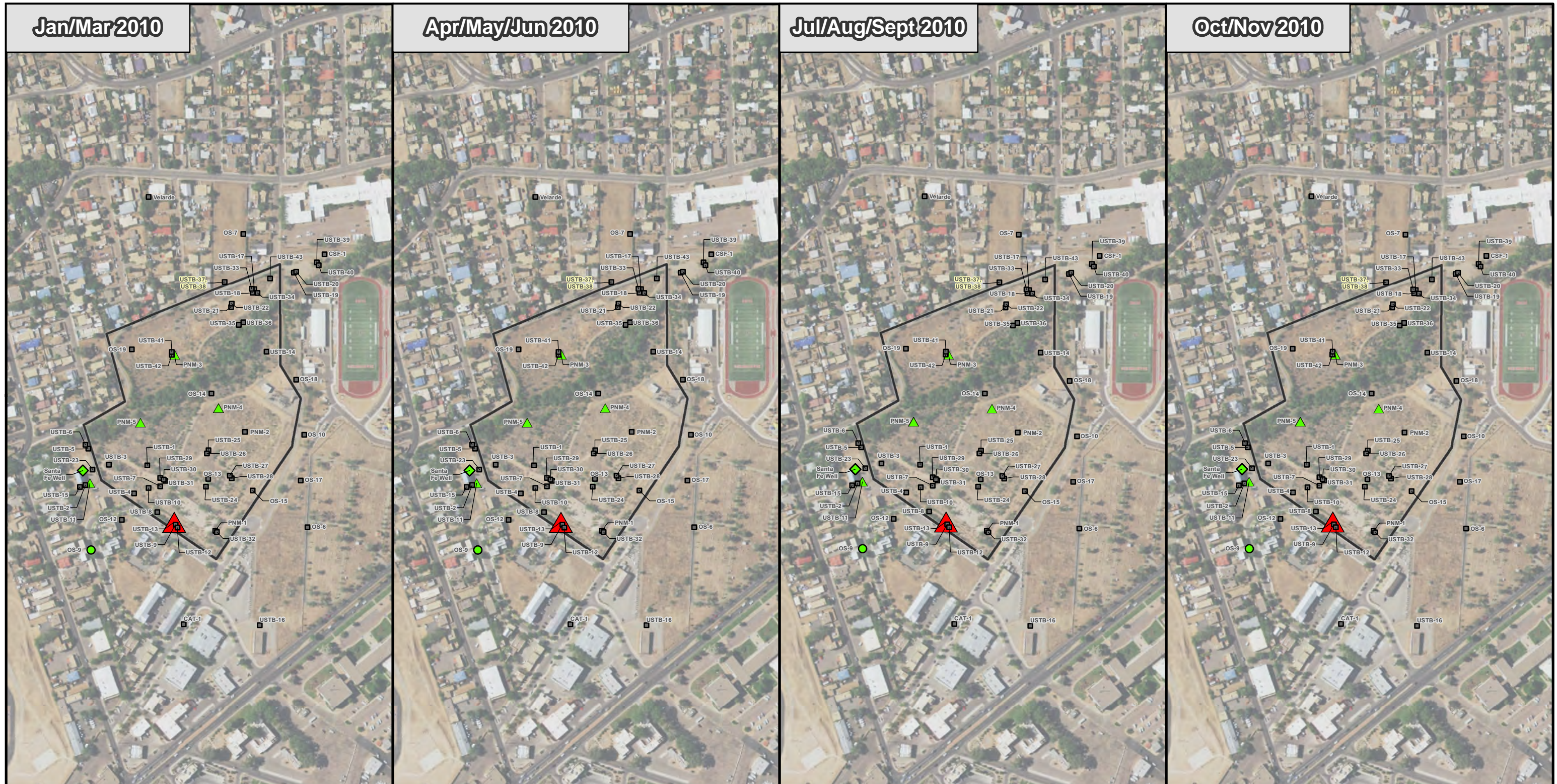
TCE Concentrations
 2018
 PNM

Jan/Mar 2010

Apr/May/Jun 2010

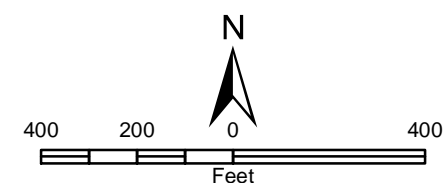
Jul/Aug/Sept 2010

Oct/Nov 2010

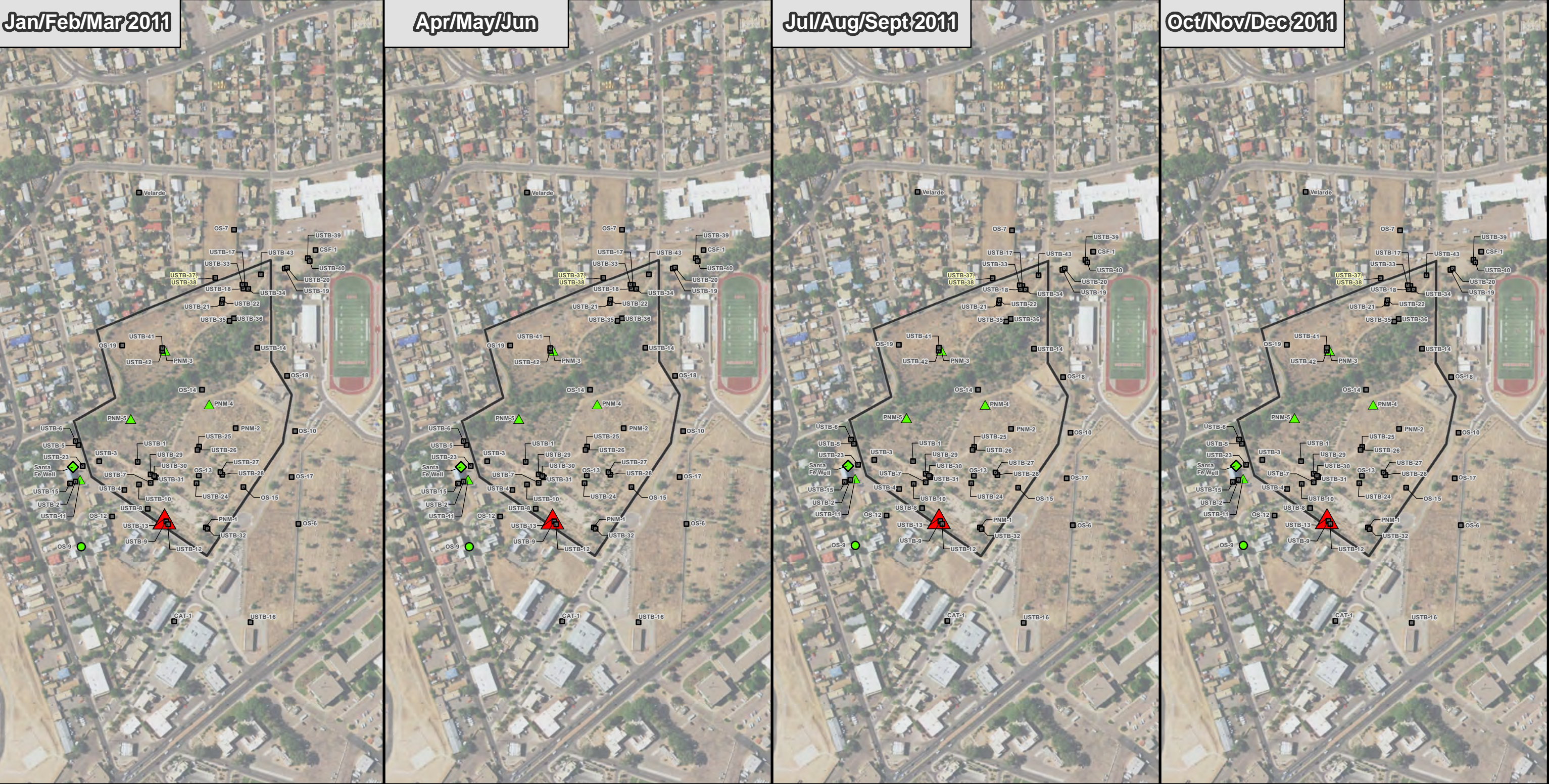


Proposed Monitoring Well
 Site Boundary
 Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <2	▲ <2	◆ <2
● >=2 - 7	▲ >=2 - 7	◆ >=2 - 7
● >=7	▲ >7	◆ >7



1,1-DCE Concentrations
 2010
 PNM



INTERA

Source(s):

Proposed Monitoring Well

Site Boundary

Not Sampled

Shallow

Intermediate

Deep

Non Detect

<2

>=2 - 7

>=7

Non Detect

<2

>=2 - 7

>7

Non Detect

<2

>=2 - 7

>7

0

200

400

Feet

1,1-DCE Concentrations

2011

PNM

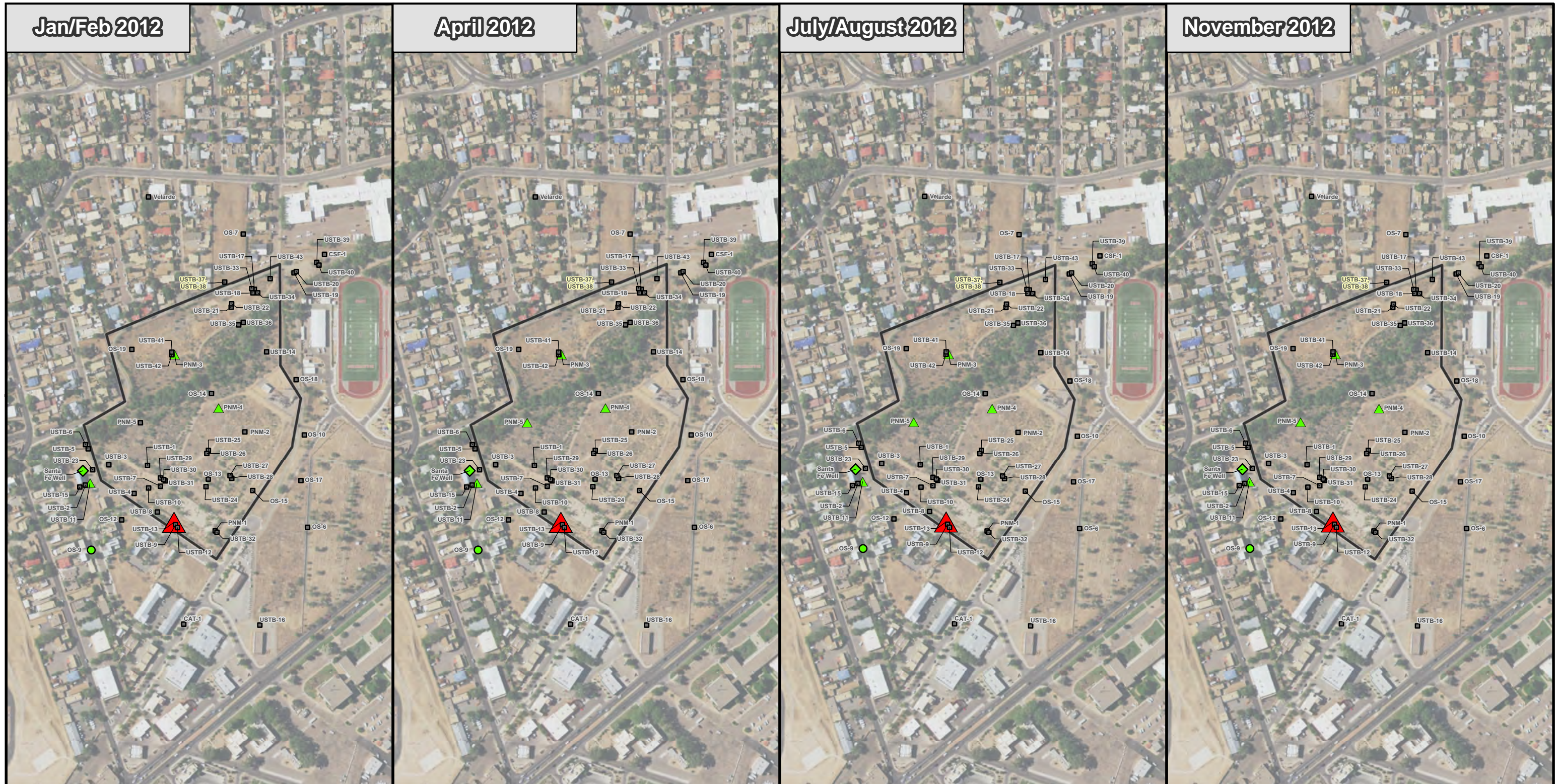
FILE: S:\ABQ\PNMRS.M001.S1AP\Graphics\MapDocs\CVOC\11-DCE\11DCE_2011.mxd 17/05/2019

Jan/Feb 2012

April 2012

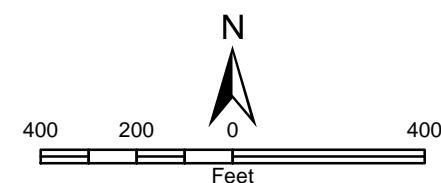
July/August 2012

November 2012



Proposed Monitoring Well
 Site Boundary
 Not Sampled

Shallow	Intermediate	Deep
● Non Detect	▲ Non Detect	◆ Non Detect
● <2	▲ <2	◆ <2
● ≥2 - 7	▲ ≥2 - 7	◆ ≥2 - 7
● ≥7	▲ >7	◆ >7



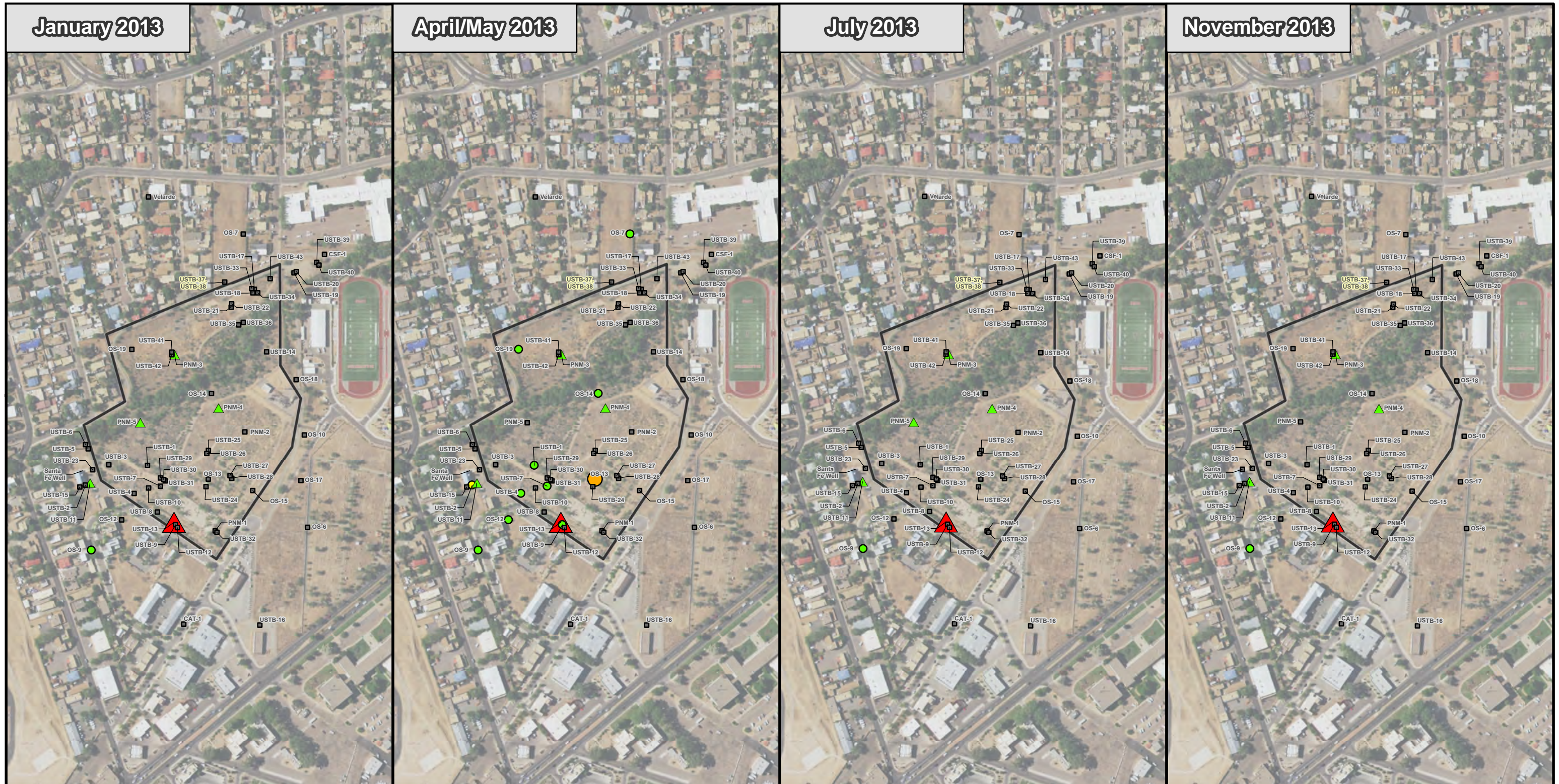
1,1-DCE Concentrations
 2012
 PNM

January 2013

April/May 2013

July 2013

November 2013



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

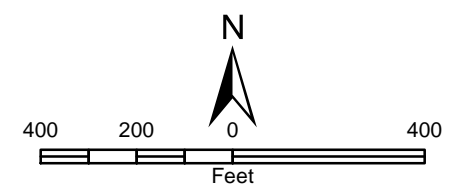
Non Detect
<2
>=2 - 7
>7

Intermediate

Non Detect
<2
>=2 - 7
>7

Deep

Non Detect
<2
>=2 - 7
>7



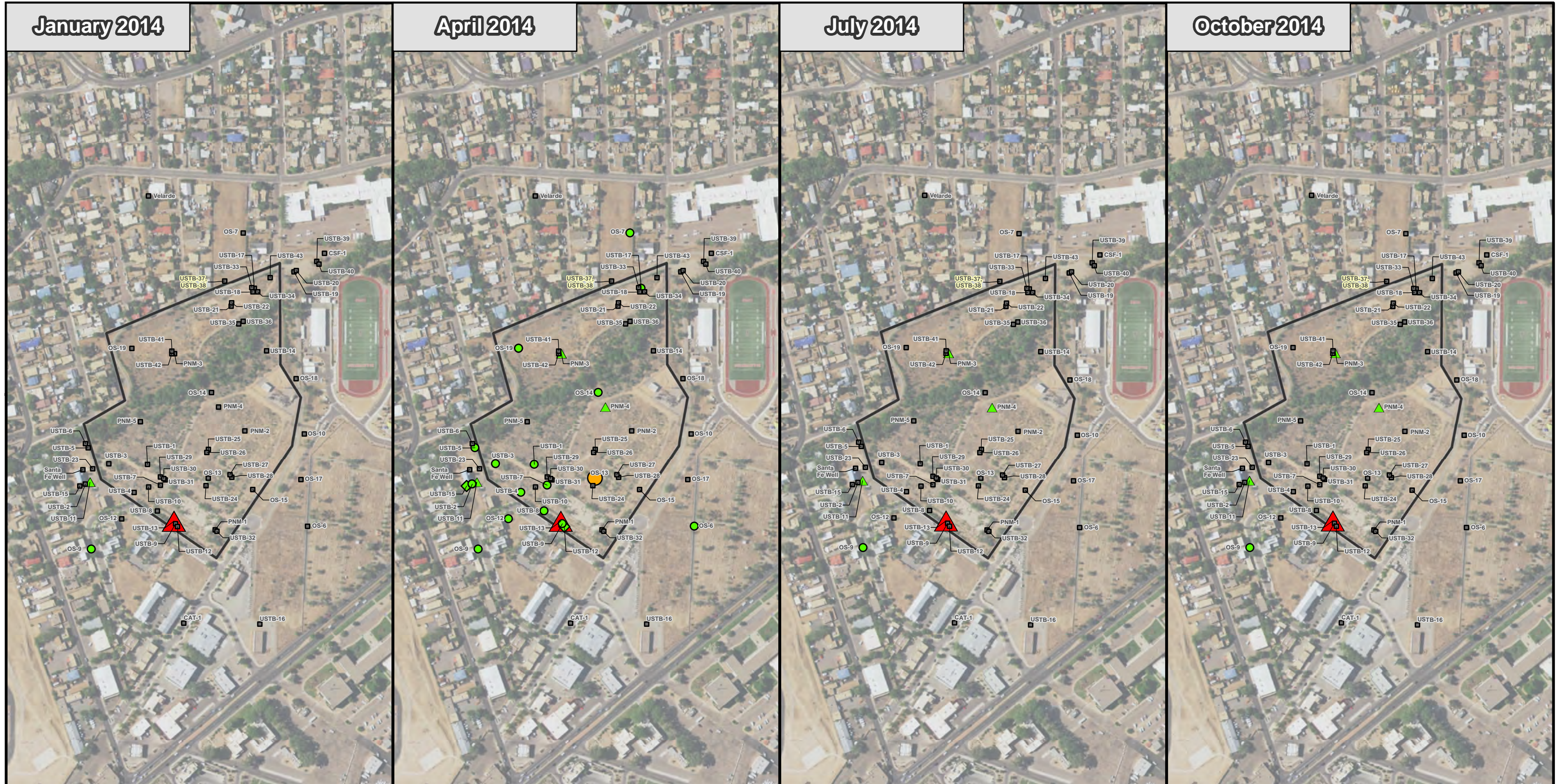
1,1-DCE Concentrations
2013
PNM

January 2014

April 2014

July 2014

October 2014



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

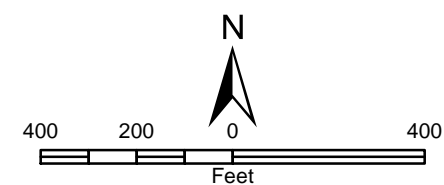
● Non Detect
● <2
● >=2 - 7
● >=7

Intermediate

▲ Non Detect
▲ <2
▲ >=2 - 7
▲ >7

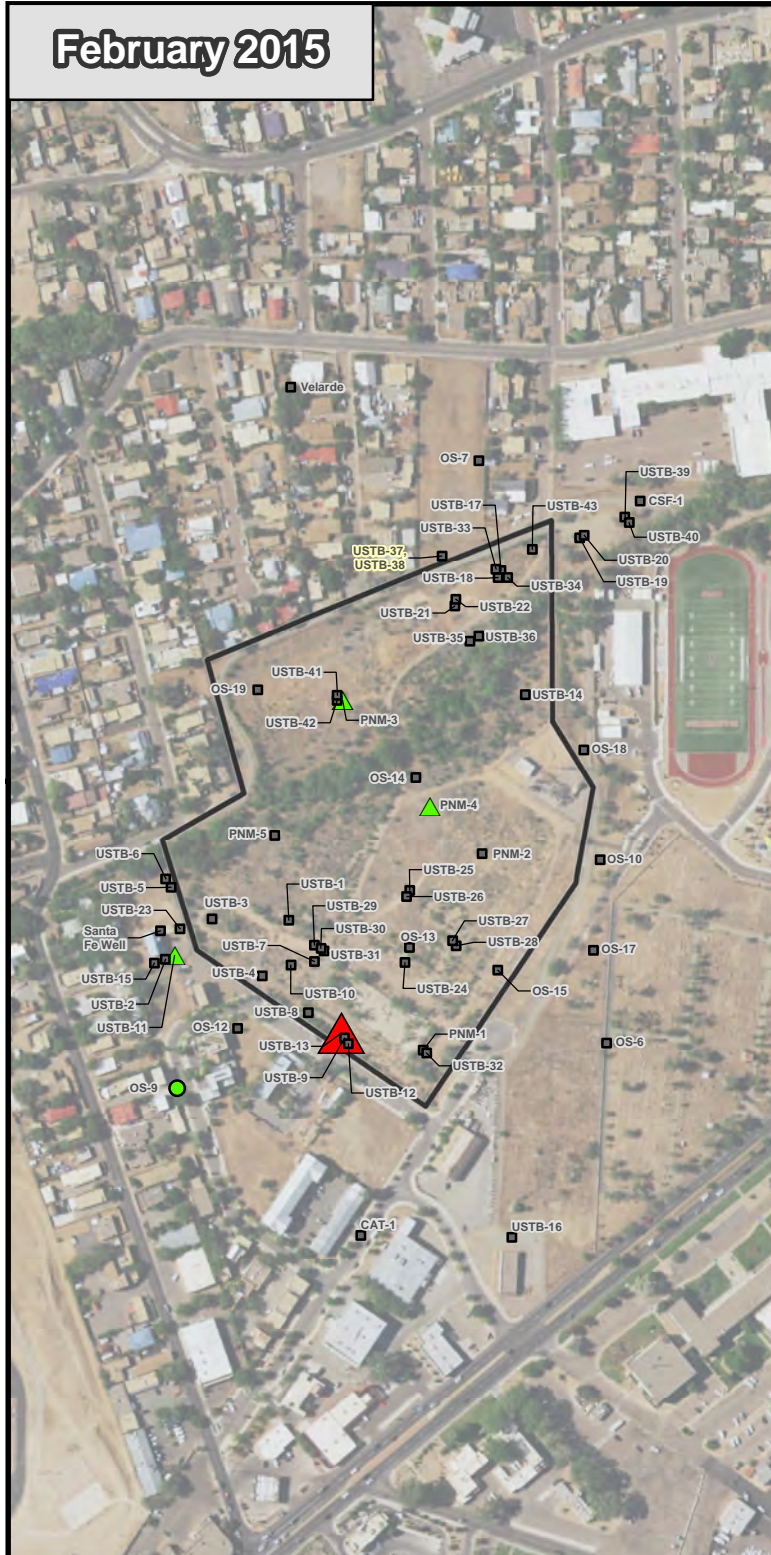
Deep

◆ Non Detect
◆ <2
◆ >=2 - 7
◆ >7

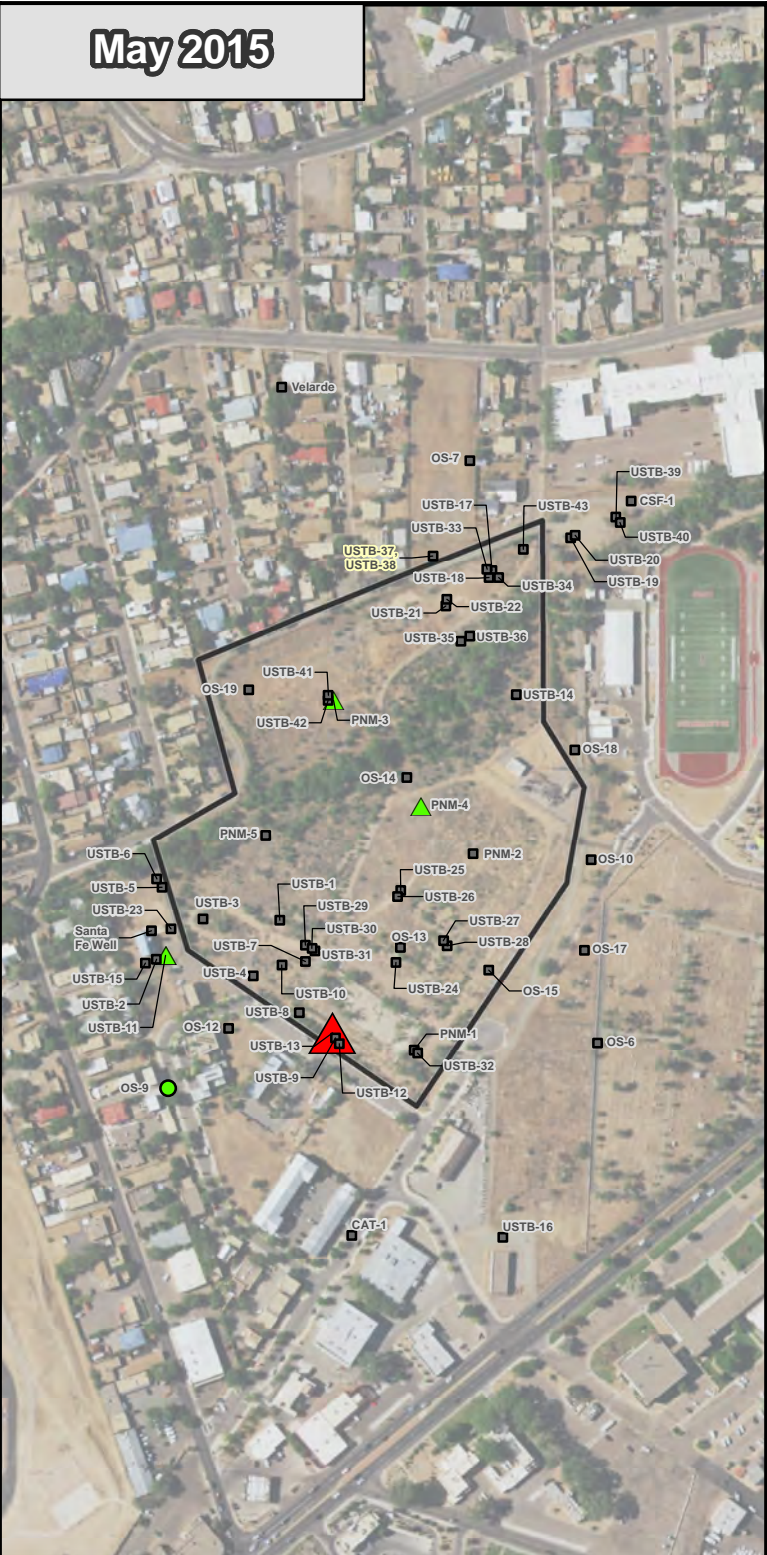


1,1-DCE Concentrations
2014
PNM

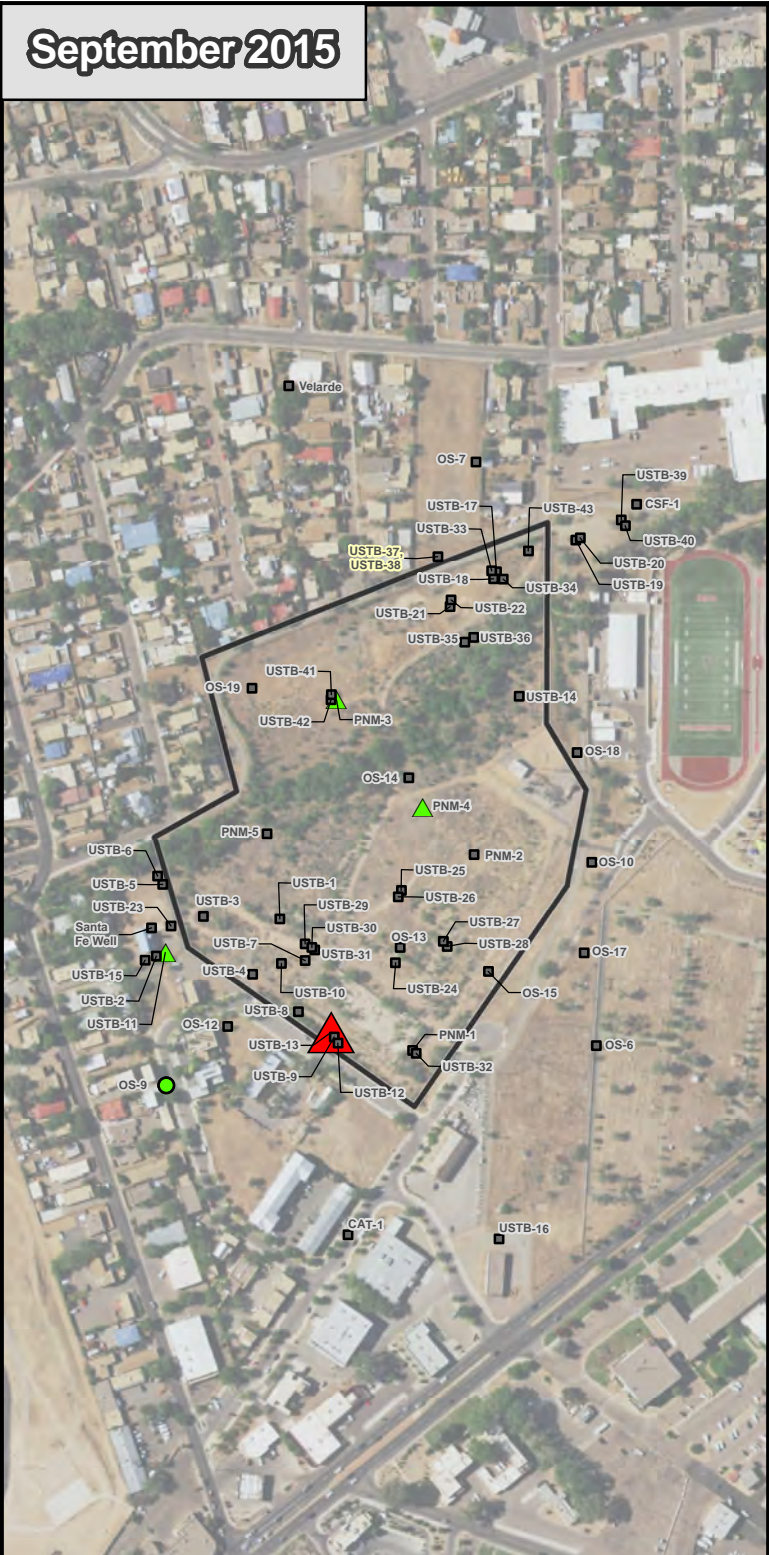
February 2015



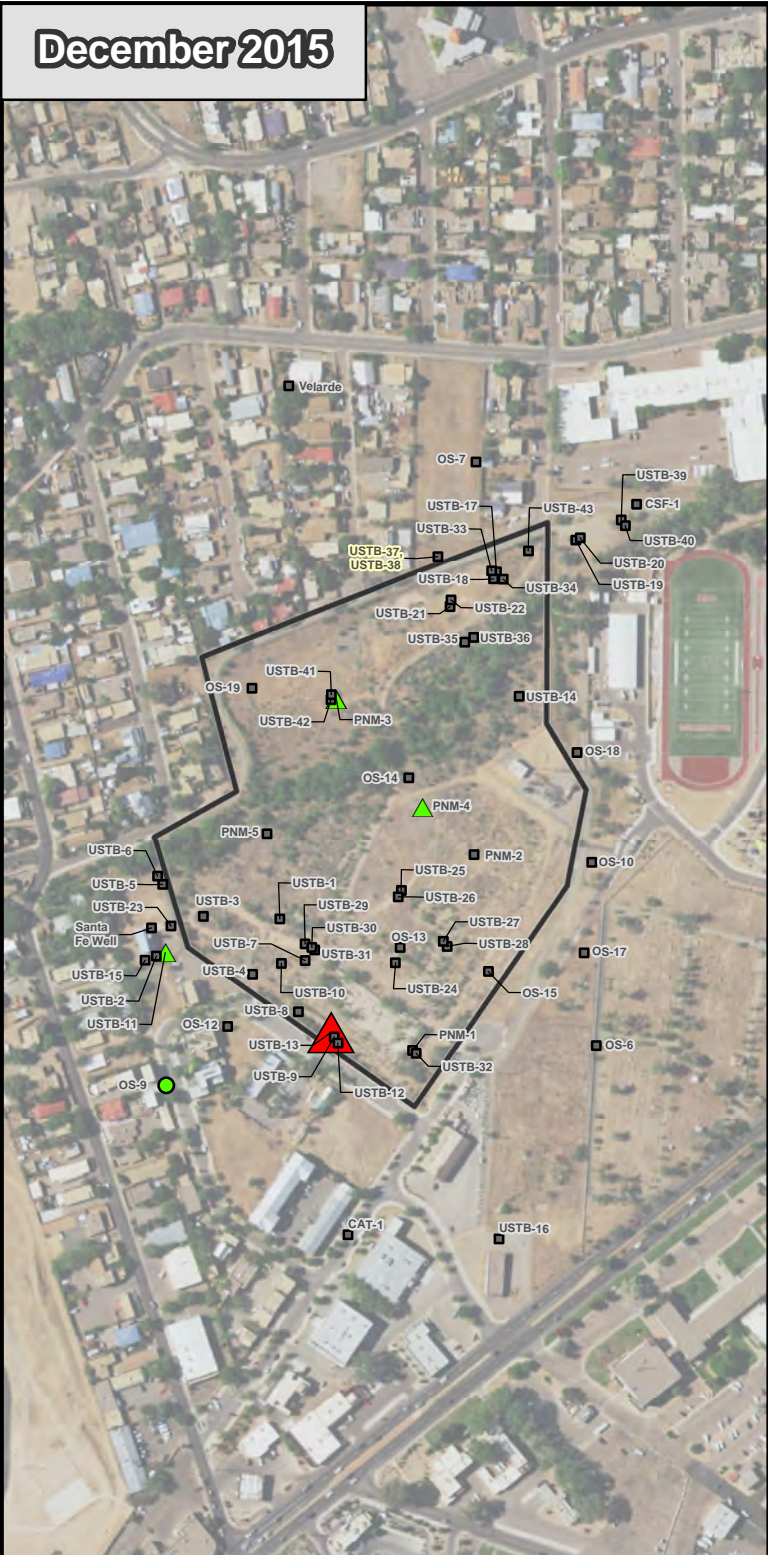
May 2015



September 2015

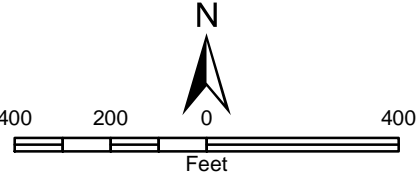


December 2015



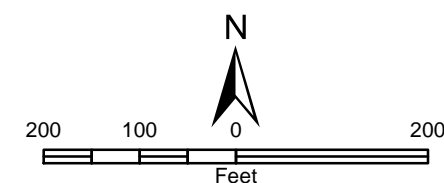
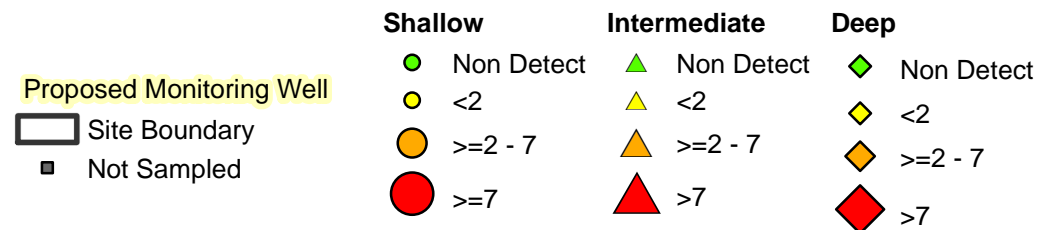
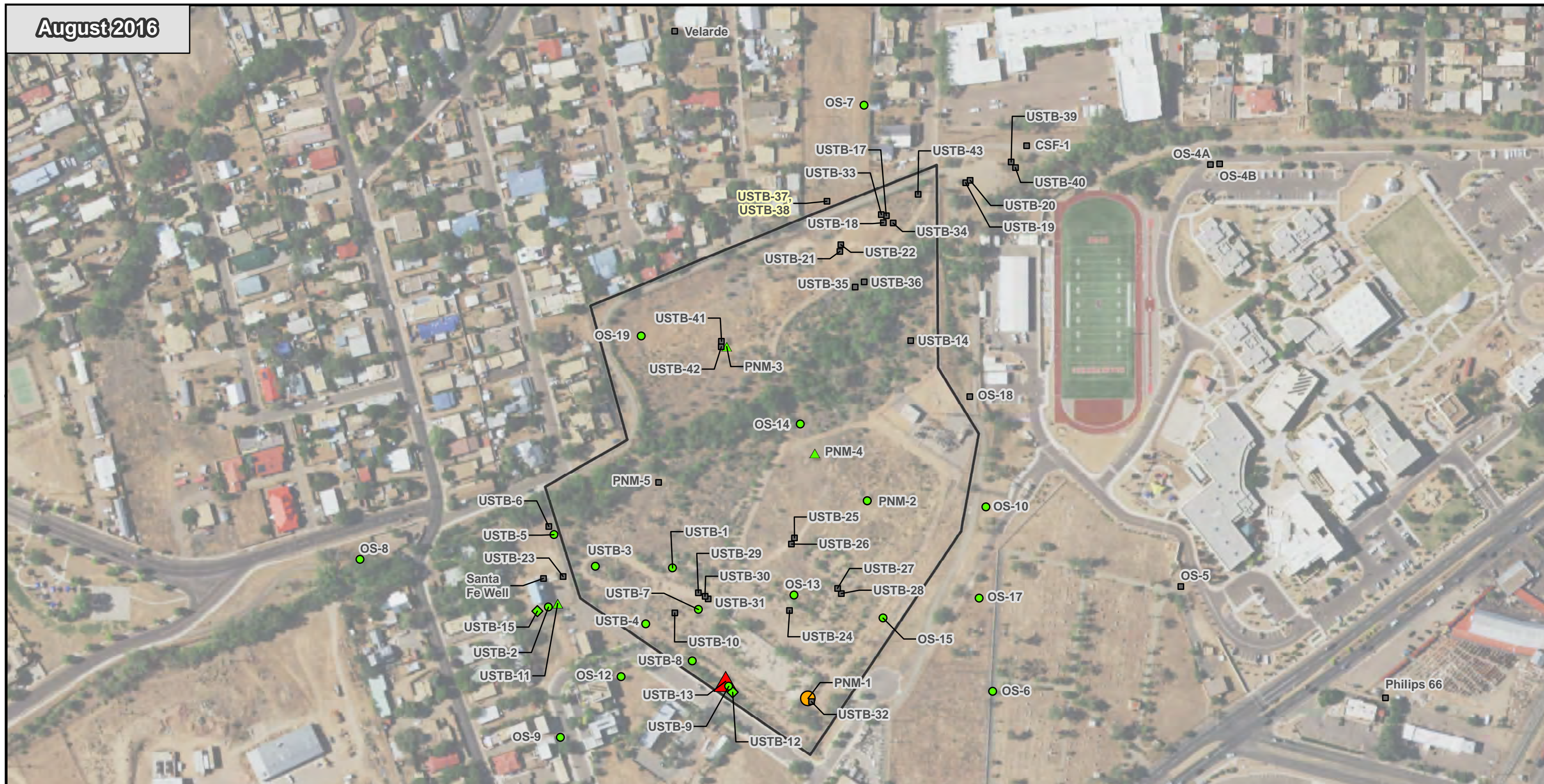
Proposed Monitoring Well
Site Boundary
Not Sampled

Shallow	Intermediate	Deep
Non Detect	Non Detect	Non Detect
<2	<2	<2
>=2 - 7	>=2 - 7	>=2 - 7
>=7	>7	>7



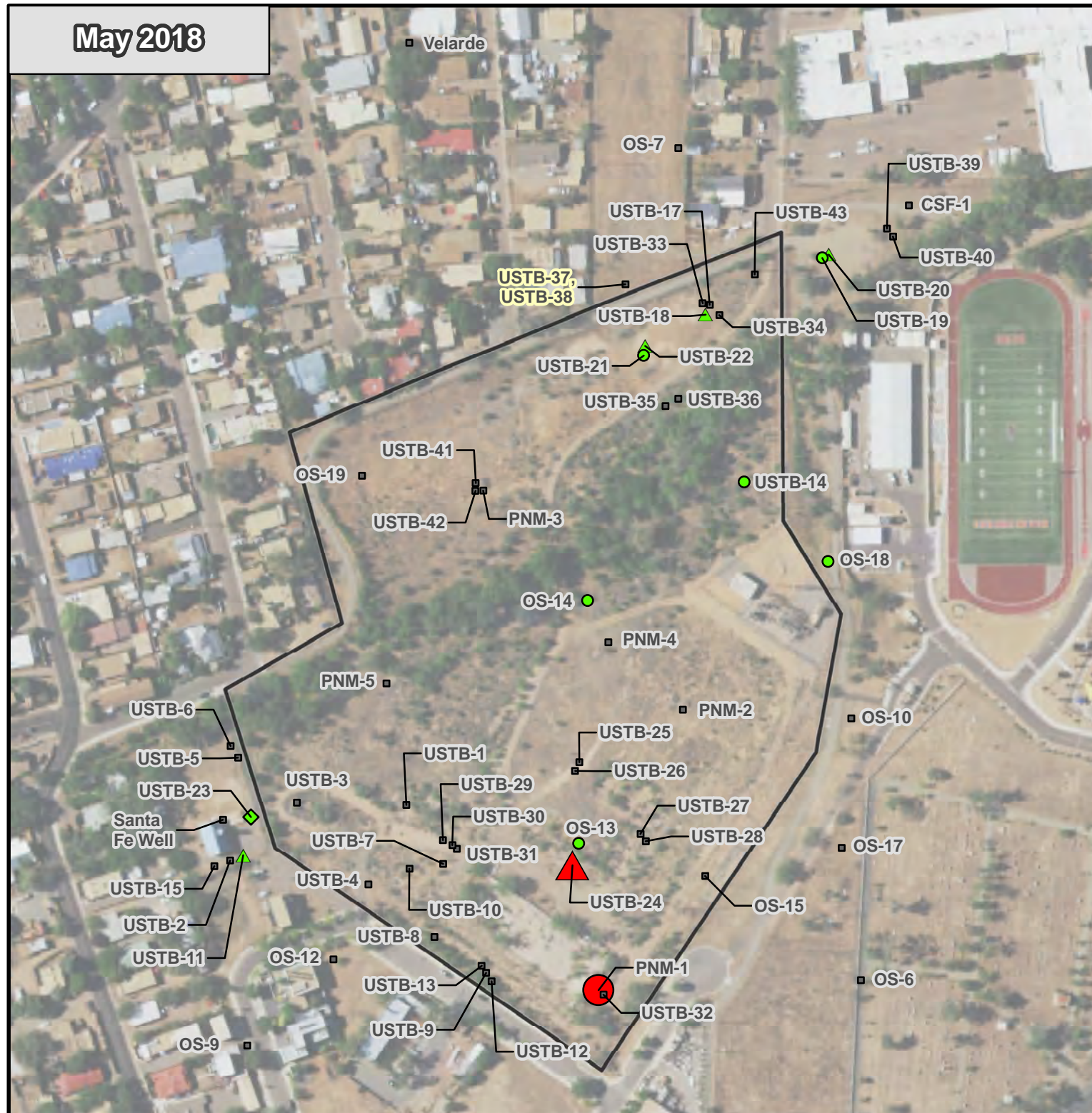
1,1-DCE Concentrations
2015
PNM

August 2016

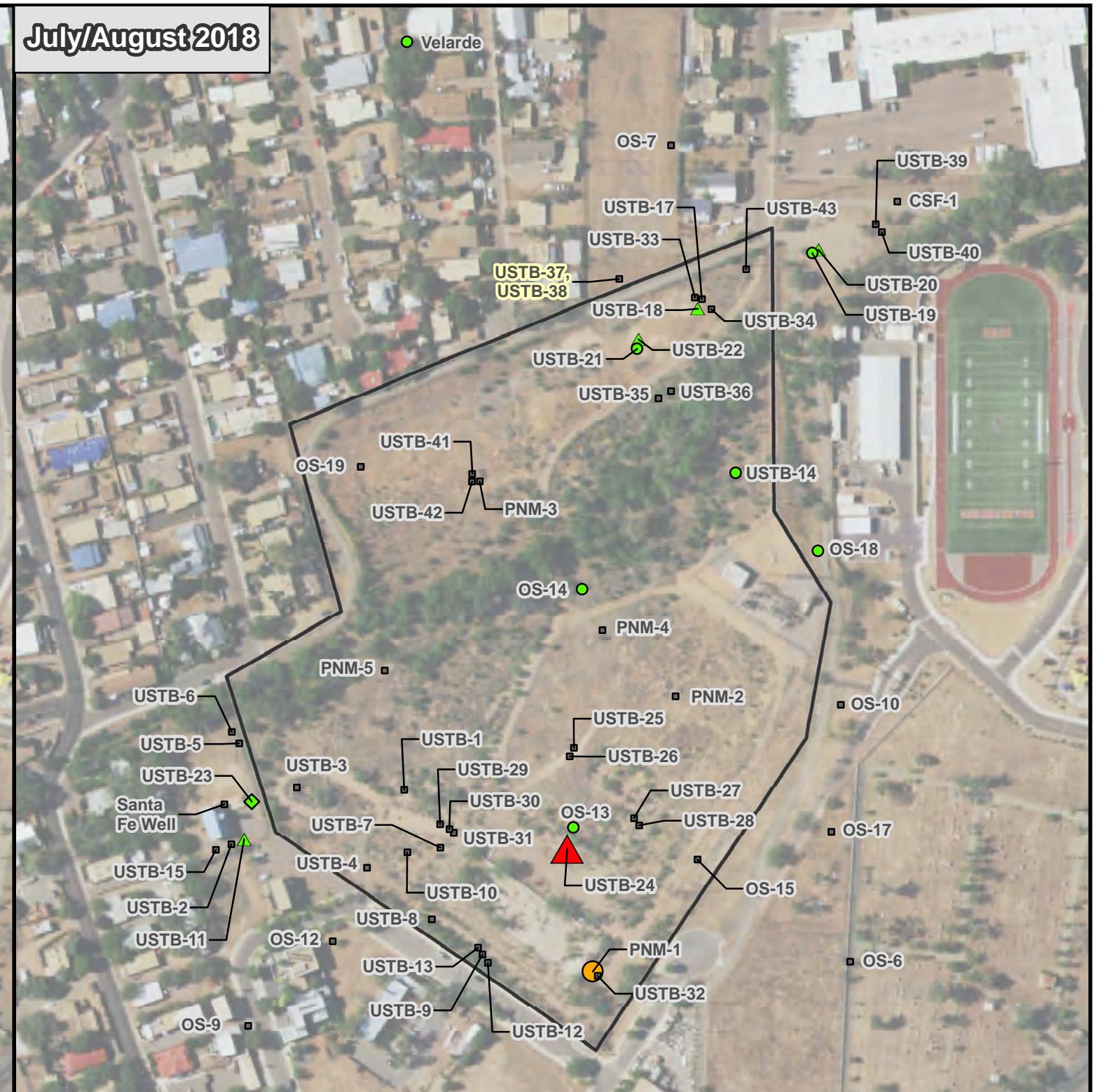


1,1-DCE Concentrations
2016
PNM

May 2018



July/August 2018



Proposed Monitoring Well

Site Boundary
Not Sampled

Shallow

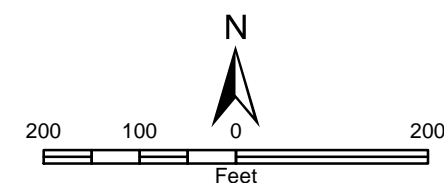
Non Detect
<2
>=2 - 7
>=7

Intermediate

Non Detect
<2
>=2 - 7
>7

Deep

Non Detect
<2
>=2 - 7
>7



1,1-DCE Concentrations
2018
PNM

APPENDIX B

INTERA Standard Operating Procedures

2.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) covers the following decontamination procedures to be implemented by INTERA field personnel and/or the INTERA subcontractor during characterization or remediation of non-radioactive hazardous and non-hazardous environmental sites:

- Project Decontamination Plan (**Section 2.1**);
- Decontamination of field personnel (**Section 2.2**);
- Decontamination of field equipment (**Section 2.3**); and
- Decontamination Effectiveness (**Section 2.4**).

The objective of decontamination procedures is to minimize the potential for cross contamination. Methods outlined in this SOP comply with following ASTM Standard:

- D5088-02(2008), *Standard Practice for Decontamination of Field Equipment Used at Waste Sites* (ASTM, 2008).

This SOP should be used in conjunction with procedures presented in the Site-Specific Health and Safety Plan (SSHASP) and in site-specific investigation planning documents such as a Sampling and Analysis Plan (SAP), Field Sampling Plan (FSP), or Work Plan (WP). This SOP will also be commonly used in conjunction with and is referenced in the following INTERA SOPs:

- 5, *Hollow-Stem Auger Drilling*;
- 6, *Direct Push Drilling*;
- 7, *Monitor Well Installation*;
- 8, *Monitor Well Development*;
- 9, *Monitor Well Gauging*;
- 10, *Monitor Well Groundwater Sampling*;
- 13, *Soil Sampling*;
- 15, *Slug Test Procedure*;
- 19, *Soil Gas Sampling*; and
- 23, *Soil Field Screening*.

2.1 Development of a Project Decontamination Plan

An appropriate project decontamination plan should be established (as part of either the SSHASP or SAP/FSP/WP) prior to personnel or equipment mobilization to areas where

the potential for exposure to hazardous substances exists. The decontamination plan for a project should address:

- Appropriate type, number, and layout of decontamination areas;
- Decontamination equipment needs (e.g., drop cloths, plastic sheeting, appropriate wash and rinse solutions, sprayers, waste containers - refer to **Attachment 1** for additional decontamination equipment that may be used at hazardous/non-hazardous waste sites);
- Appropriate decontamination methods;
- Procedures to prevent contamination of clean areas;
- Methods to minimize worker contact with contaminants during removal of Personal Protection Equipment (PPE);
- Methods for disposing of clothing and equipment, as applicable; and
- An emergency decontamination plan, if appropriate

The project decontamination plan should be revised whenever the type of PPE or equipment changes, site conditions change, or site hazards are reassessed based on new information. The decontamination plan specified in investigation planning documents may incorporate the following procedures in whole or part as long as exceptions, additions, and deletions are included.

2.1.1 Establishment of Work Zones

At any site where hazardous materials may be present, three (3) zones of contamination will be formally delineated as follows:

- Clean Zone: contaminant free zone. All access to the site is routed through the clean zone;
- Contamination Reduction Zone: acts as a buffer or intermediate zone where primary decontamination of personnel and/or equipment will be completed; and
- Exclusion Zone: contaminated area or potentially-contaminated area of the site. Access limited to an as needed basis only.

Personnel and equipment, including large equipment such as drill rigs, trucks and earth-moving equipment, in the Exclusion Zone will be decontaminated at the Exclusion Zone exit. Between the Exclusion Zone and the Clean Zone is the Contamination Reduction Zone, which provides a transition zone between the contaminated and clean areas of the site. Primary decontamination will take place at the boundary between the Exclusion Zone and the Contamination Reduction Zone. Personnel will decontaminate themselves and equipment before entering the Clean Zone from the Contamination Reduction Zone. The Clean Zone is an uncontaminated area from which operations will be directed. It is

essential that all contamination from the site be kept out of the Clean Zone. In addition, equipment should be clean upon entering the Exclusion Zone. If there is any doubt, equipment, including large equipment such as drill rigs that may be coming from another site, will be decontaminated in the Contamination Reduction Zone before entering the Exclusion Zone to prevent possible cross contamination between unrelated sites.

2.2 Procedure Implementation - Personnel Decontamination

The most effective decontamination procedure for field personnel is contamination avoidance when and wherever possible. As reasonably appropriate and applicable, all project personnel should follow standard work practices that minimize contact with potentially contaminated materials such as:

- Avoid areas of obvious contamination, do not directly touch potentially hazardous substances;
- Use remote sampling, handling, and container-opening techniques (e.g., drum grapplers, pneumatic impact wrenches);
- Protect monitoring and sampling instruments by bagging. Make openings in the bags for sample ports and sensors that must contact site materials;
- Wear disposable outer garments and use disposable equipment; and
- Encase the source of contaminants (i.e., with plastic sheeting or over packs).

At any site, personnel should decontaminate each time they leave an area of suspected or known contamination (i.e., the Exclusion Zone) and whenever they are subjected to above-normal exposure to hazards or contaminated materials. To avoid cross contamination in the Exclusion Zone, personnel decontamination in the form of glove change-out will be implemented between sample locations within a designated Exclusion Zone. Non-disposable sampling equipment will also be decontaminated between sampling locations if it will be used at multiple locations.

Depending on site conditions, personnel decontamination efforts may constitute a simple change-out and disposal of outer PPE garments (i.e., switching sampling gloves) or may be more substantive (i.e., a scrub and wash down). Typical examples of personnel decontamination procedures that may be applicable depending on site conditions are:

- Deposit hand tools and equipment on drop cloth or in other appropriate container pending decontamination;
- Respirators will be removed and placed in plastic bags pending decontamination according to manufacturers' instructions;

- Boots, reusable outer gloves and reusable cover suits will be washed using an appropriate soap such as Alconox™ in a potable water solution before being adequately rinsed with distilled, deionized or potable water, as appropriate;
- All disposable items (e.g., tape, cover suits, and any other disposable materials) will be removed and immediately placed in a container for proper disposal;
- Inner gloves will be removed, turning inside out as they are removed, and disposed of properly; and
- Exposed skin areas such as the hands and face will be washed with soap and distilled, deionized or potable water, as appropriate.

Personnel decontamination will take place in the Contamination Reduction Zone. Specifics regarding the required protocol for personnel decontamination for a site/project shall be provided in the SSHASP.

2.3 Procedure Implementation - Equipment Decontamination

Types of equipment requiring decontamination at any given site may include the following:

- Sampling equipment - will be decontaminated between individual sampling locations to ensure that representative samples are collected;
- Drilling equipment - will be decontaminated at the completion of each boring to ensure that boreholes are not cross contaminated and that contamination is contained in the Exclusion Zone; and
- Tractor, forklift, backhoe and/or other heavy equipment - will be decontaminated to ensure that contamination is contained during site activities.

At a minimum, equipment that has come into direct contact with potentially contaminated media (e.g., auger flights, drill heads, non-disposable sampling equipment) will be decontaminated before leaving the Contamination Reduction Zone by:

- Washing non-disposable sampling equipment with an appropriate detergent solution (based on the site's known or potential contaminants of concern) and a brush made of inert material to remove any particles or surface film;
- Auger flights/probes should be decontaminated prior to re-use using a heated, high-pressure wash operating at a temperature of approximately 212° F and discharging at approximately 5 gallons per minute. Strongly adhered material may require additional scrubbing using a wire or bristle brush. The inside of each auger or probe will also be cleaned with a pressure washer or steam cleaner and, if needed, scrubbed with a wire or bristle brush;

- Drill heads and other large equipment should be decontaminated using a heated, high-pressure wash, if possible, or by scrubbing as described above; and
- Double rinsing thoroughly with control water (typically first rinse with potable water in a wash tub or containment area; second rinse with a spray of distilled or deionized water).

Various solutions applicable to the decontamination of field equipment and materials are listed in **Attachment 2**. Commonly recommended decontamination procedures for various equipment and materials (in order of application) are listed in **Attachment 3**.

For most sites, use of a heavy-duty non-phosphate detergent wash, such as Alconox™, Simple Green™ or an approved equivalent, followed by one or more rinses of distilled/deionized water commonly available from commercial vendors is typical.

Regarding appropriate rinse solutions to use for decontamination purposes, the following should be noted:

1. Distilled water and deionized water are not comparable; use of distilled water is usually acceptable for most investigations. If laboratory grade deionized water is required for a site, this requirement shall be specified in the SAP/FSP/WP.
2. Tap/potable water is defined as water that is determined to be fit for human consumption. Usually this implies that some level of treatment has been performed on the water. For the purpose of implementing decontamination procedures at investigation sites, use of an untreated water supply is not an acceptable substitute for tap/potable water.
3. If metals are a primary constituent of concern at the site, an initial rinse of 0.1 molar nitric acid followed by tap water may be appropriate.
4. If organic compounds are a primary constituent of concern at a site, an initial rinse with methanol, Simple Green™ or other approved equivalent followed by a tap water rinse may be appropriate.
5. Any other additional consideration(s) regarding appropriate rinsate solutions to be implemented for a project shall be provided in the SAP/FSP/WP.

Safety Data Sheets for commonly-applied non-phosphate detergents are provided in **Attachment 4**.

Exceptions/additions to the standard rule are as follows:

- To minimize the spread of contaminated materials at the site, surficial caking of solid contamination on large equipment should be physically removed in the Exclusion Zone (or equivalent) using scrapers, brushes, or other appropriate

tools prior to moving the equipment to a designated decontamination area. Smaller equipment can be placed in a wash tub (or other applicable container) in the designated decontamination area for decontamination;

- Delicate instrumentation or sampling equipment sensitive to water will be carefully cleaned with a treated sponge or paper towel as necessary. Care should be taken to prevent equipment damage and may include bagging of equipment during use to minimize direct contact with contaminated material, as appropriate (**Section 2.2**);
- Any vehicle required to enter the Exclusion Zone or used to carry auger flights or push probes will also receive a heated, high-pressure wash in all areas where the auger flights, push probes, or contaminated material come into contact with the vehicle. Vehicle tires may also require decontamination;
- Many recommended solvents are hazardous constituents; therefore, use of these types of solvents should be evaluated with respect to known or suspected site contaminants and applied only on an as needed basis; and
- At sites where the reactivity of sampling equipment to decontamination washes creates concern for the generation of undesirable chemical by-products, the use of dedicated or disposable sampling equipment should be considered.

Allowing decontaminated equipment to air dry on a rack, sawhorse, or clean surface prior to re-use is considered optimal; however, equipment may also be wiped dry with a clean material if needed for immediate re-use. When practical, a sufficient quantity of clean, decontaminated sampling equipment should be made available so that equipment decontamination is not required between each sampling point and, ideally, can be performed in a single event.

Any solid material removed from large equipment during decontamination shall be placed in the appropriate container(s) identified for investigation-derived waste. All wash and rinse solutions shall be containerized and disposed of as specified in the SSHASP or SAP/FSP/WP.

2.4 Effectiveness Testing

Decontamination methods may vary in effectiveness of removing contamination and therefore should be assessed as part of any project at the beginning and periodically throughout the project, as appropriate. Typical methods utilized to determine decontamination effectiveness include:

- Visual observations – notice of stains, discoloration, corrosivity, or dirt;
- Swipe/wipe sampling and field screening for residual constituents; and

- Collection of a rinsate sample from decontaminated equipment.

The primary method to determine effectiveness of decontamination procedures for site personnel is via visual observation and/or self-screening. The primary method to determine effectiveness of decontamination procedures for reasonably-sized site sampling equipment is the collection of one or more equipment rinsate or rinse solution samples. For larger sampling equipment, field screening or swipe/wipe samples shall typically be collected.

Self-screening to determine the effectiveness of personnel decontamination is typically performed using the same screening tool(s) utilized for the active field screening of site samples and should be performed upon entering the Clean Zone, as applicable. Details regarding whether self-screening is appropriate for a site and the procedure and tools needed to perform self-screening shall be specified in the SSHASP.

Whether samples are to be collected from decontaminated equipment and/or used rinse solutions for project quality assurance/quality effectiveness will be established in the SAP/FSP/WP. Most sites/projects will require the collection of at least one equipment rinsate as follows:

- Collect equipment rinsate sample using ASTM International (ASTM) Type II reagent grade water, seal the rinsate sample container with a custody seal, and place the sample in the sample shipment cooler. ASTM Type II reagent grade water is defined as a distillate with the following specifications: Resistivity at 25° C = >1 megohm (MΩ–cm), Total Organic Carbon = <50 parts per billion (ppb); Sodium = <5 ppb; Chloride = <5 ppb; Total Silica= <3 ppb (ASTM, 2011).

2.5 References

ASTM International (ASTM), 2008. Standard Practice for Decontamination of Field Equipment Used at Waste Sites. D5088-02 (Reapproved 2008).

ASTM, 2011. Standard Specification for Reagent Water. D1193-06 (Reapproved 2011).

Martin, William F., Lippitt, John M., Webb, Paul J., 2000. Hazardous Waste Handbook, Third Edition. 288 pp.

2.6 Attachments

Attachment 1: Example Decontamination Equipment Used At Hazardous/Non-Hazardous Waste Sites, As Applicable

Attachment 2: Applications of Various Solutions for Decontamination of Field Equipment and Materials

Attachment 3: Recommended Decontamination Procedures for Common Types of Field Equipment and Materials

Attachment 4: Safety Data Sheets

2.7 Document History

Revision	Effective Date	Lead Author	Summary of Changes
00	1/2004	Taimur Malik	Original version
01	2/2015	Kate Herrell	Revised for inclusion in COA Brownfields QAPP
02	5/2016	Noreen Baker	Minor text revisions, set bottom margin to 1 inch
03	6/2017	Noreen Baker	Revised heading 2.6 to Attachments for consistency

Attachment 1

Example Decontamination Equipment Used at Hazardous/Non-Hazardous Waste Sites, As Applicable

Example Decontamination Equipment Used At Hazardous/Non-Hazardous Waste Sites, As Applicable.

TABLE 8.3 Recommended Supplies for Decontamination of Personnel, Clothing, and Equipment

Drop cloths (plastic or other suitable material) for heavily contaminated equipment and outer protective clothing such as overboots, outer pair of gloves, monitoring equipment, drum wrenches, etc.

Disposal collection containers (drums or suitable lined trash cans) for disposable clothing and heavily contaminated PPE.

Storage containers for contaminated wash and rinse solutions.

Lined box with absorbents for collection and control of wastes from scraping, wiping, or rinsing off gross contamination.

Wash tubs of sufficient size to enable workers to place booted foot in and wash off contaminants (without drains unless connected to a suitable collection tank or treatment system).

Rinse tubs of sufficient size to enable workers to place booted foot in and to hold the solution used to rinse the wash solutions and contaminants after washing (without drains unless connected to a suitable collection tank or treatment system).

Wash solutions pretested against contaminants for effectiveness and compatibility.

Rinse solutions (also pretested) to remove or neutralize contaminants and rinse off residues of wash solutions.

Long-handled, soft-bristled brushes to help wash and rinse off contaminants.

Lockers and cabinets for storage of decontaminated clothing and equipment.

Plastic sheeting, sealed pads with drains, or other appropriate method for containing and collecting contaminated wash and rinse water spilled during decontamination.

Shower facilities for full-body wash or, at a minimum, personal wash sinks (with drains connected to collection tank or appropriate treatment system).

Soap or wash solution, wash cloths, and towels for personnel showering.

Clean clothing and personal item storage lockers and/or closets.

TABLE 8.4 Recommended Supplies for Large Equipment and Vehicle Decontamination

Containers for gross contamination involving removal of wastes and contaminated soils caught in tires and the underside of vehicles or equipment.

Pads for collection of contaminated wash and rinse solutions with drains or sumps connected to storage tanks or approved treatment system.

Shovels, rods, and long-handled brushes for dislodging and removing wastes and contaminated soils caught in tires and the underside of vehicles or equipment.

Pressurized water and/or steam sprayer(s) for pressure washing, steam cleaning, and rinsing (particularly hard-to-reach areas).

Spray booths, curtains, or enclosures to contain splashes from pressurized sprays used to dislodge materials and clean hard-to-reach areas.

Long-handled brushes for general cleaning of exterior.

Wash solutions pretested against contaminants for effectiveness and compatibility.

Rinse solutions (also pretested) to remove or neutralize contaminants and rinse off residues of wash solutions.

Wash and rinse buckets for use in decontamination of operator areas inside the vehicle and equipment.

Brooms and brushes for cleaning operator areas inside the vehicles and equipment.

Containers for storage and/or disposal of contaminated rinse and wash solutions and damaged or heavily contaminated parts and equipment to be discarded.

From: Hazardous Waste Handbook, Third Edition. (Martin, et al., 2000)

Attachment 2
**Applications of Various Solutions for Decontamination of Field
Equipment and Materials**

TABLE 1 Applications of Various Solutions for Decontamination of Field Equipment and Materials^{A,B,C}

Solution	Concentrations	Remarks
Portable Water	Tap water (demonstrated to be analyte free)	Used under high pressure or steam to remove heavy mud and dirt, or to rinse off other solutions
Laboratory-grade water	Distilled Deionized Reagent-grade distilled and deionized water	
Low sudsing non-phosphate detergents (Liquinox, Detergent 8)	Typical concentrations are 0.5 to 2% solution by volume	General all-purpose cleaner. Detergent 8 is recommended for spray cleaning.
Sodium carbonate (baking soda)	5 to 15% aqueous solution	Used to neutralize either acidic or strongly basic contaminants
Sodium carbonate (washing soda)	10 to 20% aqueous solution	Effective for neutralizing inorganic acids, organic acids, heavy metals, metal processing wastes.
Trisodium phosphate (TSP Oakite)	10% aqueous solution	Similar to sodium carbonate. Good rinsing solution for organic compounds (such as toluene, chloroform, TCE, PBBs, and PCBs).
Calcium hypochlorite (HTH)	10% aqueous solution	Disinfectant, bleaching, and oxidizing agent for pesticides, fungicides, chlorinated phenols, dioxins, cyanides, ammonia and other non-acidic inorganic wastes.
Hydrochloric acid, nitric acid	10% nitric 10% to 20% hydrochloric	Used for inorganic bases, alkali and caustic wastes
Citric, tartaric, oxalic acids or their respective salts	5% solution	Used to clean heavy-metal contaminants
Organic solvents	Concentrated	Used to remove organic compounds that have poor solubility in water, such as oil and grease. do not use a solvent that is one of the analytes of interest or interferes with analyses. Porous materials such as polymers can absorb these solvents.

^A Examples of commonly recommended cleaning solvents include pesticide-grade isopropanol, acetone, methanol, hexane, heptane, and ethanol.

^B Adapted for Mickam et al. (1989), Moberly (1985), and Richter and Collentine (1983).

^C Many of the solvents listed are themselves hazardous materials. Care should be taken in both use and disposal of these materials.

From: ASTM D5088-02(2008) (ASTM, 2008)

Attachment 3
**Recommended Decontamination Procedures for Common Types of
Field Equipment and Materials**

TABLE 2 Commonly Recommended Decontamination Procedures for Different Equipment and Different Materials of Construction^{A, B}

	Soapy Water Wash	Tap Water Rinse	10% Nitric Acid Rinse ^C	Organic-Free Water Rinse	Rinse with Solvent	Air Dry for 24h	Oven Dry	Store in Aluminum Foil or Polyethylene	Discard After Use
Glass	1	2,4	3	5	6 ^D	7		8	
Teflon	1	2,4	3	5	6 ^E	7		8	
Metals and Stainless Steel	1	2		3	4 ^D	5		6	
Teflon Tubing	1	2			3 ^E		4 ^F	5	
PVC Tubing				Use Only New PVC Tubing					1
Stainless Tubing	1	2		3	4 ^D	5		6	
Glass Tubing	1	2,4	3	5	6 ^D	7		3	
Well Sounders	1	2		3					
Submersible Pumps	1	2		3					

^A These procedures are based on commonly recommended practices. It should be noted that there is not a lot of experimental data to support some of these practices. Mickam et al., 1989, Parker 1995, Parker and Ranney 1997a, 1997b.

^B Sampling equipment that employs a process whereby potentially contaminated material passes through internal mechanical workings (pump, housing, impellers, etc.) can be very difficult to decontaminate. This should be considered when identifying an appropriate decontamination procedure for equipment with internal sample contacting parts.

^C This step is used in removing inorganic contaminants and can be eliminated if they are not of concern.

^D Data by Parker and Ranney 1997a, 1997b should show that solvent rinsing may not be needed.

^E Data by Parker and Ranney 1997a, 1997b, show that oven drying may be more effective than an organic solvent rinse for removing sorbed organic contaminants.

^F Excessive heat that could damage the polymer should not be used. Check manufacturer's recommendations for heat tolerance.

From: ASTM D5088-02(2008) (ASTM, 2008)

Attachment 4
Safety Data Sheets

ALCONOX™ SDS

Safety Data Sheet according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Page 1/10

Printing date: 31.12.2013

Revision: 31.12.2013

1 Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Trade name: **ALCONOX**

1.2 Relevant identified uses of the substance or mixture and uses advised against
No further relevant information available.

Application of the substance / the mixture: Cleaning material/ Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer/Supplier:

Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040



Further information obtainable from: Product Safety Department

1.4 Emergency telephone number:

ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008



GHS05 corrosion

Eye Dam. 1; H318: Causes serious eye damage.



GHS07

Skin Irrit. 2; H315: Causes skin irritation.

Classification according to Directive 67/548/EEC or Directive 1999/45/EC



Xi; Irritant

R38-41: Irritating to skin. Risk of serious damage to eyes.

Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to the latest editions of the EU-lists, and extended by company and literature data.

The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation

(Contd. on page 2)

Safety Data Sheet

Page 2/10

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Printing date: 31.12.2013

Revision: 31.12.2013

Trade name: ALCONOX

(Contd. of page 1)

Hazard pictograms



GHS05

Signal word: Danger

Hazard-determining components of labelling:

sodium dodecylbenzene sulfonate

Hazard statements

H315: Causes skin irritation.

H318: Causes serious eye damage.

Precautionary statements

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P264: Wash thoroughly after handling.

P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310: Immediately call a POISON CENTER or doctor/physician.

P321: Specific treatment (see on this label).

P362: Take off contaminated clothing and wash before reuse.

P332+P313: If skin irritation occurs: Get medical advice/attention.

P302+P352: IF ON SKIN: Wash with plenty of soap and water.

Hazard description:

WHMIS-symbols:

D2B - Toxic material causing other toxic effects



NFPA ratings (scale 0 - 4)



Health = 1

Fire = 0

Reactivity = 0

HMIS-ratings (scale 0 - 4)



Health = 1

Fire = 0

Reactivity = 0

HMIS Long Term Health Hazard Substances

None of the ingredients is listed.

2.3 Other hazards

Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable.

(Contd. on page 3)

Safety Data Sheet
according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and
GHS

Page 3/10

Printing date: 31.12.2013

Revision: 31.12.2013

Trade name: **ALCONOX**

(Contd. of page 2)

3 Composition/information on ingredients

3.2 Mixtures

Description: Mixture of substances listed below with nonhazardous additions.

Dangerous components:

CAS: 68081-81-2	sodium dodecylbenzene sulfonate Xn R22; Xi R36 Acute Tox. 4, H302; Eye Irrit. 2, H319	10-25%
CAS: 497-19-8 EINECS: 207-836-8 Index number: 011-005-00-2	Sodium Carbonate Xi R36 Eye Irrit. 2, H319	2,5-10%
CAS: 7722-88-5 EINECS: 231-767-1	tetrasodium pyrophosphate substance with a Community workplace exposure limit	2,5-10%
CAS: 151-21-3 EINECS: 205-788-1	sodium dodecyl sulphate Xn R21/22; Xi R36/38 Acute Tox. 4, H302; Skin Irrit. 2, H315; Eye Irrit. 2, H319	2,5-10%

Additional information: For the wording of the listed risk phrases refer to section 16.

4 First aid measures

4.1 Description of first aid measures

After inhalation: Supply fresh air; consult doctor in case of complaints.

After skin contact:

Immediately wash with water and soap and rinse thoroughly.

If skin irritation continues, consult a doctor.

After eye contact:

Remove contact lenses if worn.

Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

After swallowing:

Rinse out mouth and then drink plenty of water.

Do not induce vomiting; call for medical help immediately.

4.2 Most important symptoms and effects, both acute and delayed

No further relevant information available.

4.3 Indication of any immediate medical attention and special treatment needed

No further relevant information available.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

CO₂, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

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5.2 Special hazards arising from the substance or mixture: No further relevant information available.

5.3 Advice for firefighters

Protective equipment:

Wear self-contained respiratory protective device.

Wear fully protective suit.

Additional information: No further relevant information available.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Product forms slippery surface when combined with water.

6.2 Environmental precautions: Do not allow to enter sewers/ surface or ground water.

6.3 Methods and material for containment and cleaning up:

Pick up mechanically.

Clean the affected area carefully; suitable cleaners are:

Warm water

6.4 Reference to other sections

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

7 Handling and storage

7.1 Precautions for safe handling

Prevent formation of dust.

Keep receptacles tightly sealed.

Information about fire - and explosion protection: No special measures required.

7.2 Conditions for safe storage, including any incompatibilities

Storage:

Requirements to be met by storerooms and receptacles: No special requirements.

Information about storage in one common storage facility: Not required.

Further information about storage conditions: Protect from humidity and water.

7.3 Specific end use(s): No further relevant information available.

8 Exposure controls/personal protection

Additional information about design of technical facilities: No further data; see item 7

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:

7722-88-5 tetrasodium pyrophosphate

REL (USA) 5 mg/m³

TLV (USA) TLV withdrawn

EV (Canada) 5 mg/m³

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Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls

Personal protective equipment:

General protective and hygienic measures:

Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.

Respiratory protection:

Not required under normal conditions of use.
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.

Protection of hands:



Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture. Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.

Material of gloves

Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber, NR
Neoprene gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:



Safety glasses

Body protection: Protective work clothing

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9 Physical and chemical properties	
9.1 Information on basic physical and chemical properties	
General Information	
Appearance:	
Form:	Powder
Colour:	White
Odour:	Odourless
Odour threshold:	Not determined.
pH-value (10 g/l) at 20 °C:	9,5 (- NA for Powder form)
Change in condition	
Melting point/Melting range:	Not Determined.
Boiling point/Boiling range:	Undetermined.
Flash point:	Not applicable.
Flammability (solid, gaseous):	Not determined.
Ignition temperature:	
Decomposition temperature:	Not determined.
Self-igniting:	Product is not self-igniting.
Danger of explosion:	Product does not present an explosion hazard.
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapour pressure:	Not applicable.
Density at 20 °C:	1,1 g/cm³
Relative density	Not determined.
Vapour density	Not applicable.
Evaporation rate	Not applicable.
Solubility in / Miscibility with water:	Soluble.
Partition coefficient (n-octanol/water):	
Not determined.	
Viscosity:	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
Solvent content:	
Organic solvents:	0,0 %
Solids content:	100 %
9.2 Other information	No further relevant information available.

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10 Stability and reactivity

10.1 Reactivity

10.2 Chemical stability

Thermal decomposition / conditions to be avoided:

No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions

Reacts with acids.

Reacts with strong alkali.

Reacts with strong oxidizing agents.

10.4 Conditions to avoid: No further relevant information available.

10.5 Incompatible materials: No further relevant information available.

10.6 Hazardous decomposition products:

Carbon monoxide and carbon dioxide

Phosphorus compounds

Sulphur oxides (SO_x)

11 Toxicological information

11.1 Information on toxicological effects

Acute toxicity:

Primary irritant effect:

On the skin: Irritant to skin and mucous membranes.

On the eye: Strong irritant with the danger of severe eye injury.

Sensitization: No sensitizing effects known.

Additional toxicological information:

The product shows the following dangers according to the calculation method of the General EU

Classification Guidelines for Preparations as issued in the latest version:

Irritant

Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation of esophagus and stomach.

12 Ecological information

12.1 Toxicity

Aquatic toxicity: No further relevant information available.

12.2 Persistence and degradability: No further relevant information available.

12.3 Bioaccumulative potential: Not worth-mentioning accumulating in organisms

12.4 Mobility in soil: No further relevant information available.

Additional ecological information:

General notes:

Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water

Do not allow product to reach ground water, water course or sewage system.

Danger to drinking water if even small quantities leak into the ground.

12.5 Results of PBT and vPvB assessment

PBT: Not applicable.

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Trade name: ALCONOX

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vPvB: Not applicable.

12.6 Other adverse effects: No further relevant information available.

13 Disposal considerations

13.1 Waste treatment methods

Recommendation

Smaller quantities can be disposed of with household waste.

Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.

The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

Uncleaned packaging:

Recommendation: Disposal must be made according to official regulations.

Recommended cleansing agents: Water, if necessary together with cleansing agents.

14 Transport information

14.1 UN-Number

DOT, ADR, IMDG, IATA, ICAO

Not Regulated

14.2 UN proper shipping name

DOT, ADR, IMDG, IATA, ICAO

Not Regulated

14.3 Transport hazard class(es)

DOT, ADR, IMDG, IATA, ICAO

Class

Not Regulated

14.4 Packing group

DOT, ADR, IMDG, IATA, ICAO

Not Regulated

14.5 Environmental hazards:

Marine pollutant:

No

14.6 Special precautions for user

Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable.

UN "Model Regulation":

Not Regulated

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15 Regulatory information

- **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture United States (USA)**

· **SARA**

· **Section 355 (extremely hazardous substances):**

None of the ingredients is listed.

· **Section 313 (Specific toxic chemical listings):**

None of the ingredients is listed.

· **TSCA (Toxic Substances Control Act):**

All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**

None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**

None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for males:**

None of the ingredients is listed.

· **Chemicals known to cause developmental toxicity:**

None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

· **IARC (International Agency for Research on Cancer)**

None of the ingredients is listed.

· **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

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Canada

Canadian Domestic Substances List (DSL)

All ingredients are listed.

Canadian Ingredient Disclosure list (limit 0.1%)

None of the ingredients is listed.

Canadian Ingredient Disclosure list (limit 1%)

497-19-8 Sodium Carbonate

7722-88-5 tetrasodium pyrophosphate

151-21-3 sodium dodecyl sulphate

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevant phrases

H302: Harmful if swallowed

H312: Harmful in contact with skin

H315: Causes skin irritation.

H319: Causes serious eye irritation.

R21/22: Harmful in contact with skin and if swallowed.

R22: Harmful if swallowed.

R36: Irritating to eyes.

R36/38: Irritating to eyes and skin.

Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road) IMDG: International Maritime Code for Dangerous Goods DOT: US Department of Transportation

IATA: International Air Transport Association

GHS: Globally Harmonized System of Classification and Labelling of Chemicals

ACGIH: American Conference of Governmental Industrial Hygienists

NFPA: National Fire Protection Association (USA)

HMIS: Hazardous Materials Identification System (USA)

WHMIS: Workplace Hazardous Materials Information System (Canada)

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Revision: 24.05.2012

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier

Trade name: **LIQUINOX**

Application of the substance / the preparation: Hand detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer/Supplier:

Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040



Further information obtainable from: Product Safety Department

1.4 Emergency telephone number:

ChemTel Inc.
(800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008



GHS07

Skin Irrit. 2: H315: Causes skin irritation.

Eye Irrit. 2: H319: Causes serious eye irritation.

Classification according to Directive 67/548/EEC or Directive 1999/45/EC



Xn, Irritant

R36/38: Irritating to eyes and skin.

Information concerning particular hazards for human and environment:

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:

The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008

The product is classified and labelled according to the CLP regulation.

Hazard pictograms



GHS07

Signal word: Warning

Hazard-determining components of labelling:

Benzenesulfonic Acid, Sodium Salts

Hazard statements:

H315 Causes skin irritation.

H319 Causes serious eye irritation.

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Precautionary statements:

- P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264 Wash thoroughly after handling.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P321 Specific treatment (see on this label).
P362 Take off contaminated clothing and wash before reuse.
P332+P313 If skin irritation occurs: Get medical advice/attention.
P337+P313 If eye irritation persists: Get medical advice/attention.
P302+P352 IF ON SKIN: Wash with plenty of soap and water.

Hazard description:

WHMIS-symbols:

D2B - Toxic material causing other toxic effects



NFPA ratings (scale 0 - 4)



Health = 1
Fire = 0
Reactivity = 0

HMIS-ratings (scale 0 - 4)



Health = 1
Fire = 0
Reactivity = 0

2.3 Other hazards

Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable.

3 Composition/Information on Ingredients

3.2 Mixtures

Description: Mixture of substances listed below with nonhazardous additions.

Dangerous components:		
CAS: 68081-81-2	Benzenesulfonic Acid, Sodium Salts	10-25%
	Xi R38-41	
	Eye Dam. 1, H318 Skin Irrit. 2, H315	
CAS: 1300-72-7 EINECS: 215-090-9	Sodium xylenesulphonate	2.5-10%
	Xi R36/37/38 Skin Irrit. 2, H315, Eye Irrit. 2, H319, STOT SE 3, H335	
CAS: 84133-50-6	Alcohol Ethoxylate	2.5-10%
	Xi R36/38 Skin Irrit. 2, H315	

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CAS: 68603-42-9 EINECS: 271-657-0	Coconut diethanolamide ☒ Xi R36/38	2.5-10%
CAS: 17572-97-3 EINECS: 241-543-5	Ethylenediaminetetraacetic acid, tripotassium salt ☒ Xi R36/37/38	2.5-10%

Additional information: For the wording of the listed risk phrases refer to section 16

4 First Aid Measures

4.1 Description of first aid measures

General information:

Take affected persons out into the fresh air.

After inhalation:

Supply fresh air; consult doctor in case of complaints.

After skin contact:

Immediately wash with water and soap and rinse thoroughly.

If skin irritation continues, consult a doctor.

After eye contact:

Remove contact lenses if worn.

Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

After swallowing:

Do not induce vomiting; call for medical help immediately.

Rinse out mouth and then drink plenty of water.

A person vomiting while laying on their back should be turned onto their side.

4.2 Most important symptoms and effects, both acute and delayed:

No further relevant information available.

4.3 Indication of any immediate medical attention and special treatment needed:

No further relevant information available.

5 Firefighting Measures

5.1 Extinguishing media:

Suitable extinguishing agents:

CO₂, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:

No further relevant information available.

5.3 Advice for firefighters:

Protective equipment:

Wear self-contained respiratory protective device.

Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.

Particular danger of slipping on leaked/spilled product.

6.2 Environmental precautions:

Dilute with plenty of water.

Do not allow to enter sewers/ surface or ground water.

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6.3 Methods and material for containment and cleaning up:

Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust). Clean the affected area carefully; suitable cleaners are:

Warm water

6.4 Reference to other sections:

See Section 7 for information on safe handling.

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information

7 Handling and Storage

7.1 Precautions for safe handling:

No special measures required.

Information about fire - and explosion protection:

No special measures required.

7.2 Conditions for safe storage, including any incompatibilities:

Storage:

Requirements to be met by storerooms and receptacles: No special requirements.

Information about storage in one common storage facility: Not required.

Further information about storage conditions: None

7.3 Specific end use(s): No further relevant information available.

8 Exposure Controls/Personal Protection

Additional information about design of technical facilities: No further data; see item 7.

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace:

The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls:

Personal protective equipment:

General protective and hygienic measures:

Keep away from foodstuffs, beverages and feed.

Immediately remove all soiled and contaminated clothing.

Wash hands before breaks and at the end of work.

Avoid contact with the eyes and skin.

Respiratory protection:

Not required.

Protection of hands:



Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

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Material of gloves:

Natural rubber, NR
Nitrile rubber, NBR
Neoprene gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material:

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection:



Safety glasses

Goggles recommended during refilling

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:

Appearance:

Form:	Liquid
Colour:	Light yellow
Odour:	Odourless
Odour threshold:	Not determined.

pH-value at 20°C:	8,5
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Change in condition:

Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	100°C

Flash point:	Not applicable.
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Flammability (solid, gaseous):	Not applicable.
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Ignition temperature:	
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Decomposition temperature:	Not determined.
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Self-igniting:	Product is not selfigniting.
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Danger of explosion:	Product does not present an explosion hazard.
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Explosion limits:

Lower:	Not determined.
Upper:	Not determined.

Vapour pressure at 20°C:	23 hPa
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Density at 20°C:	1.08 g/cm³
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Relative density:	Not determined.
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Vapour density:	Not determined.
-----------------	-----------------

Evaporation rate:	Not determined.
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Solubility in / Miscibility with water:	Fully miscible.
Segregation coefficient (n-octanol/water):	Not determined.
Viscosity:	
Dynamic:	Not determined.
Kinematic:	Not determined.
9.2 Other information:	No further relevant information available

10 Stability and Reactivity

10.1 Reactivity:

10.2 Chemical stability:

Thermal decomposition / conditions to be avoided:

No decomposition if used according to specifications.

10.3 Possibility of hazardous reactions:

Reacts with strong oxidizing agents.

Reacts with strong acids.

10.4 Conditions to avoid:

No further relevant information available.

10.5 Incompatible materials:

No further relevant information available.

10.6 Hazardous decomposition products:

Carbon monoxide and carbon dioxide

Sulphur oxides (SO_x)

Nitrogen oxides

11 Toxicological Information

11.1 Information on toxicological effects:

Acute toxicity:

Primary irritant effect:

On the skin: Irritant to skin and mucous membranes.

On the eye: Strong irritant with the danger of severe eye injury.

Sensitization: No sensitizing effects known.

Additional toxicological information:

The product shows the following dangers according to the calculation method of the General EU

Classification Guidelines for Preparations as issued in the latest version:

Irritant

12 Ecological Information

12.1 Toxicity:

Aquatic toxicity: No further relevant information available.

12.2 Persistence and degradability: No further relevant information available.

12.3 Bioaccumulative potential: No further relevant information available.

12.4 Mobility in soil: No further relevant information available.

Additional ecological information:

General notes:

Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water.

Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.

Must not reach sewage water or drainage ditch undiluted or unneutralized.

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12.5 Results of PBT and vPvB assessment:

PBT: Not applicable.

vPvB: Not applicable.

12.6 Other adverse effects: No further relevant information available.

13 Disposal Considerations

13.1 Waste treatment methods:

Recommendation:

Smaller quantities can be disposed of with household waste.

Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.

The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.

Uncleaned packaging:

Recommendation: Disposal must be made according to official regulations.

Recommended cleansing agents: Water, if necessary together with cleansing agents.

14 Transport Information

14.1 UN-Number:

DOT, ADR, ADN, IMDG, IATA, ICAO: Not Regulated

14.2 UN proper shipping name:

DOT, ADR, ADN, IMDG, IATA, ICAO: Not Regulated

14.3 Transport hazard class(es):

DOT, ADR, ADN, IMDG, IATA, ICAO: Not Regulated

14.4 Packing group:

DOT, ADR, AND, IMDG, IATA, ICAO: Not Regulated

14.5 Environmental hazards:

Marine pollutant: No

14.6 Special precautions for user: Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

UN "Model Regulation": Not Regulated

15 Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

United States (USA):

SARA:

Section 355 (extremely hazardous substances):

None of the ingredients is listed.

Section 313 (Specific toxic chemical listings):

None of the ingredients is listed.

TSCA (Toxic Substances Control Act):

All ingredients are listed.

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Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed.

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed.

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed.

Chemicals known to cause developmental toxicity:

None of the ingredients is listed.

Carcinogenic Categories:

EPA (Environmental Protection Agency):

None of the ingredients is listed.

TLV (Threshold Limit Value established by ACGIH):

None of the ingredients is listed.

NIOSH-Ca (National Institute for Occupational Safety and Health):

None of the ingredients is listed.

OSHA-Ca (Occupational Safety & Health Administration):

None of the ingredients is listed.

Canada:

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed.

Canadian Ingredient Disclosure list (limit 1%):

None of the ingredients is listed.

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevant phrases:

H315 Causes skin irritation.

H318 Causes serious eye damage.

H319 Causes serious eye irritation.

H335 May cause respiratory irritation.

R36/37/38 Irritating to eyes, respiratory system and skin.

R36/38 Irritating to eyes and skin.

R38 Irritating to skin.

R41 Risk of serious damage to eyes.

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Abbreviations and Acronyms

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent

SIMPLE GREEN™ SDS

Safety Data Sheet: **Simple Green® All-Purpose Cleaner**

Version No. 13000-14B

Issue Date: September 13, 2014

Supersedes Date: January 7, 2014

★
OSHA HCS-2012 / GHS

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner

Additional Names:

Manufacturer's Part Number: *Please refer to Section 16

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.

Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.

15922 Pacific Coast Highway

Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 • 562-795-6000 Mon – Fri, 8am – 5pm PST

Fax: 562-592-3830

Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not classified as hazardous under 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200).

OSHA HCS 2012

Label Elements

Signal Word: None

Hazard Symbol(s)/Pictogram(s): None required

Hazard Statements: None

Precautionary Statements: None

Hazards Not Otherwise Classified (HNOC): None

Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

<u>Ingredient</u>	<u>CAS Number</u>	<u>Percent Range</u>
Water	7732-18-5	> 84.8%*
Ethoxylated Alcohol	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Tetrasodium N,N-bis(carboxymethyl)-L-glutamate	51981-21-6	< 1%*
Sodium Carbonate	497-19-8	< 1%*
Citric Acid	77-92-9	< 1%*
Isothiazolinone mixture	55965-84-9	< 0.2%*
Fragrance	Proprietary Mixture	< 1%*
Colorant	Proprietary Mixture	< 1%*

*specific percentages of composition are being withheld as a trade secret

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.

Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.

Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.

Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

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Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO₂, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: For non-emergency and emergency personnel: See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems.

Individual Protection Measures / Personal Protective Equipment (PPE)

Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Green Liquid	Partition Coefficient: n-octanol/water:	Not determined
Odor:	Added sassafras odor	Autoignition Temperature:	Non-flammable
Odor Threshold:	Not determined	Decomposition Temperature:	109°F
pH ASTM D-1293:	8.5 – 9.5	Viscosity:	Like water
Freezing Point ASTM D-1177:	0-3.33°C (32-38°F)	Specific Gravity ASTM D-891:	1.01 – 1.03
Boiling Point & Range ASTM D-1120:	101°C (213.8°F)	VOCs:	**Water & fragrance exemption in calculation
Flash Point ASTM D-93:	> 212°F	SCAQMD 304-91 / EPA 24:	0 g/L 0 lb/gal 0%
Evaporation Rate ASTM D-1901:	½ Butyl Acetate @ 25°C	CARB Method 310**:	2.5 g/L 0.021 lb/gal 0.25%
Flammability (solid, gas):	Not applicable	SCAQMD Method 313:	Not tested
Upper/Lower Flammability or Explosive Limits:	Not applicable	VOC Composite Partial Pressure:	Not determined
Vapor Pressure ASTM D-323:	0.60 PSI @77°F, 2.05 PSI @100°F	Relative Density ASTM D-4017:	8.34 – 8.42 lb/gal
Vapor Density:	Not determined	Solubility:	100% in water

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Section 10: STABILITY AND REACTIVITY

Reactivity:	Non-reactive.
Chemical Stability:	Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions:	None known.
Conditions to Avoid:	Excessive heat or cold.
Incompatible Materials:	Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products:	Normal products of combustion - CO, CO ₂ .

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:	Inhalation -	Overexposure may cause headache.
	Skin Contact -	Not expected to cause irritation, repeated contact may cause dry skin.
	Eye Contact -	Not expected to cause irritation.
	Ingestion -	May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:	Oral LD ₅₀ (rat)	> 5 g/kg body weight
	Dermal LD ₅₀ (rabbit)	> 5 g/kg body weight

Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation:	Non-irritant per Dermal Irritation® assay modeling. No animal testing performed.
Eye Damage/Irritation:	Minimal irritant per Ocular Irritation® assay modeling. No animal testing performed.
Germ Cell Mutagenicity:	Mixture does not classify under this category.
Carcinogenicity:	Mixture does not classify under this category.
Reproductive Toxicity:	Mixture does not classify under this category.
STOT-Single Exposure:	Mixture does not classify under this category.
STOT-Repeated Exposure:	Mixture does not classify under this category.
Aspiration Hazard:	Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity:	Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic:	Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC ₅₀ & IC ₅₀ ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial:	Not tested on finished formulation.
Persistence and Degradability:	Readily Biodegradable per OCED 301D, Closed Bottle Test.
Bioaccumulative Potential:	No data available.
Mobility in Soil:	No data available.
Other Adverse Effects:	No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

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Section 14: TRANSPORT INFORMATION

U.N. Number: Not applicable
 Transport Hazard Class(es): Not applicable
 Packing Group: Not applicable
 Environmental Hazards: Marine Pollutant - NO
 Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
 Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG: Not Regulated for shipping.
 IMO / IDMG: Not classified as Hazardous

ICAO/ IATA: Not classified as Hazardous
 ADR/RID: Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
 Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
 Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed

Texas ESL:

Ethoxylated Alcohol	68439-46-3	60 µg/m ³ long term	600 µg/m ³ short term
Sodium Citrate	68-04-2	5 µg/m ³ long term	50 µg/m ³ short term
Sodium Carbonate	497-19-8	5 µg/m ³ long term	50 µg/m ³ short term
Citric Acid	77-92-9	10 µg/m ³ long term	100 µg/m ³ short term

Section 16: OTHER INFORMATION

Size	UPC	Size	UPC
2 oz. Pump	043318130366	1 Gallon w/ Dilution Bottle	043318000669
2 oz. Pump	043318131035	1 Gallon	043318000799
4 oz. Pump	043318130014	1 Gallon w/ Dilution Bottle	043318001383
16 oz. Trigger	043318130021	1 Gallon w/ Dilution Bottle	043318002021
22 oz. Trigger	043318130229	1 Gallon	043318130052
24 oz. Trigger, 12 per case	043318000034	1 Gallon w/ Dilution Bottle, 112 per case	043318480140
24 oz. Trigger	043318000300	1 Gallon w/ Dilution Bottle, 4 per case	043318480416
24 oz. Trigger	043318130137	1 Gallon w/ Dilution Bottle, 24 per case	043318480492
32 oz. Trigger	043318000652	1 Gallon w/ laundry	043318002052
32 oz. Trigger	043318130335	1 Gallon w/ towel	043318001222
67.6 oz.	043318000393	140 oz.	043318001390
67.6 oz.	043318130144	140 oz., 168 per case	043318561405
1 Gallon w/ Dilution Bottle	043318000539	140 oz. w/ Dilution Bottle	043318001468
1 Gallon w/ Dilution Bottle	043318000645		

USA items listed only. Not all items listed. USA items may not be valid for international sale.

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Section 16: OTHER INFORMATION - continued

NFPA:

Health – None

Flammability – Non-flammable

Stability – Stable

Special - None



Acronyms

NTP National Toxicology Program

OSHA Occupational Safety and Health Administration

TSCA Toxic Substances Control Act

IARC

CPSC

DSL

International Agency for Research on Cancer

Consumer Product Safety Commission

Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.

This SDS has been revised in the following sections: Revised SDS layout

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

METHANOL SDS



Methanol

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/03/2013

Revision date: 11/15/2013

Supersedes: 10/02/2013

Version: 1.2

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	: Substance
Substance name	: Methanol
CAS No	: 67-56-1
Product code	: VT430
Formula	: CH ₄ O
Synonyms	: acetone alcohol / alcohol C1 / alcohol, methyl / carbinol / colonial spirits / columbian spirits / green wood spirits / manhattan spirits / methyl alcohol / methyl hydrate / methyl hydroxide / methylen / methylol / monohydroxymethane / pyroligneous spirit / pyroxylic spirit / wood alcohol / wood naphtha

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	: Solvent
------------------------------	-----------

1.3. Details of the supplier of the safety data sheet

Val Tech Diagnostics, A Division of LabChem Inc
Jackson's Pointe Commerce Park Building 1000
1010 Jackson's Pointe Court
Zellenople, PA 16063
T 412-826-5230
F 724-473-0647

1.4. Emergency telephone number

Emergency number	: CHEMTREC: 1-800-424-9300 or 011-703-527-3887
------------------	--

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam., Liq. 2	H225
Acute Tox. 3 (Oral)	H301
Acute Tox. 3 (Dermal)	H311
Acute Tox. 3 (Inhalation)	H331
STOT SE 1	H370

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US)



GHS02



GHS06



GHS05

Signal word (GHS-US)

: Danger

Hazard statements (GHS-US)

: H225 - Highly flammable liquid and vapour
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled
H370 - Causes damage to organs (liver, kidneys, central nervous system, optic nerve) (Dermal, oral)

Precautionary statements (GHS-US)

: P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking
P233 - Keep container tightly closed
P240 - Ground/bond container and receiving equipment
P241 - Use explosion-proof electrical, ventilating, lighting equipment
P242 - Use only non-sparking tools
P243 - Take precautionary measures against static discharge
P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves, protective clothing, eye protection, face protection

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P301 + P310 - IF SWALLOWED: immediately call a POISON CENTER or doctor/physician
P303 + P361 + P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304 + P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P330 - If swallowed, rinse mouth
P363 - Wash contaminated clothing before reuse
P370 + P378 - In case of fire: Use carbon dioxide (CO₂), powder, alcohol-resistant foam for extinction
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed
P235 - Keep cool
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent
Name : Methanol
CAS No : 67-56-1
EC no : 200-659-6
EC index no : 603-001-00-X

Name	Product identifier	%	GHS-US classification
Methanol (Main constituent)	(CAS No) 67-56-1	100	Flam. Liq. 2, H225 Acute Tox. 3 (Oral), H301 Acute Tox. 3 (Dermal), H311 Acute Tox. 3 (Inhalation), H331 STOT SE 1, H370

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Never give alcohol to drink.

First-aid measures after inhalation : Remove the victim into fresh air. Immediately consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Consult a doctor/medical service.

First-aid measures after eye contact : Rinse with water. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Give nothing to drink. Do not induce vomiting. Immediately consult a doctor/medical service. Call Poison Information Centre (www.big.be/antigif.htm). Ingestion of large quantities: immediately to hospital. Take the container/vomit to the doctor/hospital. Doctor: administration of chemical antidote. Doctor: gastric lavage.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Slight irritation. EXPOSURE TO HIGH CONCENTRATIONS: Coughing. Symptoms similar to those listed under ingestion.

Symptoms/injuries after skin contact : Symptoms similar to those listed under ingestion. Slight irritation.

Symptoms/injuries after eye contact : Redness of the eye tissue. Lacrimation.

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Symptoms/injuries after ingestion	: Nausea, Vomiting, AFTER ABSORPTION OF HIGH QUANTITIES: FOLLOWING SYMPTOMS MAY APPEAR LATER: Change in the haemogramme/blood composition, Headache, Feeling of weakness, Abdominal pain, Muscular pain, Central nervous system depression, Dizziness, Mental confusion, Drunkenness, Coordination disorders, Disturbed motor response, Disturbances of consciousness, Visual disturbances, Blindness, Respiratory difficulties, Cramps/uncontrolled muscular contractions.
Chronic symptoms	: ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Red skin, Dry skin, Skin rash/inflammation, Headache, Disturbed tactile sensibility, Visual disturbances, Sleeplessness, Gastrointestinal complaints, Cardiac and blood circulation effects.

4.3. Indication of any immediate medical attention and special treatment needed

Hospitalize at once. Until victim can be cared for by specialized staff:

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	: Preferably, alcohol resistant foam, Water spray, BC powder, Carbon dioxide.
Unsuitable extinguishing media	: Solid water jet ineffective as extinguishing medium.

5.2. Special hazards arising from the substance or mixture

Fire hazard	: DIRECT FIRE HAZARD. Highly flammable. Gas/vapour flammable with air within explosion limits. INDIRECT FIRE HAZARD. May be ignited by sparks.
Explosion hazard	: DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".
Reactivity	: On heating: release of toxic/corrosive/combustible gases/vapours (formaldehyde). Upon combustion: CO and CO ₂ are formed. Violent to explosive reaction with (some) metal powders and with (strong) oxidizers. Violent exothermic reaction with (some) acids and with (some) halogens compounds.

5.3. Advice for firefighters

Firefighting instructions	: Cool tanks/drums with water spray/remove them into safety. Do not move the load if exposed to heat. Take account of toxic fire-fighting water. Use water moderately and if possible collect or contain it.
Protection during firefighting	: Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment	: Gas-tight suit.
Emergency procedures	: Keep upwind. Mark the danger area. Consider evacuation. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosionproof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment	: Equip cleanup crew with proper protection.
Emergency procedures	: Stop leak if safe to do so. Ventilate area.

6.2. Environmental precautions

Prevent soil and water pollution. Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

For containment	: Contain released substance, pump into suitable containers. Consult "Material-handling" to select material of containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute combustible/toxic gases/vapours with water spray. Take account of toxic/corrosive precipitation water. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.
Methods for cleaning up	: Take up liquid spill into a non combustible material e.g.: sand, earth, vermiculite slaked lime or soda ash. Scoop absorbed substance into closing containers. See "Material-handling" for suitable container materials. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

Methanol

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SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling** : Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Observe strict hygiene. Keep container tightly closed. Measure the concentration in the air regularly. Work under local exhaust/ventilation.
- Hygiene measures** : Do not eat, drink or smoke when using this product. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

- Incompatible products** : Strong oxidizers. Strong bases. Strong acids. Acid anhydrides. Acid chlorides.
- Incompatible materials** : Direct sunlight. Heat sources. Sources of ignition.
- Heat and ignition sources** : KEEP SUBSTANCE AWAY FROM: heat sources, ignition sources.
- Prohibitions on mixed storage** : KEEP SUBSTANCE AWAY FROM: combustible materials, oxidizing agents, (strong) acids, (strong) bases, halogens, amines, water/moisture.
- Storage area** : Store at room temperature. Keep out of direct sunlight. Store in a dry area. Keep container in a well-ventilated place. Fireproof storeroom. Keep locked up. Provide for a tub to collect spills. Provide the tank with earthing. Unauthorized persons are not admitted. Aboveground. Meet the legal requirements.
- Special rules on packaging** : SPECIAL REQUIREMENTS: closing, dry, clean, correctly labelled, meet the legal requirements. Secure fragile packagings in solid containers.
- Packaging materials** : SUITABLE MATERIAL: steel, stainless steel, iron, glass, MATERIAL TO AVOID: lead, aluminium, zinc, polyethylene, PVC.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Methanol (67-56-1)		
USA ACGIH	ACGIH TWA (ppm)	200 ppm
USA ACGIH	ACGIH STEL (ppm)	200 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	260 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm

8.2. Exposure controls

- Appropriate engineering controls** : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Keep concentrations well below lower explosion limits.
- Personal protective equipment** : Safety glasses. Protective clothing. Gloves. Full protective flameproof clothing. Face shield.



- Materials for protective clothing** : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: polyethylene/ethylenevinylalcohol, styrene-butadiene rubber, viton. GIVE LESS RESISTANCE: chloroprene rubber, chlorinated polyethylene, natural rubber, nitrile rubber/PVC. GIVE POOR RESISTANCE: leather, neoprene, nitrile rubber, polyethylene, PVA, PVC, polyurethane.
- Hand protection** : Gloves.
- Eye protection** : Combined eye and respiratory protection. Safety glasses.
- Skin and body protection** : Head/neck protection. Protective clothing.
- Respiratory protection** : Gas mask with filter type AX at conc. in air > exposure limit. Wear gas mask with filter type A if conc. in air > exposure limit. High vapour/gas concentration: self-contained respirator.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state** : Liquid

05/15/2014

EN (English)

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Appearance	: Liquid
Molecular mass	: 32.04 g/mol
Colour	: Colourless
Odour	: Characteristic odour, Mild odour, Pleasant odour, Alcohol odour, Commercial/unpurified substance; Irritating/pungent odour
Odour threshold	: 2000 - 8800 ppm 2620 - 11528 mg/m ³
pH	: No data available
Relative evaporation rate (butylacetate=1)	: 4.1
Relative evaporation rate (ether=1)	: 6.3
Melting point	: -98 °C
Freezing point	: No data available
Boiling point	: 65 °C
Flash point	: 11 °C
Critical temperature	: 240 °C
Self ignition temperature	: 455 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: 128 hPa
Vapour pressure at 50 °C	: 552 hPa
Critical pressure	: 79547 hPa
Relative vapour density at 20 °C	: 1.1
Relative density	: 0.79
Relative density of saturated gas/air mixture	: 1.0
Density	: 792 kg/m ³
Solubility	: Soluble in water, Soluble in ethanol, Soluble in ether, Soluble in acetone, Soluble in chloroform. Water: Complete Ethanol: Complete Ether: Complete Acetone: Complete
Log Pow	: -0.77 (Experimental value, Other, Experimental value, Other)
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: 0.6 mPa·s (20 °C)
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: 5.5 - 36.5 vol %

9.2. Other information

Minimum ignition energy	: 0.14 mJ
Saturation concentration	: 166 g/m ³
VOC content	: 100 %
Other properties	: Clear, Hygroscopic, Volatile, Substance has neutral reaction.

SECTION 10: Stability and reactivity

10.1. Reactivity

On heating; release of toxic/corrosive/combustible gases/vapours (formaldehyde). Upon combustion; CO and CO₂ are formed. Violent to explosive reaction with (some) metal powders and with (strong) oxidizers. Violent exothermic reaction with (some) acids and with (some) halogens compounds.

10.2. Chemical stability

Hygroscopic.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Direct sunlight, High temperature, Incompatible materials, Open flame, Sparks, Overheating.

Methanol

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10.5. Incompatible materials

Strong oxidizers. Strong bases. Strong acids. Peroxides. Acid anhydrides. Acid chlorides.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity

☐ Toxic if swallowed. Toxic in contact with skin. Toxic if inhaled.

Methanol (MF 67-56-1)	
LD50 oral rat	> 5000 mg/kg (1187-2769 mg/kg bodyweight: Rat; Rat)
LD50 dermal rabbit	15800 mg/kg (Rabbit)
LC50 inhalation rat (mg/l)	85 mg/l/4h (Rat)
LC50 inhalation rat (ppm)	64000 ppm/4h (Rat)
Skin corrosion/irritation	☐ Not classified
Serious eye damage/irritation	☐ Not classified
Respiratory or skin sensitisation	☐ Not classified
Germ cell mutagenicity	☐ Not classified
Carcinogenicity	☐ Not classified
Reproductive toxicity	☐ Not classified
Specific target organ toxicity (single exposure)	☐ Causes damage to organs (liver, kidneys, central nervous system, optic nerve) (Dermal, oral).
Specific target organ toxicity (repeated exposure)	☐ Not classified
Aspiration hazard	☐ Not classified
Symptoms/injuries after inhalation	☐ Slight irritation. EXPOSURE TO HIGH CONCENTRATIONS: Coughing. Symptoms similar to those listed under ingestion.
Symptoms/injuries after skin contact	☐ Symptoms similar to those listed under ingestion. Slight irritation.
Symptoms/injuries after eye contact	☐ Redness of the eye tissue. Lacrimation.
Symptoms/injuries after ingestion	☐ Nausea. Vomiting. AFTER ABSORPTION OF HIGH QUANTITIES: FOLLOWING SYMPTOMS MAY APPEAR LATER: Change in the haemogramme/blood composition. Headache. Feeling of weakness. Abdominal pain. Muscular pain. Central nervous system depression. Dizziness. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness. Visual disturbances. Blindness. Respiratory difficulties. Cramps/uncontrolled muscular contractions.
Chronic symptoms	☐ ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Red skin. Dry skin. Skin rash/inflammation. Headache. Disturbed tactile sensibility. Visual disturbances. Sleeplessness. Gastrointestinal complaints. Cardiac and blood circulation effects.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	☐ Classification concerning the environment: not applicable.
Ecology - air	☐ TA-Luft Klasse 5.2.5/I.
Ecology - water	☐ Not harmful to fishes (LC50(96h) >1000 mg/l). Not harmful to invertebrates (Daphnia) (EC50 (48h) > 1000 mg/l). Not harmful to algae (EC50 (72h) >1000 mg/l). Slightly harmful to bacteria (EC50: 100 - 1000 mg/l). Inhibition of activated sludge.

Methanol (67-56-1)	
LC50 fishes 1	15400 mg/l (96 h; Lepomis macrochirus; Lethal)
EC50 Daphnia 1	> 10000 mg/l (48 h; Daphnia magna; Lethal)
LC50 fish 2	10800 mg/l 96 h; Salmo gairdneri (Oncorhynchus mykiss)
EC50 Daphnia 2	24500 mg/l (48 h; Daphnia magna)
Threshold limit other aquatic organisms 1	6600 mg/l (16 h; Pseudomonas putida)
Threshold limit algae 1	530 mg/l (192 h; Microcystis aeruginosa)
Threshold limit algae 2	8000 mg/l (168 h; Scenedesmus quadricauda)

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12.2. Persistence and degradability

Methanol (67-56-1)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil.
Biochemical oxygen demand (BOD)	0.6 - 1.12 g O ₂ /g substance
Chemical oxygen demand (COD)	1.42 g O ₂ /g substance
ThOD	1.5 g O ₂ /g substance
BOD (% of ThOD)	0.8 % ThOD

12.3. Bioaccumulative potential

Methanol (67-56-1)	
BCF fish 1	< 10 (Leuciscus idus)
Log Pow	-0.77 (Experimental value; Other, Experimental value; Other)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Methanol (67-56-1)	
Surface tension	0.023 N/m (20 °C)

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations	<ul style="list-style-type: none"> Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Incinerate under surveillance with energy recovery. Do not discharge into drains or the environment. Obtain the consent of pollution control authorities before discharging to wastewater treatment plants.
Additional information	<ul style="list-style-type: none"> LWCA (the Netherlands): KGA category 06. Hazardous waste according to Directive 2008/98/EC.

SECTION 14: Transport information

In accordance with DOT

Transport document description	UN1230 Methanol, 3, II
UN-No. (DOT)	1230
DOT NA no.	UN1230
DOT Proper Shipping Name	Methanol
Department of Transportation (DOT) Hazard Classes	3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120
Hazard labels (DOT)	3 - Flammable liquid



DOT Symbols	D - Proper shipping name for domestic use only, or to and from Canada
Packing group (DOT)	II - Medium Danger

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DOT Special Provisions (49 CFR 172.102)	<p>IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized.</p> <p>T7 - 4 178.274(d)(2) Normal,..... 178.275(d)(3)</p> <p>TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: (image) Where: tr is the maximum mean bulk temperature during transport, Tf is the temperature in degrees celsius of the liquid during filling, and a is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (Tf) and the maximum mean bulk temperature during transportation (tr) both in degrees celsius; b. For liquids transported under ambient conditions may be calculated using the formula: (image) Where: d15 and d50 are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively.</p>
DOT Packaging Exceptions (49 CFR 173.xxx)	150
DOT Packaging Non Bulk (49 CFR 173.xxx)	202
DOT Packaging Bulk (49 CFR 173.xxx)	242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	1 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	60 L
DOT Vessel Stowage Location	<p>B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.</p>
DOT Vessel Stowage Other	40 - Stow "clear of living quarters"

Additional Information

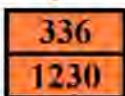
Other information	No supplementary information available.
State during transport (ADR-RID)	as liquid.

ADR

Transport document description	UN 1230 Methanol, 3 (6.1), II, (D/E)
Packing group (ADR)	II
Class (ADR)	3 - Flammable liquid
Hazard identification number (Kernler No.)	336
Classification code (ADR)	FT1
Danger labels (ADR)	<p>3 - Flammable liquids</p> <p>6.1 - Toxic substances</p>



Orange plates



Tunnel restriction code

D/E

Transport by sea

UN-No. (IMDG)	1230
Class (IMDG)	3 - Flammable liquids
Subsidiary risk (IMDG)	6.1
EmS-No. (1)	F-E
MFAG-No	19
EmS-No. (2)	S-D

Air transport

UN-No.(IATA)	1230
Class (IATA)	3 - Flammable Liquids

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Packing group (IATA) : II - Medium Danger
Subsidiary risk (IATA) : 6.1

SECTION 15: Regulatory information

15.1. US Federal regulations

Methanol (67-56-1)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
RQ (Reportable quantity, section 304 of EPA's List of Lists) :	5000 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Fire hazard

15.2. International regulations

CANADA

Methanol (67-56-1)	
Listed on the Canadian DSL (Domestic Substances List) inventory:	
WHMIS Classification	Class B Division 2 - Flammable Liquid Class D Division 2 Subdivision A - Very toxic material causing other toxic effects Class D Division 2 Subdivision B - Toxic material causing other toxic effects

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2 H225
Acute Tox. 3 (Inhalation) H331
Acute Tox. 3 (Dermal) H311
Acute Tox. 3 (Oral) H301
STOT SE 1 H370
STOT SE 1 H370
STOT SE 1 H370

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

F: R11
T: R23/24/25
T: R39/23/24/25

Full text of R-phrases: see section 16

15.2.2. National regulations

Methanol (67-56-1)	
Listed on the Canadian Ingredient Disclosure List	

15.3. US State regulations

Methanol(67-56-1)	
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
No significance risk level (NSRL)	23000 µg/day

SECTION 16: Other information

Full text of H-phrases: see section 16:

Acute Tox. 3 (Dermal)	Acute toxicity (dermal), Category 3
Acute Tox. 3 (Inhalation)	Acute toxicity (inhal.), Category 3

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Acute Tox. 3 (Oral)	Acute toxicity (oral), Category 3
Flam. Liq. 2	Flammable liquids, Category 2
STOT-SE 1	Specific target organ toxicity — single exposure, Category 1
H225	Highly flammable liquid and vapour
H301	Toxic if swallowed
H311	Toxic in contact with skin
H331	Toxic if inhaled
H370	Causes damage to organs

NFPA health hazard

NFPA fire hazard

NFPA reactivity

- 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given.
- 3 - Liquids and solids that can be ignited under almost all ambient conditions.
- 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health

Flammability

Physical

Personal Protection

- 2 Moderate Hazard - Temporary or minor injury may occur
- 3 Serious Hazard
- 0 Minimal Hazard
- H

SDS US ValTech

Information in this SDS is from available published sources and is believed to be accurate. No warranty, expression implied, is made that the information is accurate or reliable. The user must determine suitability of this information for his application.

NITRIC ACID SDS



Nitric Acid, 10% v/v (1+9)

Safety Data Sheet

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Date of issue: 10/31/2013 Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Product name : Nitric Acid, 10% v/v (1+9)
Product code : LC17730

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Met. Corr. 1 H290
Skin Corr. 1B H314
Eye Dam. 1 H318

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :



GHS05

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : H290 - May be corrosive to metals
H314 - Causes severe skin burns and eye damage

Precautionary statements (GHS-US) : P234 - Keep only in original container
P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P280 - Wear protective gloves, protective clothing, eye protection, face protection
P301+P330+P331 - IF SWALLOWED: rinse mouth. Do NOT induce vomiting
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P363 - Wash contaminated clothing before reuse
P390 - Absorb spillage to prevent material damage
P405 - Store locked up
P406 - Store in corrosive resistant container with a resistant inner liner
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

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SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product Identifier	%	GHS-US classification
Water	(CAS No.) 7732-18-5	90.5	Not classified
Nitric Acid, 70% w/w	(CAS No.) 7697-37-2	9.5	Ox. Liq. 3, H272 Met. Corr. 1, H290 Skin Corr. 1A, H314 Eye Dam. 1, H318

SECTION 4: First aid measures

4.1. Description of first aid measures

- First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
- First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after skin contact : Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/physician.

4.2. Most important symptoms and effects, both acute and delayed

- Symptoms/injuries : Causes severe skin burns and eye damage.
- Symptoms/injuries after eye contact : Causes serious eye damage.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.
- Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

- Reactivity : Thermal decomposition generates : Corrosive vapours.

5.3. Advice for firefighters

- Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.
- Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

- Protective equipment : Protective goggles. Protective clothing. Gloves. Combined gas/dust mask with filter type B/P3.
- Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

- Protective equipment : Equip cleanup crew with proper protection.
- Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

- Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials. Absorb spillage to prevent material damage.

Nitric Acid, 10% v/v (1+9)

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6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Additional hazards when processed : May be corrosive to metals.
- Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour. Do not breathe mist, vapours, spray.
- Hygiene measures : Wash exposed skin thoroughly after handling. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

- Technical measures : Comply with applicable regulations.
- Storage conditions : Keep only in the original container in a cool, well ventilated place away from : incompatible materials. Keep container closed when not in use.
- Incompatible products : Strong bases, Halogens, metals, aluminium, Strong reducing agents.
- Incompatible products : Sources of ignition. Direct sunlight.
- Packaging materials : Store in corrosive resistant/... container with a resistant inner liner.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Nitric Acid, 70% w/w (7697-37-2)		
USA ACGIH	ACGIH TWA (ppm)	2 ppm
USA ACGIH	ACGIH STEL (ppm)	2 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	5 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	2 ppm

8.2. Exposure controls

- Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate general and local exhaust ventilation.
- Personal protective equipment : Avoid all unnecessary exposure. Combined gas/dust mask with filter type B/P3. Gloves. Protective clothing. Protective goggles.



- Hand protection : Wear protective gloves.
- Eye protection : Chemical goggles or face shield.
- Skin and body protection : Wear suitable protective clothing.
- Respiratory protection : Wear appropriate mask.
- Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state : Liquid
- Appearance : Colorless to pale yellow liquid.
- Colour : Colourless to light yellow.
- Odour : characteristic, Pungent.
- Odour threshold : No data available
- pH : No data available
- Relative evaporation rate (butylacetate=1) : No data available
- Melting point : No data available
- Freezing point : No data available

Nitric Acid, 10% v/v (1+9)

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Boiling point	: No data available
Flash point	: No data available
Self ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Density	: 1.05 g/ml
Solubility	: Soluble in water.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: 0.99 cSt
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: No data available

9.2. Other Information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Thermal decomposition generates : Corrosive vapours.

10.2. Chemical stability

Not established.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Strong reducing agents. Strong bases, metals, aluminium. Ammonia, combustible materials, Halogens.

10.6. Hazardous decomposition products

Nitrogen oxides. Thermal decomposition generates : Corrosive vapours.

SECTION 11: Toxicological information

11.1. Information on toxicological effects:

Acute toxicity : Not classified

Water (7732-18-5)	
LD50 oral rat	≥ 90000 mg/kg
Skin corrosion/irritation	: Causes severe skin burns and eye damage.
Serious eye damage/irritation	: Causes serious eye damage.
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified

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Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.

Symptoms/injuries after eye contact : Causes serious eye damage.

SECTION 12: Ecological information

12.1. Toxicity

Nitric Acid, 70% w/w (7697-37-2)	
LC50 fishes 1	25 - 36 mg/l (96 h; Lepomis macrochirus; Pure substance)
EC50 Daphnia 1	180 mg/l (48 h; Daphnia magna; Pure substance)
LC50 fish 2	72 ppm (Gambusia affinis; Pure substance)
Threshold limit algae 1	> 19 mg/l (Algae; Pure substance)

12.2. Persistence and degradability

Nitric Acid, 10% v/v (1+9)	
Persistence and degradability	Not established.
Nitric Acid, 70% w/w (7697-37-2)	
Persistence and degradability	Biodegradability: not applicable. No (test) data on mobility of the components of the mixture available.
Biochemical oxygen demand (BOD)	Not applicable
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

12.3. Bioaccumulative potential

Nitric Acid, 10% v/v (1+9)	
Bioaccumulative potential	Not established.
Nitric Acid, 70% w/w (7697-37-2)	
BCF fish 1	<= 1 (Piscés)
Log Pow	-2.3 (OECD 107: Partition Coefficient (n-octanol/water): Shake Flask Method)
Bioaccumulative potential	Bioaccumulation: not applicable.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to comply with local, state and federal regulations.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN2031 Nitric acid other than (red fuming, with not more than 20 percent nitric acid), 8, II

UN-No. (DOT) : 2031

DOT NA no. : UN2031

DOT Proper Shipping Name : Nitric acid other than red fuming, with not more than 20 percent nitric acid

Department of Transportation (DOT) Hazard Classes : 8 - Class 8 - Corrosive material 49 CFR 173.136

Nitric Acid, 10% v/v (1+9)

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Hazard labels (DOT)

8 - Corrosive substances



Packing group (DOT)

II - Medium Danger

DOT Special Provisions (49 CFR 172.102)

A6 - For combination packagings, if plastic inner packagings are used, they must be packed in tightly closed metal receptacles before packing in outer packagings.
B2 - MC 300, MC 301, MC 302, MC 303, MC 305, and MC 306 and DOT 406 cargo tanks are not authorized.
B47 - Each tank may have a reclosing pressure relief device having a start-to-discharge pressure setting of 310 kPa (45 psig).
B53 - Packagings must be made of either aluminum or steel.
IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized.
T8 - 4 178.274(d)(2) Normal..... Prohibited
TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = $95 / (1 + a (t_r - t_f))$ Where: t_r is the maximum mean bulk temperature during transport, t_f is the temperature in degrees celsius of the liquid during filling, and is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (t_f) and the maximum mean bulk temperature during transportation (t_r) both in degrees celsius. b. For liquids transported under ambient conditions may be calculated using the formula: $a = (d_{15} - d_{50}) / 35 \cdot d_{50}$ Where: d_{15} and d_{50} are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively.
TP12 - This material is considered highly corrosive to steel.

DOT Packaging Exceptions (49 CFR 173.xxx)

: None

DOT Packaging Non Bulk (49 CFR 173.xxx)

: 158

DOT Packaging Bulk (49 CFR 173.xxx)

: 242

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)

: 1 L

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)

: 30 L

DOT Vessel Stowage Location

: D - The material must be stowed "on deck only" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers or one passenger per each 3 m of overall vessel length, but the material is prohibited on passenger vessels in which the limiting number of passengers is exceeded.

Additional Information

Other information

: No supplementary information available.

ADR

Transport document description

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1: US Federal regulations

Nitric Acid, 10% v/v (1+9)	
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard
Nitric Acid, 70% w/w (7697-37-2)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
RQ (Reportable quantity, section 304 of EPA's List of Lists)	1000 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard

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Nitric Acid, 10% v/v (1+9)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

15.2. International regulations

CANADA

Nitric Acid, 10% v/v (1+9)	
WHMIS Classification	Class E - Corrosive Material
Nitric Acid, 70% w/w (7697-37-2)	
Listed on the Canadian DSL (Domestic Substances List) inventory.	
WHMIS Classification	Class E - Corrosive Material Class C - Oxidizing Material

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Nitric Acid, 70% w/w (7697-37-2)	
Listed on the Canadian Ingredient Disclosure List	

15.3. US State regulations

No additional information available

SECTION 16: Other information

Other information : None.

Full text of H-phrases: see section 16:

Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Met. Corr. 1	Corrosive to metals, Category 1
Ox. Liq. 3	Oxidising Liquids, Category 3
Skin Corr. 1A	Skin corrosion/irritation, Category 1A
Skin Corr. 1B	Skin corrosion/irritation, Category 1B
H272	May intensify fire; oxidiser
H290	May be corrosive to metals
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage

NFPA health hazard

NFPA fire hazard

NFPA reactivity

NFPA specific hazard

- : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
- : 0 - Materials that will not burn.
- : 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
- : OX - This denotes an oxidizer, a chemical which can greatly increase the rate of combustion/fire.



Nitric Acid, 10% v/v (1+9)**Safety Data Sheet**

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

HMIS III Rating

Health	: 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given
Flammability	: 0 Minimal Hazard
Physical	: 1 Slight Hazard
Personal Protection	: H

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc. assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

10/31/2013

EN (English)

8/8

9.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) covers the following monitor well gauging activities to be implemented by INTERA field personnel during characterization, remediation, or monitoring of environmental sites:

- Depth to water (DTW) (**Section 9.1**);
- Phase separated hydrocarbon (PSH) levels (**Section 9.2**); and
- Well total depth (TD) (**Section 9.3**).

The objective of this SOP is to promote standardization between monitoring/sample collection events in order to obtain consistent and accurate data inputs for the site/project that can be evaluated over time. As applicable, well gauging data collected at a site may provide a long-term record of:

- Seasonal groundwater fluctuations;
- Presence, location, and thickness of measurable amounts of PSH; and
- Effectiveness of recovery well operations.

This SOP should be used in conjunction with procedures presented in the INTERA Site-Specific Health and Safety Plan (SSHASP) and in site-specific investigation planning documents such as a Sampling and Analysis Plan (SAP), Field Sampling Plan (FSP), or Work Plan (WP). This SOP will also be commonly used with and is referenced in the following INTERA SOPs:

- 1, *Air Monitoring*;
- 2, *Decontamination*;
- 8, *Monitor Well Development*;
- 10, *Monitor Well Sampling for Groundwater*;
- 15, *Slug Test Procedures*;
- 20, *LNAPL Sampling*; and
- 30, *Field Forms*.

9.1 Procedure – Measuring DTW

The following procedure is to be utilized at wells not suspected to contain PSH. Gauging DTW may be performed separately or in conjunction with purging and sampling of a well. If well sampling is also to be performed, DTW measurements should be collected prior to any activity which may alter the water level, such as bailing, pumping or hydraulic testing.

In either case, standard procedure is as follows:

1. Confirm that equipment required for DTW gauging is available, cleaned, and in good working order. Equipment to be taken to the site by the INTERA field staff may include:
 - Water-level indicator such as an electric water-level meter or equivalent that provides measurement accuracy up to one hundredth of a foot (0.01 foot);
 - Socket wrenches, bung wrenches and/or open-end wrenches;
 - Other tools such as screw drivers, hammer, pliers, bolt cutter, and extra batteries, as necessary;
 - Key or combination for monitor well lock;
 - Applicable decontamination equipment as outlined in INTERA SOP 2, *Decontamination*;
 - Appropriate Personal Protection Equipment (PPE) as defined in the SSHASP;
 - Traffic safety equipment (traffic cones, barriers, caution tape and other traffic control equipment), as required;
 - Air monitoring equipment, as appropriate;
 - Field logbook and site plan indicating well locations;
 - Copies of previous well gauging data, if available;
 - Copies of well construction diagrams or table with expected total depths, if available;
 - Weighted metal measuring tape for measurement of total depths, if necessary;
 - Trash bag/waste container for investigation-derived waste (e.g. used paper towels from decontamination of water-level meter between wells); and
 - Plastic sheeting, if appropriate.
2. Determine sequence of wells to be gauged for the site. If applicable, attempt to gauge wells in order of least contaminated to most contaminated to minimize the potential for cross contamination between wells. If chemistry is unknown, measure wells from upgradient to downgradient, if known.
3. Verify well location ID.

4. If applicable, sweep area around the well vault to minimize dislodging loose materials (e.g. rocks and organic debris) into the well vault and potentially into the open well.
5. Place plastic sheeting/drop cloth next to the well to create a clean surface onto which the measurement and sampling equipment can be placed. Do not place tools, equipment, or other materials on the sheet unless they have been cleaned first and do not place tools, equipment or other materials directly on the ground surface or well pad. Plastic sheeting may not be necessary if equipment will not be placed on the ground.
6. Open the monitor well cover/vault, taking care to place loose components (e.g., cover bolts, washers, and tools) in a protected area away from the well opening.
7. Don appropriate PPE. At a minimum, this should include gloves and eye protection. Specifics regarding appropriate PPE for a site is provided in the SSHASP.
8. Upon opening the well cover/vault, monitor atmosphere for hazardous conditions using procedures outlined in INTERA SOP 1, *Air Monitoring*. Depending on known or suspected contaminants of concern at the site, one or more of the following monitoring devices may be appropriate: a photoionization detector (PID), a flame ionization detector (FID), a lower explosive limit (LEL)/oxygen (O₂) meter, and/or a hydrogen sulfide (H₂S) meter. PID monitoring is a common requirement for chlorinated solvent sites; H₂S monitoring is a common requirement at crude oil sites. Specifics regarding the types of monitoring requirements that may be applicable for a site will be documented in the SSHASP.
9. Inspect for insects or any damaged or broken components prior to placing hands in well cover/vault. Remove and/or note in logbook, as appropriate. As appropriate, take a photograph to document any alterations of significance (i.e., top of the well casing might have been altered) and contact Project Manager prior to proceeding.
10. Unlock and/or remove the monitor well cap. Recheck air monitoring readings as described in number 8.
11. Check for the measuring point at the top of the well. The measuring-point location should be clearly marked on the innermost casing (typically a filed or chiseled notch marked with paint or permanent ink) or identified in previous sample-collection records and should correspond to the surveyed well casing rim or other surveyed datum.

- a. If no measuring-point can be identified, establish and mark a measuring point on the north side of the innermost well casing (preferable) or at the highest point. Document location on the appropriate INTERA field form (**SOP 30, Field Form 4 – Monitor Well Gauging Data**) and/or in the field logbook. **NOTE:** The same point should be used for all subsequent gauging efforts.
12. Lower the water-level indicator line into the well casing, taking care to ensure that the line hangs freely in the well casing and does not adhere to the wall of the well casing. For most sites, an electric water-level meter is considered appropriate. Prior to lowering water level meter into the well, turn on the meter to check that it is in working order being careful to follow manufacturer's instructions.
13. Continue to lower the water-level indicator into the well until contact with water is felt or the meter sounds and/or lights. A precise measurement of DTW should be determined to 0.01 foot by repeatedly raising and lowering the line along the measuring point to converge on an exact measurement.
14. Record the final DTW measurement on the appropriate field form (**SOP 30, Field Form 4**) and/or in the field logbook. If the field form is unavailable, data may be recorded in the field logbook along with measurement date and time.

NOTE: If a gauging instrument is missing any footage, make a notation on the gauging form (e.g. "subtract 1 foot from all gaugings" on the form). **Read measurements directly from the tape;** do not make mental adjustments to readings as it could lead to errors. The data can always be corrected post-reading if adequately documented.

15. Retract the water-level indicator line from the well casing while holding paper towels prepared with the appropriate detergent wash and rinse to decontaminate the indicator tape prior to use at another well location. Typically, only the probe and the portion of the tape that has been lowered below the top of the well vault requires decontamination. To decontaminate, pass the line through the paper towel with the section wetted with detergent wash placed nearest to the well head and the section wetted with rinse water placed nearest to the water-level reel. This process is most efficiently accomplished by two people but can be completed in sections by one person. Do not allow tape to contact unprotected ground surface. Complete decontamination by spraying down the probe sides with the detergent solution and end with distilled/deionized water.

9.1.1 Additional Considerations for DTW Gauging Recent Pumping

At sites where groundwater pumping may have recently occurred in the vicinity of the monitor well, subsequent water-level measurements may be appropriate to confirm that

site static water level conditions have been documented. In these instances, a second water-level measurement should be taken anywhere from 30 minutes to 60 minutes after the initial measurement to verify that a static water-level measurement was obtained. If static conditions have not been reached, information documenting pumping affects should be included in the field logbook.

Confined Aquifers

At sites where confined aquifers are present and monitor wells are **NOT** vented, the wells need to be opened and allowed to equilibrate for 30 minutes to 60 minutes depending on tightness of the formation being monitored. Tighter formations may require longer time periods to equilibrate.

Sites with Shallow Groundwater Gradients

For sites where the groundwater gradient is extremely shallow and/or groundwater flow direction is of significant concern, special care should be taken to:

- Allow the water level to equilibrate prior to reading after removing well caps;
- Employ the same water-level indicator on all site wells; and
- Obtain DTW measurements for all wells within the minimum possible time.

9.2 Procedure – Measuring Phase-Separated Hydrocarbons (PSH)

The following procedure is to be utilized at wells known or suspected to contain PSH. PSH frequently occurs at hazardous sites as either light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL). If present, LNAPL will float on top of the water column; DNAPL will be present at the base of the water column.

In general, the procedure for gauging PSH levels in a well is the same as that for obtaining DTW measurements but noting and applying the following exceptions:

- Use an oil/water interface probe with separate tones for PSH and water instead of a standard electric water-level meter to obtain a PSH level reading (applicable to both LNAPL and DNAPL);
- A precise measurement of LNAPL should be determined by repeatedly raising and lowering the line along the measuring point to converge on an exact measurement and followed by repeated measurements of the water level to obtain a precise measurement of DTW (note that the order measurement is reversed when obtaining depth to water and PSH measurements in a well where DNAPL is present); and
- Non-disposable equipment that has come into direct contact with water or PSH must be rinsed with methanol or alternative products such as Simple Green® in

accordance with INTERA SOP 2, *Decontamination*, in addition to applying the standard rinses of potable tap and distilled/deionized water.

9.3 Procedure – Measuring TD

Well TD is required to calculate the volume of standing water in the well and to document the amount of siltation that may have occurred. Moreover, measuring well TD provides checks for casing integrity. Corrosion can cause leaking or collapse of the well casing, which could lead to erroneous or misleading water level measurements. Corrosion, silting, and bio fouling can clog well screens and result in a sluggish response or no response to water-level changes, as well as changes in groundwater chemistry.

In general, the procedure for measuring well TD is the same as that for obtaining DTW measurements with the following additions:

- Proper equipment should be utilized to obtain well TD. If possible, TD should be obtained using a weighted metal measuring tape. A water-level indicator with unprotected sensor(s) sensitive to sediment contact should not be used as contact with the bottom of the well may cause damage to the instrument.
- If applicable, have previously available well TD measurements for reference. Being aware of the previously documented well TD can aid in avoiding any unnecessary damage to the gauging instrument used when contact with the bottom is achieved.
- Well TD is typically measured and recorded only to the nearest one-tenth of a foot (0.1 foot) (EPA, 2013). However, state-specific requirements may request measurements to be recorded to 0.01 foot (TCEQ, 2001). Such state-specific requirements shall be addressed in the SAP/FSP/WP.
- If using a water-level indicator with a probe to measure well TD, make sure to add the length of the probe (i.e., 0.10 foot) that extends below the 0.00-foot mark on the indicator tape to the final well TD measurement.
- As required, well TD measurements should be collected after the completion of a sampling event or at least 24-hr prior to sampling. This precaution is to minimize the effects any increased turbidity in the well water (a common result of well TD measurements) may have on sampling results.
- Well TD measurements should be compared to previous well TD records such as those recorded at the time of drilling and well installation to help evaluate the general condition of the well and/or well screen.
- Well TD measurements should be collected for a site at least once a year or as deemed appropriate based on an evaluation of accrued DTW measurements. If

excessive sediment buildup (i.e., exceeds one foot) or a well screen impediment is suspected, redevelopment/replacement of the well may need to be considered.

9.4 References

Environmental Protection Agency (EPA), 2013. Groundwater Level and Well Depth Measurement Operating Procedure. Region 4, Science and Ecosystem Support Division. #SESDPROC-105-R2. January 29.

Texas Commission on Environmental Quality (TCEQ), 2001. TCEQ Remediation Division Superfund Section Field Standard Operating Procedures (SOPs), SOP 7.1 - Water Level/Sediment Measurement. Revision 1. April 25.

9.5 Attachments

None.

9.6 Document History

Revision	Effective Date	Lead Author	Summary of Changes
00	2/2006	Taimur Malik	Original version
01	2/2015	Kate Herrell	Revised for inclusion in COA Brownfields QAPP
02	3/2015	Noreen Baker	Inserted #9 and #10 in Section 9.1 that were inadvertently removed from Revision 01
03	6/2017	Noreen Baker	Removed Field Form as an attachment, added reference to SOP 30, Field Forms

10.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) covers two basic techniques and associated requirements and equipment commonly applied for obtaining a groundwater sample from a permanent groundwater monitor well:

- Well purging via standard high-volume purging techniques (typically equal to 3 to 5 well casing volumes) (**Section 10.4**);
- Well purging via low-flow/micropurging techniques (**Section 10.5**); and
- Collection of a Groundwater Sample (**Section 10.7**).

These techniques may be implemented by INTERA field personnel during characterization, remediation, or monitoring of environmental sites.

Procedures in this SOP do not apply to the following:

- Passive groundwater sampling techniques, and
- Sampling of groundwater monitor wells where free-phase non-aqueous phase liquid (NAPL) is present.

For most environmental purposes, groundwater sampling from a permanent groundwater monitor well is performed in an attempt to obtain one or more samples representative of a site's in-situ aquifer conditions. Data obtained from these samples can subsequently be evaluated to assess the relative presence or absence of various contaminants of concern (COCs) at a site. The objective of this SOP, therefore, is to promote proper application of specific and commonly available groundwater purge and sample methods (**Section 10.6**) and standardize sample groundwater collection techniques (**Section 10.7**) for consistent and accurate data. Unrepresentative samples can lead to misinterpretations of groundwater quality, which may have a significant impact on assessing whether remedial action(s) are required for a site.

In most cases, collection of a “representative” groundwater sample requires the application of a two-step process:

- Step 1: well purging, and
- Step 2: collection and preservation (if required) of the groundwater sample for subsequent COC analysis.

Well purging is the process of removing stagnant or “old” water from the well casing that is likely not representative of true aquifer conditions due to surface infiltration, settling, atmospheric exposure, biologic (biofouling) and/or chemical (volatilization) degradation. The exact method of purging and the degree (i.e., total volume required for extraction) to which purging is conducted for a well is dependent on conditions at the site (e.g., aquifer characteristics, COCs, depth to water [DTW]), well construction, and the well's observed

water yield. At some sites where low-flow sampling techniques are applied, no purging of groundwater might be preferred (ASTM, 2019). Selection of appropriate well purge and sample equipment is briefly discussed in **Section 10.1** of this SOP.

NOTE: Purging is not required prior to sampling newly-installed wells. However, groundwater samples should not be collected in newly-installed, permanent wells until the well has been properly developed and has been allowed time to fully recover and re-equilibrate to static conditions (70% to 90% of the original bore volume). Assuming sufficient well recovery has occurred, sampling should occur within 24 hours of well development because the sample(s) to be collected becomes less and less representative of in-situ aquifer conditions as recovery time increases. Unless otherwise specified in a SAP/FSP/WP, groundwater sampling is not recommended for wells that cannot attain sufficient recovery within 24 hours of development.

Collection of a groundwater sample is only initiated upon achievement of calculated well purge volume and/or upon stabilization of selected water quality parameters, whichever are most likely to obtain groundwater samples that meet the site/project data quality objectives (DQOs). Calculation of an appropriate well purge volume is discussed in **Section 10.2** of this SOP. Evaluating water quality parameters and determining appropriate stabilization criteria for each applicable parameter is discussed in **Section 10.3** of this SOP.

Methods outlined in this SOP comply with following ASTM Standards:

- D4448-01, *Standard Guide for Sampling Ground-Water Monitoring Wells* (ASTM, 2019);
- D5903-96, *Standard Guide for Planning and Preparing for a Groundwater Sampling Event* (ASTM, 2012); and
- D6634/D6634M-14, *Standard Guide for the Selection of Purging and Sampling Devices for Groundwater Monitoring Wells* (ASTM, 2014).

This SOP should be used in conjunction with procedures presented in the INTERA Site-Specific Health and Safety Plan (SSHASP) and in site-specific investigation planning documents such as a Sampling and Analysis Plan (SAP), Field Sampling Plan (FSP), or Work Plan (WP). This SOP will also be commonly used with and is referenced in the following INTERA SOPs:

- 1, *Air Monitoring*;
- 2, *Decontamination*;
- 9, *Monitor Well Gauging*; and
- 30, *Field Forms*.

10.1 Selection of Appropriate Well Purge and Sample Equipment

A wide variety of applicable purge and sample equipment is available for the collection of a groundwater sample. These devices facilitate the movement and extraction of groundwater from a well by one of the following mechanisms: grab (e.g., bailer, syringe, thief sampler), suction-lift (e.g., surface-applied centrifugal, vacuum, and peristaltic pumps), inertial-lift (e.g., Waterra pump), and positive displacement (e.g., submersible pump, gas-drive pumps, bladder pump, and piston pump). To select the most appropriate groundwater purging and sampling device(s) for a well, the following must be considered:

- Reliability, durability, ease of operation, and portability of the device;
- Device compatibility with well construction;
- DTW; and
- Potential impact(s) to sample integrity and material compatibility with established COCs.

Operational characteristics of typical groundwater purge and sample devices are listed in **Attachment 1**. Material considerations in the selection of sampling equipment are listed in **Attachment 2**. Basic descriptions of commonly-utilized groundwater purge and sample equipment is provided in the following subsections.

10.1.1 Grab Sampling (down-hole) Collection Devices

Bailers, syringe, and thief (messenger) samplers are all examples of devices used for grab purging and sampling. These devices are lowered into the well casing by cable, rope, chain, or tubing.

Bailers are the most typically applied grab sampler. Bailers are available in a variety of sizes and materials such as PVC, stainless steel, polyethylene, and Teflon® and may be equipped with a single or dual check valve. When choosing a bailer for purging and sampling, care must be taken to select a bailer type and composition that is compatible with site conditions and DQOs (**Attachment 2**). Teflon® bailers are generally the most "inert" while PVC bailers are less expensive and are sufficiently resistant to withstand short term exposure to most common contaminants. **Bailers not comprised of a chemically inert material (such as stainless steel) and not easily decontaminated should not be used to purge and/or sample more than a single well.** In these cases, the use of disposable bailers, usually comprised of polyethylene, are the most practical option.

Some considerations when choosing whether to use a grab sampler for collection:

1. Can easily aerate or agitate the sample causing oxidation, degassing and/or stripping of VOCs, and other alterations to the groundwater chemistry;

2. Can be susceptible to generating artificial variability in accuracy and precision of groundwater sample chemistry due to operator techniques;
3. Can increase sample turbidity and the potential for mixing with stagnant water;
4. Increased potential to introduce surface and down-hole contamination with repeated insertion and extraction of the device through the well casing;
5. Impractical for wells with deep DTWs (> 50 ft bgs) and/or high yields (> 20 gallons). These conditions mandate that long periods be spent during purging and sample collection, or that centrifugal pumps be used; and
6. Typically withdraws water from the top of the water column in the well and this water has already been exposed to the atmosphere. Exposure to the atmosphere can cause volatilization and reactions with carbon dioxide which can cause subsequent lowering of groundwater pH.

10.1.2 Pumping Devices

There are many varieties of pumps that can be used for the collection of a groundwater sample from a monitor well including suction lift pumps, electric submersible pumps, and positive displacement pumps. Below are brief descriptions of the available pump types and their ideal application(s).

- **Suction–Lift Pumps** - Suction-lift pumps include peristaltic pumps, surface centrifugal pumps, and vacuum pumps and are most typically used for purging and less so for sampling. Because the ability of suction-lift pumps to lift water is limited by the available atmospheric pressure, they are only functional for purging and sampling from depths of less than approximately 25 ft bgs at mean sea level. Vacuum pumps and, to a lesser extent surface centrifugal pumps, are not as appropriate as peristaltic pumps when collecting groundwater samples. However, the EPA does not recommend use of any suction–lift pump for the collection of VOC-containing groundwater (ASTM, 2019).
- **Inertial-Lift Pumps** - Inertial-lift pumps are ideal for well development but should not be used to collect volatile–sensitive groundwater samples. The inertial-lift pump is capable of operating efficiently at depths to 30 m (100 ft). It is effective in small diameter wells or direct-push technology probes which are typically 12.5 mm (1/2-in.) diameter. The pumping rate ranges from 0 to 7.6 L/min (0 to 2 gal/min) (42), depending on the rate of the up and down pumping stroke and the tube diameter (ASTM, 2019). The Waterra inertial-lift pump is a commonly used inertial-lift pump.
- **Positive Displacement Pumps** - Positive displacement pumps are widely available pumps often useful for groundwater purging and sampling. Positive

displacement pumps include gas-drive pumps, bladder pumps, piston pumps, and electric submersible pumps. The bladder pump is generally considered the best overall type of pump to collect groundwater samples for inorganic and/or organic analyses. Electric submersible pumps are used to purge and sample groundwater from a variety of depths. Electric submersible pumps include centrifugal submersible pumps, helical rotor (progressing cavity) pumps, and gear pumps. Submersible pumps provide relatively high discharge rates for water withdrawal at depths beyond suction-lift capabilities and higher extraction rates than many other methods. Centrifugal submersible pumps are most commonly used yet cause considerable water agitation due to the movement of the impeller(s). Gear pumps are the best-suited electric submersible pumps for groundwater purging and sampling, and one of the best overall pumps for minimizing volatilization of groundwater samples.

The pump of choice for purging is usually a function of the well diameter, DTW, well total depth (TD), and the calculated volume of purge water required. A peristaltic pump is typically used whenever the water level is above the limit of suction, i.e., approximately 25 feet bgs at mean sea level (**NOTE:** there is a loss of one foot of suction lift for every one-thousand-foot increase in elevation). For wells where the water level is below the limit of suction and/or where there is a large volume of water to be purged, a variable speed electric submersible pump is preferred.

Other than pump functionality, two site-specific criteria must also be considered when selecting the most appropriate pump for the activity. First, construction material of the pump and tubing should not contain materials or constituents that interact with potential and/or known COCs or any other constituent of interest that may cause bias in sample results (i.e., false positives) (**Attachment 2**). Second, if the sample is to be analyzed for VOCs, a pump that minimizes sample agitation and subsequent volatilization should be used. The most appropriate pumps under these conditions are the gear pump or the bladder pump.

Regardless of which type of pump is used, the pumping rate should be low enough to avoid turbulent flow. In addition, the pump must be capable of moving some solids without damage. Inertial-lift pumps are often preferred for small diameter wells (i.e., <2 inches) due to the surging action of the pumps and their low well yield requirements.

10.2 Procedure – Calculation of Purge Volume

In most cases, site or project DQOs establish a need to purge some minimal volume of stagnant or old groundwater from a monitor well prior to groundwater sample collection. The amount of water to be purged depends upon well depth, hydraulic properties, purging methodology (standard high-volume [**Section 10.4**] or low-flow [**Section 10.5**]), and

program requirements. There is no set number of volumes to be purged that fits all situations. It is generally agreed, however, that for standard high-volume purge and sample techniques, typically a minimum of 3 well casing volumes is required. In most cases, a purge of 3 well casing volumes is acceptable **on the condition** that stabilization of the water quality parameters such as temperature, pH, and specific conductance, is also achieved (**Section 10.3.1**) (EPA, 2003). In instances where stabilization cannot be achieved (i.e., as a result of inherent aquifer characteristics), purging shall typically continue until a total of five well casing volumes are removed or as otherwise directed by the Project Manager (EPA, 2003; EPA, 2013d).

Well casing volume can be defined as the volume of groundwater observed in the well casing under static conditions as follows:

Equation 1:

$$V_{wc} = \frac{\pi D^2 h}{4}$$

Where:

- V_{wc} (ft³) = well casing volume
- D (ft) = inner diameter of well casing
- h (ft) = height of the water column in the well casing.

NOTE: V_{wc} in units of cubic feet can be converted to gallons by multiplying by 7.48 gal/ft³.

The inner diameter of the well casing (D) is a known parameter that can be established by reviewing well installation documentation for the well. The height of the water column in the well casing (h) is calculated by subtracting the depth to groundwater as measured (in feet) prior to development or purging from the known TD of the well (in feet) as determined prior to development or purging. The minimum purge volume of three well casings is calculated by taking the well casing volume (in gallons) calculated using **Equation 1** and multiplying by 3.

Alternatively, the well casing volume may be determined using a casing volume per foot factor for the appropriate diameter well as summarized in **Table 1** (EPA, 2013d). The height of the water column in the well casing is multiplied by the appropriate single-well volume factor or triple well volume factor in **Table 1** to determine either the single well casing volume or the triple well casing volume, in gallons, for the well to be purged.

As such, the typical minimum purge volume of three well casings can be easily calculated by multiplying the height of the water column in the well casing by the appropriate triple well volume factor in Column 3 of **Table 1**. Purge volume of five well casings is calculated by multiplying the height of the water column in the well casing by the appropriate single well volume factor in Column 1 and then multiplying by 5.

Table 1: Well Casing Diameter versus Volume of Water

Casing Diameter (inches)	Gallons/ft, One Water Column	Gallons/ft, Three Water Columns
1	0.04	0.12
2	0.16	0.48
3	0.37	1.11
4	0.65	1.98
5	1.02	3.06
6	1.47	4.41
7	1.99	5.97
8	2.61	7.83
9	3.30	9.90
10	4.08	12.24
11	4.93	14.79
12	5.87	17.61

10.3 Procedure – Measurement of Water Quality Parameters

The other critical element used to assess whether the groundwater to be collected from the monitor well is representative of in-situ conditions is the stabilization of certain measured field water quality parameters. Stabilization of field water quality parameters is especially critical when low-flow or micopurging techniques are required to successfully collect a sample.

The intent of utilizing water quality field parameters to drive groundwater sampling is to identify when the physical and/or chemical characteristics of groundwater entering the well begin to reflect that of the surrounding aquifer system. Collection of water quality parameters also helps establish a baseline and inherent quality assurance (QA) for the data being collected that may be used to guide further sampling efforts and identify changes in the systems being evaluated.

Numerous instruments are commercially available for measuring water quality parameters. As such, setup and implementation of instruments should follow a basic format that applies consistency of use. Regardless of the brand of meter used, all meters should be properly maintained, calibrated, and operated in accordance with the manufacturer's instructions. Calibration fluids for any instrument used should be National Institute of Standards and Technology (NIST)-traceable, and there should be enough volume to conduct one or more daily calibrations throughout the sampling event (as required by the manufacturer's specifications).

For most sampling efforts, INTERA personnel utilize a multi-parameter water quality meter equipped with a flow-through cell, such as the hand-held YSI meter. These systems

contain multiple probes that can measure several parameters simultaneously. Multi-parameter water quality meters have the ability to measure temperature, pH, turbidity, dissolved oxygen (DO), specific conductance, and oxygen-reduction potential (ORP). For some site DQOs, turbidity may be a critical parameter to assess during purging and sampling. In these instances, a separate turbidity meter should be used or turbidity measurements should be read prior to entry into the flow-through cell to avoid potential sediment build-up which can bias the turbidity measurement.

When using a flow-through-cell to measure parameters, sediment build-up and any generation of trapped gas must be monitored (EPA, 2010). Transparent flow-through-cells are preferred because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities in the field notes.

Throughout the duration of the measurement process, the flow-through-cell must also remain free of any gas bubbles. Entrapped gas may cause the monitoring probes to act erratically. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help minimize this affect. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

10.3.1 Water Quality Parameters and Stabilization Criteria

Water quality parameters that may be monitored in the field include the following: pH, specific conductivity, temperature, turbidity, oxidation-reduction potential (ORP), and dissolved oxygen (DO). Water quality indicator parameters should be monitored continuously during purging, and measurements are typically recorded at intervals of three (3) to five (5) minutes apart. During low-flow purging, care should be taken to ensure that at least one flow-through-cell volume has been turned over between measurements (EPA, 2010). Therefore, depending on the flow rate and flow-through-cell volume, the interval between measurements may need to be increased accordingly.

The following parameters are typically always monitored during well purging: pH, specific conductance, temperature, and sometimes turbidity depending on project objectives. Some recent regional guidance procedures have subsequently removed temperature from the list of required parameters (EPA, 2013d). Due to its susceptibility to quickly re-equilibrate upon collection and the fact that it is often measured in a separate container at the surface rather than in the actual sampling access point, the use of temperature to determine stability is suspect and will not necessarily be representative of actual groundwater conditions. However, other regional regulatory authorities still maintain

temperature as a required parameter (TWDB, 2003) as it may be needed to properly interpret other chemical parameter results in certain situations. Whether additional/alternate parameters such as ORP and DO are required shall be established in the SAP/FSP/WP.

Purging is considered complete and sampling may begin when all of the water quality parameters defined for a project have stabilized. Stabilization occurs when three (3) consecutive measurements are within the range of stabilization criteria as set by the EPA or other appropriate regulatory authority. Specific stabilization criteria for standard high-volume purging and low-flow purging are provided below in Section 10.4 and Section 10.5, respectively. General procedures for measuring specific water quality parameters during groundwater sampling activities are described further in **Attachment 3**.

10.4 Procedure – High-Volume Purging

Evacuation of (3) three to (5) five well casing volumes prior to collecting a groundwater sample is the most standard purge application and can be effectively implemented using a variety of instruments and equipment under a variety of site conditions (**Section 10.1**). Ideally, the use of an appropriate pump is preferred over the use of a bailer due to the inherent dependence on an individual operator's technique that may or may not properly minimize turbidity and loss of volatile organic constituents and may result in collection of an unrepresentative sample (EPA, 2013d). However, the low cost and versatility of bailing makes purging and sampling via a bailer a preferred option for many sites.

The general procedure for effective groundwater sampling using a high-volume purge technique to be completed by INTERA staff is presented as follows:

1. Confirm all equipment needed to complete the selected activities is available, cleaned, and in good working order prior to initiating field efforts. Exact equipment needs will be well-specific and will depend on the diameter of the well, the depth to the static water level, and other factors. At a minimum, field equipment should include:
 - Appropriate type and amount of PPE as specified in the SSHASP;
 - Site map, well completion diagrams, and a copy of the SSHASP and SAP/FSP/WP;
 - Field logbook, waterproof pens, appropriate water level indicator, time-keeping device, camera, calculator, applicable field forms (**SOP 30, Field Form 5 – Standard Purging and Sampling Data** or **SOP 30, Field Form 6 – Low Flow Purging and Sampling Data**);

- Well purge and sample equipment as designated in the SAP/FSP/WP. List of potential groundwater purge and sample equipment is provided as **Attachment 4**;
 - Water quality meter(s) as specified in the SAP/FSP/WP and extra batteries;
 - Waste storage containers (e.g., drums, 5-gallon buckets) for temporary or permanent containment and measurement of extracted well water;
 - Tools for opening well vaults (e.g., socket wrench, screwdriver, hammer, bolt cutter) and/or managing selected IDW storage containers (e.g., steel 55-gallon drum[s], 5-gallon bucket[s]);
 - Appropriate type and volume of personnel and equipment decontamination supplies (INTERA SOP 2, *Decontamination*) to execute the projected activities;
 - Traffic safety equipment (traffic cones, barriers, caution tape and other traffic control equipment), as required;
 - Air monitoring equipment, as required per the SSHASP;
 - Field logbook and site plan indicating well locations;
 - Copies of previous well gauging and sample data, if available; and
 - Trash bag/waste container for IDW (i.e., used paper towels from decontamination of non-disposable equipment between wells).
2. Verify/define work zones and IDW storage and containment area(s) for the site as established in the SAP/FSP/WP or the SSHASP.
 3. Calibrate required field screening or monitoring equipment per the manufacturer's instructions. Calibrate any instrumentation required to ascertain water quality parameters as identified in the SAP/FSP/WP and as described in **Section 10.3** of this SOP.

NOTE: If a site requires additional field screening or personnel monitoring during well purging (i.e., high levels of VOCs), this requirement shall be outlined in the SAP/FSP/WP or SSHASP, respectively.

4. As applicable, determine sequence of wells to be sampled. If multiple wells are to be sampled at a contaminated site, sample wells in order of least contaminated to most contaminated to minimize the potential for cross contamination and use disposable purge and sample equipment as reasonably achievable. If chemistry is unknown, measure wells from upgradient to downgradient, if possible.

5. Verify the need to collect any QA/quality control samples during the sample collection event. If required, designate appropriate location(s).
6. Upon arrival at a monitor well, note any unusual conditions pertaining to the monitor well including, but not limited to, water ponding in the proximity of the well casing, cracks in the well casing footing, or other surface damage that is identifiable. In the event the well has incurred damage, record observations in the field logbook, photograph damage, and inform site management prior to proceeding.
7. Verify well is appropriately marked (well location identifier). If applicable, sweep area around the well vault to minimize dislodging loose materials (e.g., rocks and organic debris) into the well vault and potentially into the open well.
8. Stage appropriate sampling and monitoring equipment. Per the SAP/FSP/WP, obtain and stage the appropriate number and type of IDW container(s) and/or apply ground cloth or plastic sheeting around location prior to sample initiation. If using a staging cloth, do not place tools, equipment, or other materials on the sheet unless they have been cleaned first.
9. Open the monitor well cover/vault, taking care to place loose components (e.g., cover bolts, washers, and tools) in a protected area away from the well opening.
10. Don appropriate PPE. At a minimum this should include gloves, foot, and eye protection. If sampling is to occur in a zone where overhead hazards exist, a hard hat shall also be worn. Use of any sound-generating equipment, such as a generator, will require hearing protection. Refer to the SSHASP for specifics regarding required PPE at a site.
11. Upon opening the well cover/vault and as applicable, monitor atmosphere for hazardous conditions using procedures outlined in INTERA SOP 1, *Air Monitoring*. Depending on known or suspected COCs, one or more of the following monitoring devices may be appropriate: a photoionization detector (PID), a flame ionization detector (FID), a lower explosive limit (LEL)/oxygen (O₂) meter, and/or a hydrogen sulfide (H₂S) meter. PID monitoring is a common requirement for chlorinated solvent sites; H₂S monitoring is a common requirement at crude oil sites. Specifics regarding the types of monitoring requirements that may be applicable for a site will be documented in the SSHASP.
12. Inspect well vault for insects and note any damaged or broken components prior to placing hands in well cover/vault. Remove and/or note in logbook as appropriate. As appropriate, take a photograph to document any alterations of

significance (i.e., missing well cap, excessive debris in well vault, top of the well casing might have been altered) and inform site management prior to proceeding.

13. Unlock and/or remove monitor well cap and place it upside down on a dry surface to prevent foreign material from being deposited within the well once the cap is replaced. If applicable, re-check air monitoring readings as described in **Step 11**.
14. Obtain a well TD and DTW measurement from the marked datum point of the well using the appropriate method(s) defined in INTERA SOP 9, *Water Level Gauging*.
15. Calculate the appropriate minimum purge volume (typically 3 well casing volumes) to achieve proper well purging using the equations provided in **Section 10.2** of this SOP. If an alternate site/well-specific minimum purge volume is required due to known or anticipated site conditions, this shall be identified in the SAP/FSP/WP. Document well casing and purge volume requirements in the field logbook and/or on the appropriate field form (**SOP 30, Field Form 5 or SOP 30, Field Form 6**).
16. Once an appropriate minimum purge volume has been collected, purging via the selected method of groundwater extraction can proceed in conjunction with the collection and measurement of appropriate field water quality parameters as defined in **Section 10.3** of this SOP and/or the SAP/FSP/WP. Procedure implementation of purging methods most commonly applied by INTERA personnel are provided in **Section 10.6**.

NOTE: In some situations, even if slow purge rates are applied, a well may be fully evacuated of groundwater and go “dry” prior to the minimum purge volume being met. The term “dry” is defined here as insufficient water to collect a complete sample volume. In these instances, different procedures must apply (Yeskis and Zavala, 2002). Full evacuation of the well generally constitutes an adequate purge, and the well can be sampled following sufficient recovery within an appropriate time frame (usually within 24 hours). ***It is not necessary that the well be evacuated three times before it is sampled.*** Measurement of pH, specific conductance, and temperature during collection of the sample should be measured and recorded, as the stabilized measurements for the sampling event (EPA, 2013d).

17. Purging and/or water quality parameter measurements shall continue according to this SOP unless otherwise specified in the SAP/FSP/WP. Typically purging is considered complete and sampling may commence when one of the following conditions have been obtained:
 - The well is purged dry. Sampling should begin no sooner than two hours after purging and after a sufficient volume for a water-quality sample or

after sufficient recovery (commonly 90%) is present (Yeskis and Zavala, 2002).

- Three well casing volumes have been purged and water quality parameters have stabilized (i.e., three (3) consecutive measurements are within the range of stabilization criteria provided below in **Table 2**).
- In instances where stabilization cannot be achieved (i.e., as a result of inherent aquifer characteristics), purging shall typically continue until a total of five well casing volumes are removed.

Table 2: Water Quality Parameter Stabilization Criteria - Standard High Volume Purging

Parameter	Stabilization Criteria	Reference
pH	±0.2 units	
Specific Conductance	±10%	
Temperature	±1°C	
Turbidity	±10% (when turbidity is greater than 10 NTUs)	Yeskis and Zavala, 2002
Oxidation/Reduction Potential (ORP)	±10 millivolts	EPA, 2010 Yeskis and Zavala, 2002
Dissolved Oxygen (DO)	±0.3 milligrams per liter	Yeskis and Zavala, 2002

Note: Stabilization criteria may change depending on project objectives or state-specific/federal criteria (Yeskis and Zavala, 2002), and these criteria will be established in the SAP/FSP/WP.

18. All purge water shall be containerized into a graduated container to measure the purged water volume. Purge water is then either containerized for storage and eventual disposition or spread onto an impermeable surface away from the well and allowed to evaporate. Specifics regarding the handling, storage and disposal of site purge water shall be identified in the SAP/FSP/WP.

19. Upon completion of purging and if well recovery rate is significant enough to obtain a groundwater sample(s), proceed to the collection of groundwater sample(s) as discussed in **Section 10.7** of this SOP.

10.5 Procedure – Micropurging

In general, the goal of low-flow groundwater sampling is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations.

Micropurging is when well purging (and sampling) is performed at very low pumping rates (0.1 - 1.0 L/min) and is volume independent. Purge water is extracted from the well casing only until measured water quality parameters exhibit steady state conditions, which is the primary indicator that water is being drawn directly from the aquifer. Micropurging minimizes hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns; minimal mixing of the water column and the laminar groundwater flow through the screen provides for a more consistent sample (ASTM, 2019). EPA recommends that both groundwater purging and sampling should invariably be performed at low rates so that the drawdown does not exceed 0.3 feet (EPA, 2010).

Micropurging and low-flow sampling procedures are preferred at sites/wells exhibiting the following conditions:

- Heterogeneous aquifer systems (susceptible preferential recharge and sample bias);
- Wells capable of sustaining a yield approximately equal to the pumping rate;
- VOCs and metals are COCs;
- Inherent turbid aquifer characteristics; and
- Groundwater contains hazardous/toxic constituents requiring treatment/special disposal.

Micropurging is typically performed using adjustable rate, submersible pumps (e.g., centrifugal and bladder pumps) that are constructed of stainless steel or Teflon. As stated in **Section 10.1**, bladder pumps are preferred for sampling groundwater containing VOCs and dissolved gases.

Inertial pumping devices (motor driven or manual) are not recommended for micropurging. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

The general procedure for effective groundwater purging using the micropurging technique to be completed by INTERA staff is presented as follows:

1. Follow **Steps 1 through 14** as described for standard high volume purging (**Section 10.4**)
2. Slowly install pump and associated cables, tubing, and electric lines to the designated sample depth (mid-point of the screen or as otherwise specified in the SAP/FSP/WP). Keep pump intake at least 2 feet above the bottom of the well to minimize mobilization of any particulates that may be present. Do not turn on the pump at this time.

NOTE: Tubing placed at the ground surface should be kept as short as possible to minimize latent heating due to sunlight and ambient air exposure. Heating may promote volatilization of any groundwater constituents. If excessive turbidity is anticipated for a well, it may be appropriate to consider installation of the pump the day prior to allow any particulates that were disturbed during pump insertion to settle.

3. Measure water level and record information on the appropriate field form and/or in the field logbook. If applicable, install pressure transducer(s) to track drawdown. Verify that a graduated container is setup and available to accept and measure the total volume of groundwater to be purged.
4. Turn on pump. Start the pump at low speed (i.e., approximately 0.1 L/min) and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and, if present, fix or replace affected equipment.
5. Gradually adjust pump rate to match the well's recharge rate (i.e., until little to no drawdown occurs and the water level has stabilized). As applicable, adjust pumping rate to correspond to rate used during previous sampling event(s). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

NOTE: Any required adjustments should ideally be completed in the first fifteen minutes of pumping in order to help minimize purge time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made.

6. Once water levels have stabilized, connect all equipment chosen to monitor the selected water quality field parameters. Typically the minimum required parameters include: temperature, conductivity, pH, and turbidity (**Section 10.3**). If excessive turbidity is anticipated at a well, the well may require extended purging and/or pump installation the day prior (see **Step 2** above) to minimize particulate buildup in the equipment (such as the flow-through-cell).

NOTE: During the early stages of purging, emphasis should be on minimizing and stabilizing pumping stress and recording those adjustments; stabilization of water quality parameters are secondary until water levels have satisfactorily been stabilized.

7. Monitor and record the water level, pumping rate(s), and selected water quality parameters every five minutes (**or as appropriate**) during purging. Record any required pumping rate adjustments (both time and flow rate).

NOTE: Pump flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (i.e., for a 250 mL flow-through-cell with a flow rate of 50 mL/min, the monitoring frequency would be every 5 minutes; for a 500 mL flow-through-cell it would be every 10 minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly (EPA, 2010).

8. Micropurging is considered complete and sampling may begin when all selected indicator field parameters have stabilized according to the stabilization criteria identified below in **Table 3** or as identified in the SAP/FSP/WP.

Table 3: Water Quality Parameter Stabilization Criteria - Micropurging

Parameter	Stabilization Criteria	Reference
pH	±0.1 units	EPA, 2010
Specific Conductance	±3%	EPA, 2010
Temperature	±3%	EPA, 2010
Turbidity	±10% for values greater than 5 NTU; if three turbidity values are less than 5 NTU, consider the values as stabilized)	EPA, 2010
Oxidation-Reduction Potential (ORP)	±10 millivolts	EPA, 2010
Dissolved Oxygen (DO)	±10% for values greater than 0.5 mg/L; if three DO values are less than 0.5 mg/L, consider the values as stabilized)	EPA, 2010

9. All purge water shall be containerized in a graduated container to measure the purged water volume. Purge water is then either containerized for storage and eventual disposition or spread onto an impermeable surface away from the well and allowed to evaporate. Specifics regarding the handling, storage and disposal of site purge water shall be identified in the SAP/FSP/WP.
10. Upon completion of purging, proceed to the collection of groundwater sample(s) as discussed in **Section 10.7** of this SOP.

10.6 Procedure – Specific Application of Common Purge and Sample Methods

10.6.1 Bailer

1. Obtain a decontaminated or new bailer and rope or cord made out of nylon, polypropylene, or other equivalent material.
2. Tie a bowline knot or equivalent through the bailer loop. Test knot for security and the bailer itself to ensure that all parts are intact before inserting the bailer into the well.
3. Remove the protective wrapping from the bailer.
4. Slowly lower the bailer into the well casing, allowing it to gently immerse into the top of the water column and sink to the bottom of the well.
5. Cut the cord at a proper length. Verify that the bailer rope/cable is of sufficient length as to reach at least 20 feet below the top of the water surface in the monitor well.

NOTE: Bailer or bailer rope should never touch the ground surface at any time during purging and sampling.

6. Once cord/rope is set, begin to raise the bailer slowly by grasping a section of cord using each hand alternately in a "windmill" action. This method requires the sampler's hands to be kept approximately 2 to 3 feet apart and the bailer rope to be alternately looped onto or off each hand as the bailer is raised (and lowered). Alternate methods may be used to raise the bailer including use of a reel or a plastic-lined bucket into which the rope is manually fed.

NOTE: It is critical that bailers be slowly and gently immersed into the top of the water column, particularly during final stages of purging, to minimize turbidity and disturbance of VOCs. If possible, the water should be bailed at a rate slow enough that does not cascade down the sides of the well screen, which causes stripping of VOCs.

7. Upon recovery to the surface, grasp bailer and pour extracted groundwater into a graduated container to measure the purged water volume

10.6.2 Submersible Pump

1. Operate pump according to the manufacturer's instruction. Attach for use single well dedicated or disposable tubing and any required flow controllers. Refer to SAP/FSP/WP or other site-specific documentation (e.g., field logbook) to identify appropriate pump start-up and purge flow rates.
2. Lower the clean pump to the required depth, as identified by the SAP/FSP/WP. This is typically no more than 3 feet to 5 feet into the water column and towards

the top or center of the well screen. Verify that the pump intake hose is fully immersed and is not contacting sediment.

NOTE: DO NOT place the pump assembly deep into the water column as this may short-circuit the purging effort (EPA, 2013d). When purging, water needs to be “pulled” from the formation through the well screen and up through the well casing so that the entire static volume of water is removed. If the pump is placed deep into the water column, the water above the pump may not be removed, and subsequent samples, particularly if collected with a bailer, may not be representative of aquifer conditions.

3. If appropriate, lower and set a water level measuring device into the well casing to monitor drawdown while pumping.
4. Initiate pumping and observe recovery rate. If the recovery rate of the well is faster than the pump rate and no observable draw down occurs, the pump should be raised until the intake is within one foot of the top of the water column for the duration of purging. If the pump rate exceeds the recovery rate of the well, the pump will have to be lowered, as needed, to accommodate the drawdown.
5. Direct the discharge through the flow-through cell and into a graduated container to measure the purged water volume.

10.6.3 Bladder Pump

1. Attach for use single well dedicated or disposable tubing into the vacuum port of the pump head. Ensure a snug fit. This section of tubing should be cut at a length equal to the well depth plus an additional 5 to 10 ft allow for operation of the pump at all possible water level conditions in the well.
2. Lower the pump into the well, using a stainless steel safety line connected to the eye safety stem on the pump (if portable) or a suspension hook on the well head (if dedicated) to the appropriate sample depth (either midpoint of the screen or another depth as designated by the SAP/FSP/WP).
3. Connect the supply line from the compressed gas supply to the control unit. A drive line connects from the control unit to the top of the well (dedicated) or to a reel (portable).
4. Turn on pump and begin purging. Operate pump according to the manufacturer’s instruction. Refer to **Section 10.5** of this SOP, the SAP/FSP/WP, or other site-specific documentation (e.g., field logbook) to identify appropriate pump start-up and purge flow rates.

5. For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water during sampling so that one pulse will fill a 40 mL VOC vial.

10.6.4 Peristaltic Pump

6. Attach for use single well dedicated or disposable tubing into the vacuum port of the pump head. Ensure a snug fit. This section of tubing should be cut at a length equal to the well depth plus an additional 5 to 10 feet allow for operation of the pump at all possible water level conditions in the well.
7. Run another (shorter) section of tubing from the pump discharge port to into a graduated container to measure the purged water volume.
8. Place the free end of the tubing into the well until the end of the tubing is just below the surface of the water column.
9. Secure tubing to the well casing or other secure object using electrician's tape or other suitable means. This will prevent the tubing from being lost in the well should the tubing detach from the pump head.
10. Turn on pump to produce a vacuum on the well side of the pump head and begin purging. Operate pump according to the manufacturer's instruction. Refer to SAP/FSP/WP or other site-specific documentation (e.g., field logbook) to identify appropriate pump start-up and purge flow rates.
11. Observe pump direction to ensure that a vacuum is being applied to the purge line. If the purge line is being pressurized, either switch the tubing at the pump head or reverse the polarity of the cables on the pump or on the battery.
12. If the pumping rate exceeds the recovery rate of the well, continue to lower the tubing into the well, as needed, until the drawdown stabilizes or the well is fully evacuated. If the pump is equipped to modify pump rate, reduce the speed of the pump in an attempt to stabilize drawdown.

NOTE: When using a peristaltic pump for purging, it is important to try and maintain the tubing intake (to the degree possible) towards the uppermost portion of the water column (EPA, 2013d). This is to minimize the potential for short-circuiting the purging effort as there may not be a complete exchange and removal of stagnant water in the portion of the water column residing above the tubing intake. This is particularly important for wells exhibiting recovery rates equal to or very nearly equal to the purge rate.

10.7 Procedure – Groundwater Sample Collection

Sampling is the process of collecting, containerizing, and preserving the groundwater sample after the purging process is complete. Samples from monitor wells are collected either with portable, low-capacity pumps, a bailer, or with other types of sampling devices designed for water quality work (USGS, 2006). Sampling devices can be dedicated for use at a given well or can be installed in the well for the duration of the monitoring effort.

In general, the water level in a well that has been purged using the standard high volume purging method should be allowed to recover to at least 70% of its static volume before a sample is collected. Monitor wells that experience significant drawdown during purging and do not readily recharge within the time frame of a reasonable sampling effort (within a period of one hour) (i.e., slow recovery or low-yield wells) may be left to recharge over whatever time period is deemed necessary for the well to sufficiently recharge to obtain a complete sample, up to a maximum of 24 hours. However, it is important to note the longer the recovery time, the lower the confidence that the sample to be collected can be considered representative of ambient aquifer water composition. Unless otherwise specified in a SAP/FSP/WP, groundwater sampling is not recommended for wells that cannot attain sufficient recovery (commonly 90%) within 24 hours of purging (Yeskis and Zavala, 2002; USGS, 2006).

The general procedure for collecting a groundwater sample from a monitor well after standard high volume purging and sufficient recovery is presented as follows:

1. As required, obtain a final water level measurement and record in the field logbook. This may be needed if sample collection is initiated after a relatively significant amount of time has elapsed since final purging activities (such as overnight).
2. Determine the appropriate groundwater sampling method (e.g., bailer, submersible pump, or peristaltic pump) by referring to the SAP/FSP/WP.

NOTE: Chosen sample collection equipment may be the same as that equipment utilized for well purging; however, the exact equipment chosen for sample collection is primarily dependent on the established DQOs and COCs and the advantages and disadvantages each sample collection method has on best attaining these DQOs. Therefore, it may be appropriate to use one or more alternate methods to achieve the most representative samples.

3. To collect the sample, follow method specific application of the chosen equipment **as listed below** and described in **Section 10.6** of this SOP. Typically, water samples should be collected at or near the midpoint of the well screen.

- **Groundwater Sampling Via Bailer**

- Slowly lower bailer into the water column, allowing the bailer to fill slowly from the bottom. Take care not to drop or splash the bailer.
 - Once the bailer has been lowered to approximately the mid-point of the screen, slowly raise the bailer to minimize creating turbulence in the well and minimize drawing fine-grained sediment into the well. When withdrawing the bailer back to the surface take care not to hit the sides of the well as this may cause flaking of material into the bailer.
 - Gently empty water directly from the full bailer into sample containers, taking care not to allow contact between the bailer and the sample container. Apply and use VOA tips, as required, to aid in the controlled filling of 40 mL vials.
 - **Groundwater Sampling Via Pump:**
 - Pumping rate should be approximately 0.1 L/min (or less). If a greater pumping rate was used for purging, then the pumping rate should be adjusted (reduced) prior to sampling.
 - Groundwater should be pumped directly into the sample containers and pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help ensure that the sample tubing remains water filled. If saturated pump tubing cannot be maintained to the sampling point, collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing to collect the VOC/dissolved gases samples. As applicable (low-flow), record any new drawdown depth and flow rate.
4. During sample collection, groundwater should be transferred directly from the sampling device into the appropriate sample containers (with preservatives as required) supplied by the laboratory, taking care not to allow the sample device to come into contact with the sample container. During transfer, efforts should be made to reduce the flow from either the pump discharge line or the bailer during sample collection to minimize sample agitation. This can often be accomplished by allowing the discharged groundwater to flow gently down the inside of the container.
 5. Samples collected for analysis of VOC, acidity and alkalinity must not have any headspace. All other sample containers must be filled with an allowance for headspace as specified by the laboratory. If pre-preserved containers are not

supplied by the laboratory, the appropriate preservative must be added to applicable samples as soon as practical upon collection.

6. For some analyses, such as dissolved metals, the groundwater sample will require pre-filtering prior to preservation. Typically field filtering is accomplished via use of an 0.45 μm in-line membrane filter as follows:
 - Filter approximately 100 mL of sample through filter and dispose of as appropriate.
 - Filter sample directly into a clean sample container, replacing filters as needed to obtain sufficient volume.
 - Preserve immediately according to program methodology requirements.

NOTE: Potential differences may result from variations in filtration procedures used to process water samples for the determination of trace element concentrations. A number of factors associated with filtration can substantially alter "dissolved" trace element concentrations; these include filter pore size, filter type, filter diameter, filtration method, volume of sample processed, suspended sediment concentration, suspended sediment grain-size distribution, concentration of colloids and colloidally associated trace elements, and concentration of organic matter. Therefore, field method application consistency is critical in the comparison of both short-term and long-term results for these types of samples.

7. Unless otherwise specified in the SAP/FSP/WP, collect samples in the following order, as applicable: VOCs, SVOCs, metals, and other inorganics (TCEQ, 2001a; 2001b; and 2013). This order may be changed in situations where effective turbidity levels are difficult to maintain during groundwater sample collection: Removal and insertion of equipment after the purge and prior to actual sampling may negate the low turbidities achieved during purging and elevate turbidity back to unacceptable levels. In these instances, it may be advantageous to collect metals first as per EPA (2013d). The order of sample collection will be specified in the SAP/FSP/WP.
8. Note date and time of each collected sample in the field logbook and/or on the appropriate field form (**SOP 30, Field Form 7 – Sample Control Log** and **SOP 30, Field Form 8 – Chain-of-Custody**). **NOTE:** Chain-of-Custody forms are typically provided by the laboratory being used for the project analyses. **SOP 30, Field Form 8** should only be used in the event laboratory-provided Chain-of-Custody Forms are not available.

9. Confirm that all sample containers are labeled and that the labels are affixed to the sample/sample bag appropriately. Labels should contain the following information:
 - Project name and/or number;
 - Field sample number;
 - Initials of collector;
 - Well ID;
 - Date and time of collection; and
 - Sample type and preservative (if any).
10. Place the sealed and labeled sample container in an appropriate container for storage. Appropriate storage, packaging for shipment, and shipment requirements will be identified in the SAP/FSP/WP and shall be dependent on site COCs, the types of sample containers, and the selected mode of transport.
11. Decontaminate equipment, as necessary, prior to advancing to another location in accordance with INTERA SOP 2, *Decontamination*.
12. Document groundwater purge and collection information on the appropriate field form (**SOP 30, Field Form 5** or **SOP 30, Field Form 6**) and/or in the field logbook, taking care to cite any problems or unusual conditions encountered. Make sure the following information is noted:
 - Well location ID;
 - Water levels before and after purging and prior to sampling;
 - Well volume and purge determinations;
 - Field water quality parameters before, during, and after the event, as applicable;
 - Total volume and physical characteristics of purged water; and
 - Type and capacity of pump or bailer used and pumping rates (if applicable).

Upon completion of a groundwater sampling event:

1. Verify that a completed chain-of-custody form documenting all collected samples and any QA samples is placed in the container for transfer to the specified laboratory.
2. Ship/deliver sample(s) to the specified laboratory for analysis. If delivering samples via third party, verify that custody seals are applied across the opening of shipping containers. This minimizes the potential for tampering with the collected samples

as shipping container(s) cannot be opened without breaking the custody seals. Applied custody seals should contain the following information:

- Collector's signature or initials; and
 - Date of shipping.
3. When scheduling for shipment/delivery of sample(s) to the laboratory, observe and comply with all minimum holding-time requirements for degradable constituents. This is especially pertinent if VOC samples were collected as most VOC samples have a less than 48-hour holding time.

10.8 References

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10.9 Attachments

- Attachment 1: Operational Characteristics of Available Purge and Sample Devices
- Attachment 2: Material Considerations in Selection of Sampling Equipment
- Attachment 3: General Procedures for Measuring Specific Water Quality Parameters
- Attachment 4: General Groundwater Sampling Equipment List

10.10 Document History

Revision	Effective Date	Lead Author	Summary of Changes
2004.0	4/2004	Taimur Malik	Original version
2004.1	2/2015	Kate Herrell	Revised for inclusion in COA Brownfields QAPP
2004.2	10/2015	Noreen Baker	Text revisions to clarify different stabilization criteria between standard purging and micropurging.
2004.3	6/2017	Noreen Baker	Removed Field Forms as attachments, added references to SOP 30, Field Forms
2004.4	7/2019	Noreen Baker	Updated reference to ASTM Standard D4448-01 to reflect most recent version.

Attachment 1
Operational Characteristics of Available Purge and Sample Devices

Operational Characteristics of Available Purge and Sample Devices

(English Units)

Device	Type	Approximate Minimum Well Diameter (Inches)	Maximum Lift (Feet)	Maximum Design Flow Rate (gpm)	Typical Flow Rate @ Maximum Lift (gpm)	Minimum Achievable Flow (Discharge) Rate (gpm)	Power Source
Bailer	GS	0.75	No Limit	Highly Variable	Highly Variable	<0.026	Manual or Mechanical
Messenger	GS	1.5	No Limit	Highly Variable	Highly Variable	<0.026	Manual or Mechanical
Syringe	GS	1.5	No Limit	0.26 gals. ^A	0.26 gals. ^A	<0.026	Pneumatic
Centrifugal Pump	CP	1.0	25.0	30.0–40.0	Highly Variable	Same as Max.	IC Engine or Electric
Peristaltic Pump	SL	0.5	29.0	12.0	0.1	<0.026	Electric
Centrifugal Submersible Pump	CP	2.0	270	9.0	0.5	<0.026	Electric
		4.0	1700	85.0	1.2	<0.026	Electric
Gas Displacement Pump	PD	0.75	250	9.0	1.0	<0.026	Pneumatic
Bladder Pump	PD	0.75	1000	3.5	0.1	<0.026	Pneumatic
Single-Acting Piston Pump	PD	2.0	400	5.0	4.5	<0.026	Pneumatic/Mechanical
Dual-Acting Piston Pump	PD	1.5	1000	2.0	0.4	<0.026	Pneumatic
Progressive Cavity Submersible Pump	PD	2.0	180	1.2	0.3	<0.026	Electric
Gear Submersible Pump	PD	2.0	125	1.4	0.1	<0.026	Electric
		3.0	175	1.7	0.1	<0.026	Electric
Inertial Lift Pump	IL	0.75	260	4.0	4.0	<0.026	Manual, Electric or IC Engine

(Metric Units)

Device	Type	Approximate Minimum Well Diameter (Inches)	Maximum Lift (Feet)	Maximum Design Flow Rate (gpm)	Typical Flow Rate @ Maximum Lift (gpm)	Minimum Achievable Flow (Discharge) Rate (gpm)	Power Source
Bailer	GS	19	No Limit	Highly Variable	Highly Variable	<0.1	Manual or Mechanical
Messenger	GS	38.0	No Limit	Highly Variable	Highly Variable	<0.1	Manual or Mechanical
Syringe	GS	38.0	No Limit	1.0 liter ^A	1.0 liter ^A	<0.1	Pneumatic
Centrifugal Pump	CP	25.0	7.6	115–150	Highly Variable	Same as Max.	IC Engine or Electric
Peristaltic Pump	SL	12.0	8.8	45.0	0.4	<0.1	Electric
Centrifugal Submersible Pump	CP	50.0	80	34.0	2.0	<0.1	Electric
		100	520	322	4.5	<0.1	Electric
Gas Displacement Pump	PD	19	75.0	34.0	4.0	<0.1	Pneumatic
Bladder Pump	PD	19	305	13.0	0.4	<0.1	Pneumatic
Single-Acting Piston Pump	PD	50.0	125	19.0	17.0	<0.1	Pneumatic/Mechanical
Dual-Acting Piston Pump	PD	38.0	305	7.5	1.5	<0.1	Pneumatic
Progressive Cavity Submersible Pump	PD	50.0	55.0	4.5	1.0	<0.1	Electric
Gear Submersible Pump	PD	50.0	40.0	5.3	0.4	<0.1	Electric
		76.0	5.0	6.4	0.4	<0.1	Electric
Inertial Lift Pump	IL	19.0	80.0	15.0	15.0	<0.1	Manual, Electric or IC Engine

Excerpted from (ASTM, 2006)

Attachment 2
Material Considerations in Selection of Sampling Equipment

Material Considerations in Selection of Sampling Equipment (ASTM, 2019)

Material	Considerations
Polytetrafluoroethylene	<ul style="list-style-type: none"> • Virgin PTFE readily sorbs some organic solutes (16) • Ideal material in corrosive environments where inorganic compounds are of interest • Useful where pure product (organic compound) or high concentrations of PVC solvents exist • Potential structural problems because of its low tensile and compressive strengths, low wear resistance, and the extreme flexibility of the casing string as compared to other engineering plastics (17, 18, 19) • Potential problems with obtaining a seal between the casing and the annular sealant because of PTFEs low coefficient of friction and antistick properties as compared to other plastics (19) • Maximum string length of 2-in. (~5-cm) diameter schedule PTFE casing should not exceed about 375 ft (~115 m) (20) • Expensive
Polyvinylchloride	<ul style="list-style-type: none"> • Leaching of compounds of tin or antimony, which are contained in original heat stabilizers during polymer formulation, could occur after long exposure • When used in conjunction with glued joints, leaching of volatile organic compounds from PVC primer and glues, such as THF (tetrahydrofuran), MEK (methyl ethyl ketone), MIBK (methyl isobutyl ketone) and cyclohexanone could leach into ground water. Therefore, threaded joints below the water table, sealed with O-rings or Teflon tape, are preferred • Cannot be used where pure product or high concentrations of a PVC solvent exist • There is conflicting data regarding the resistance of PVC to deterioration in the presence of gasoline (21) • Maximum string length of 2-in. (~5-cm) diameter threaded PVC casing should not exceed 2000 ft (~610 m) (20) • PVC can warp and melt if neat cement (cement and water) is used as an annular or surface seal because of heat of hydration (22, 17) • PVC can volatilize CFCs into the atmosphere within the unsaturated zone, which can be a potential problem for studies of gas and moisture transport through the unsaturated zone • Easy to cut, assemble, and place in the borehole • Inexpensive
Stainless steel	<ul style="list-style-type: none"> • Generally has high corrosion resistance, which differs with type • Corrosion can occur under acidic and oxidizing conditions • Corrosion products are mostly iron compounds, with some trace elements • Primarily two common types: <ul style="list-style-type: none"> (1) Type 304 Stainless Steel: Iron alloyed with the following elements (percentages): Chromium (18-20 %), Nickel (8-11 %), Manganese (2 %), Silicon (0.75 %), Carbon (0.08 %), Phosphorus (0.04 %), Sulfur (0.03 %) (2) SS 316: Iron alloyed with the following elements (in percentages): Chromium (16-18 %), Nickel (11-14 %), Manganese (2 %), Molybdenum (2-3 %), Silicon (0.75 %), Carbon (0.08 %), Phosphorus (0.04 %), Sulfur (0.03 %) • Corrosion resistance is good for Type 304 stainless steel under aerobic conditions. Type 316 stainless steel has improved corrosion resistance over Type 304 under reducing conditions (23) • Expensive
Galvanized steel	<ul style="list-style-type: none"> • Less corrosion resistance than stainless steel and more resistance to corrosion than carbon steel (see Carbon steel entry) • Oxide coating could dissolve under chemically reduced conditions and release zinc and cadmium, and raise pH • Weathered or corroded surfaces present active adsorption sites for organic and inorganic constituents • Inexpensive
Carbon steel	<ul style="list-style-type: none"> • Corrosion products can occur (for example, iron and manganese oxides, metal sulfides, and dissolved metal species) • Sorption of organic compounds onto metal corrosion products is possible • Weathered surfaces present active adsorption sites for organic and inorganic constituents • Inexpensive

Attachment 3
General Procedures for Measuring Specific Water Quality Parameters

Temperature

Temperature is a measure of hot or cold on a defined scale through use of a thermometer. Field temperature measurements may be made with a field thermometer, equipment thermistor, or NIST-traceable thermometer. At a minimum, the temperature measurement device should be capable of measuring in 0.1°C increments (EPA, 2014b). Whichever type of thermometer is applied, it should be calibrated prior to use, if possible.

Temperature measurement devices such as field thermometers and equipment thermistors will be verified against a NIST-traceable thermometer prior to use and should agree within $\pm 4.0^\circ\text{C}$. Measurement devices such as pH, conductivity and DO meter thermistors that also include an internal temperature sensor will also be verified against a NIST-traceable thermometer before each use.

To measure temperature in a groundwater sample:

- Clean probe end with de-ionized water and immerse into sample.
- If not measuring in-situ, swirl the thermometer in the sample to facilitate mixing and equilibration.
- Allow thermometer to equilibrate with the sample for at least one minute.
- Suspend the thermometer away from the sides and bottom to observe the reading.
- Record the reading in the field logbook and/or on the appropriate field form. Temperature units are typically recorded in $^\circ\text{C}$ and should be recorded to the nearest tenth (0.1).

CONVERSION FORMULAS:

$$^\circ\text{F} = (1.8 \times n^\circ\text{C}) + 32$$

or

$$^\circ\text{C} = 0.56 \times (n^\circ\text{F} - 32)$$

Where:

n = reported measurement in either $^\circ\text{C}$ or $^\circ\text{F}$, as appropriate.

10.10.1 pH

pH is defined as the negative logarithm of the effective hydrogen-ion concentration and is used to express both acidity and alkalinity on a scale with a defined range of 0 (acid) to 14 (base) with 7 representing neutrality. For water sampling, pH is typically measured by a pH meter equipped with a temperature-compensation adjustment and capable of reproducing readings to within 0.2 standard units. All pH meters used in field operations will be maintained and operated in accordance with the manufacturer's instructions and

any required calibration and verification checks will be documented and maintained in a logbook prior to use. Ambient temperature in the immediate vicinity of the pH meter should also be measured and recorded in the field logbook to verify that the instrument is being operated within the manufacturer's specified range of operating temperatures.

For most pH meters, at a minimum, a two-point calibration should be conducted prior to use to ensure the accuracy of the meter. The following basic guidelines for pH meter calibration/verification are taken from a regional EPA SOP and are provided as an example (EPA, 2013a):

1. Verify the meter's internal temperature sensor (thermistor) against a NIST-traceable thermometer and note any differences between the thermistor and the NIST-traceable thermometer in the logbook. If the temperatures do not agree within $\pm 4^{\circ}\text{C}$, the unit or probe must be repaired or replaced. Alternatively, if the meter can be used in a manual temperature compensation mode, the NIST-traceable thermometer may be used for temperature readings and the necessary corrections applied. Check and record the temperatures of the standards and the samples.
2. If the pH range of the sample is not known, the pH of the sample to be tested should be estimated either from historical data or by using a four-color pH indicator paper or equivalent. Using this information, calibrate the pH meter with the buffers that bracket the expected pH range. Buffer solutions are commonly pH 4, 7 and 10. It may be possible to configure the pH meter so that it can be standardized with buffers other than those in the default configuration.
3. Immerse the probe in the first buffer solution and calibrate the meter to read the correct pH. After the initial buffer calibration, calibrate the meter using other buffer solutions, as appropriate. Rinse the probe with de-ionized water and blot dry or otherwise remove excess rinse water between the different buffer solutions. Record the buffer values and temperatures used to calibrate the meter.
4. Rinse the probe with de-ionized water, blot dry or otherwise remove excess rinse water and immerse it into the appropriate buffer and read as a sample. If the meter reads within ± 0.2 S.U. of the known value of the buffer, record the value indicated by the meter. If the meter is outside of the acceptable accuracy range, it should be recalibrated. If it is still outside of the acceptable accuracy range after the second calibration, the electrode and/or meter may need to be replaced and/or a consult with technical support from the instrument's manufacturer may be necessary.
5. Once the meter has been properly calibrated and verified (**Steps 1-4 above**), it is ready for use. Rinse the probe with de-ionized water and store it according to manufacturer's recommendations.

NOTE: Unless the manufacturer indicates that the meter maintains its calibration upon shut down, meters must be re-calibrated if they need to be turned off during a period of use.

Procedure for measuring pH in the field is as follows:

- Collect sample. If the meter's thermistor is to be used for the temperature of record for the measurement activity, the temperature should be read as soon as the reading stabilizes and prior to measuring pH.
- Immerse the probe in sample, keeping it away from the sides and bottom of the sample container. Allow ample time for the probe to equilibrate with the sample.
- While suspending the probe away from the sides and bottom of the sample container, record the pH. Units of pH are standard units and should be recorded to the nearest tenth (0.1).
- Rinse probe with de-ionized water and store in container filled with de-ionized water until next sample.
- As appropriate, periodically check the pH by rinsing probe with de-ionized water, blot dry or otherwise remove excess rinse water and immerse it into an appropriate buffer solution. If the measured pH differs by ≥ 0.2 , the meter must be recalibrated.
- Perform a post calibration at the end of the day and record all findings in the field logbook and/or on the appropriate field form.

Specific Conductance

Specific conductance is a measure of the ability of an aqueous solution to conduct an electric current and is customarily reported in microSiemens per centimeter ($\mu\text{S}/\text{cm}$) at 25° C. Like pH, specific conductance is typically measured by a meter equipped with a temperature-compensation adjustment as conductivity is affected by temperature. If an instrument that does not automatically compensate for temperature is used, the user should document temperature first so that appropriate adjustments can be made in accordance with the manufacturer's instructions and/or method.

All meters used in field operations will be maintained and operated in accordance with the manufacturer's instructions and any required calibration and verification checks will be documented and maintained in a logbook prior to use. Ambient temperature in the immediate vicinity of the meter should also be measured and recorded in the field logbook to insure the instrument is being operated within the manufacturer's specified range of operating temperatures. The following basic guidelines for meter calibration/verification are taken from a regional EPA SOP and are provided as an example (EPA, 2012).

1. Verify the meter's internal temperature sensor (thermistor) against a NIST-traceable thermometer and note any differences between the thermistor and the NIST-traceable thermometer in the logbook. If the temperatures do not agree within $\pm 4^{\circ}\text{C}$, the unit or probe must be repaired or replaced. Alternatively, if the meter can be used in a manual temperature compensation mode, the NIST-traceable thermometer may be used for temperature readings and the necessary corrections applied. Check and record the temperatures of the standards and the samples.
2. Rinse the probe with de-ionized water and blot dry before conducting subsequent calibration and verification checks.
3. Immerse the probe in the first standard solution and calibrate or verify the meter against that solution. Fresh standards should be used for each calibration. After the initial standard, calibrate and/or verify the meter using additional standards, as appropriate. Rinse the probe with de-ionized water and blot dry or otherwise remove excess rinse water between the different standards. Record the standard values/temperatures used to calibrate or verify the meter.
4. For a properly calibrated meter, meter readings should be within $\pm 10\%$ of the standard solution(s) known values. If reading are outside this limit and cannot be corrected by adjusting the cell constant of the probe, the meter or probe may need to be replaced and/or a consult with technical support from the instrument's manufacturer may be necessary.
5. After calibration is complete, place the probe back into the calibration standard used and record a post-calibration reading. Record a post calibration reading for each standard used. If the meter is not accurate to within $\pm 10\%$ of the standard solution(s) known values, it should be recalibrated. If it is still outside of the acceptable accuracy range after the second calibration, the meter or probe may need to be replaced and/or a consult with technical support from the instrument's manufacturer may be necessary.
6. Once the meter has been properly calibrated and verified (**Steps 1-5 above**), it is ready for use. Rinse the probe with de-ionized water and store it according to manufacturer's recommendations.

Procedure for measuring conductivity in the field is as follows:

- Collect sample. Check and record temperature. Adjust temperature to reflect that of sample if required.
- Fully immerse probe in the sample keeping it away from the sides and bottom of the container.

- Record the result in the field logbook or the appropriate field form. Results should be reported to the nearest 10 for readings below 1,000 $\mu\text{S}/\text{cm}$ and to the nearest 100 for readings above 1,000 $\mu\text{S}/\text{cm}$. Note that some meters will automatically change units from $\mu\text{S}/\text{cm}$ to mS/cm and care should be taken to record readings using the correct units.
- Rinse probe with de-ionized water and store in container filled with de-ionized water until next sample.
- As appropriate, periodically check the specific conductance by rinsing probe with de-ionized water, blot dry or otherwise remove excess rinse water and immerse it into an appropriate standard solution. If the measured conductivity differs by $\pm 10\%$, the meter must be recalibrated.
- Perform a post calibration at the end of the day and record all findings in the field logbook and/or on the appropriate field form.

Dissolved Oxygen

Dissolved oxygen can be defined as the volume of oxygen contained in a volume of water. DO readings can be very sensitive since the solubility of oxygen in water is dependent on water temperature, salinity and pressure. As water temperature decreases, oxygen solubility increases; as salinity increases, oxygen solubility decreases, and as atmospheric pressure decreases, oxygen solubility decreases.

As such, DO should be measured in-situ or down hole whenever possible. If in-situ measurements are not possible, precautions should be taken to minimize the time the sample is exposed to ambient air. DO readings should not exceed the saturation limit of oxygen in water (8 to 10 mg/L); if readings greater than 10 mg/L are observed, the meter is probably not functioning correctly.

Several methods utilizing a variety of technologies are available for measuring DO, specifically Clark cell probes and luminescent probes (EPA, 2014a). Clark cell probes utilize an oxygen permeable membrane that covers an electrolytic cell consisting of a cathode and an anode. The anode acts as a reference electrode. After passing through the permeable membrane, the oxygen is reduced by an applied potential voltage that is referenced to the anode. The reduction current at the cathode is directly proportional to the partial pressure of oxygen in liquid, expressed as %-air saturation. The concentration of oxygen, in mg/l, is calculated based on the %-air saturation reading and the solubility of oxygen in water at the sample temperature.

Luminescent probes employ a light emitting diode (LED) to provide incident light, which excites the oxygen-sensitive luminescent-dye molecule substrate of the sensor. After dissipation of the excitation energy, longer-wavelength light is emitted (luminescence).

The magnitude of steady-state luminescence (intensity) is measured by the sensor and is inversely proportional to the dissolved oxygen concentration.

For any system, all instruments used in field operations will be maintained and operated in accordance with the manufacturer's instructions and any required calibration and verification checks will be documented and maintained in a logbook prior to use.

In general, calibrating for DO should be conducted at temperatures and pressures as close as possible to those of the sample media for the most accurate measurements and the temperature probe or thermistor should be verified using a NIST-traceable thermometer prior to each calibration. Most DO meters utilize a one-point calibration generally performed using either water-saturated air or air-saturated water.

When using the water-saturated air method, the probe should be placed in a 100% relative humidity environment and the temperature and DO readings should be allowed to equilibrate. After equilibration, the meter should be set to read the appropriate DO concentration based on the temperature and barometric pressure.

When using air-saturated water for calibration, an aeration device such as an aquarium pump with a diffusion stone should be placed in a vessel containing tap water. The water in the vessel should be aerated for a minimum of one hour at a constant temperature. Saturation should be verified by placing the DO probe in the vessel and monitoring the temperature and DO readings for stabilization. Avoid placing the probe in the direct stream of air bubbles. Bubbles can accumulate on the probe surface and cause erroneous readings. Once the water is saturated, the temperature of the water and the barometric pressure can be used to determine the DO value. The meter can then be set to read that value.

The procedure for collecting a DO sample is as follows:

- Inspect membrane of the DO meter for air bubbles and/or holes. If air bubbles or holes exist, replace the membrane.
- Calibrate the instrument in accordance with manufacturer's specifications (typically to a percent)
- Collect sample. Measure the temperature of the sample and adjust the temperature setting of the DO meter, if applicable.
- Record the reading in the field logbook or on the appropriate field form. DO is measured in units of mg/L. Results should be reported to the nearest tenth (0.1).
- As appropriate, periodically check DO calibration throughout the course of a day's activities to quantify potential instrument drift.

- Perform a post calibration at the end of the day and record all findings in the field logbook and on the appropriate field form.

Oxidation-Reduction Potential

Oxidation is the process of liberating electrons or gaining oxygen. Examples of oxidation include conversion of elemental iron to rust, elemental sulfur to sulfate, and elemental hydrogen to water. Reduction is the process of gaining electrons resulting in the charge on some atomic unit in the species to be reduced. Oxidation-reduction potential (ORP) or redox potential is a measure of the intensity or activity of a medium to mediate reactions of important elements in biological systems (e.g., O, N, Mn, Fe, S, and C) and other metallic elements. ORP is measured in millivolts (mv).

In aqueous solutions, a numerically positive ORP represents an environment conducive to the oxidation of an introduced substance by reduction of the original media; conversely, a numerically negative ORP represents an environment conducive to the reduction of an introduced substance by oxidation of the original media. However, like pH, ORP represents an intensity factor. It does not characterize the capacity of the system for oxidation or reduction in much the same way that pH does not characterize the buffering capacity (EPA, 2013c).

ORP measurements should be conducted in a fashion that prevents the addition or loss of any potential oxidants or reductants as readings could be compromised by exposing the sample to air or allowing H₂S to off-gas from anoxic samples. Like DO, ORP measurements should be conducted in situ or by using a flow-through cell whenever possible.

Instruments/meters used to measure ORP are the practical implementation of electrochemical cells, which use metal electrodes in a solution to generate an electric current or voltage. When interpreted properly, ORP combined with other conventional water quality parameters is useful in developing a more complete understanding of water chemistry. However, in most environmental media, ORP will not reach equilibrium due to low concentrations or interferences from multiple species. Consequently, ORP measurements are generally considered semi-quantitative in environmental media, unless certain conditions exist.

If ORP is to be utilized for a specific site, a determination of whether the instrument requires verification or calibration shall be established in the corresponding SAP or equivalent. In most applications, the ORP information is required only to be semi-quantitative; as such, the selected instrument can be calibrated to standard solutions appropriate for the project using the manufacturer's recommended procedure. One minute after calibration, the instrument should display a stable reading within +/-10mV of the predicted reading.

NOTE: Special care should be taken when calibrating or verifying ORP instruments as the reagents commonly used in the preparation of ORP calibration standards are toxic. Avoid unnecessary exposure to these materials through the use of protective clothing, eye wear and gloves. If ORP calibrations are required per the site DQOs, refer to the specific Personal Protection Equipment (PPE) requirements outlined in the SSHASP.

The procedure for measuring ORP is as follows:

- Inspect membrane for air bubbles and/or holes. If air bubbles or holes exist, replace the membrane.
- Calibrate the instrument in accordance with manufacturer's specifications.
- Collect sample. Measure the temperature and pH of the sample at the same time the ORP is measured. ORP may need to be measured in an upright position to assure salt bridge flow is maintained.
- Record the reading in the field logbook or on the appropriate field form. Results should be reported to the nearest mV.
- As appropriate, periodically check DO calibration throughout the course of a day's activities to quantify potential instrument drift.
- Perform a post calibration at the end of the day and record all findings in the field logbook and on the appropriate field form.

NOTE: In the absence of a specified reference scale, ORP data has no meaning. Therefore, the reference scale used should always be specified in reporting or discussing ORP data. ORP measurements converted to a hydrogen scale can be reported as "Eh". Data reported as the direct field measurement without correction might be described as "ORP referenced to Ag/AgCl electrode" or "EAg/AgCl".

To apply corrections to obtain Eh from a direct field measurement of ORP, the known half-cell potential of the reference electrode is required and the measurement adjusted as follows:

Equation 4:

$$E_{h,\text{sample}} = \text{ORP}_{\text{sample}} + H$$

Where:

$E_{h,\text{sample}}$ (mV)	=	ORP measurement relative to Standard Hydrogen Electrode (SHE)
$\text{ORP}_{\text{sample}}$ (mV)	=	ORP field measurement
H	=	half-cell potential of reference electrode as utilized for measurement.

The half-cell potential of a silver/silver chloride reference electrode at various temperatures and with various molarities of potassium chloride (KCl) filling solutions is presented on **Table 3** (EPA, 2013c). YSI sondes and Thermo electrodes typically use 4M KCl filling solutions; Eureka sondes typically use 3.3M KCl filling solutions.

Table 3: Half-Cell Potential of Ag/AgCl Reference Electrode

T(°C)	Molarity of KCl filling solution			
	3M	3.3M*	3.5M	Sat/4M
10	220	217	215	214
15	216	214	212	209
20	213	210	208	204
25	209	207	205	199
30	205	203	201	194
35	202	199	197	189
40	198	195	193	184

*interpolated values

Turbidity

Turbidity is caused by suspended and colloidal matter such as clay, silt, organic and inorganic matter and microscopic organisms. Many methods are available for the measurement of turbidity including turbidimeters and optical probes. Turbidity is measured by determining the amount of scatter when a light is passed through a sample and is represented in units identified as nephelometric turbidity units (NTUs).

Many brands of instruments are commercially available for the measurement of turbidity incorporating a wide variety of technologies. The manufacturer's instruction manual should be consulted for specific procedures regarding their calibration, maintenance and use. Calibration of any instrument used for measurement of turbidity must be conducted and/or verified prior to each use or on a daily basis, whichever is most appropriate. Depending on the instrument, the verification and calibration can differ slightly. If the instrument readings do not agree within $\pm 10\%$ of the calibration standards, the unit must be recalibrated, repaired or replaced (EPA, 2013b).

Depending on the meter, the sample measurement procedure for turbidity can differ slightly. The following procedure is a commonly applied procedure for measuring turbidity in grab samples.

- Rinse the sample cell with de-ionized water.
- Collect a representative sample and pour off enough to fill the cell to the identified fill line and replace the cap on the cell.
- Wipe off excess water and any streaks with a soft, lint-free cloth such as lens paper.

- Turn instrument on. Place the meter on a flat, sturdy surface. Do not hold the instrument while making measurements.
- Insert the sample cell in the instrument so the diamond or orientation mark aligns with the raised orientation mark in the front of the cell compartment. Close lid.
- If appropriate, select manual or automatic range selection by pressing the range key.
- If appropriate, select signal averaging mode by pressing the Signal Average key. Use signal average mode if the sample causes a noisy signal (display changes constantly).
- Press Read. The display will show ---- NTU. Then the turbidity is displayed in NTU. After the lamp symbol turns off, record the result in the field logbook or on the appropriate field form. Units should be recorded to the nearest whole unit.
- Rinse the cell with de-ionized water or rinse out with sample water prior to the next reading.
- As appropriate, periodically check the turbidity by rinsing probe with de-ionized water, blot dry or otherwise remove excess rinse water and immerse it into an appropriate standard solution. If the measured turbidity differs by $\pm 10\%$, the meter must be recalibrated.
- Perform a post calibration at the end of the day and record all findings in the field logbook and on the appropriate field form.

NOTE: In assessing acceptable turbidity levels, visual observation is often considered sufficient for most sites. Depending on the DQOs and regulatory authority for a project, however, there may be specific quantitative constraints on achieving clear, artifact-free water. RCRA regulations cite the need to achieve purge water that is at or less than 5 NTUs (EPA, 1992a and b) as observed on a turbidity meter; however, for marginal aquifers with high lithological heterogeneity (i.e., interbedded sand and clay), this is often not attainable (EPA, 1992a). However, when samples are collected for metals, semivolatile organic compounds (SVOCs), and pesticides, every effort must be made to reduce turbidity to 10 NTUs or less (not just the stabilization of turbidity) prior to the collection of the water sample (Yeskis and Zavala, 2002; TCEQ, 1998). If turbidity cannot be reduced below 10 NTUs, groundwater samples may be filtered in the field using a filter that is not less than 10.0 microns (TCEQ, 1998).

Attachment 4
General Groundwater Sampling Equipment List

General Groundwater Sampling Equipment List

The following list identifies the types of instruments, equipment, supplies, and documents that may be used for a range of groundwater sampling applications. A project-specific equipment list will be selected from this list, based on project DQOs and sample point conditions.

1. Sampling vehicle with various pumps, electrical generator, air compressor, hoses, clean water tank, decontamination equipment, etc.
2. Portable pump with water discharge tubing and power source (i.e., Geotech GeoSub pump electric submersible, Monsoon DC powered pump, or equivalent)
3. Dedicated pumps (i.e., stainless steel bladder pump and dedicated electric submersible pumps [for wells that are too deep for bladder pumps])
4. Bailer (diameters 1" to 4"; materials of construction are HDPE, PVC, and stainless steel) with rope (i.e., stainless steel bailer with dedicated rope or cable)
5. Cutting knife
6. Portable generator and extension cord
7. Portable air compressor (up to 150 psi)
8. Water-quality indicator parameter instrument(s) (YSI 556 or equivalent) to measure the selected parameters per the SAP or equivalent
9. Calibration fluids for water-quality parameter meter(s)
10. Turbidity meter
11. Flow-through cell and tubing
12. Water level measurement device of appropriate length
13. Water filtration apparatus, as needed (Masterflex or equivalent peristaltic pump (for use with bailed samples) and 0.45 μ filters)
14. Decontamination equipment for bailer and portable pumps (i.e., two 5-gallon buckets, distilled or deionized [DI] water, liquinox or other approved cleaner as identified in INTERA SOP 2, *Decontamination*)
15. Sample coolers for field storage and shipping
16. Sample containers

17. Laboratory-supplied preservatives in containers
18. Ice
19. Analyte list corresponding to laboratory bottle order
20. Sample container labels
21. Custody seals (if required per SAP/FSP/WP)
22. Chain-of-Custody form(s) (**SOP 30, Field Form 8**)
23. Water-sampling field data report forms (**SOP 30, Field Form 5** or **SOP 30, Field Form 6**)
24. Sample control logs (if required) (**SOP 30, Field Form 7**)

APPENDIX C

Field Forms

[illegible]

PROJECT NAME: _____ WELL NO.: _____
PROJECT NO.: _____ DATE: _____ FIELD CREW: _____

WATER LEVEL AND WATER COLUMN HEIGHT

TIME	DEPTH TO BOTTOM OF WELL (DTB) (ft btoc)	DEPTH TO WATER (DTW) (ft btoc)	Water Column Height (DTB-DTW) (ft)

ft btoc: feet below top of casing from designated measuring point

PURGE VOLUME

Well Casing Diameter (inches)	Volume/Linear Foot (see conversion table below)	1 Well Volume (gal)	2 Well Volumes (gal)	3 Well Volumes (gal)

VOLUME/LINEAR FOOT (gal/ft) (Use well casing ID)

1" = 0.04	1.5" = 0.09	2" = 0.17	3" = 0.38	4" = 0.66	6" = 1.5	8" = 2.6	10" = 4.1
-----------	-------------	-----------	-----------	-----------	----------	----------	-----------

1 well casing volume = Volume/Linear Foot x Water Column Height

METHOD OF PURGING: _____

METHOD OF SAMPLING: _____

WATER LEVEL/WATER QUALITY INSTRUMENTS USED

INSTRUMENT	SERIAL NO.	TIME CALIBRATION PERFORMED	TECH	COMMENTS

WATER QUALITY READINGS DURING PURGING

TIME	TEMP (°C)	pH	SP. COND. (µS/cm)	DO (mg/L)	ORP (mV)	Total Volume Purged (gal)	Comments (color/odor)

*If measured.

Stabilization = Temp ±1°C; pH ±0.2 units; Sp. Cond. ±10%; Turb. ±10%

[illegible]

Stabilization = **Temp** $\pm 1^{\circ}\text{C}$; **pH** ± 0.2 units; **Sp. Cond.** $\pm 10\%$; **Turb.** $\pm 10\%$

GROUNDWATER SAMPLE ID: _____ DUPLICATE SAMPLE ID: _____

Time	Bottle Type	Analytical Method	# of Bottles	Volume	Preservative
TOTAL:					

2015.1

Project Name: _____						Project No.: _____					
Site Location: _____											
Field Sample No.	Lab I.D.	Sampler Initials	Date Collected	Time Collected	Sample Media	Depth Interval	Sample Location/ Coordinates	Replicate/ Duplicate Sample? (Y/N)	Corresponding Field Sample No.	Composite? (Y/N)	Comments

Sample Media
 01 - SURFACE WATER, 02 - POND BOTTOM WATER, 03 - POND BOTTOM SLUDGE
 04 - SOIL, UNDERLYING SOIL, 05 - SURFACE WASTE, 06 - GROUND WATER,
 07 - TANK WASTE, 08 - NAPL, 09 - TRIP BLANK, 10 - FIELD BLANK.

APPENDIX D

Site-Specific Health and Safety Plan

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Stage 1 Abatement Plan

**Former Santa Fe Generating Station
(Santa Fe Well-S)**

Santa Fe, Santa Fe County, New Mexico 87505

Prepared by:



**6000 Uptown Boulevard NE, Suite 220
Albuquerque, New Mexico 87110**

June 2019

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EMERGENCY CONTACTS & PROCEDURES

Emergency Contacts List
Hospital Route Map
Written Directions to Hospital
Site Emergency Response Plan

LIST OF FIGURES

Figure 1	Site Location Map
Figure 2	Site Plan

LIST OF FORMS

Form 1	Site Personnel Acknowledgement Form
Form 2	Safety Meeting Attendance Forms
Form 3	Job Safety Analysis Forms
Form 4	Behavior Based Safety Encounter Form
Form 5	Incident Investigation Report Form
Form 6	Site Visitor Log
Form 7	Vehicle Inspection Checklist
Form 8	Hot Work Permit

LIST OF ATTACHMENTS

Attachment A	Job Safety Analyses Program
Attachment B	Behavior Based Safety Program
Attachment C	Heat and Cold Stress Casualty Prevention Program
Attachment D	Health and Safety Requirements for Drilling Operations
Attachment E	Health and Safety Requirements for Heavy and Light Equipment
Attachment F	HazCom Program and Chemical Safety Data Sheets
Attachment G	Respiratory Protection Program
Attachment H	Confined Space Program

HAZCOM

Hazardous Chemical List
Safety Data Sheets

ACRONYMS AND ABBREVIATIONS

1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene
ANSI	American National Standards Institute
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylene
CFR	Code of Federal Regulations
CGI	combustible gas indicator
COPC	contaminant of potential concern
CPR	cardiopulmonary resuscitation
EDB	1,2-dibromoethane
EDC	1,2-dichloroethane
EPA	Environmental Protection Agency
eV	electron volt
ft	feet
HazCom	Hazard Communication
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Health and Safety Officer
INTERA	INTERA Incorporated
IDLH	immediately dangerous to life or health
JSA	Job Safety Analysis
LEL	lower explosive limit
LFG	landfill gas
MSDS	Material Safety Data Sheet
MTBE	methyl tert-butyl ether
NIOSH	National Institute for Occupational Safety and Health
NMWQCC	New Mexico Water Quality Control Commission
OSHA	Occupational Safety and Health Administration
P.E.	Professional Engineer
PEL	permissible exposure limit
PID	photoionization detector
PPE	personal protective equipment
ppm	parts per million
SCBA	self-contained breathing apparatus
SDS	safety data sheet
Site	Former Santa Fe Generating Station
SOW	scope of work
SSHASP	Site-Specific Health and Safety Plan
SSO	Site Safety Officer
SVOC	semi-volatile organic compounds
Total Naphthalenes	naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene
TWA	time weighted average
UST	underground storage tank

VOCs volatile organic compounds

Public Service Company of New Mexico
Stage 1 Abatement Plan;
Former Santa Fe Generating Station
(Santa Fe Well-S)

SITE-SPECIFIC HEALTH AND SAFETY PLAN

INTERA Incorporated's (INTERA) Site-Specific Health and Safety Plan (SSHASP) is a dynamic document that is subject to change during the performance of the INTERA scope of work (SOW) designed for Stage 1 Abatement Activities at the Former Santa Fe Generating Station (Site) in Santa Fe, New Mexico (Site) (**Figure 1**). The purpose of this SSHASP is to protect personnel involved in the ongoing activities at the Site. All INTERA personnel and INTERA subcontractor personnel involved in activities at the Site must review this SSHASP and sign the Personnel Acknowledgment Form (**Form 1**) prior to beginning work at the Site.

Project Manager	Eileen Marcillo – INTERA	(505) 428-0066
Site Safety Officer (SSO)	Andrew Murphy – INTERA	(505) 428-0846
Field Sampler(s)	Lee Dalton – INTERA Andrew Murphy – INTERA Austin Hanson – INTERA	(505) 246-1600, ext. 1213 (505) 428-0846 (505) 246-1600, ext. 1224
INTERA Albuquerque Office Health and Safety Officer (HSO)	Brian Archuleta – INTERA	(505) 246-1600, ext. 1215
Client Project Manager	John Hale – PNM	(505) 241-2014
GWQB Project Manager	Kate Herrell	(505) 948-0534

SSHASP Prepared By Andrew Murphy, INTERA in accordance with applicable provisions of the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120.

SSHASP Reviewed By: Eileen Marcillo, INTERA

INTERA Project No.: PNMRS.M001.S1AP SFGS Stage 1 Abatement Plan\Task 1 S1AP Proposal

1.0 SITE LOCATION AND DESCRIPTION

Site Address: (nearby) INTERSECTION OF FLAGMAN WAY & SHOOFLY ST.

Santa Fe, NM 87505. (**Figure 1**)

General Location and Site Description:

The Former Santa Fe Generating Station (Site) is located just northwest of the intersection between Cerrillos and Cordova Roads in Santa Fe, NM. The Site is a former PNM electric power generating station operated from around the 1950s through the 1980s. The Site is a vacant lot but there are many groundwater monitoring, injection and extraction wells across the Site.

Site Access Description:

- The Site can be accessed from two locations. To the north the Site can be accessed from the end of Felipe Place and from the south the Site can be accessed from Flagman Way. Additional groundwater monitoring wells are located along Shoefly Street, Flagman Way, Acequia Trail, Potencia Street, Railfan Road, and at the New Mexico School for the Deaf (**Figure 2**).

Contaminants of potential concern (COPS) list:

- Petroleum Hydrocarbons
 - Benzene, Toluene, Ethylbenzene, Xylenes (BTEX); 1,2-dibromoethane (EDB), 1,2-dichloroethane (EDC), methyl tertiary-butyl ether (MTBE), methylnaphthalene, 2-methylnaphthalene, naphthalene
- Chlorinated Solvents
 - carbon tetrachloride (carbon tet), 1,1-Dichloroethene (1,1-DCE), methylene chloride, tetrachloroethylene (PCE), trichloroethylene (TCE), and vinyl chloride (VC)
- Nitrate

General Site Hazards:

- On-Site contamination
- Traffic throughout the Site, including a homeless population who frequent the area
- Physical hazards (See Table 4-1)

In the event of an emergency – the muster point is the intersection of Flagman Way and Shoefly Street. The **Emergency Contacts List**, **Site Emergency Response Plan** and **Hospital Route Map** are located in the **Emergency Contacts & Procedures Tab**.

1.1 SITE HISTORY

1950 – 1980: Electric power generating station operational (NMED GWQB, 2000)

1951: Santa Fe Well (Baca St Well) was installed and turned on. The well does not contain an annular seal which was typical for this time (NMED GWQB, 2000).

1952: Approximately 84,000 gallons of fuel oil leaked into the soil from a leaking underground pipe that was connected to one for the ASTs at the power plant. It was reported that all of the fuel was missing from the one of the fuel oil tanks (PNM, 1995). The leak occurred in a portion of the pipeline connecting the fuel oil tank to the 18,000 gallon underground "Day Tank" (PNM, 1995). The leak was repaired but there was no investigation to determine the extent of the environmental damage (NMED GWQB, 2000).

1950s - 1970s: A 1,000 gallon tank was installed at the location UST-A, later this tank was replaced in the same location by a 2,000 gallon tank. Both tanks are believed to have held gasoline. The location noted as UST-B may have held as many as three tanks. From the 1960s to 1970s, one or two 1,000 or 2,000-gallons USTs existed at this location, a 10,000-gallon UST was installed in 1979. The original tanks may have contained diesel at some time (not confirmed) but reportedly contained regular gasoline (Metric, 1995).

1953 – 1985: A service center was operated within the southern portion of the property between 1953 and 1985. Five USTs containing gasoline were located at two different locations within the service center. The volumes of these USTs could not be identified, and no soil contamination was identified down to 30 feet below the tank pits during UST removal in 1989 (NMED GWQB, 2000).

1/15/1987: The 2,000-gallon UST was removed from location UST-A, no evidence for a release was found at the time the tank was removed. The 10,000 gallon UST was removed from location UST-B, no evidence of release was found during UST removal activities (Metric, 1995).

October, 1988: Benzene and ethylene dibromide (EDB) contamination discovered in the Santa Fe Well (NMED, 1994).

December, 1988: The Santa Fe Well was shut down due to the presence of gasoline constituents in the water. SDCW installed a granulated activated carbon (GAC) wellhead treatment system and the well was returned to service in 1989 (Metric, 1995).

1989: Four monitoring wells (USTB-1 through USTB-4) were installed as part of the investigation into petroleum contamination found in the Santa Fe well (Metric, 1995).

October, 1989: Santa Fe Well returned to service with wellhead treatment consisting of GAC.

1989 – 1990: A subsurface soil investigation was conducted, chlorinated solvents, predominantly tetrachloroethene (PCE), were found near the former service center building. PNM voluntarily removed and incinerated 220 cubic yards of contaminated soil. Laboratory analysis of soil samples from the limits of the excavation revealed that contaminant levels were below the EPA's Toxicity Characteristic Leaching Procedure (TCLP) levels (Settlement Agreement, 1992).

1/31/1991: A total of 38 potential off-site contamination sources were identified. Three possible sources have been designated as top priority and were addressed in the off-site investigation (EID, 1991).

1992: Monitoring wells OS-1 through OS-11 were installed.

April, 1992: The Santa Fe Well was shut down again due to gasoline constituents detected in a nearby monitoring well. Monitoring well USTB-5 installed (Metric, 1995).

12/9/1992: Settlement Agreement between PNM and the NMED signed.

1993: Monitoring wells OS-12, PNM-1, PNM-2, CAT-1, USTB-6 through USTB-9, USTB-10 (unknown but most likely drilled in this year), USTB-11, USTB-12 (unknown but most likely drilled in this year), and USTB-13 through USTB-17 were installed as part of the ongoing investigation (Metric, 2003).

April, 1993: First Amendment Signed. Required obligations of PNM and its successors.

April - June, 1994: Monitoring wells OS-13 through OS-20 were installed as part of the ongoing investigation.

May, 1995: NMED sent letter designating PNM as source of contamination.

July, 1995: Second Amendment signed. PNM agreed to continue investigation despite disagreement with the NMED on source of contamination. Corrective Action Fund now available for reimbursement.

1996: The Santa Fe well was started on July 16 but was shut down August 27 due to excess sedimentation and not due to hydrocarbon contamination (PNM, 1998).

April, 1996: Third Amendment signed. Provided payment to NMED by PNM for oversight activities.

October, 1996: Fourth Amendment signed. Provided that PNM would pay \$1.22 million for aquifer testing, groundwater monitoring, and remediation of the Site.

1997: Wells CSF-1, CSF-2U, and CSF-2L were installed (Metric, 2003).

December, 1997: As of the end of 1997, 33 monitoring wells have been completed (PNM, 2002).

October 5, 1998: The Santa Fe Well was returned to service with a wellhead treatment system. The wellhead treatment system consisted of: acid metering to a lower pH, air stripping to remove VOCs; the addition of flocculant, a settling basin, a multimedia sand filter and bag filters to remove suspended and dissolved solids, two GAC units in series for removal of any remaining sorbable organics, and chlorination and fluoridation prior to distribution to the Santa Fe municipal water supply (PNM, 2002).

July, 2001: City of Santa Fe took over operation of SDCW company from PNM.

October 5, 1998 - March 1, 2002: Santa Fe Well wellhead treatment system and the Zone 2 bioremediation nutrient injection system operated continuously through this period. The injection system was shut down on 10/10/01 to assess the effectiveness, and in March 2002 the injection system was reactivated. Zone 2 is the predominant zone of hydrocarbon contaminations. Nutrient and hydrogen peroxide were injected into six on-site monitoring wells (USTB-4, USTB-7, USTB-9, OS-13, OS-15, and PNM-1) to stimulate in-situ degradation of organic constituents. The system injected a mixture of water and hydrogen peroxide at a continual flow rate of 20 gallons per minute (gpm) using the six injection wells. Injections were attempted into USTB-1 but were ceased due to low injection rates (PNM, 2002).

March, 2002: The bioremediation nutrient injection system was turned off and the efficiency was evaluated. In March 2002, the system was reactivated. The date this system ceased operation could not be determined by INTERA.

August 26, 2003: Fifth Amendment to the Settlement Agreement between the NMED And PNM was signed. The amendment included the installation of two new monitoring wells PNM- and PNM-4, and one extraction well for consumption, PNM-5 (PNM, 2002).

November 19, 2012: The Santa Fe Well was shut down when a 50-60 gpm drop in the flow rate began to cause the well to cycle on and off in 30 minute intervals. PNM determined that the reduced flowrate in extraction well PNM-5 was causing excessive amounts of backpressure in the system. Once PNM-5 was shut down, the Santa Fe Well and associated wellhead treatment system were put back into service and operated normally (PNM, 2012).

August, 2013: The Santa Fe Well (including PNM-5) went out of service due to the failure of the systems variable frequency drive (VFD). The VFD controls the operation of the booster pumps which pump treated water into the City's distribution system (PNM, 2015).

2018 & 2019 (ongoing) – INTERA installed seven groundwater monitoring wells on the Site and in the general vicinity of Santa Fe Well – S during the first round of additional site investigation activities and another 19 groundwater monitoring wells as part of the PSTB CAF activities to further characterize the petroleum hydrocarbon plume.

Presently, the Santa Fe well is still not operating.

1.2 TASKS TO BE PERFORMED UNDER THIS SSHASP

The following provides a summary of INTERA's tasks associated with this project. Please refer to other project documents for specific objectives and detailed task information. All tasks performed by INTERA and INTERA subcontractors will be covered by this SSHASP. **Additional tasks can be hand-written into this list as they are added to the project scope.** These tasks include:

- Drilling, well installation, and well development
- Handling investigation derived waste
- Metal detector survey to attempt to find and locate wells not previously located
- Monitoring Well Survey
- Well redevelopment
- Pump removal/install
- Measure fluid levels
- Collect groundwater samples
- Plug and Abandon select wells
- Repair wellheads by adding new surface completions

Hazardous materials likely encountered at the Site include gasoline, diesel fuels, and possibly oils and grease. Specific COPCs identified in groundwater at the Site include: BTEX; EDB, 1EDC, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, MTBE, PCE, TCE, 1,1-DCE, Carbon Tet, methylene chloride, vinyl chloride, and nitrate.

Potential activities likely to involve direct contact with wastes or COPCs include:

- Drilling
- Field screening
- Collecting soil samples
- Installing wells
- Developing wells
- Handling investigation derived waste
- Decontaminating non-disposable sampling equipment
- Collecting water level measurements and ground water samples
- Preparing analytical samples for shipment
- Decontaminating non-disposable sampling equipment
- Collecting soil samples Collecting water level measurements and groundwater samples
- Preparing analytical samples for shipment

2.0 ROLES AND RESPONSIBILITIES

The responsibilities of the INTERA Project Management team are outlined below. All personnel have the authority and responsibility to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request.

Project Manager – Responsible for any changes to the SOW and oversight of all general operations of the project on a day-to-day basis. Project Manager responsibilities include the following:

- Evaluate each new Site activity for hazards and conduct a hazard assessment.
- Assist in preparation of this SSHASP, as necessary.
- Review each revision of this SSHASP or designate a qualified individual to conduct the review, as appropriate.
- Supervise the implementation of the current and approved SSHASP with assistance from the INTERA Corporate Health and Safety Officer (HSO)
- Assign a Site Safety Officer (SSO) for the Site.
- Assign trained personnel to the Site and verify that personnel assigned to the Site are in compliance with respect to OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and annual 8-hour refresher training in accordance with OSHA regulation 29 Code of Federal Regulations (CFR) 1910.120 for general site workers.
- Verify that personnel assigned to the Site are in compliance with regard to the necessary Medical Surveillance.
- Verify that personnel assigned to the Site are in compliance with regard to necessary respirator training, fit-testing requirements, and medical monitoring, as appropriate for job requirements.
- Determine that the project is performed in a manner consistent with this SSHASP.
- Determine compliance with this SSHASP by INTERA and contractor personnel, as appropriate.
- Report safety-related incidents or accidents to the INTERA Corporate HSO.

SSO – Responsible for Site health and safety and work operations. The SSO is responsible for reporting all safety and health concerns to the Project Manager and the INTERA Corporate HSO. SSO responsibilities include the following:

- Assist the Project Manager and INTERA Corporate HSO in implementing this SSHASP.
- Assist the Project Manager in conducting hazard assessments.
- Direct health and safety activities on Site, including the implementation and maintenance of a Site-specific Hazard Communication (HazCom) Program.
- Monitor compliance with the current and approved SSHASP.
- Assist the Project Manager in assessing and providing proper personal protection equipment (PPE) and other health and safety equipment for the project.
- Maintain health and safety equipment on-site, as specified in this SSHASP.
- Assist the Project Manager and INTERA Corporate HSO in implementing this SSHASP.
- Inform Site visitors as to on-site procedures, conditions, and hazards before allowing visitors to enter the Site.
- Report safety-related incidents or accidents to the Project Manager and the HSO.

- Implement emergency action and evacuation procedures, as necessary, in response to Site conditions and events.
- Direct personnel to change work practices if they are deemed to be hazardous to the health and safety of personnel.
- Make PPE exceptions for Site personnel based on Site-specific information such as air monitoring data, visual observations, and weather data/observations.
- Suspend work or otherwise limit exposure to personnel if the SSHASP appears to be unsuitable or inadequate.
- Remove personnel from the project if their actions or condition endangers their health and safety or the health and safety of co-workers.

INTERA Corporate HSO – Responsible for implementing, maintaining, and evaluating the INTERA Corporate Health and Safety Program. Responsibilities include serving as the program administrator for the Respiratory Protection Program, assisting Project Managers in assessing hazardous sites, supporting the development and evaluation of SSHASPs and associated programs and plans, and assisting employees in obtaining and maintaining training necessary to perform their tasks.

3.0 COMPREHENSIVE PLAN FOR SITE SAFETY

INTERA considers the prevention of illness, injury, and accidents in the workplace to have greater importance than any other facet of the work. Safety shall always take precedence over expediency or shortcuts, and every attempt shall be made to reduce the possibility of injury, illness, or accident occurrence. All Site activities shall be conducted in accordance with the established safety regulations of the Occupational Safety and Health Administration (OSHA), and other applicable Federal, State, County, and City regulations. The requirements and actions summarized in the following sections will be completed by INTERA and INTERA subcontracted personnel (as necessary). Personnel must sign the Site Personnel Acknowledgment Form included as **Form 1** indicating that they have read and understood this SSHASP. This SSHASP does not cover any activities that the client, or personnel subcontracted to the client, may perform at the Site without INTERA involvement.

INTERA subcontractors are responsible for having their own Health and Safety Plan, which must be at least as stringent as INTERA's SSHASP, and are responsible for complying with all applicable OSHA regulations. Subcontractors may be requested to provide their Health and Safety Plan to the Project Manager for review prior to commencement of work at the Site. Subcontractors will be monitored for compliance with all INTERA SSHASP requirements as well as all applicable OSHA regulations.

The training and medical surveillance requirements described in the following sections apply to all INTERA employees and INTERA subcontractor employees.

3.1 HEALTH AND SAFETY TRAINING REQUIREMENTS

Site personnel must have completed the 40-hour OSHA 1910.120 HAZWOPER training and must be up to date on their 8-hour HAZWOPER refresher training. This training includes general training for hazard recognition, use of Site monitoring instruments, and use of PPE. Equivalent training may be acceptable, but must be approved by the Project Manager. Site personnel are also required to have completed a minimum of three days of actual field work under the direct supervision of a trained, experienced supervisor before they will be allowed to engage in hazardous substance removal or other activities that have the potential to expose workers to hazardous substances and health hazards.

On-site project managers and Site supervisors will have completed at least eight additional hours of specialized training at the time of job assignment on such topics as, but not limited to, the employer's safety and health program and the associated employee training program, PPE program, spill containment program, and health hazard monitoring procedure and techniques.

Site personnel should have up-to-date training in first aid, blood-borne pathogens, and cardiopulmonary resuscitation (CPR).

Emergency response by Site personnel is limited to system maintenance needs. Medical or fire emergencies will be handled by trained Emergency Medical Personnel. Personnel who will respond to system maintenance emergencies shall be properly trained in the operation of the system they are responding about.

Personnel will not be allowed to work or supervise work at the Site until they have received all project training necessary for the level of their job responsibilities. Complete copies of certification documents recording that all Site personnel have had the necessary training will be kept by the Project Manager. Copies of these documents will be provided to the Client upon request.

3.2 MEDICAL SURVEILLANCE

All Site personnel who may need to wear a respirator or who may be exposed to hazardous substances above published exposure levels for 30 days or more a year are required to participate in their employer-sponsored medical surveillance program (this includes subcontractors). All INTERA field personnel are given the option of participating in the medical surveillance program even if they do not fall under the previous requirements, at no cost to themselves.

Employees participating in the medical surveillance program will receive a medical examination by a physician at least once every 12 months. This examination must certify that the employee is fit to work around hazardous substances and is fit to use appropriate respiratory protection equipment required to perform job responsibilities.

3.3 ACCIDENT/INCIDENT PREVENTION PROGRAM

Accidents can be prevented, and INTERA values employee involvement to provide a safe and healthy working environment for our employees, subcontractors, and clients, and to protect the public and preserve Site assets and property.

3.3.1 TAILGATE SAFETY MEETINGS

All Site personnel (INTERA personnel, subcontractors, and Site visitors) are required to participate in Tailgate Safety Meetings prior to starting work each day and at the beginning of each new task. The purpose of Tailgate Safety Meetings is to review the health and safety concerns at the Site. Topics to be presented include PPE, chemical and physical hazards, mobile phone availability, emergency procedures, hospital route, special equipment used on-site for that day (if any), and other topics as necessary. Personnel will sign a Safety Meeting Attendance Form (**Form 2**) at the conclusion of the health and safety meeting.

3.3.2 HAZARD RECOGNITION AND REPORTING

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Every employee has the right and responsibility to communicate their health and safety concerns to management and to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace.

Each time a new task is started at the Site, a Job Safety Analysis (JSA) will be completed prior to commencement of the task. A new JSA will not need to be created each time the task is to be repeated (i.e.: a JSA for ground water sampling will be filled out prior to the first sampling event, and field personnel will review the JSA at the beginning of each subsequent sampling event, but will not need to recreate the JSA).

The Job Safety Analysis Program can be seen in **Attachment A** and completed JSAs, as well as blank forms can be found under **Form 3**.

3.3.3 BEHAVIOR BASED SAFETY PROGRAM

The Behavior-Based Safety (BBS) Program is a safety audit process that helps personnel identify and choose a safe behavior over an unsafe one. This process is designed to open the communication lines between personnel to reinforce safe behaviors and correct unsafe behaviors in order to eliminate incidents, including accidents and illnesses. BBS Audits can be performed

by any field personnel who are observing other field personnel (i.e.: if there is a team of two personnel doing ground water sampling, one person may do an audit by watching the other person perform the sampling). Safety in the workplace is based on the following components:

- A specific person's physical capabilities, experience, and training.
- The environment the specific person works in, including engineering controls, equipment available for the task, and the job task itself.
- The specific person's behavior while performing the task.

The BBS Program is based on behavioral observations by someone not involved in the task, a review of the observations (both safe and unsafe behaviors), positive reinforcement on the safe behaviors, non-threatening feedback on the unsafe behaviors, and improvement goals. These observations provide direct, measurable information on safe work practices.

Specific instructions on how to perform a BBS Encounter can be found in **Attachment B** and the BBS Encounter Forms are available as **Form 4**. Completed BBS Encounter Forms will be kept in this SSHASP and reviewed occasionally by the INTERA Corporate HSO to ensure that safe behaviors are being continued. A BBS Encounter should be performed for each task a minimum of once a year. Complicated tasks or tasks performed on a regular basis should have more frequent BBS Encounters.

3.3.4 INCIDENT INVESTIGATION

All incidents (injuries, illnesses, fatalities, and near-misses) must be reported to the Project Manager, the INTERA Corporate HSO IMMEDIATELY. Incidents must be documented by the employee(s) who witnessed the event (and with the Project Manager's involvement) on the INTERA Incident Investigation Report Form. The INTERA Incident Investigation Report Form is included as **Form 5**. *The completed form must be submitted to the INTERA Corporate HSO as follows:*

- IMMEDIATELY for a fatality (Must also be reported to OSHA *IMMEDIATELY*, and no longer than 8 hours after the incident).
- BY THE END OF THE WORK SHIFT for an injury.
- WITHIN 24 HOURS for a near-miss.

The INTERA Corporate HSO will perform an investigation following any personal injury accidents, equipment or property damage accidents, and near-misses in order to properly ascertain the cause of the incident and to prevent future incidents.

3.4 SITE CONTROL

Visits to project sites by persons not directly involved in tasks identified in the project work plan are discouraged. Persons designated as "Site visitors" will sign in on a Site Visitor Log (included as **Form 6**) and will be briefed by the SSO as to Site procedures, conditions, and hazards before entering the Site. Site visitors shall provide their own PPE as required for the area that they are visiting and shall be expected to follow applicable procedures and protocols. Site visitors will be asked to remain in the Clean Zone (if applicable) unless accompanied by INTERA personnel.

3.5 TRANSPORTATION OF SITE MATERIALS

Potential Site materials generated during implementation of the activities described herein shall be managed by field personnel accordingly. Transportation of Site materials off-site other than anticipated contact waste and collected ground water samples is not anticipated. Personnel shall

not transport any contaminated Site materials or product from the Site in company vehicles or rental vehicles. Contaminated materials and/or product shall be disposed of properly via a subcontractor using the proper chain of custody applicable by regulations for disposal of hazardous or non-hazardous waste. For any potentially hazardous media, field personnel shall comply with DOT requirements which may require alternate arrangements for transporting these types of media, as required.

In the event that free product (e.g. LNAPL) is encountered during monitoring at the Site and removal is required, product shall be skimmed, bailed, or pumped into drums for temporary storage. Care shall be taken during pumping that the product is not spilled or an overflow does not occur. Personnel shall don the proper PPE during the handling and containerizing of free product. Dermal protection including gloves, long sleeve shirts, and pants (or coveralls/tyvek) shall be worn during product pumping activities for added personnel protection. Breathing exposure levels shall be recorded using the photoionization detector (PID) meter during the product draw-down test to monitor personnel exposures (**Section 5.4**). Level C PPE shall be donned if necessary (**Section 5.1**). The drums shall be labeled according to their contents and stored temporarily in a safe manner.

To prevent risks to the health and safety of laboratory personnel, laboratory directors or contacts shall be informed of any contaminant levels in collected samples that would require special handling procedures upon transfer of sample custody.

Site litter may also be transported offsite by INTERA as part of good housekeeping procedures.

4.0 SITE HAZARDS

4.1 PHYSICAL HAZARDS

There are numerous physical hazards at any site. All personnel have the authority and responsibility to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. All field personnel shall follow the **Site Emergency Response Plan** included in the **Emergency Contacts & Procedures Tab**, and shall report any new hazards to the SSO and the INTERA Corporate HSO so steps can be taken to mitigate the hazard.

A list of potential physical health and safety hazards associated with the activities at the Site are provided in **Table 4-1**. This list is not all-inclusive; additional physical hazards may be listed on task-specific JSAs found in **Attachment A**.

Table 4-1: Potential Physical Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Heat or cold stress	<ul style="list-style-type: none"> Adverse weather conditions can occur any time of the year PPE such as respirators, gloves, and protective clothing can exacerbate heat stress 	<ul style="list-style-type: none"> Drink plenty of fluids and be aware of potential heat stress conditions. Notify supervisor of any adverse physical conditions before and during the task. See Attachment C for more information on the Heat and Cold Stress Casualty Prevention Plan.
Slip, trip, and fall hazards	<ul style="list-style-type: none"> Construction zone conditions, debris, and wet ground 	<ul style="list-style-type: none"> Be aware of surroundings while working and don't leave equipment on the ground in work areas.
Straining and pinching hazards	<ul style="list-style-type: none"> Working around machinery and equipment (including drill rigs) Rushing too quickly to finish a task Using an improper tool to complete the job 	<ul style="list-style-type: none"> Ensure that you have the proper training and tools to perform the job. Be aware of your surroundings, and know the hazards of the machinery or equipment you are using. See Attachment D for Health and Safety Requirements for Drilling Operations. See Attachment E for Health and Safety Requirements for Heavy and Light Equipment. Slow down and take the time to do the job right. Use the vehicle inspection checklist (Form 7) to ensure that vehicles are in proper working order.

Table 4-1: Potential Physical Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Automobile and pedestrian accidents	<ul style="list-style-type: none"> Traveling on paved roads to get to the Site Traveling on dirt roads to get to a work location Working around heavy equipment Gauging and sampling wells near the highway/roadways 	<ul style="list-style-type: none"> Be aware of your surroundings and designate standing and working areas that are away from driving areas. See Attachment E for Health and Safety Requirements for Heavy and Light Equipment. Use the vehicle inspection checklist (Form 7) to ensure that vehicles are in proper working order. Have two INTERA personnel individuals working, with one staff member dedicated to watching vicinity traffic. Use traffic cones in areas subject to traffic If necessary, park the work vehicle in a fashion that will block on-coming traffic (if working in a lane) with hazard lights on and place traffic cones in front of the vehicle
Head injuries	<ul style="list-style-type: none"> Overhead hazards Heavy equipment 	<ul style="list-style-type: none"> Wear a hard hat when working around overhead hazards. Be aware of overhead hazards at all times.
Falling from heights	<ul style="list-style-type: none"> Working at heights 	<ul style="list-style-type: none"> All personnel will be harnessed and anchored when working at heights above 6 feet, or where there is a danger of falling.
Electric shock	<ul style="list-style-type: none"> Heavy equipment, including drill rig malfunction or incorrect use Remediation system equipment malfunction or incorrect use Buildup of static electricity Drilling near overhead or buried electric lines while still energized 	<ul style="list-style-type: none"> Inspect equipment prior to use. Follow correct procedures for discharging energy prior to repair or maintenance as described in the Lock Out/Tag Out Program in Section 5.8. Consider all electric lines to be energized unless the power company is on-site to verify shutoff with lockout/tagout procedures. Drilling or raising the mast within 20 feet of overhead power lines is not allowed. See Attachment D for Health and Safety Requirements for Drilling Operations.
Fire	<ul style="list-style-type: none"> Steel cutting, brazing, welding, and other activities that generate heat, sparks, or open flames 	<ul style="list-style-type: none"> Performing these tasks in windy conditions or near ignitable materials is discouraged. A Hot Work Permit (Form 8) shall be requested from INTERA prior to performing these tasks, and the established procedures described in Section 5.9 shall be followed.

Table 4-1: Potential Physical Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Whipping Hoses and fluid burns	<ul style="list-style-type: none"> Release of pressurized hydraulic or pneumatic lines 	<ul style="list-style-type: none"> Inspect hoses regularly for exposed reinforcement wires, leaks, damaged or corroded fittings, excessive dirt or grease buildup, and missing guards, shields, and clamps.
Noise hazards	<ul style="list-style-type: none"> Operation of heavy equipment (including drill rigs) Traffic Operation of remediation equipment (blowers, pumps, compressors, etc.) 	<ul style="list-style-type: none"> Wear appropriate hearing protection for the job. Hearing protection must be worn when the 8-hour time-weighted average noise level reaches or exceeds 85 decibels. In general, if you have to raise your voice for someone to hear you at arm's length, you should be wearing hearing protection.
Lightning strikes	<ul style="list-style-type: none"> Working during thunderstorms 	<ul style="list-style-type: none"> If lightning is heard, the "15-15" rule should be employed – if the time between the lightning and thunder is 15 seconds or less, work should be stopped and shelter should be found. Work should not resume until 15 minutes or more has passed from hearing the last thunder. If the lightning cannot be seen but thunder is heard, then it is likely that lightning is within striking range. The nearest acceptable shelter is usually inside a vehicle. If moving to a vehicle is not immediately practical, the "lightning crouch" should be employed. This involves squatting on the ground with feet together and head tucked while covering one's ears.

4.2 CHEMICAL HAZARDS

Personnel and Site visitors may be exposed to chemical hazards through four routes of exposure: inhalation, ingestion, skin contact, and eye contact. Ingestion of chemical hazards shall be controlled by prohibiting eating, drinking, or smoking in the immediate vicinity of the work area and any known hazardous chemicals, and by requiring all field personnel to wash hands (and face, if necessary) before eating, drinking, or smoking.

Skin and eye contact with chemical hazards can cause serious burns, rashes, or irritations. All field personnel shall follow the **Site Emergency Response Plan** included in the **Emergency Contacts & Procedures Tab**, and shall report any skin or eye contact symptoms to the SSO and the INTERA Corporate HSO so steps can be taken to eliminate similar exposures.

The best assurance of protection against hazardous chemicals is avoidance. Whenever possible, Site personnel shall avoid direct contact with contaminated (or potentially contaminated) surfaces. Workers shall not kneel or place equipment on potentially contaminated ground. If contact is unavoidable in order to perform a required task, potential hazards are minimized by using appropriate PPE to protect against exposure to toxic materials.

A list of potential chemical hazards associated with the activities at this Site is provided in **Table 4-2**. This list is not all-inclusive; additional chemical hazards may be listed on task-specific JSAs found in **Attachment A**. Chemicals that are brought on Site by INTERA or INTERA subcontractors are part of the HazCom Program and will be listed on the Hazardous Chemicals List in **Attachment F**. Information on chemicals expected to be encountered at the Site can be found on the provided safety data sheets (SDSs) (**Attachment F**).

Table 4-2: Potential Chemical Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Contaminated soils	<ul style="list-style-type: none"> Potential known or unknown contaminated soils within the work area Dusty working conditions 	<ul style="list-style-type: none"> Wear appropriate PPE (nitrile gloves, dust mask, etc.). Limit exposure to known contaminated areas. Discontinue work if extremely dusty conditions persist. Be aware of unusual odors and ground color while excavating. Wash hands before eating, drinking, or applying cosmetics/sunscreen.
Chemical burns	<ul style="list-style-type: none"> Spills or other contact with preservatives in ground water sampling bottles 	<ul style="list-style-type: none"> Wear appropriate PPE (nitrile gloves, eye protection). Avoid skin contact with preservatives. Wash hands before eating, drinking, or applying cosmetics/sunscreen. Avoid tipping over preservative bottles before they are filled with sample water.

Table 4-2: Potential Chemical Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Exposure to heavy metals or other contaminants in ground water	<ul style="list-style-type: none"> • Ingestion or skin contact with ground water 	<ul style="list-style-type: none"> • Wear appropriate PPE (nitrile gloves, eye protection). • Avoid skin contact with ground water. • Wash hands before eating, drinking, or applying cosmetics/sunscreen. • Avoid spilling filled sample bottles. • Be aware of purge water location.
Chemical release	<ul style="list-style-type: none"> • Spills that occur during fueling or when lubricating equipment and vehicles • Spills from equipment malfunction 	<ul style="list-style-type: none"> • Fuel or lubricate equipment in a designated area with appropriate spill preventions in place. • Be prepared to clean up all contamination resulting from accidental spills.
Fuel Oils, Gasoline, and other Volatile Organic Compounds	<ul style="list-style-type: none"> • Contaminated water or soil within the work area. • Spills that occur during fueling or when lubricating equipment and vehicles • Spills from equipment malfunction 	<ul style="list-style-type: none"> • Wear appropriate PPE (nitrile gloves). • Limit exposure to known contaminated areas. • Fuel or lubricate equipment in a designated area with appropriate spill preventions in place. • Be prepared to clean up all contamination resulting from accidental spills. • Be aware of unusual odors and ground color while excavating. • Wash hands before eating, drinking, or applying cosmetics/sunscreen.

Fuel oils are generally low in toxicity, have low volatility, and are not readily absorbed through the skin; however, they may cause skin irritation, or "dermatitis", upon contact. Waste oils may contain certain cancer causing components such as heavy metals and oil derivatives which can be absorbed through the skin.

Gasoline is considered more toxic than oils; it has relatively high volatility, and certain components are readily absorbed through the skin. Gasoline contains certain components, such as benzene, which are classified as potential carcinogens.

VOCs represent the primary COPCs at the Site; therefore, caution should be taken to limit potential exposure to VOCs via inhalation as a result of volatilizing from contaminated ground water. The symptoms of inhalation over-exposure to petroleum products include dizziness, loss of coordination, general malaise, headaches, and nausea. If any of these symptoms occur, the project manager and the nearest hospital should be contacted. The dangers associated with over-exposure to petroleum products should be acknowledged and taken seriously.

4.3 BIOLOGICAL HAZARDS

Numerous types of pests and organisms may be present at the Site. A list of potential biological health and safety hazards associated with the activities at the Site is provided in **Table 4-3**. This

list is not all-inclusive; additional biological hazards may be listed on task-specific JSAs found in **Attachment A**.

Table 4-3: Potential Biological Hazards		
Potential Hazard	Source of Potential Hazard	Hazard Mitigation Control
Poisoning or allergic reaction	<ul style="list-style-type: none"> Stinging or biting insects (bees, wasps, spiders) Venomous snakes 	<ul style="list-style-type: none"> Avoid exposing hands or other body parts to cool, dark areas where these pests are known to dwell. Use caution opening well vaults and other cool, dark enclosures. Do not intentionally approach snakes or insects except to move them away from the working area, if this can be done safely.
Bite lacerations	<ul style="list-style-type: none"> Feral or domestic animals and livestock Rodents Reptiles 	<ul style="list-style-type: none"> Avoid exposing hands or other body parts to cool, dark areas where these pests are known to dwell. Use caution when walking in rocky terrain where reptiles could be hiding. Avoid contact with feral or domestic animals and livestock. Contact authorities if an unrestrained animal is exhibiting aggressive behavior toward Site personnel.
Exposure to Hanta Virus or Plague	<ul style="list-style-type: none"> Contact with rodents or rodent excrement Agitating dried rodent urine or droppings greatly increases the potential for exposure 	<ul style="list-style-type: none"> Areas with visible evidence of rodent activity and excrement should be avoided. If avoidance is not possible, it is important to NOT stir up dust by sweeping or vacuuming up droppings, urine, or nesting materials. While wearing a dust mask and latex or nitrile gloves, spray with a mixture of 1 part bleach to 10 parts water. Use paper towels to collect the excrement, and place in a trash bag.
Exposure to unknown biological pathogens	<ul style="list-style-type: none"> Blood-borne pathogen exposure from an injury 	<ul style="list-style-type: none"> If contact is unavoidable in order to perform a required task, potential hazards are minimized by using appropriate PPE to protect against exposure. All Site personnel will be up to date on first aid and blood-borne pathogen training.

5.0 SITE HEALTH & SAFETY PROCEDURES

Personnel who are new to the Site should have reviewed this SSHASP prior to arrival at the Site. Upon arrival at the Site, the SSO or other supervisory personnel should lead a general Site orientation. The following topics should be covered during this orientation:

- Discussion of the Site's history and any identified COPCs
- Discussion and identification of Site work zones and control measures (exclusion zone, contamination reduction zone, clean zone, PPE, and location of emergency equipment).
- Identification of "shut-off" switches located on any equipment to be used and familiarization with their use.
- Discussion of the location and use of the nearest phone(s).
- Review of emergency procedures and the location of the nearest hospital. The **Hospital Route Map** is included in the **Emergency Contacts & Procedures Tab**.
- Personnel must sign the Site Personnel Acknowledgment Form included as **Form 1** indicating that they have read and understood this SSHASP.

General good housekeeping practices to be followed at the Site are as follows:

- If necessary, ONE CALL Notification should be completed prior to beginning Site work. Location of power, gas, phone, and cable lines will be verified with the individual utility departments.
- A Tailgate Safety Meeting: Conducted prior to the start of work each day and at the beginning of each new task. All personnel (INTERA and any associated subcontractors) will attend this health and safety meeting to review the safety concerns at the Site. Topics to be presented include PPE, chemical and physical hazards, mobile phone availability, emergency procedures, hospital route, special equipment used on Site for that day (if any), and other topics as necessary. Personnel will sign a Safety Meeting Attendance Form (**Form 2**) at the conclusion of each daily meeting.
- Proper PPE shall be selected for the work to be performed (see **Section 5.1**).
- Bottled water or a water source shall always be available on-site for use as an eye wash and for use when administering first aid. Personnel are responsible for bringing drinking water to the Site to prevent dehydration (wash hands and/or face before drinking).
- A first aid kit will be in the field vehicle for use during work activities, and any injuries shall be reported to the SSO, Project Manager, and INTERA Corporate HSO IMMEDIATELY.
- A telephone (cell phone is acceptable) for emergency situations must be easily accessible and in working order when performing any type of fieldwork. All Site workers shall be made aware of the location of a telephone each day before work activities begin. If cell phone service at the Site is limited, workers must be aware of the nearest location where cell service is known to work.

5.1 SAFETY EQUIPMENT

To provide a better understanding about how to properly protect the head, eyes, skin, feet, and respiratory system, this subsection discusses general safety equipment and PPE. The SSO has the authority to make PPE exceptions for Site personnel if he/she deems it in the best interest of the field personnel's wellbeing. Such a PPE exception (i.e., modification to the guidance laid out in this SSHASP) shall be based on Site-specific information such as air monitoring data, visual observations, and weather data/observations. An example of such a modification to the SSHASP

is a decrease in the use of respirators, hard hats, or poorly breathable clothing if heat stress is a primary concern during Site activities and the use of the PPE was intended for a low-risk precaution. The SSO shall not make a PPE exception/modification if personnel shall be without the protection needed to be safe or to properly protect their health. If it appears that proposed and readily available PPE is inadequate, Site work shall be suspended until new PPE or planning allows personnel to work safely.

5.1.1 OSHA PPE PROTECTION LEVELS

OSHA divides PPE used to protect the body against contact with known or anticipated chemical hazards into four categories (i.e., Levels A, B, C, and D) according to the degree of protection afforded. The levels of protection that may be used at the Site are as follows, and the PPE used with each level is shown in **Table 5-1** below.

- Level C – The concentration(s) and type(s) of airborne substance(s) is known and criteria for using air purifying respirators are met.
 - The types of air contaminants have been identified, concentrations have been measured, and an air-purifying respirator is available that can remove the contaminants.
 - All criteria for the use of air-purifying respirators have been met.
 - Vapors and gases are known to not contain high levels of chemicals harmful to skin or are not capable of being absorbed through the skin, but skin contact with liquid chemicals is hazardous.
- Level D – A work uniform affording minimal protection; used for nuisance contamination only.
 - The atmosphere contains no known hazard.
 - Work functions preclude splashes, immersion, or the potential for unexpected inhalation of, or contact with, hazardous levels of any chemicals

Table 5-1: PPE Required for OSHA Protection Levels		
Protection Level	Required PPE	PPE Modifications (as needed)
Level C	Full-face or half-mask air purifying respirators Hooded chemical-resistant clothing Chemical-resistant outer gloves Chemical-resistant inner gloves	Coveralls or appropriate work clothes (under chemical resistant clothing) Chemical-resistant steel-toe boots Chemical-resistant boot covers Hard hat Escape mask Face shield
Level D	Coveralls or appropriate work clothes Chemical-resistant steel-toe boots	Chemical resistant gloves Chemical-resistant boot covers Safety glasses or splash goggles Hard hat Escape mask Face shield

5.1.2 PPE LEVELS APPROVED FOR THE SITE

The levels of protection that may be applicable to the anticipated activities specified in this SSHASP are:

- Level D,
- Modified Level D, and in certain cases,
- Level C

Level D: This level of PPE will be required during basic Site maintenance activities. This includes steel-toe boots, long pants, long-sleeve shirts (short-sleeve shirts will be allowed in hot weather and as activities permit), and safety glasses. High-visibility safety vests and hard hats will be required when working near roadways or while heavy equipment (including drill rigs) is operational. Hearing protection is required when working around heavy equipment or any other time high noise levels are anticipated.

Modified Level D: This level of PPE will be required during groundwater sampling or any time direct contact with soil, groundwater or a waste stream is expected. This level includes all the requirements of Level D, with the addition of chemical-resistant gloves and chemical splash goggles (if necessary).

Modified Level C: *It is recommended that all Site personnel be prepared for this contingency level of protection.* This level of PPE will be required when personnel will be working in conditions where concentrations of contaminants in air have the potential to be above the action levels shown in the Respiratory Protection Section of this SSHASP (**Section 5.4.1**), and oxygen levels are measured to be above 19.5%. This level includes all the requirements of Level D, with a full-face respirator and the proper cartridges, as determined by the situation. To fulfill this requirement, medical surveillance and respirator training shall have been completed by personnel before work commences. Each employee shall have his/her own respirator fit-tested to ensure proper fit. Proof of respirator training and fit testing should be submitted to the Project Manager before work commences. A copy of the INTERA respirator selection and maintenance procedures are included in **Attachment G**.

NOTE: In the event that Site conditions require the use of Level A or Level B PPE, the Corporate HSO will be notified immediately to verify that proper training and procedures are in place prior to conduct of fieldwork. Revisions to this SSHASP will also be necessary.

Personnel are NOT authorized to work in immediately dangerous to life or health (IDLH) conditions.

5.1.3 GENERAL PPE REQUIREMENTS

Any PPE provided must meet NIOSH or American National Standards Institute (ANSI) specifications.

- **General Work Clothing:** Clothing must be close fitting and comfortable, but without loose ends, straps, drawstrings, or belts, or otherwise unfastened parts that might catch on rotating or moving components of equipment. Long pants and long-sleeve shirts (short-sleeve shirts will be allowed in hot weather and as activities permit) are required at all times.
- **Chemical Protective Clothing:** In the event that free product is encountered, Tyvek shall be worn over general work clothing if deemed necessary by the SSO.

- **Safety Headgear:** Head protection shall be nonconductive to prevent limited electrical shock and shall meet the requirements of ANSI Standard Z89.1. Required when working near roadways, while heavy equipment (including drill rigs) is operational, or where an overhead hazard is present.
- **Safety-toe Boots:** Foot protection shall meet the requirements of ANSI Standard Z41.1, Class 75 (steel-toe boots, steel shank, chemical resistant, 6- to 8-inch tops, etc.). Required by all Site personnel and visitors at all times.
- **High Visibility Safety Vests:** Must be fluorescent orange, yellow, or green with high-visibility reflective tape. Required when working near roadways or while heavy equipment (including drill rigs) is operational.
- **Safety Glasses:** All eye protection shall meet ANSI Z87.1 standards. Prescription glasses shall be an approved safety type or safety glasses that fit over the prescription glasses must be used. Eye protection should be worn at all times, and splash goggles should be worn when splashes present a significant hazard to eyes.
- **Gloves:** Specific gloves should be selected based on the activities being performed. Puncture resistant (i.e., leather) gloves shall be worn for protection against cuts and abrasions that could occur while handling tools or other sharp objects. Chemical-resistant gloves shall be worn during activities that could result in contact with hazardous chemicals, ground water, or other contamination. Care should be taken to select the proper glove type based on the chemicals to be handled (i.e., nitrile gloves for ground water sampling, or butyl gloves for sulfuric acid handling).
- **Hearing Protection:** Ear plugs will be available to site personnel if necessary. Hearing protection is required when working around heavy equipment, or any other time high noise levels are anticipated.
- **Fall Protection:** Full body harnesses with shock absorbing lanyards will be required when working above 6 feet, or when there is a danger of falling (this also applies to the use of ladders).

5.2 WORK ZONES

To minimize the movement of contaminants from work sites to uncontaminated areas, three work zone areas will be established as-needed at work areas where contact with contamination or hazardous chemicals occurs. The work zone areas may be revised as contaminant data is collected at the Site. The three work zones include the following:

- Zone 1: Exclusion Zone
- Zone 2: Contamination Reduction Zone
- Zone 3: Clean Zone

Exclusion Zone: The Exclusion Zone is the zone where contamination does or could occur. Persons entering this zone shall wear the level of protection deemed necessary in the Safety Equipment Section (**Section 5.1**). Smoking, eating, and drinking are not allowed in this zone.

Contamination Reduction Zone: Between the Exclusion Zone and the Clean Zone is the personal Contamination Reduction Zone, which provides a transition zone between the contaminated and clean areas of the Site. This zone shall be located directly outside the Exclusion Zone. Personnel shall decontaminate in the Contamination Reduction Zone when leaving the Exclusion Zone. Decontamination procedures shall be followed as shown in **Section 5.3**. Smoking, eating, and drinking are not allowed in this zone.

Clean Zone: The Clean Zone shall be an uncontaminated area from which operations shall be directed. It is essential that contamination from the work area be kept out of this area.

At excavations and drilling sites where contamination is anticipated, the boundaries of the Exclusion Zone will be defined with flagging and caution tape. The Contamination Reduction Zone at excavations will be defined with marking paint and/or stakes and will extend 50 feet (or as far as deemed necessary by the SSO) from the boundary of the Exclusion Zone.

During ground water sampling activities at well vaults with contamination, the Exclusion Zone will be defined by the bollards surrounding each vault (if applicable). If no bollards are present, cones will be placed to define the boundaries of the Exclusion Zone. The Contamination Reduction Zone will extend 10 feet (or as far as deemed necessary by the SSO) from the Exclusion Zone boundary and will be marked with cones or stakes.

5.3 DECONTAMINATION PROCEDURES

- Remove gross contamination from tools, respirator (if used), monitoring equipment, etc., prior to leaving the Site using either de-ionized water or an Alconox/water solution.
- Either completely decontaminate soiled equipment at the work site using detergent and water (if possible) or wrap equipment in a plastic bag for transport until complete decontamination is possible. Decontamination of excavation equipment is not necessary unless municipal waste and/or stained soil with odor is encountered during digging or drilling.
- Dispose of contaminated gloves, Tyvek suits, used respirator cartridges, paper towels, etc., by placing in a plastic bag and discarding in a designated waste container for the Site (non-hazardous waste).
- Wash hands (and face, if necessary) thoroughly with soap and water before lunch or coffee breaks and after finishing work for the day.

5.4 AIR QUALITY MONITORING

Air monitoring will be conducted, as necessary, for oxygen content, combustible vapors, and toxic vapors during any field investigation work. As applicable, monitoring shall be conducted using a Combustible Gas Indicator (CGI) for LFG, a PID for organic vapors, and meters measuring specific toxic vapors (such as hydrogen sulfide) for Site investigation or remediation tasks. The PID and CGI meters shall be used to establish background levels at the Site prior to initiation of activities. Readings shall be used in conjunction with information about known or suspected contaminants at the Site to determine the level of protection required. Readings above background shall be recorded on an air monitoring log and/or in the field log book.

For the activities described herein, only monitoring for organic vapors is anticipated to be required. A PID, equipped with a 10.6 electron volt (eV) lamp, is considered sufficient to provide a response to the COPCs identified for this Site. The 10.6 eV lamp responds to carbon aliphatic compounds greater than C₄ (methane) including all olefins and all aromatics, and responds to inorganic compounds such as hydrogen sulfide, ammonia, bromine, and iodine, i.e., any compound with an ionization potential of less than 10.6 eV. Specifically, the PID will be used to detect for the presence of non-methane organic compounds in the breathing zone. A PID equipped with a 10.6 eV lamp should provide the sensitivity necessary to identify the typical LFG constituents (other than methane). Even though the PID can identify hydrogen sulfide, it cannot distinguish it from other compounds of similar ionization potential.

PID measurements above background will be recorded in the field logbook or logged by the meter. Alarm set points will be set for audible response.

5.4.1 AIR QUALITY ACTION LEVELS

For this Site, air-quality and field personnel exposure to organic vapors shall be monitored using both the PID and/or olfactory/visual cues.

In general, for a Site with potential exposure to organic vapors the following action levels are applicable:

1. PID breathing zone readings
 - 0 to 10 parts per million (ppm) – remain in LEVEL D or MODIFIED LEVEL D, continue air monitoring.
 - 10 to 25 ppm – Remove unnecessary personnel, establish work zones as described in **Section 5.2**, continue air monitoring.
 - Greater than 25 ppm and less than 75 ppm — Discontinue work and NOTIFY PROJECT MANAGER of readings between 25 ppm and 75 ppm. Personnel working in exposure areas must be prepared in LEVEL C PPE (half-face respirators are acceptable at this action level) with organic vapor cartridges.
 - At levels consistently above 75 ppm in the breathing zone, discontinue work and wait for notification to either proceed or evacuate site. The PROJECT MANAGER SHALL NOTIFY THE CORPORATE HSO of readings higher than 75 ppm. Personnel working in exposure areas must be prepared in LEVEL C PPE (full-face respirators are required at this action level) with organic vapor cartridges.
2. Detection through senses – If soils contaminated with oil and/or gasoline are detected with visual or olfactory senses by an employee, personnel shall move upwind of the odor and inform the Site Project Manager of the location of the odor.

The following table (**Table 5-2**) presents specific COPCs that may be present at the Site and their associated exposure limits. The OSHA Permissible Exposure Limit (PEL) are regulatory limits on the amount or concentration of a substance in the air at which workers will be protected against the health effects of exposure to hazardous substances. OSHA PELs are based on an 8-hour time weighted average (TWA) exposure. The IDLH level is an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere (29 CFR* 1910.120).

Table 5-2: COPC Exposure Limits and Overexposure Effects				
COPC	OSHA PEL-TWA (ppm)	STEL (ppm)	IDLH	Routes and Symptoms of Exposure
Benzene	1 for 8Hr-TWA	5	500	Routes: Inhalation, absorption, and contact Symptoms of Exposure: Acute: Eye/skin irritant, headache, dizziness, drowsiness, confusion, tremors and loss of consciousness; Chronic: aplastic anemia, leukemia, multiple myeloma, chromosomal aberrations

Table 5-2: COPC Exposure Limits and Overexposure Effects

COPC	OSHA PEL-TWA (ppm)	STEL (ppm)	IDLH	Routes and Symptoms of Exposure
Ethylbenzene	100 for 8Hr-TWA	125 (NIOSH)	800	Routes: Inhalation, absorption, and contact Symptoms of Exposure: Eye and throat sensitivity, dizziness
Toluene	200 for 8Hr-TWA 300 ceiling	150 (NIOSH)	2000	Routes: Inhalation, absorption, and contact Symptoms of Exposure: tiredness, confusion, weakness, drunken-type actions, memory loss, loss of appetite, and hearing and color vision loss, light-headedness, nausea, unconsciousness
Total Xylenes	100 for 8Hr-TWA	150	1000	Routes: Inhalation, absorption, and contact Symptoms of Exposure: headache, dizziness, nausea and vomiting; weakness, irritability, slowed reaction time
Naphthalene	10 for 8Hr-TWA	15	500	Routes: Inhalation, absorption, and contact Symptoms of Exposure: fatigue, lack of appetite, restlessness, pale skin, confusion, nausea, vomiting, diarrhea
MTBE	50 for 8Hr-TWA	-	-	Routes: Inhalation, absorption, and contact Symptoms of Exposure: headaches, upset stomach, dizziness, lightheadedness, confusion and soreness in the nose or throat.
EDC	1 for 8Hr-TWA	2	-	Routes: Inhalation, absorption, and contact Symptoms of Exposure: respiratory irritant, headaches, drowsiness, nausea, unconsciousness
EDB	20 for 8Hr-TWA 30 ceiling	-	-	Routes: Inhalation, absorption, and contact Symptoms of Exposure: respiratory/eye/nose/skin irritant; weakness, coughing, chest pain, abdominal pain, vomiting, diarrhea, loss of appetite, loss of consciousness
Fuel Oils general (Diesel Fuel)	100 (ACGIH TLV)	-	NA	Routes: Inhalation, ingestion, and absorption Symptoms of Exposure: Breathing diesel fuel for long periods of time may cause kidney damage and lower your blood's ability to clot. Short term exposure may cause nausea, eye irritation, increased blood pressure, headache, and light-headedness.
Gasoline general (unleaded)	300	500	1500	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/respiratory irritant, dermatitis, neurological effects, sudden death from cardiac arrest, and hematologic changes.
carbon tetrachloride	10 for 8 hr-TWA	25	200	Routes: Inhalation, absorption, and contact Symptoms of Exposure: headache, weakness, lethargy, nausea, vomiting
1,1-DCE	100 for 8Hr-TWA	100	3000	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/respiratory irritant, dermatitis, liver and kidney dysfunction

Table 5-2: COPC Exposure Limits and Overexposure Effects

COPC	OSHA PEL-TWA (ppm)	STEL (ppm)	IDLH	Routes and Symptoms of Exposure
methylene chloride	25 for 8-hr TWA	125	2300	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/skin/respiratory irritant, neurological effects, neurotoxin if ingested.
nitrate	-	-	-	-
PCE	100 for 8-hr TWA	100	25 (ACGIH)	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/respiratory irritant, headaches, and loss of coordination.
TCE	25 for 10-hr TWA	100	-	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/respiratory irritant, kidney complications, liver complications, scleroderma, and increased risk of cancers.
vinyl chloride	1 for 8-hr TWA	5	-	Routes: Inhalation, absorption, and contact Symptoms of Exposure: eye/respiratory irritant, dizziness, liver, lung, and kidney damage.

Information on any additional chemicals that may be utilized on-Site is provided in the HAZCOM section at the end of this SSHASP.

5.5 RESPIRATORY PROTECTION PROGRAM

No respirator is capable of preventing all airborne contaminants from entering the wearer's breathing zone. Properly selected and used respirators help protect against certain airborne contaminants by reducing airborne contaminant concentrations in the breathing zone to below recommended exposure levels. Misuse of respirators may result in overexposure to the contaminant and cause sickness or death. For this reason, proper respirator selection, training, use, and maintenance are mandatory in order for the wearer to be properly protected.

The Respiratory Protection Program Administrator is the INTERA Corporate HSO (see **Attachment G** for INTERA's Respiratory Protection Program). The administrator's duties are to oversee the development of the respiratory program and to ensure it is carried out correctly. The administrator will evaluate the program regularly to ensure that procedures are followed, respirator use is monitored, and respirators continue to provide adequate protection when job conditions change.

The following tasks at the Site may require respirators:

- Excavation of contaminated soils.
- Operation or maintenance of soil vapor extraction pilot testing.
- Sampling of contaminated soils.
- When air monitoring Action Levels (see **Section 5.4.1**) are reached during field tasks.

5.5.1 RESPIRATOR SELECTION CRITERIA

*Respirators approved for use at this Site are LEVEL C, air purifying respirators (for more information on respirator PPE protection levels, please see **Section 5.1.1**). **Air purifying respirators can only be used when ambient oxygen levels are measured above 19.5%.***

These respirators will be used if organic vapors (as measured with a PID in the breathing zone) reach greater than 50 ppm, and INTERA determines (using the CGI) that these levels of organic vapors are not caused by the presence of hydrogen sulfide. Work will be discontinued temporarily while personnel prepare to switch to LEVEL C respiratory protection. Combination organic vapor/particulate cartridges will be used with full face respirators. It should be noted that hydrogen sulfide will be monitored with a CGI, and if hydrogen sulfide is measured in excess of 10 ppm, then the area will be evacuated immediately. Only LEVEL B, supplied air respirators can be used in situations where hydrogen sulfide is present.

NOTE: In the event that Site conditions require the use of Level A or Level B PPE, the Corporate HSO will be notified immediately to verify that proper training and procedures are in place prior to conducting the fieldwork. Revisions to this SSHASP will also be necessary.

The following guidance should be used when Site conditions warrant additional attention and personnel suspect that the respiratory protection level they are currently at (or about to switch to) may not be adequate. The respirator selected must have an assigned protection factor adequate for the particular workplace exposure. Divide the air contaminant concentration by the occupational exposure limit to obtain a hazard ratio. Then select a respirator with an assigned protection factor greater than or equal to that hazard ratio. Respirator selection guidance for specific contaminants can also be found on the SDS sheets in **Attachment F**.

$$\text{Hazard Ratio} = \frac{\text{Airborne Contaminant Concentration}}{\text{Occupational Exposure Limit}}$$

Assigned protection factors per OSHA 29 CFR 1910.134 are as follows:

- Air purifying respirators
 - Half facepiece (filtering facepiece, both disposable and reusable): 10
 - Full facepiece: 50
- Powered air purifying respirators
 - Loose-fitting facepiece: 25
 - Half facepiece: 50
 - Full facepiece, helmet, or hood: 1,000
- Continuous flow supplied air respirators
 - Loose-fitting facepiece: 25
 - Half facepiece: 50
 - Full facepiece, helmet, or hood: 1,000
- Pressure demand supplied air respirators
 - Full facepiece: 1,000
 - With escape SCBA: 10,000
 - With pressure demand SCBA: 10,000

5.5.2 FIT TESTING

All personnel who must wear a respirator will be fit-tested before using their respirator, and fit testing will be repeated annually in accordance with INTERA's Respiratory Protection Program

(Attachment G). Prior to fit testing, personnel will be required to participate in the medical surveillance program as described in **Section 3.2** to ensure that they are healthy enough to wear a respirator. Fit testing will also be done when a different respirator facepiece is chosen, when there is a physical change on an employee's face that would affect fit, or when personnel or a medical provider state that the fit is unacceptable.

Employees will not be allowed to wear respirators with tight-fitting facepieces if they have facial hair (e.g., beards, stubble, bangs), are not wearing normally worn dentures, have facial deformities (e.g., scars, deep skin creases, prominent cheekbones), or have other facial features that interfere with the facepiece seal or valve function. Jewelry or headgear that projects under the facepiece seal is also not allowed.

5.6 CONFINED SPACES

No one shall enter a confined space without the proper training and documentation needed to perform confined space work activities. Following are definitions associated with a confined space and the procedures that should be used in the event that a confined space is encountered. Please refer to **Attachment H** for INTERA's Confined Spaces Program.

A **confined space** is an enclosed or partially enclosed space that:

1. Has been identified as such in a risk assessment.
2. Is not intended or designed primarily as a place of work.
3. May have restricted entry and exit.
4. May:
 - a. Have an atmosphere which contains potentially harmful levels of contaminant.
 - b. Not have a safe level of oxygen, e.g., following a nitrogen purge.
 - c. Cause entrapment or engulfment.

Confined spaces may include, but are not limited to:

1. Storage tanks, process vessels, boilers, pressure vessels, tank-like compartments that have only a manhole for entry, and ceiling and floor spaces.
1. Open-topped pits, grease traps, or excavations more than 1.5 meters deep.
2. Pipes, pumps, sewers, shafts, ducts, drains, tunnels, cellars, basements, or similar.
3. Abandoned mine workings and adits.

Contaminant: Any dust, fume, mist, vapor, gas, or other substance in liquid or solid form, the presence of which may be harmful to health and safety.

Entry to confined space: This occurs when a person's whole body, upper body, or head is within the confined space. However, this is not intended to prevent a person from inserting a hand or an arm into a confined space while holding a test instrument or probe as part of the evaluation procedure provided that this procedure is duly authorized.

Identification: Confined spaces must be identified and signs erected at the entry points denoting that a permit is required prior to entry. Where signage is impractical, for example with adits, other means of highlighting the dangers need to be used.

Permit-Required Confined Space: A confined space that requires a permit before the space can be entered because it has, or has the potential for, one or more of the following characteristics:

- An atmosphere that can become IDLH due to toxic, flammable, or asphyxiating characteristics.

- The potential for engulfment.
- A size or shape that can trap or asphyxiate.
- Any other recognized serious hazard.

Confined spaces are not anticipated on-Site. If a confined space is encountered, a sign stating that entry is prohibited shall be posted and the Project Manager and Corporate HSO shall be notified. No one shall enter a confined space without the proper training and documentation needed to perform confined space work activities. Confined space entry will not be performed during the execution of this SOW. Hazardous gases can accumulate in confined spaces. All personnel shall not enter a confined space for any reason at any time. If it is determined that a confined space must be entered during this project, work must stop while this SSHASP is being revised to include a Confined Space Program.

5.7 HAZARD COMMUNICATION (HAZCOM) PROGRAM

The Site-specific HazCom Program designates the project personnel responsible for the implementation and maintenance of hazardous chemical labeling and provides information for employee training on HazCom requirements for the Site. A description of the HazCom program is provided in **Attachment F**, and the **Hazardous Chemical List** and **Safety Data Sheets** (SDSs) can be found in the **HAZCOM** Section at the back of this SSHASP.

The Hazardous Chemical List includes chemicals that are currently present at the Site, or which may be brought to the Site as required for the specific tasks to be performed. SDSs provide detailed information on specific chemicals, including potential hazardous effects, physical and chemical characteristics, and recommendations for appropriate protective measures.

5.8 LOCK OUT/TAG OUT PROGRAM

Some Site activities may require working on equipment that is typically energized or under pneumatic pressure. Minimum requirements for the lock-out of energy isolating devices whenever maintenance or servicing is done on machines or equipment must be followed. Lock-out/tag-out procedures shall be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or the release of stored energy could cause injury.

All employees are required to comply with the restrictions and limitations imposed upon them during the use of lock-out. The authorized employees are required to perform the lock-out in accordance with approved procedures. All employees, upon observing a machine or piece of equipment which is locked out to perform servicing or maintenance, shall not attempt to start, energize, or use that machine or equipment.

5.8.1 DEFINITIONS:

- **Hazardous energy:** Electrical, pneumatic, hydraulic, stored (springs, batteries), potential (by virtue of position), heat (hot water, steam).
- **Isolation Officer:** Whenever a piece of equipment is to be isolated, there must be a person designated to carry out the Isolation Procedure. That person is referred to as the Isolation Officer. No person may be designated as the Isolation Officer for a piece of equipment unless he or she has been trained, tested, and certified as competent to carry out the Isolation Procedure for that piece of equipment. Tests for voltage, for example, require competency in electrical work as outlined in the electrical standard.

- **Isolation Procedure:** All designated systems and equipment must have written procedures for isolation. This procedure will set out how the system or equipment is to be made safe and kept safe. It will include for example: decontamination; venting of stored energy; securing of rotors or fan blades; shocking of vehicles; and disconnecting, blocking, or bleeding of equipment, cables, pipes, and vessels. It will show any connections to Distributed Control Systems. It will also show the isolation points for lock-out and test procedures.

5.8.2 PREPARATION FOR LOCK-OUT/TAG-OUT

- Obtain the proper Isolation Procedure for the equipment or machine to be locked out or tagged out.
- Identify the Isolation Officer and other affected employees by name (or job title) who may be involved in the impending lock-out/tag-out work.

5.8.3 SEQUENCE OF LOCK-OUT

- The Isolation Officer will notify all affected persons that servicing, or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.
- The Isolation Officer shall refer to the company procedure to identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy.
- If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).
- De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).
- Lock-out the energy isolating device(s) with assigned individual lock(s). The Isolation Officer's Lock must be the first to be applied and the last to be removed. The Isolation Officer's lock must be a master series lock since it will remain on the equipment when handing over to subsequent shifts. Keys to the Isolation Officer's lock must only be held by other designated Isolation Officers for that equipment. Where isolation involves only one person and it is not appropriate for a master series lock to be utilized, the person must be an Isolation Officer and he or she must apply his or her personal lock.
- After locking and tagging, the Isolation Officer must clear the area of personnel before a trial step to ensure that the equipment has been isolated. In case of electrical isolation, a test for voltage must be carried out after turning off the switching device to ensure the absence of voltage. Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure) must be dissipated or restrained by methods such as grounding, repositioning, blocking, and bleeding down. The Isolation Officer will ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verifying the isolation of the equipment by operating the push button or other normal operating control(s), or by testing to make certain the equipment will not operate.
- Caution: Return operating control(s) to the neutral or "off" position after verifying the isolation of the equipment.

The machine or equipment is safely locked out if the above steps are taken. If other personnel are performing work on the same system or related system, a separate independent lock-out/tag-out procedure shall be followed. Lock-outs shall be placed on the original lock-out. The process

shall be repeated for each individual task. Everyone, including the Isolation Officer, who has to perform work on the equipment or system, must first apply a personal lock and identification tag in accordance with the Isolation Procedure. Personal locks must be such that they can only be unlocked by their owner. Personal locks may never be removed other than by the person to whom they belong, unless in the presence of and under the supervision of the Project Manager or his or her appointed nominee, and in accordance with a written procedure.

5.8.4 RESTORING EQUIPMENT TO SERVICE

When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps shall be taken.

1. Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
2. Check the work area to ensure that all employees have been safely positioned or removed from the area.
3. Verify that the controls are in neutral.
4. Check for other lock-outs or tags that may have been placed on the machine or equipment by others.
 - a. Personnel will remove their lock-out devices, and the Isolation Officer will remove his or her lock-out device last.
 - b. Re-energize the machine or equipment. Note: The removal of some forms of blocking may require re-energization of the machine before safe removal.
 - c. Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

5.9 HOT WORK

This section is primarily a contingency for subcontractors that may need to do hot work. All temporary operations involving open flames or purposefully producing heat and/or spark shall be performed with the proper safety controls and equipment in place to eliminate the risk associated with igniting combustible materials. No hot work shall be conducted without first completing a Hot Work Permit.

A Hot Work Program shall be followed when performing any brazing, cutting, grinding, soldering, welding, or other activity that results in the production of excessive heat. Properly designed and operated “intrinsically safe” equipment are excluded from the Hot Work Program. The permit requirement may be fulfilled by completing the permit form included as **Form 8** and abiding by the Hot Work Program. The Hot Work Program includes the following procedures:

- Establish permissible areas for hot work.
- Ensure that only approved apparatus, such as torches, manifolds, regulators, and pressure reducing valves, are used.
- Ensure that all individuals involved in the hot work operations are familiar with Hot Work Program requirements.
- Ensure that all individuals involved in the hot work operations are trained in the safe operation of their equipment and the safe use of the process. These individuals must have an awareness of the risks involved and understand the emergency procedures in the event of a fire.

- Determine Site-specific flammable materials, hazardous processes, or other potential fire hazards present or likely to be present in the work location.
- Ensure combustibles are protected from ignition by the following means:
 - Move the work to a location free from combustibles or flammable gasses.
 - If the work cannot be moved, ensure the combustibles are moved to a safe distance or have the combustibles properly shielded against ignition, and ventilate the area and continuously monitor for flammable gasses.
 - Ensure hot work is scheduled such that operations that could expose flammables or combustibles to ignition do not occur during hot work operations.
 - If any of these conditions cannot be met, then hot work must not be performed.
- Determine that fire protection and extinguishing equipment are properly located and readily available.
- Ensure sufficient local exhaust ventilation is provided to prevent accumulation of any smoke and fumes.
- Ensure that an individual is posted to watch for fire (fire watch) when hot work is performed in a location where other than a minor fire might develop, or where the following conditions exist:
 - Combustible materials in building construction or contents are closer than 35 feet to the point of hot work.
 - Combustible materials are more than 35 feet away, but are easily ignited by sparks.
 - Wall or floor openings are within 35 feet and expose combustible materials in adjacent areas. This includes combustible materials concealed in walls or floors.
 - Combustible materials are adjacent to the opposite side of partitions, walls, ceilings, or roofs, and are likely to be ignited.
- Where a fire watch is not required, a final inspection shall be conducted 1/2-hour after the completion of hot work operations to detect and extinguish possible smoldering fires.

An operator must cease hot work operations if unsafe conditions develop or are suspected.

EMERGENCY CONTACTS AND PROCEDURES

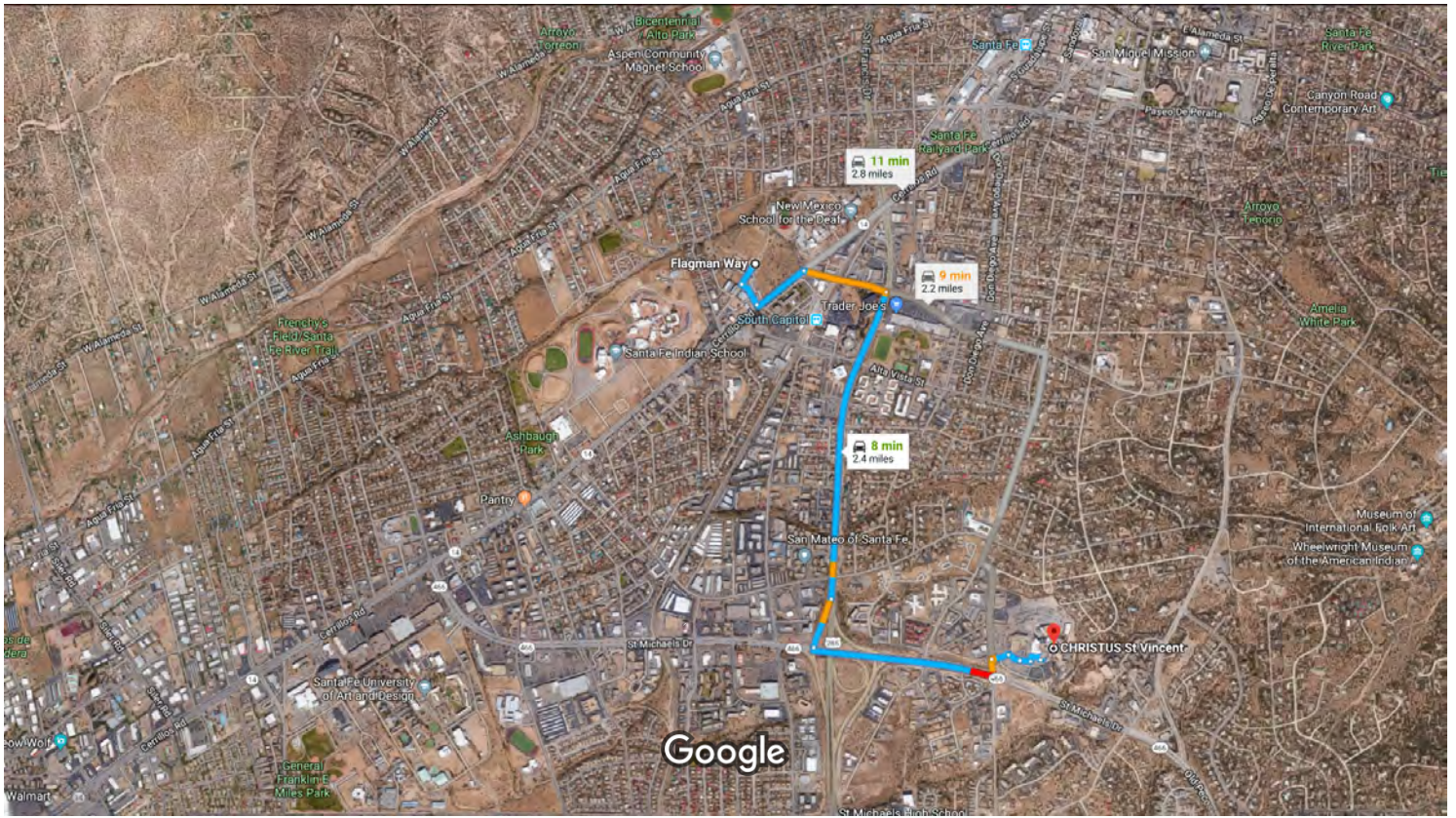
Emergency Contacts List
Hospital Route Map
Written Directions to Hospital
Site Emergency Response Plan

EMERGENCY CONTACTS LIST

AMBULANCE:	911
FIRE:	911
POLICE:	911 (Santa Fe Police Dept: (505) 428-3710 non-emergency)
POISON CONTROL:	1-800-222-1222
SITE ADDRESS:	Former Santa Fe Generating Station – NE corner of Flagman Way and Shoefly St, Santa Fe, NM. 87505
HOSPITAL: Address:	Christus St. Vincent Hospital 455 St. Michaels Dr, Santa Fe, NM 87505
Hospital Phone Number:	(505) 913-3361
LOCATION OF NEAREST HOSPITAL:	Christus St. Vincent (See Map)
LOCATION OF NEAREST PHONE:	mobile

Project Manager	Eileen Marcillo – INTERA	(505) 428-0066
Site Safety Officer (SSO)	Andrew Murphy – INTERA	(505) 428-0846
Field Sampler(s)	Lee Dalton – INTERA Andrew Murphy – INTERA Austin Hanson – INTERA	(505) 246-1600, ext. 1213 (505) 428-0846 (505) 246-1600, ext. 1224
INTERA Albuquerque Office Health and Safety Officer (HSO)	Brian Archuleta – INTERA	(505) 246-1600, ext. 1215
Client Project Manager	John Hale – PNM	(505) 241-2014
GWQB Project Manager	Kate Herrell	(505) 948-0534

Directions to Hospital from Site



Imagery ©2018 Google, Map data ©2018 Google 1000 ft

Flagman Way



Santa Fe, NM 87505

Take Railfan Rd to Cerrillos Rd








- ↑ 1. Head southwest on Flagman Way toward Shoofly St
52 s (0.1 mi)
- ↶ 2. Turn left onto Railfan Rd
367 ft
- ↶ 3. Turn left onto Cerrillos Rd
400 ft
- ↷ 4. Turn right at the 1st cross street onto Cordova Rd
38 s (0.2 mi)
- ↷ 5. Turn right onto S St Francis Dr
1 min (0.2 mi)

Follow S St Francis Dr and St Michaels Dr to Hospital Dr

- ↷ 5. Turn right onto S St Francis Dr
3 min (1.6 mi)
- 0.9 mi

-  6. Take the St Michael's Dr exit
- 0.2 mi
-  7. Turn left onto St Michaels Dr
- 0.5 mi

Continue on Hospital Dr to your destination

- 2 min (0.2 mi)
-  8. Turn left onto Hospital Dr
- 266 ft
-  9. Turn right
- 269 ft
-  10. Turn right
- 194 ft
-  11. Keep left
- 164 ft
-  12. Turn left
- 246 ft
-  13. Turn left
-  Destination will be on the right
- 75 ft

CHRISTUS St Vincent

455 St Michaels Dr, Santa Fe, NM 87505

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

EMERGENCY RESPONSE PLAN

Any incident or accident must be reported to the Project Manager and the INTERA Corporate HSO immediately. Incidents must be documented by the employee(s) who witnessed the event (and with the Project Manager's involvement) on the INTERA Incident Investigation Report Form.

EMERGENCY COMMUNICATION PROTOCOLS:

In the case of an emergency, *CALL 911*.

- Talk in a controlled and steady manner
- Pass on as much information as possible (Person, Location, Nature or Emergency, Injuries, Assistance required, any other important detail)
- Verify that the emergency communication has been heard and understood

The person receiving the call should:

- Record all details
- Seek clarification on all details as necessary
- Begin organizing emergency responders and contacting persons that need to know

Other Site Personnel

- Make yourself ready in case you are called up to assist in the emergency response

PERSONAL INJURY: Check the accident scene to determine if you or anyone else is in danger. FOLLOW EMERGENCY COMMUNICATION PROTOCOLS. Keep all non-essential personnel out of the area. Remove personnel from immediate danger if there is no suspicion of neck or back injury. If there is a question about whether it is safe to move the victim, DO NOT move the victim; instead, make him or her as comfortable as possible while waiting for emergency assistance. Administer appropriate minor first aid only within your competency and training. Wait for emergency personnel to assist, and notify the Project Manager and INTERA Corporate HSO as soon as personnel are out of immediate danger.

CHEMICAL EXPOSURE: For signs of inhalation exposure, retreat to fresh air for recovery. If symptoms are serious, such as nausea or fainting, FOLLOW EMERGENCY COMMUNICATION PROTOCOLS and discontinue work at that location. In the case of skin or eye irritation due to chemical contact FOLLOW EMERGENCY COMMUNICATION PROTOCOLS, and wash affected skin with soap and water, or flush eyes with generous amounts of water while waiting for emergency response. Notify the Project Manager and INTERA Corporate HSO as soon as personnel are out of immediate danger.

FIRE: If fire occurs, FOLLOW EMERGENCY COMMUNICATION PROTOCOLS. After the alarm has been raised, if the fire can be easily contained and extinguished, do so with a portable fire extinguisher. Project vehicles will have working fire extinguishers in them for use in the event of small fires. Personnel shall only use extinguishers in cases of small fires, when the individual has been trained to use a portable fire extinguisher and is comfortable attempting to put out the fire. If the fire cannot be contained and extinguished with a portable fire extinguisher, or if explosion risk is present, evacuate all personnel to the muster point. There is no building or equipment that is more valuable than a person. It is preferable that the fire creates damage rather than injury. All unnecessary personnel must be kept back from the fire and out of harm's way.

SITE EVACUATION: If an emergency Site evacuation becomes necessary for any reason, the SSO shall alert all personnel to leave the Site and notify the Project Manager of the situation. Personnel shall not return to the Site until an all-clear notification has been received from the SSO.

EMERGENCY SITUATIONS INVOLVING THE SURROUNDING COMMUNITY: In the highly unlikely event that a Site emergency has the potential to affect the community surrounding the Site, FOLLOW EMERGENCY COMMUNICATION PROTOCOLS and notify the Project Manager as soon as practical. No communication is to be made to community or media groups, if calls come in from either of these groups, contact details such as names and numbers are to be collected and passed onto the Project Manager (and then to the Client) to formulate a response.

SPILL RESPONSE: Where chemicals are unknown or the hazard is great, FOLLOW EMERGENCY COMMUNICATION PROTOCOLS then establish an exclusion zone. This exclusion zone must be maintained until cleanup has been completed or the area determined safe. All appropriate PPE must be worn as per the SDS for cleanup and response to a chemical spill.

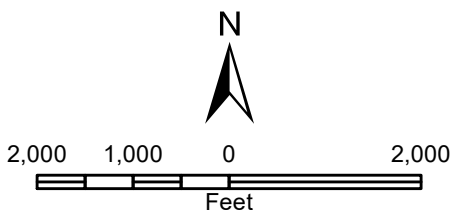
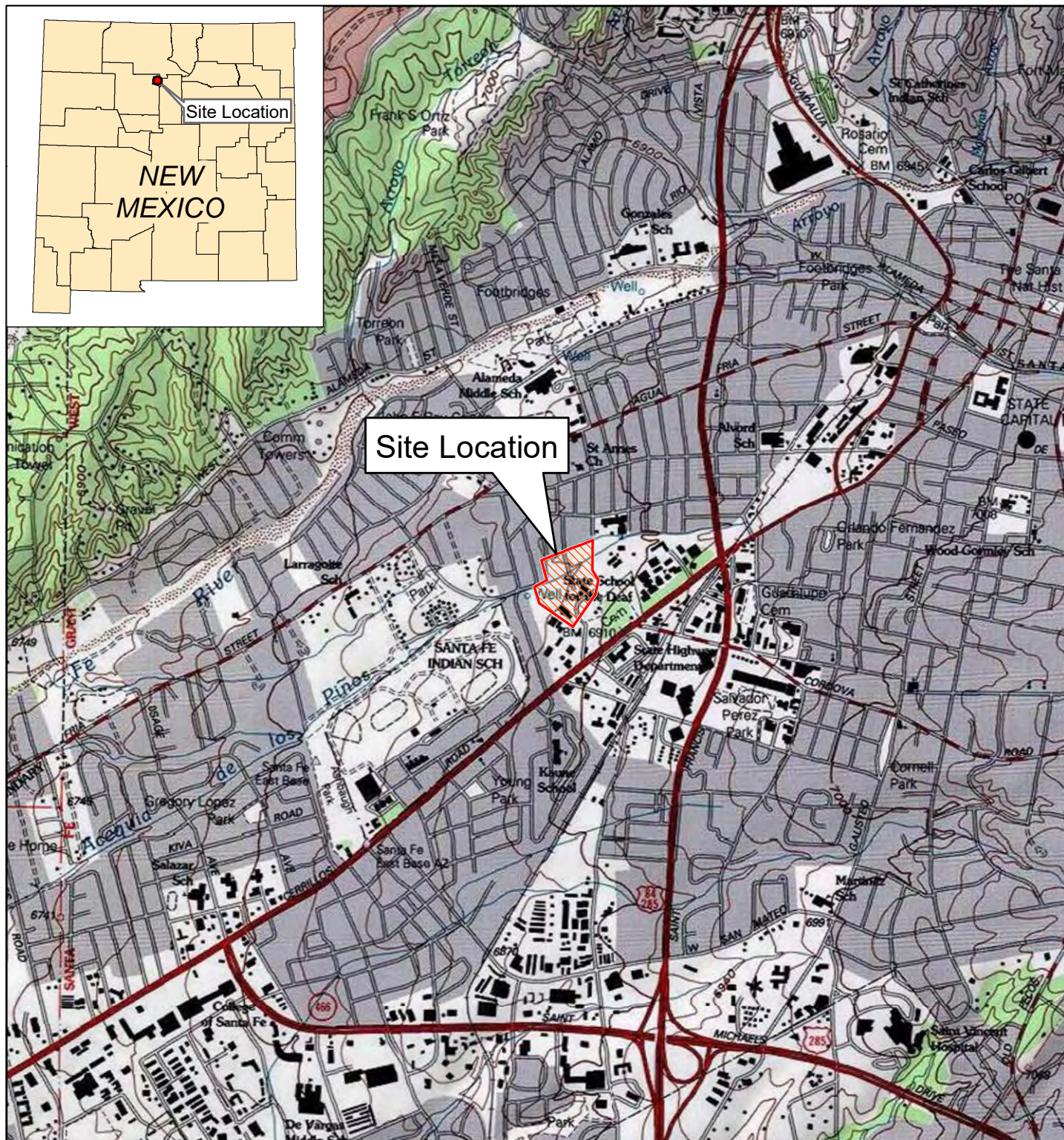
For known low-hazard spills - a Spill Kit may be available at the Site. Small spills may be cleaned up with a shovel and a bucket. An external resource may need to be engaged for larger spills.

Any amount of any material in such quantity as may with reasonable probability injure or be detrimental to human health, animal or plant life, or property, or may unreasonably interfere with the public welfare or the use of property, must be reported to the New Mexico Environment Department (505-827-9329). This includes chemical, biohazardous, petroleum-product, and sewage spills and incidents. In addition to recent spills, the discovery of evidence of previous unauthorized discharges, such as contaminated soil or ground water, also must be reported. New Mexico has not established reportable quantities. Verbal notification must be provided as soon as possible after learning of a discharge, but in no event more than twenty-four (24) hours thereafter.

FIGURES

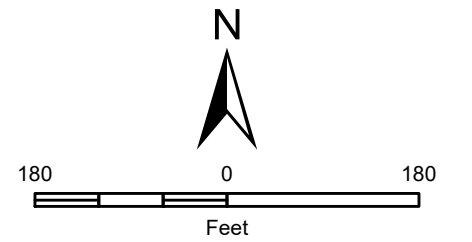
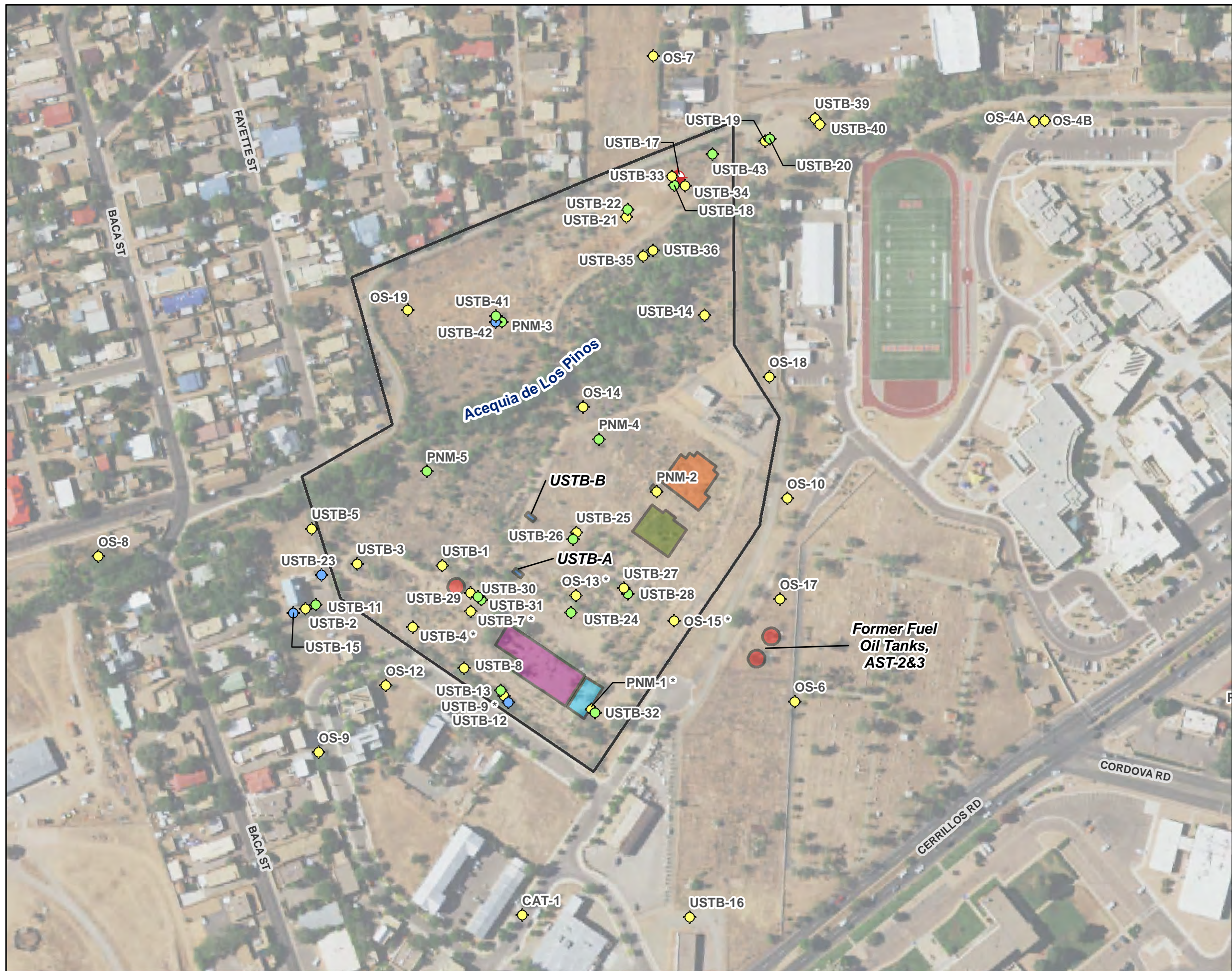
Figure 1
Figure 2

Site Location Map
Site Plan



Source(s): Topo – ESRI ArGIS Online

Figure 1
Site Location
 Stage 1 Abatement Plan Proposal
 Former Santa Fe Generating Station (Santa Fe Well-S)
 Santa Fe, Santa Fe County, New Mexico



Sources: Aerial – NAIP imagery, dated 2018

Legend

- Monitoring Well, P and A
- Monitoring Well, Shallow
- Monitoring Well (dry), Intermediate
- Monitoring Well, Deep
- Former Day Tank
- Excavated Solvent Soil
- Former AST
- Former Cooling Tower
- Former Power Plant
- Former Service Center
- Former UST
- Site Boundary

* = used as former bionutrient injection well

Monitoring well depth designation based on location of top of screen below ground surface.

Shallow = top of screens range from 250 to 294 ft bgs
Intermediate = top of screens range from 295 to 362 ft bgs
Deep = top of screens range from 370 to 648 ft bgs

Figure 2b
Site Vicinity, Zoomed
Stage 1 Abatement Plan Proposal
Former Santa Fe Generating Station
(Santa Fe Well-S)
Santa Fe, Santa Fe County, New Mexico

FORM 1

Site Personnel Acknowledgement Form

FORM 2

Safety Meeting Attendance Forms



SAFETY MEETING ATTENDANCE FORM

Date: _____ Project Number: _____

Project Title & Task: _____

Has a Job Safety Analysis Form been completed for this task? ☐ Yes ☐ No (if no, fill it out now)

SAFETY TOPICS PRESENTED (describe specifics)

Protective Clothing/Equipment _____

Emergency Procedures _____

Chemical Hazards _____

Confirm that Safety Data Sheets are available for listed hazardous chemicals/substances. ☐ Yes ☐ N/A

Location of Nearest Hospital _____

Physical Hazards _____

Location of Mobile Phone _____

Special Equipment _____

Other _____

ATTENDEES

Printed Name

Signature

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by:

Printed Name

Signature



SAFETY MEETING ATTENDANCE FORM

Date: _____ Project Number: _____

Project Title & Task: _____

Has a Job Safety Analysis Form been completed for this task? ☐ Yes ☐ No (if no, fill it out now)

SAFETY TOPICS PRESENTED (describe specifics)

Protective Clothing/Equipment _____

Emergency Procedures _____

Chemical Hazards _____

Confirm that Safety Data Sheets are available for listed hazardous chemicals/substances. ☐ Yes ☐ N/A

Location of Nearest Hospital _____

Physical Hazards _____

Location of Mobile Phone _____

Special Equipment _____

Other _____

ATTENDEES

Printed Name

Signature

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by:

Printed Name

Signature



SAFETY MEETING ATTENDANCE FORM

Date: _____ Project Number: _____

Project Title & Task: _____

Has a Job Safety Analysis Form been completed for this task? ☐ Yes ☐ No (if no, fill it out now)

SAFETY TOPICS PRESENTED (describe specifics)

Protective Clothing/Equipment _____

Emergency Procedures _____

Chemical Hazards _____

Confirm that Safety Data Sheets are available for listed hazardous chemicals/substances. ☐ Yes ☐ N/A

Location of Nearest Hospital _____

Physical Hazards _____

Location of Mobile Phone _____

Special Equipment _____

Other _____

ATTENDEES

Printed Name

Signature

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by:

Printed Name

Signature



SAFETY MEETING ATTENDANCE FORM

Date: _____ Project Number: _____

Project Title & Task: _____

Has a Job Safety Analysis Form been completed for this task? ☐ Yes ☐ No (if no, fill it out now)

SAFETY TOPICS PRESENTED (describe specifics)

Protective Clothing/Equipment _____

Emergency Procedures _____

Chemical Hazards _____

Confirm that Safety Data Sheets are available for listed hazardous chemicals/substances. ☐ Yes ☐ N/A

Location of Nearest Hospital _____

Physical Hazards _____

Location of Mobile Phone _____

Special Equipment _____

Other _____

ATTENDEES

Printed Name

Signature

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by:

Printed Name

Signature



SAFETY MEETING ATTENDANCE FORM

Date: _____ Project Number: _____

Project Title & Task: _____

Has a Job Safety Analysis Form been completed for this task? ☐ Yes ☐ No (if no, fill it out now)

SAFETY TOPICS PRESENTED (describe specifics)

Protective Clothing/Equipment _____

Emergency Procedures _____

Chemical Hazards _____

Confirm that Safety Data Sheets are available for listed hazardous chemicals/substances. ☐ Yes ☐ N/A

Location of Nearest Hospital _____

Physical Hazards _____

Location of Mobile Phone _____

Special Equipment _____

Other _____

ATTENDEES

Printed Name

Signature

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted by:

Printed Name

Signature

FORM 3

Job Safety Analysis Forms

JOB SAFETY ANALYSIS (JSA) AND PERSONAL PROTECTIVE EQUIPMENT (PPE) WORKSHEET

Project Site Evaluated: _____ Project Task Evaluated: _____

Name of Person Completing Assessment: _____ Project Number: _____ Date: _____

Use additional sheets as necessary.

<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED:	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT:	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	

JOB SAFETY ANALYSIS (JSA) FORM

Project Title & Task: _____ Person Completing Assessment: Emily Woolsey/Ashley Arrossa

Date: 1/22/15, Revised 2/27/2015 Project Number: NMDOT.M002.PSTB Professional Services and Emergency Response

Step Number	Description Of Job Step	Potential Hazard	Source Of Potential Hazard	Probability (A-E)	Consequence (1-5)	Hazard Classification	Hazard Mitigation Control
1	Loading/unloading vehicle	Personnel injury/damage to equipment	Lifting heavy objects, loading/arranging sampling materials	B	1-3	B3	Proper lifting procedures, wearing gloves, securing items with ratchet-straps or bungee cords, not overloading a truck/trailer (items falling out)
2	Travel to/within Site	Personnel injury/damage to equipment.	Dangerous road conditions Unsafe driving Vehicle malfunction	C	1-4	C4	Practice safe driving, no mobile phone use during driving, keep updated on weather and road conditions, always park in an area away from heavy use, use a buddy when backing up or driving in tight spaces

Notes: Probability (A = Almost Certain, B = Likely, C = Possible, D = Unlikely, E = Rare)
 Consequence (1 = Minor, 2 = Medium, 3 = Serious, 4 = Major, 5 = Catastrophic)
 Classification (C1, D1, E1, D2, E2 = Low; A1, B1, C2, D3, E3 = Moderate; A2, B2, B3, C3, D4, E4, E5 = High; or A3, A4, A5, B4, B5, C4, C5, D5 = Critical)

3	General: movement within Site	Personnel injury	Slips, trips, and falls due to uneven terrain, construction conditions, weather conditions, or isolated area (creek bed, eg.).	B	1-3	B3	Inspect work area prior to beginning work, wear appropriate footwear, de-ice or shovel icy areas, use hand rails where installed, inspect slopes for stability prior to walking up/down, communicate location to coworker prior to entering uneven terrain or when working in separate location
4	Well location/excavation	Personnel injury, damage to equipment	Improper equipment use, dropped equipment	B	1-3	B3	Inspect work area prior to beginning task; use proper tool/equipment (breaker bar, chisel, rock hammer, mallet, shovel, eg.); use gloves, attempt to locate the well with a scaled map and measuring tools prior to excavation so as not to unearth/strike something other than the well.
5	Opening well vaults	Bug bites, pinches, cuts, bruising, injury from lifting	Insects living in well vault, well vault lid, collapsed/damaged well vault, improper lifting	B	2-3	B3	Wear appropriate PPE (work gloves), lift properly including with a partner, lever and with the legs, assess well condition to determine proper tool for the job.

Notes: Probability (A = Almost Certain, B = Likely, C = Possible, D = Unlikely, E = Rare)
 Consequence (1 = Minor, 2 = Medium, 3 = Serious, 4 = Major, 5 = Catastrophic)
 Classification (C1, D1, E1, D2, E2 = Low; A1, B1, C2, D3, E3 = Moderate; A2, B2, B3, C3, D4, E4, E5 = High; or A3, A4, A5, B4, B5, C4, C5, D5 = Critical)

6	Measuring water levels	Pinch, friction burn, splashes, caught between	Measurement tape, moving spool, improper technique	B	2	B2	Wear appropriate PPE (safety glasses, nitrile gloves), lower and raise at an appropriate speed, when measuring larger depths, decontaminate on the way down or use a wetted paper towel, use a partner for great depths
7	General: Hand tools and power tools	Personnel injury due or damage to equipment	Damaged tools or power tools or power cords.	C	1-3	C3	Ensure proper use, trained personnel, inspect tools prior to use, wear appropriate PPE .
8	Groundwater sampling	Chemical burns, exposure to heavy metals or other contaminants in groundwater	Spills or other contact with preservatives in groundwater sampling bottles, ingestion or skin contact with groundwater	C	2	C2	Wear appropriate PPE (nitrile gloves, eye protection), avoid skin contact with preservatives, wash hands before eating, drinking, or applying cosmetics/sunscreen, avoid spilling filled sample bottles, be aware of purge water location.

Notes: Probability (A = Almost Certain, B = Likely, C = Possible, D = Unlikely, E = Rare)
 Consequence (1 = Minor, 2 = Medium, 3 = Serious, 4 = Major, 5 = Catastrophic)
 Classification (C1, D1, E1, D2, E2 = Low; A1, B1, C2, D3, E3 = Moderate; A2, B2, B3, C3, D4, E4, E5 = High; or A3, A4, A5, B4, B5, C4, C5, D5 = Critical)

9	GENERAL: Weather conditions	Slips, trips, fall, damage to equipment	Moisture preventing grip to tools, icy conditions	C	2	C2	Work at a manageable (slower) speed, wear gloves, be aware of purge water (icing in cold weather, creating mud/slick areas) stop work if conditions prevent safe work
10	GENERAL: Struck by or Struck Against & Caught Between	Personnel injured or equipment damage	Interaction or moving apparatus	D	2-3	D3	Qualified personnel performing task, equipment inspected prior to use, use of proper PPE, awareness of surroundings and moving vehicles, eye contact/hand signals
11	GENERAL: Heat Stress/Cold Stress	Personnel illness	Heat stress or cold exposure	C	2	C2	Workers monitor themselves and others, drink water and regular breaks, appropriate clothing and exposure limits.
12	GENERAL: Hand tools	Personnel injury and damage to equipment	Damaged hand tools, improper use	C	2	C2	Qualified personnel performing task, appropriate training, appropriate PPE, inspection of tools prior to use

Notes: Probability (A = Almost Certain, B = Likely, C = Possible, D = Unlikely, E = Rare)
 Consequence (1 = Minor, 2 = Medium, 3 = Serious, 4 = Major, 5 = Catastrophic)
 Classification (C1, D1, E1, D2, E2 = Low; A1, B1, C2, D3, E3 = Moderate; A2, B2, B3, C3, D4, E4, E5 = High; or A3, A4, A5, B4, B5, C4, C5, D5 = Critical)

13	Hand excavation (shoveling)	Personnel injury, damage to equipment	Dropped object, improper techniques	D	2	D2	Wear PPE (gloves), take breaks, use proper equipment (spade, flat shovel, breaker bar, hand trowel, rake, eg.) when applicable, use partner, be aware of ground stability during/following excavation.

Notes: Probability (A = Almost Certain, B = Likely, C = Possible, D = Unlikely, E = Rare)
 Consequence (1 = Minor, 2 = Medium, 3 = Serious, 4 = Major, 5 = Catastrophic)
 Classification (C1, D1, E1, D2, E2 = Low; A1, B1, C2, D3, E3 = Moderate; A2, B2, B3, C3, D4, E4, E5 = High; or A3, A4, A5, B4, B5, C4, C5, D5 = Critical)

DIRECTIONS

For complete directions filling out the JSA, please refer to Appendix 12 of the Corporate Health and Safety Plan. Use a separate form for each task. Examples of tasks include groundwater monitoring, drilling, or system maintenance. This form should be completed by employees who have good attention to detail, think logically, and have a good grasp of the procedures required to complete each task.

1ST COLUMN

Step #: List consecutive numbers for each step in the task. Examples of steps in the task include loading equipment, driving to the site, setting up at the site, each step in performing the task, or cleanup at the site.

Description of Job Step: The wording for each job step should begin with an "Action" word like "remove," "open," or "weld." The action is completed by naming the item to which the action (verb) applies; for example, "remove extinguisher," "aim hose," "squeeze lever."

2ND COLUMN

Potential Hazard: Examples of hazards are "head injuries," "electric shock," or "trench collapse."

Source of Potential Hazard: Examples of hazard sources are "overhead equipment," "working around high voltage," or "working in trenches."

Ask and discuss these questions:

1. Is there a danger of striking against, being struck by, or otherwise being injured by contacting an object?
2. Can the worker be caught in, on, or between objects?
3. Can the worker slip or trip? Could they fall on the same level or to another?
4. Can the worker strain themselves by pushing, pulling, or lifting?
5. Is the environment hazardous (toxic gasses, vapors, mists, fumes, dusts or heat)?
6. Can the tools cause a problem, can they cut, fail or malfunction?
7. Can things splash or be thrown toward the employee?
8. Could dangers be created if the task steps are completed out of sequence?
9. Are there gages or other instruments that must be watched and reacted to properly if the job is to be done safely?

4TH COLUMN

Body Part Affected: What body part could be injured by the potential hazard?

Type of Affect: i.e., inhalation, impact, splash, falling object, etc.

Is PPE Required? Yes or No

Type of PPE Required: i.e., hard hat, safety glasses, steel toes, Tyvek, gloves, etc.

3RD COLUMN

Risk Hazard Rank: The identified hazards for each step should be described in terms of probability, consequence and hazard classification. The probability, or likelihood, that the hazard will occur should be ranked from A (almost certain) to E (rare), and the consequence, or severity, of the injury if it were to happen, should be ranked from 1 (minor) to 5 (catastrophic). The consequence and probability are then cross-referenced in the matrix to determine the classification of the hazard, from low to critical. The classification of the hazard can then be used to prioritize hazard mitigation controls and show workers where they need to pay the most attention on the job.

		Consequence				
		1 Minor	2 Medium	3 Serious	4 Major	5 Catastrophic
Probability	A – Almost Certain	Moderate	High	Critical	Critical	Critical
	B – Likely	Moderate	High	High	Critical	Critical
	C – Possible	Low	Moderate	High	Critical	Critical
	D – Unlikely	Low	Low	Moderate	High	Critical
	E – Rare	Low	Low	Moderate	High	High

5TH COLUMN

Hazard Mitigation Control: Mitigation controls should precisely state what to do and how to do it. Example: Set wrench securely. Test its grip by exerting a slight pressure on it. Brace yourself against something immovable, or take a solid stance with feet wide apart, before exerting pressure. This prevents loss of balance if the wrench slips.

General precautions like "Be alert," "Use caution," or "Be careful" are not useful.

Completed JSAs should be stored in the SSHASP and reviewed during the Daily Safety Meeting.

FORM 4

Behavior Based Safety Encounter Form

BEHAVIOR BASED SAFETY ENCOUNTER FORM

Project Title & Task: _____

Observer's Name: _____ Project Number: _____

Encounter Date: _____ Time: _____ Duration: _____

How many people were observed?

Task Observed

Interaction Comments:

Was a pre-task hazard assessment conducted? (yes or no):

Remedial Actions
(Commitments by Participants):

By who:

Date to be completed:

BEHAVIOR BASED SAFETY ENCOUNTER FORM (continued)

Project Title & Task: _____

Observer's Name: _____ Project Number: _____

Encounter Date: _____ Time: _____ Duration: _____

Interaction Categories		Select all the categories that apply and indicate a desired (✓) and/or undesired (✗) behaviour count for each.
Condition of Work Area		
<input type="checkbox"/> Work area Clean & Orderly	<input type="checkbox"/> Slips, Trips Fall Hazards	<input type="checkbox"/> Adequate lighting
<input type="checkbox"/> Work area barrier in place	<input type="checkbox"/> Air Quality	<input type="checkbox"/> Visibility to heavy equipment
Body position and ergonomics		
<input type="checkbox"/> Movements & positions - lifting / carrying	<input type="checkbox"/> Contact with-Electric current	<input type="checkbox"/> Movements & positions-Avoiding pinch points
<input type="checkbox"/> Movements & positions - overexertion / strain	<input type="checkbox"/> Movements & positions - bending / twisting	<input type="checkbox"/> Movements & positions - repetitive acts / movements
Body protection and PPE		
<input type="checkbox"/> Protecting hearing	<input type="checkbox"/> Protecting respiratory system	<input type="checkbox"/> Protecting the-body
<input type="checkbox"/> Protecting the-head	<input type="checkbox"/> Protecting the-eyes / face	<input type="checkbox"/> Protecting the-feet
<input type="checkbox"/> Protecting the-hands / arms		
Equipment and tools		
<input type="checkbox"/> Tool / equipment selection - correct for job and proper use	<input type="checkbox"/> Tool/equipment selection - good condition/proper storage	<input type="checkbox"/> Pre-op equipment inspection
Practices and housekeeping		
<input type="checkbox"/> Controls implemented for identified hazards	<input type="checkbox"/> Hazardous materials - use and storage requirements followed	<input type="checkbox"/> Communicating with others about hazards / risks
<input type="checkbox"/> Rushing / multi-tasking	<input type="checkbox"/> Walking and working surfaces/platforms (clear and clean)	<input type="checkbox"/> Proper workplace housekeeping maintained
Procedures / permits		
<input type="checkbox"/> Proper procedures followed	<input type="checkbox"/> Management of change	<input type="checkbox"/> Run-off is controlled
<input type="checkbox"/> Work at heights (protecting from fall hazards)	<input type="checkbox"/> Lifting (following safe work practices)	<input type="checkbox"/> Isolation (proper use of lock-out/tag-out)
<input type="checkbox"/> Confined spaces (following safe work practices)	<input type="checkbox"/> Hot work (following safe work practices)	<input type="checkbox"/> Dust control procedures followed (minimizing dust)
<input type="checkbox"/> Hazardous materials - proper segregation & disposal	<input type="checkbox"/> Hydrocarbon pollution prevention measures taken	
Vehicles / mobile equipment and driving		
<input type="checkbox"/> Eyes on direction of travel	<input type="checkbox"/> Pre-shift inspection	<input type="checkbox"/> Securing parked vehicles
<input type="checkbox"/> Vehicle speed (driving to conditions / speed limits)	<input type="checkbox"/> Wearing seatbelt	<input type="checkbox"/> Operating Safely (interaction between people & equipment)
Weather		
<input type="checkbox"/> Protecting from cold stress	<input type="checkbox"/> Protecting from heat stress	<input type="checkbox"/> Protecting from lightning
<input type="checkbox"/> Protecting from rain	<input type="checkbox"/> Protecting from (UV exposure)	

FORM 5

Incident Investigation Report Form

INCIDENT INVESTIGATION REPORT FORM

Attach additional pages as necessary, if more than one employee was injured, each employee must fill out their own form. This form should also be used to report near-misses and property or environmental damage.

Incident Investigator to fill out:			
Reportable / Recordable / Non-Recordable / Near Miss / Property Damage / Environmental Damage		Case Number from OSHA 300 Log:	
Site:	Project Number:		
SECTION 1: INCIDENT REPORT			
<u>Employee Injured, Ill, or Deceased</u> (Skip this box for near-miss and property or environmental damage) Name: Address: Date of Birth: Date Hired: Male / Female		SECTION 1	
<u>Names and Project Roles of Other Affected Personnel</u> (Witnesses of incident and/or personnel involved in near-miss or property or environmental damage)			
Site Project Manager			
Event Date	Event Time		Time Personnel Began Work
Exact Location of Event: (description or address, if available)			
Event Resulted in: (circle one) Fatality / Injury / Illness / Near-Miss / Property Damage / Environmental Damage			
If fatality, date of death: ____ / ____ / ____			
Nature of the Event: (brief summary including body parts affected and/or property that was damaged)			
Object or substance that directly harmed the employee or property: (Leave blank if not applicable)			
Task Being Performed Just Prior To The Incident: (Describe the work objective, the specific activity being carried out, and any tools or equipment being used)			

Incident Investigator to fill out:	
Reportable / Recordable / Non-Recordable / Near Miss / Property Damage / Environmental Damage	Case Number from OSHA 300 Log:
Site:	Project Number:
Did the incident involve a vehicle? (include full description of vehicle and rental agency information if appropriate)	
Full Description of Incident: (include task being performed, how the event occurred, equipment being used at the time, materials involved, workplace condition, and any other impacts)	
Was First Aid Given? (Yes or No – Skip to next section if No)	
	Name of First Aid Attendant(s):
	List First Aid Given:
Was Medical Treatment Beyond First Aid Necessary? (Yes or No – Skip to next section if No)	
	Was Employee Treated in an Emergency Room? (Yes or No)
	Was Employee Hospitalized overnight as an in-patient? (Yes or No)
	Type of Emergency Transportation: (i.e., ambulance)
	Location of Medical Treatment Facility: Name: Address: Phone number:
	Name of Doctor Providing Medical Treatment:
	Expected Length of Medical Leave Resulting from Incident:
	Medical Diagnosis:
Section 1 Completed by: _____ Title: _____ Phone: _____ Date: _____	

SECTION 1

Incident Investigator to fill out:	
Reportable / Recordable / Non-Recordable / Near Miss / Property Damage / Environmental Damage	Case Number from OSHA 300 Log:
Site:	Project Number:

SECTION 2: INVESTIGATION REPORT (to be filled out by Incident Investigator)	SECTION 2																													
Witness statements: (attach sheets as necessary, or NA if no witnesses)																														
Evidence collected:																														
Factors in Incident: (check all that apply) <table style="width: 100%; border: none;"> <tr> <td><input type="checkbox"/> Mental stress factor</td> <td><input type="checkbox"/> Fatigue</td> <td><input type="checkbox"/> Remote site health</td> </tr> <tr> <td><input type="checkbox"/> Alcohol/drugs</td> <td><input type="checkbox"/> Exposure to sound/noise</td> <td><input type="checkbox"/> Exposure to particulates</td> </tr> <tr> <td><input type="checkbox"/> Biological exposure</td> <td><input type="checkbox"/> Mechanical vibration</td> <td><input type="checkbox"/> Cold Stress</td> </tr> <tr> <td><input type="checkbox"/> Chemical exposure</td> <td><input type="checkbox"/> Travel health</td> <td><input type="checkbox"/> Heat Stress</td> </tr> <tr> <td><input type="checkbox"/> Exposure to ionizing radiation</td> <td><input type="checkbox"/> Exposure to non-ionizing radiation</td> <td><input type="checkbox"/> Pre-existing medical condition</td> </tr> <tr> <td><input type="checkbox"/> Exposure to gas or vapour</td> <td><input type="checkbox"/> Repetitive movements</td> <td><input type="checkbox"/> Working at height</td> </tr> <tr> <td><input type="checkbox"/> Other muscular stress</td> <td><input type="checkbox"/> Other health/exposure</td> <td><input type="checkbox"/> Workplace design</td> </tr> <tr> <td><input type="checkbox"/> Non-compliance</td> <td><input type="checkbox"/> Equipment/property design</td> <td><input type="checkbox"/> Lifting/Hoisting</td> </tr> <tr> <td><input type="checkbox"/> Electrical</td> <td><input type="checkbox"/> Equipment/property fire</td> <td><input type="checkbox"/> Equipment/property damage</td> </tr> <tr> <td><input type="checkbox"/> Equipment failure</td> <td><input type="checkbox"/> Housekeeping</td> <td><input type="checkbox"/> Not otherwise specified</td> </tr> </table>		<input type="checkbox"/> Mental stress factor	<input type="checkbox"/> Fatigue	<input type="checkbox"/> Remote site health	<input type="checkbox"/> Alcohol/drugs	<input type="checkbox"/> Exposure to sound/noise	<input type="checkbox"/> Exposure to particulates	<input type="checkbox"/> Biological exposure	<input type="checkbox"/> Mechanical vibration	<input type="checkbox"/> Cold Stress	<input type="checkbox"/> Chemical exposure	<input type="checkbox"/> Travel health	<input type="checkbox"/> Heat Stress	<input type="checkbox"/> Exposure to ionizing radiation	<input type="checkbox"/> Exposure to non-ionizing radiation	<input type="checkbox"/> Pre-existing medical condition	<input type="checkbox"/> Exposure to gas or vapour	<input type="checkbox"/> Repetitive movements	<input type="checkbox"/> Working at height	<input type="checkbox"/> Other muscular stress	<input type="checkbox"/> Other health/exposure	<input type="checkbox"/> Workplace design	<input type="checkbox"/> Non-compliance	<input type="checkbox"/> Equipment/property design	<input type="checkbox"/> Lifting/Hoisting	<input type="checkbox"/> Electrical	<input type="checkbox"/> Equipment/property fire	<input type="checkbox"/> Equipment/property damage	<input type="checkbox"/> Equipment failure	<input type="checkbox"/> Housekeeping
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Incident Investigator to fill out:																																																
Reportable / Recordable / Non-Recordable / Near Miss / Property Damage / Environmental Damage				Case Number from OSHA 300 Log:																																												
Site:			Project Number:																																													
Actual Consequence Level (1 to 5 from Section 3.0 of Incident Investigation Program)																																																
<p>Potential Risk Classification Table (This table is used for any incident, near-miss, or property or environmental damage to determine if the Actual Consequence Level was a reasonably expected outcome or if the outcome could have been even worse. If the Maximum Reasonable Outcome was High or Critical, Corrective Actions must be put in place to lower future Reasonable Outcomes.)</p> <table border="1" style="margin: 10px auto; border-collapse: collapse; text-align: center;"> <tr> <th colspan="2" rowspan="2"></th> <th colspan="5">Consequence</th> </tr> <tr> <th>1 Minor</th> <th>2 Medium</th> <th>3 Serious</th> <th>4 Major</th> <th>5 Catastrophic</th> </tr> <tr> <th rowspan="5" style="writing-mode: vertical-rl; transform: rotate(180deg);">Probability</th> <th>A – Almost Certain</th> <td>Moderate</td> <td>High</td> <td>Critical</td> <td>Critical</td> <td>Critical</td> </tr> <tr> <th>B – Likely</th> <td>Moderate</td> <td>High</td> <td>High</td> <td>Critical</td> <td>Critical</td> </tr> <tr> <th>C – Possible</th> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Critical</td> <td>Critical</td> </tr> <tr> <th>D – Unlikely</th> <td>Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>Critical</td> </tr> <tr> <th>E – Rare</th> <td>Low</td> <td>Low</td> <td>Moderate</td> <td>High</td> <td>High</td> </tr> </table>								Consequence					1 Minor	2 Medium	3 Serious	4 Major	5 Catastrophic	Probability	A – Almost Certain	Moderate	High	Critical	Critical	Critical	B – Likely	Moderate	High	High	Critical	Critical	C – Possible	Low	Moderate	High	Critical	Critical	D – Unlikely	Low	Low	Moderate	High	Critical	E – Rare	Low	Low	Moderate	High	High
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Max Reasonable Probability (A to E)																																																
Summary of Investigation Findings:																																																

Incident Investigator to fill out:	
Reportable / Recordable / Non-Recordable / Near Miss / Property Damage / Environmental Damage	Case Number from OSHA 300 Log:
Site:	Project Number:
Corrective Actions Taken to Prevent Recurrence of Event:	
Date Corrective Actions Implemented: ____ / ____ / ____	
Risk Analysis: (does the corrective action generate a new risk?)	
<div style="border: 1px solid black; padding: 5px; display: inline-block; transform: rotate(-90deg); transform-origin: center;">SECTION 2</div>	
Section 2 Completed by: _____ Title: _____	
Phone: _____ Date: _____	

List of Necessary Contacts for Notification of Incident:

- INTERA Corporate Health and Safety Officer
- INTERA Branch Office Health and Safety Coordinator
- INTERA Project Manager, as applicable
- INTERA Human Resources Manager
- Client Project Manager, as applicable
- OSHA, as applicable

Form 6

Site Visitor Log

SITE VISITOR LOG

Project Title & Task: _____ Project Number: _____

Date	Name/Signature	Company/Organization	Purpose of Visit	Arrival Time	Departure Time

Form 7



Vehicle Inspection Checklist

PASSENGER VEHICLE INSPECTION CHECKLIST

Project Title & Task: _____

Name of Inspector: _____ Project Number: _____

License Plate: _____ Make/Model/Color: _____

Insert a check mark  if ok, or an  if there is an item deficiency.

Date							
Tire inflation							
Lug nuts							
Exhaust System							
Brakes							
Parking brake							
Engine lubricants							
Engine Coolants							
Steering							
Windshield							
Windshield Wipers							
Heater / Defroster							
Head / tail lights							
Turn indicators							
Instrument gauges							
<i>Initials of Operator</i>							

DESCRIPTION OF DEFICIENCIES: _____

REMEDY FOR DEFICIENCIES: _____

COMMENTS: _____



HEAVY EQUIPMENT INSPECTION CHECKLIST

Project Title & Task: _____

Date: _____ Project Number: _____

Name of Inspector: _____

License Plate: _____ Make/Model/Color: _____

Insert a check mark  if ok, or an  if there is an item deficiency.

FROM THE GROUND

Bucket or Blade	Excessive Wear or Damage, Cracks	
Bucket or Blade Cylinder & Linkage	Excessive Wear, Damage, Leaks, Lubricate	
Stick, Cylinder	Wear, Damage, Leaks, Lubricate	
Boom, Cylinders	Wear, Damage, Leaks, Lubricate	
Underneath Machine	Final Drive Leaks, Swing Drive Leaks, Damage	
Track Sag	Tightness, Wear	
Pivot Shafts	Oil Leaks	
Carbody	Cracks, Damage	
Undercarriage	Wear, Damage, Tension	
Steps and Handholds	Condition and Cleanliness	
Batteries & Hold Downs	Cleanliness, Loose Bolts & Nuts	
Windshield Wipers & Washers	Wear, Damage, Fluid Level	
Fire Extinguisher	Charge, Damage	
Engine Coolant	Fluid Level	
Primary/Secondary Fuel Filters	Leaks, Drain Water Separator	
Air Filter	Restriction Indicator	
Hydraulic Oil Tank	Fluid Level, Damage, Leaks	
Hydraulic Oil	Filter Leaks	
Radiator	Fin Blockage, Leaks	
Hydraulic Oil Cooler	Fin Blockage, Leaks	
AC Condenser	Fin Blockage, Leaks	
Lights and Mirrors	Damage	
Engine Oil Filter	Filter Leaks	
Hydraulic Oil Filter	Filter Leaks	
Overall Machine	Loose/Missing Nuts, Bolts, Guards, Cleanliness	

ENGINE COMPARTMENT

Engine Oil	Fluid Level	
Gear Oil	Fluid Level, Leaks	
Fuel Tank	Fuel Level, Damage, Leaks	
All Hoses	Cracks, Wear Spots, Leaks	
All Belts	Tightness, Wear, Cracks	
Overall Engine Compartment	Trash or Dirt Buildup, Leaks	

INSIDE THE CAB

Seat	Adjustment	
Seat belt & Mounting	Damage, Wear, Adjustment, Age	
Horn, Travel Alarm, Lights	Proper Function	
Indicators	Proper Function	
Monitor Panel	Proper Function	
Switches	Proper Function	
Travel Controls	Correct Operation	
Mirrors Adjustment	Adjustment, Cracks/Broken	
Heating and Cooling System	Proper Function	
Overall Cab Interior	Overall Cab Interior Cleanliness	

COMMENTS: _____

Form 8

Hot Work Permit

HOT WORK PERMIT

All temporary operations involving open flames or producing heat and/or sparks require a Hot Work Permit. This includes, but is not limited to, Brazing, Cutting, Grinding, Soldering, Thawing, and Welding.

INSTRUCTIONS FOR SAFETY SUPERVISOR

1. Verify precautions listed at right (or do not proceed with the work).
2. Complete page 1 and retain for job files.
3. Post page 2 in vicinity of hot work.

Date	Job No.
Location (Be Specific)	
Description of Work Being Performed	
Name of Person/Contractor Doing Hot Work	
The above location has been examined, the precautions checked on the Hot Work Checklist have been taken to prevent fire, and permission is authorized for this work.	
Signed: _____ (Permit Authorizing Individual)	
Signed: _____ (Person doing Hot Work)	
Signed: _____ (Fire Watch)	
Time Started: Date: _____ Time: _____ AM/PM	
Date: _____ Time: _____ AM/PM	
FIRE WATCH SIGNOFF Work area and all adjacent areas to which sparks and heat might have spread were inspected during the fire watch period and were found fire safe. Signed: _____	
FINAL CHECKUP (minimum 30 minutes after Hot Work) Work area was monitored for _____ hour(s) following Hot Work and found fire safe. Signed: _____	

HOT WORK CHECKLIST

OK NA

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Hot Work Equipment in good condition (e.g., power source, welding leads, torches, etc.). |
| <input type="checkbox"/> | <input type="checkbox"/> | Multi-purpose fire extinguisher and/or water pump can. |

REQUIREMENTS WITHIN 35 FEET OF WORK

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Debris, flammable Liquids, dry weeds, flammable solids, and oily deposits removed. |
| <input type="checkbox"/> | <input type="checkbox"/> | Explosive atmosphere in area checked for and eliminated. |
| <input type="checkbox"/> | <input type="checkbox"/> | Combustible surfaces wet down and covered with damp sand or fire blankets. |
| <input type="checkbox"/> | <input type="checkbox"/> | Remove flammable and combustible material where possible. Otherwise protect with fire blankets, guards, or metal shields. |

WORK IN CONFINED SPACES

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Confined space cleaned of all combustibles (example: grease, oil, flammable vapors). |
| <input type="checkbox"/> | <input type="checkbox"/> | Containers purged of flammable liquids/vapors. |
| <input type="checkbox"/> | <input type="checkbox"/> | Follow confined space guidelines. |

FIRE WATCH/HOT WORK AREA MONITORING

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Fire watch will be provided during and for 30 minutes after work, including any coffee or lunch breaks. |
| <input type="checkbox"/> | <input type="checkbox"/> | Fire watch is supplied with an extinguisher, and/or water pump can, also making use of other extinguishers located throughout work area. |
| <input type="checkbox"/> | <input type="checkbox"/> | Fire watch is trained in use of this equipment and familiar with fire notification procedures. |
| <input type="checkbox"/> | <input type="checkbox"/> | Fire watch may be required for opposite side of vent shafts, plates, scrap metal, etc. |
| <input type="checkbox"/> | <input type="checkbox"/> | Post warning sign when others are working in the vicinity |

OTHER PRECAUTIONS TAKEN (LIST)

WARNING!

HOT WORK IN PROGRESS WATCH FOR FIRE!

IN CASE OF AN EMERGENCY:

CALL: FIRE DEPARTMENT

AT: 911

WARNING!

Attachment A

Job Safety Analysis Program

TABLE OF CONTENTS

1.0	PURPOSE.....	1
2.0	RESPONSIBILITY.....	1
3.0	PROCEDURES FOR COMPLETING A JSA AND PPE EVALUATION	1
4.0	TRAINING	4

LIST OF FORMS

Form 1: Job Safety Analysis and Personal Protective Equipment Worksheet

1.0 PURPOSE

The purpose of this Job Safety Analysis (JSA) and Personal Protective Equipment (PPE) Plan (Plan) is to provide for the protection of employees from workplace hazards by training them to identify the hazards or potential risks associated with each step of the job and to develop a solution for each hazard that will eliminate, reduce or control the exposure to the hazard. This Plan will result in a series of JSAs (which include PPE evaluations) that provide written, step-by-step procedures for reducing hazards for routine and non-routine project tasks/jobs, as necessary, along with the required PPE for each step. This Plan is an integral piece of the overall INTERA Corporate Health and Safety Program (CHSP).

2.0 RESPONSIBILITY

The Corporate Health and Safety Officer is designated as the Plan Administrator and, as such, is responsible for the implementation of the Plan and has full authority to make the decisions necessary to provide for the success of the Plan. This authority includes hiring personnel and purchasing the equipment necessary to implement and operate the Plan. Branch Health and Safety Coordinators are the designated representative of the Corporate Health and Safety Officer, and are responsible for implementation and operation of the Plan in each branch office. The Plan has been developed in accordance with the requirements of 29 CFR 1910.132 and covers each of the basic elements in the regulations. The Corporate Health and Safety Officer will review the Plan annually and will amend these instructions when necessary.

INTERA employees whose work includes performing field activities at client sites and locations that where job hazards may exist (including, but not limited to, hazardous wastes) and/or PPE is required for the safe conduct of work will be trained to the Plan. The Corporate Health and Safety Officer or Branch Health and Safety Coordinator will be responsible for ensuring that these employees are trained in the provisions of this Plan.

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Employees are encouraged to communicate their health and safety concerns to the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace. Additionally, the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers have the authority to halt operations because of non-compliance with the provisions of this Plan. It is the responsibility of the Site Safety Officer to inspect field project areas for compliance with the Plan.

3.0 PROCEDURES FOR COMPLETING A JSA AND PPE EVALUATION

JSAs (which include PPE evaluations) should be completed for each routine and non-routine project task, as necessary, prior to that task being performed and when there are changes in the steps of the task. The JSA process is to be used when required by the host facility, when directed by the Corporate Health and Safety Officer, Branch Office Health and Safety Coordinator, Project Manager or Site Safety Officer, or when the Risk Hazard Rank presented below is moderate or higher. By developing JSAs, which include a PPE evaluation, and using them for employee training, employees will have a better idea of the hazards involved with the various tasks/jobs that they may perform during conduct of activities in the field. JSAs will allow employees to think about the steps required to complete each task, to identify the hazards associated with each step of the task, and to eliminate, reduce or control the identified hazards including the appropriate PPE to use to mitigate the hazard. Employees who are new to a job will receive instructions in hazard avoidance in a logical, organized manner, and employees who are familiar with the job will be reminded of

tasks that require more attention to detail in order to complete them safely. Safety observations can be made by using the completed JSA as a guide during the safety audit review process described in the Behavior-Based Safety Program in **Appendix 13** or as part of the Incident Investigation procedures in **Appendix 3**.

Create the Right Environment

Personnel who complete JSAs should be employees who have good attention to detail, think logically, and have a good grasp of the procedures required to complete each task/job. JSAs should be completed in advance of the activity being performed, although it is acceptable to fill it out at the site, immediately before the task will be performed. At the beginning of each work day, applicable JSAs should be incorporated into the Safety Meeting attended by everyone who will be involved with the task(s) (including subcontractors). Items to discuss during the Safety Meeting include the proper steps necessary to complete each task/job, associated hazards with each step and the procedures to be used to eliminate, reduce or control the identified hazards, including use of appropriate PPE. The hazard assessment is meant to determine if hazards are present, or are likely to be present, that necessitate the use of PPE or other hazard mitigation measures. PPE will be selected that best protects affected employees from the hazards identified. Written certification that the hazard assessment has been completed is required per 1910.132(d)(2) and is accomplished through completion of the form **Job Safety Analysis and Personal Protective Equipment Worksheet** which is included as **Form 1** at the end of this Plan. Worksheets will be kept with the Site-Specific Health and Safety Plan (SSHASP) or on file in designated corporate health and safety file cabinets and/or each branch office, as appropriate. Employees need to know that the purpose of the JSA is to study the job and make it standardized and safer. Workers are welcome to add to the JSA whenever they feel a hazard exists that has not been identified as part of the task and has not already been addressed in the JSA.

Identify Job Steps

When completing a JSA Worksheet, attached as **Form 1** to this Plan, step numbers are listed in the first column of the worksheet followed by a description of the step in the worksheet of an action in the second column of the worksheet. The wording for each job step should begin with an "Action" word like "remove," "open," or "weld." The action is completed by naming the item to which the action (verb) applies; for example, "remove extinguisher," "aim hose," "squeeze lever."

Identify Potential Hazards and Sources of Hazards

In the 3rd and 4th columns of the worksheet, hazards and hazard sources should be listed for each step. Employees and subcontractors may be actively involved in the hazard identification process, as appropriate. Examples of hazards are "head injuries," "electric shock," or "trench collapse." Examples of hazard sources are "overhead equipment," "working around high voltage," or "working in trenches." Examples of mitigation procedures are "wear hardhat that is properly fitted and in good condition", "follow proper lock out/tag out procedures" or "follow proper trench collapse protection procedures". The JSA should identify hazards that are present or could be present along with any problems that have occurred in the past. Additionally, for each identified hazard, a method for mitigating the exposure to the hazard should be identified. The purpose of the JSA is to identify hazards produced by the environment (tools, workstation, and site) as well as hazards connected with the job procedure. The following list of questions that will serve as initial training in identifying hazards

1. Is there a danger of striking against, being struck by, or otherwise being injured by contacting an object?
2. Can the worker be caught in, on, or between objects?
3. Can the worker slip or trip? Could they fall on the same level or to another?

4. Can the worker strain themselves by pushing, pulling, or lifting?
5. Is the environment hazardous (toxic gasses, vapors, mists, fumes, dusts or heat)?
6. Can the tools cause a problem, can they cut, fail or malfunction?
7. Can things splash or be thrown toward the employee?
8. Could dangers be created if the task steps are completed out of sequence?
9. Are there gages or other instruments that must be watched and reacted to properly if the job is to be done safely?

Risk Hazard Rank

In the next three columns, the identified hazards should be described in terms of probability, consequence and hazard classification, according to the table below. The probability, or likelihood, that the hazard will occur should be ranked from A (almost certain) to E (rare), and the consequence, or severity, of the injury if it were to happen, should be ranked from 1 (minor) to 5 (catastrophic). The consequence and probability should then be cross-referenced in the table below to determine the classification of the hazard, from low to critical. The classification of the hazard can then be used to prioritize hazard mitigation controls and show workers where they need to pay the most attention on the job.

		Consequence				
		1 Minor	2 Medium	3 Serious	4 Major	5 Catastrophic
Probability	A – Almost Certain	Moderate	High	Critical	Critical	Critical
	B – Likely	Moderate	High	High	Critical	Critical
	C – Possible	Low	Moderate	High	Critical	Critical
	D – Unlikely	Low	Low	Moderate	High	Critical
	E – Rare	Low	Low	Moderate	High	High

Develop Recommendations for PPE

In the next four columns, a determination for the required PPE is made. Columns 8 and 9 indicate the body part and type of affect anticipated by the hazard identified for the job step such as, the hazard is a contaminated groundwater during water well sampling, the body part impacted could be the eyes, and the type of affect could be chemical splash. Then in columns 10 and 11 eleven, whether PPE is necessary and what type of PPE would be required. In our example column ten would indicate yes and 11 would indicate splash-proof glasses/goggles.

The results of this assessment will be included in the SSHASP. Employees will be notified of the JSA results and the reasons why specific types of PPE were chosen for the work activities. The types of PPE selected for specific work activities will be also be defined in the SSHASP, which employees must read and sign prior to commencing work (refer to the [Site Personnel Acknowledgement Form in Appendix 9](#)). Acknowledgement Forms will be kept with the SSHASP in project files for the duration of the project.

Employees will be provided with the proper, clean, and reliable PPE for the job at no charge to the employee. Efforts will be made (when practical) to provide the employees with a selection of PPE types so they can choose the best PPE for their needs and comfort. Employees are responsible for inspecting their personal protective equipment before each use. If it is damaged or defective, or even appears so, it is not to be used, and the employee is to obtain replacement PPE. INTERA must pre-approve the use of any employee-provided PPE.

Develop Recommendations for Mitigating Hazards

In the last column, the Hazard Mitigation Control should be listed for each step of the process. Hazard Mitigation Controls must be specific and concrete. General precautions like “Be alert,” “Use caution,” or “Be careful” are not useful. Mitigation controls should precisely state what to do and how to do it. This recommendation – “make certain the wrench does not slip or cause loss of balance” is only partially helpful. It does not tell how to prevent the wrench from slipping. An effective mitigation control tells both “what” and “how” as illustrated by the following example: “Set wrench securely. Test its grip by exerting a slight pressure on it. Brace yourself against something immovable, or take a solid stance with feet wide apart, before exerting pressure. This prevents loss of balance if the wrench slips.”

Proper Job Instruction

After the JSA has been completed, it should be readily available to all workers for review during the Daily Safety Meetings. JSAs will also be available at the job site if questions arise regarding how to perform the job safely and efficiently. JSAs should be reviewed daily and at the beginning of each task and are not to be used only for occasional reference, such as when an incident occurs.

When conducting training on job-specific JSAs and PPE:

1. Have a plan. By reading the JSA, the trainer can obtain the knowledge to do the job correctly and safely. Convey to the employee how much skill you expect him/her to have and how soon you expect them to have that skill.
2. Have everything ready. The right equipment, materials, PPE and supplies should be in place before you begin teaching the employee so the steps will occur in an orderly, organized fashion. Have the workplace arranged as the employee will see it when they work and as they are expected to keep it.

Job-specific training will be performed by the Project Manager or Site Safety Officer at the beginning of the job and whenever job duties change. Training will be documented on the **Daily Safety Meeting Form**, which can be found in **Appendix 9** of this CHSP.

4.0 TRAINING

INTERA employees who are working in areas where job hazards may exist or who may be required to use and wear PPE will be trained in the contents of this Plan. Training to the Plan is accomplished through reading and acknowledgement. Employees receive a copy of the JSA and PPE Plan (**Appendix 12** of the CHSP) at commencement of employment and after each revision. Employees working in an area where job hazards may exist or identified as having to use and wear PPE are required to sign the Acknowledgment page at the front of the Plan confirming that they have read, understood, are familiar with, and will comply with the standards that have been established in the Plan. Signing of an Acknowledgment page is also required upon receipt of revisions to the Plan. Signed acknowledgement pages will be kept with a master copy of the CHSP on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files.

In addition, employees that are working in areas where job hazards exist or who use and/or need to wear PPE will be trained before start of work at each site where job hazard exist or that requires the use of PPE

as specified by 29 CFR 1910.132. Site-specific job safety training and PPE training will be documented using the **Safety Meeting Attendance Form** at the beginning of each project. Daily review of site requirements for JSAs and PPE will also be recorded on the **Safety Meeting Attendance Form** along with additional training in the event that PPE requirements change. The **Safety Meeting Attendance Form** is included in **Appendix 9** of this CHSP. PPE training will include the following:

- When PPE is necessary;
- What PPE is necessary;
- How to properly don, doff, adjust and wear PPE;
- Limitations of the PPE; and
- The proper care, maintenance, useful life and disposal of the PPE.

Retraining is required under the following circumstances:

- Changes in workplace render previous training obsolete;
- Changes in the types of PPE to be used render previous training obsolete; and
- Inadequacies in an employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

In addition to the initial and site-specific PPE training as described above, annual PPE training and review is provided for employees that may be exposed to hazardous substances as part of their OSHA 40-hour HAZWOPER training and annual 8-hour refresher training for general site workers. PPE training records will be kept on file in designated health and safety file cabinets in the corporate office and/or each branch office, as appropriate.

JOB SAFETY ANALYSIS (JSA) AND PERSONAL PROTECTIVE EQUIPMENT (PPE) WORKSHEET

Project Site Evaluated: _____ Project Task Evaluated: _____

Name of Person Completing Assessment: _____ Project Number: _____ Date: _____

Use additional sheets as necessary.

<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	
<div>Step #</div> <div>DESCRIPTION OF JOB STEP:</div>	POTENTIAL HAZARD	RISK HAZARD RANK PROBABILITY	BODY PART AFFECTED:	HAZARD MITIGATION CONTROL:
			TYPE OF AFFECT:	
	SOURCE OF POTENTIAL HAZARD	CONSEQUENCE	IS PPE REQUIRED?	
		HAZARD CLASSIFICATION	TYPE OF PPE REQUIRED:	

JOB SAFETY ANALYSIS (JSA) AND PERSONAL PROTECTIVE EQUIPMENT (PPE) WORKSHEET

Project Site Evaluated:		Overall Hazard Classification (use highest code from each step): Critical						
PNM Former Santa Fe Generating Station								
Project Task Evaluated: Groundwater Sampling		Consequence						
		1 Minor	2 Medium	3 Serious	4 Major	5 Catastrophic		
Prepared by (Name/Title):		Probability	A - Almost Certain	Moderate	High	Critical	Critical	Critical
			B - Likely	Moderate	High	High	Critical	Critical
Project Number:			C - Possible	Low	Moderate	High	Critical	Critical
			D - Unlikely	Low	Low	Moderate	High	Critical
Date: 1/22/15; 2/27/15 (revised); 1/9/18 (revised)			E - Rare	Low	Low	Moderate	High	High

Job Step #1: Loading/ Unloading Vehicle	POTENTIAL HAZARD: Personnel injury/damage to vehicle or equipment		SOURCE OF POTENTIAL HAZARD: Lifting heavy objects, loading/arranging sampling materials	
	RISK HAZARD RANK	PROBABILITY: Likely	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: High
	BODY PART AFFECTED: Back, joints, hands, feet			
	TYPE OF AFFECT: Strained back, pulled muscles, joint pain, foot injuries if objects dropped while loading/unloading; property damage			
	TYPE OF PPE REQUIRED: Leather gloves and/or steel-toed boots depending on nature of items being loaded			
	HAZARD MITIGATION: *Use proper lifting procedures, i.e., lift with legs not the back *Get assistance when loading heavy equipment, as needed *Wear leather gloves *Secure items with ratchet-straps or bungee cords *Avoid overloading a truck/trailer to prevent items falling off during transport			

Job Step #2: Travel to/within Site	POTENTIAL HAZARD: Traffic accidents, personnel injury, vehicle damage		SOURCE OF POTENTIAL HAZARD: Dangerous road conditions, unsafe driving, vehicle malfunction	
	RISK HAZARD RANK	PROBABILITY: Possible	CONSEQUENCE: Major	HAZARD CLASSIFICATION: Critical
	BODY PART AFFECTED: Whole body			
	TYPE OF AFFECT: Serious physical trauma/personal injury; property damage			
	TYPE OF PPE REQUIRED: Buckled seatbelts are required when vehicle is in motion, high-visibility safety vests when working in traffic areas			
HAZARD MITIGATION: *Practice safe/defensive driving *Don't drive distracted, no mobile phone use while driving, do not attempt to set or change navigation system while driving *Keep updated on weather and road conditions *Ensure vehicle is properly maintained, know location of spare tire and know process for changing flat tire *Always park in areas away from heavy traffic, use the buddy system when backing up, parking, and/or driving in tight spaces				
Job Step #3: General Movement Around Site	POTENTIAL HAZARD: Slips, trips, falls, damage to equipment		SOURCE OF POTENTIAL HAZARD: Slip, trips, and falls due to uneven terrain, construction conditions, weather conditions (e.g., snow, mud)	
	RISK HAZARD RANK	PROBABILITY: Likely	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: High
	BODY PART AFFECTED: Whole body			
	TYPE OF AFFECT: Abrasions, broken bones, sprains			
	TYPE OF PPE REQUIRED: Sturdy boots with good ankle support			
HAZARD MITIGATION: *Inspect work area prior to beginning work, be aware of site conditions and variability in surface terrain *Wear appropriate footwear, de-ice or shovel icy areas, use hand rails where installed *Inspect slopes for stability prior to walking up/down, communicate location to coworker prior to entering uneven terrain or when working in separate location *Do not be in a hurry, take measured steps, and be sure that footing is stable Eyes on path				

Job Step #4: Well Location/ Excavation	POTENTIAL HAZARD: Personnel injury/damage to equipment		SOURCE OF POTENTIAL HAZARD: Improper equipment use, dropped equipment	
	RISK HAZARD RANK	PROBABILITY: Likely	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: High
	BODY PART AFFECTED: Whole body			
	TYPE OF AFFECT: Physical trauma/personal injury; property damage			
	TYPE OF PPE REQUIRED: leather gloves			
	HAZARD MITIGATION: *Inspect work area prior to beginning work *Use proper tools/equipment (breaker bar, chisel, rock hammer, mallet, shovel, etc.) *Use proper gloves for task *Attempt to locate the well with a scaled map and measuring tools prior to the excavation so as not to unearth/strike something other than the well			
	Job Step #5: Opening Well Vaults	POTENTIAL HAZARD: Bug bites, pinches, cuts, bruising, injury from lifting		SOURCE OF POTENTIAL HAZARD: Insects living in well vault, well vault lid, collapsed/damaged well vault, improper lifting
RISK HAZARD RANK		PROBABILITY: Likely	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: High
BODY PART AFFECTED: Exposed body parts: hands, head, feet; back				
TYPE OF AFFECT: Allergic reaction, pain, swelling; strained back				
TYPE OF PPE REQUIRED: Work gloves; steel-toed boots; bug repellent/spray				
HAZARD MITIGATION: *Lift properly including with a partner, lever, and with the legs; use tools when practical *Assess well condition to determine proper tool for the job *Do not reach hands into dark areas/spaces where snakes or insects may be hiding; clear before accessing *Be aware of any field staff that may be allergic to bee stings, etc. and have appropriate medication on hand, if needed				

Job Step #6: Measuring Water Levels	POTENTIAL HAZARD: Pinch, friction, burn, splashes, caught between		SOURCE OF POTENTIAL HAZARD: Measurement tape, moving spool, improper technique	
	RISK HAZARD RANK	PROBABILITY: Likely	CONSEQUENCE: Medium	HAZARD CLASSIFICATION: High
	BODY PART AFFECTED: Hands, face			
	TYPE OF AFFECT: Cuts, friction burn, chemical effects due to exposure to contaminated water			
	TYPE OF PPE REQUIRED: Safety glasses with splash shield, chemical resistant gloves			
	HAZARD MITIGATION: *Lower and raise tape at an appropriate speed *When measuring larger depths, decontaminate on the way down or use a wetted paper towel *Use a partner for great depths *Practice Safety in Motion techniques			
	Job Step #7: Use of Hand Tools and Power Tools	POTENTIAL HAZARD: Personnel injury/electric shock or damage to equipment		SOURCE OF POTENTIAL HAZARD: Damaged hand tools, power tools, or power cords; improper use
RISK HAZARD RANK		PROBABILITY: Possible	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: High
BODY PART AFFECTED: Whole body				
TYPE OF AFFECT: Abrasions, cuts, electric shock, burns				
TYPE OF PPE REQUIRED: work gloves				
HAZARD MITIGATION: *Ensure proper use per manufacturer guidelines and/or user manual *Tools should be used by trained personnel only *Inspect tools prior to use for broken parts, missing parts, worn power cords, etc. *Ensure guards are in place *Operate within designed limits				

Job Step #8: Groundwater Sampling	POTENTIAL HAZARD: Chemical burns, exposure to heavy metals or other contaminants in groundwater		SOURCE OF POTENTIAL HAZARD: Spills or other contact with preservatives in groundwater sampling bottles, ingestion or skin contact with groundwater		
	RISK HAZARD RANK	PROBABILITY: Possible	CONSEQUENCE: Medium	HAZARD CLASSIFICATION: Moderate	
	BODY PART AFFECTED: Skin, lungs, whole body				
	TYPE OF AFFECT: Burns on skin or breathing pathway; see SDSs for chemical-specific affects on body				
	TYPE OF PPE REQUIRED: Safety glasses with splash guard, chemical-resistant gloves (nitrile)				
HAZARD MITIGATION: *Avoid skin contact with preservatives *Read and understand applicable Safety Data Sheets *Avoid contact with contaminated groundwater including contact with bare skin and inhalation of vapors *Be aware of purge water location *Wash hands before eating, drinking or applying cosmetics/sunscreen *Avoid spilling filled sample bottles; ensure lids are tight; set on even surface; controlled pours					
Job Step #8 (con): Groundwater Sampling	POTENTIAL HAZARD: Weather conditions- heat stress, sunburn, cold stress, illness, slips, trips, falls, damage to equipment		SOURCE OF POTENTIAL HAZARD: Sun/heat, high humidity, cold temperatures, moisture preventing grip to tools, icy conditions		
	RISK HAZARD RANK	PROBABILITY: Possible	CONSEQUENCE: Medium	HAZARD CLASSIFICATION: Moderate	
	BODY PART AFFECTED: Whole body, skin, especially exposed skin and extremities				
	TYPE OF AFFECT: Dehydration, sunburn, heat cramps/exhaustion/stroke, hypothermia, frostbite, abrasions, cuts, broken bones				
	TYPE OF PPE REQUIRED: Sunscreen; hat; work gloves; warm and/or cold weather clothing, as appropriate				
	HAZARD MITIGATION: GENERAL: *Wear sunscreen and hat to prevent sun exposure *Work at a manageable (slower) speed *Stop work if conditions prevent safe work HOT: *Take frequent water and rest breaks, use buddy system to monitor for signs of heat stress COLD: *Wear appropriate cold weather clothing such as warm hat, gloves, coat , thermal socks, long underwear *Be aware of purge water and other wet spots that may ice in cold weather or otherwise create muddy/slick areas				

Job Step #8 (con): Groundwater Sampling	POTENTIAL HAZARD: Struck by, pushed against, and/or caught between		SOURCE OF POTENTIAL HAZARD: Interaction with other vehicles, moving parts, machines, or equipment	
	RISK HAZARD RANK	PROBABILITY: Unlikely	CONSEQUENCE: Serious	HAZARD CLASSIFICATION: Moderate
	BODY PART AFFECTED: Whole body			
	TYPE OF AFFECT: Serious physical trauma/personal injury; crushing injury; property damage			
	TYPE OF PPE REQUIRED: High-visibility safety vests, work gloves, steel-toed boots			
HAZARD MITIGATION: *Ensure that qualified personnel perform task *Inspect equipment inspected prior to use *Have awareness of surroundings and moving vehicles, eye contact, hand signals				

Attachment B

Behavior Based Safety Program

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LIST OF FORMS

Form 1: Behavior-Based Safety Encounter Form

1.0 PURPOSE

The purpose of this Behavior-Based Safety (BBS) Program is to maintain a superior organizational safety culture and communication throughout INTERA. A behavior-based safety approach promotes people-focused interventions, incorporating one-on-one or group observations of employees performing work tasks, setting goals for improving task safety and giving feedback on safety-related behavior. This Program is an integral piece of the overall INTERA Corporate Health and Safety Program (CHSP). The BBS Program is designed to:

- Engage, motivate, assist, reinforce and sustain safe behaviors,
- Examine motivation underlying behaviors in order to increase safe behavior,
- Be an on-going effort continually promoting sustainable, positive results,
- Emphasize increasing safe behaviors, and
- Aims to understand causes of incidents and near misses and correct them through behavior of appropriate people.

The BBS Program is a safety audit process that helps personnel identify and choose a safe behavior over an unsafe one. This process is designed to open the communication lines between personnel to reinforce safe behaviors and correct unsafe behaviors in order to eliminate incidents, including accidents and illnesses. Safety in the workplace is based on the following components:

- A specific person's physical capabilities, experience, and training.
- The environment the specific person works in, including engineering controls, equipment available for the task, and the job task itself.
- The specific person's behavior while performing the task.

The BBS Program is based on behavioral observations by someone not involved in the task, a review of the observations (both safe and unsafe behaviors), positive reinforcement on the safe behaviors, non-threatening feedback on the unsafe behaviors, and improvement goals. These observations provide direct, measurable information on safe work practices, and personnel should be aware that they may be observed at any time.

2.0 RESPONSIBILITY

The Corporate Health and Safety Officer (Amy Andrews) is designated as the Program Administrator and, as such, is responsible for this Program and has the authority to make necessary decisions regarding hiring personnel and purchasing the equipment necessary to implement and operate the Program. Branch Health and Safety Coordinators are the designated representative of the Corporate Health and Safety Officer and are responsible for implementation and operation of this Program in each branch office. The Corporate Health and Safety Officer will review the Program annually and will amend these instructions as necessary.

INTERA employees whose work includes performing field activities at client sites will be trained to this Program. The Corporate Health and Safety Officer or Branch Health and Safety Coordinator will be responsible for ensuring that these employees are trained in the provisions of this Program.

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Employees are encouraged to communicate their health and safety concerns to the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace. Additionally, the Corporate Health and Safety Officer,

Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers have the authority to halt operations because of non-compliance with the provisions of this Program. It is the responsibility of the Site Safety Officer to inspect field project areas for compliance with the Program.

3.0 GUIDANCE FOR PERFORMING BEHAVIOR-BASED SAFETY ENCOUNTERS

Employees performing behavior-based observations will be trained on how to accurately and effectively use the Behavior-Based Safety Encounter Form, Form 1 of this appendix. Initial training is provided in the following guidelines. Additional training will take place on-the-job by an experienced employee, Project Manager or Site Safety Officer or by third-party training consultants. Employees performing observations:

- shall inform the person that they are being observed and shall remain clearly visible during observation,
- shall look for both safe and at-risk behaviors,
- shall complete the Behavior-Based Safety Encounter Form, Form 1 of this appendix by completing the appropriate sections for the task being performed,
- shall consider what behaviors mean when observing, reporting and delivering feedback,
- shall consider feedback training and role play and/or mentoring and coaching when appropriate,
- shall give prompt and effective feedback based on the observation summarizing positive safety behaviors that were observed then one or two areas that require change.

Behavior-Based Safety Encounter Forms are available as Form 1 of this Appendix. The steps for a person conducting a BBS Encounter are as follows:

1. Identify a person doing a job task for observation.
2. Familiarize yourself with the potential risks of this task.
3. Observe the work being performed and ask yourself these questions:
 - a. Is the person wearing the proper Personal Protective Equipment (PPE) for the task?
 - b. Is the person following a logical sequence of work?
 - c. Is the person performing any safe or unsafe acts?
 - d. Are the working conditions safe?
4. After the person has finished the task (do not interrupt), approach him or her to discuss your observations.
5. Recognize and complement the person for specific safe behaviors.
6. Involve the person in a discussion of the task (ask questions, listen). Ask these questions:
 - a. What PPE is required for this task?
 - b. Is there a Job Safety Analysis or a Standard Operation Procedure (SOP) for this task?
 - c. Is there anything we can do to make your job safer and do you have safety concerns?
7. Review behaviors and conditions that could be improved and ask the person to make a personal commitment to improve at least one aspect of his or her work.
8. Thank the person for taking the time to participate in your Behavior-Based Safety Encounter.
9. Document the encounter. Behaviors to be improved only need to be documented on the form if it is necessary to inform someone other than the person involved in the encounter.

Completed Behavior-Based Safety Encounter Forms will be kept in the SSHASP, branch Health and Safety files and Corporate Health and Safety Files and reviewed annually to ensure that safe behaviors are being

continued. Completed Behavior-Based Safety Encounter Forms will be used to gather data and perform trend analysis. Whenever possible, at least four Behavior-based Safety Encounter Forms will be prepared each year for trend analysis which will be performed annually. Once the trend analysis is performed, if the trend analysis indicates a need for improvement, an action plan will be developed and communicated to employees by personal communication, safety meeting, or email. The action plan should be specific and focused on the safety elements in need of improvement.

4.0 TRAINING

INTERA employees whose work includes performing field activities at client sites will be trained to this Program. Training to the BBS Program is accomplished through reading and acknowledgement. Employees receive a copy of the BBS Program (**Appendix 13** of the CHSP) at commencement of employment and after each revision, and employees identified as performing field activities at client sites are required to sign the Acknowledgment page at the front of the BBSP confirming that they have read, understood, are familiar with, and will comply with the standards that have been established in the Program. Signing of an Acknowledgement page is also required upon receipt of revisions to the Program. Signed acknowledgement pages will be kept with a master copy of the CHSP on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files.

BEHAVIOR-BASED SAFETY ENCOUNTER FORM

Work Site Observed:		
Interaction Date:	Interaction Start Time:	Interaction Duration:
Observers Names:		
How many people were observed?		
Task Observed		
Interaction Comments:		
Was a pre-task hazard assessment conducted? (yes or no):		
If yes, what hazards were identified?		
Remedial Actions (Commitments by Participants):	Who:	Date to be completed:

BEHAVIOR-BASED SAFETY ENCOUNTER FORM (continued)

Interaction Categories		Select all the categories that apply and indicate a desired (✓) and/or undesired (✗) behaviour count for each.
Condition of Work Area		
<input type="checkbox"/> Work area Clean & Orderly	<input type="checkbox"/> Slips, Trips Fall Hazards	<input type="checkbox"/> Adequate lighting
<input type="checkbox"/> Work area barrier in place	<input type="checkbox"/> Air Quality	<input type="checkbox"/> Visibility to heavy equipment
Body position and ergonomics		
<input type="checkbox"/> Movements & positions - lifting / carrying	<input type="checkbox"/> Contact with-Electric current	<input type="checkbox"/> Movements & positions-Avoiding pinch points
<input type="checkbox"/> Movements & positions - overexertion / strain	<input type="checkbox"/> Movements & positions - bending / twisting	<input type="checkbox"/> Movements & positions - repetitive acts / movements
Body protection and PPE		
<input type="checkbox"/> Protecting hearing	<input type="checkbox"/> Protecting respiratory system	<input type="checkbox"/> Protecting the body
<input type="checkbox"/> Protecting the head	<input type="checkbox"/> Protecting the eyes / face	<input type="checkbox"/> Protecting the feet
<input type="checkbox"/> Protecting the hands / arms		
Equipment and tools		
<input type="checkbox"/> Tool / equipment selection - correct for job and proper use	<input type="checkbox"/> Tool/equipment selection - good condition/proper storage	<input type="checkbox"/> Pre-op equipment inspection
Practices and housekeeping		
<input type="checkbox"/> Controls implemented for identified hazards	<input type="checkbox"/> Hazardous materials - use and storage requirements followed	<input type="checkbox"/> Communicating with others about hazards / risks
<input type="checkbox"/> Rushing / multi-tasking	<input type="checkbox"/> Walking and working surfaces/platforms (clear and clean)	<input type="checkbox"/> Proper workplace housekeeping maintained
Procedures / permits		
<input type="checkbox"/> Proper procedures followed	<input type="checkbox"/> Management of change	<input type="checkbox"/> Run-off is controlled
<input type="checkbox"/> Work at heights (protecting from fall hazards)	<input type="checkbox"/> Lifting (following safe work practices)	<input type="checkbox"/> Isolation (proper use of lock-out/tag-out)
<input type="checkbox"/> Confined spaces (following safe work practices)	<input type="checkbox"/> Hot work (following safe work practices)	<input type="checkbox"/> Dust control procedures followed (minimizing dust)
<input type="checkbox"/> Hazardous materials - proper segregation & disposal	<input type="checkbox"/> Hydrocarbon pollution prevention measures taken	
Vehicles / mobile equipment and driving		
<input type="checkbox"/> Eyes on direction of travel	<input type="checkbox"/> Pre-shift inspection	<input type="checkbox"/> Securing parked vehicles
<input type="checkbox"/> Vehicle speed (driving to conditions / speed limits)	<input type="checkbox"/> Wearing seatbelt	<input type="checkbox"/> Operating Safely (interaction between people & equipment)
Weather		
<input type="checkbox"/> Protecting from cold stress	<input type="checkbox"/> Protecting from heat stress	<input type="checkbox"/> Protecting from lightning
<input type="checkbox"/> Protecting from rain	<input type="checkbox"/> Protecting from (UV exposure)	

Page ____ of ____

Attachment C

Heat and Cold Stress Casualty Prevention Program

HEAT & COLD STRESS

CASUALTY PREVENTION PLAN

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1.0 HEAT STRESS CASUALTY PREVENTION PLAN

The increase in ambient air temperature and decreased body ventilation caused by protective outerwear creates an increase in the potential for injury, specifically, heat stress. Site personnel will be instructed in the identification of heat stress, the first-aid treatment procedures for the worker, and the prevention of heat stress casualties.

1.1 Sources of Heat Stress

Any process or job site that is likely to raise the workers deep core temperature (often listed as higher than 100.4 degrees F (38°C)) raises the risk of heat stress. Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees. Outdoor operations conducted in hot weather especially those that require workers to wear semi-permeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

Age, weight, degree of physical fitness, degree of acclimatization, metabolism, dehydration, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury. Individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

1.2 Identification and Treatment of Heat Stress

Heat stress disorders include heat stroke (which can result in death), heat exhaustion (which can result in loss of consciousness, but responds well to treatment), heat cramps, heat rashes, and heat fatigue. The following sections list specifics on each condition, and how to treat the condition.

1.2.1 Heat Stroke

Heat Stroke is the most serious heat related disorder and occurs when the body's temperature regulation fails and body temperature rises to critical levels. The condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency that may result in death.

Symptoms: The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature (between 107°F and 110°F). Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly.

First Aid: If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady, cool area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the worker's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

1.2.2 Heat Exhaustion

Heat exhaustion can be a precursor to heat stroke. However, unlike heat stroke, heat exhaustion responds readily to prompt treatment.

Symptoms: Usually begins with headache, nausea, vertigo, muscle weakness, thirst, and giddiness. Vomiting is common and the bowels may move involuntarily. The worker is very pale, his skin is clammy, and he may perspire profusely. The pulse is weak and fast, and breathing is shallow. Heat collapse may occur unless he lies down. This may pass, but sometimes it remains and death could occur.

First Aid: Immediately remove the worker to in a shady or cool area with good air circulation (in Zone 2, the Contamination Reduction Zone, if at a contaminated site). Remove all protective outer wear. Treat the worker for shock (make him lie down, raise his feet 6-12 inches and keep him warm, but loosen all clothing). If the worker is conscious, it may be helpful to give him sips of a salt-water solution (one teaspoon of salt to one glass of water). If the worker does not respond quickly to first aid, obtain professional medical assistance.

1.2.3 Heat Collapse

Heat collapse is often associated with heat exhaustion. In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable and can be dangerous especially if workers are operating machinery or controlling an operation that should not be left unattended. The worker may also be injured when he or she faints.

Symptoms: Rapid loss of consciousness, other symptoms are similar to heat exhaustion or heat stroke.

First Aid: Check to see if the worker is breathing. If he or she is breathing, position the person on his or her back. Raise the worker's legs at least 12 inches above the ground.

Remove all protective outer wear as gently as possible. Loosen any restrictive clothing or belts. If the worker does not regain consciousness within one minute, call 911. Check the person's airway to make sure it is not obstructed. Check again to see if the person is breathing, coughing, or moving. These are signs of positive circulation. If these signs are absent, start CPR until emergency personnel arrive. If the worker regains consciousness, follow first aid guidance under heat exhaustion.

1.2.4 Heat Cramps

Heat Cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution ($\pm 0.3\%$ NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments. Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur.

Symptoms: Muscle cramps, often in the legs, but could occur in any portion of the body.

First Aid: Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

1.2.5 Heat Rashes

Heat Rashes are the most common problem in hot work environments where the skin is persistently wetted by unevaporated sweat.

Symptoms: Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Heat rash papules may become infected if they are not treated.

First Aid: In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

1.3 Prevention of Heat Stress

Acclimatize workers by exposing them to work in a hot environment for progressively longer periods. NIOSH (1986) suggests that workers who have had previous experience in jobs where heat levels are high enough to produce heat stress may acclimatize with a regimen of 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

Replace Fluids by providing cool (50°-60°F) water or any cool liquid (except alcoholic beverages) to workers and encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

Reduce the physical demands by reducing physical exertion such as excessive lifting, climbing, or digging with heavy objects. Spread the work over more individuals, use relief workers or assign extra workers. Provide external pacing to minimize overexertion.

Provide recovery areas such as air-conditioned enclosures, rooms, or work trucks and provide intermittent rest periods with water breaks.

Reschedule hot jobs for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

A work/rest guideline will be implemented for personnel required to wear Level C protection. The maximum wearing time guidelines are as follows:

Ambient Temperatures	Maximum Wearing Time
Above 90° F	½ hour
80° - 90° F	1 hour
70° - 80° F	2 hours
60° - 70° F	3 hours
50° - 60° F	4 hours
40° - 50° F	5 hours
30° - 40° F	6 hours
Below 30° F	8 hours

A sufficient period will be allowed for personnel to “cool down.” This may require shifts of workers during operations.

1.3.1 Personal Protective Equipment to Minimize Heat Stress

Reflective clothing, which can vary from vests and jackets to suits that completely enclose the worker from neck to feet, can reduce the radiant heat reaching the worker. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

Auxiliary body cooling ice vests, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not tether the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.

Wetted clothing such as terry cloth coveralls or two-piece, whole-body cotton suits are another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. This approach to auxiliary cooling can be quite effective under conditions of high temperature, good air flow, and low humidity.

1.4 Heat Stress Monitoring

Monitor workers who are at risk of heat stress, such as those wearing semi-permeable or impermeable clothing when the temperature exceeds 70°F, while working at high metabolic loads (greater than 500 kcal/hour). Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by or 33%, while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33%.

The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P1) with the pulse rate taken at 2.5 minutes (P3) after the rest break starts. The two pulse rates can be interpreted using the following criteria.

Heart rate recovery pattern	P3	Difference between P1 and P3
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period, and before the worker drinks water. Oral temperature (TO) at the beginning of the rest period should not exceed 99° F. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period stays the same. However, if the TO exceeds 99.7° F at the beginning of the next period, the following work cycle should be further shortened by 33%. TO should be measured again at the end of the rest period to make sure it has dropped below 99° F.

1.5 Heat Stress Training

Workers should be properly trained on the above Heat Stress program, and should be aware of the following:

- Knowledge of the hazards of heat stress;
- Recognition of predisposing factors, danger signs, and symptoms;
- Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
- Employee responsibilities in avoiding heat stress;
- Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
- Use of protective clothing and equipment; and
- Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.

1.6 Heat Stress References

<https://www.osha.gov/SLTC/emergencypreparedness/guides/heat.html>

2.0 COLD STRESS CASUALTY PREVENTION PLAN

Anyone working in a cold environment may be at risk of cold stress. Some workers may be required to work outdoors in cold environments and for extended periods, which creates an increase in the potential for cold stress injury. Site personnel will be instructed in the identification of cold stress, the first-aid treatment procedures for the worker, and the prevention of cold stress casualties.

2.1 Sources of Cold Stress

What constitutes extreme cold and its effects can vary across different areas of the country. In regions that are not used to winter weather, near freezing temperatures are considered "extreme cold." A cold environment forces the body to work harder to maintain its temperature. Whenever temperatures drop below normal and wind speed increases, heat can leave your body more rapidly. Wind chill is the temperature your body feels when air temperature and wind speed are combined. For example, when the air temperature is 40°F, and the wind speed is 35 mph, the effect on the exposed skin is as if the air temperature was 28°F. Cold stress occurs by driving down the skin temperature and eventually the internal body temperature (core temperature). This may lead to serious health problems, and may cause tissue damage, and possibly death.

Risk factors that contribute to cold stress include wetness/dampness, dressing improperly, and exhaustion, predisposing health conditions such as hypertension, hypothyroidism, and diabetes, and poor physical conditioning.

2.1 Identification and Treatment of Cold Stress

In a cold environment, most of the body's energy is used to keep the internal core temperature warm. Over time, the body will begin to shift blood flow from the extremities (hands, feet, arms, and legs) and outer skin to the core (chest and abdomen). This shift allows the exposed skin and the extremities to cool rapidly and increases the risk of frostbite and hypothermia. Combine this scenario with exposure to a wet environment, and trench foot may also be a problem.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is soaked in perspiration. Special protection of the hands is required to maintain manual dexterity for the prevention of accidents. Additional caution shall be exercised when workers are exposed to vibration, since blood circulation in extremities may already be impaired. Eye protection shall be worn by workers employed out of doors in a snow and/or ice terrain.

Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Provisions must be made to prevent hypothermia and secondary freezing of damaged tissues, in addition to providing for first aid treatment.

2.1.1 Hypothermia

Hypothermia occurs when body heat is lost faster than it can be replaced and the normal body temperature (98.6°F) drops to less than 95°F. Hypothermia is most likely at very cold temperatures, but it can occur even at cool temperatures (above 40°F), if a person becomes chilled from rain, sweat, or submersion in cold water.

Symptoms: In the mild symptoms of hypothermia, the exposed worker is still alert, but he or she may begin to shiver and stomp the feet in order to generate heat. As the body temperature continues to fall, symptoms will worsen and shivering will stop. The worker may lose coordination and fumble with items in

the hand, become confused and disoriented, he or she may be unable to walk or stand, pupils become dilated, pulse and breathing become slowed, and loss of consciousness can occur. A person could die if help is not received immediately.

First Aid: Call 911 immediately in an emergency; otherwise seek medical assistance as soon as possible. Move the person to a warm, dry area. Remove wet clothes and replace with dry clothes, cover the body (including the head and neck) with layers of blankets; and with a vapor barrier (e.g. tarp, garbage bag). Do not cover the face.

If medical help is more than 30 minutes away, give warm sweetened drinks if alert (no alcohol), to help increase the body temperature. Never try to give a drink to an unconscious person. Place warm bottles or hot packs in armpits, sides of chest, and groin. Call 911 for additional rewarming instructions.

If a person is not breathing or has no pulse, call 911 for emergency medical assistance immediately. Treat the worker as per instructions for hypothermia, but be very careful and do not try to give an unconscious person fluids. Check him/her for signs of breathing and for a pulse. Check for 60 seconds. If after 60 seconds the affected worker is not breathing and does not have a pulse, trained workers may start rescue breaths for 3 minutes. Recheck for breathing and pulse, check for 60 seconds. If the worker is still not breathing and has no pulse, continue rescue breathing. Only start chest compressions per the direction of the 911 operator or emergency medical services. Reassess patient's physical status periodically.

2.1.2 Frostbite

Frostbite is an injury to the body that is caused by freezing of the skin and underlying tissues. The lower the temperature, the more quickly frostbite will occur. Frostbite typically affects the extremities, particularly the feet and hands. Amputation may be required in severe cases.

Symptoms: Reddened skin develops gray/white patches. Numbness in the affected body part, and the body part feels firm or hard. In severe cases, blisters may occur in the affected part.

First Aid: Follow the recommendations described above for hypothermia. Do not rub the affected area to warm it because this action can cause more damage. Do not apply snow/water. Do not break blisters. Loosely cover and protect the area from contact. Do not try to rewarm the frostbitten area before getting medical help; for example, do not place in warm water. If a frostbitten area is rewarmed and gets frozen again, more tissue damage will occur. It is safer for the frostbitten area to be rewarmed by medical professionals. Give warm sweetened drinks, if the person is alert. Avoid drinks with alcohol.

2.1.3 Trench Foot

Trench Foot or immersion foot is caused by prolonged exposure to wet and cold temperatures. It can occur at temperatures as high as 60°F if the feet are constantly wet. Non-freezing injury occurs because wet feet lose heat 25-times faster than dry feet. To prevent heat loss, the body constricts the blood vessels to shut down circulation in the feet. The skin tissue begins to die because of a lack of oxygen and nutrients and due to the buildup of toxic products.

Symptoms: Redness of the skin, swelling, numbness, blisters

First Aid: Call 911 immediately in an emergency; otherwise seek medical assistance as soon as possible. Remove the shoes, or boots, and wet socks. Dry the feet.

2.2 Prevention of Cold Stress

Engineering controls can be used to warm the work area. For example, radiant heaters may be used to warm workers in outdoor stations. If possible, shield work areas from drafts or wind to reduce wind chill.

Safe work practices should be used to help prevent cold stress. For example, it is easy to become dehydrated in cold weather. Workers should be provided with plenty of warm sweetened liquids (avoid alcoholic drinks). If possible, heavy work should be scheduled during the warmer part of the day. Workers should be assigned to tasks in pairs (buddy system), so that they can monitor each other for signs of cold stress. Workers should be allowed to interrupt their work, if they are extremely uncomfortable. Workers should be allowed frequent breaks in warm areas (including inside a heated truck). Acclimatize new workers and those returning after time away from work, by gradually increasing their workload, and allowing more frequent breaks in warm areas, as they build up a tolerance for working in the cold environment.

Dressing properly is extremely important to preventing cold stress. The type of fabric worn also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, silk and most synthetics, on the other hand, retain their insulation even when wet. The following are recommendations for working in cold environments:

Wear at least three layers of loose fitting clothing. Layering provides better insulation. Do not wear tight fitting clothing. An inner layer of wool, silk or synthetic helps keep moisture away from the body. A middle layer of wool or synthetic helps provide insulation even when wet. An outer wind and rain protection layer helps allows some ventilation to prevent overheating. Wear a hat or hood to help keep your whole body warmer. Hats reduce the amount of body heat that escapes from your head. Use a knit mask to cover the face and mouth (if needed). Use insulated gloves to protect the hands (water resistant if necessary). Wear insulated and waterproof boots (or other footwear).

2.3 Cold Stress Training

Workers should be properly trained on the above Heat Stress program, and should be aware of the following:

- Knowledge of the hazards and symptoms of cold stress.
- Monitor your physical condition and that of your coworkers.
- Dress properly for the cold.
- Stay dry in the cold because moisture or dampness (e.g. from sweating) can increase the rate of heat loss from the body.
- Keep extra clothing (including underwear) handy in case you get wet and need to change.
- Drink warm sweetened fluids (no alcohol).
- Use proper engineering controls, safe work practices, and personal protective equipment (PPE) provided by your employer.

2.4 Cold Stress References

<https://www.osha.gov/SLTC/emergencypreparedness/guides/cold.html>
<http://www.cdc.gov/niosh/topics/coldstress/>

Attachment D

Health and Safety Requirements for Drilling Operations

HEALTH AND SAFETY REQUIREMENTS FOR DRILLING OPERATIONS

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HEALTH AND SAFETY REQUIREMENTS FOR DRILLING OPERATIONS

1.0 INTRODUCTION & POLICY

INTERA Inc. (INTERA) considers the prevention of illness, injury, and accidents in the work place to have greater importance than any other facet of the work. Safety will always take precedence over expediency or shortcuts, and every attempt will be made to reduce the possibility of injury, illness, or accident occurrence in the performance of drilling operations.

All personnel, including INTERA subcontractors, lower tier subcontractors, consultants, and service personnel, who perform any task in relation to the drilling efforts or are visitors to the drilling site(s) must adhere to the provisions of these requirements

As personnel safety is of the highest priority in performance of the work at this site, INTERA personnel will suspend drilling operations when an unsafe practice or condition is observed. Drilling will not proceed until the unsafe practice or condition is corrected. The subcontractor shall not be compensated for efforts required to correct any unsafe practice or condition created by his/her actions.

All applicable Federal, State, County and City safety regulations and practices shall be strictly adhered to at all times. These regulations and practices shall include, but are not solely limited to, the wearing of approved safety hats, shoes, glasses, hearing protection, and etc. No unauthorized personnel, private vehicles, cameras, firearms, personal pets, illicit drugs, or alcoholic beverages will be allowed on the designated project area.

The contractor shall be responsible for monitoring of subcontractor personnel required by OSHA, e.g. silica and heavy metals. All subcontractor personnel shall adhere to the INTERA operational health and safety regulations. **The “Statement of understanding” contained in the back of the INTERA Health and Safety Regulations for Drilling Operations must be signed by all Subcontractor personnel (including any lower tier) prior to working on this project.**

2.0 RESPONSIBILITIES AND AUTHORITIES

2.1 GENERAL

All personnel, including subcontractors, and site visitors shall receive **daily** safety instruction and information regarding potential safety hazards at the site. Daily on-site safety briefings shall be conducted by the Site Health and Safety Officer. Such daily training will be documented in the project records. All visitors will be escorted by a representative during their presence at the drilling site(s).

All personnel, including INTERA and lower-tier subcontractors, (including replacement and/or additional personnel) working on the drilling project must have met the minimum training requirements and have proof of their training as set forth in the site-specific health and safety plan developed for the project. Each individual's training must be documented prior to that person performing any work on the project. The following responsibilities and authorities are assigned with respect to compliance and implementation of these minimum requirements:

2.2 PERSONNEL

- The **Project Manager** shall be responsible for assigning a qualified field supervisor to the project who is cognizant of the required tasks and knowledgeable of drilling techniques and drilling safety procedures. The Project Manager is also responsible for providing adequate logistical support to ensure maximum safety during the drilling operations.
- The **Site Manager** shall be responsible for the day-to-day field operations and compliance with these requirements. The Site Manager shall fully coordinate the field drilling activities with the on-site Health and Safety technician and other responsible field personnel to assure that all drilling tasks are performed in the safest manner possible. Any violation of the provisions of these requirements will be reported immediately to the INTERA Corporate Health and Safety Officer and to the Project Manager. Should any variance from standard drilling procedures be required in completion of the designated drilling tasks, the Site Manager shall obtain concurrence from the Project Manager and the INTERA Health and Safety Officer prior to implementation.
- The **Site Health and Safety Officer** is responsible for the on-site monitoring of industrial and environmental safety, monitoring for compliance with the health and safety requirements, and any site-specific health and safety plan(s). The Site Health and Safety Officer shall take immediate corrective action when a safety violation is observed or reported.
- It shall be the responsibility of all **Field Personnel** working on a drilling project to promote safety at all times in the performance of their assigned tasks. All field personnel shall be aware of suspected site-specific hazards and shall be adequately trained to respond to such hazards in a safe and timely manner. In addition, it is the responsibility of all field personnel to report any real or suspected unsafe situation, act, or questionable practice immediately to the Site Health and Safety Officer or Field Supervisor.

A INTERA representative shall be on site at all times when drilling operations are in progress.

2.3 SUBCONTRACTOR AND SUBCONTRACTOR PERSONNEL:

The subcontractor is responsible for the safety of his/her operations as well as those operations of his/her subcontractor(s), who are also subject to all provisions of these minimum requirements. Any injury/illness that occurs as a direct result of work being performed under a subcontract or purchase order requires the subcontractor to notify INTERA **immediately** as well as submitting an accident report covering the incident. The accident report is to be submitted to the INTERA Corporate Health and Safety Officer within 24 hours of the accident. The subcontractor is required to participate in any INTERA internal investigation of such accident(s). The subcontractor is responsible to notify OSHA in accordance with 29CFR1904, as applicable.

The subcontractor must have a written and functional safety program to protect site workers, the general public, and the environment. The scope of the subcontractor program will be determined by the size and complexity of the project and the recognizable hazards of the work to be performed. Before work commences, this safety management program and implementation plan must be reviewed and approved, in writing, by the INTERA Health and Safety Officer.

2.3.1 The Drill Rig (Driller) Operator:

- The subcontractor shall designate, in writing, the on-site person who is in full charge of subcontractor's operations. The drill rig operator shall:
- consider safety as the primary importance and have and exercise the required authority to enforce safety at all times.
- be the leader in using proper personal safety gear and set an example in adhering to the rules and regulations that are set forth for the project.
- enforce the use of proper personal protective safety equipment (PPE) and take appropriate corrective action when proper PPE equipment is not being used or being used improperly by other subcontractor personnel.
- understand that proper maintenance of tools and equipment and general "housekeeping" on and around the drill rig will provide an appropriate environment to promote and enforce safety.
- visually inspect the rig and ancillary equipment **daily**, and preferably at the start of each drilling shift, to insure that the required safety devices, e.g., emergency engine shut-down switches and back-up alarms, are installed and are functional.
- inspect the rig to insure that applicable safety placards are installed at potential safety hazard locations as recommended by the manufacturer.
- inspect the drill rig at least daily for structural damage, excessive wire rope and rigging wear, improper wire rope spooling, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, and damaged or non-functioning pressure gauges and pressure relief valves. Any discrepancy will be corrected prior to operation of the rig.
- document all inspections, including daily, weekly, or periodic on the daily drilling report form at the time of inspection.
- have had adequate training on that rig type and is thoroughly familiar with the rig's controls, capabilities, limitations, and operating parameters.
- assure that all crew members are aware of the location and are capable of operating all emergency shut-down devices.
- monitor all gauges and warning lights and that control levers are functioning properly while the rig is operating.
- assure that all new drill rig workers are informed of safe operating practices on and around the drill rig.
- assure that each new employee understands the safety requirements and practices and shall document the new employee's acceptance of the requirements.
- observe the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. No person who is obviously impaired to a point of being detrimental to safety or task performance will be allowed to work on the rig or remain on the immediate drill site.
- assure that there is a fully stocked first-aid kit and two 10-lb U.L.-listed, Class ABC rated, fire extinguishers (that meets DOT standards) on the rig at all times.
- be trained to proficiency and capable of using first-aid kits, fire extinguishers and all other safety devices and equipment. At least one member of the drill crew shall possess a valid certificate of First Aid/CPR training from the U.S. Bureau of Mines, American Red Cross, or equivalent training. Training shall be documented.
- maintain a current, posted list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and shall inform other members of the drill crew of the existence, location and proper use of the list.

3.0 Individual Protective Equipment

- Any personal protective equipment (PPE) provided must meet NIOSH/ANSI specifications
- Clothing must be close fitting and comfortable, but without loose ends, straps, draw strings or belts or otherwise unfastened parts that might catch on rotating or moving component of the drill.
- Safety Head Gear. Approved safety hats (hard hats) will be worn properly at all times by everyone working or visiting within the posted perimeter of the drill site. Head protection shall be non-conductive to prevent from limited electrical shock and shall meet requirements of ANSI Standard Z89.1. It is recommended that safety hats be worn anytime when within 100 feet of an active rig.
- Safety Shoes or Boots. Safety shoes or boots shall be worn by all drilling personnel and all visitors to the drill site that observe drilling operations within close (within posted perimeter of drill site) proximity of the drill rig. Foot protection shall meet the requirements of ANSI Standard Z41.1, Class 75.
- Safety Glasses. All drilling personnel and visitors to the drill site are required to wear approved safety glasses with side shields or goggles while the drill rig is in operation or other drilling functions are being performed. Prescription glasses shall be an approved safety type or goggles must be used. Additional eye protection is required for work more hazardous to eyes, e.g. welding, cutting, grinding, or handling of chemicals. All eye protection shall meet ANSI Z87.1 standards.
- Gloves. All drilling personnel shall wear gloves for protection against cuts and abrasion which could occur while handling wire rope or cable and from contact with sharp edges and burrs on drill rods, drill pipe and other drilling or sampling tools.
- Hearing Protection. All drill crew personnel, site workers, and drill site visitors shall wear noise reducing ear protection when appropriate. In accordance with USDOE Order 5480.4, hearing protection is mandatory on DOE sites when the time-weighted-average (TWA) noise level reaches or exceeds 85 dBA.
- Other Protective Equipment. For some drilling operations, the prevailing environment or regulations may dictate that other protective equipment be used. When drilling is performed in chemically- or radiologically-contaminated areas, special protective equipment and clothing will be used as required by the site-specific Health and Safety Plan for each given task.

4.0 Housekeeping On and Around the Drill Rig

- Suitable storage facilities shall be provided so that tools, materials and supplies can be conveniently and safely handled without creating a safety hazard for personnel on the drill site or in the adjacent area.
- Storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig is prohibited within the project site or area.
- Drill pipe, drill rods, casing, augers and similar drilling tools shall be properly stacked and secured on racks or sills to prevent spreading, rolling, or sliding.
- Penetration or other driving hammers shall be placed at a safe location on the ground or secured on the rig to prevent movement when not in use.
- Work areas, platforms, walkways, scaffolding and other access ways shall be kept free of materials, debris, obstructions, and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.
- All hand controls, control linkages, warning and operation lights and lenses shall be kept

free of excess oil, grease, ice, or other foreign material that may interfere with safe operation.

- Gasoline or other motor fuels or flammable liquids will not be stored in any container that does not meet current regulations for storage of the specific fuel or flammable liquid. Fueling of engines shall be done only from U.L.-approved safety cans or other approved bulk fueling system(s). Any engine to be refueled shall be shut off and sufficiently cooled before and during the refueling operation.
- All gasoline engines, when operated in fire danger areas or other areas as specified in the project SOW, will be equipped with exhaust spark arresters.
- All tanks, including fuel, water (potable and non-potable), hydraulic oil, etc., shall be labeled and placarded as to tank contents.
- All wiping clothes, oily rags, and other such materials used for maintenance shall be stored in an approved fire-resistant metal container until properly disposed of.

5.0 Maintenance Safety

- Shut down the drill rig and/or auxiliary equipment engine(s) to make repairs or adjustments or to lubricate fittings (except repairs or adjustments that can only be made with the engine(s) running. In such cases, a qualified operator shall remain at the shut-down control station during the maintenance). Take precautions to prevent accidental starting of an engine during maintenance by removing, locking, and tagging out the ignition key or ignition control(s).
- Block the rig carrier wheels and/or lower the leveling jacks or both and set parking brakes before working under a drill rig.
- When possible and appropriate, release all pressure on the hydraulic systems, the drilling fluid circulation system and the air pressure systems of the drill rig prior to performing maintenance or repairs. Use lockout/tagout controls.
- Welding or cutting on or near a fuel tank or other flammable material is prohibited. If fuel tank repairs, requiring cutting or welding, are required, the tank(s) shall be removed from the project before repairs are attempted.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.
- Replace all caps, filler plugs, protective guards or panels, high pressure hose clamps and safety chains or cables that have been removed for maintenance before returning the drill rig to service.
- Personnel shall remain clear of all rotating equipment.
- All exposed drive shafts, drive chains and sprockets, drive belts, and similar power transmitting components shall have guards installed, as per OSHA and equipment manufacturer standards, during drilling operations.
- All exposed exhaust pipe(s) and/or systems shall be guarded or insulated adequately to protect personnel from burns and prevent fire hazards.
- All air and fluid circulation hose connections shall be secured with safety chains or clamped to prevent whipping in the event of a break or failure.
- Each crew member shall promptly report any worn, defective, or unsafe items which are observed to the driller or on-site subcontractor supervisor.
- Pipelines, tanks, and other storage facilities (for fuel, oil, gas, mud, foamers, etc.) shall be inspected frequently and kept from leaking. Any spills or leaks will be cleaned up immediately.
- A spill-containment plan shall be addressed in the subcontractor's written safety program for

the project.

6.0 Safe Use of Hand Tools

- When a hand tool becomes damaged, the tool shall either be repaired before further usage or removed and tagged out of service.
- Hand tools shall be used only for the express purpose for which they were designed.
- Keep all tools cleaned and stored in an orderly, safe manner when not in use.
- Never use pipe wrenches as substitute for a rod holding device.
- Replace pipe wrench hook and heel jaws when they become visibly worn.
- When breaking tool joints manually on a hard surface or on a drilling platform, position hands so that fingers will not be injured between the wrench handle and the hard surface or the platform, should the wrench slip or the joint suddenly release.

7.0 Clearing the Work Area

- Prior to drilling, adequate site clearing and leveling shall be performed to accommodate the drill rig, ancillary equipment, and supplies and provide a safe working area. Drilling shall not be commenced when tree limbs, dry vegetation, unstable ground or site obstructions may cause unsafe tool handling or potential fire hazards.

8.0 Start Up

- All drill rig personnel and visitors shall be instructed to stand clear of the drill rig or auxiliary equipment immediately prior to and during starting of an engine.
- Make sure all gear boxes are in neutral, all drawworks clutches and hoist levers are disengaged or in the neutral position, all hydraulic levers are in the correct non-actuating positions, and the cathead rope is not on the cathead spool before starting a drill rig engine or engaging the power train.

9.0 Safety During Drilling Operations

- No personnel, other than the assigned rig crew, shall be allowed on or under an operating rig deck for any reason. No personnel shall attempt to make any type of inspection of the subcontractor's equipment unless a subcontractor representative is present during the inspection.
- The drill rig shall not be moved from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), always check for overhead wires and obstructions. An observer shall be posted at a strategic location to ensure adequate clearance is maintained (see section 2.3.9).
- The mast shall not be raised or lowered during wind speeds that exceed the rig manufacturer's maximum wind load design or when visibility is restricted.
- Before raising or lowering the mast (derrick), the area shall be inspected for potential safety hazards. All unnecessary drill rig personnel and visitors shall be cleared from the areas immediately to the rear, front and the sides of the mast. Once the mast is raised into position, the mast or derrick locks will be secured. The rig shall not be operated unless mast locks are functional and are locked. Prior to lowering, mast hydraulic system(s) will be

checked for proper operation.

- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must be first leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig shall be releveled immediately if settling occurs after the initial set-up.
- The operator of a drill rig shall operate a drill rig only from the driller's control station. **The operator shall remain at the control station at all times when the rig is in operation.**
- Throwing or intentional dropping of tools shall not be permitted.
- If it is necessary to drill within an enclosed area, make certain that exhaust gases are conducted out of the area and sufficient ventilation is provided.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. All open boreholes shall be covered, protected or backfilled adequately and according to local or state regulations on completion of the drilling project.
- When using a mast or derrick ladder, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. The three-point system of 2 hands and 1 foot or two feet and 1 hand being in contact while climbing is mandatory. Always ensure that shoe soles are clean and dry before attempting climbing or descending the mast.
- When climbing to a mast or derrick platform that is higher than 20 feet (6 m), an approved safety climbing device shall be used. Anyone working on a derrick board, platform, or mast shall wear an approved safety belt or harness securely fastened by an approved safety lanyard.
- When working on a mast or derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoisting line, traveling block, or other moving hoisting equipment. Rack only one pipe stand at a time. Always stay clear of moving hoisting line, traveling block, elevators, or hoisting plugs.
- Loose tools and similar items shall not be left on the derrick platform or on structural members of the derrick.
- Any working platform over 4 feet (1.2 m) above ground surface shall have 4-inch toe boards, a mid railing, and top safety railing 42 inches high installed that will withstand 200 lbs. lateral force.
- Before manually lifting any object, personnel shall ensure sure that the load is within their personal lifting capacity.
- Personnel shall not ride the hoisting line, catline, traveling block, the traveling block hook, the elevators, or any suspended equipment as a means of ascending or descending to or from the derrick.
- Assure that equipment furnished for use on the site is maintained in safe operating condition and operated only by qualified personnel. Cranes, pressure vessels, and large earth moving equipment shall have valid certificates and logs of inspection and maintenance.
- The location of the nearest phone or radio to contact emergency services shall be prominently posted. Site-specific emergency preparedness actions will be recognized and communicated to rig personnel by the subcontractor supervisor.
- **Daily** safety meetings shall be held to inform employees and other subcontractors of progress of work, changes, hazards anticipated and inspection deficiencies or good examples of employee protection. A daily "toolbox meeting" will be used to assure that good communications are maintained. A record must be kept of the subject(s) discussed and any suggestions made. Attendance will be recorded of those participants at the meeting.
- Horseplay, practical jokes, and scuffling are strictly forbidden on the drill site at all times.
- All rig steps, ladders, stairways, platforms, and walkways shall be keep free of mud, snow, ice, tools, and other materials that may cause slipping.

10.0 Overhead and Buried Utilities

- Overhead and buried utilities shall be located, noted, and emphasized on all boring location plans and boring assignment sheets. **INTERA uses a "double barrier" system for surveying underground utilities. No borehole will be drilled until the exact location to be drilled is surveyed by an independent utility locator service and their findings verified by a INTERA Utility Line Locator.**
- When overhead electrical power lines exist at or near a drilling site or project, personnel shall consider all wires to be energized and dangerous.
- Visually inspect the drill site for sagging power lines before entering the site. Do not lift power lines to gain entrance or exit. Call the responsible utility and ask them to lift or raise the lines or de-energize (turn off) the power.
- An observer or "spotter" shall be posted at a sufficient distance from the rig to adequately monitor for safe clearance (minimum of 20 feet) during the raising and lowering of the rig mast when operating in the vicinity of overhead power lines or other overhead obstructions.
- Before raising the drill rig mast (derrick) in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or lowered. Do not raise the mast or operate the drill rig if this distance is less than 20 feet (6 m). INTERA policy for operating boomed or drilling equipment with mast, tower, or derrick in proximity of overhead power lines requires that a minimum clearance of 20 feet be maintained. The INTERA 20-foot minimum clearance requirement may only be reduced to the OSHA minimum powerline clearance requirement with approval of the INTERA technical monitor or designee. Any such approval will be granted only after a thorough inspection, which must determine that no safety hazard will be created or will exist by the application of the OSHA requirement. **UNDER NO CIRCUMSTANCES WILL MINIMUM OSHA POWERLINE CLEARANCE REQUIREMENTS BE VIOLATED UNLESS THE LINES ARE DE-ENERGIZED, GROUNDED, AND TAGGED OUT BY THE RESPONSIBLE UTILITY COMPANY OR THEIR DESIGNEE.** Any such variance will be fully documented by the grantor. In addition, a INTERA SAFE WORK PERMIT must be issued before any work is performed under the variance.

11.0 Safe Use of Electricity

- All wiring shall be installed in accordance with the National Electrical Code using high quality connections, fixtures and wire, insulated and protected with consideration of the drilling environment. Makeshift wiring and equipment shall not be permitted.
- All portable electrical equipment used by personnel shall have GFCI (ground fault circuit interrupt) protection.
- **Only qualified electricians will attempt repairs on electrical lines or installation of complex electrical devices.**
- All lights positioned above working areas shall be enclosed in cages or similar enclosures to prevent loose or detached lamps or vapor-tight enclosures from falling on workers. All light bulbs shall be heavy-duty, outdoor type, and shatterproof type.
- Electrical cables shall be guarded and located so as to prevent damage by drilling operations or by the movement of personnel, tools or supplies.
- All plug receptacles shall be the three-prong, U-blade, grounded type and have adequate current carrying capacity for the electrical tools that may be used and shall be GFCI

protected.

- All electric tools shall have three-prong, U-blade, ground wire plugs and cords.
- Do not use electrical tools with lock-on devices.
- All electrical welders, generators, control panels and similar devices will be adequately grounded.
- Electrical control panels, fuse boxes, transformers and similar equipment shall have a secure, protective enclosure. Only weatherproof boxes and fittings shall be used for exterior application. Panels, fuses, and breakers shall be labeled to indicate their function.
- Poles used to hold wiring and lights shall not be used for any other purpose.
- Power shall be turned off and locked out before changing fuses or light bulbs.

12.0 Safe Use of Wire Line Hoists, Wire Rope and Hoisting Hardware

- Any required hoisting operations which are not performed with the drill rig equipment, e.g., crane operations, shall be conducted in accordance with applicable OSHA requirements.
- All wire ropes and fittings shall be visually inspected in accordance with the manufacturer's recommendations and applicable OSHA requirements during use and thoroughly inspected at least once a week for: abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, or damage to lifting hardware. Any discrepancies shall be corrected before operations continue.
- All manufactured cable-end fittings and connections shall be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications. This includes cable clamps and thimbles. All cable ends shall be wired or taped down.
- If a ball-bearing type hoisting plug is used to hoist drill rods, drill pipe, or casing, the bearings shall be inspected and lubricated daily to assure that the hoisting plug rotates freely under load.
- Wire rope size shall be properly matched to sheave groove size. Non-rotating wire rope is suggested for light rig application.
- Minimize shock and side loading of wire rope. Apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen catline ropes. Keep ropes protected from adverse weather.
- Protect wire rope from sharp corners or edges. Avoid *pile-up* or uneven spooling of wire rope.
- Replace faulty guides and rollers.
- Replace worn sheaves and sheave bearings with parts equal to or exceeding original manufacturer specification(s).
- Replace damaged safety latches on safety hooks before using.
- Know the safe load capacity of the hoisting equipment being used. Never exceed this limit.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, hoisting plugs, elevators, shackles and other lifting aids. Never exceed the manufacturer's rated load capacity for any reason.
- Do not guide wire rope on hoist drums with hands or feet.
- Keep hands and other extremities away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up and when the load is being hoisted.
- Following the installation of new wire rope, lift a light load first to allow the wire rope to adjust.

- Never leave a load suspended when the hoist is unattended.
- Never hoist the load over the head, body, or feet of any personnel.
- Inspect daily, or at the start of each shift, all rotating cable attachments, e.g. safety hooks, deadman anchors, and hoisting apparatus, for freedom of movement.

13.0 Safe Use of Catheads and Rope Hoists

- Keep the cathead spool clean and free of rust and oil and grease.
- Check the cathead periodically, with the engine not running, for rope wear grooves.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of the body.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load, or than can be safely released.
- Do not leave a cathead unattended with the rope wrapped on the cathead spool when cathead power is engaged.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- The cathead operator must be able to operate the cathead standing on a level surface with firm footing and without distraction or disturbance.

14.0 Safe Use of Augers

The following general procedures shall be used when starting a boring with continuous flight or hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of downward pressure prior to rotation to seat the auger head below the ground surface.
- Observe the auger head while slowly engaging the clutch or rotation control. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated one foot or more below ground surface.
- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.
- An auger guide can facilitate the starting of a straight hole through hard ground or pavement.
- Use only the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with hands, feet, wrenches or any tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of an auger section in the ground or other hard surfaces such as the drill rig platform.
- Never place feet under the auger section that is being hoisted.
- When rotating augers, stay clear of the auger and other rotating components of the drill rig. **Never reach behind or around a rotating auger for any reason whatever. A minimum of 18 inches clearance shall be maintained between personnel, clothing, footwear and**

other personal apparel and the rotating augers, kellys, heads, drillrod or other rotating components of the drill rig.

- Use a long-handled shovel to move auger cuttings away from the auger, ensuring that the shovel blade does not come in contact with the rotating auger. Never use hands or feet to move cuttings away from the auger.
- Never attempt to remove cuttings from rotating augers. Augers should be cleaned only when the auger drive is in neutral and rotation of the augers has ceased.
- Auger speed shall be only that speed necessary for penetration and cuttings removal. High-speed auger rotation shall not be used for penetration or cuttings removal unless approved by the on-site INTERA field supervisor. In such cases, all unnecessary personnel will be removed from the rig operating area.
- Free-standing auger(s) shall be secured to prevent accidental falling.

15.0 Safety During Rotary and Core Drilling Operations

- Water swivels, Chiksan joints, and hoisting plugs shall be lubricated and checked for *frozen* bearings before use. A swivel guide cable and anchor chain shall be used to prevent swivel hose whip in case of swivel failure.
- Pressure relief valves shall be installed and operable on all circulation systems. Protective covers shall be installed on shear-type relief valves.
- Direct-reading pressure gauges shall be installed on all air and drilling fluid delivery lines. Gauges shall be operable at all times and must represent the true pressure of the medium being transported in the line(s). This shall include all ancillary equipment, e.g., grout mixers, auxiliary circulation pumps, and other such equipment.
- Drill rod chuck jaws shall be checked periodically and replaced when necessary.
- Drill rod movement shall not be braked or retarded by using the drill rod chuck jaws.
- Drill rods or drill pipe shall not be held or lowered into the hole with pipe wrenches. Use slips, clamps, spiders, or other suitable holding devices.
- In the event of a plugged bit or other circulation (fluid or air) blockage, the pressure in the piping and hose(s) between the pump, or air compressor, and the obstruction shall be relieved or bled down before breaking the first tool joint. Line pressure shall be relieved prior to breaking any tool joint connection.
- When drill rods or drill pipe are hoisted from the borehole, they shall be cleaned for safe handling with a rubber pipe wiper or other suitable apparatus. Do not use hands to clean or strip drilling fluids from downhole tools as they are being hoisted.
- If work must progress over a portable drilling mud pit, do not attempt to stand on narrow sides or cross members. The mud pit shall be equipped with rough surfaced, fitted cover panels of adequate strength to support the combined weight of drill rig personnel.
- Drill rods and drill pipe shall not be lifted and leaned unsecured against the mast. A suitable method shall be provided for securing the upper ends of the drill rod or drill pipe sections for safe vertical storage or the tools must be laid down.
- Only personnel necessary to perform hoisting or tripping operations shall be on the rig during these operations.
- Remain well clear of moving rotary tables, kellys, quillrods, pull-down chains, drive lines, drive chains, and other rotating components at all times.
- When air rotary or air coring operations are in progress, all discharges, e.g., dust, cuttings, and fluids shall be contained. All shrouds, curtains, diverter head(s), cyclone separator(s), blooie line(s), and other necessary containment equipment will be used at all times. Any variance from these requirements must be approved in writing by INTERA before any such

variance is implemented.

- All rig air-delivery systems used in environmental drilling applications will be equipped with oil-separating, 10 micron in-line filter(s) to remove oil that might be discharged into the air stream by the compressor(s). These filters shall be inspected daily and serviced as applicable.

16.0 Off-Road Movement of Drilling Equipment and/or Components

- Before off-road movement of a drill rig, visually survey the route of travel, inspecting the proposed route for unstable road bed(s) and bridges, depressions, stumps, gullies, ruts, and similar obstacles which might impede safe movement of the equipment.
- The braking system of the drill rig carrier shall always be tested for adequate operation before movement.
- Inspect the complete drive-train, including drive shafts, U-joints, carrier bearings, flanges, etc. of the rig truck or carrier at least weekly.
- Use caution when traversing slopes. Conservatively evaluate side hill capability of drill rigs, as the arbitrary addition of drilling tools may raise the center of gravity. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (however, do not exceed rated tire pressure).
- Properly secure all drilling equipment and tools, including drill rod, drill pipe, casing, and other tubular material before transport.
- Use only those routes that have been designated for rig travel and movement.

17.0 Hazardous Materials and Waste

- The subcontractor shall provide material safety data sheets (MSDS) for all hazardous materials used in the drilling operation(s) as per 29CFR1910.1200. Personnel must be trained in accordance with 29 CFR 1910.120 for handling any such hazardous materials as well as any site-specific requirements pertinent to the particular task being undertaken.
- Chemicals, corrosives, and etc. shall be properly labeled, placarded, and stored.
- Any waste generated by drilling operations shall be handled as per site-specific project requirements.
- All cuttings, dust, fluids, and other waste generated by drilling activities must be contained and disposed of as per site-specific project requirements. In no case where drilling is being performed in a posted radiological and hazardous waste area shall dust, cuttings, fluids, or other subsurface waste be discharged to the atmosphere, unless engineering controls are used to separate particulate matter from the discharged air. Engineering controls may include, but are not solely limited to, the use of cyclone separator(s), HEPA (high efficiency particulate air) filters, or other suitable, approved controls.
- All spills and leaks, including but not solely limited to, oils, fuels, grease, motor coolants, drilling additives, or other potentially hazardous wastes, will be cleaned up immediately and properly disposed of. The cause of such spills or leaks shall be determined and appropriate corrective action taken before drilling is resumed. Such events will be reported by the subcontractor to INTERA as per direction of the applicable Health and Safety Plan and/or Statement of Work governing the project tasks.
- A subcontractor shall not perform any work identified in the site-specific project Health and Safety Plan or Project Statement of Work (SOW) requiring a SAFE WORK PERMIT (SWP) or RADIATION WORK PERMIT (RWP), until such permit is issued by INTERA. This

includes, but is not solely limited to, such tasks as welding, working in a confined space area, cutting, grinding, or other related activities where heat, open flame, and/or sparks may be generated. All provisions of the issued permit(s) shall be adhered to while working on the project.

18.0 Statement of Understanding

All personnel, including INTERA and subcontractor, are required to read and fully understand the provisions of these minimum requirements. The INTERA field supervisor shall document that all INTERA personnel working on the drilling project have read and understand the requirements. The subcontractor and each subcontractor employee working on the project shall sign the attached STATEMENT OF UNDERSTANDING before commencing any work on the project.

ATTACHMENT A
STATEMENT OF UNDERSTANDING
DRILLING HEALTH AND SAFETY REQUIREMENTS
FOR DRILLING OPERATIONS

I, the undersigned, as an employee of the Subcontractor doing business as _____, have received and have read the INTERA Health and Safety Requirements for Drilling Operations. Further, I understand all provisions of these requirements.

Name (please print)	Signature	Date	Position
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____
9. _____	_____	_____	_____
10. _____	_____	_____	_____
11. _____	_____	_____	_____
12. _____	_____	_____	_____
13. _____	_____	_____	_____
14. _____	_____	_____	_____
15. _____	_____	_____	_____

ATTACHMENT B
EQUIPMENT SAFETY INSPECTION CHECKLIST
FOR SMALL AUGER, ROTARY, AND CORE RIGS

Contractor: _____ Rig Type: _____ Rig no. _____ Date: ____/____/____
 Safety Inspector: _____ Project: _____

I. Rig Carrier <input type="checkbox"/> Overall Appearance <input type="checkbox"/> Oil Leaks <input type="checkbox"/> Fuel Leaks <input type="checkbox"/> Fire Extinguisher <input type="checkbox"/> Back-up Alarm <input type="checkbox"/> Exhaust System <input type="checkbox"/> Wheel Chocks <input type="checkbox"/> Outrigger Jacks <input type="checkbox"/> Fuel Tank Placard(s) <input type="checkbox"/> Portable fuel containers <input type="checkbox"/> Other: _____	IV. Power Train/Drill Unit <input type="checkbox"/> Chain/belt Guards <input type="checkbox"/> Fluid Leaks <input type="checkbox"/> Driveline Guards <input type="checkbox"/> Hydraulic Hoses <input type="checkbox"/> Safety Chains/lanyards <input type="checkbox"/> Gauges <input type="checkbox"/> Loose Bolts <input type="checkbox"/> Rotary Table <input type="checkbox"/> Drive Head <input type="checkbox"/> Auger Drive <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	VIII. Hoisting Equipment <input type="checkbox"/> Hoisting Plug(s) <input type="checkbox"/> Lifting Iron(s) <input type="checkbox"/> Elevators <input type="checkbox"/> Weight Indicator <input type="checkbox"/> Safety Hook(s) <input type="checkbox"/> Spider(s) <input type="checkbox"/> Slips <input type="checkbox"/> Foot Clamps <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____
II. Mast <input type="checkbox"/> Crown Block <input type="checkbox"/> Hinge Pins <input type="checkbox"/> Lock Pins/Devices <input type="checkbox"/> Lights/Wiring <input type="checkbox"/> Safety Climbing Device <input type="checkbox"/> Safety Belts/Harness <input type="checkbox"/> Racking Board <input type="checkbox"/> Ladders <input type="checkbox"/> Deadman Anchors <input type="checkbox"/> Standpipe <input type="checkbox"/> Swivel Hose <input type="checkbox"/> Safety Chains/Clamps <input type="checkbox"/> Mast Rams/Cylinders <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	V. Pump(s)/Compressor(s) <input type="checkbox"/> Sheaf Relief Valve Cover(s) <input type="checkbox"/> Pressure Relief Valve(s) <input type="checkbox"/> Flowline Safety Clamps/chains <input type="checkbox"/> Belt/Chain Guards <input type="checkbox"/> Vibrator Line Anchor <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	IX. Downhole Equipment <input type="checkbox"/> Drillpipe <input type="checkbox"/> Drillcollars <input type="checkbox"/> Core Rod <input type="checkbox"/> Core Barrel(s) <input type="checkbox"/> Augers <input type="checkbox"/> Samplers <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____
III. Rig Engine(s) <input type="checkbox"/> Fuel Tank(s) <input type="checkbox"/> Exhaust System <input type="checkbox"/> Electrical System <input type="checkbox"/> Belt/Drive Line Guards <input type="checkbox"/> Emergency Shut-down System(s) <input type="checkbox"/> Heat Shields <input type="checkbox"/> Fluid Leaks <input type="checkbox"/> Gauges <input type="checkbox"/> Clutches <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	VI. Hoists/Catheads <input type="checkbox"/> Chain Guard(s) <input type="checkbox"/> Spool/Drum wear-cracks <input type="checkbox"/> Safety Devices\Spool Divider <input type="checkbox"/> Clutch(es) <input type="checkbox"/> Brake(s) <input type="checkbox"/> Hydraulics <input type="checkbox"/> Wireline Drum-coring <input type="checkbox"/> Drive Hammer(s) <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	X. Safety Equipment <input type="checkbox"/> Placards/Warning Signs <input type="checkbox"/> Applicable OSHA Postings <input type="checkbox"/> First Aid Kit(s) <input type="checkbox"/> Applicable Regulation Posting <input type="checkbox"/> Emergency Medical Posting(s) <input type="checkbox"/> Emergency Procedures <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____
VII. Wireline/Catline <input type="checkbox"/> Wear/broken strands <input type="checkbox"/> Spooling <input type="checkbox"/> Cable Clamps and Thimbles <input type="checkbox"/> Cable Ends <input type="checkbox"/> Catline Rope Condition <input type="checkbox"/> Other: _____	XI. Personal Protective Equipment <input type="checkbox"/> Hard Hats <input type="checkbox"/> Safety Glasses <input type="checkbox"/> Safety boots/shoes <input type="checkbox"/> Other: _____ <input type="checkbox"/> Other: _____	XII. Other Items <input type="checkbox"/> _____ <input type="checkbox"/> _____

COMMENTS: _____

Attachment E

Health and Safety Requirements for Heavy and Light Equipment

HEALTH AND SAFETY REQUIREMENTS FOR HEAVY AND LIGHT EQUIPMENT

General

1. Ensure operators have demonstrated skills and/or have attended training on the safe operation of heavy/light equipment.
2. Operate equipment according to Department of Transportation (DOT) regulations.
3. Meet manufacturer's minimum requirements for safe operation of equipment.
4. Daily inspect heavy/light equipment before use. Identify defective equipment, remove it from service, and do not use it until repaired.
5. Before operating heavy/light equipment, inspect work areas, and provide safeguards for identified hazards.
6. Ensure operator's manual is accessible for all heavy/light equipment.
7. Before operating heavy/light equipment greater than 20 horsepower with an operator's seat (excluding trucks), ensure it is equipped with approved roll over protection safety (ROPS), if required.
8. Ensure heavy/light equipment with an operator's seat and equipped with roll over protection safety (ROPS) is equipped with a seat belt.
9. When operating heavy/light equipment, wear a seat belt where provided.
10. Before exiting operator's seat from all heavy/light equipment, lower attachments to the ground and apply parking brake.
11. When riding on heavy/light equipment, ride only on designated positions.
12. Do not use heavy/light equipment as a lifting device unless the equipment and rigging have been load-tested.
13. Ensure all equipment operated during poor visibility or inclement weather is equipped with proper lighting and appropriate safety devices (e.g., windshield wipers, defroster).
14. If it created a hazard to persons in the immediate work area, do not operate equipment.
15. Operate all heavy/light equipment within manufacturer's recommended operating parameters.
16. When digging, drilling, driving objects, or trenching close to energized circuits, locate underground utilities (e.g., electrical lines, telephone, water, natural gas, and other piping systems) and take measures to prevent damage.
17. Be careful when using ladders, handrails, steps, etc., to climb on or off heavy/light equipment.
18. Chock all vehicles with dual wheels. Chock medium-and heavy-duty vehicles (one ton or greater) and, on extremely hilly and mountainous terrain, chock smaller vehicles (1/2 ton pickups and 3/4 ton service vehicles).
19. Wear footwear appropriate for the environment and for the equipment being used.

Operation of Light Equipment (Mowers, Tractors, chain Saws, Tamps, Etc.)



1. For manual opening of tailgates on dump trucks, install and use handgrips.
2. Ensure farm tractors used with bush hogs are equipped with heavy-metal mesh guards for personal protection.
3. When engaged in a winching operation with light equipment, be positioned safely (e.g., behind the door).
4. When working in the bucket of an aerial lift, wear a fall protection harness.
5. When operating a chain saw, wear eye and face protection and, except when working from a bucket truck or wood pole, wear chaps.
6. When operating a weedeater with a blade (brushsaw), wear leggings or chaps and eye and face protection.
7. When operating a tamp (except for pole tamps), wear foot protection including toe and metatarsal guards.
8. Use the following required personal protective equipment:
 - a. Hard hats
 - b. Hearing protection
 - c. Safety glasses
 - d. Work gloves

Operation of Heavy Equipment (Bulldozers, Motor Graders, Packers, Core Drills, Etc.)

1. When engaged in a winching operation, use heavy equipment equipped with heavy-metal mesh guards for protection.
2. Ensure all heavy equipment is equipped with back-up alarms and warning devices.
3. Ensure all heavy equipment is equipped with a fire extinguisher.
4. When clearing wooded areas, use heavy equipment equipped with closed clearing cab.
5. Safety glasses and heard hat are not required in the enclosed cab of bulldozers.
6. Use the following required personal protective equipment:
 - a. Hard hats
 - b. Hearing protection
 - c. Safety glasses

ATTACHMENT A **EQUIPMENT SAFETY INSPECTION CHECKLIST** **FOR LIGHT EQUIPMENT**

Safety Inspector: _____ Site/Project: _____ Date: __/__/__
 License Plate: _____ Make/Model/Color: _____

Insert a check mark  if ok, or an  if there is an item deficiency.

Date							
Tire inflation							
Lug nuts							
Exhaust System							
Brakes							
Parking brake							
Engine lubricants							
Engine Coolants							
Steering							
Windshield							
Windshield Wipers							
Heater / Defroster							
Head / tail lights							
Turn indicators							
Instrument gauges							
<i>Initials of Operator</i>							

DESCRIPTION OF DEFICIENCIES: _____

REMEDY FOR DEFICIENCIES: _____

COMMENTS: _____

ATTACHMENT B **EQUIPMENT SAFETY INSPECTION CHECKLIST** **FOR HEAVY EQUIPMENT**

Safety Inspector: _____ Site/Project: _____ Date: __/__/__
 Equipment Type: _____ Equipment Number: _____

Insert a check mark ✓ if ok, an ✗ if there is an item deficiency, or "NA" if the item does not apply.

FROM THE GROUND

Bucket or Blade	Excessive Wear or Damage, Cracks	
Bucket or Blade Cylinder & Linkage	Excessive Wear, Damage, Leaks, Lubricate	
Stick, Cylinder	Wear, Damage, Leaks, Lubricate	
Boom, Cylinders	Wear, Damage, Leaks, Lubricate	
Underneath Machine	Final Drive Leaks, Swing Drive Leaks, Damage	
Track Sag	Tightness, Wear	
Pivot Shafts	Oil Leaks	
Carbody	Cracks, Damage	
Undercarriage	Wear, Damage, Tension	
Steps and Handholds	Condition and Cleanliness	
Batteries & Hold Downs	Cleanliness, Loose Bolts & Nuts	
Windshield Wipers & Washers	Wear, Damage, Fluid Level	
Fire Extinguisher	Charge, Damage	
Engine Coolant	Fluid Level	
Primary/Secondary Fuel Filters	Leaks, Drain Water Separator	
Air Filter	Restriction Indicator	
Hydraulic Oil Tank	Fluid Level, Damage, Leaks	
Hydraulic Oil	Filter Leaks	
Radiator	Fin Blockage, Leaks	
Hydraulic Oil Cooler	Fin Blockage, Leaks	
AC Condenser	Fin Blockage, Leaks	
Lights and Mirrors	Damage	
Engine Oil Filter	Filter Leaks	
Hydraulic Oil Filter	Filter Leaks	
Overall Machine	Loose/Missing Nuts, Bolts, Guards, Cleanliness	

ENGINE COMPARTMENT

Engine Oil	Fluid Level	
Gear Oil	Fluid Level, Leaks	
Fuel Tank	Fuel Level, Damage, Leaks	
All Hoses	Cracks, Wear Spots, Leaks	
All Belts	Tightness, Wear, Cracks	
Overall Engine Compartment	Trash or Dirt Buildup, Leaks	

INSIDE THE CAB

Seat	Adjustment	
Seat belt & Mounting	Damage, Wear, Adjustment, Age	
Horn, Travel Alarm, Lights	Proper Function	
Indicators	Proper Function	
Monitor Panel	Proper Function	
Switches	Proper Function	
Travel Controls	Correct Operation	
Mirrors Adjustment	Adjustment, Cracks/Broken	
Heating and Cooling System	Proper Function	
Overall Cab Interior	Overall Cab Interior Cleanliness	

COMMENTS: _____

Attachment F

HazCom Program Description

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LIST OF ATTACHMENTS

Attachment A: Labeling Systems

Attachment B: 29 CFR 1910.119 Appendix A – Threshold Quantities for Highly Hazardous Chemicals

1.0 PURPOSE

This Hazard Communication Program (HazCom Program) supplements the INTERA Corporate Health and Safety Program (CHSP) and is included as **Appendix 7** to the CHSP. The HazCom Program identifies the procedures that are used to protect the health of employees while performing the services provided by INTERA. This Program cannot be considered as encompassing of all potential hazards or of all safe practices and conditions that should be followed and maintained, but as a general guidance document providing direction for situations involving hazardous substances in the workplace. This Program is an integral piece of the overall INTERA Corporate Health and Safety Program (CHSP).

2.0 POLICY

INTERA does not routinely conduct activities that expose employees to significant chemical, mechanical, electrical or physical hazards. However, infrequent activities may occasionally result in the potential for exposure. The HazCom Program has been implemented to inform INTERA employees about hazardous substances in the workplace, the potential harmful effects of these substances and the appropriate control measures. The management of INTERA has developed the HazCom Program to provide a safe workplace for its employees and subcontractors. This HazCom Program applies to INTERA employees and subcontractors, and follows all the elements of the OSHA HAZCOM regulations found in 29 CFR 1910.1200. The expense associated with training and recordkeeping will be borne by the company.

3.0 RESPONSIBILITY

The Corporate Health and Safety Officer (Amy Andrews) is designated as the Program Administrator and, as such, is responsible for the HazCom Program and has the authority to make the necessary decisions regarding hiring personnel and purchasing of equipment necessary to implement and operate the HazCom Program. Branch Health and Safety Coordinators are designated representatives of the Corporate Health and Safety Officer, and are responsible for implementation and operation of this Program in each branch office. The Program Administrator will review the Program annually and will amend these instructions as necessary.

The Corporate Health and Safety Officer or Branch Health and Safety Coordinators will be responsible for ensuring that employees are trained in the provisions of the HazCom Program. Details regarding employee training are provided in Section 7.0 of this document.

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Employees are encouraged to communicate their health and safety concerns to the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace. Additionally, the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers have the authority to halt operations because of non-compliance with the provisions of this Program. It will be the responsibility of the Site Safety Officer to inspect field project areas for compliance with this HazCom Program.

4.0 TERMS AND DEFINITIONS

The following terms and definitions are applicable to the INTERA HazCom Program:

Exposure: any situation arising from work operations where an employee may ingest, inhale, absorb through the skin or eyes, or otherwise come into contact with a hazardous substance.

Field Activities: activities that require employees to be "outdoors" or out of the office environment.

Hazardous Substances: any substance that can be defined as a toxic substance or as a hazardous chemical. Toxic substances are any of the substances listed in the latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances or has yielded positive evidence of acute or chronic health hazard in human, animal or other biological testing. Hazardous chemicals refer to any element, chemical compound or mixture of elements and/or compounds whose presence or use is a physical hazard or health hazard, as defined by 29 CFR Section 1910.1200(c).

Health Hazard: a substance for which there is significant evidence, based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. Substances identified as a health hazard include those that have been shown to have carcinogenic effects and those that have toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which may damage the lungs, skin, eyes, or mucus membranes.

Physical Hazard: a substance for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Safety Data Sheet (SDS): a detailed information bulletin prepared by the manufacturer or importer of a chemical that describes the physical and chemical properties, physical and health hazards, routes of exposure, precautions for safe handling and use, emergency and first-aid procedures, and control measures.

Multi-employer Worksites: worksites where there are two or more different employers working in close proximity on the same site. These sites require the exchange of hazard information, including SDS's among the employers, as well as exchanging hazard information with the Host employer.

Office Activities: activities performed while employees are in the offices of the corporation, or its clients, subcontractors, or vendors.

5.0 HAZCOM PROGRAM ELEMENTS

5.1 CHEMICAL PURCHASE REQUIREMENTS

Hazardous chemicals/substances purchased by INTERA shall be accompanied with a vendor furnished Safety Data Sheet (SDS). SDSs will be kept in designated 3-ring binders as follows: one binder will contain SDSs relating to hazardous chemicals present in the office setting and one binder will have SDSs relating to hazardous chemicals present at off-site field projects. One set of binders will be kept in each office, as appropriate. The office-setting SDS binder will be stored in the main copy room/supply room in each office, and the field project SDS binder will be stored in the field supply room or in the office of the Branch Health and Safety Coordinator, whichever is most convenient. The field project SDS binder will serve as the source of SDSs for inclusion in Site-Specific Health and Safety Plans (SSHASPs), as necessary for specific field projects. SDSs must be kept for **30 years** per OSHA 1910.1020(c)(5).

INTERA employees who purchase hazardous chemicals must determine whether a current SDS is either already included in the appropriate SDS binder or is received with the shipment. For new hazardous chemicals, an SDS should be obtained and submitted to the Corporate Health and Safety Officer or to the Branch Health and Safety Coordinator within ten (10) working days of the purchase.

The HazCom Program **does not** apply to consumer products such as Windex and printer toner and ink cartridges where the employer can show that the product is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product and the use results in a duration and frequency of

exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the intended purpose (29 CFR 1910.1200(a)(6)(ix)).

5.2 CHEMICAL LABELING REQUIREMENTS

The INTERA employee responsible for purchasing a specific hazardous or toxic chemical will also be responsible for ensuring that all containers of the hazardous or toxic chemical entering the workplace are properly labeled. The manufacturer's original label shall include the following according to the Globally Harmonized System of Classification and Labeling of Chemicals (GHS):

1. Product identifier;
2. Signal word (either "Warning" or "Danger");
3. Standardized Hazard Statement corresponding to health, physical, and environmental hazard classes;
4. Hazard pictogram(s);
5. Precautionary statement(s), and
6. Name, address, and telephone number of chemical manufacturer, importer, or other responsible party.

Unlabeled containers are not acceptable and will not be used. Original labels shall not be defaced or removed. All labels will be legible, in English, and prominently displayed on the container. If the hazardous chemical is to be transferred to a separate container, the new container shall be properly labeled in accordance with the original label. Additional details regarding proper labeling of containers is provided in **Attachment A** to this HazCom Program including information on labeling systems used prior to conversion to GHS.

5.3 REQUIREMENTS FOR SAFETY DATA SHEETS

Filing System:

SDSs shall be stored in loose-leaf binders that are available to employees as described above in Section 3.1. Each binder shall include a Hazardous Chemical List (HCL), which is an index that lists hazardous chemicals in alphabetical order by product name. For hazardous chemicals stored and used in the office, the SDS binders are kept in the main copy room/supply room in each office, and field project SDS binders will be stored in the field supply room or in the office of the Branch Office Health and Safety Coordinator, whichever is most convenient. SDS binders are available to employees during normal business. Site-specific SDSs shall also be kept in each field vehicle or field office that contains chemicals for use in the field and must be included as an attachment to the SSHASP.

The Program Administrator will be responsible for maintaining the overall SDS system with support from Branch Office Health and Safety Coordinators, as delegated, and will review incoming data sheets for new and significant health and safety information and will make sure that the new information is provided to the affected employees. The Site Safety Officer is responsible for maintaining SDS data for individual field projects.

SDS Binders:

Each SDS Binder shall include:

- An HCL that lists hazardous chemicals in alphabetical order by product name for all SDS's in the office or for all SDSs used in field projects, as applicable, and
- A current SDS for each hazardous chemical used in the office or in the field.

NOTE: SDSs must be kept for 30 years.

SDS Contents:

According to GHS, each SDS shall include:

- Section 1. Identification;
- Section 2. Hazard(s) identification;
- Section 3. Composition/information on ingredients;
- Section 4. First-aid measures;
- Section 5. Fire-fighting measures;
- Section 6. Accidental release measures;
- Section 7. Handling and storage;
- Section 8. Exposure controls/personal protection;
- Section 9. Physical and chemical properties;
- Section 10. Stability and reactivity;
- Section 11. Toxicological information;
- Section 12. Ecological information;
- Section 13. Disposal considerations;
- Section 14. Transport information;
- Section 15. Regulatory information; and
- Section 16. Other information, including date of preparation or last revision.

5.4 NON-ROUTINE TASKS

The Project Manager, the Site Safety Officer and/or the employee are responsible for identifying non-routine project tasks. Before any non-routine task is performed, employees shall be advised of any special precautions that may be required. In the event such tasks are required, the Site Safety Officer will provide the following information about the task as it relates to the specific chemicals and hazards expected to be encountered:

- Specific chemicals and hazards;
- Personal protective equipment (PPE) required;
- Safety measures to be taken;
- Measures that have been taken to minimize the hazards including ventilation and respirator use;
- Presence of other employees, and
- Emergency procedures.

5.5 HAZARDOUS CHEMICAL LIST

The Hazardous Chemical List or HCL is essentially an index of SDSs for all on-site hazardous chemicals, either in the office or in the field. The HCLs for each branch office are available from the respective Branch Office Health and Safety Coordinator as well as from the front of their office-specific SDS binders, kept in the main copy/supply room of each office. Similarly, HCLs related to field projects can be found at the front of field project SDS binders that are maintained at each office, as appropriate, and inside the SSHASP for that project.

5.6 CLIENT AND MULTI-EMPLOYER SITES

In some cases, INTERA personnel may bring hazardous chemicals to a Host/Client's facility or location where INTERA is one of several employers. In these cases, INTERA shall:

- inform the Host/Client/other employers of the hazardous chemicals INTERA is bringing on site;
- provide access to the INTERA HazCom Program, appropriate SDSs and HCLs, and labeling information on the hazardous chemicals INTERA is bringing on site, and
- provide information on the precautionary measures that INTERA employees must take when working with the hazardous chemicals.

When working at a Host/Client's facility or on a multi-employer site, INTERA employees have the right to view SDSs of hazardous chemicals to which they may be exposed. The INTERA Site Safety Officer on multi-employer sites will request copies of hazard information from other employers and/or the Host/Client employer to make available as an attachment to the SSHASP.

INTERA may also opt to rely on the Host/Client's Hazard Communication Program to meet the requirements of OSHA's Hazard Communication standard. In these cases, the responsibility for hazard communication will be specified through contractual or other means.

5.7 PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS

Process safety management of highly hazardous chemicals is required to prevent or minimize the consequences of catastrophic releases of toxic, reactive, flammable or explosive chemicals as defined by 29 CFR 1910.119. Process safety management of highly hazardous chemicals applies to the following:

- A process which involves a chemical at or above the specified threshold quantities listed in Appendix A of 29 CFR 1910.119 (Appendix A is provided as **Attachment B** at the end of this Program);
- A process which involves a Category 1 flammable gas (as defined in 1910.1200(c)) or a flammable liquid with a flashpoint below 100 °F (37.8 °C) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:
 - Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling), if such fuels are not a part of a process containing another highly hazardous chemical covered by this standard; or,
 - Flammable liquids with a flashpoint below 100 °F (37.8 °C) stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

For sites where highly hazardous chemicals are present, a written plan of action will be developed and included in the SSHASP. The written plan of action will include all elements as required by 29 CFR 1910.119(c), (d), (e) and (f). Employees involved in processes related to the highly hazardous chemical will be trained according to 29 CFR 1910.119(g). Training will be documented, as appropriate, and will be kept on file in designated health and safety file cabinets in the corporate office and/or each branch office.

6.0 RESPONSIBILITIES

Program Administrator

The Program Administrator is responsible for administering the Hazard Communication Program. Duties of the program administrator include:

- Coordinating with Site Safety Officers or Branch Health and Safety Coordinators to keep the following up to date:
 - Container labels,
 - SDS availability, and
 - Workplace chemical lists;
- Arranging for and/or conducting training;
- Coordinating the transfer of HAZCOM information between INTERA and contractor/client;
- Maintaining records required by the HazCom Program;
- Evaluating the HazCom Program;
- Updating the HazCom Program, as needed; and
- Halting any operation in the company where there is danger of serious personal injury.

The Program Administrator for INTERA is the Corporate Health and Safety Officer. Certain administrative activities that are the responsibility of the Program Administrator, such as providing copies of the CHSP and the HazCom Program to new employees, may be delegated to INTERA administrative staff and/or Branch Office Health and Safety Coordinators, as appropriate.

Administrative Staff

INTERA administrative staff are responsible for providing new employees with copies of the CHSP, which includes the Hazard Communication Program as **Appendix 7**. The administrative staff may also be responsible for other administrative activities as delegated by the Program Administrator.

Project Managers

Project Managers are responsible for ensuring that the HazCom Program is implemented on their particular projects. In addition to being knowledgeable about the particular hazards associated with their project, Project Managers must also confirm that those working on the project understand the hazards. Duties of the Project Manager include:

- Identifying and evaluating potential hazards for the project, including those associated with non-routine tasks;
- Ensuring that employees working on their project have received appropriate hazard communication training;
- Being aware of hazards and corresponding protective measures associated with the project;
- Monitoring work areas and operations to identify new or changed hazards;
- Coordinating with the Program Administrator on how to address any issues which arise regarding the HazCom Program, and
- Halting any operation in the company where there is danger of serious personal injury.

Site Safety Officer

Duties of the Site Safety Officer include:

- Identifying and evaluating potential hazards for the project, including those associated with non-routine tasks;
- Identifying special precautions related to non-routine tasks and communicating to affected employees;
- Inspecting field project areas for compliance with the HazCom Program;
- Maintaining SDS data for individual field projects;
- Requesting copies of hazard information from other employers and/or the Host/Client employer on multi-employer sites and making the hazard information available as an attachment to the SSHASP; and
- Halting any operation in the company where there is danger of serious personal injury.

Employees

Each employee has the responsibility to notify his/her Manager when he/she is unsure of the hazards associated with a particular project. Employees must also:

- Know the location of SDS's and have a copy of the written HazCom Program;
- Be able to identify the Program Administrator;
- Before entering a work area, the employee will ascertain what hazards they may be exposed to and then take appropriate action to protect themselves;
- Inform their Project Manager if the actual hazards encountered are significantly different from those identified in the training and instruction received;
- Inform the Project Manager or Program Administrator of hazardous products received without labels, damaged labels, or without SDS support documentation;
- Send appropriate SDS copies to the Site Safety Officer and Program Administrator, and
- Inform the Project Manager or the Program Administrator of any hazards that they feel are not adequately addressed in the workplace or of any other concerns that they have regarding the HazCom Program.

Subcontractors

The Project Manager will provide the following information to all subcontractors:

- List of hazardous chemicals to which they may be exposed while in the workplace;
- Measures to minimize the possibility of exposure;
- Location of SDSs and labeling requirements for hazardous chemicals, and
- Procedures to follow if they are exposed.

The Project Manager will expect and collect from subcontractors:

- SDS, labeling, and hazard information on all hazardous chemicals brought on site, and
- Copies of subcontractor written policies and procedures for hazard communication, when appropriate.

7.0 TRAINING

Initial Training

The Program Administrator will provide training to all employees on the elements of the HazCom Program, their responsibilities under the HazCom Program, and on the applicable regulatory requirements. Initial training to the HazCom Program is accomplished through reading and acknowledgement of this Program. Each employee will receive a copy of the CHSP at commencement of employment. The HazCom Program is included in the CHSP as **Appendix 7**, and each employee is required to sign the Acknowledgment page at the front of this HazCom Program confirming that they have read, understood, are familiar with, and will comply with the standards that have been established in the HazCom Program. Signing of an Acknowledgment page is also required in response to revisions to the HazCom Program. Signed acknowledgement pages will be kept with a master copy of the Corporate Health and Safety Program on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files.

Elements of the Training

Specific elements of HazCom Program training shall include:

- Information on any operations in the work area where hazardous chemicals are present;
- The location and availability of the written hazard communication program (**Appendix 7** of the CHSP, issued to all employees on commencement of work);
- The location and availability of the HCL (located at the front of each SDS binder);
- The location of the safety data sheets (SDS binders in offices or field truck/field office, as appropriate);
- Methods and observation techniques used to determine the presence or release of hazardous chemicals in the work area such as monitoring, visual appearance or odor of hazardous chemical when being released;
- The physical and health hazards of the hazardous chemicals in the work area;
- How to decrease or prevent exposure to these chemicals through the use of control/work practices and PPE;
- Emergency procedures to follow if exposed to hazardous chemicals;
- Proper labeling requirements for containers; and
- Explanation on how to read and interpret labels and SDSs.

Training beyond initial training to the HazCom Program as described above is not required for employees that are not involved in projects where hazardous chemicals are present and who work in offices where hazardous chemicals are not present.

Site-specific HazCom information will be included in SSHASPs. Additional training is required whenever a new health hazard is introduced into the work area. Employees expected to come in contact with the new health hazard (hazardous chemical) will be informed of its presence, will be instructed on its safe use, and will be trained on the hazards associated with the new hazardous chemical. Site-specific HazCom training will be documented using the **Safety Meeting Attendance Form** at the beginning of each project and whenever a new health hazard is introduced into the work area. The **Safety Meeting Attendance Form** is provided in **Appendix 9** of the CHSP.

Additional chemical-specific training will be provided, as appropriate, for specific hazardous chemicals such as hydrogen sulfide (refer to **Appendix 26** – Hydrogen Sulfide Awareness Plan).

Additional training with regard to the content and use of safety data sheets is also provided to employees who conduct field activities at sites that may contain hazardous chemicals as part of their OSHA 40-hour HAZWOPER training and annual 8-hour refreshers in accordance with OSHA regulation 29 CFR 1910.120 for general site workers (refer to **Appendix 11** – Hazardous Waste Operations and Emergency Response Plan).

HazCom training will be documented, as appropriate, and will be kept on file in designated corporate health and safety file cabinets and/or each branch office, as appropriate.

8.0 HAZCOM PROGRAM EVALUATION

The Program Administrator will conduct periodic evaluations of the workplace to ensure that the provisions of this HazCom Program are being implemented. Evaluations will include consultations with employees and their managers, site inspections, and a review of records.

Evaluation of the HazCom Program will be documented, as appropriate, and addressed by the Program Administrator. Documentation will include problems identified, if any, along with steps to be taken to correct deficiencies in the HazCom Program and target dates for the implementation of those corrections.

9.0 DOCUMENTATION AND RECORDKEEPING

A written copy of this HazCom Program and the applicable OSHA standard is provided to all employees as **Appendix 7** of the CHSP, which is provided to employees upon commencement of employment and after each revision. A replacement copy of the CHSP or of the HazCom Program will be supplied to any employee upon request.

Training records (signed acknowledgement pages) will be kept with a master copy of the CHSP on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files. These records will be updated as new employees are trained and as existing employees receive additional training.

10.0 MISCELLANEOUS

Non-English Speaking Employees

Care must be taken to make sure that hazard information is communicated to employees who may have difficulty with hazard information written in English. INTERA does not have this issue with the current work force, but should this situation arise in the future, the anticipated remedy will be to either provide these employees with a bi-lingual manager to translate the English hazard information, or if possible, to obtain hazard information in an alternate language.

LABELING SYSTEMS

Containers of hazardous chemicals shall be properly labeled. Labels or other forms of warning must be legible, in English, and prominently displayed on the container. A proper label is one that contains the name of the product (as it appears on the Safety Data Sheet [SDS]), as well as any physical and health hazards, including target organs (e.g., lung irritant).

The manufacturer's name and address shall also be included on the label. Most INTERA operations will rely on the manufacturer's label to meet regulatory requirements. Therefore, labels that have been placed on a container by the product's manufacturer shall not be removed, defaced, or covered. If the manufacturer's label is missing, illegible, or damaged, a label providing the required information shall be affixed.

As described below, there are currently five types of labels used in industry today. The final label described, the Global Harmonization System label, should ultimately be the only label in use.

1. **American National Standard Institute (ANSI):** Uses mostly words to describe the hazard along with some graphics, colors and geometric shapes. The hazard level is printed in the top of the label:

DANGER = serious hazard

WARNING = less hazardous but still severe

CAUTION = moderate hazard but still of concern



2. **Department of Transportation (DOT):** Prints the class or division of hazard on the label. The color of the label denotes a different hazard (e.g., flammable gas or liquids are red, explosives are orange, etc.). The DOT Hazard Class list is presented below:

Class 1: Explosives

Class 2: Gases

Class 3: Flammable Liquids

Class 4: Flammable Solids

Class 5: Oxidizers and Organic Peroxides

Class 6: Toxic Materials and Infectious Substances

Class 7: Radioactive Materials

Class 8: Corrosive Materials

Class 9: Miscellaneous



3. **National Fire Protection Agency (NFPA):** Uses four color-coded diamonds. Each color signifies a particular hazard and a number or letter within each color diamond denotes the level of hazard. The NFPA ratings are typically skewed in favor of fire safety meaning they assign a greater risk to flammable materials and immediate risks than to long term risks.

Blue – This diamond contains the Health hazard associated with a chemical. A number ranging from 0 to 4 denotes the level of hazard associated with the chemical, as detailed below.

0-Normal material

1-Slightly hazardous

2-Hazardous

3-Extreme danger

4-Deadly


Red – This diamond contains the Fire hazard associated with the chemical. A number ranging from 0 to 4 denotes the flash point of the chemical, as detailed below. This is an indicator of how readily a material will burn, so the lower the flash point of a material, the easier it will burn.

- 0-Will not burn
- 1-Above 200 °F
- 2-Between 200 °F and 100 °F
- 3-Below 100 °F
- 4-Below 73 °F

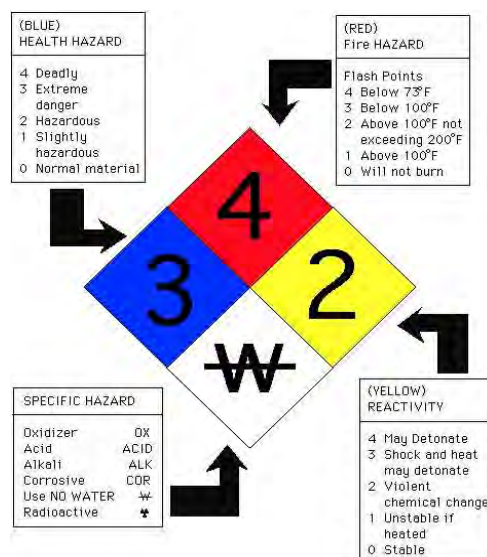
Yellow – This diamond contains the Reactivity hazard associated with the chemical. A number ranging from 0 to 4 denotes the reactivity of the chemical, as detailed below.

- 0-Stable
- 1-Unstable if heated
- 2-Violent chemical change
- 3-Shock or heat may detonate
- 4-May detonate

White – This diamond contains specific additional information about the chemical. The information may provide insight into the way a fire-fighting team approaches the chemical or how the material should be handled. A few examples of specific hazards are listed below.

OXY	Oxidizer
ACID	Acid
ALK	Alkali
COR	Corrosive
	Radioactive
W	Use NO WATER

The NFPA classification is illustrated in this diagram:












4. **Hazardous Materials Identification System (HMIS):**

This system uses a color and numbering system similar to the NFPA, but as shown in the figure below, uses a table instead of a diamond. This system also provides a section with a personal protection code in order to assist personnel with choosing the correct level of protective gear.



5. **Global Harmonization System (GHS):** GHS labels include: a product identifier; a signal word (either Category 1 "Warning" or Category 2 "Danger"); standardized hazard statements corresponding to health, physical, and environmental hazard classes; hazard symbols/hazard pictograms; precautionary statements, and the name, address, and telephone number of the chemical manufacturer, importer, or other responsible party. The GHS hazard pictograms, along with their names and associated hazards are indicated below. Pictograms are on a white background with a red diamond.

 <p>Explosion hazard</p>	<p>Usage</p> <ul style="list-style-type: none"> • Unstable explosives • Self-reactive substances and mixtures • Organic peroxides
 <p>Flame</p>	<p>Usage</p> <ul style="list-style-type: none"> • Flammable gases • Flammable aerosols • Flammable liquids • Flammable solids • Self-reactive substances and mixtures • Pyrophoric liquids, category 1 • Pyrophoric solids, category 1 • Self-heating substances and mixtures • Substances and mixtures, which in contact with water, emit flammable gases • Organic peroxides
 <p>Oxidizing hazard</p>	<p>Usage</p> <ul style="list-style-type: none"> • Oxidizing gases • Oxidizing liquids • Oxidizing solids
 <p>Gas cylinder</p>	<p>Usage</p> <ul style="list-style-type: none"> • Compressed gases • Liquefied gases • Refrigerated liquefied gases • Dissolved gases
 <p>Corrosion</p>	<p>Usage</p> <ul style="list-style-type: none"> • Corrosive to metal • Skin corrosion • Serious Eye Damage

 Skull and crossbones	<p>Usage</p> <ul style="list-style-type: none"> • Acute toxicity (severe)
 Exclamation mark	<p>Usage</p> <ul style="list-style-type: none"> • Acute toxicity (harmful) • Skin irritation • Eye irritation • Skin sensitization • Respiratory tract irritation • Narcotic effects
 Health hazard	<p>Usage</p> <ul style="list-style-type: none"> • Respiratory sensitization • Mutagen • Carcinogen • Reproductive toxicity • Target organ toxicity • Aspiration hazard
 Environment	<p>Usage</p> <ul style="list-style-type: none"> • Acute hazards to the aquatic environment • Chronic hazards to the aquatic environment

29 CFR 1910.119 APPENDIX A

This Appendix contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity.

CHEMICALNAME	CAS*	TQ**
Acetaldehyde	75-07-0	2500
Acrolein (2-Popenal)	107-02-8	150
Acrylyl Chlorde	814-68-6	250
Allyl Chlorid	107-05-1	1000
Allylamine	107-11-9	1000
Alkylaluminum	Varies	5000
Ammonia, Anhydrous	7664-41-7	10000
Ammonia solutions (greater than 44% ammonia by weight)	7664-41-7	15000
AmmoniumP erchlorate	7790-98-9	7500
Ammonium Permanganate	7787-36-2	7500
Arsine (also called Arsenic Hydride)	7784-42-1	100
Bis (Chloromethyl) Ether	542-88-1	100
Boron Trichloride	10294-34-5	2500
Boron Trifluoride	7637-07-2	250
Bromine	7726-95-6	1500
Bromine Chloride	13863-41-7	1500
Bromine Pentafluoride	7789-30-2	2500
Bromine Trifluoride	7787-71-5	15000
3-Bromopropyne (also calledPropargylBromide)	106-96-7	100
Butyl Hydroperoxide (Tertiary)	75-91-2	5000
Butyl Perbenzoate (Tertiary)	614-45-9	7500
Carbonyl Chloride (see Phosgene)	75-44-5	100
Carbonyl Fluoride	353-50-4	2500
Cellulose Nitrate(concentration greater than 12.6% nitrogen	9004-70-0	2500
Chlorine	7782-50-5	1500
Chlorine Dioxide	10049-04-4	1000
Chlorine Pentrafluoride	13637-63-3	1000
Chlorine Trifluoride	7790-91-2	1000
Chlorodiethylaluminum (also called Diethylaluminum Chloride)	96-10-6	5000
1-Chloro-2, 4-Dinitrobenzene	97-00-7	5000
Chloromethyl Methyl Ether	107-30-2	500
Chloropicrin	76-06-2	500
Chloropicrin and Methyl Bromide mixture	None	1500
Chloropicrin and Methyl Chloride mixture	None	1500
Cumene Hydroperoxide	80-15-9	5000
Cyanogen	460-19-5	2500
Cyanogen Chloride	506-77-4	500
Cyanuric Fluoride	675-14-9	100
Diacetyl Peroxide (concentration greater than 70%)	110-22-5	5000
Diazomethane	334-88-3	500
Dibenzoyl Peroxide	94-36-0	7500
Diborane	19287-45-7	100
Dibutyl Peroxide (Tertiary)	110-05-4	5000
Dichloro Acetylene	7572-29-4	250
Dichlorosilane	4109-96-0	2500
Diethylzinc	557-20-0	10000

Corporate Health and Safety Program: Appendix 7
Hazard Communication Program
Attachment B: 29 CFR 1910.119 Appendix A –
Threshold Quantities for Highly Hazardous Chemicals

CHEMICALNAME	CAS*	TQ**
Diisopropyl Peroxydicarbonate	105-64-6	7500
Dilauroyl Peroxide	105-74-8	7500
Dimethyldichlorosilane	75-78-5	1000
Dimethylhydrazine,1,1-	57-14-7	1000
Dimethylamine, Anhydrous	124-40-3	2500
2,4-Dinitroaniline	97-02-9	5000
Ethyl Methyl Ketone Peroxide (also Methyl Ethyl Ketone Peroxide; concentration greater than 60%)	1338-23-4	5000
Ethyl Nitrite	109-95-5	5000
Ethylamine	75-04-7	7500
Ethylene Fluorohydrin	371-62-0	100
Ethylene Oxide	75-21-8	5000
Ethyleneimine	151-56-4	1000
Fluorine	7782-41-4	1000
Formaldehyde (Formalin)	50-00-0	1000
Furan	110-00-9	500
Hexafluoroacetone	684-16-2	5000
HydrochloricAcid, Anhydrous	7647-01-0	5000
HydrofluoricAcid, Anhydrous	7664-39-3	1000
Hydrogen Bromide	10035-10-6	5000
Hydrogen Chloride	7647-01-0	5000
Hydrogen Cyanide, Anhydrous	74-90-8	1000
Hydrogen Fluoride	7664-39-3	1000
Hydrogen Peroxide (52% by weight or greater)	7722-84-1	7500
Hydrogen Selenide	7783-07-5	150
Hydrogen Sulfide	7783-06-4	1500
Hydroxylamine	7803-49-8	2500
Iron, Pentacarbonyl	13463-40-6	250
Isopropylamine	75-31-0	5000
Ketene	463-51-4	100
Methacrylaldehyde	78-85-3	1000
Methacryloyl Chloride	920-46-7	150
Methacryloyloxyethyl Isocyanate	30674-80-7	100
Methyl Acrylonitrile	126-98-7	250
Methylamine, Anhydrous	74-89-5	1000
Methyl Bromide	74-83-9	2500
Methyl Chloride	74-87-3	15000
Methyl Chloroformate	79-22-1	500
Methyl Ethyl Ketone Peroxide (concentration greater than 60%)	1338-23-4	5000
Methyl Fluoroacetate	453-18-9	100
Methyl Fluorosulfate	421-20-5	100
Methyl Hydrazine	60-34-4	100
Methyl Iodide	74-88-4	7500
Methyl Isocyanate	624-83-9	250
Methyl Mercaptan	74-93-1	5000
Methyl Vinyl Ketone	79-84-4	100
Methyltrichlorosilane	75-79-6	500
Nickel Carbonyl (Nickel Tetracarbonyl)	13463-39-3	150
Nitric Acid (94.5% by weight or greater)	7697-37-2	500

**Corporate Health and Safety Program: Appendix 7
Hazard Communication Program
Attachment B: 29 CFR 1910.119 Appendix A –
Threshold Quantities for Highly Hazardous Chemicals**

CHEMICALNAME	CAS*	TQ**
Nitric Oxide	10102-43-9	250
Nitroaniline (para Nitroaniline)	100-01-6	5000
Nitromethane	75-52-5	2500
Nitrogen Dioxide	10102-44-0	250
Nitrogen Oxides (NO; NO(2); N2O4; N2O3)	10102-44-0	250
Nitrogen Tetroxide (also called Nitrogen Peroxide)	10544-72-6	250
Nitrogen Trifluoride	7783-54-2	5000
Nitrogen Trioxide	10544-73-7	250
Oleum (65% to 80% by weight; also called Fuming Sulfuric Acid)	8014-95-7	1000
Osmium Tetroxide	20816-12-0	100
Oxygen Difluoride (Fluorine Monoxide)	7783-41-7	100
Ozone	10028-15-6	100
Pentaborane	19624-22-7	100
Peracetic Acid (concentration greater 60% Acetic Acid; also called Peroxyacetic Acid)	79-21-0	1000
Perchloric Acid (concentration greater than 60% by weight)	7601-90-3	5000
Perchloromethyl Mercaptan	594-42-3	150
Perchloryl Fluoride	7616-94-6	5000
Peroxyacetic Acid (concentration greater than 60% Acetic Acid; also called Peracetic Acid)	79-21-0	1000
Phosgene (also called Carbonyl Chloride)	75-44-5	100
Phosphine (Hydrogen Phosphide)	7803-51-2	100
Phosphorus Oxychloride (also called Phosphoryl Chloride)	10025-87-3	1000
Phosphorus Trichloride	7719-12-2	1000
Phosphoryl Chloride (also called Phosphorus Oxychloride)	10025-87-3	1000
Propargyl Bromide	106-96-7	100
Propyl Nitrate	627-3-4	2500
Sarin	107-44-8	100
Selenium Hexafluoride	7783-79-1	1000
Stibine (Antimony Hydride)	7803-52-3	500
Sulfur Dioxide (liquid)	7446-09-5	1000
Sulfur Pentafluoride	5714-22-7	250
Sulfur Tetrafluoride	7783-60-0	250
Sulfur Trioxide (also called Sulfuric Anhydride)	7446-11-9	1000
Sulfuric Anhydride (also called Sulfur Trioxide)	7446-11-9	1000
Tellurium Hexafluoride	7783-80-4	250
Tetrafluoroethylene	116-14-3	5000
Tetrafluorohydrazine	10036-47-2	5000
Tetramethyl Lead	75-74-1	1000
Thionyl Chloride	7719-09-7	250
Trichloro (chloromethyl) Silane	1558-25-4	100
Trichloro (dichlorophenyl) Silane	27137-85-5	2500
Trichlorosilane	10025-78-2	5000
Trifluorochloroethylene	79-38-9	10000
Trimethoxysilane	2487-90-3	1500

Footnote* Chemical Abstract Service Number

Footnote** Threshold Quantity in Pounds (Amount necessary to be covered by this standard.)

Attachment G

Respiratory Protection Program

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LIST OF ATTACHMENTS

Attachment A: NIOSH Air Purifying Respirator Selection Flow Chart
Attachment B: Respiratory Medical Evaluation Questionnaire
Attachment C: Respirator Inspection Checklist

1.0 PURPOSE

The purpose of this Respiratory Protection Program is to provide for the protection of employees from respiratory hazards through proper use of respirators. Respirators are to be used only where engineering control of respiratory hazards is not feasible, while engineering controls are being installed or in emergency situations. This Program is an integral piece of the overall INTERA Corporate Health and Safety Program (CHSP).

2.0 RESPONSIBILITY

The Corporate Health and Safety Officer (Amy Andrews) is designated as the Respiratory Program Administrator and, as such, is responsible for this Program and has full authority to make the decisions necessary for the success of this Program. This authority includes hiring personnel and purchasing the equipment necessary to implement and operate the Program. Branch Health and Safety Coordinators are the designated representative of the Corporate Health and Safety Officer, and are responsible for implementation and operation of this Program in each branch office. This written Program was developed in accordance with the requirements of 29 CFR 1910.134 and covers each of the basic elements in the regulations. The Corporate Health and Safety Officer will review the Program annually and will amend these instructions as necessary.

The Corporate Health and Safety Officer or Branch Health and Safety Coordinators, in conjunction with Project Managers and Site Safety Officers, will review employee job descriptions and determine which, if any, employees may be required to wear respiratory protection as part of their job responsibilities. INTERA employees whose work includes wearing respiratory protection will be trained to this Program. The Corporate Health and Safety Officer or Branch Health and Safety Coordinator will be responsible for ensuring that these employees are trained in the provisions of this Program.

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. This authority includes halting operations because of respiratory hazards. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Employees are encouraged to communicate their health and safety concerns to the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace. Additionally, the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers have the authority to halt operations because of non-compliance with the provisions of this Program. It is the responsibility of the Site Safety Officer to inspect field project areas for compliance with the Program.

3.0 PROCEDURES FOR SELECTING RESPIRATORS FOR USE IN THE WORKPLACE

Selection of respirators can be broken into two broad categories based on atmosphere characterization, i.e. is the atmosphere immediately dangerous to life or health (IDLH) or not. The Corporate Health and Safety Officer in conjunction with the Project Manager and the Site Safety Officer will determine whether the workplace atmosphere is IDLH or not. This determination will be based on field measurements of air quality using calibrated instruments that are operated by qualified personnel. The measurements will include oxygen levels, combustibles (as measured by combustible gas indicators), and toxics. If any oxygen levels and/or toxics fall into ranges that are considered IDLH, only NIOSH-approved positive pressure, pressure demand, supplied air equipment will be utilized.

There are two general types of positive pressure, pressure demand respirators: open circuit self-contained breathing apparatuses (SCBAs) where the breathing air source is designed to be carried by the user and supplied air respirators (SARs) where the breathing air is supplied through an airline. For SAR/airline units, an auxiliary self-contained air supply (express bottle) will also be required. Positive pressure, pressure demand, supplied air respirators will only be used by personnel properly trained in accordance with Section 10.0 of this Program and will use air that has been tested according to Section 8.0 of this Program. In general, INTERA does not perform field work at sites that contain hazard levels that are IDLH, or where Level A or Level B PPE is required. **In the event that site conditions require the use of Level A or Level B PPE, the Corporate Health and Safety Officer will be notified immediately to verify that proper training and procedures are in place prior to conduct of fieldwork.**

NOTE: Work will **not** occur at a site where the atmosphere is explosive, including atmospheres where oxygen levels exceed 23.5%.

For non-IDLH atmospheres where air contaminants exceed published exposure limits, air-purifying respirators (APRs) may be worn. The NIOSH Respirator Decision Logic tree in **Attachment A** will be used to determine if an APR can be used, to select the proper respirator configuration if an APR is appropriate and to determine the proper concentration range of contaminants. A combination of input from the Host/Client Site Safety Officer, from NIOSH Pocket Guide recommendations and from manufacturer specifications will be used to determine cartridge selection. Only NIOSH-approved air purifying respirators and cartridges will be used. NIOSH Pocket Guides may be obtained from the Corporate Health and Safety Officer.

There are three types of air-purifying respirators: particulate filters, cartridges and canisters. Cartridges and canisters contain sorbent medium. Combination devices are also available which contain layers of sorbent materials and filters, but these have not been tested for effectiveness against simultaneous exposure to more than one agent. The different types of APRs are color coded as follows:

- Magenta – high efficiency particulate filter – good for particulates such as dust, fumes, mist, asbestos, etc.;
- Black – organic vapor;
- White – acid gas;
- Yellow – combination organic vapor/acid gas; and
- Green – ammonia and organic vapor.

Chemical sorbent cartridges and canisters may have an expiration date. Once opened, humidity and other factors shorten their useful life and the canister/cartridge should be used immediately. After use, the canister/cartridge will be discarded.

4.0 MEDICAL EVALUATIONS

An employee will not be assigned to a task requiring the use of a respirator unless it has been determined that the employee is physically able to perform the work while using the equipment. Respiratory Medical Evaluations will be provided at no cost to the employee and will be done according to the **Respiratory Medical Evaluation Questionnaire** provided in **Attachment B**. A company-approved physician/medical provider will determine what health and physical conditions are pertinent. Respiratory Medical Evaluations will be done before an employee is fit tested and/or required to use a respirator.

Additional medical evaluations, using the **Respiratory Medical Evaluation Questionnaire** as provided in **Attachment B** or a questionnaire provided by the medical provider that obtains the same information as the questionnaire in **Attachment B**, will be provided in response to any of the following:

- An employee reports medical signs or symptoms that are related to ability to use a respirator;
- A physician/medical provider, manager, or the respirator program administrator informs the employer that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature) that may result in a substantial increase in the physiological burden placed on an employee.

The medical status of each employee that uses a respirator will also be reviewed annually during routine medical surveillance. Medical records will be kept in accordance with the OSHA requirements in 29 CFR 1910.1020(c)(6)(i). Respiratory Medical Evaluation Questionnaires, results of medical exams, and Physician's Written Opinions will be kept on file in designated corporate health and safety file cabinets and copies of relevant records will be kept at each branch office, as appropriate. Confidential records will be kept in locked file cabinets that can be accessed only by the Corporate Health and Safety Officer, Branch Office Health and Safety Coordinators, or Corporate Human Resources personnel (as appropriate), for the employee's term of employment plus 30 years.

5.0 FIT TEST PROCEDURES FOR TIGHT FITTING RESPIRATORS

There are two types of fit test procedures: qualitative fit testing and quantitative fit testing. Both of these fit-test protocols are described in 29 CFR 1910.134, Appendix A. Qualitative fit tests may be conducted at the direction of the Corporate Health and Safety Officer, Branch Health and Safety Coordinator, the Project Manager or the Site Safety Officer. Quantitative fit test will be done at an approved respirator fit test contractor's facility, and successful fit tests will be verified by the Project Manager prior to use at a specific job site. Fit tests performed by the selected fit test contractor will conform to the protocols in 29 CFR 1910.134, Appendix A

Qualitative fit testing may be performed for air purifying respirators during initial and refresher Hazardous Waste Operations and Emergency Response (HAZWOPER) training or during the annual physical by a certified individual, or at other times, as needed. The respirator fit test will be repeated annually for employees who regularly use respirators. For those employees who seldom or infrequently use respirators, it is possible that more than one year may elapse between respirator uses. In those cases, fit tests will be performed prior to any re-use of respirators. Quantitative fit testing for supplied air respirators will be done on an as needed basis prior to work requiring their use. . Fit test records, both qualitative and quantitative, will be kept for term of employment in designated corporate health and safety file cabinets and/or each branch office, as appropriate.

Anyone needing prescription eyewear, that is also required to wear a respirator, will be provided with a spectacle kit designed to fit the specific facepiece that the employee must wear. Employees will also be trained on the importance of maintaining the face-to-facepiece seal. No facial hair will be allowed anywhere on the sealing surface.

6.0 PROCEDURES FOR PROPER USE OF RESPIRATORS IN EMERGENCY SITUATIONS

The normal procedure for INTERA employees during an emergency is to evacuate the work area when alarms are sounded and to remain outside the effected area until the "all clear" is sounded. Therefore, there no additional procedures are provided for emergency situations.

7.0 PROCEDURES FOR CLEANING, STORING, INSPECTING, REPAIRING AND DISCARDING RESPIRATORS

Supplied air respiratory equipment will be rented from vendors who will provide the equipment and the necessary documentation of periodic inspections of the air packs, air line masks, regulators, hoses and alarms. The equipment will be stored on-site in the cases provided by the rental company. For projects where this equipment will be used for more than one day, the Project Manager will have a representative from the supplied air equipment vendor to clean, disinfect, recharge and/or repair the equipment at a frequency that will have the equipment ready for use prior to the next day the equipment will be worn. At a minimum, supplied air equipment will be inspected once per month while on site. Respirator face-pieces will be periodically washed by the wearer of the device and checked by the Site Safety Officer during the course of the day, as necessary, to prevent eye or skin irritation associated by respirator use. Documentation of inspections by equipment vendors will be kept on file in designated health and safety file cabinets in the corporate office and each branch office, as appropriate.

For air-purifying respirators, the Site-Specific Health and Safety Plan (SSHASP) will specify whether full-face or half-face respirators will be required. Full and half-face respirators will be thoroughly cleaned and disinfected using the procedure outlined in **Attachment C** according to the following schedule:

- Respirators issued for the exclusive use of an employee shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition;
- Respirators issued to more than one employee shall be cleaned and disinfected before being worn by different individuals, and
- Respirators used in fit testing and training shall be cleaned and disinfected after each use.

Once cleaned and disinfected, respirators shall be stored in a way that protects them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture and damaging chemicals. Respirators will be stored in bags/cases provided by the manufacturer or in a zip-lock-type sealable bag in a manner that prevents deformation of the facepiece and exhalation valve.

Respirators used in routine situations by INTERA personnel shall be inspected BEFORE each use and during cleaning. Respirator inspections will be documented using the Respirator Inspection Checklist provided in **Attachment C** by the employee to whom the respirator has been issued. Completed Respirator Inspection Checklists will be kept on file in designated health and safety file cabinets in the corporate office and each branch office, as appropriate. Inspections will include a check of respirator function including tightness of connections and the condition of various parts and a check of elastomeric parts for pliability and signs of deterioration.

Respirators that fail inspection will be removed from service until the respirator can be repaired, or if the respirator cannot be repaired, it will be removed from service permanently and replaced with a new respirator. Any repairs to respirators must be performed by the respirator manufacturer or by a competent respirator repair facility. Completed repairs will be documented on the appropriate Respirator Inspection Checklist.

8.0 PROCEDURES FOR ENSURING ADEQUATE AIR QUALITY AND ADEQUATE FLOW OF AIR FOR SUPPLIED AIR RESPIRATORS

Before using any supplied air respiratory equipment from a vendor, the Project Manager or Site Safety Officer will receive and review the Quality Assurance Report on the OSHA Grade D parameters for the air and the test report on the flow volume on the masks. If it is a supplied air job, a qualified "bottle-watch" will be assigned the responsibility of ensuring adequate air flow to the users on air-line respirators. The "bottle-watch" will do this by maintaining pressure on the low pressure side of the regulator in the range of 60 -

120 psig and by asking the users about the adequacy of air flow when they come out of the area each break time. **Never use Oxygen as a substitute for breathing air.**

9.0 TRAINING OF EMPLOYEES IN THE RESPIRATORY HAZARDS WHICH THEY ARE POTENTIALLY EXPOSED

The only employees that will be allowed to wear respirators at INTERA are those who must also receive HAZWOPER training (29 CFR 1910.120). Therefore, the hazard awareness, air monitoring and health hazard aspects of potential workplace air are adequately covered by that training, and these concepts are also reviewed during the annual HAZWOPER refresher. The records of the training content and employee performance in that training are kept on file in designated corporate health and safety file cabinets and each branch office, as appropriate.

10.0 TRAINING IN THE PROPER USE OF RESPIRATORS

INTERA employees, whose job responsibilities include the use of respirators, will be trained in the contents of this Program. Initial training to the Respiratory Protection Program is accomplished through reading and acknowledgement of this Program. Each employee will receive a copy of the Respiratory Protection Program (**Appendix 14** of the CHSP) at commencement of employment and after each revision, and employees identified as having the need (or potential need) to wear a respirator are required to sign the Acknowledgment page at the front of this Respiratory Protection Program confirming that they have read, understood, are familiar with, and will comply with the standards that have been established in the Respiratory Protection Program. Signing of an Acknowledgment page is also required in response to revisions to the Respiratory Protection Program. Signed acknowledgement pages will be kept with a master copy of the CHSP on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files.

Additional training in the use of respirators is provided by the training contractor providing HAZWOPER training and is documented on training class certificates and through completion of fit test forms. The training gives the employee the opportunity to:

- Handle the respirator;
- Inspect valves, straps, and face piece;
- Have it fitted properly;
- Learn negative and positive pressure checks;
- Practice donning and doffing procedures; and
- Learn cleaning, storing and disinfecting procedures.

This training, along with annual HAZWOPER refreshers, also reviews the proper application of air purifying respirators according to the APR Selection Flow Chart provided in Section 3.0 and reminds employees of the limitations of both air purifying and supplied air respirators.

11.0 PERIODIC EVALUATIONS

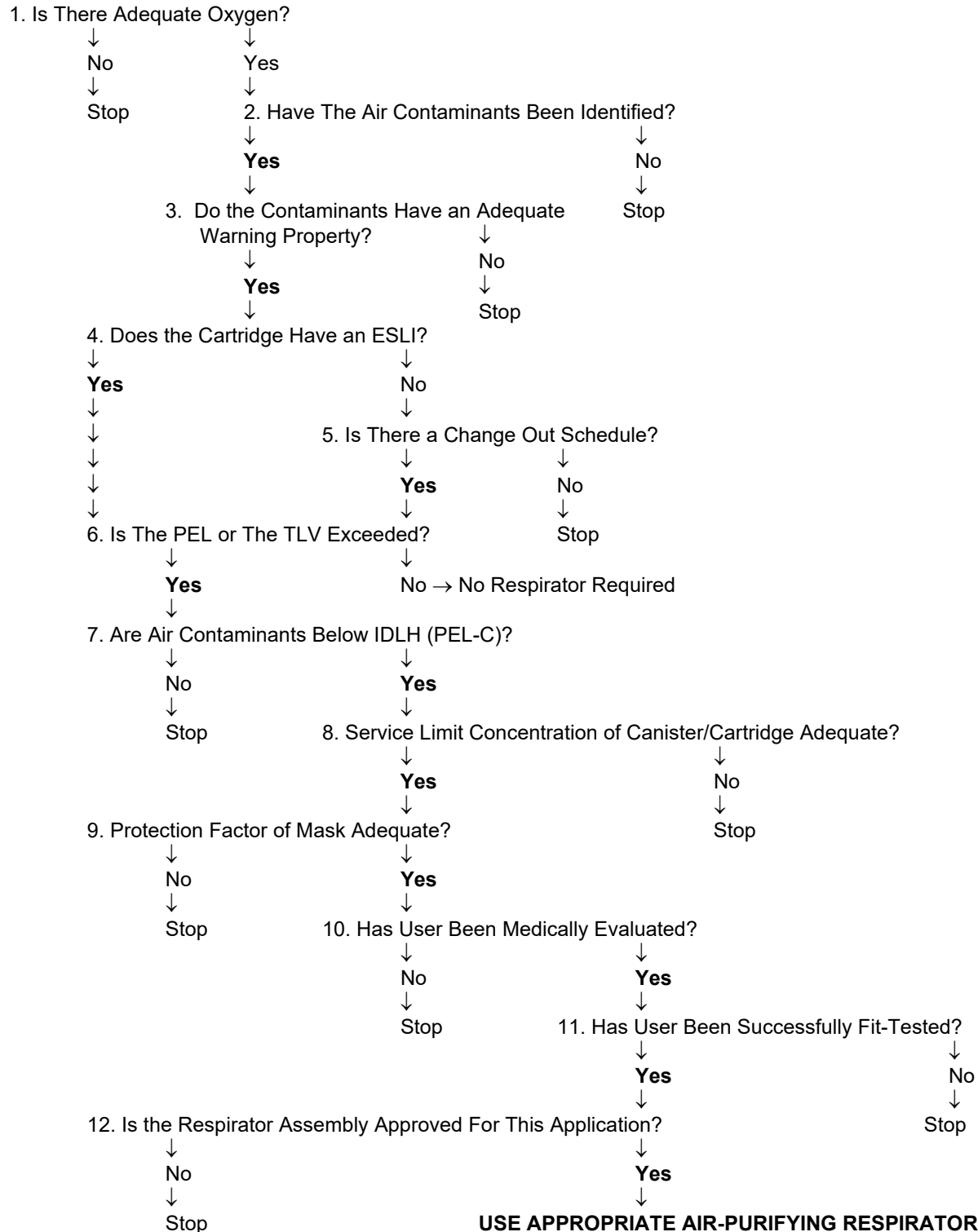
The Corporate Health and Safety Officer will review this written Program annually to ensure its effectiveness and make changes where appropriate. The Corporate Health and Safety Officer and/or the Project Manager will perform periodic inspections of work areas where respirators are used to ensure compliance with the written Program. The Corporate Health and Safety Officer, Branch Health and Safety Coordinator and/or the Project Manager will also consult regularly with employees to assess employee's views on program effectiveness and to identify and address any problems, as appropriate. Workplace inspections and employee consultations will be done in accordance with 29 CFR 1910.134(l)(1) and (2) and will be

documented and kept on file in designated corporate health and safety file cabinets and/or each branch office, as appropriate.

12.0 VOLUNTARY RESPIRATOR USE

Employees who voluntarily use a respirator to avoid exposures to hazards even if the amount of hazardous substances does not exceed the limits set by OSHA standards must be provided with a copy of 29 CFR 1910.134, Appendix D. Employees must read and adhere to 29 CFR 1910.134, Appendix D to make sure that the respirator is used properly and is kept clean so that the respirator itself does not become a hazard.

NIOSH APR SELECTION FLOW CHART (Can An Air-Purifying Respirator Be Used?)



29 CFR 1910.134 APPENDIX C: OSHA RESPIRATOR MEDICAL EVALUATION QUESTIONNAIRE
(Mandatory, but other forms that ask the same questions are acceptable)

To the employer: Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee:

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date: _____
2. Your name: _____
3. Your age (to nearest year): _____
4. Sex (circle one): Male/Female
5. Your height: _____ ft. _____ in.
6. Your weight: _____ lbs.
7. Your job title: _____
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____
9. The best time to phone you at this number: _____
10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one):
Yes/No
11. Check the type of respirator you will use (you can check more than one category):
 - a. _____ N, R, or P disposable respirator (filter-mask, non-cartridge type only).
 - b. _____ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained breathing apparatus).
12. Have you worn a respirator (circle one): Yes/No
If "yes," what type(s): _____

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you *currently* smoke tobacco, or have you smoked tobacco in the last month: Yes/No
2. Have you *ever had* any of the following conditions?
 - a. Seizures: Yes/No
 - b. Diabetes (sugar disease): Yes/No
 - c. Allergic reactions that interfere with your breathing: Yes/No
 - d. Claustrophobia (fear of closed-in places): Yes/No
 - e. Trouble smelling odors: Yes/No
3. Have you *ever had* any of the following pulmonary or lung problems?
 - a. Asbestosis: Yes/No
 - b. Asthma: Yes/No
 - c. Chronic bronchitis: Yes/No
 - d. Emphysema: Yes/No
 - e. Pneumonia: Yes/No
 - f. Tuberculosis: Yes/No
 - g. Silicosis: Yes/No
 - h. Pneumothorax (collapsed lung): Yes/No
 - i. Lung cancer: Yes/No
 - j. Broken ribs: Yes/No
 - k. Any chest injuries or surgeries: Yes/No
 - l. Any other lung problem that you've been told about: Yes/No
4. Do you *currently* have any of the following symptoms of pulmonary or lung illness?
 - a. Shortness of breath: Yes/No
 - b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No

- c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
 - d. Have to stop for breath when walking at your own pace on level ground: Yes/No
 - e. Shortness of breath when washing or dressing yourself: Yes/No
 - f. Shortness of breath that interferes with your job: Yes/No
 - g. Coughing that produces phlegm (thick sputum): Yes/No
 - h. Coughing that wakes you early in the morning: Yes/No
 - i. Coughing that occurs mostly when you are lying down: Yes/No
 - j. Coughing up blood in the last month: Yes/No
 - k. Wheezing: Yes/No
 - l. Wheezing that interferes with your job: Yes/No
 - m. Chest pain when you breathe deeply: Yes/No
 - n. Any other symptoms that you think may be related to lung problems: Yes/No
5. Have you *ever had* any of the following cardiovascular or heart problems?
- a. Heart attack: Yes/No
 - b. Stroke: Yes/No
 - c. Angina: Yes/No
 - d. Heart failure: Yes/No
 - e. Swelling in your legs or feet (not caused by walking): Yes/No
 - f. Heart arrhythmia (heart beating irregularly): Yes/No
 - g. High blood pressure: Yes/No
 - h. Any other heart problem that you've been told about: Yes/No
6. Have you *ever had* any of the following cardiovascular or heart symptoms?
- a. Frequent pain or tightness in your chest: Yes/No
 - b. Pain or tightness in your chest during physical activity: Yes/No
 - c. Pain or tightness in your chest that interferes with your job: Yes/No
 - d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
 - e. Heartburn or indigestion that is not related to eating: Yes/No
 - d. Any other symptoms that you think may be related to heart or circulation problems: Yes/No
7. Do you *currently* take medication for any of the following problems?
- a. Breathing or lung problems: Yes/No
 - b. Heart trouble: Yes/No
 - c. Blood pressure: Yes/No
 - d. Seizures: Yes/No
8. If you've used a respirator, have you *ever had* any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)
- a. Eye irritation: Yes/No
 - b. Skin allergies or rashes: Yes/No
 - c. Anxiety: Yes/No
 - d. General weakness or fatigue: Yes/No
 - e. Any other problem that interferes with your use of a respirator: Yes/No
9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire: Yes/No
- Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.
10. Have you *ever lost* vision in either eye (temporarily or permanently): Yes/No
11. Do you *currently* have any of the following vision problems?
- a. Wear contact lenses: Yes/No
 - b. Wear glasses: Yes/No
 - c. Color blind: Yes/No
 - d. Any other eye or vision problem: Yes/No
12. Have you *ever had* an injury to your ears, including a broken ear drum: Yes/No
13. Do you *currently* have any of the following hearing problems?
- a. Difficulty hearing: Yes/No

- b. Wear a hearing aid: Yes/No
- c. Any other hearing or ear problem: Yes/No
- 14. Have you *ever had* a back injury: Yes/No
- 15. Do you *currently* have any of the following musculoskeletal problems?
 - a. Weakness in any of your arms, hands, legs, or feet: Yes/No
 - b. Back pain: Yes/No
 - c. Difficulty fully moving your arms and legs: Yes/No
 - d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
 - e. Difficulty fully moving your head up or down: Yes/No
 - f. Difficulty fully moving your head side to side: Yes/No
 - g. Difficulty bending at your knees: Yes/No
 - h. Difficulty squatting to the ground: Yes/No
 - i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
 - j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

- 1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No
 - If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No
- 2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No
 - If "yes," name the chemicals if you know them: _____
 - _____
 - _____

- 3. Have you ever worked with any of the materials, or under any of the conditions, listed below:
 - a. Asbestos: Yes/No
 - b. Silica (e.g., in sandblasting): Yes/No
 - c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No
 - d. Beryllium: Yes/No
 - e. Aluminum: Yes/No
 - f. Coal (for example, mining): Yes/No
 - g. Iron: Yes/No
 - h. Tin: Yes/No
 - i. Dusty environments: Yes/No
 - j. Any other hazardous exposures: Yes/No
 If "yes," describe these exposures: _____

- 4. List any second jobs or side businesses you have: _____

- 5. List your previous occupations: _____

- 6. List your current and previous hobbies: _____

- 7. Have you been in the military services? Yes/No
 - If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No
- 8. Have you ever worked on a HAZMAT team? Yes/No
- 9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No
 - If "yes," name the medications if you know them: _____
- 10. Will you be using any of the following items with your respirator(s)?
 - a. HEPA Filters: Yes/No
 - b. Canisters (for example, gas masks): Yes/No
 - c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?:
- Escape only (no rescue): Yes/No
 - Emergency rescue only: Yes/No
 - Less than 5 hours *per week*: Yes/No
 - Less than 2 hours *per day*: Yes/No
 - 2 to 4 hours per day: Yes/No
 - Over 4 hours per day: Yes/No
12. During the period you are using the respirator(s), is your work effort:
- Light* (less than 200 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.
Examples of a light work effort are *sitting* while writing, typing, drafting, or performing light assembly work; or *standing* while operating a drill press (1-3 lbs.) or controlling machines.
 - Moderate* (200 to 350 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.
Examples of moderate work effort are *sitting* while nailing or filing; *driving* a truck or bus in urban traffic; *standing* while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; *walking* on a level surface about 2 mph or down a 5-degree grade about 3 mph; or *pushing* a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.
 - Heavy* (above 350 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hrs. _____ mins.
Examples of heavy work are *lifting* a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; *shoveling*; *standing* while bricklaying or chipping castings; *walking* up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).
13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No
If "yes," describe this protective clothing and/or equipment: _____
14. Will you be working under hot conditions (temperature exceeding 77 deg. F): Yes/No
15. Will you be working under humid conditions: Yes/No
16. Describe the work you'll be doing while you're using your respirator(s):

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):
- | | |
|---|-------|
| Name of the first toxic substance: | _____ |
| Estimated maximum exposure level per shift: | _____ |
| Duration of exposure per shift: | _____ |
| Name of the second toxic substance: | _____ |
| Estimated maximum exposure level per shift: | _____ |
| Duration of exposure per shift: | _____ |
| Name of the third toxic substance: | _____ |
| Estimated maximum exposure level per shift: | _____ |
| Duration of exposure per shift: | _____ |
| The name of any other toxic substances that you'll be exposed to while using your respirator: | |
| _____ | |
| _____ | |
19. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

RESPIRATOR INSPECTION CHECKLIST

Name of Inspector: _____ DATE: _____

Respirator Serial Number (or other identifying mark): _____

	<u>OK</u>	<u>NEEDS REPAIR</u>	<u>DATE REPAIRED</u>
1. Inhalation Valve	_____	_____	_____
2. Exhalation Valve(s)	_____	_____	_____
3. Cartridge to Cartridge Holder Gasket	_____	_____	_____
4. Other Gaskets/Canisters/Filters	_____	_____	_____
5. Face Piece Lens	_____	_____	_____
6. Straps	_____	_____	_____
7. Connecting Tube	_____	_____	_____
8. Face Sealing Surface Pliable and Intact	_____	_____	_____
9. General Cleanliness	_____	_____	_____

Other Comments:

Respirator Cleaning and Disinfecting Procedure

To clean the respirator:

1. Remove filters, cartridges or canisters and disassemble the facepiece according to the manufacturer's instructions.
2. Discard or repair any defective parts.
3. Thoroughly wash all components and surfaces in warm water with a mild detergent or with a cleaner recommended by the manufacturer. A soft bristle (not wire) brush may be used to facilitate the removal of dirt.
4. Rinse components thoroughly in clean, warm, preferably running water. Drain.
5. If the cleaner does not include a disinfecting agent, respirator components should be immersed for two minutes in a hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of warm water (43°F).
6. Rinse components thoroughly in clean, warm, preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized to prevent dermatitis or deterioration of respirator.
7. Components should be hand-dried with a clean lint-free cloth or air-dried.
8. Reassemble facepiece, replacing filter, cartridges, and canisters where necessary.
9. Test the respirator to ensure that all components work properly.

Attachment H

Confined Space Program

TABLE OF CONTENTS

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LIST OF FORMS

Form 1: Confined Space Entry Permit and Confined Space Entry Planning Worksheet

LIST OF ATTACHMENTS

Attachment A: Confined Spaces Glossary

1.0 POLICY

INTERA employees, who are required to perform Confined Space Entry work as defined by OSHA in 29 CFR 1910.146, will be trained in the contents and requirements of this Program. They will also be trained on the personnel protective equipment (PPE), ventilation equipment and rescue and retrieval equipment that are required for each particular Confined Space Entry. A written program for confined space entry will be established in the Site-Specific Health and Safety Plan (SSHASP), and a copy of the Confined Spaces Program will be included as an attachment to the SSHASP. This Program is an integral piece of the overall INTERA Corporate Health and Safety Program (CHSP).

2.0 RESPONSIBILITY

The Corporate Health and Safety Officer (Amy Andrews) is designated as the Confined Spaces Program Administrator and, as such, is responsible for this Program and has the authority to make necessary decisions regarding hiring personnel and purchasing the equipment necessary to implement and operate the Program. Branch Health and Safety Coordinators are the designated representative of the Corporate Health and Safety Officer, and are responsible for implementation and operation of this Program in each branch office. This written Program has been developed in accordance with the requirements of 29 CFR 1910.146 and covers each of the basic elements in the regulations. The Corporate Health and Safety Officer will review the Program annually and will amend these instructions as necessary.

The Corporate Health and Safety Officer or the Branch Health and Safety Coordinator and the Project Manager will review any project that involves Confined Space Entry work and will determine whether the Host Employer/Client or the INTERA Confined Spaces Program will apply. The Corporate Health and Safety Officer or the Branch Health and Safety Coordinator and the Project Manager will review employee job descriptions and determine which, if any, employees have job responsibilities that include Confined Space Entry work and those employees will be trained to this Program. The Corporate Health and Safety Officer or the Branch Health and Safety Coordinator will be responsible for ensuring that employees are trained in the provisions of this Program.

All INTERA personnel have the authority to stop an activity if it is being performed in a hazardous manner. If an employee believes that he or she is being asked to perform work in an unsafe environment, that employee is authorized to decline the request. Employees are encouraged to communicate their health and safety concerns to the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers to implement changes to work procedures where needed to reduce injury and illness exposures in the workplace. Additionally, the Corporate Health and Safety Officer, Branch Health and Safety Coordinators, Project Managers and/or Site Safety Officers have the authority to halt operations because of non-compliance with the provisions of this Program.

3.0 DEFINITIONS

Confined Space

Confined spaces are characterized by the following conditions:

- It is not meant to be continuously occupied by workers;
- It has limited or restricted openings for entry and exit;
- It has poor natural ventilation; and
- Its size, shape or use may injure workers entering or working in it.

Permit-Required Confined Space (Permit-Space)

A permit-required confined space is a confined space that requires a permit before the space can be entered because it has or has the potential for one or more of the following characteristics:

- Atmosphere can become immediately dangerous to life or health (IDLH) due to toxic, flammable or asphyxiating characteristics;
- Potential for engulfment;
- Size or shape can trap or asphyxiate; or
- Any other recognized serious hazard.

Additional terms are defined in the Glossary provided as **Attachment A** to this Program.

4.0 INSPECTION AND EVALUATION

Work areas for field projects will be inspected and evaluated to determine if they require a confined space entry permit. The inspection is the responsibility of the Site Safety Officer. Hazards will be determined and evaluated. Conditions that prohibit entry to a permit-space will be evaluated and listed on the confined space entry permit and kept with the SSHASP.

5.0 PERMITS

Entry to a permit-space is restricted to those employees listed on the permits and only permit-listed tasks will be performed. Permits must be available to all employees that are required to enter a permitted confined space. The permit is valid only for the duration of the task. Permits must be retained by the employer whose Program was followed. Permits for any Confined Space Entry that is performed following the INTERA Program will be kept with the SSHASP in the project files for a minimum of one year. Copies of permits will be forwarded to the Corporate Health and Safety Officer. The Corporate Health and Safety Officer will conduct an annual review of any entries performed following the INTERA Program and will make changes to the Confined Spaces Program, as necessary.

Confined Space Entry Permits must be posted at the point of entry throughout the duration of the entry and must include the following:

- Identification of the space;
- Purpose of entry;
- Date and duration of permit;
- List of authorized entrants;
- Names of current attendants and entry supervisor;
- List of hazards in the permit space;
- List of measures to isolate the permit space and eliminate or control hazards;
- The acceptable entry conditions;
- Results of tests initialed by the persons performing tests;
- Rescue and emergency services and means to summon;
- Communication procedures for attendants and entrants;
- Required equipment (respirators, communication devices, alarm, etc.);
- Any other necessary information; and

- Any additional permits (such as for hot work under a Hot Work Permit).

A blank **Confined Space Entry Permit** is provided as **Form 1** to this Program. This form should be used for any Confined Space Entry done under the INTERA Confined Spaces Program. **Form 1** also includes the **Confined Space Entry Planning Worksheet** which should be used in planning for the entry and in filling out the **Confined Space Entry Permit**.

6.0 CONFINED SPACE NOTICE

The Site Safety Officer will inform employees through signs, or other equally effective means, of confined spaces that require a permit to enter. Normal work for INTERA does not require confined space entry work. As such, no confined spaces are routinely entered and employees are not typically trained. However, employees will be trained prior to confined spaces work, should the need arise.

Personnel Authorized to Issue Entry Permits – Entry Supervisors

Entry supervisors are authorized to issue entry permits and must know and understand the hazards associated with confined spaces. Before signing the permit, entry supervisors must complete the permit and verify the following:

- That proper air monitoring and testing has been conducted;
- That proper equipment and work procedures are in place for conduct of the work authorized in the confined space;
- That the space is prepared and isolated;
- That a trained rescue team is available; that the means for summoning them are operable and that the procedures in place will provide for a timely response; and
- That all entrants have been given the opportunity to witness the air monitoring.

Entry supervisors may terminate entry and cancel permits. They must remove unauthorized individuals who enter a confined space. They also must determine that conditions are acceptable as specified in the permit.

Personnel Authorized to Enter Confined Spaces - Entrants

An employee who is authorized by the employer to enter into a permit-required confined space is referred to as the entrant. Personnel identified as entrants on permits must know the hazards they may face, be trained to recognize signs or symptoms of exposure, and understand the consequences of exposure to hazards.

Entrants must know how to use any needed equipment, communicate with attendants, alert attendants when a warning symptom or other hazardous condition exists and exit as quickly as possible whenever ordered or alerted (by alarm, warning sign or prohibited condition) to do so. Entrants will be provided an opportunity to witness any air quality testing prior to their entering a permit-required confined space.

Attendants

Attendants must know the hazards of the confined space and be aware of potential exposures. Attendants must perform the following duties:

- check permits to confirm list of authorized entrants
- prevent entry to those without a permit;
- maintain a continuous count of those in a confined space;
- monitor activity in the confined space; and

- remain outside the confined space until relieved.

If necessary, an attendant will:

- order everyone to exit a confined space;
- contact rescuers by radio provided by the Host Site, or by cell phone; and
- perform non-entry rescues.

Attendants may not perform any duty that will interfere with the duties listed above. INTERA attendants will not monitor more than one permit-required confined space at a time.

Authorized Personnel Training in the use of Gas Monitor Devices

INTERA will provide the necessary oxygen, combustible gas and toxic gas monitoring equipment. Equipment will be calibrated and only properly trained personnel will be allowed to use the sampling equipment to determine safe entry parameters. In some cases, the air monitoring of confined spaces will be performed by trained safety personnel provided by the Host Employer/Client. Entrants or their representatives will be given the opportunity to witness the air monitoring measurements and review the results. Entrants will also be allowed to request additional air monitoring measurements whenever they believe conditions may have changed.

Authorized On-Site Rescue Team Members

On-site rescue teams will consist of Host Employer/Client personnel whenever possible. However, in the event that a project involving confined spaces is undertaken by INTERA at a site where Host Employer/Client rescue personnel are not available, INTERA will provide a properly-trained rescue team.

On-site rescue teams should use employee retrieval systems whenever possible. On-site teams must be properly equipped. They must practice simulated rescues at least once every twelve (12) months. Rescue teams will receive the same training as authorized entrants and additional training on the use of PPE, use of rescue equipment and first aid, including CPR.

Outside Rescue Services

Rescue team services will be provided by the Host Employer/Client whenever possible, and they will be responsible for contracting with outside rescue services. In the event that a project involving permit-spaces is undertaken by INTERA at a site where Host Employer/Client support is not available, INTERA will contract with outside rescue services.

Outside rescue services will be called in the event of any emergency involving confined spaces. Outside rescue services must be made aware of hazards and have access to permit-spaces in order to develop rescue plans and practice rescues. Employers must provide hospitals or treatment facilities with any Safety Data Sheets (SDSs) or other information about known hazards in a permit-space, if the information can aid in treatment of rescued employees.

Preventing Unauthorized Entry

Barricades and signs will be posted around permit-required confined spaces to notify individuals that only trained employees will be allowed beyond the barricades. The attendant and supervisor will allow no unauthorized persons to enter the space.

Informing Other Contractors

INTERA will require any other contractor who intends to put employees in the confined space to provide proof of training at the required level. There will be a pre-entry meeting to review the permit form, the specific project hazards and required protective clothing. Other contractors will also be required to provide their own attendant and have their supervisor co-sign the permit.

Permit Issuing and Cancellation

Only properly trained and certified supervisors may issue a confined-space permit after the Host Employer/Client or INTERA safety personnel have verified the space has been properly prepared, the air quality has been checked, and that procedures have been followed according to the applicable Confined Spaces Program.

The permit can be cancelled by the supervisor, the attendant, or the entrant should any conditions develop that violate the permit entry conditions. This cancellation will be communicated by the attendant using the evacuation alarm specified on the permit to remove entrants from the space. The situation will be evaluated to determine the steps needed to re-issue a permit after the cancellation, but the initial permit will note the time of cancellation along with supervisor and attendant signatures. This cancelled permit is no longer valid, and a new permit will be issued prior to re-entering the space.

In addition, any Host Employer/Client site audible alarms will cancel any confined space permit using the same procedures listed above, and a new permit will be required to re-enter the space.

7.0 CONFINED SPACES TRAINING

INTERA employees who are required to perform work in permit-required confined spaces will be trained in the contents of this Program. Training to the Confined Spaces Program is accomplished through reading and acknowledgement. Employees receive a copy of the Confined Spaces Program (**Appendix 19** of the CHSP) at commencement of employment, and employees identified as having the need to work in permit-required confined spaces are required to sign the Acknowledgment page at the front of the Confined Spaces Program confirming that they have read, understood, are familiar with, and will comply with the standards that have been established in the Program. Signing of an Acknowledgement page is also required upon receipt of revisions to the Program. Signed acknowledgement pages will be kept with a master copy of the CHSP on file in designated health and safety file cabinets at each branch office and a copy will be kept in the designated corporate health and safety files.

Additional training in a classroom setting is required to provide employees with the understanding, skills and knowledge to do their job safely. Training will be provided on the specific duties required for Entrants, Attendants, Supervisors and the Rescue Team. Training must include both initial and refresher courses. Refresher training is necessary when duties change, when hazards change, or whenever an evaluation determines inadequacies in an employee's knowledge. Certification of training must include the employee's name, signature or initials of trainer and date of training. Original certificates indicating completion of training are to be kept by the employee. A copy will be kept on file in designated corporate health and safety file cabinets as well as at the branch office of the respective employee. Training records are kept for the term of employment of the employee.

**INTERA CONFINED SPACE ENTRY
PERMIT**

Permit Number _____ Date _____

Location & Description of Confined Space:

Purpose of Entry:

Scheduled Start _____ a.m.
_____ p.m.
Day / Date / Time

Scheduled Finish _____ a.m.
_____ p.m.
Day / Date / Time

Entrants:

Attendants:

{Check those items below which are applicable to your confined space permit.}

TYPES OF HAZARDS

- | | | |
|--|---|---|
| <input type="checkbox"/> Oxygen-Deficient Atmosphere | <input type="checkbox"/> Engulfment | <input type="checkbox"/> Energized Electrical Equipment |
| <input type="checkbox"/> Oxygen-Enriched Atmosphere | <input type="checkbox"/> Toxic Atmosphere | <input type="checkbox"/> Entrapment |
| <input type="checkbox"/> Welding/Cutting | <input type="checkbox"/> Flammable Atmosphere | <input type="checkbox"/> Hazardous Chemical |

Note: If welding/cutting operations are to be performed, attach hot work permit to entry form.

ISOLATION PROCEDURES

- | | |
|---|---|
| <input type="checkbox"/> Equipment depressurized, drained, free of toxic/flammable material | <input type="checkbox"/> SDS/MSDSs reviewed |
| <input type="checkbox"/> Control valves locked/tagged | <input type="checkbox"/> Other Lock Out/Tag Out, as necessary |
| | <input type="checkbox"/> Energy sources de-energized |

SAFETY PRECAUTIONS

- | | | |
|--|---|--|
| <input type="checkbox"/> Protective Gloves/Other PPE | <input type="checkbox"/> Barricade Job Area | <input type="checkbox"/> Lifelines |
| <input type="checkbox"/> Entry and Caution Signs Posted | <input type="checkbox"/> Respirators (note type in Remarks below) | <input type="checkbox"/> Current H&S Certifications |
| <input type="checkbox"/> Fire-Retardant Clothing | <input type="checkbox"/> Lockout/Tagout | <input type="checkbox"/> Lighting |
| <input type="checkbox"/> Ventilation (e.g. mechanical power vent. fan) | <input type="checkbox"/> Fire Extinguishers | <input type="checkbox"/> Ground Fault Interrupter |
| <input type="checkbox"/> Two-way Radio | <input type="checkbox"/> Alert/Air Horns | <input type="checkbox"/> Other Communication Equipment |

Remarks: _____

ENVIRONMENTAL TESTING

<u>ACCEPTABLE ENTRY CONDITIONS</u>	<u>TESTED</u>	<u>DATE / TIME</u>
Oxygen: 19.5% - 23.5%	_____ %	_____ a/p
Lower Explosive Limit: <10% LEL	_____ %	_____ a/p
Toxic Atmosphere (Benzene): 0.5 ppm or less	_____ ppm	_____ a/p
Toxic Atmosphere (H2S): <5ppm	_____ ppm	_____ a/p
Toxic Atmosphere (CO): <10ppm	_____ ppm	_____ a/p

Instruments Used:

Calibration Date:

<u>RE-TESTING</u>	<u>TESTED</u>	<u>DATE / TIME</u>
Oxygen: _____ %	_____ a/p	_____ % _____ a/p
LEL: <10% LEL _____ %	_____ a/p	_____ % _____ a/p
Toxic: _____ ppm	_____ a/p	_____ ppm _____ a/p
Toxic: _____ ppm	_____ a/p	_____ ppm _____ a/p
Toxic: _____ ppm	_____ a/p	_____ ppm _____ a/p

Additional testing _____

Employee Conducting Safety Checks **SIGNATURE:** _____

Remark on the overall condition of the confined space.

ENTRY SUPERVISOR AUTHORIZATION

All actions and/or conditions for safe entry have been performed.

Entry Supervisor

PLEASE SIGN AND PRINT

ENTRY CANCELLATION

Entry has been completed and all entrants have exited permit space.

Entry Supervisor

PLEASE SIGN AND PRINT

IN CASE OF EMERGENCY CALL 911

{CFR 1910.146 (f)(11)}

CONFINED SPACE ENTRY PLANNING WORKSHEET

What is the type of the confined space? _____

Where is the confined space located? _____

Reason for entering the confined space: _____

Contents of the confined space: _____

List oxygen level _____

Describe the procedures used to test oxygen and the testing equipment used: _____

List flammable gas level _____

Describe the procedures used to test flammable gas level and the testing equipment used: _____

List toxic gas levels _____

Describe the procedures used to test toxic gas levels and the testing equipment used: _____

List all mechanical and physical hazards: _____

Describe the procedures for isolating all mechanical and physical hazards: _____

What type of ventilation will be used? ☐ Mechanical ☐ Natural

Describe procedures: _____

Will the confined space be purged? _____

If yes, list the procedures: _____

Will the confined space be cleaned? _____

If yes, list procedures: _____

List all chemicals that will be used: _____

Will warning signs or barriers be needed? _____

If yes, describe what type and where they must be placed: _____

List the names and job assignments for every individual who will be involved in the entry.

Name

Job Assignment

List all equipment that will be needed.

Type of Equipment

Quantity

CONFINED SPACES GLOSSARY

Acceptable Entry Conditions - The conditions that must exist in a permit space to allow entry and so that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Attendant - An individual stationed outside one or more permit-spaces who monitors the authorized entrants and who performs attendant's duties assigned in the employer's permit-space plan.

Authorized Entrant - An employee who is authorized by the employer to enter into a permit-space.

Blanking or Blinding - The absolute closure of a pipe, line or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and is capable of withstanding the maximum pressure of the pipe, line or duct with no leakage beyond the plate.

Confined Space - A space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work and (2) has limited or restricted entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and (3) is not designed for continuous employee occupancy.

Double Block and Bleed - The closure of a line, duct or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency - Any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment - The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be breathed in and can cause death by filling or plugging the respiratory system; or that can exert enough force on the body to cause death by strangulation, constriction or crushing.

Entry - The action by which a person passes through an opening into a permit-required space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry Permit - The written or printed document that is provided by the employer to allow and control entry into the permit-space and contains the information of the permit-required confined space plan.

Entry Supervisor - The person (such as the employer, project manager or safety officer) responsible for determining if acceptable entry conditions are present at a permit-space where entry is planned; for authorizing entry and overseeing entry operations; and for terminating entry as required by this plan. Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this plan for each role he or she fills. Also, the duties of the entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous Atmosphere - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of the ability to self-rescue (that is escape unaided from a permit space), injury, or illness from one or more of the following causes: (1) flammable gas, vapor or mist in excess of ten (10%) percent of its lower explosive limit (LEL); (2) airborne combustible dust at a concentration that meets or exceeds its LEL; (3) atmospheric oxygen concentration below 19.5 percent or above 23.5 percent; (4) atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, *Occupational Health and Environmental Control*, or in Subpart Z, *Toxic and Hazardous Substances*, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit; (5) any other atmospheric condition that is immediately dangerous to life or health.

Hot Work Permit - The employer's written authorization to perform operations (for example, riveting, welding, cutting, burning and heating) capable of providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH)- Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting - The displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation - The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Line Breaking - The intentional opening of a pipe, line or duct that is or has been carrying flammable, corrosive or toxic material, an inert gas or any fluid at a volume, pressure or temperature capable of causing injury.

Non-Permit Confined Space - A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Oxygen Deficient Atmosphere - Means an atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen-Enriched Atmosphere - An atmosphere containing more than 23.5% oxygen by volume.

Permit-Required Confined Space (Permit-Space) - A confined space that has one or more of the following characteristics: (1) contains or has a potential to contain a hazardous atmosphere; (2) contains a material that has the potential for engulfing an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross-section; and (4) contains any other recognized serious safety or health hazard.

Permit-Required Confined Space Plan (Permit-Space Plan) - The employer's overall plan for controlling and, where appropriate, for protecting employees from permit-space hazards or for regulating employee entry into permit-spaces.

Permit System - The employer's written procedure of preparing and issuing permits for entry and for returning the permit-space to service following termination of entry.

Prohibited Condition - Any condition in a permit-space that is not allowed by the permit during the period when entry is authorized.

Rescue Services - The personnel designated to rescue employees from permit-spaces.

Retrieval System - The equipment (including retrieval line, chest or full body harness, wristlets [if appropriate], and lifting device or anchor) used for non-entry rescue of persons from permit-spaces.

Testing - The process by which the hazards that may confront entrants of a permit-space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit-space.

HAZCOM

Hazardous Chemical List
Safety Data Sheets

LIST OF SITE CHEMICALS AND COPCS

Site COPCs

1. Benzene
2. Ethylbenzene
3. Toluene
4. total xylenes
5. total naphthalene
6. MTBE
7. EDC
8. EDB
9. PCE
10. TCE
11. 1,1-DCE
12. Methylene Chloride
13. Vinyl Chloride
14. nitrate
15. unleaded gasoline
16. diesel fuel

Site Chemicals

1. motor oil
2. bentonite
3. Portland Cement
4. mercuric chloride (HgCl_2) as sample preservative
5. nitric acid (HNO_3) as sample preservative
6. sodium thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) as sample preservative

SAFETY DATA SHEET

Creation Date 24-Nov-2010

Revision Date 18-Jan-2018

Revision Number 3

1. Identification

Product Name Carbon tetrachloride

Cat No. : AC148170000; AC148170010; AC148170025

Synonyms Tetrachloromethane

Recommended Use Laboratory chemicals.

Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 / **Europe**:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 3
Acute dermal toxicity	Category 3
Acute Inhalation Toxicity - Dusts and Mists	Category 3
Carcinogenicity	Category 2
Specific target organ toxicity - (repeated exposure)	Category 1

Label Elements

Signal Word

Danger

Hazard Statements

Toxic if swallowed
Toxic in contact with skin
Toxic if inhaled
May cause cancer
Causes damage to organs through prolonged or repeated exposure

**Precautionary Statements****Prevention**

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician

Skin

IF ON SKIN: Wash with plenty of soap and water
Call a POISON CENTER or doctor/physician if you feel unwell
Remove/Take off immediately all contaminated clothing
Wash contaminated clothing before reuse

Ingestion

IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Rinse mouth

Storage

Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Harmful to aquatic life with long lasting effects
Harms public health and the environment by destroying ozone in the upper atmosphere

WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Carbon tetrachloride	56-23-5	>95

4. First-aid measures

Eye Contact

Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation

Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Drowsiness. Dizziness. Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	982 °C / 1799.6 °F
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Hydrogen chloride gas Carbon monoxide (CO) Carbon dioxide (CO₂) Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health
3

Flammability
0

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation. Avoid contact with the skin and the eyes. Keep people away from and upwind of spill/leak.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Carbon tetrachloride	TWA: 5 ppm STEL: 10 ppm Skin	(Vacated) TWA: 2 ppm (Vacated) TWA: 12.6 mg/m ³ Ceiling: 25 ppm TWA: 10 ppm	IDLH: 200 ppm STEL: 2 ppm STEL: 12.6 mg/m ³	TWA: 5 ppm TWA: 30 mg/m ³ STEL: 20 ppm STEL: 126 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment**Eye/face Protection**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-23 °C / -9.4 °F
Boiling Point/Range	76 °C / 168.8 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	121 mbar @ 20 °C
Vapor Density	No information available
Specific Gravity	1.594
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	982 °C / 1799.6 °F
Decomposition Temperature	> 100°C
Viscosity	0.97 mPa.s at 20 °C
Molecular Formula	C Cl ₄
Molecular Weight	153.82

10. Stability and reactivity

Reactive Hazard

None known, based on information available

Stability

Stable under normal conditions.

Conditions to Avoid	Incompatible products.
Incompatible Materials	Strong oxidizing agents, Fluorine, Metals
Hazardous Decomposition Products	Hydrogen chloride gas, Carbon monoxide (CO), Carbon dioxide (CO ₂), Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbon tetrachloride	LD50 = 2350 mg/kg (Rat)	LD50 = 5070 mg/kg (Rat)	LC50 = 8000 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Carbon tetrachloride	56-23-5	Group 2B	Reasonably Anticipated	A2	X	A2

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Carbon tetrachloride	EC50: = 830 mg/L, 24h	LC50: 9.68 - 11.3 mg/L, 96h	EC50 = 34 mg/L 10 min	EC50: = 28 mg/L, 24h

	(Tetrahymena pyriformis)	static (Pimephales promelas) LC50: 23 - 33 mg/L, 96h static (Lepomis macrochirus) LC50: 36.3 - 47.3 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 5.6 mg/L 5 min	(Daphnia magna) EC50: = 29 mg/L, 48h (Daphnia magna)
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Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Carbon tetrachloride	2.75

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Carbon tetrachloride - 56-23-5	U211	-

14. Transport information

DOT

UN-No 1846
 Proper Shipping Name CARBON TETRACHLORIDE
 Hazard Class 6.1
 Packing Group II

TDG

UN-No 1846
 Proper Shipping Name CARBON TETRACHLORIDE
 Hazard Class 6.1
 Packing Group II

IATA

UN-No UN1846
 Proper Shipping Name CARBON TETRACHLORIDE
 Hazard Class 6.1
 Packing Group II

IMDG/IMO

UN-No UN1846
 Proper Shipping Name CARBON TETRACHLORIDE
 Hazard Class 6.1
 Packing Group II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Carbon tetrachloride	X	X	-	200-262-8	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Carbon tetrachloride	56-23-5	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Carbon tetrachloride	X	10 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Carbon tetrachloride	X	X	-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Carbon tetrachloride	10 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Carbon tetrachloride	56-23-5	Carcinogen	5 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Carbon tetrachloride	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	24-Nov-2010
Revision Date	18-Jan-2018
Print Date	18-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Version 3.12
Revision Date 02/14/2018
Print Date 10/19/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : 1,1-Dichloroethylene

Product Number : 513172

Brand : Aldrich

Index-No. : 602-025-00-8

CAS-No. : 75-35-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 1), H224

Acute toxicity, Oral (Category 3), H301

Skin irritation (Category 2), H315

Eye irritation (Category 2A), H319

Carcinogenicity (Category 2), H351

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H224 : Extremely flammable liquid and vapour.

H301 : Toxic if swallowed.

H315 : Causes skin irritation.

H319 : Causes serious eye irritation.

H351 : Suspected of causing cancer.

Precautionary statement(s)

P201 : Obtain special instructions before use.

P202 : Do not handle until all safety precautions have been read and understood.

P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P321	Specific treatment (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C ₂ H ₂ Cl ₂
Molecular weight	: 96.94 g/mol
CAS-No.	: 75-35-4
EC-No.	: 200-864-0
Index-No.	: 602-025-00-8

Hazardous components

Component	Classification	Concentration
Vinylidene chloride		
	Flam. Liq. 1; Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; H224, H301, H315, H319, H351	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES**5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE**7.1 Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature 2 - 8 °C

Air and moisture sensitive. Store under inert gas.

Storage class (TRGS 510): 3: Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Vinylidene chloride	75-35-4	TWA	5.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Liver damage Kidney damage Not classifiable as a human carcinogen		
		Potential Occupational Carcinogen See Appendix A		
		PEL	1 ppm 4 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm

Break through time: 480 min

Material tested: Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact

Material: butyl-rubber

Minimum layer thickness: 0.3 mm

Break through time: 30 min

Material tested: Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance	Form: liquid, clear Colour: colourless
b) Odour	No data available
c) Odour Threshold	No data available
d) pH	No data available
e) Melting point/freezing point	-122.0 °C (-187.6 °F)
f) Initial boiling point and boiling range	30.0 - 32.0 °C (86.0 - 89.6 °F)
g) Flash point	-19 °C (-2 °F) - closed cup
h) Evaporation rate	No data available
i) Flammability (solid, gas)	No data available
j) Upper/lower flammability or explosive limits	Upper explosion limit: 15.5 %(V) Lower explosion limit: 6.5 %(V)
k) Vapour pressure	658.6 hPa (494.0 mmHg) 667.3 hPa (500.5 mmHg) at 20.0 °C (68.0 °F) 2,137.4 hPa (1,603.2 mmHg) at 55.0 °C (131.0 °F)
l) Vapour density	No data available
m) Relative density	1.21 g/cm ³
n) Water solubility	0.2 g/l at 20 °C (68 °F)
o) Partition coefficient: n-octanol/water	No data available
p) Auto-ignition temperature	520.0 °C (968.0 °F) 580.0 °C (1,076.0 °F)
q) Decomposition temperature	No data available
r) Viscosity	No data available
s) Explosive properties	No data available
t) Oxidizing properties	No data available

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

Test for peroxide formation before using or discard after 3 months.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials

Oxidizing agents, Copper, Aluminum, and its alloys, Peroxides, Strong bases, Oxygen

10.6 Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 200.0 mg/kg

Inhalation: Lung irritation

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Additional Information

RTECS: KV9275000

Nausea, Headache, Vomiting, Dizziness, Drowsiness, Confusion., Incoordination., Central nervous system depression,
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Daphnia magna (Water flea) - 11.60 - 11.79 mg/l
	LC50 - Pimephales promelas (fathead minnow) - 108.00 - 169.00 mg/l
	LC50 - Lepomis macrochirus (Bluegill) - 74.00 - 220.00 mg/l
	LC50 - Cyprinodon variegatus (sheepshead minnow) - 249.00 mg/l
	LC50 - other fish - 250.00 mg/l
	LC50 - other fish - 224.00 mg/l
	LC50 - Pimephales promelas (fathead minnow) - 108 mg/l - 96 h
	NOEC - Cyprinodon variegatus (sheepshead minnow) - 80 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 11.6 mg/l - 48 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1303 Class: 3 Packing group: I
Proper shipping name: Vinylidene chloride, stabilized
Reportable Quantity (RQ): 100 lbsMarine pollutant:yes
Poison Inhalation Hazard: No

IMDG

UN number: 1303 Class: 3 Packing group: I EMS-No: F-E, S-D
Proper shipping name: VINYLIDENE CHLORIDE, STABILIZED
Marine pollutant:yes Marine pollutant: yes

IATA

UN number: 1303 Class: 3 Packing group: I
Proper shipping name: Vinylidene chloride, stabilized

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Vinylidene chloride	75-35-4	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Vinylidene chloride	75-35-4	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Vinylidene chloride	75-35-4	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Vinylidene chloride	75-35-4	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H224	Extremely flammable liquid and vapour.
H301	Toxic if swallowed.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H351	Suspected of causing cancer.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	2

NFPA Rating

Health hazard:	2
Fire Hazard:	4
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.12

Revision Date: 02/14/2018

Print Date: 10/19/2018

SAFETY DATA SHEET

Creation Date 27-Jan-2010

Revision Date 17-Jan-2018

Revision Number 6

1. Identification

Product Name	Methylene chloride
Cat No. :	D37-1; D37-4; D37-20; D37-200; D37-200LC; D37-500; D37FB-19; D37FB-50; D37FB-115; D37FB-200; D37POP-19; D37POPB-50; D37POPB-200; D37RB-19; D37RB-50; D37RB-115; D37RB-200; D37RS-19; D37RS-28; D37RS-50; D37RS-115; D37RS-200; D37SK-4; D37SK-4LC; D37SS-28; D37SS-50; D37SS-115; D37SS-200; D37SS-1350; D37RS1000ASME; NC1485726; D37RE200ASME; NC1568702
CAS-No	75-09-2
Synonyms	Dichloromethane; DCM
Recommended Use	Laboratory chemicals.
Uses advised against	Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number

CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Liver, Kidney, Blood.	

Label Elements

Signal Word

Danger

Hazard Statements

Causes skin irritation

Causes serious eye irritation

May cause drowsiness or dizziness

May cause cancer

May cause damage to organs through prolonged or repeated exposure

**Precautionary Statements****Prevention**

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Use personal protective equipment as required

Wash face, hands and any exposed skin thoroughly after handling

Wear eye/face protection

Do not breathe dust/fume/gas/mist/vapors/spray

Use only outdoors or in a well-ventilated area

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

If eye irritation persists: Get medical advice/attention

Storage

Store locked up

Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Methylene chloride	75-09-2	>99.5

4. First-aid measures

General Advice

If symptoms persist, call a physician.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.
Inhalation	Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.
Ingestion	Clean mouth with water and drink afterwards plenty of water.
Most important symptoms and effects	None reasonably foreseeable. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	556 °C / 1032.8 °F
Explosion Limits	
Upper	23 vol %
Lower	13 vol %
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂) Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health
2

Flammability
1

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions	Should not be released into the environment.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Ensure adequate ventilation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Methylene chloride	TWA: 50 ppm	(Vacated) TWA: 500 ppm (Vacated) STEL: 2000 ppm (Vacated) Ceiling: 1000 ppm TWA: 25 ppm STEL: 125 ppm	IDLH: 2300 ppm	TWA: 100 ppm TWA: 330 mg/m ³ STEL: 500 ppm STEL: 1740 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment**Eye/face Protection**

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Long sleeved clothing.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-97 °C / -142.6 °F
Boiling Point/Range	39 °C / 102.2 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	23 vol %
Lower	13 vol %
Vapor Pressure	350 mbar @ 20°C
Vapor Density	2.93 (Air = 1.0)
Specific Gravity	1.33
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	556 °C / 1032.8 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C H ₂ Cl ₂
Molecular Weight	84.93

10. Stability and reactivity

Reactive Hazard

None known, based on information available

Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat.
Incompatible Materials	Strong oxidizing agents, Strong acids, Amines
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO ₂), Hydrogen chloride gas, Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methylene chloride	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rat)	53 mg/L (Rat) 6 h 76000 mg/m ³ (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Methylene chloride	75-09-2	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Confirmed Animal Carcinogen

A4 - Not Classifiable as a Human Carcinogen

A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects Mutagenic effects have occurred in microorganisms.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Liver Kidney Blood

Aspiration hazard	No information available
Symptoms / effects, both acute and delayed	Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Endocrine Disruptor Information	No information available
Other Adverse Effects	Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methylene chloride	EC50:>660 mg/L/96h	Pimephales promelas: LC50:193 mg/L/96h	EC50: 1 mg/L/24 h EC50: 2.88 mg/L/15 min	EC50: 140 mg/L/48h

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methylene chloride	1.25

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Methylene chloride - 75-09-2	U080	-

14. Transport information

DOT

UN-No	UN1593
Proper Shipping Name	DICHLOROMETHANE
Hazard Class	6.1
Packing Group	III

TDG

UN-No	UN1593
Proper Shipping Name	DICHLOROMETHANE
Hazard Class	6.1
Packing Group	III

IATA

UN-No	UN1593
Proper Shipping Name	Dichloromethane
Hazard Class	6.1
Packing Group	III

IMDG/IMO

UN-No	UN1593
Proper Shipping Name	Dichloromethane
Hazard Class	6.1
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methylene chloride	X	X	-	200-838-9	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Methylene chloride	75-09-2	>99.5	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Methylene chloride	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depleters	Class 2 Ozone Depleters
Methylene chloride	X		-

OSHA Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Methylene chloride	125 ppm STEL 12.5 ppm Action Level 25 ppm TWA	-

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methylene chloride	1000 lb 1 lb	-

California Proposition 65

This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Methylene chloride	75-09-2	Carcinogen	200 µg/day 50 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methylene chloride	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade	No information available
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16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	27-Jan-2010
Revision Date	17-Jan-2018
Print Date	17-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

Revision Number 5

1. Identification

Product Name Tetrachloroethylene

Cat No. : AC445690000; ACR445690010; AC445690025; AC445691000

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet**Company**

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone NumberFor information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99**CHEMTREC** Tel. No. **US**:001-800-424-9300 / **Europe**:001-703-527-3887**2. Hazard(s) identification****Classification**

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements**Signal Word**

Danger

Hazard Statements

Causes skin irritation

Causes serious eye irritation

May cause an allergic skin reaction

May cause drowsiness or dizziness

May cause cancer

May cause damage to organs through prolonged or repeated exposure

**Precautionary Statements****Prevention**

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Storage

Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice

If symptoms persist, call a physician.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation

Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion

Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects

None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician

Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point No information available

Method - No information available

Autoignition Temperature No information available

Explosion Limits

Upper No data available

Lower No data available

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products

Chlorine Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health
2

Flammability
0

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Ensure adequate ventilation.

Environmental Precautions Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m ³ Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 100 ppm TWA: 670 mg/m ³ TWA: 200 ppm TWA: 1250 mg/m ³ STEL: 200 ppm STEL: 1340 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Long sleeved clothing.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C ₂ Cl ₄
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium
Hazardous Decomposition Products	Chlorine, Hydrogen chloride gas, Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Confirmed Animal Carcinogen

A4 - Not Classifiable as a Human Carcinogen

A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disruptors Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.53 - 2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
 Proper Shipping Name TETRACHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

TDG

UN-No UN1897

Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III
IATA	
UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III
IMDG/IMO	
UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Subsidiary Hazard Class	P
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	X	X	-	204-825-9	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

Print Date 23-Jan-2018

Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 03-Feb-2010

Revision Date 14-Jul-2016

Revision Number 2

1. Identification

Product Name Trichloroethylene

Cat No. : T340-4; T341-4; T341-20; T341-500; T403-4

Synonyms Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)

Recommended Use Laboratory chemicals.

Uses advised against

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number

CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements**Signal Word**

Danger

Hazard Statements

Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure

**Precautionary Statements****Prevention**

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Storage

Store locked up
Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Trichloroethylene	79-01-6	100

4. First-aid measures

General Advice

Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation

Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a

pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature 410 °C / 770 °F

Explosion Limits

Upper 10.5 vol %

Lower 8 vol %

Oxidizing Properties Not oxidising

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health
2

Flammability
1

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.

Environmental Precautions Should not be released into the environment. Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m ³ Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m ³ TWA: 100 ppm	IDLH: 1000 ppm	TWA: 100 ppm TWA: 535 mg/m ³ STEL: 200 ppm STEL: 1080 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Long sleeved clothing.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	10.5 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C
Viscosity	0.55 mPa.s (25°C)

Molecular Formula C₂ H Cl₃
Molecular Weight 131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Hydrogen chloride gas, Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO₂)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4290 mg/kg (Rat) LD50 = 4920 mg/kg (Rat)	LD50 > 20 g/kg (Rabbit) LD50 = 29000 mg/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Reasonably Anticipated	A2	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure	Central nervous system (CNS)
STOT - repeated exposure	Kidney Liver Heart spleen Blood
Aspiration hazard	No information available
Symptoms / effects, both acute and delayed	Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Endocrine Disruptor Information	No information available
Other Adverse Effects	The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is: Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus) LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
 Proper Shipping Name TRICHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

TDG

UN-No UN1710
 Proper Shipping Name TRICHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

IATA

UN-No UN1710
 Proper Shipping Name TRICHLOROETHYLENE

Hazard Class	6.1
Packing Group	III
IMDG/IMO	
UN-No	UN1710
Proper Shipping Name	TRICHLOROETHYLENE
Hazard Class	6.1
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Trichloroethylene	X	X	-	201-167-4	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

Component	TSCA 12(b)
Trichloroethylene	Section 5

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	100	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Trichloroethylene	X		-

OSHA Occupational Safety and Health Administration

Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010

Revision Date 14-Jul-2016

Print Date 14-Jul-2016

Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

M9192 - ANSI - EN



OXY Oxy Vinyls, LP

A subsidiary of Occidental Petroleum Corporation



VINYL CHLORIDE (MONOMER)

SDS No.: M9192

SDS Revision Date: 06-Apr-2015

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Identification:	Oxy Vinyls, LP 5005 LBJ Freeway Suite 2200 Dallas, Texas 75244-6119
24 Hour Emergency Telephone Number:	1-800-733-3665 or 1-972-404-3228 (USA); CHEMTREC (within USA and Canada): 1-800-424-9300; CHEMTREC (outside USA and Canada): +1 703-527-3887; CHEMTREC Contract No: CCN16186
To Request an SDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Product Identifier:	VINYL CHLORIDE (MONOMER)
Synonyms:	VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer
Product Use:	PVC Manufacturing
Uses Advised Against:	Aerosol propellant.

2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

VINYL CHLORIDE (MONOMER)

SDS No.: M9192

SDS Revision Date: 06-Apr-2015

EMERGENCY OVERVIEW:

Color: Colorless
Physical state Compressed, liquefied gas
Odor: Sweet
Signal Word: **DANGER**

MAJOR HEALTH HAZARDS: CONTAINS VINYL CHLORIDE, A KNOWN HUMAN CANCER AGENT. MAY CAUSE CANCER. CONTACT WITH LIQUID MAY CAUSE FROSTBITE TO EXPOSED TISSUE. MAY PRODUCE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION INCLUDING HEADACHE, DIZZINESS, NAUSEA, LOSS OF BALANCE AND DROWSINESS. CAUSES SKIN IRRITATION. CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION. CAUSES DAMAGE TO LIVER, BLOOD, NERVOUS SYSTEM, LYMPHATIC SYSTEM, AND MUSCULOSKELETAL SYSTEM THROUGH PROLONGED OR REPEATED EXPOSURE. CAUSES DAMAGE TO LUNGS THROUGH PROLONGED OR REPEATED EXPOSURE BY INHALATION. SUSPECTED OF CAUSING GENETIC DEFECTS. SUSPECTED REPRODUCTIVE HAZARD.

PHYSICAL HAZARDS: Extremely flammable gas under pressure.

PRECAUTIONARY STATEMENTS: Keep away from heat, sparks and flame. Wash thoroughly after handling. Avoid contact with eyes, skin and clothing. Do not breathe vapors or spray mist. Do not eat, drink or smoke in areas where this material is used. Use only outdoors or in a well-ventilated area. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Store in well-ventilated place. Keep container tightly closed.

GHS CLASSIFICATION:

GHS: PHYSICAL HAZARDS:	Flammable Gas - Cat. 1 Extremely Flammable Gas Under Pressure - Liquefied
GHS: CONTACT HAZARD - SKIN:	Category 2 - Causes skin irritation.
GHS: CONTACT HAZARD - EYE:	Category 2B - Causes eye irritation
GHS: TARGET ORGAN TOXICITY (SINGLE EXPOSURE):	Category 3 - May cause respiratory tract irritation Category 3 - May cause drowsiness or dizziness
GHS: TARGET ORGAN TOXICITY (REPEATED EXPOSURE):	Category 1 - Causes damage to liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system through prolonged or repeated exposure
GHS: CARCINOGENICITY:	Category 1A - May cause cancer.
GHS: GERM CELL MUTAGENICITY:	Category 2 - Suspected of causing genetic defects
GHS: REPRODUCTION TOXIN:	Category 2 - Suspected of damaging fertility or the unborn child
GHS - OSHA Hazard(s)	Simple Asphyxiant: May displace oxygen and cause rapid suffocation

Unknown Acute Dermal Toxicity:

100% of this product consists of ingredient(s) of unknown acute dermal toxicity.

VINYL CHLORIDE (MONOMER)

SDS No.: M9192

SDS Revision Date: 06-Apr-2015

Unknown Acute Inhalation Toxicity:

100% of this product consists of ingredient(s) of unknown acute inhalation toxicity.

GHS SYMBOL:

Flame, Gas cylinder, Exclamation mark, Health hazards



GHS SIGNAL WORD: DANGER

GHS HAZARD STATEMENTS:

GHS - Physical Hazard Statement(s)

Extremely flammable gas

Contains gas under pressure; may explode if heated

May displace oxygen and cause rapid suffocation

GHS - Health Hazard Statement(s)

Causes eye irritation

Causes skin irritation

May cause drowsiness or dizziness

May cause respiratory irritation

Causes damage to organs through prolonged or repeated exposure: (liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system)

May cause cancer

Suspected of causing genetic defects

Suspected of damaging fertility or the unborn child

GHS - OSHA Hazard(s)

Simple Asphyxiant: May displace oxygen and cause rapid suffocation

GHS - Precautionary Statement(s) - Prevention

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Keep away from heat/sparks/open flames/hot surfaces. — No smoking

Do not breathe dust/fume/gas/mist/vapors/spray

Use personal protective equipment as required

Wear protective gloves/protective clothing/eye protection/face protection

Wash thoroughly after handling

Do not eat, drink or smoke when using this product

Use only outdoors or in a well-ventilated area

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GHS - Precautionary Statement(s) - Response

Leaking gas fire: Do not extinguish, unless leak can be stopped safely

Eliminate all ignition sources if safe to do so

IF INHALED: Remove person to fresh air and keep comfortable for breathing

Call a POISON CENTER or doctor/physician if you feel unwell

IF ON SKIN: Wash with plenty of water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash it before reuse

Specific treatment (see First Aid information on product label and/or Section 4 of the SDS)

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continue rinsing

If eye irritation persists: Get medical advice/attention

Specific treatment (see Section 4 of the safety data sheet and/or the First Aid information on the product label)

Get medical advice/attention if you feel unwell

IF exposed or concerned: call a POISON CENTER or doctor/physician

GHS - Precautionary Statement(s) - Storage

Store in a well-ventilated place. Keep container tightly closed

Protect from sunlight

Store locked up

GHS - Precautionary Statement(s) - Disposal

Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

Hazards Not Otherwise Classified (HNOC)

Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.)

Polymerization can occur

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer

Component	Percent [%]	CAS Number
Vinyl chloride	99 - 100	75-01-4

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

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SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water (100-105 °F, 38-41 °C). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure in occupational environment.

Most Important Symptoms/Effects (Acute and Delayed) ..

Acute Symptoms/Effects: Listed below. Prolonged, high concentration exposures may cause unconsciousness or death.

Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).

Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.

Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.

Ingestion (Swallowing): Ingestion is not a likely route of exposure.

Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Delayed Symptoms/Effects:

- Carcinogen: Long term significant occupational overexposure to VCM has been associated with a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer
- Suspected mutagen and suspected of causing reproductive damage
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hand (Raynaud's Syndrome)
- Scleroderma is characterized by a hardening and tightening of patches of skin
- Raynaud's syndrome is characterized by an exaggerated response to cold temperatures or emotional distress, which can cause numbness, pain or color changes in the fingers or toes

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

Medical Conditions Aggravated by Exposure: Alcoholic Liver Disease. Infectious Hepatitis. Cirrhosis.

Protection of First-Aiders: Protect yourself by avoiding contact with this material. Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.). Use personal protective equipment. Refer to Section 8 for specific personal protective equipment recommendations. At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission.

Notes to Physician: There is no specific antidote. Treat symptoms with supportive care. Cardiac stimulants such as epinephrine should be avoided in persons overexposed to chlorinated hydrocarbons.

5. FIRE-FIGHTING MEASURES

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Fire Hazard: Severe fire hazard. Vapor/air mixtures are explosive. Vapors or gases may ignite at distant sources and flash back. Containers may rupture or explode if exposed to heat.

Extinguishing Media: Stop flow of gas before extinguishing fire. Use carbon dioxide, regular dry chemical, foam or water. Use water spray to keep containers cool.

Fire Fighting: Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this can't be done, then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode.

Hazardous Combustion Products: Oxides of carbon, Hydrogen chloride, Phosgene

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Lower Flammability Level (air): 3.6%

Upper Flammability Level (air): 33.0%

Flash point: -108 °F (-78 °C)

Auto-ignition Temperature: 882 °F (472 °C)

GHS: PHYSICAL HAZARDS:

- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:

Isolate hazard area and deny entry. Keep unnecessary and unprotected persons away. Eliminate all sources of heat and ignition. Ventilate closed spaces before entering. Wear appropriate personal protective equipment recommended in Section 8, Exposure Controls / Personal Protection, of the SDS. Refer to Section 7, Handling and Storage, for additional precautionary measures.

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Methods and Materials for Containment and Cleaning Up:

Remove sources of ignition. Ventilate closed spaces before entering. Stop leak if possible without personal risk. Vapors or gases may ignite at distant ignition sources and flash back. See Section 13, Disposal considerations, for additional information.

Environmental Precautions:

Keep out of water supplies and sewers. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Precautions for Safe Handling:

Avoid breathing vapor or mist. Avoid contact with skin, eyes and clothing. Keep away from heat, sparks and flame. Ground any equipment used in handling. Use non-sparking tools and equipment. All energized electrical equipment must be designed in accordance with the electrical classification of the area.

Safe Storage Conditions:

Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Store in a cool, dry area. Store in a well-ventilated area. Do not enter confined spaces unless adequately ventilated. Avoid heat, flames, sparks and other sources of ignition. May be subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

Incompatibilities/ Materials to Avoid:

oxidizing agents, oxides of nitrogen, metals, aluminum, aluminum alloys, copper, metal alkyl complexes and alkali metals such as sodium, potassium and their alloys

GHS: PHYSICAL HAZARDS:

- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure Limit(s): As listed below.

Component	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PEL Ceiling
Vinyl chloride 75-01-4	1 ppm	5 ppm	-----

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration;
PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit

NON-REGULATORY EXPOSURE LIMIT(S): As listed below.

Component	CAS Number	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA (Vacated)	OSHA STEL (Vacated)	OSHA Ceiling (Vacated)
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VINYL CHLORIDE (MONOMER)

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Vinyl chloride	75-01-4	1 ppm	-----	-----	-----	-----	-----
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- The Non-Regulatory United States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear safety glasses with side-shields. If eye contact is likely, wear chemical resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear appropriate chemical resistant clothing.

Hand Protection: Wear appropriate chemical resistant gloves. Consult a glove supplier for assistance in selecting an appropriate chemical resistant glove.

Protective Material Types: Butyl rubber, Nitrile, Silver Shield®, Viton®

Respiratory Protection: Refer to 29 CFR 1910.1017 for selection of respirators for vinyl chloride. A respiratory protection program that meets applicable regulatory requirements must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	Compressed, liquefied gas
Color:	Colorless
Odor:	Sweet
Odor Threshold [ppm]:	Not reliable to prevent excessive exposure.
Molecular Weight:	62.5
Molecular Formula:	C ₂ H ₃ Cl
Decomposition Temperature:	Not applicable
Boiling Point/Range:	7 °F (-14 °C)
Freezing Point/Range:	No data available.
Melting Point/Range:	Not applicable
Vapor Pressure:	2660 mmHg @ 25 °C
Vapor Density (air=1):	2.15
Relative Density/Specific Gravity (water=1):	0.91 @ 25/25 °C
Water Solubility:	2.7 g/L

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pH:	Not applicable
VOC Content (%):	100%
Volatility:	100%
Evaporation Rate (ether=1):	>15
Partition Coefficient (n-octanol/water):	Log Kow = 1.36
Flash point:	-108 °F (-78 °C)
Flammability (solid, gas):	No data available
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Auto-ignition Temperature:	882 °F (472 °C)
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Reactivity: Not reactive under normal temperatures and pressures.

Chemical Stability: Stable at normal temperatures and pressures.

Possibility of Hazardous Reactions:

Avoid air and sunlight. Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

Conditions to Avoid:

(e.g., static discharge, shock, or vibration) -. Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Incompatibilities/ Materials to Avoid:

oxidizing agents. oxides of nitrogen. metals. aluminum. aluminum alloys. copper. metal alkyl complexes and alkali metals such as sodium, potassium and their alloys.

Hazardous Decomposition Products: oxides of carbon, chlorine, hydrogen chloride, phosgene

Hazardous Polymerization: Polymerization can occur. Avoid elevated temperatures, oxidizing agents, oxides of nitrogen, oxygen, peroxides, other polymerization catalysts/initiators, air and sunlight.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

PRODUCT TOXICITY DATA: VINYL CHLORIDE (MONOMER)

VINYL CHLORIDE (MONOMER)

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LD50 Oral: > 4,000 mg/kg oral-rat LD50	LD50 Dermal: -----	LC50 Inhalation: -----
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COMPONENT TOXICITY DATA:**Note:** The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
Vinyl chloride 75-01-4	-----	-----	18 pph (15 min-Rat)

POTENTIAL HEALTH EFFECTS:

- Eye contact:** Causes eye irritation. Rapid evaporation of the material may cause frostbite.
- Skin contact:** Causes skin irritation. Rapid evaporation of the material may cause frostbite.
- Inhalation:** May cause respiratory tract irritation. Several minutes of exposure to high, but attainable concentrations (over 1000 ppm) may cause difficulty breathing, central nervous system depression and symptoms such as: ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual and or hearing disturbances, nausea, memory loss. Prolonged, high concentration exposures may cause unconsciousness or death. Cardiac: Acute intoxication may cause irregular heartbeats.
- Ingestion:** Not a likely route of exposure in occupational settings.
- Chronic Effects:** Chronic exposure to vinyl chloride monomer (VCM) may cause damage to the nervous system, respiratory system, musculoskeletal system, and lymphatic system. Occupational overexposure has produced a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer. Repeated prolonged exposure may damage: skin (scleroderma), bones (acro-osteolysis), blood vessels in the hands (Raynaud's Syndrome). Suspected of causing genetic defects. Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

SIGNS AND SYMPTOMS OF EXPOSURE:

Listed below.

- Inhalation (Breathing):** Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
- Skin:** Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
- Eye:** Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
- Ingestion (Swallowing):** Ingestion is not a likely route of exposure.

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Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

GHS HEALTH HAZARDS:

Skin Absorbent / Dermal Route? No.

GHS: CONTACT HAZARD - SKIN: Category 2 - Causes skin irritation

GHS: CONTACT HAZARD - EYE: Category 2B - Causes eye irritation

GHS: CARCINOGENICITY:
Category 1A - May cause cancer.

Component	NTP:	IARC (GROUP 1):	IARC (GROUP 2):	OSHA:
Vinyl chloride	Listed	Group 1	Not listed	Listed

SPECIFIC TARGET ORGAN TOXICITY (Single Exposure):

Category 3 - Respiratory Tract Irritation

Category 3 - Narcotic Effects

SPECIFIC TARGET ORGAN TOXICITY (Repeated or Prolonged Exposure):

Category 1 - Liver, Blood, Nervous System, Lymphatic System, Musculoskeletal System, Respiratory System

MUTAGENIC DATA:

Category 2 - Suspected of causing genetic defects. Mutagenic in bacteria studies. Genetic studies in animals were negative in some cases and positive in others.

REPRODUCTIVE TOXICITY:

Category 2 - Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:**Aquatic Toxicity:**

This material is believed to be practically non-toxic to fish on an acute basis (LC50>100 mg/L).

FATE AND TRANSPORT:

BIODEGRADATION: Vinyl chloride may degrade under anaerobic conditions.

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PERSISTENCE: Tropospheric half-life is estimated to be 23 hours. If released to air, this material will remain in the gas phase. If released to soil, volatilization will occur, but material that does not volatilize may be highly mobile. If released to water, evaporation will occur.

BIOCONCENTRATION: Bioconcentration potential is low (BCF <100 or log Kow <3).

13. DISPOSAL CONSIDERATIONS

Waste from material:

Reuse or reprocess, if possible. May be subject to disposal regulations. Dispose in accordance with all applicable regulations.

Container Management:

Refer to manufacturer/supplier for information on recovery/recycling. Dispose of container in accordance with applicable local, regional, national, and/or international regulations. Container rinsate must be disposed of in compliance with applicable regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized
HAZARD CLASS/ DIVISION: 2.1
LABELING REQUIREMENTS: 2.1
RQ (lbs): RQ 1 Lbs. (Vinyl chloride)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

UN NUMBER: UN1086
SHIPPING NAME: Vinyl chloride, stabilized
CLASS OR DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

MARITIME TRANSPORT (IMO / IMDG) Regulated

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized

VINYL CHLORIDE (MONOMER)

SDS No.: M9192

SDS Revision Date: 06-Apr-2015

HAZARD CLASS / DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	CERCLA Reportable Quantities:
Vinyl chloride	1 lb (final RQ)

SARA EHS Chemical (40 CFR 355.30)

Not regulated

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10):

Fire Hazard, Reactive Hazard, Sudden Release of Pressure, Acute Health Hazard, Chronic Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):

The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Component	Status:
Vinyl chloride	0.1 %

OSHA SPECIFICALLY REGULATED SUBSTANCES:

OSHA 29 CFR 1910.1017 (Vinyl chloride); The U.S. Department of Labor, Occupational Safety and Health Administration specifically regulates manufacturing, handling and processing of vinyl chloride. Such regulations have been published at 29 CFR 1910.1017.

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):

The PSM standard may apply to processes which involve a flammable liquid or gas in a quantity of 10,000 pounds (4535.9 kg) or more.

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA): All components are listed or exempt.

TSCA 12(b): This product is not subject to export notification.

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

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STATE REGULATIONS

Component	California Proposition 65 Cancer WARNING:	California Proposition 65 CRT List - Male reproductive toxin:	California Proposition 65 CRT List - Female reproductive toxin:	Massachusetts Right to Know Hazardous Substance List	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List
Vinyl chloride 75-01-4	Listed	Not Listed	Not Listed	Listed	2001	carcinogen; flammable - fourth degree; mutagen

Component	New Jersey - Environmental Hazardous Substance List	Pennsylvania Right to Know Hazardous Substance List	Pennsylvania Right to Know Special Hazardous Substances	Pennsylvania Right to Know Environmental Hazard List	Rhode Island Right to Know Hazardous Substance List
Vinyl chloride 75-01-4	Listed	Listed	Present	Present	Not Listed

CANADIAN REGULATIONS

• This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations

WHMIS - Classifications of Substances:

- A - Compressed Gas
- B1 - Flammable Gas
- D2A - Poisonous and Infectious Material; Materials causing other toxic effects - Very toxic material
- D2B - Poisonous and Infectious Material; Materials causing other toxic effects - Toxic material
- F - Dangerously reactive material

16. OTHER INFORMATION

Prepared by: OxyChem Corporate HESS - Product Stewardship

Rev. Date: 06-Apr-2015

HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association HMIS: Rating Instructions, 2nd Edition)

Health Rating: 2*

Flammability Rating: 4

Reactivity Rating: 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health Rating: 2

Flammability: 4

Reactivity Rating: 2

VINYL CHLORIDE (MONOMER)

SDS No.: M9192

SDS Revision Date: 06-Apr-2015

Reason for Revision:

- Revised Major Health Hazards: SEE SECTION 2
- Revised GHS Information: SEE SECTION 2
- Updated First Aid Measures: SEE SECTION 4
- PPE recommendations have been modified: SEE SECTION 8
- Toxicological Information has been revised: SEE SECTION 11
- Updated Disposal Considerations. SEE SECTION 13
- Updated Transportation Information: SEE SECTION 14

IMPORTANT:

The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESSED OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal and other factors that may involve other or additional legal, environmental, safety or performance considerations, and OxyChem assumes no liability whatsoever for the use of or reliance upon this information. While our technical personnel will be happy to respond to questions, safe handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Safety Data Sheet available to your employees

End of Safety Data Sheet

BENZENE

PRODUCT IDENTIFICATION

Chemical Name and Synonyms:

Benzene; Benzol; Carbon oil; Cyclohexatriene; Phenyl hydride

Chemical Family:

Aromatic hydrocarbon

Chemical Formula:

C₆H₆

Product Use:

Laboratory solvent

Manufacturer's Name and Address:

Caledon Laboratories Ltd.
 40 Armstrong Avenue
 Georgetown, Ontario L7G 4R9

Telephone No:

(905) 877-0101

Fax No:

(905) 877-6666

Emergency Telephone No:

CANUTEC (613) 996-6666

HAZARDOUS INGREDIENTS OF MATERIALS

Ingredients	%	TLV Units	CAS No.
Benzene	99	0.5 ppm	71-43-2

STEL 2.5 ppm

PHYSICAL DATA

Physical State:

Liquid

Odour and Appearance:

Clear, colourless to light yellow with an aromatic odour

Odour Threshold (ppm):

61 ppm (detection); 97 ppm (recognition) Poor warning qualities, threshold is above TLV.

Vapour Pressure (mm Hg):

75 mm Hg at 20°C

Vapour Density (Air = 1):

2.7

Evaporation Rate:

2.8 (diethyl ether = 1)

Boiling Point (°C):

80°C

Freezing Point (°C):

5.5°C

pH:

Not applicable

Specific Gravity:

0.877 @ 20°C

Coefficient of Water/Oil distribution:

LogP(oct) 1.18-1.9

SHIPPING DESCRIPTION

UN:

1114

T.D.G. Class:

3 (9.2)

Pkg. Group:

II

REACTIVITY DATA

Chemical Stability:

Stable

Incompatibility with other substances:

May react violently or explosively with strong oxidizing agents, strong acids, halogens and halogenated compounds, oxygen, oxone. Can explode on contact with chromic anhydride, permanganic acid, chlorine, nitryl perchlorate. Spontaneously flammable with sodium or potassium peroxide. Metal perchlorates recrystallized from benzene, can explode spontaneously. Contact with acids liberates toxic gas. Attacks rubber and plastics. Not corrosive to metals.

Reactivity:

Avoid high temperatures, sparks, open flames, hot surfaces, all sources of ignition, all incompatible materials, generation of mist or vapour.

Hazardous Decomposition Products:

CO_x

FIRE AND EXPLOSION DATA

Flammability:

Extremely flammable liquid and vapour. Mixtures with air are explosive. Can accumulate static charge by flow or agitation. Vapours are heavier than air and may travel considerable distance to source of ignition and flash back. Liquid can float on water and may spread fire.

Extinguishing Media:

Dry chemical, foam, carbon dioxide. Water may be used to cool containers and disperse vapours but will be ineffective for extinguishing fire because it will not cool liquid below flash point. Fight fire from upwind, from a safe distance. Firefighters must wear protective equipment (NIOSH/ OSHA approved positive-pressure, full face-piece self-contained breathing apparatus) and encapsulating chemical splash suit to prevent any inhalation or contact with this chemical.

Flash Point (Method Used):

-11°C (TCC)

Autoignition Temperature:

498°C

Upper Flammable Limit (% by volume):

7.1%

Lower Flammable Limit (% by volume):

1.3%

Hazardous Combustion Products:

CO_x, irritating aldehydes, ketones.

Sensitivity to Impact:

Not expected to be sensitive

Sensitivity to Static discharge:

Liquid can accumulate static charge by flow or agitation. Vapour in the flammable range can be ignited by a electrostatic discharge of sufficient energy.

TOXICOLOGICAL PROPERTIES AND HEALTH DATA

Toxicological Data:

LD₅₀:

(oral rat) 930 mg/kg, 1 mL/kg; (dermal, guinea pig) 9,400 µL/kg

LC₅₀:

(rat) 34mL/kg/2h; 6.5 mL/kg/4h

Effects of Acute Exposure to Product:

Inhaled:

Toxic. Irritating to upper respiratory tract. Exposure to 50-150 ppm causes central nervous system depression with drowsiness, dizziness, headache, nausea. Exposure to 20,000 ppm for a 5-10 minutes can cause death. High concentrations

BENZENE

cause decreased judgement, feelings of well being, loss of balance, delirium, coma with motor restlessness, cardiac arrhythmias, pulmonary edema, cardiac or respiratory failure and death. Respiratory or cardiac complications may occur from within a few minutes to several days after exposure. May cause liver or kidney damage, and damage to blood and immune systems. If the exposure is not fatal, symptoms, such as unsteady gait, cardiac distress, internal bleeding, secondary infections, may persist for several weeks.

In contact with skin:

Based on animal studies, moderately irritating to skin, causing burning sensation, blistering and swelling. May be absorbed through skin, increasing systemic effects in "Inhaled".

In contact with eyes:

No human information. Based on animal studies, vapour is moderately irritating to eyes; liquid can cause burning sensation and transient corneal injury but not permanent damage.

Ingested:

Toxic. Causes burning sensation in mouth and throat. Readily absorbed, causing systemic intoxication with symptoms as in "Inhaled". Aspiration may cause immediate pulmonary edema and hemorrhage. The usual lethal dose in humans is 10-15 mL, but smaller amounts have been reported to cause death. If ingestion is not fatal, it may produce longterm effects that persist for up to a year.

Effects of Chronic Exposure to Product:

Studies have proved conclusively that prolonged or repeated exposure causes severe effects on the blood system, damage to bone marrow, and all types of blood cells, harmful changes to the immune system, including reduced lymphocyte counts.

Carcinogenicity:

Confirmed human carcinogen (designation A1). Causes cancer of white blood cells; aplastic anaemia; leukemia

Teratogenicity:

Crosses placental barrier, may cause teratogenic effects. Animal testing shows benzene fetotoxic, causing reduced birth weight and minor skeletal variations at levels that produce mild maternal toxicity.

Reproductive Effects:

Effects at doses which caused other significant signs of toxicity.

Mutagenicity:

Causes chromosomal aberrations in virtually all studies on animals and workers.

Synergistic Products:

Alcohols react synergistically. The use of alcoholic beverages may increase the toxic effects. The use of epinephrine may cause cardiac arrhythmias. Interactions with other medications have been reported.

PREVENTIVE MEASURES

Engineering Controls:

Non-sparking, grounded, separate, exhaust ventilation required.

Respiratory Protection:

At any concentration above the TLV, at any detectable concentration, or for fire or spill conditions where the concentration is unknown, NIOSH/OSHA approved positive-pressure, full face-piece self-contained breathing apparatus or positive-pressure, full face-piece supplied-air respirator with an auxiliary positive-pressure, self-contained breathing apparatus. IDLH (Immediately Dangerous to Life or Health) for benzene is 500 ppm; carcinogenic effects were not considered in establishing this value.

Eye Protection:

Chemical safety goggles and face shield.

Skin Protection:

Polyvinyl alcohol, Viton™/butyl rubber, Barrier (PE/PA/PE), Silver Shield/4H™ (polyethylene/ethylene vinyl alcohol), Responder™, Tychem™ BR/LV, Tychem™ TK gloves. Other impervious clothing, coveralls, boots, etc. as required to prevent contact.

Other Personal Protective Equipment:

Safety shower and eye-wash fountain available in work area.

Leak and Spill Procedure:

Eliminate all sources of ignition. Evacuate area. Cleanup personnel must be thoroughly trained in the hazards of this chemical and must wear protective equipment and clothing sufficient to prevent inhalation of vapours or mists and contact with skin and eyes. Do not touch spilled product. Stop or reduce discharge if safe to do so. Contain spill with activated carbon adsorbent or other inert material (sand, earth). Prevent from entering sewers or waterways, or confined spaces. Collect material into sealed, labelled containers for collection by disposal company. Contaminated absorbent may pose the same hazards as the spilled product; handle with the same caution. Ventilate area of spill, and flush with copious amounts of running water.

Waste Disposal:

Follow all federal, provincial and local regulations for disposal.

Handling Procedures and Equipment:

FLAMMABLE, TOXIC, CARCINOGEN, TERATOGEN, MUTAGEN. Workers must be thoroughly trained in the handling of hazardous materials and in the particular hazards of this material and its safe use, and must wear appropriate protective equipment and clothing. Ensure that engineering controls are operating effectively. Eliminate all ignition sources. Post "No Smoking" signs. Ground and bond equipment and containers to prevent a static charge buildup. Use spark-resistant tools and avoid "splash filling" of containers. Keep storage and work areas free of combustible or incompatible materials. Use the smallest amount possible for the purpose in a designated, well ventilated area. Avoid generating mists or vapours. AVOID ALL CONTACT AND INHALATION. Empty containers may contain hazardous residues; treat with caution.

Storage Requirements:

Store in suitable, labelled containers, in a cool, dry, well-ventilated area, out of direct sunlight and away from all sources of ignition and incompatible or combustible materials. Keep containers tightly closed. Storage facilities should be made of fire-resistant materials. Provide raised sills and trenches to drain to a safe area. Do not expose sealed containers to elevated temperatures. Protect from damage, and inspect frequently for signs of leaking. Treat empty containers with caution, as they may contain hazardous residues. Post "NO SMOKING" signs. Have appropriate fire extinguishers and spill cleanup equipment near the storage area.

FIRST AID MEASURES

Specific Measures:

Eyes:

IMMEDIATELY flush eyes with gently running water for at least thirty (30) minutes, holding eyelids open while flushing. Wear gloves to avoid contact. Take care not to flush contaminated water into unaffected eye. Get MEDICAL ATTENTION immediately.

Skin:

Under running water, remove contaminated clothing (including

BENZENE

rings, watches, belts and shoes). Wear gloves to avoid contact. IMMEDIATELY flush exposed area with large amounts of warm running water for at least thirty (30) minutes or until chemical is removed. Get medical attention. Discard contaminated clothing.

Inhalation:

IMMEDIATELY remove to fresh air (caution must be used by rescuers to avoid exposure to contaminating fumes). Remove any sources of ignition. Give oxygen and get medical attention for any breathing difficulty. If breathing has stopped give artificial respiration (use a mouth guard to prevent contact with chemical). If breathing and pulse are absent give CPR.

IMMEDIATELY OBTAIN MEDICAL ATTENTION. Stay with casualty until medical assistance is reached.

Ingestion:

DO NOT INDUCE VOMITING. DANGER OF ASPIRATION WITH VOMITING. If casualty is alert and not convulsing, rinse out mouth with water, and give 1 to 2 glasses of water or milk to drink to dilute material. GET MEDICAL ATTENTION IMMEDIATELY. If spontaneous vomiting occurs, have casualty lean forward with head down to avoid breathing in of vomitus. Rinse mouth and give more water to drink.

REFERENCES USED

CCINFO disc: Cheminfo

Royal Society of Chemistry: Chemical Safety Data Sheets, Vol. 1, 1992

Sax, Lewis: Hawley's Condensed Chemical Dictionary, 11th ed., 1987

Suppliers' Material Safety Data Sheets

ADDITIONAL INFORMATION

Date Issued:

November 1, 1988

Revision:

February 2012

MSDS:

1600-1, 1600-3, 1600-4, 1601-2

Proposed WHMIS Designation:

B2; D2A; D2B

Prepared by: Caledon Laboratories Ltd. (905)

877-0101 Caledon Laboratories Ltd. believes the information contained herein is reliable and accurate. Caledon makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such information is solely for your consideration, investigation, and verification.



Material Safety Data Sheet

Section 1. Chemical Product and Company Identification

Product name	Ethylbenzene	<u>In Case of Emergency</u>	Chemtrec: (800) 424-9300 Total Petrochemicals & Refining USA, Inc.: (800) 322-3462
Supplier	Total Petrochemicals & Refining USA, Inc. P O Box 674411 Houston, TX 77267-4411	<u>Technical Information</u>	For non-emergency product information: email product.stewardship@total.com
Chemical Family	Aromatic.	MSDS#	BC0003
CAS Registry Number	100-41-4	Validation Date	1/1/2014
		Print Date	1/1/2014
Synonym	Ethylbenzene, Phenylethane, EB		

Section 2. Hazards Identification

Emergency Overview FLAMMABLE LIQUID AND VAPOR.

MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION.
MAY BE HARMFUL IF ABSORBED THROUGH SKIN.
MAY BE HARMFUL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE.
MAY BE HARMFUL IF INHALED.
CONTAINS MATERIAL WHICH CAN CAUSE CANCER.

CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LUNGS, LIVER,
RESPIRATORY TRACT, SKIN, EYES, CENTRAL NERVOUS SYSTEM.

Routes of Entry Eye contact. Ingestion. Inhalation. Skin contact.

Potential Acute Health Effects

Eyes May cause eye irritation. Vapor may be irritating to eyes.

Skin Absorbed through skin. May cause skin irritation. Skin inflammation is characterized by itching, scaling, reddening or, occasionally, blistering.

Inhalation May cause respiratory tract irritation. May cause mucous membrane irritation. Can cause central nervous system (CNS) depression. Exposure at high concentrations may cause narcosis. Symptoms of narcosis include fatigue, drowsiness, staggering gait, and incoordination.

Ingestion Aspiration hazard if swallowed. Can enter lungs and cause damage. May be fatal if swallowed. Possible pneumonia if vomited.

Potential Chronic Health Effects **CARCINOGENIC EFFECTS:** Classified A3 (Proven for animals.) by ACGIH, 2B (Possible for humans.) by IARC [ethylbenzene]. Classified None. by OSHA [ethylbenzene]. Ethylbenzene is not listed as a carcinogen by NTP.

This material contains low levels of benzene, which is a known human carcinogen listed under IARC, NTP, and OSHA.

MUTAGENIC EFFECTS: Classified 2 by European Union [benzene].

TERATOGENIC EFFECTS: Ethylbenzene may have teratogenic effects based upon results of animal testing. Benzene and toluene may cause teratogenic effects.

Chronic exposure to ethyl benzene causes fatigue, headache, and eye and upper respiratory tract irritation. Repeated contact with the skin may cause drying, defatting, and dermatitis

Medical Conditions Aggravated by Overexposure Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

**Overexposure /Signs/
Symptoms**

Headaches, dizziness, fatigue, eye, nose and throat irritation. Skin inflammation is characterized by itching, scaling, reddening or, occasionally, blistering. Symptoms of narcosis include fatigue, drowsiness, staggering gait, and incoordination.

See Toxicological Information (Section 11)

Section 3. Composition and Information on Ingredients

Occupational exposure limits, if available, are listed in Section 8.

Substance Name	CAS #	% by Weight
ethylbenzene	100-41-4	99 - 99.9
benzene	71-43-2	<0.2
toluene	108-88-3	< 0.4

Section 4. First Aid Measures

Eye Contact	Check for and remove any contact lenses. IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. COLD water may be used. DO NOT use an eye ointment. Seek medical attention.
Skin Contact	In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	DO NOT induce vomiting or give liquids. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Section 5. Fire Fighting Measures

Flammability of the Product	Flammable.
Auto-ignition Temperature	432°C (809.6°F)
Flash Points	Closed cup: 13°C (55.1°F) [Tagliabue.] Open cup: 21°C (69.8°F)
Flammable Limits	LOWER: 1.3% UPPER: 7.1%
Products of Combustion	These products are carbon oxides (CO, CO2).
Fire Hazards in Presence of Various Substances	Extremely flammable in presence of open flames and sparks, or heat.
Explosion Hazards in Presence of Various Substances	Risks of explosion of the product in presence of mechanical impact: Not expected. Risks of explosion of the product in presence of static discharge: Expected.
Fire Fighting Media and Instructions	Recommended: alcohol-resistant foam, CO ₂ , powders, water spray.
Protective Clothing (Fire)	Wear MSHA/NIOSH approved self-contained breathing apparatus or equivalent and full protective gear.
Special Remarks on Fire Hazards	Flammable.

Section 6. Accidental Release Measures

Small Spill and Leak	Absorb with an inert material and put the spilled material in an appropriate waste disposal.
Large Spill and Leak	Flammable liquid, insoluble in water. Contain spill and safely stop the flow. Warn personnel to move away. Eliminate all sources of ignition. Ventilate. Absorb with DRY earth, sand or other non-combustible material.

Section 7. Handling and Storage

Handling	Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. May produce or accumulate static electricity with the risk of causing fire and explosion. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.
Storage	Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Take precautionary measures against static discharges. Ground all equipment containing material. All efforts should be made to prevent any leaks or spills. Storage tanks containing should be engineered to prevent contact with water resources, as this material could contaminate the water resources. Surface spills can reach groundwater through porous soil or cracked surfaces. The storage tanks should be monitored regularly for leaks. Where spills or leaks are possible, a comprehensive response plan should be developed and implemented.

Section 8. Exposure Controls/Personal Protection

Engineering Controls	Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Personal Protection	<p><i>Eyes</i> Safety glasses with side shields.</p> <p><i>Body</i> Flame retardant clothing covering the entire body.</p> <p><i>Respiratory</i> At high concentrations be sure to use a MSHA/NIOSH approved respirator or equivalent.</p> <p><i>Hands</i> Gloves (impervious).</p> <p><i>Feet</i> Shoes.</p>

Protective Clothing (Pictograms)



Personal Protection in Case of a Large Spill

Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Product Name

Exposure Limits

ethylbenzene	OSHA PEL (United States, 11/2006). TWA: 100 ppm 8 hour(s). NIOSH REL (United States, 6/2009). TWA: 100 ppm 10 hour(s). STEL: 125 ppm 15 minute(s). ACGIH TLV (United States, 1/2011). TWA: 20 ppm 8 hour(s). ACGIH TLV (United States, 3/2012). STEL: 125 ppm 15 minute(s).
benzene	NIOSH REL (United States, 6/2009). TWA: 0.1 ppm 10 hour(s). STEL: 1 ppm 15 minute(s). OSHA PEL (United States, 11/2006). TWA: 1 ppm 8 hour(s). STEL: 5 ppm 15 minute(s). ACGIH TLV (United States, 3/2012). TWA: 0.5 ppm 8 hour(s).
toluene	ACGIH TLV (United States, 3/2012). TWA: 20 ppm 8 hour(s). OSHA PEL Z2 (United States, 11/2006). TWA: 200 ppm 8 hour(s). CEIL: 300 ppm AMP: 500 ppm 10 minute(s). NIOSH REL (United States, 6/2009). TWA: 100 ppm 10 hour(s). STEL: 150 ppm 15 minute(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical State and Appearance	Liquid. (Liquid)
Color	Colorless liquid with distinctive aromatic odor
Odor	Sweet (aromatic) odor.
Molecular Weight	Not applicable.
Molecular Formula	C ₆ H ₅ -CH ₂ -CH ₃
Boiling/Condensation Point	136°C (277°F)
Melting/Freezing Point	-95°C (-139°F)
Critical Temperature	344°C (651°F)
Specific Gravity	0.87 (Water = 1)
Vapor Pressure	10 mm of Hg (@ 25.6°C)
Vapor Density	3.66 (Air = 1)
Volatility	100% (v/v).
Evaporation Rate	94 times slower compared to Ethylether
VOC	100 (%)
LogK _{ow}	The product is more soluble in oil; log(oil/water) = 3.1
Solubility in Water	Negligible.

Section 10. Stability and Reactivity

Stability and Reactivity	The product is stable.
Conditions of Instability	Avoid heat, sparks, & static electricity.
Incompatibility with Various Substances	Reactive with oxidizing agents.
Hazardous Decomposition Products	Under normal conditions of storage and use, hazardous decomposition products should not be produced. In a fire, hazardous decomposition products may be produced, including carbon monoxide, carbon dioxide, dense smoke, and various hydrocarbons.

**Hazardous
Polymerization**

Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological Information

Toxicity to Animals	Product/ingredient name	Result	Species	Dose	Exposure
	ethylbenzene	LD50 Dermal	Rabbit	>5000 mg/kg	-
		LD50 Dermal	Rabbit	17800 uL/kg	-
		LD50 Oral	Rat	3500 mg/kg	-
		LC50 Inhalation Vapor	Rat	55000 mg/m ³	2 hours
	benzene	LD50 Dermal	Rabbit	>9400 uL/kg	-
		LD50 Intraperitoneal	Rat	1100 ug/kg	-
		LD50 Oral	Rat	930 mg/kg	-
		LD50 Oral	Rat	1 mL/kg	-
		LD50 Oral	Rat	6400 mg/kg	-
		LD50 Oral	Rat	1800 mg/kg	-
		LC50 Inhalation Gas.	Rat	10000 ppm	7 hours
Chronic Effects on Humans	<p>CARCINOGENIC EFFECTS: Classified A3 (Proven for animals.) by ACGIH, 2B (Possible for humans.) by IARC [ethylbenzene]. Classified None. by OSHA [ethylbenzene]. Ethylbenzene is not listed as a carcinogen by NTP.</p> <p>This material contains low levels of benzene, which is a known human carcinogen listed under IARC, NTP, and OSHA.</p> <p>MUTAGENIC EFFECTS: Classified 2 by European Union [benzene].</p> <p>TERATOGENIC EFFECTS: Ethylbenzene may have teratogenic effects based upon results of animal testing. Benzene and toluene may cause teratogenic effects.</p> <p>Chronic exposure to ethyl benzene causes fatigue, headache, and eye and upper respiratory tract irritation. Repeated contact with the skin may cause drying, defatting, and dermatitis</p>				
Other Toxic Effects on Humans	<p>May cause skin, eye and respiratory irritation. May be harmful if absorbed through skin. Aspiration hazard if swallowed. Can enter lungs and cause damage. Can cause central nervous system (CNS) depression.</p>				

Section 12. Ecological Information

Ecotoxicity			
Product/ingredient name	Result	Species	Exposure
Ethylbenzene	Acute EC50 2.93 mg/l	Daphnia - Daphnia magna - Neonate - <=24 hours	48 hours
	Acute LC50 9.1 mg/l	Fish - Pimephales promelas - 30 days - 0.079 g	96 hours
Biodegradable/OECD	Biodegradation of ethylbenzene is fairly rapid in sewage or activated sludge inoculua. It is totally degraded in groundwater in 8 days and seawater in 10 days.		
Mobility	In the atmosphere, it exists primarily in the vapor phase based on its vapor pressure. It photochemically degrades by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially returns to the earth in rain. Degradation occurs faster under smog conditions. Photooxidation products include ethylphenol, benzaldehyde, acetophenone and m- and p-ethylnitrobenzene. In water, ethylbenzene's concentration decreases by evaporation and biodegradation. The rate of decrease is dependent on the season. Half-lives in water range from several days to 2 weeks. Some ethylbenzene is absorbed by sediment, but bioconcentration in fish is not expected to be significant. Ethylbenzene is adsorbed moderately by soil. It does not significantly hydrolyze in either water or soil.		

Section 13. Disposal Considerations

Waste Information	Recycle to process, if possible. Recover free liquid. Transfer to a safe disposal area in accordance with federal, state, and local regulations.
Waste Stream	This material, as supplied, when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR 261) due to its ignitability and due the composition containing some listed components (benzene and possibly others). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the material is a hazardous waste.
Consult your local or regional authorities.	

CEPA Toxic substances: None of the components are listed.
Canadian ARET: None of the components are listed.
Canadian NPRI: The following components are listed: Ethylbenzene
Alberta Designated Substances: None of the components are listed.
Ontario Designated Substances: None of the components are listed.
Quebec Designated Substances: None of the components are listed.

DSCL (EEC) R11- Highly flammable.
 R20- Harmful by inhalation.

CEPA DSL/NDL All components are listed or exempted.

International Lists **Australia inventory (AICS):** All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory (ENCS): All components are listed or exempted.
Japan inventory (ISHL): Not determined.
Korea inventory (KECI): All components are listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.

State Regulations

Louisiana Spill: The requirement for Tier 2 reporting is: LAC 33 Part V. Hazardous Wastes and Hazardous Materials, Subpart 2. Department of Public Safety and Corrections Hazardous Materials, Chapter 101. Hazardous Material Information Development, Preparedness, and Response Act, Section 10109. Inventory Reporting.

The release notification rules are: LAC 33 Part V. Hazardous Wastes and Hazardous Materials, Subpart 2. Department of Public Safety and Corrections Hazardous Materials, Chapter 101. Hazardous Material Information Development, Preparedness, and Response Act, Section 10111. Release and Incident Reporting.

Massachusetts Substances: The following components are listed: ETHYL BENZENE

New Jersey Hazardous Substances: The following components are listed: ETHYL BENZENE

New York Acutely Hazardous Substances: The following components are listed:

Ethylbenzene

Pennsylvania RTK Hazardous Substances: The following components are listed: BENZENE, ETHYL-

California Prop. 65 WARNING: This product contains a chemical or chemicals known to the state of California to cause cancer, birth defects or other reproductive harm: ethylbenzene, toluene, benzene

Section 16. Other Information

Label requirements

FLAMMABLE LIQUID AND VAPOR.

MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION.
 MAY BE HARMFUL IF ABSORBED THROUGH SKIN.
 MAY BE HARMFUL IF SWALLOWED. CAN ENTER LUNGS AND CAUSE DAMAGE.
 MAY BE HARMFUL IF INHALED.
 CONTAINS MATERIAL WHICH CAN CAUSE CANCER.

CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LUNGS, LIVER, RESPIRATORY TRACT, SKIN, EYES, CENTRAL NERVOUS SYSTEM.

Hazardous Material Information System (U.S.A.)

Health	*	2
Fire Hazard		3
Reactivity		0
Personal Protection		

National Fire Protection Association (U.S.A.)



References

NIOSH Pocket Guide
HSDB - Hazardous Substances Data Bank
Chemtox Database
NIOSH/OSHA/DOE Health Guidelines

Validated on 1/1/2014.

Printed 1/1/2014.

Chemtrec:

(800) 424-9300

Total Petrochemicals & Refining USA, Inc.:

(800) 322-3462

Notice to Reader

The information contained in this Material Safety Data Sheet (MSDS) / Safety Data Sheet (SDS) is believed by Total Petrochemicals & Refining USA, Inc. (TPRI) to be accurate on the date issued. However, materials may present unknown hazards and should be used with caution. Final determination of suitability and use of any material is the sole responsibility of the user. Neither TPRI nor any of its subsidiaries or affiliated companies assumes any liability whatsoever for the accuracy or completeness of the information contained herein or reliance thereto. If the material is repackaged, the user is responsible and must ensure that proper health, safety and other necessary information is included with the material and/or on the container. NO WARRANTIES OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING THE MATERIALS OR THE INFORMATION CONTAINED IN THIS SDS. ALTERATION OF THIS DOCUMENT IS STRICTLY PROHIBITED.

MSDS Name

Ethylbenzene

MSDS Code

ETHYLBENZENE

28

To obtain an electronic copy of this MSDS, please email: product.stewardship@total.com.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Substance
Substance name : Toluene
CAS No : 108-88-3
Product code : LC26170
Formula : C₇H₈
Synonyms : benzyl hydride / methylbenzene / phenylmethane / tolunol / toluol oil / toluole
BIG no : 10046

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Solvent

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Liq. 2 H225
Skin Irrit. 2 H315
Repr. 2 H361
STOT SE 3 H336
STOT RE 2 H373
Asp. Tox. 1 H304

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US)



GHS02

GHS07

GHS08

Signal word (GHS-US)

: Danger

Hazard statements (GHS-US)

: H225 - Highly flammable liquid and vapour
H304 - May be fatal if swallowed and enters airways
H315 - Causes skin irritation
H336 - May cause drowsiness or dizziness
H361 - Suspected of damaging fertility or the unborn child
H373 - May cause damage to organs through prolonged or repeated exposure

Precautionary statements (GHS-US)

: P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from heat, sparks, open flames, hot surfaces. - No smoking
P233 - Keep container tightly closed
P240 - Ground/bond container and receiving equipment
P241 - Use explosion-proof electrical, ventilating, lighting equipment
P242 - Use only non-sparking tools
P243 - Take precautionary measures against static discharge
P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves, protective clothing, eye protection, face protection

Toluene

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according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

P301+P310 - IF SWALLOWED: immediately call a POISON CENTER or doctor/physician
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P331 - If swallowed, do NOT induce vomiting
P332+P313 - If skin irritation occurs: Get medical advice/attention
P362 - Take off contaminated clothing and wash before reuse
P370+P378 - In case of fire: Use carbon dioxide (CO₂), powder, alcohol-resistant foam for extinction
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations
P235 - Keep cool

2.3. Other hazards

Other hazards not contributing to the classification : None under normal conditions.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Toluene (Main constituent)	(CAS No) 108-88-3	100	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Repr. 2, H361 STOT SE 3, H336 STOT RE 2, H373 Asp. Tox. 1, H304

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital. Never give alcohol to drink.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Take victim to a doctor if irritation persists.

First-aid measures after eye contact : Rinse immediately with plenty of water. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not give milk/oil to drink. Do not induce vomiting. Give activated charcoal. Call Poison Information Centre (www.big.be/antigif.htm). Consult a doctor/medical service if you feel unwell. Ingestion of large quantities: immediately to hospital.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia. Nausea. Abdominal pain. Symptoms similar to those listed under inhalation.

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Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Preferably: alcohol resistant foam. Water spray. BC powder. Polyvalent foam. AFFF foam. Carbon dioxide.

Unsuitable extinguishing media : Container may slop over if solid jet (water/foam) is applied.

5.2. Special hazards arising from the substance or mixture

Fire hazard : DIRECT FIRE HAZARD. Highly flammable. Gas/vapour flammable with air within explosion limits. INDIRECT FIRE HAZARD. May build up electrostatic charges: risk of ignition. May be ignited by sparks. Gas/vapour spreads at floor level: ignition hazard. Reactions involving a fire hazard: see "Reactivity Hazard".

Explosion hazard : DIRECT EXPLOSION HAZARD. Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD. may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".

Reactivity : Upon combustion: CO and CO₂ are formed. Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

5.3. Advice for firefighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety. Do not move the load if exposed to heat.

Protection during firefighting : Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Gloves. Protective goggles. Head/neck protection. Protective clothing. Large spills/in enclosed spaces: compressed air apparatus. Large spills/in enclosed spaces: gas-tight suit.

Emergency procedures : Keep upwind. Mark the danger area. Consider evacuation. Seal off low-lying areas. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosionproof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment : Do not breathe gas, fumes, vapour or spray. Equip cleanup crew with proper protection.

Emergency procedures : Stop leak if safe to do so. Ventilate area. If a major spill occurs, all personnel should be immediately evacuated and the area ventilated.

6.2. Environmental precautions

Prevent soil and water pollution.

6.3. Methods and material for containment and cleaning up

For containment : Contain released substance, pump into suitable containers. Consult "Material-handling" to select material of containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute/disperse combustible gas/vapour with water curtain. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.

Methods for cleaning up : Liquid spill: cover with foam. Take up liquid spill into inert absorbent material, e.g.: sand, earth, vermiculite. Scoop absorbed substance into closing containers. See "Material-handling" for suitable container materials. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

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SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling : Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over. Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Observe strict hygiene. Keep container tightly closed. Measure the concentration in the air regularly. Work under local exhaust/ventilation.
- Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

- Incompatible products : Strong oxidizers.
- Incompatible materials : Direct sunlight. Heat sources. Sources of ignition.
- Heat and ignition sources : KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.
- Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: oxidizing agents. (strong) acids. halogens.
- Storage area : Store at ambient temperature. Ventilation at floor level. Fireproof storeroom. Provide for a tub to collect spills. Provide the tank with earthing. Under a shelter/in the open. Store only in a limited quantity. May be stored under nitrogen. Meet the legal requirements. Keep out of direct sunlight.
- Special rules on packaging : SPECIAL REQUIREMENTS: closing. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.
- Packaging materials : SUITABLE MATERIAL: metal. stainless steel. carbon steel. aluminium. nickel. polypropylene. glass. tin. MATERIAL TO AVOID: polyethylene.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Toluene (108-88-3)		
USA ACGIH	ACGIH TWA (ppm)	20 ppm
USA ACGIH	ACGIH STEL (ppm)	20 ppm
USA OSHA	OSHA PEL (TWA) (ppm)	200 ppm
USA OSHA	OSHA PEL (STEL) (ppm)	500 ppm 10-min peak per 8 hour shift
USA OSHA	OSHA PEL (Ceiling) (ppm)	300 ppm

8.2. Exposure controls

- Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation.
- Materials for protective clothing : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: tetrafluoroethylene. viton. PVA. GIVE LESS RESISTANCE: butyl rubber. natural rubber. neoprene. nitrile rubber. polyethylene. neoprene/natural rubber. nitrile rubber/PVC. GIVE POOR RESISTANCE: chloroprene rubber.
- Hand protection : Gloves.
- Eye protection : Safety glasses.
- Skin and body protection : Head/neck protection. Protective clothing.
- Respiratory protection : Wear gas mask with filter type A if conc. in air > exposure limit.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state : Liquid
- Appearance : Liquid.
- Molecular mass : 92.14 g/mol
- Colour : Colourless.
- Odour : Aromatic odour.
- Odour threshold : 0.2 - 69 ppm
0.8 - 276 mg/m³
- pH : No data available

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Relative evaporation rate (butylacetate=1)	: 2.24
Melting point	: -95 °C
Freezing point	: No data available
Boiling point	: 111 °C
Flash point	: 4 °C
Critical temperature	: 321 °C
Self ignition temperature	: 480 °C
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: 29 hPa
Vapour pressure at 50 °C	: 109 hPa
Critical pressure	: 41077 hPa
Relative vapour density at 20 °C	: 3.2
Relative density	: 0.87
Relative density of saturated gas/air mixture	: 1.6
Density	: 870 kg/m ³
Solubility	: Insoluble in water. Soluble in ethanol. Soluble in ether. Soluble in acetone. Soluble in chloroform. Soluble in carbondisulfide. Soluble in acetic acid. Soluble in ethylacetate. Soluble in petroleum spirit. Water: 0.05 g/100ml Ethanol: Complete Ether: Complete Acetone: > 10 g/100ml
Log Pow	: 2.73 (Experimental value; Other; 20 °C, Experimental value; Other; 20 °C, Experimental value; Other; 20 °C)
Log Kow	: No data available
Viscosity, kinematic	: 0.690 mm ² /s (20 °C)
Viscosity, dynamic	: 0.0006 Pa.s (20 °C)
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: 1.3 - 7 vol % 46 - 270 g/m ³

9.2. Other information

Minimum ignition energy	: 0.3 mJ
Specific conductivity	: 1.0 pS/m
Saturation concentration	: 110 g/m ³
VOC content	: 100 %
Other properties	: Gas/vapour heavier than air at 20°C. Clear. Volatile. Substance has neutral reaction. May generate electrostatic charges.

SECTION 10: Stability and reactivity

10.1. Reactivity

Upon combustion: CO and CO₂ are formed. Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Heat. Direct sunlight. Sparks. Open flame.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

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SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Toluene (\f)108-88-3	
LD50 oral rat	> 2000 mg/kg (5580 mg/kg bodyweight; Rat; Rat; Experimental value)
LD50 dermal rabbit	12223 mg/kg (>5000 mg/kg bodyweight; Rabbit; Rabbit; Experimental value; Other,>5000 mg/kg bodyweight; Rabbit; Rabbit; Experimental value; Other)
LC50 inhalation rat (mg/l)	> 20 mg/l/4h (Rat)

Skin corrosion/irritation : Causes skin irritation.

Serious eye damage/irritation : Not classified

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Toluene (108-88-3)	
IARC group	3 - Not classifiable

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : May cause drowsiness or dizziness.

Specific target organ toxicity (repeated exposure) : May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard : May be fatal if swallowed and enters airways.

Symptoms/injuries after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.

Symptoms/injuries after skin contact : Tingling/irritation of the skin.

Symptoms/injuries after eye contact : Irritation of the eye tissue.

Symptoms/injuries after ingestion : Risk of aspiration pneumonia. Nausea. Abdominal pain. Symptoms similar to those listed under inhalation.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

Likely routes of exposure : Inhalation;Skin and eye contact

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Classification concerning the environment: not applicable.

Ecology - air : TA-Luft Klasse 5.2.5/l.

Ecology - water : Fouling to shoreline. Ground water pollutant. Toxic to fishes. Toxic to invertebrates. Harmful to algae. Inhibits photosynthesis of algae. Harmful to bacteria. Taste alteration in fishes/aquatic organisms.

Toluene (108-88-3)	
LC50 fishes 1	24 mg/l 96 h; Salmo gairdneri (Oncorhynchus mykiss)
EC50 Daphnia 1	84 mg/l (24 h; Daphnia magna; Locomotor effect)
LC50 fish 2	13 mg/l (96 h; Lepomis macrochirus)
EC50 Daphnia 2	11.5 - 19.6 mg/l (48 h; Daphnia magna)
Threshold limit algae 1	> 400 mg/l (168 h; Scenedesmus quadricauda; Toxicity test)
Threshold limit algae 2	105 mg/l (192 h; Microcystis aeruginosa)

12.2. Persistence and degradability

Toluene (108-88-3)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Low potential for adsorption in soil.
Biochemical oxygen demand (BOD)	2.15 g O ₂ /g substance
Chemical oxygen demand (COD)	2.52 g O ₂ /g substance
ThOD	3.13 g O ₂ /g substance
BOD (% of ThOD)	0.69 % ThOD

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12.3. Bioaccumulative potential

Toluene (108-88-3)	
BCF fish 1	13.2 (Anguilla japonica)
BCF fish 2	90 (72 h; Leuciscus idus)
BCF other aquatic organisms 1	380 (24 h; Chlorella sp.; Fresh weight)
BCF other aquatic organisms 2	4.2 (Mytilus edulis; Fresh weight)
Log Pow	2.73 (Experimental value; Other; 20 °C, Experimental value; Other; 20 °C, Experimental value; Other; 20 °C)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Toluene (108-88-3)	
Surface tension	0.03 N/m (20 °C)

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Do not landfill. Remove to an authorized waste incinerator for solvents with energy recovery. Do not discharge into drains or the environment. May be discharged to company wastewater treatment plant.

Additional information : LWCA (the Netherlands): KGA category 03. Hazardous waste according to Directive 2008/98/EC.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1294 Toluene, 3, II
UN-No.(DOT) : 1294
DOT NA no. : UN1294
DOT Proper Shipping Name : Toluene
Department of Transportation (DOT) Hazard Classes : 3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120
Hazard labels (DOT) : 3 - Flammable liquid



Packing group (DOT) : II - Medium Danger
DOT Special Provisions (49 CFR 172.102) : IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 °C (1.1 bar at 122 °F), or 130 kPa at 55 °C (1.3 bar at 131 °F) are authorized.
T4 - 2.65 178.274(d)(2) Normal..... 178.275(d)(3)
TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = $97 / (1 + a (tr - tf))$ Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.
DOT Packaging Exceptions (49 CFR 173.xxx) : 150
DOT Packaging Non Bulk (49 CFR 173.xxx) : 202
DOT Packaging Bulk (49 CFR 173.xxx) : 242
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 5 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 60 L

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DOT Vessel Stowage Location : B - (I) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.

Additional information

Other information : No supplementary information available.

State during transport (ADR-RID) : as liquid.

ADR

Transport document description : UN 1294 Toluene, 3, II, (D/E)

Packing group (ADR) : II

Class (ADR) : 3 - Flammable liquids

Hazard identification number (Kemler No.) : 33

Classification code (ADR) : F1

Danger labels (ADR) : 3 - Flammable liquids



Orange plates :

Tunnel restriction code : D/E

Transport by sea

UN-No. (IMDG) : 1294

Class (IMDG) : 3 - Flammable liquids

EmS-No. (1) : F-E

EmS-No. (2) : S-D

Air transport

UN-No.(IATA) : 1294

Class (IATA) : 3 - Flammable Liquids

Packing group (IATA) : II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Toluene (108-88-3)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on SARA Section 313 (Specific toxic chemical listings)

RQ (Reportable quantity, section 304 of EPA's List of Lists) : 1000 lb

SARA Section 311/312 Hazard Classes : Immediate (acute) health hazard
Fire hazard

15.2. International regulations

CANADA

Toluene (108-88-3)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification : Class B Division 2 - Flammable Liquid
Class D Division 2 Subdivision B - Toxic material causing other toxic effects
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects

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EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2 H225
Repr. 2 H361d
Asp. Tox. 1 H304
STOT RE 2 H373
Skin Irrit. 2 H315
STOT SE 3 H336

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

F; R11
Repr.Cat.3; R63
Xn; R65
Xn; R48/20
Xi; R38
R67

Full text of R-phrases: see section 16

15.2.2. National regulations

Toluene (108-88-3)

Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

Toluene(108-88-3)

U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
No significance risk level (NSRL)	7000 µg/day

SECTION 16: Other information

Full text of H-phrases: see section 16:

Asp. Tox. 1	Aspiration hazard, Category 1
Flam. Liq. 2	Flammable liquids, Category 2
Repr. 2	Reproductive toxicity, Category 2
Skin Irrit. 2	Skin corrosion/irritation, Category 2
STOT RE 2	Specific target organ toxicity — Repeated exposure, Category 2
STOT SE 3	Specific target organ toxicity — Single exposure, Category 3, Narcosis
H225	Highly flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H315	Causes skin irritation
H336	May cause drowsiness or dizziness
H361	Suspected of damaging fertility or the unborn child
H373	May cause damage to organs through prolonged or repeated exposure

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- | | |
|--------------------|--|
| NFPA health hazard | : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given. |
| NFPA fire hazard | : 1 - Must be preheated before ignition can occur. |
| NFPA reactivity | : 2 - Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water. |



HMIS III Rating

- | | |
|---------------------|---|
| Health | : 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given |
| Flammability | : 1 Slight Hazard |
| Physical | : 2 Moderate Hazard |
| Personal Protection | : H |

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

1. Identification

Product identifier	Residual Solvent Class II - Xylenes	
Other means of identification		
Catalog number	1601849	
Recommended use	Specified quality tests and assay use only.	
Recommended restrictions	Not for use as a drug. Not for administration to humans or animals.	
Manufacturer/Importer/Supplier/Distributor information		
Company name	U. S. Pharmacopeia	
Address	12601 Twinbrook Parkway Rockville MD 20852-1790 US	
Telephone	RS Technical Services	301-816-8129
Website	www.usp.org	
E-mail	RSTECH@usp.org	
Emergency phone number	CHEMTREC within US & Canada	1-800-424-9300
	CHEMTREC outside US & Canada	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Flammable liquids	Category 2
Health hazards	Serious eye damage/eye irritation	Category 2B
	Carcinogenicity	Category 2
OSHA hazard(s)	Not classified.	
Label elements		



Signal word	Danger	
Hazard statement	Highly flammable liquid and vapor. Causes eye irritation. Suspected of causing cancer.	
Precautionary statement		
Prevention	Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.	
Response	If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. In case of fire: Use appropriate media for extinction. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. If exposed or concerned: Get medical advice/attention.	
Storage	Store in a well-ventilated place. Keep cool. Store locked up.	
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.	
Hazard(s) not otherwise classified (HNOC)	Not classified.	

3. Composition/information on ingredients

Mixture

Hazardous components

Chemical name	Common name and synonyms	CAS number	%
Dimethyl Sulfoxide		67-68-5	98.915
Xylene		1330-20-7	0.90055
Ethylbenzene		100-41-4	0.18445

4. First-aid measures

Inhalation	If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Call a physician if symptoms develop or persist.
Skin contact	Rinse skin with water/shower. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. If ingestion of a large amount does occur, call a poison control center immediately.
Most important symptoms/effects, acute and delayed	Irritation of eyes and mucous membranes.
Indication of immediate medical attention and special treatment needed	Treatment of overdose may include the following: Because of the risk of CNS depression and pulmonary aspiration, do not induce vomiting. Activated charcoal may induce vomiting and pulmonary aspiration. Routine use is not recommended. Support respiratory and cardiovascular function. Monitor for respiratory distress. Delayed pulmonary edema may not develop for 24 to 72 hours. If symptomatic, obtain chest x-ray; if severe, monitor arterial blood gases or pulse oximetry. PEEP or CPAP may be necessary. If CNS depression, noncardiogenic pulmonary edema, or ARDS develop, endotracheal intubation, assisted ventilation, and supplemental oxygen may be required. Monitor cardiac function. Epinephrine and other sympathomimetics should be used with caution. Xylene may decrease the myocardial threshold to the arrhythmogenic effects of such drugs, increasing the risk of arrhythmias. Monitor fluid and electrolyte status. Correct hypokalemia and acidemia with intravenous potassium and sodium bicarbonate. Hypocalcemia may ensue following fluid and electrolyte replenishment. This should be corrected with intravenous calcium. [Meditext 2003]
General information	Remove from exposure. Remove contaminated clothing. For treatment advice, seek guidance from an occupational health physician or other licensed health-care provider familiar with workplace chemical exposures. In the United States, the national poison control center phone number is 1-800-222-1222. If person is not breathing, give artificial respiration. If breathing is difficult, give oxygen if available. Persons developing serious hypersensitivity (anaphylactic) reactions must receive immediate medical attention.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	By heating and fire, harmful vapors/gases may be formed.
Special protective equipment and precautions for firefighters	Wear suitable protective equipment. Use protective equipment appropriate for surrounding materials.
Fire-fighting equipment/instructions	In the event of fire, cool tanks with water spray. As with all fires, evacuate personnel to a safe area. Firefighters should use self-contained breathing equipment and protective clothing.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Keep unnecessary personnel away. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Avoid inhalation of vapors. Wear appropriate personal protective equipment.
Methods and materials for containment and cleaning up	Remove sources of ignition. Absorb spillage with suitable absorbent material. For waste disposal, see section 13 of the SDS. Clean surface thoroughly to remove residual contamination. Keep combustibles (wood, paper, oil, etc.) away from spilled material.

7. Handling and storage

Precautions for safe handling	As a general rule, when handling USP Reference Standards, avoid all contact and inhalation of dust, mists, and/or vapors associated with the material. Clean equipment and work surfaces with suitable detergent or solvent after use. After removing gloves, wash hands and other exposed skin thoroughly.
Conditions for safe storage, including any incompatibilities	Store in tight container as defined in the USP-NF. This material should be handled and stored per label instructions to ensure product integrity.

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Ethylbenzene (CAS 100-41-4)	PEL	435 mg/m3 100 ppm
Xylene (CAS 1330-20-7)	PEL	435 mg/m3 100 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value
Ethylbenzene (CAS 100-41-4)	REL	435 mg/m3 100 ppm
	STEL	545 mg/m3 125 ppm

US. ACGIH Threshold Limit Values

Components	Type	Value
Ethylbenzene (CAS 100-41-4)	STEL	125 ppm
	TWA	100 ppm
Xylene (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

US. Workplace Environmental Exposure Level (WEEL) Guides

Components	Type	Value
Dimethyl Sulfoxide (CAS 67-68-5)	TWA	250 ppm

Biological limit values

US. ACGIH. BEIs. Biological Exposure Indices

Components	Value	Determinant	Sampling Time
Ethylbenzene (CAS 100-41-4)	0.7 g/g	Sum of mandelic acid and phenyl glyoxylic acid	*
Xylene (CAS 1330-20-7)	1.5 g/g	Methylhippuric acids	*

Appropriate engineering controls

Airborne exposure should be controlled primarily by engineering controls such as general dilution ventilation, local exhaust ventilation, or process enclosure. Local exhaust ventilation is generally preferred to general exhaust because it can control the contaminant at its source, preventing dispersion into the work area. An industrial hygiene survey involving air monitoring may be used to determine the effectiveness of engineering controls. Effectiveness of engineering controls intended for use with highly potent materials should be assessed by use of nontoxic surrogate materials. Local exhaust ventilation such as a laboratory fume hood or other vented enclosure is recommended, particularly for aerosol-generating procedures.

Individual protection measures, such as personal protective equipment

Eye/face protection

Safety glasses with sideshields are recommended. Face shields or goggles may be required if splash potential exists or if corrosive materials are present. Approved eye protection (e.g., bearing the ANSI Z87 or CSA stamp) is preferred. Maintain eyewash facilities in the work area.

Skin protection

Hand protection

Chemically compatible gloves. For handling solutions, ensure that the glove material is protective against the solvent being used. Use handling practices that minimize direct hand contact. Employees who are sensitive to natural rubber (latex) should use nitrile or other synthetic nonlatex gloves. Use of powdered latex gloves should be avoided due to the risk of latex allergy.

Other

For handling of laboratory scale quantities, a cloth lab coat is recommended. Where significant quantities are handled, work clothing may be necessary to prevent take-home contamination.

Respiratory protection

Where respirators are deemed necessary to reduce or control occupational exposures, use NIOSH-approved respiratory protection and have an effective respirator program in place (applicable U.S. regulation OSHA 29 CFR 1910.134).

Thermal hazards

Not available.

General hygiene considerations

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Appearance	Clear liquid.
Physical state	Liquid.
Form	Liquid.
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor density	Not available.
Relative density	Not available.
Solubility in water	Not available.
Partition coefficient (n-octanol/water)	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.

10. Stability and reactivity

Reactivity	No reactivity hazards known.
Chemical stability	Risk of explosion.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Heat, flames, and sparks. Avoid temperatures exceeding the flash point.
Incompatible materials	Alkaline metals. Isocyanates.
Hazardous decomposition products	Irritating and/or toxic fumes or gases. Emits toxic fumes under fire conditions.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Based on available data, the classification criteria are not met.
Inhalation	Due to lack of data the classification is not possible.
Skin contact	Based on available data, the classification criteria are not met.
Eye contact	Causes eye irritation.
Symptoms related to the physical, chemical, and toxicological characteristics	Nausea. Vomiting. Diarrhea. Garlic-like taste or odor on breath and skin. Drowsiness. Headache. Fatigue. Dizziness. Weakness. Confusion. Incoordination. Memory loss. Vertigo. Irritability. Tremor. Skin inflammation. Chest tightness.
Delayed and immediate effects of exposure	Pulmonary edema. Respiratory depression. Respiratory failure. Convulsions. Seizures. Central nervous system depression. Arrhythmias. Ototoxicity. Coma. Death.
Medical conditions aggravated by exposure	Alcoholism. Heart disease. Liver disease. Kidney disease. Neurological disorders. Blood disorders. Impaired pulmonary function. Skin disorders.
Acute toxicity	Based on available data, the classification criteria are not met.

Components	Species	Test Results
Dimethyl Sulfoxide (CAS 67-68-5)		
Acute		
Dermal		
LD50	Mouse	50000 mg/kg
	Rat	40000 mg/kg
Inhalation		
LC50	Rat	> 2000 mg/m3, 40 hours
		> 1600 mg/m3, 4 hours
Oral		
LD50	Mouse	7920 mg/kg

Components	Species	Test Results
	Rat	14500 mg/kg 17.9 ml/kg
Ethylbenzene (CAS 100-41-4)		
Acute		
<i>Dermal</i>		
LD50	Rabbit	17800 mg/kg
<i>Inhalation</i>		
LC50	Rat	17.2 mg/l/4h
<i>Oral</i>		
LD50	Rat	3500 mg/kg
Xylene (CAS 1330-20-7)		
<i>Dermal</i>		
LD50	Rat	> 1700 mg/kg, 4 hours
<i>Inhalation</i>		
LC50	Rat	5000 ppm
<i>Oral</i>		
LD50	Mouse	2119 mg/kg
	Rat	4300 mg/kg
Skin corrosion/irritation	Based on available data, the classification criteria are not met.	
Serious eye damage/eye irritation	Causes eye irritation.	
Local effects		
Xylene		5 mg Irritancy test Result: Irritant. Species: Rabbit Organ: Eye. Test Duration: 24 hours Severity: Severe.
Ethylbenzene		500 mg Irritancy test Result: Irritant. Species: Rabbit Organ: Eye. Severity: Severe.
Xylene		500 mg Irritancy test Result: Irritant. Species: Rabbit Organ: Skin. Test Duration: 24 hours Severity: Moderate.
Ethylbenzene		87 mg Irritancy test Result: Irritant. Species: Rabbit Organ: Eye. Severity: Mild.
Dimethyl Sulfoxide		Irritancy test Result: Irritant. Species: Human Organ: Skin. Irritancy test Result: Irritant. Species: Rabbit Organ: Skin. Severity: Moderate.
		Irritancy test Result: Negative. Species: Mouse Organ: Skin. Test Duration: 30 weeks Severity: No dermal injury Irritancy test (Draize) Result: Negative. Species: Rabbit Organ: Eye. Test Duration: 24 hours Severity: Slight.

Local effects

Dimethyl Sulfoxide

Irritancy test (Draize)
Result: Negative.
Species: Rabbit
Organ: Skin.
Test Duration: 24 hours
Severity: Mild.

Respiratory sensitization

Due to lack of data the classification is not possible.

Skin sensitization

Based on available data, the classification criteria are not met.

Sensitization

Dimethyl Sulfoxide

Buehler test
Result: Negative.
Species: Guinea pig
Organ: Skin.
Sensitization (patch) test
Result: Non-sensitizing.
Species: Human
Organ: Skin.

Ethylbenzene

Germ cell mutagenicity

Due to lack of data the classification is not possible.

Mutagenicity

Xylene

Ames assay
Result: Negative.
DNA repair microsuspension assay
Result: Negative.
E. coli assay
Result: Negative.
Gene mutation assays in yeast
Result: Negative.
In vitro cytogenetic assay in Chinese hamster ovary cells
Result: Negative.
In vitro reverse mutation studies in Salmonella
Result: Negative.
In vivo cytogenetic assay in rats
Result: Positive.
In vivo micronucleus assay in mice
Result: Negative.
In vivo sex-linked recessive lethal mutation assay in D. melanogaster
Result: Negative.
Mouse dominant lethal assay
Result: Negative.
Mouse lymphoma assay
Result: Positive.
Mouse lymphoma forward gene mutation assay
Result: Negative.
Rat dominant lethal assay
Result: Negative.
S. typhimurium Ames assay
Result: Negative.
Sister chromatid exchange assay in hamsters
Result: Negative.

Ethylbenzene

Dimethyl Sulfoxide

Xylene

Ethylbenzene

Xylene

Ethylbenzene

Carcinogenicity

Suspected of causing cancer.

Xylene

0 - 1000 mg/kg Carcinogenicity study
Result: No evidence of organ toxicity on histopathological examination or of any treatment related increase in incidence of neoplasia.
Species: Mouse
0 - 500 mg/kg Carcinogenicity study
Result: No treatment related increase in the incidence of tumors.
Species: Rat
Test Duration: 103 weeks
0 - 750 ppm Carcinogenicity study
Result: Increased incidences of alveolar/bronchiolar neoplasms in males, increased incidences of hepatocellular neoplasms in females.
Species: Mouse
Test Duration: 103 weeks

Ethylbenzene

Ethylbenzene	0 - 750 ppm Carcinogenicity study Result: Increased incidences of renal tubule neoplasms and testicular adenomas in males; increased incidences of renal tube adenomas in females. Species: Rat Test Duration: 104 weeks 500 mg/kg/day Carcinogenicity study Result: Significant increase in total malignant tumors. Species: Rat Test Duration: 104 weeks
Dimethyl Sulfoxide	9 g/kg Carcinogenicity test (oral or topical) Result: No tumor development observed. Species: Rhesus monkey Test Duration: 18 months Carcinogenicity study
Ethylbenzene	
Reproductive toxicity	Due to lack of data the classification is not possible.
Reproductivity	
Xylene	0 - 138 ppm Reproductivity study Result: Maternal body weight was reduced and relative liver weights increased; increased incidence of delayed development and a minor variant (extra ribs) were reported. Species: Rat 0 - 230 ppm Reproductivity study Result: No effects on maternal body weight gain or fetal body weights; no teratogenic effects. Species: Rat 0 - 772 ppm Reproductivity study Result: Post-implantation loss was increased but there was no effect on mean litter size. Species: Rat 4300 mg/m3 Reproductivity test Result: Maternal toxicity was reflected in increased liver, kidney, and spleen weights. Species: Rat 600 - 2400 mg/m3 Reproductivity test Result: Caused skeletal growth retardation, extra ribs, and reduced fetal growth rate at the highest concentration. Species: Rat
Ethylbenzene	
Specific target organ toxicity - single exposure	Based on available data, the classification criteria are not met.
Specific target organ toxicity - repeated exposure	Based on available data, the classification criteria are not met.
Aspiration hazard	Due to lack of data the classification is not possible.

12. Ecological information

Ecotoxicity

Components		Species	Test Results
Dimethyl Sulfoxide (CAS 67-68-5)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	33000 - 37000 mg/l, 96 hours
Ethylbenzene (CAS 100-41-4)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	1.37 - 4.4 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	4.2 mg/l, 96 hours
Xylene (CAS 1330-20-7)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	2.661 - 4.093 mg/l, 96 hours
Persistence and degradability	No data is available on the degradability of this product.		
Bioaccumulative potential	Not available.		
Mobility in soil	Not available.		
Other adverse effects	Not available.		

13. Disposal considerations

Disposal instructions	Dispose in accordance with all applicable regulations. Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.
Local disposal regulations	Not available.
Hazardous waste code	Not available.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number	UN1175
UN proper shipping name	Flammable liquid, n.o.s. (Xylene/Ethylbenzene mixture)
Transport hazard class(es)	3
Subsidiary class(es)	Not available.
Packing group	II

IATA

UN number	UN1175
UN proper shipping name	Flammable liquid, n.o.s. (Xylene/Ethylbenzene mixture)
Transport hazard class(es)	3
Subsidiary class(es)	-
Packaging group	II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code No information available.

DOT



IATA



15. Regulatory information

US federal regulations All components are on the U.S. EPA TSCA Inventory List.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - No
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SARA 302 Extremely hazardous substance No

SARA 311/312 Hazardous chemical No

Other federal regulations

Safe Drinking Water Act (SDWA) Not regulated.

Food and Drug Administration (FDA) Not regulated.

US state regulations

WARNING: This product contains a chemical known to the State of California to cause cancer.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other information, including date of preparation or last revision

Issue date 04-15-2014

Version # 01

Further information Not available.

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FLINN SCIENTIFIC, INC.

Safety Data Sheet (SDS)

SDS #: 531.00

Revision Date: March 25, 2014

SECTION 1 — CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Naphthalene

Flinn Scientific, Inc. P.O. Box 219, Batavia, IL 60510 (800) 452-1261

CHEMTREC Emergency Phone Number: (800) 424-9300

Signal Word **DANGER**

Pictograms



SECTION 2 — HAZARDS IDENTIFICATION

Hazard class: Flammable solids (Category 1 or 2). Flammable solid (H228). Keep away from heat, sparks, open flames, and hot surfaces. No smoking (P210).

Hazard class: Acute toxicity, oral (Category 4). Harmful if swallowed (H302). Do not eat, drink or smoke when using this product (P270).

Hazard class: Serious eye damage or irritation (Category 2B). Causes eye irritation (H320).

Hazard class: Carcinogenicity (Category 2). Suspected of causing cancer (H351). Obtain special instructions before use (P201). Do not handle until all safety precautions have been read and understood (P202).

SECTION 3 — COMPOSITION, INFORMATION ON INGREDIENTS

Component Name	CAS Number	Formula	Formula Weight	Concentration
Naphthalene	91-20-3	C ₁₀ H ₈	128.17	

SECTION 4 — FIRST AID MEASURES

Call a POISON CENTER or physician if you feel unwell.

If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do so. Continue rinsing (P305+P351+P338). **If eye irritation persists:** Get medical advice or attention (P337+P313).

If on skin: Wash with plenty of water.

If swallowed: Rinse mouth. Call a POISON CENTER or physician if you feel unwell (P302+P301+P312).

SECTION 5 — FIRE FIGHTING MEASURES

Class IIIA combustible solid.

Flash point: 79 °C Flammable limits: Lower: 0.9% Upper: 5.9% Autoignition Temperature: 526 °C

When heated to decomposition, may emit toxic fumes.

In case of fire: Use a tri-class dry chemical fire extinguisher (P370+P378).

NFPA CODE

H-2

F-2

R-0

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Remove all ignition sources and water. Sweep up the spill, place in a sealed bag or container, and dispose. Ventilate area and wash spill site after material pickup is complete. See Sections 8 and 13 for further information.

SECTION 7 — HANDLING AND STORAGE

Flinn Suggested Chemical Storage Pattern: Organic #3. Store with hydrocarbons, oils, esters and aldehydes. Keep container tightly closed. Store in a cool, dry place within a Flinn Chem-Saf™ bag. Ground or bond container and receiving equipment (P240). Use explosion-proof electrical and ventilating equipment (P241).

SECTION 8 — EXPOSURE CONTROLS, PERSONAL PROTECTION

Wear protective gloves, protective clothing, and eye protection (P280). Wash hands thoroughly after handling (P264). Exposure guidelines: PEL/TLV 10 ppm (OSHA/ACGIH) Readily absorbed through the skin.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

White, volatile flakes, cubes, sphere or powder. Odor of moth balls.	Boiling point: 217.9 °C
Soluble: Absolute alcohol and ether. Insoluble in water.	Melting point: 80.2 °C
	Specific gravity: 1.0253
	Vapor density: 4.4

SECTION 10 — STABILITY AND REACTIVITY

Shelf life: Volatile flakes, keep tightly closed. See Section 7 for further information.

SECTION 11 — TOXICOLOGICAL INFORMATION

Acute effects: Toxic, irritant	ORL-RAT LD ₅₀ : 490 mg/kg
Chronic effects: Possible carcinogen.	IHL-RAT LC ₅₀ : N.A.
Target organs: Eyes, blood, kidneys	SKN-RAT LD ₅₀ : >2500 mg/kg

N.A. = Not available, not all health aspects of this substance have been fully investigated.

SECTION 12 — ECOLOGICAL INFORMATION

Data not yet available.

SECTION 13 — DISPOSAL CONSIDERATIONS

Please review all federal, state and local regulations that may apply before proceeding. Flinn Suggested Disposal Method #18b is one option.

SECTION 14 — TRANSPORT INFORMATION

Shipping name: Naphthalene, refined; Hazard class: 4.1, Flammable solid; UN number: UN1334

N/A = Not applicable

SECTION 15 — REGULATORY INFORMATION

TSCA-listed, EINECS-listed (202-049-5), RCRA code U165.

SECTION 16 — OTHER INFORMATION

This Safety Data Sheet (SDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific, Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. The data should not be confused with local, state, federal or insurance mandates, regulations, or requirements and CONSTITUTE NO WARRANTY. Any use of this data and information must be determined by the science instructor to be in accordance with applicable local, state or federal laws and regulations. The conditions or methods of handling, storage, use and disposal of the product(s) described are beyond the control of Flinn Scientific, Inc. and may be beyond our knowledge. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THIS PRODUCT(S).

Consult your copy of the *Flinn Science Catalog/Reference Manual* for additional information about laboratory chemicals.

Revision Date: March 25, 2014



SAFETY DATA SHEET

Creation Date 28-May-2009

Revision Date 12-Sep-2014

Revision Number 4

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product Description: tert-Butyl methyl ether
Cat No. : 378720000; 378720010; 378720025; 378720100
Synonyms 2-Methyl-2-methoxy propane; MTBE; Methyl tert-butyl ether
CAS-No 1634-04-4
EC-No. 216-653-1
Molecular Formula C5 H12 O
Reach Registration Number -

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended Use Laboratory chemicals.
Uses advised against No Information available

1.3. Details of the supplier of the safety data sheet

Company Acros Organics BVBA
Janssen Pharmaceuticaaan 3a
2440 Geel, Belgium
E-mail address begel.sdsdesk@thermofisher.com

1.4. Emergency telephone number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 / **Europe**:001-703-527-3887

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

CLP Classification - Regulation (EC) No 1272/2008

Physical hazards

Flammable liquids

Category 2

Health hazards

Skin Corrosion/irritation

Category 2

Environmental hazards

Based on available data, the classification criteria are not met

Classification according to EU Directives 67/548/EEC or 1999/45/EC

Symbol(s) Xi - Irritant
F - Highly flammable
R-phrases(s) R11 - Highly flammable
R38 - Irritating to skin

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For the full text of the R-phrases and H-Statements mentioned in this Section, see Section 16.

2.2. Label elements



Signal Word

Danger

Hazard Statements

H225 - Highly flammable liquid and vapor

H315 - Causes skin irritation

Precautionary Statements

P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking

P240 - Ground/Bond container and receiving equipment

P302 + P352 - IF ON SKIN: Wash with plenty of soap and water

2.3. Other hazards

No information available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances

Component	CAS-No	EC-No.	Weight %	CLP Classification - Regulation (EC) No 1272/2008	DSD Classification - 67/548/EEC
Methyl tert-butyl ether	1634-04-4	EEC No. 216-653-1	>95	Skin Irrit. 2 (H315) Flam. Liq. 2 (H225)	F; R11 Xi; R38

Reach Registration Number	-
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For the full text of the R-phrases and H-Statements mentioned in this Section, see Section 16.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Ingestion

Do not induce vomiting. Obtain medical attention.

Inhalation

Move to fresh air. If breathing is difficult, give oxygen. Get medical attention immediately if symptoms occur.

Protection of First-aiders

Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination.

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4.2. Most important symptoms and effects, both acute and delayed

Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting: Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

4.3. Indication of any immediate medical attention and special treatment needed

Notes to Physician

Treat symptomatically. Symptoms may be delayed.

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.

Extinguishing media which must not be used for safety reasons

Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products

Carbon monoxide (CO), Carbon dioxide (CO₂).

5.3. Advice for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. Ensure adequate ventilation.

6.2. Environmental precautions

Should not be released into the environment. See Section 12 for additional ecological information.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.

6.4. Reference to other sections

Refer to protective measures listed in Sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges. Use only under a chemical fume hood. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

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7.2. Conditions for safe storage, including any incompatibilities

Keep containers tightly closed in a dry, cool and well-ventilated place. Flammables area. Keep away from heat and sources of ignition. Keep container tightly closed in a dry and well-ventilated place. May form explosive peroxides on prolonged storage.

7.3. Specific end use(s)

Use in laboratories

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Exposure limits

List source(s): **EU** - Commission Directive 2006/15/EC of 7 February 2006 establishing a second list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Directives 91/322/EEC and 2000/39/EC on the protection of the health and safety of workers from the risks related to chemical agents at work. **UK** - EH40/2005 Containing the workplace exposure limits (WELs) for use with the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended). Updated by September 2006 official press release and October 2007 Supplement.

Component	European Union	The United Kingdom	France	Belgium	Spain
Methyl tert-butyl ether	TWA: 50 ppm 8 hr TWA: 183.5 mg/m ³ 8 hr STEL: 100 ppm 15 min STEL: 367 mg/m ³ 15 min	STEL: 100 ppm 15 min STEL: 367 mg/m ³ 15 min TWA: 50 ppm 8 hr TWA: 183.5 mg/m ³ 8 hr	TWA / VME: 50 ppm (8 heures). TWA / VME: 183.5 mg/m ³ (8 heures). STEL / VLCT: 367 mg/m ³ . STEL / VLCT: 100 ppm.	TWA: 40 ppm 8 uren TWA: 146 mg/m ³ 8 uren STEL: 100 ppm 15 minuten STEL: 367 mg/m ³ 15 minuten	STEL / VLA-EC: 100 ppm (15 minutos). STEL / VLA-EC: 367 mg/m ³ (15 minutos). TWA / VLA-ED: 50 ppm (8 horas) TWA / VLA-ED: 183.5 mg/m ³ (8 horas)

Component	Italy	Germany	Portugal	The Netherlands	Finland
Methyl tert-butyl ether		TWA: 50 ppm (8 Stunden). AGW - exposure factor 1.5 TWA: 180 mg/m ³ (8 Stunden). AGW - exposure factor 1.5 TWA: 50 ppm (8 Stunden). MAK TWA: 180 mg/m ³ (8 Stunden). MAK Höhepunkt: 75 ppm Höhepunkt: 270 mg/m ³	STEL: 100 ppm 15 minutos STEL: 367 mg/m ³ 15 minutos TWA: 50 ppm 8 horas TWA: 183.5 mg/m ³ 8 horas	STEL: 360 mg/m ³ 15 minuten TWA: 180 mg/m ³ 8 uren	TWA: 50 ppm 8 tunteina STEL: 100 ppm 15 minuutteina

Component	Austria	Denmark	Switzerland	Poland	Norway
Methyl tert-butyl ether	MAK-KZW: 100 ppm 15 Minuten MAK-KZW: 360 mg/m ³ 15 Minuten MAK-TMW: 50 ppm 8 Stunden MAK-TMW: 180 mg/m ³ 8 Stunden	TWA: 40 ppm 8 timer TWA: 144 mg/m ³ 8 timer	STEL: 75 ppm 15 Minuten STEL: 270 mg/m ³ 15 Minuten TWA: 50 ppm 8 Stunden TWA: 180 mg/m ³ 8 Stunden	STEL: 270 mg/m ³ 15 minutach TWA: 180 mg/m ³ 8 godzinach	TWA: 50 ppm 8 timer TWA: 183.5 mg/m ³ 8 timer STEL: 100 ppm 15 minutter. listed in the List of Administrative Norms STEL: 367 mg/m ³ 15 minutter. listed in the List of Administrative Norms

Component	Bulgaria	Croatia	Ireland	Cyprus	Czech Republic
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SAFETY DATA SHEET

tert-Butyl methyl ether

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Methyl tert-butyl ether	TWA: 50 ppm TWA: 183.5 mg/m ³ STEL : 100 ppm STEL : 367 mg/m ³	TWA-GVI: 50 ppm 8 satima. TWA-GVI: 183.5 mg/m ³ 8 satima. STEL-KGVI: 100 ppm 15 minutama. STEL-KGVI: 367 mg/m ³ 15 minutama.	TWA: 50 ppm 8 hr. TWA: 183.5 mg/m ³ 8 hr. STEL: 100 ppm 15 min STEL: 367 mg/m ³ 15 min	STEL: 367 mg/m ³ STEL: 100 ppm TWA: 183.5 mg/m ³ TWA: 50 ppm	TWA: 100 mg/m ³ 8 hodinách. Ceiling: 200 mg/m ³
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Component	Estonia	Gibraltar	Greece	Hungary	Iceland
Methyl tert-butyl ether	TWA: 50 ppm 8 tundides. TWA: 180 mg/m ³ 8 tundides. STEL: 75 ppm 15 minutites. STEL: 250 mg/m ³ 15 minutites.	TWA: 183.5 mg/m ³ 8 hr TWA: 50 ppm 8 hr STEL: 367 mg/m ³ 15 min STEL: 100 ppm 15 min	STEL: 100 ppm STEL: 367 mg/m ³ TWA: 50 ppm TWA: 183.5 mg/m ³	STEL: 367 mg/m ³ 15 percekben. CK TWA: 183.5 mg/m ³ 8 órában. AK	STEL: 100 ppm STEL: 367 mg/m ³ TWA: 50 ppm 8 klukkustundum. TWA: 183.5 mg/m ³ 8 klukkustundum. Ceiling: 100 ppm Ceiling: 367 mg/m ³

Component	Latvia	Lithuania	Luxembourg	Malta	Romania
Methyl tert-butyl ether	STEL: 100 ppm STEL: 367 mg/m ³ TWA: 50 ppm TWA: 183.5 mg/m ³	TWA: 50 ppm IPRD TWA: 183.5 mg/m ³ IPRD STEL: 100 ppm STEL: 367 mg/m ³	TWA: 50 ppm 8 Stunden STEL: 367 mg/m ³ 15 Minuten STEL: 100 ppm 15 Minuten	TWA: 183.5 mg/m ³ TWA: 50 ppm STEL: 367 mg/m ³ 15 minuti STEL: 100 ppm 15 minuti	TWA: 50 ppm 8 ore TWA: 183.5 mg/m ³ 8 ore STEL: 100 ppm 15 minute STEL: 367 mg/m ³ 15 minute

Component	Russia	Slovak Republic	Slovenia	Sweden	Turkey
Methyl tert-butyl ether	TWA: 100 mg/m ³ STEL: 300 mg/m ³ vapor	Ceiling: 367 mg/m ³	TWA: 50 ppm 8 urah TWA: 183.5 mg/m ³ 8 urah STEL: 100 ppm 15 minutah STEL: 367 mg/m ³ 15 minutah	STV: 60 ppm 15 minuter STV: 220 mg/m ³ 15 minuter LLV: 30 ppm 8 timmar. LLV: 110 mg/m ³ 8 timmar.	STEL: 100 ppm 15 dakika STEL: 367 mg/m ³ 15 dakika

Biological limit values

This product, as supplied, does not contain any hazardous materials with biological limits established by the region specific regulatory bodies.

Monitoring methods

BS EN 14042:2003 Title Identifier: Workplace atmospheres. Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents.

MDHS70 General methods for sampling airborne gases and vapours

MDHS 88 Volatile organic compounds in air. Laboratory method using diffusive samplers, solvent desorption and gas chromatography

MDHS 96 Volatile organic compounds in air - Laboratory method using pumped solid sorbent tubes, solvent desorption and gas chromatography

Derived No Effect Level (DNEL) No information available

Route of exposure	Acute effects (local)	Acute effects (systemic)	Chronic effects (local)	Chronic effects (systemic)
Oral Dermal Inhalation				

Predicted No Effect Concentration (PNEC) No information available.

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8.2. Exposure controls

Engineering Measures

Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Wherever possible, engineering control measures such as the isolation or enclosure of the process, the introduction of process or equipment changes to minimise release or contact, and the use of properly designed ventilation systems, should be adopted to control hazardous materials at source

Personal protective equipment

Eye Protection

Safety glasses with side-shields (European standard - EN 166)

Hand Protection

Protective gloves

Glove material	Breakthrough time	Glove thickness	EU standard	Glove comments
Nitrile rubber	< 211 minutes	0.38 mm	Level 4	Permeation rate 1 µg/cm ² /min
Viton (R)	< 152 minutes	0.7 mm	Level 4	Permeation rate 17 µg/cm ² /min
			EN 374	As tested under EN374-3 Determination of Resistance to Permeation by Chemicals

Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure

Inspect gloves before use.

Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. (Refer to manufacturer/supplier for information)

Ensure gloves are suitable for the task: Chemical compatibility, Dexterity, Operational conditions, User susceptibility, e.g. sensitisation effects, also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion.

Remove gloves with care avoiding skin contamination.

Respiratory Protection

No protective equipment is needed under normal use conditions.

Large scale/emergency use

Use a NIOSH/MSHA or European Standard EN 136 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced

Recommended Filter type: low boiling organic solvent Type AX Brown conforming to EN371

Small scale/Laboratory use

Maintain adequate ventilation Use a NIOSH/MSHA or European Standard EN 149:2001 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Recommended half mask:- Valve filtering: EN405; or; Half mask: EN140; plus filter, EN 141

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

Environmental exposure controls

No information available.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance

Colorless

Physical State

Liquid

Odor

Petroleum distillates

Odor Threshold

No data available

pH

No information available

Melting Point/Range

-110 °C / -166 °F

Softening Point

No data available

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Boiling Point/Range	54 - 56 °C / 129.2 - 132.8 °F	
Flash Point	-28 °C / -18.4 °F	Method - No information available
Evaporation Rate	No data available	
Flammability (solid,gas)	Not applicable	Liquid
Explosion Limits	Lower 1.6 vol% Upper 8.4 vol%	
Vapor Pressure	268 mbar @ 20 °C	
Vapor Density	0.2	(Air = 1.0)
Specific Gravity / Density	0.740	
Bulk Density	Not applicable	Liquid
Water Solubility	51 g/L (20°C)	
Solubility in other solvents	No information available	
Partition Coefficient (n-octanol/water)		
Component	log Pow	
Methyl tert-butyl ether	1.06	
Autoignition Temperature	224 - °C / 435.2 - °F	
Decomposition temperature	No data available	
Viscosity	0.36 mPa.s at 20 °C	
Explosive Properties	No information available	Vapors may form explosive mixtures with air
Oxidizing Properties	No information available	

9.2. Other information

Molecular Formula	C5 H12 O
Molecular Weight	88.15

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

None known, based on information available

10.2. Chemical stability

Stable under normal conditions

10.3. Possibility of hazardous reactions

Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

10.4. Conditions to avoid

Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

10.5. Incompatible materials

Strong oxidizing agents.

10.6. Hazardous decomposition products

Carbon monoxide (CO). Carbon dioxide (CO₂).

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Product Information

(a) acute toxicity;

Oral	Based on available data, the classification criteria are not met
Dermal	Based on available data, the classification criteria are not met
Inhalation	Based on available data, the classification criteria are not met

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
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Methyl tert-butyl ether	2963 mg/kg (Rat)	10000 mg/kg (Rabbit)	23576 ppm (Rat) 4 h
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(b) skin corrosion/irritation; Category 2

(c) serious eye damage/irritation; No data available

(d) respiratory or skin sensitization;

Respiratory No data available

Skin No data available

(e) germ cell mutagenicity; No data available

Mutagenic effects have occurred in experimental animals

(f) carcinogenicity; No data available

The table below indicates whether each agency has listed any ingredient as a carcinogen
Limited evidence of a carcinogenic effect

Component	EU	UK	Germany	IARC
Methyl tert-butyl ether			Cat. 3B	group 3

(g) reproductive toxicity;

No data available

Reproductive Effects Experiments have shown reproductive toxicity effects on laboratory animals.

Developmental Effects Developmental effects have occurred in experimental animals.

Teratogenicity Teratogenic effects have occurred in experimental animals.

(h) STOT-single exposure; No data available

(i) STOT-repeated exposure; No data available

Target Organs Skin, Eyes, Central nervous system (CNS), Liver, Kidney, Blood.

(j) aspiration hazard; No data available

Other Adverse Effects

Tumorigenic effects have been reported in experimental animals. See actual entry in RTECS for complete information

Symptoms / effects, both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting:
Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecotoxicity effects

. Do not empty into drains.

Component	Freshwater Fish	Water Flea	Freshwater Algae	Microtox
Methyl tert-butyl ether	887 mg/L LC50 96 h 100 mg/L LC50 96 h 929 mg/L LC50 96 h 672 mg/L LC50 96 h	542 mg/L EC50 = 48 h	800 mg/L EC50 > 72 h 184 mg/L EC50 = 96 h	EC50 = 11.4 mg/L 30 min EC50 = 8.23 mg/L 5 min EC50 = 9.67 mg/L 15 min

12.2. Persistence and degradability

Persistence

Persistence is unlikely, based on information available.

12.3. Bioaccumulative potential

Bioaccumulation is unlikely

Component	log Pow	Bioconcentration factor (BCF)
Methyl tert-butyl ether	1.06	No data available

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12.4. Mobility in soil

The product contains volatile organic compounds (VOC) which will evaporate easily from all surfaces. Will likely be mobile in the environment due to its volatility. Disperses rapidly in air.

12.5. Results of PBT and vPvB assessment

No data available for assessment.

12.6. Other adverse effects

Endocrine Disruptor Information

Component	EU - Endocrine Disruptors Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Methyl tert-butyl ether	Group III Chemical		

Persistent Organic Pollutant Ozone Depletion Potential

This product does not contain any known or suspected substance

This product does not contain any known or suspected substance

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste from Residues / Unused Products

Waste is classified as hazardous. Dispose of in accordance with the European Directives on waste and hazardous waste. Dispose of in accordance with local regulations.

Contaminated Packaging

Dispose of this container to hazardous or special waste collection point. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep product and empty container away from heat and sources of ignition.

European Waste Catalogue (EWC)

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific.

Other Information

Waste codes should be assigned by the user based on the application for which the product was used. Do not dispose of waste into sewer. Can be incinerated, when in compliance with local regulations.

SECTION 14: TRANSPORT INFORMATION

IMDG/IMO

14.1. UN number

UN2398

14.2. UN proper shipping name

Methyl butyl ether

14.3. Transport hazard class(es)

3

14.4. Packing group

II

ADR

14.1. UN number

UN2398

14.2. UN proper shipping name

METHYL tert-BUTYL ETHER

14.3. Transport hazard class(es)

3

14.4. Packing group

II

IATA

14.1. UN number

UN2398

14.2. UN proper shipping name

METHYL TERT-BUTYL ETHER

14.3. Transport hazard class(es)

3

14.4. Packing group

II

14.5. Environmental hazards

No hazards identified

14.6. Special precautions for user

No special precautions required

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14.7. Transport in bulk according to Not applicable, packaged goods
Annex II of MARPOL73/78 and the
IBC Code

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

International Inventories X = listed

Component	EINECS	ELINCS	NLP	TSCA	DSL	NDSL	PICCS	ENCS	IECSC	AICS	KECL
Methyl tert-butyl ether	216-653-1	-		X	X	-	X	X	X	X	X

National Regulations

Component	Germany - Water Classification (VwVwS)	Germany - TA-Luft Class
Methyl tert-butyl ether	WGK 1	

Component	France - INRS (Tables of occupational diseases)
Methyl tert-butyl ether	Tableaux des maladies professionnelles (TMP) - RG 84

Take note of Control of Substances Hazardous to Health Regulations (COSHH) 2002 and 2005 Amendment.

Take note of Dir 94/33/EC on the protection of young people at work

Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

15.2. Chemical safety assessment

A Chemical Safety Assessment/Report (CSA/CSR) has not been conducted

SECTION 16: OTHER INFORMATION

Full text of R-phrases referred to under sections 2 and 3

R11 - Highly flammable

R38 - Irritating to skin

Full text of H-Statements referred to under sections 2 and 3

H225 - Highly flammable liquid and vapor

H315 - Causes skin irritation

Legend

CAS - Chemical Abstracts Service

EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

IECSC - Chinese Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

ENCS - Japanese Existing and New Chemical Substances

AICS - Australian Inventory of Chemical Substances

NZIoC - New Zealand Inventory of Chemicals

WEL - Workplace Exposure Limit

ACGIH - American Conference of Governmental Industrial Hygienists

DNEL - Derived No Effect Level

RPE - Respiratory Protective Equipment

LC50 - Lethal Concentration 50%

NOEC - No Observed Effect Concentration

PBT - Persistent, Bioaccumulative, Toxic

TWA - Time Weighted Average

IARC - International Agency for Research on Cancer

PNEC - Predicted No Effect Concentration

LD50 - Lethal Dose 50%

EC50 - Effective Concentration 50%

POW - Partition coefficient Octanol:Water

vPvB - very Persistent, very Bioaccumulative

ADR - European Agreement Concerning the International Carriage of Dangerous Goods by Road

ICAO/IATA - International Civil Aviation Organization/International Air Transport Association

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IMO/IMDG - International Maritime Organization/International Maritime Dangerous Goods Code

OECD - Organisation for Economic Co-operation and Development

BCF - Bioconcentration factor

MARPOL - International Convention for the Prevention of Pollution from Ships

ATE - Acute Toxicity Estimate

VOC - Volatile Organic Compounds

Key literature references and sources for data

Suppliers safety data sheet, Chemadvisor - LOLI, Merck index, RTECS

Training Advice

Chemical hazard awareness training, incorporating labelling, Safety Data Sheets (SDS), Personal Protective Equipment (PPE) and hygiene.

Fire prevention and fighting, identifying hazards and risks, static electricity, explosive atmospheres posed by vapours and dusts.

Chemical incident response training.

Use of personal protective equipment, covering appropriate selection, compatibility, breakthrough thresholds, care, maintenance, fit and standards.

First aid for chemical exposure, including the use of eye wash and safety showers.

Creation Date 28-May-2009

Revision Date 12-Sep-2014

Revision Summary Update to Format.

This safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

A&K PETROCHEM

SAFETY DATA SHEET

1. IDENTIFICATION

Product Identifier: 1,2-Dichloroethane

Distributor Information

Name: A&K Petrochem Industries Ltd
 Address: 316 Edgeley Blvd
 Concord, Ontario, Canada L4K 3Y3
 Phone: 416-213-5611

Emergency Phone Number

CANUTEC: 613-996-6666

2. HAZARD(S) IDENTIFICATION

Hazard classification

Physical hazards

Flammable liquids Category 2

Health hazards

Acute toxicity (Oral) Category 4

Skin corrosion/irritation Category 2

Serious eye damage/eye irritation Category 2

Carcinogenicity Category 1B

Specific target organ toxicity - single exposure Category 3

Label elements

Hazard symbol:	Signal word:	Danger	Hazard statement:	Highly flammable liquid and vapor.
		Harmful if swallowed.		
		Causes skin irritation.		
		Causes serious eye irritation.		
		May cause respiratory irritation.		
		May cause cancer.		

Precautionary statement

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Do not eat, drink or smoke when using this product. Avoid breathing dust/fume/gas/mist/vapors. Wear protective gloves/protective clothing/eye protection/face protection. Use only outdoors or in a well-ventilated area. Wash hands thoroughly after handling.

Response: In case of fire: Use water spray, foam, dry powder or carbon dioxide for extinction. IF exposed or concerned: Get medical advice/attention. IF SWALLOWED: Call a POISON CENTER/doctor/ if you feel unwell. Rinse mouth. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell. Specific treatment (see this label).

Storage: Store in a well-ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal: Dispose of contents/container to an appropriate treatment and disposal

facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.

Other hazards which do not result in GHS classification:

Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
ETHYLENE DICHLORIDE		107-06-2	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. FIRST-AID MEASURES

General information:	Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.
Ingestion:	Rinse mouth. Call a POISON CENTER or doctor/physician if you feel unwell.
Inhalation:	Move to fresh air. Get medical attention if symptoms persist.
Skin contact:	Wash with soap and water. If skin irritation occurs: Get medical advice/attention. Take off immediately all contaminated clothing. Wash contaminated clothing before reuse.
Eye contact:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Most important symptoms/effects, acute and delayed	
Symptoms:	Irritating to eyes, respiratory system and skin. Narcotic effect.
Indication of immediate medical attention and special treatment needed	
Treatment:	Symptoms may be delayed. Treat symptomatically.

5. FIRE-FIGHTING MEASURES

General fire hazards:	Flammable liquid and vapor.
Suitable (and unsuitable) extinguishing media:	
Suitable extinguishing media:	Water spray, foam, dry powder or carbon dioxide.
Unsuitable extinguishing media:	Avoid water in straight hose stream; will scatter and spread fire.
Specific hazards arising from the chemical:	Vapors may cause a flash fire or ignite explosively. Vapors may travel considerable distance to a source of ignition and flash back. Prevent buildup of vapors or gases to explosive concentrations. Heat may cause the containers to explode.
Special protective equipment and precautions for firefighters	
Special fire fighting procedures:	Use water spray to keep fire-exposed containers cool. Water may be ineffective in fighting the fire. Fight fire from a protected location. Move containers from fire area if you can do so without risk.
Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures:	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Keep unauthorized personnel away. Keep upwind. Use personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. See Section 8 of the MSDS for Personal
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Take precautionary measures containment and cleaning up:	Protective Equipment. Methods and material for Eliminate all ignition sources if safe to do so.
Notification Procedures:	against static discharges. Stop leak if possible without any risk. Use only non-sparking tools. Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. Dike far ahead of larger spill for later recovery and disposal.
Environmental precautions:	Prevent entry into waterways, sewer, basements or confined areas. Stop leak if you can do so without risk. Inform authorities if large amounts are involved.
	Do not contaminate water sources or sewer. Prevent further leakage or spillage if safe to do so.

7. HANDLING AND STORAGE

Precautions for safe handling:	DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Take precautionary measures against static discharges. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Wear protective gloves/protective clothing/eye protection/face protection. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Wash hands thoroughly after handling.
Conditions for safe storage, including any incompatibilities:	Keep away from food, drink and animal feeding stuffs. Keep container tightly closed in a cool, well-ventilated place. Ground container and transfer equipment to eliminate static electric sparks. Comply with all national, state, and local codes pertaining to the storage, handling, dispensing, and disposal of flammable liquids.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Occupational exposure limits

Chemical identity	Type	Exposure Limit values		Source
ETHYLENE DICHLORIDE	TWA	10 ppm		US. ACGIH Threshold Limit Values (2011)
	REL	1 ppm	4 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	STEL	2 ppm	8 mg/m3	US. NIOSH: Pocket Guide to Chemical Hazards (2010)
	TWA	1 ppm	4 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	STEL	2 ppm	8 mg/m3	US. OSHA Table Z-1-A (29 CFR 1910.1000) (1989)
	TWA	50 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)
	Ceiling	100 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)
	MAX. CONC	200 ppm		US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)

Appropriate engineering controls	No data available.
Individual protection measures, such as personal protective equipment	
General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. An eye wash and safety shower must be available in the immediate work area. Use explosion-proof ventilation equipment.
Eye/face protection:	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection:	Chemical resistant gloves
Other:	Wear suitable protective clothing.

Respiratory protection:	In case of inadequate ventilation use suitable respirator.
Hygiene measures:	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Provide eyewash station and safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Physical state:	Liquid
Form:	Liquid
Color:	Colorless
Odor:	Chloroform-like odor
Odor threshold:	No data available.
pH:	No data available.
Melting point/freezing point:	-35.3 °C
Initial boiling point and boiling range:	83 °C
Flash Point:	13 °C (Closed Cup)
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	15.9 %(V)
Flammability limit - lower (%):	6.2 %(V)
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	10.52 kPa (25 °C)
Vapor density:	No data available.
Relative density:	1.24 (20 °C)
Solubility(ies)	
Solubility in water:	8.1 g/l (20 °C)
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	1.48
Auto-ignition temperature:	413 °C
Decomposition temperature:	No data available.
Viscosity:	No data available.
Other information	
Molecular weight:	98.96 g/mol (C ₂ H ₄ Cl ₂)

10. STABILITY AND REACTIVITY

Reactivity:	No data available.
Chemical stability:	Material is stable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur.
Conditions to avoid:	Heat, sparks, flames. Contact with incompatible materials.
Incompatible materials:	Ammonia. Caustics. Reducing agents. Oxidizing agents. Alkali metals. Alkali earth metals. Organic peroxides/hydroperoxides. Amines.
Hazardous decomposition products:	By heating and fire, toxic vapors/gases may be formed.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	
Ingestion:	Harmful if swallowed.
Inhalation:	May cause irritation to the respiratory system. May cause drowsiness or dizziness.
Skin contact:	Causes skin irritation.
Eye contact:	Causes serious eye irritation.
Information on toxicological effects	
Acute toxicity (list all possible routes of exposure)	
Oral	
Product:	LD 50 (Rat): 670 mg/kg
Dermal	

Product:	No data available.
Inhalation	
Product:	LD 50 (Rat, 7 h): 1,000 mg/l
Repeated dose toxicity	
Product:	No data available.
Skin corrosion/irritation	
Product:	Causes skin irritation.
Serious eye damage/eye irritation	
Product:	Causes serious eye irritation.
Respiratory or skin sensitization	
Product:	Not a skin sensitizer.
Carcinogenicity	
Product:	May cause cancer. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
ETHYLENE	Overall evaluation: 2B. Possibly carcinogenic to humans.
DICHLORIDE	
US. National Toxicology Program (NTP) Report on Carcinogens:	
ETHYLENE	Reasonably Anticipated to be a Human Carcinogen.
DICHLORIDE	
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):	
No carcinogenic components identified	
Germ cell mutagenicity	
In vitro	
Product:	No mutagenic components identified
In vivo	
Product:	No mutagenic components identified
Reproductive toxicity	
Product:	No data available.
Specific target organ toxicity - single exposure	
Product:	Inhalation - vapor: Respiratory System - Respiratory tract irritation.
Specific target organ toxicity - repeated exposure	
Product:	No data available.
Aspiration hazard	
Product:	Not classified
Other effects:	None known.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product:	No data available.
Specified substance(s):	
ETHYLENE	LC 50 (Sheepshead minnow (Cyprinodon variegatus), 96 h): > 130 - < 230 mg/l Mortality
DICHLORIDE	LC 50 (Fathead minnow (Pimephales promelas), 96 h): 110 - 123 mg/l Mortality
	LC 50 (Rainbow trout, donaldson trout (Oncorhynchus mykiss), 96 h): 225 mg/l Mortality
	LC 50 (Bluegill (Lepomis macrochirus), 96 h): 230 - 710 mg/l Mortality

Aquatic invertebrates

Product:	No data available.
Specified substance(s):	
ETHYLENE	EC 50 (Water flea (Daphnia magna), 48 h): 140 - 190 mg/l Intoxication
DICHLORIDE	LC 50 (Water flea (Daphnia magna), 48 h): 160 - 280 mg/l Mortality

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.
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Aquatic invertebrates

Product:	No data available.
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Toxicity to Aquatic Plants

Product:	No data available.
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Persistence and degradability

Biodegradation

Product:	There are no data on the degradability of this product.
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BOD/COD ratio	
Product:	No data available.
Bioaccumulative potential	
Bioconcentration factor (BCF)	
Product:	No data available on bioaccumulation.
Partition coefficient n-octanol / water (log Kow)	
Product:	Log Kow: 1.48
Mobility in soil:	The product is partly soluble in water. May spread in the aquatic environment.
Other adverse effects:	The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

13. DISPOSAL CONSIDERATIONS

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws.
Contaminated packaging:	Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. TRANSPORT INFORMATION

DOT

UN number:	UN 1184
UN proper shipping name:	Ethylene dichloride
Transport hazard class(es)	
Class(es):	3, 6.1
Label(s):	3, 6.1
Packing group:	II
Marine Pollutant:	No

IMDG

UN number:	UN 1184
UN proper shipping name:	ETHYLENE DICHLORIDE
Transport hazard class(es)	
Class(es):	3, 6.1
Label(s):	3, 6.1
EmS No.:	F-E, S-D
Packing group:	II
Marine Pollutant:	No

IATA

UN number:	UN 1184
Proper Shipping Name:	Ethylene dichloride
Transport hazard class(es):	
Class(es):	3, 6.1
Label(s):	3, 6.1
Marine Pollutant:	No
Packing group:	II

15. REGULATORY INFORMATION

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

ETHYLENE DICHLORIDE Reportable quantity: 100 lbs.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

X Acute (Immediate) X Chronic (Delayed) X Fire Reactive Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification
 Chemical identity RQ
 ETHYLENE DICHLORIDE 100 lbs.

SARA 311/312 Hazardous chemical
 Chemical identity Threshold Planning Quantity
 ETHYLENE DICHLORIDE 500 lbs

SARA 313 (TRI reporting)

Chemical identity	Reporting threshold for other users	Reporting threshold for manufacturing and processing
ETHYLENE DICHLORIDE	100 lbs	25000 lbs.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)
 ETHYLENE DICHLORIDE Reportable quantity: 100 lbs.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):
 None present or none present in regulated quantities.

US state regulations

US. California Proposition 65
 ETHYLENE DICHLORIDE Carcinogenic.

US. New Jersey Worker and Community Right-to-Know Act
 ETHYLENE DICHLORIDE Listed

US. Massachusetts RTK - Substance List
 ETHYLENE DICHLORIDE Listed

US. Pennsylvania RTK - Hazardous Substances
 ETHYLENE DICHLORIDE Listed

US. Rhode Island RTK
 ETHYLENE DICHLORIDE Listed

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EU EINECS List:	On or in compliance with the inventory
EU ELINCS List:	Not in compliance with the inventory.
Japan (ENCS) List:	Not in compliance with the inventory.
EU No Longer Polymers List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	Not in compliance with the inventory.
Korea Existing Chemicals Inv. (KECI):	On or in compliance with the inventory
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	On or in compliance with the inventory
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16. OTHER INFORMATION

NFPA Hazard ID

Flammability : 3

Health : 2

Reactivity : 0

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date: 04-11-2014

Revision date: No data available.

Version #: 1.0

Further information: No data available.

DISCLAIMER

The information presented in this Safety Data Sheet (SDS/MSDS) was prepared based on data that is believed to be accurate.

A&K Petrochem / A&K Finechem / ANK Pharmaceuticals provide this information "as is" without warranty of any kind.

This SDS is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product, as is not intended to be comprehensive as to the manner and conditions of use, handling, storage, or disposal of the product. Individuals receiving this SDS must always exercise their own independent judgement in determining the appropriateness of such issues.

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1. Identification

Product identifier 1,2-Dibromoethane

Other means of identification

Item N-10150

Synonym(s) ETHYLENE BROMIDE

Recommended use For Laboratory Use Only

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information**Manufacturer**

Company name Chem Service, Inc.

Address 660 Tower Lane
West Chester, PA 19380
United States

Telephone Toll Free 800-452-9994
Direct 610-692-3026

Website www.chemservice.com

E-mail info@chemservice.com

Emergency phone number Chemtrec US 800-424-9300
Chemtrec outside US +1 703-527-3887

2. Hazard(s) identification

Physical hazards Not classified.

Health hazards

Acute toxicity, oral	Category 3
Acute toxicity, dermal	Category 3
Acute toxicity, inhalation	Category 3
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2A
Carcinogenicity	Category 1
Reproductive toxicity	Category 2
Specific target organ toxicity, single exposure	Category 3 respiratory tract irritation

Environmental hazards

Hazardous to the aquatic environment, acute hazard	Category 3
Hazardous to the aquatic environment, long-term hazard	Category 2

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Toxic if swallowed. Toxic in contact with skin. Causes skin irritation. Causes serious eye irritation. Toxic if inhaled. May cause respiratory irritation. May cause cancer. Suspected of damaging fertility or the unborn child. Harmful to aquatic life. Toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use only outdoors or in a well-ventilated area. Avoid breathing mist or vapor. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.

Response	If swallowed: Immediately call a poison center/doctor. If on skin: Wash with plenty of water. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a poison center/doctor. Specific treatment (see this label). Rinse mouth. If skin irritation occurs: Get medical advice/attention. If eye irritation persists: Get medical advice/attention. Take off immediately all contaminated clothing and wash it before reuse. Collect spillage.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Not applicable.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
1,2-Dibromoethane	ETHYLENE BROMIDE	106-93-4	100

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a POISON CENTER or doctor/physician.
Skin contact	Take off immediately all contaminated clothing. Wash with plenty of soap and water. Call a POISON CENTER or doctor/physician if you feel unwell. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Most important symptoms/effects, acute and delayed	Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Take off immediately all contaminated clothing. IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Wash contaminated clothing before reuse.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO ₂).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire-fighting equipment/instructions	Move containers from fire area if you can do so without risk.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Immediately evacuate personnel to safe areas. Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate protective equipment and clothing during clean-up. Avoid inhalation of vapors. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
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Methods and materials for containment and cleaning up

Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Cover with plastic sheet to prevent spreading. Absorb in vermiculite, dry sand or earth and place into containers. Prevent entry into waterways, sewer, basements or confined areas. Following product recovery, flush area with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination.

Environmental precautions

Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.

Avoid release to the environment. Contact local authorities in case of spillage to drain/aquatic environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling

Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not taste or swallow. Avoid breathing vapor. Avoid contact with skin. Avoid contact with eyes. Avoid contact during pregnancy/while nursing. Avoid prolonged exposure. Avoid contact with clothing. Use only outdoors or in a well-ventilated area. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. When using, do not eat, drink or smoke. Wash hands thoroughly after handling. Wash contaminated clothing before reuse. Avoid release to the environment. Do not empty into drains.

Conditions for safe storage, including any incompatibilities

Store locked up. Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

US. OSHA Table Z-2 (29 CFR 1910.1000)

Material	Type	Value
1,2-Dibromoethane (CAS 106-93-4)	Ceiling	30 ppm
	TWA	20 ppm

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value
1,2-Dibromoethane (CAS 106-93-4)	Ceiling	0.13 ppm
	TWA	0.045 ppm

Biological limit values

No biological exposure limits noted for the ingredient(s).

Exposure guidelines

US - California OELs: Skin designation

1,2-Dibromoethane (CAS 106-93-4) Can be absorbed through the skin.

US - Minnesota Haz Subs: Skin designation applies

1,2-Dibromoethane (CAS 106-93-4) Skin designation applies.

US ACGIH Threshold Limit Values: Skin designation

1,2-Dibromoethane (CAS 106-93-4) Can be absorbed through the skin.

Appropriate engineering controls

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear eye/face protection. Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear appropriate chemical resistant gloves.

Other Wear appropriate chemical resistant clothing.

Respiratory protection In case of insufficient ventilation, wear suitable respiratory equipment.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations

When using, do not eat, drink or smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form	Liquid
Color	Colorless
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	49.95 °F (9.97 °C)
Initial boiling point and boiling range	267.8 - 269.6 °F (131 - 132 °C)
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	1.49 kPa at 25 °C 1.49 kPa at 25 °C
Vapor density	6.5
Relative density	Not available.
Solubility(ies)	
Solubility (water)	4 g/l
Partition coefficient (n-octanol/water)	2
Auto-ignition temperature	Not available.
Decomposition temperature	464 - 518 °F (240 - 270 °C)
Viscosity	Not available.
Other information	
Density	2.17 g/cm3
Dynamic viscosity	1.73 mPa.s
Dynamic viscosity temperature	68 °F (20 °C)
Kinematic viscosity	0.8 mm²/s estimated
Molecular formula	C2-H4-Br2
Molecular weight	187.86 g/mol
Percent volatile	100 %
Specific gravity	2.17
VOC (Weight %)	100 %

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Hydrogen bromide.

11. Toxicological information

Information on likely routes of exposure

Ingestion	Toxic if swallowed.
Inhalation	Toxic by inhalation.
Skin contact	Toxic in contact with skin. Causes skin irritation.

Eye contact	Causes serious eye irritation.	
Symptoms related to the physical, chemical and toxicological characteristics	Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Skin irritation. May cause redness and pain.	
Information on toxicological effects		
Acute toxicity	Toxic by inhalation. Toxic if swallowed. Toxic in contact with skin. May cause respiratory irritation.	
Product	Species	Test Results
1,2-Dibromoethane (CAS 106-93-4)		
Acute		
Dermal		
LD50	Rabbit	300 mg/kg
	Rat	300 mg/kg
Inhalation		
LC50	Guinea pig, Rat	> 200 ppm, 4 Hours
	Rat	14.3 mg/l, 30 Minutes
Oral		
LD50	Guinea pig	110 mg/kg
	Mouse	420 mg/kg
	Rabbit	55 mg/kg
	Rat	55 mg/kg
Other		
LD50	Mouse	220 mg/kg
* Estimates for product may be based on additional component data not shown.		
Skin corrosion/irritation	Causes skin irritation.	
Serious eye damage/eye irritation	Causes serious eye irritation.	
Respiratory or skin sensitization		
Respiratory sensitization	Not available.	
Skin sensitization	This product is not expected to cause skin sensitization.	
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.	
Carcinogenicity	May cause cancer.	
IARC Monographs. Overall Evaluation of Carcinogenicity		
1,2-Dibromoethane (CAS 106-93-4)	2A Probably carcinogenic to humans.	
US. National Toxicology Program (NTP) Report on Carcinogens		
1,2-Dibromoethane (CAS 106-93-4)	Reasonably Anticipated to be a Human Carcinogen.	
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)		
Not listed.		
Reproductive toxicity	Possible reproductive hazard. Suspected of damaging fertility or the unborn child.	
Specific target organ toxicity - single exposure	Respiratory tract irritation.	
Specific target organ toxicity - repeated exposure	Not classified.	
Aspiration hazard	Not available.	
Chronic effects	Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.	

12. Ecological information

Ecotoxicity	Toxic to aquatic life with long lasting effects. Accumulation in aquatic organisms is expected.		
Product	Species		Test Results
1,2-Dibromoethane (CAS 106-93-4)			
Aquatic			
Fish	LC50	Medaka, high-eyes (Oryzias latipes)	27.6 - 37.4 mg/l, 96 hours
* Estimates for product may be based on additional component data not shown.			
Persistence and degradability	No data is available on the degradability of this product.		
Bioaccumulative potential	Not available.		

Partition coefficient n-octanol / water (log Kow)

1.96

Mobility in soil

No data available.

Other adverse effects

No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations**Disposal instructions**

Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.

Local disposal regulations

Dispose in accordance with all applicable regulations.

Hazardous waste code

The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

US RCRA Hazardous Waste U List: Reference

1,2-Dibromoethane (CAS 106-93-4)

U067

Waste from residues / unused products

Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).

Contaminated packaging

Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information**DOT****UN number**

UN1605

UN proper shipping name

Ethylene dibromide

Transport hazard class(es)**Class**

6.1(PGI, II)

Subsidiary risk

-

Label(s)

6.1

Packing group

I

Special precautions for user

Read safety instructions, SDS and emergency procedures before handling.

Special provisions

2, B9, B14, B32, B77, T20, TP2, TP13, TP38, TP45

Packaging exceptions

None

Packaging non bulk

227

Packaging bulk

244

IATA**UN number**

UN1605

UN proper shipping name

Ethylene dibromide

Transport hazard class(es)**Class**

6.1(PGIII)

Subsidiary risk

-

Packing group

Not applicable.

Environmental hazards

No.

ERG Code

6L

Special precautions for user

Read safety instructions, SDS and emergency procedures before handling.

Other information**Passenger and cargo aircraft**

Allowed.

Cargo aircraft only

Allowed.

IMDG**UN number**

UN1605

UN proper shipping name

ETHYLENE DIBROMIDE

Transport hazard class(es)**Class**

6.1(PGI, II)

Subsidiary risk

-

Packing group

I

Environmental hazards**Marine pollutant**

No.

EmS

F-A, S-A

Special precautions for user

Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to
Annex II of MARPOL 73/78 and
the IBC Code

Not available.

DOT



IATA



IMDG



15. Regulatory information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

All components are on the U.S. EPA TSCA Inventory List.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

1,2-Dibromoethane (CAS 106-93-4)

Listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical

Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
1,2-Dibromoethane	106-93-4	100

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

1,2-Dibromoethane (CAS 106-93-4)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Hazardous substance
Section 112(r) (40 CFR 68.130)

Safe Drinking Water Act (SDWA) 0 mg/l
0.00005 mg/l

US state regulations

US. Massachusetts RTK - Substance List

1,2-Dibromoethane (CAS 106-93-4)

US. New Jersey Worker and Community Right-to-Know Act

1,2-Dibromoethane (CAS 106-93-4) 500 LBS

US. Pennsylvania RTK - Hazardous Substances

1,2-Dibromoethane (CAS 106-93-4)

US. Rhode Island RTK

1,2-Dibromoethane (CAS 106-93-4)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

1,2-Dibromoethane (CAS 106-93-4) Listed: July 1, 1987

US - California Proposition 65 - CRT: Listed date/Developmental toxin

1,2-Dibromoethane (CAS 106-93-4) Listed: May 15, 1998

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

1,2-Dibromoethane (CAS 106-93-4) Listed: May 15, 1998

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 06-03-2014
Version # 01
NFPA ratings Health: 3
Flammability: 0
Instability: 0

Disclaimer

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

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This product is furnished FOR LABORATORY USE ONLY.



Material Safety Data Sheet

MSDS ID NO.: 0127MAR019
Revision date: 12/07/2010

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product name: Marathon Regular Unleaded Gasoline
Synonym: Conventional Regular Unleaded Gasoline
Chemical Family: Petroleum Hydrocarbon
Formula: Mixture

Manufacturer:
Marathon Petroleum Company LP
539 South Main Street
Findlay OH 45840

Other information: 419-421-3070
Emergency telephone number: 877-627-5463

2. COMPOSITION/INFORMATION ON INGREDIENTS

Gasoline is a complex combination of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons having carbon numbers predominantly greater than C3 and boiling in the range of 85-500 F. Can contain small amounts of dye and other additives (>0.02%) which are not considered hazardous at the concentrations used.

Product information:

Name	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA - Vacated PELs - Time Weighted Ave	Other:
Marathon Regular Unleaded Gasoline	86290-81-5	100	300 ppm TWA 500 ppm STEL		

Component Information:

Name	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA - Vacated PELs - Time Weighted Ave	Other:
Saturated Hydrocarbons	Mixture	55-85			

Name	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA - Vacated PELs - Time Weighted Ave	Other:
Aromatic Hydrocarbons	Mixture	10-40			
Unsaturated Hydrocarbons	Mixture	1-15			
Toluene	108-88-3	1-15	20 ppm TWA	= 100 ppm TWA = 375 mg/m ³ TWA = 150 ppm STEL = 560 mg/m ³ STEL	
Xylene	1330-20-7	2-10	100 ppm TWA 150 ppm STEL	= 100 ppm TWA = 435 mg/m ³ TWA = 150 ppm STEL = 655 mg/m ³ STEL	
1,2,4-Trimethylbenzene	95-63-6	1-5	= 25 ppm TWA	= 125 mg/m ³ TWA = 25 ppm TWA	
Benzene	71-43-2	0.5-3.5	Skin - potential significant contribution to overall exposure by the cutaneous route 0.5 ppm TWA 2.5 ppm STEL	= 25 ppm Ceiling = 10 ppm TWA = 50 ppm STEL	OSHA Exposure Limit as specified in 1910.1028: =1.0 ppm TWA = 5 ppm STEL = 0.5 ppm Action Level
Hexane	110-54-3	0-3	Skin - potential significant contribution to overall exposure by the cutaneous route 50 ppm TWA	= 180 mg/m ³ TWA = 50 ppm TWA	
Ethyl Benzene	100-41-4	0.5-2.0	100 ppm TWA 125 ppm STEL	= 100 ppm TWA = 435 mg/m ³ TWA = 125 ppm STEL = 545 mg/m ³ STEL	
Naphthalene	91-20-3	0.1-0.5	Skin - potential significant contribution to overall exposure by the cutaneous route 10 ppm TWA 15 ppm STEL	= 10 ppm TWA = 50 mg/m ³ TWA = 15 ppm STEL = 75 mg/m ³ STEL	

Notes:

The manufacturer has voluntarily elected to reflect exposure limits contained in OSHA's 1989 air contaminants standard in its MSDS's, even though certain of those exposure limits were vacated in 1992.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

DANGER!

FUMES MAY CAUSE EYE AND RESPIRATORY IRRITATION.

MAY BE HARMFUL OR FATAL IF SWALLOWED

MAY CAUSE LUNG DAMAGE

OVEREXPOSURE MAY CAUSE CNS DEPRESSION

BREATHING HIGH CONCENTRATIONS CAN CAUSE IRREGULAR HEARTBEATS WHICH MAY BE FATAL

DANGER - CONTAINS BENZENE - MAY CAUSE CANCER

CAN CAUSE LEUKEMIA AND OTHER BLOOD DISORDERS.

POTENTIAL REPRODUCTIVE HAZARD

SEE TOXICOLOGICAL INFORMATION SECTION FOR MORE INFORMATION

EXTREMELY FLAMMABLE LIQUID AND VAPOR

VAPOR MAY CAUSE FLASH FIRE OR EXPLOSION

MATERIAL MAY ACCUMULATE STATIC CHARGE

STABLE

Inhalation:

Breathing high concentrations may be harmful.

May cause central nervous system depression or effects. Symptoms may include headache, excitation, euphoria, dizziness, incoordination, drowsiness, light-headedness, blurred vision, fatigue, tremors, convulsions, loss of consciousness, coma, respiratory arrest and death, depending on the concentration and duration of exposure.

Breathing high concentrations of this material, for example, in a confined space or by intentional abuse, can cause irregular heartbeats which can cause death. See Toxicological Effects (Section 11) for more information.

Ingestion:

Swallowing this material may be harmful.

May cause irritation of the mouth, throat and gastrointestinal tract.

May cause central nervous system depression or effects. Symptoms may include salivation, pain, nausea, vomiting and diarrhea. Exposure may also cause central nervous system symptoms similar to those listed under "Inhalation" (see Inhalation section).

Skin contact:

Contact may cause reddening, itching and inflammation.

Skin contact may cause harmful effects in other parts of the body.

Eye contact:

Contact may cause pain and severe reddening and inflammation of the conjunctiva.

Effects may become more serious with repeated or prolonged contact.

Carcinogenic Evaluation:

Product information:

Name	IARC Carcinogens:	NTP Carcinogens:	ACGIH - Carcinogens:	OSHA - Select Carcinogens:
Marathon Regular Unleaded Gasoline 86290-81-5	A2 - Possible Human Carcinogen		A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans	

Notes:

The International Agency for Research on Cancer (IARC) has determined that there is inadequate evidence for the carcinogenicity of gasoline in humans. IARC determined that limited evidence of carcinogenicity in animals exists. IARC's overall evaluation of gasoline, in spite of limited carcinogenicity evidence, has resulted in the IARC designation of gasoline as possibly carcinogenic to humans (Group 2B) because gasoline contains benzene.

IARC has determined that there is inadequate evidence for the carcinogenicity of gasoline engine exhaust in humans or animals. However, IARC's overall evaluation on gasoline engine exhaust, in spite of the absence of carcinogenicity data, has resulted in the IARC designation of gasoline engine exhaust as possibly carcinogenic to humans (Group 2B) because of the presence of certain engine exhaust components.

Component Information:

Name	IARC Carcinogens:	NTP Carcinogens:	ACGIH - Carcinogens:	OSHA - Select Carcinogens:
Toluene 108-88-3		male rat-no evidence; female rat-no evidence; male mice-no evidence; female mice-no evidence	A4 - Not Classifiable as a Human Carcinogen	
Xylene 1330-20-7		male rat-no evidence; female rat-no evidence; male mice-no evidence; female mice-no evidence	A4 - Not Classifiable as a Human Carcinogen	
Benzene 71-43-2	Supplement 7 [1987], Monograph 29 [1982]	Known Human Carcinogen male rat-clear evidence; female rat-clear evidence; male mice-clear evidence; female mice-clear evidence	A1 - Confirmed Human Carcinogen	Present
Ethyl Benzene 100-41-4	Monograph 77 [2000]	male rat-clear evidence; female rat-some evidence; male mice-some evidence; female mice-some evidence	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans	Present
Naphthalene 91-20-3	Monograph 82 [2002]	Reasonably Anticipated To Be A Human Carcinogen male rat-clear evidence; female rat-clear evidence; male mice-no evidence; female mice-some evidence	A4 - Not Classifiable as a Human Carcinogen	Present

Notes:

The International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and OSHA have determined that there is sufficient evidence for the carcinogenicity of benzene in humans (Group 1A).

The International Agency for Research on Cancer (IARC) has determined that there is sufficient evidence for the carcinogenicity of alcoholic beverages (ethanol) in humans (Group 1).

The International Agency for Research on Cancer (IARC) has concluded that ethyl benzene is possibly carcinogenic to humans (Group 2B).

The International Agency for Research on Cancer (IARC) and the Environmental Protection Agency (EPA) have determined that naphthalene is a possible human carcinogen.

4. FIRST AID MEASURES

Eye Contact:

Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. GET IMMEDIATE MEDICAL ATTENTION.

Skin Contact:

Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. Get medical attention if irritation persists. Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties.

Ingestion:

Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest.
GET IMMEDIATE MEDICAL ATTENTION.

Inhalation:

Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear and give oxygen. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

NOTES TO PHYSICIAN:

INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.

INGESTION: If ingested this material represents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended.

Medical Conditions Aggravated By Exposure:

blood (anemia), bone marrow,
blood-forming organs, skin, respiratory system, lungs, liver, kidney,

5. FIRE FIGHTING MEASURES

Suitable extinguishing media:

For small fires, Class B fire extinguishing media such as CO₂, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Fire fighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

5. FIRE FIGHTING MEASURES

Specific hazards:

This product has been determined to be a flammable liquid per the OSHA Hazard Communication Standard, and should be handled accordingly. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the North American Emergency Response Guide 128.

Special protective equipment for firefighters:

Avoid using straight water streams. Water may be ineffective in extinguishing low flash point fires, but can be used to cool exposed surfaces. Avoid excessive water spray application. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Keep run-off water out of sewers and water sources.

Flash point:

-50 F

Autoignition temperature:

CA 495 F

Flammable limits in air - lower (%):

1.4

Flammable limits in air - upper (%):

7.6

NFPA rating:

Health: 1

Flammability: 3

Instability: 0

Other: -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:

Keep public away. Isolate and evacuate area. Shut off source if safe to do so. Eliminate all ignition sources. Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate. Contain liquid with sand or soil. Recover and return free product to proper containers. Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids.

7. HANDLING AND STORAGE

Handling:

Comply with all applicable EPA, OSHA, NFPA and consistent state and local requirements. Use appropriate grounding and bonding practices. Store in properly closed containers that are appropriately labeled and in a cool well-ventilated area. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Do not cut, drill, grind or weld on empty containers since they may contain explosive residues. Avoid skin contact. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water.

For use as a motor fuel only. Product should never be used as a solvent due to its flammable and potentially toxic properties. Siphoning by mouth can result in lung aspiration which can be harmful or fatal.

Portable containers of 12 gallons (45 liters) or less should never be filled while they are in or on a motor vehicle or marine craft. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. Containers should be placed on the ground. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers. A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling. Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT

Engineering measures:	Local or general exhaust required in an enclosed area or when there is inadequate ventilation.
Respiratory protection:	Approved organic vapor chemical cartridge or supplied air respirators should be worn for exposures to any components exceeding the TWA or STEL. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 1910.134. Self-contained breathing apparatus should be used for fire fighting.
Skin and body protection:	Use nitrile rubber, viton or PVA gloves for repeated or prolonged skin exposure.
Eye protection:	No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields.
Hygiene measures:	No special protective clothing is normally required. Select protective clothing depending on industrial operations. Use mechanical ventilation equipment that is explosion-proof.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Appearance:	Clear Or Colored Liquid
Physical state (Solid/Liquid/Gas):	Liquid
Substance type (Pure/Mixture):	Mixture
Color:	Clear or Colored
Odor:	Strong Hydrocarbon
Molecular weight:	100
pH:	Neutral
Boiling point/range (5-95%):	90-437 F
Melting point/range:	Not determined.
Decomposition temperature:	Not applicable.

9. PHYSICAL AND CHEMICAL PROPERTIES:

Specific gravity:	0.70-0.77
Density:	5.9-6.3 lbs/gal
Bulk density:	No data available.
Vapor density:	3-4
Vapor pressure:	Not determined.
Evaporation rate:	No data available.
Solubility:	Negligible
Solubility in other solvents:	No data available.
Partition coefficient (n-octanol/water):	2.13-4.5
VOC content(%):	100%
Viscosity:	No data available.

10. STABILITY AND REACTIVITY

Stability:	The material is stable at 70 F, 760 mm pressure.
Polymerization:	Will not occur.
Hazardous decomposition products:	Combustion produces carbon monoxide, aldehydes, aromatic and other hydrocarbons.
Materials to avoid:	Strong oxidizers such as nitrates, chlorates, peroxides.
Conditions to avoid:	Excessive heat, sources of ignition, open flame.

11. TOXICOLOGICAL INFORMATION

Acute toxicity:

Product information:

Name	CAS Number	Inhalation:	Dermal:	Oral:
Marathon Regular Unleaded Gasoline	86290-81-5	>10,000 ppm [Dog]	>5 ml/kg [Rabbit]	>14 ml/kg [Rat]

Toxicology Information:

BENZENE: Studies of Workers Overexposed to Benzene: Studies of workers exposed to benzene show clear evidence that overexposure can cause cancer and other diseases of the blood forming organs including Acute Myelogenous Leukemia (AML), and Aplastic Anemia (AA), an often fatal disease. Some studies suggest overexposure to benzene may also be associated with Myelodysplastic Syndrome (MDS). Findings from a Case-Control study of workers exposed to benzene was reported during the 2009 Benzene Symposium in Munich included an increase in Acute Myeloid Leukemias and Non-Hodgkins Lymphoid Neoplasms (NHLN) of the subtype follicular lymphoma (FL) in some occupational categories. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of AA have been reported in the offspring of persons severely overexposed to benzene. Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and minor skeletal variations. Benzene has been classified as a proven human carcinogen by OSHA and a Group 1 (Carcinogenic to Humans) material by IARC. The current proposed IARC classification for benzene is summarized as follows: Sufficient evidence for Acute Myeloid Leukemia; limited evidence for Acute Lymphatic Leukemia, Chronic Lymphatic Leukemia, Non-Hodgkin Lymphoma, and Multiple Myeloma.

NAPHTHAS: In a large epidemiological study on over 15,000 employees at several petroleum refineries and amongst residents located near these refineries, no increased risk of kidney cancer was observed in association with gasoline exposures (a similar material). In a similar study, no increased risk of kidney cancer was observed among petroleum refinery workers, but there was a slight trend in the incidence of kidney cancers among service station employees, especially after a 30-year latency period.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

TOLUENE: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Abuse of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system, and can cause CNS depression, cardiac arrhythmias, and death. Studies of workers indicate longterm exposure may be related to impaired color vision and hearing. Some studies of workers suggest longterm exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest longterm exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals have been largely negative. Positive findings include small increases in minor

skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Adverse effects on the liver, kidney, thymus and nervous system were observed in animal studies following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

ETHYLBENZENE: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). The incidence of tumors was also elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals have demonstrated evidence of ototoxicity (hearing loss) following exposure levels as low as 300 ppm for 5 days. Studies in laboratory animals indicate some evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

XYLENES, ALL ISOMERS: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross overexposure. Effects from Prolonged or Repeated Exposure: Impaired neurological function was reported in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure. The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

C9 AROMATIC HYDROCARBONS: A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with Glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to

naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

N-HEXANE: Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Testicular atrophy and partial to full loss of the germ cell line were observed in sub-chronic high-dose inhalation studies of laboratory rodents. These effects appeared irreversible. Rodent reproduction studies have shown evidence of reduced fetal weight but no frank malformations.

PENTANES: Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

CARBON MONOXIDE: is a chemical asphyxiant with no warning properties (such as odor). At 400-500 ppm for 1 hour headache and dyspnea may occur. If activity is increased, symptoms of overexposure may include nausea, irritability, increased respiration, tinnitus, sweating, chest pain, confusion, impaired judgement, dizziness, weakness, drowsiness, ataxia, irregular heart beat, cyanosis and pallor. Levels in excess of 1000 ppm can result in collapse, loss of consciousness, respiratory failure and death. Extremely high concentrations (12,800 ppm) can cause immediate unconsciousness and death in 1-3 minutes. Repeated anoxia can lead to central nervous system damage and peripheral neuropathy, with loss of sensation in the fingers, amnesia, and mental deterioration and possible congestive heart failure. Damage may also occur to the fetus, lung, liver, kidney, spleen, cardiovascular system and other organs.

COMBUSTION ENGINE EXHAUST: Chronic inhalation studies of gasoline engine exhaust in mice, rats and hamsters did not produce any carcinogenic effects. Condensates/extracts of gasoline engine exhaust produced an increase in tumors compared to controls when testing by skin painting, subcutaneous injection, intratracheal instillation or implantation into the lungs.

Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffers Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

TARGET ORGANS:

central nervous system, brain, peripheral nervous system, auditory system, respiratory system, mucous membranes, lungs, skin, eyes, heart, blood-forming organs, bone marrow, reproductive organs, testes, immune system, lymphatics, thymus, thyroid, pituitary gland,

12. ECOTOXICOLOGICAL INFORMATION

Mobility:

May partition into air, soil and water.

Ecotoxicity:

Toxic to aquatic organisms.

Bioaccumulation:

Not expected to bioaccumulate in aquatic organisms.

Persistence/Biodegradation:

Readily biodegradable in the environment.

13. DISPOSAL CONSIDERATIONS

Cleanup Considerations:

This product as produced is not specifically listed as an EPA RCRA hazardous waste according to federal regulations (40 CFR 261). However, when discarded or disposed of, it may meet the criteria of an "characteristic" hazardous waste. This product could also contain benzene at >0.5 ppm and could exhibit the characteristics of "toxicity" as determined by the toxicity characteristic leaching procedure (TCLP). This material could become a hazardous waste if mixed or contaminated with a hazardous waste or other substance(s). It is the responsibility of the user to determine if disposal material is hazardous according to federal, state and local regulations.

14. TRANSPORT INFORMATION

49 CFR 172.101:**DOT:**

Transport Information:	This material when transported via US commerce would be regulated by DOT Regulations.
Proper shipping name:	Gasoline
UN/Identification No:	UN 1203
Hazard Class:	3
Packing group:	II
DOT reportable quantity (lbs):	Not applicable.

Proper shipping name:	Gasoline
UN/Identification No:	UN 1203
Hazard Class:	3
Packing group:	II

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b):

This product and/or its components are listed on the TSCA Chemical Inventory.

OSHA Hazard Communication Standard:

This product has been evaluated and determined to be hazardous as defined in OSHA's Hazard Communication Standard.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302:

This product contains the following component(s) that have been listed on EPA's Extremely Hazardous Substance (EHS) List:

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Saturated Hydrocarbons	NA
Aromatic Hydrocarbons	NA
Unsaturated Hydrocarbons	NA
Toluene	NA
Xylene	NA
1,2,4-Trimethylbenzene	NA
Benzene	NA
Hexane	NA
Ethyl Benzene	NA
Naphthalene	NA

SARA Section 304:

This product contains the following component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	CERCLA/SARA - Hazardous Substances and their Reportable Quantities
Saturated Hydrocarbons	NA
Aromatic Hydrocarbons	NA
Unsaturated Hydrocarbons	NA
Toluene	= 454 kg final RQ
Xylene	= 100 lb final RQ = 45.4 kg final RQ
1,2,4-Trimethylbenzene	NA
Benzene	= 10 lb final RQ = 4.54 kg final RQ
Hexane	= 2270 kg final RQ = 5000 lb final RQ
Ethyl Benzene	= 1000 lb final RQ = 454 kg final RQ
Naphthalene	= 100 lb final RQ = 45.4 kg final RQ

SARA Section 311/312

The following EPA hazard categories apply to this product:

Acute Health Hazard
Chronic Health Hazard
Fire Hazard

SARA Section 313:

This product contains the following component(s) that may be subject to reporting on the Toxic Release Inventory (TRI) From R:

Name	CERCLA/SARA 313 Emission reporting:
Saturated Hydrocarbons	None
Aromatic Hydrocarbons	None
Unsaturated Hydrocarbons	None

Name	CERCLA/SARA 313 Emission reporting:
Toluene	= 1.0 % de minimis concentration
Xylene	= 1.0 % de minimis concentration
1,2,4-Trimethylbenzene	= 1.0 % de minimis concentration
Benzene	= 0.1 % de minimis concentration
Hexane	= 1.0 % de minimis concentration
Ethyl Benzene	= 0.1 % de minimis concentration
Naphthalene	= 0.1 % de minimis concentration

State and Community Right-To-Know Regulations:

The following component(s) of this material are identified on the regulatory lists below:

Saturated Hydrocarbons

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Aromatic Hydrocarbons

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Unsaturated Hydrocarbons

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed

Saturated Hydrocarbons

New Jersey Right-To-Know:	Not Listed.
Pennsylvania Right-To-Know:	Not Listed.
Massachusetts Right-To Know:	Not Listed.
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Not Listed
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Toluene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	developmental toxicity, initial date 1/1/91
New Jersey Right-To-Know:	sn 1866
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin)
Michigan critical materials register list:	= 100 lb Annual usage threshold
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	flammable - third degree; teratogen
New Jersey - Environmental Hazardous Substances List:	SN 1866 TPQ 500 lb
Illinois - Toxic Air Contaminants	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	= 1 lb RQ land/water = 1000 lb RQ air

Xylene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	sn 2014
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Toxic (skin); Flammable (skin)
Michigan critical materials register list:	= 100 lb Annual usage threshold all isomers
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	flammable - third degree

Saturated Hydrocarbons

New Jersey - Environmental Hazardous
Substances List:

Illinois - Toxic Air Contaminants

New York - Reporting of Releases Part 597 -
List of Hazardous Substances:

SN 2014 TPQ 500 lb

Present

= 1 lb RQ land/water

= 1000 lb RQ air

1,2,4-Trimethylbenzene

Louisiana Right-To-Know:

California Proposition 65:

New Jersey Right-To-Know:

Pennsylvania Right-To-Know:

Massachusetts Right-To Know:

Florida substance List:

Rhode Island Right-To-Know:

Michigan critical materials register list:

Massachusetts Extraordinarily Hazardous
Substances:

California - Regulated Carcinogens:

Pennsylvania RTK - Special Hazardous
Substances:

New Jersey - Special Hazardous Substances:

New Jersey - Environmental Hazardous
Substances List:

Illinois - Toxic Air Contaminants

New York - Reporting of Releases Part 597 -
List of Hazardous Substances:

Not Listed

Not Listed

sn 2716

Environmental hazard

Present

Not Listed.

Toxic

Not Listed.

Not Listed

Not Listed

Not Listed

Not Listed

SN 2716 TPQ 500 lb

Present

Not Listed

Benzene

Louisiana Right-To-Know:

California Proposition 65:

New Jersey Right-To-Know:

Pennsylvania Right-To-Know:

Massachusetts Right-To Know:

Florida substance List:

Rhode Island Right-To-Know:

Michigan critical materials register list:

Massachusetts Extraordinarily Hazardous
Substances:

California - Regulated Carcinogens:

Pennsylvania RTK - Special Hazardous
Substances:

New Jersey - Special Hazardous Substances:

New Jersey - Environmental Hazardous
Substances List:

Illinois - Toxic Air Contaminants

New York - Reporting of Releases Part 597 -
List of Hazardous Substances:

Not Listed

carcinogen, initial date 2/27/87

developmental toxicity, initial date 12/26/97

male reproductive toxicity, initial date 12/26/97

sn 0197

Environmental hazard; Special hazardous substance

Carcinogen; Extraordinarily hazardous

Not Listed.

Toxic (skin); Flammable (skin); Carcinogen (skin)

= 100 lb Annual usage threshold

carcinogen; extraordinarily hazardous

Not Listed

Present

carcinogen; flammable - third degree; mutagen; teratogen

SN 0197 TPQ 500 lb

Present

= 1 lb RQ land/water

= 10 lb RQ air

Hexane

Louisiana Right-To-Know:

California Proposition 65:

New Jersey Right-To-Know:

Pennsylvania Right-To-Know:

Massachusetts Right-To Know:

Not Listed

Not Listed

sn 1340

Present

Present

Saturated Hydrocarbons

Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 1340 TPQ 500 lb
Illinois - Toxic Air Contaminants	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	= 1 lb RQ air = 1 lb RQ land/water

Ethyl Benzene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	carcinogen, initial date 6/11/04
New Jersey Right-To-Know:	sn 0851
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	carcinogen; flammable - third degree
New Jersey - Environmental Hazardous Substances List:	SN 0851 TPQ 500 lb
Illinois - Toxic Air Contaminants	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	= 1 lb RQ land/water = 1000 lb RQ air

Naphthalene

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	carcinogen, initial date 4/19/02
New Jersey Right-To-Know:	sn 1322
Pennsylvania Right-To-Know:	Environmental hazard
Massachusetts Right-To Know:	Present
Florida substance List:	Not Listed.
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan critical materials register list:	Not Listed.
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	carcinogen

Saturated Hydrocarbons

New Jersey - Environmental Hazardous
Substances List:

Illinois - Toxic Air Contaminants

New York - Reporting of Releases Part 597 -
List of Hazardous Substances:

SN 1322 TPQ 500 lb

Present

= 1 lb RQ land/water

= 100 lb RQ air

Canadian Regulatory Information:

Canada DSL/NDL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
Toluene	B2, D2A, D2B	1 %
Xylene	B2, D2A, D2B	
1,2,4-Trimethylbenzene	B3	0.1 %
Benzene	B2, D2A, D2B	0.1 %
Hexane	B2, D2A	1 %
Ethyl Benzene	B2, D2A, D2B	0.1 %
Naphthalene	B4, D2A	1 %

NOTE: Not Applicable.

16. OTHER INFORMATION

Additional Information: No data available.

Prepared by: Mark S. Swanson, Manager, Toxicology and Product Safety

The information and recommendations contained herein are based upon tests believed to be reliable. However, Marathon Petroleum Company LP (MPC) does not guarantee their accuracy or completeness nor shall any of this information constitute a warranty, whether expressed or implied, as to the safety of the goods, the merchantability of the goods, or the fitness of the goods for a particular purpose. Adjustment to conform to actual conditions of usage maybe required. MPC assumes no responsibility for results obtained or for incidental or consequential damages, including lost profits arising from the use of these data. No warranty against infringement of any patent, copyright or trademark is made or implied.

End of Safety Data Sheet



1. Product and company identification

Product name	DIESEL FUEL NO. 2
MSDS #	11155
Code	11155
Product use	Fuel.
Synonyms	Ultra Low Sulfur No. 2 Amoco Premier Diesel Fuel, Ultra Low Sulfur No. 2 Amoco Premier Diesel Fuel – Winterized, Ultra Low Sulfur No. 2 BP Supreme Diesel, Low Sulfur No. 2 BP Diesel Fuel, Ultra Low Sulfur No. 2 BP Diesel Fuel, Ultra Low Sulfur No. 2 BP Diesel Fuel – Winterized
Supplier	BP Products North America Inc. 150 West Warrenville Road Naperville, Illinois 60563-8460 USA
EMERGENCY HEALTH INFORMATION:	1 (800) 447-8735 Outside the US: +1 703-527-3887 (CHEMTREC)
EMERGENCY SPILL INFORMATION:	1 (800) 424-9300 CHEMTREC (USA)
OTHER PRODUCT INFORMATION	1 (866) 4 BP - MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com

2. Hazards identification

Physical state	Liquid.
Color	Colorless. to Various Colors. (May be dyed Red., Light Green. ,Yellow.)
Emergency overview	<p>WARNING !</p> <p>COMBUSTIBLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED. ASPIRATION HAZARD. HARMFUL OR FATAL IF LIQUID IS ASPIRATED INTO LUNGS. MAY CAUSE RESPIRATORY TRACT IRRITATION. INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS, AND NAUSEA, AND MAY LEAD TO UNCONSCIOUSNESS.</p> <p>Combustible liquid. Harmful if swallowed. Aspiration hazard if swallowed. Can enter lungs and cause damage. Keep away from heat, sparks and flame. Avoid exposure - obtain special instructions before use. Do not breathe vapor or mist. Do not ingest. If ingested, do not induce vomiting. Avoid contact with eyes, skin and clothing. Contains material which may cause cancer, based on animal data. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.</p>
Routes of entry	Dermal contact. Eye contact. Inhalation. Ingestion.
Potential health effects	
Eyes	Slightly irritating to the eyes.
Skin	Prolonged or repeated contact can defat the skin and lead to irritation and/or dermatitis.
Inhalation	May cause respiratory tract irritation. Inhalation causes headaches, dizziness, drowsiness and nausea and may lead to unconsciousness. See toxicological information (section 11).

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Ingestion Harmful if swallowed. Aspiration hazard if swallowed. Can enter lungs and cause damage. See toxicological information (section 11).

See toxicological information (section 11)

3. Composition/information on ingredients

Ingredient name	CAS #	%
Petroleum distillates (Diesel Fuel No. 2)	68476-34-6	95 - 100
Contains one or more of the following biodiesels:	Varies	0 - 5
soybean oil, me ester	67784-80-9	.
Fatty acids, sunflower-oil, Me esters	68919-54-0	.
Fatty acids methyl esters	67762-38-3	.
Fatty acids, vegetable-oil, Methyl esters	68990-52-3	.
rape oil, me ester	73891-99-3	.
Fatty acids, canola-oil, Me esters	129828-16-6	.
fatty acids, tallow, me esters	61788-61-2	.
Contains:		
Naphthalene	91-20-3	1 - 3
May also contain small quantities of proprietary performance additives.		

4. First aid measures

Eye contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.
Skin contact	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention if irritation develops.
Inhalation	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion	Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. Never give anything by mouth to an unconscious person. Get medical attention immediately.

5. Fire-fighting measures

Flammability of the product	Combustible liquid.
Auto-ignition temperature	257°C (494°F)
Flash point	Closed cup: >38°C (>100.4°F) [Pensky-Martens.]
Explosion limits	Lower: 0.6% Upper: 7.5%
Fire/explosion hazards	Combustible liquid and vapor. Vapor may cause flash fire. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.
Unusual fire/explosion hazards	Explosive in the presence of the following materials or conditions: open flames, sparks and static discharge and heat.
Extinguishing media	
Suitable	In case of fire, use water fog, foam, dry chemicals, or carbon dioxide.
Not suitable	Do not use water jet.
Fire-fighting procedures	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
Hazardous combustion products	Combustion products may include the following: carbon oxides (CO, CO ₂) (carbon monoxide, carbon dioxide)
Protective clothing (fire)	

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Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Do not use water jet.

Special remarks on fire hazards

6. Accidental release measures

Environmental precautions

Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Personal protection in case of a large spill

Chemical splash goggles. Chemical-resistant protective suit. Boots. Chemical-resistant gloves. Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Suggested protective clothing might not be adequate. Consult a specialist before handling this product. CAUTION: The protection provided by air-purifying respirators is limited. Use a positive pressure air-supplied respirator if there is any potential for an uncontrolled release, if exposure levels are not known, or if concentrations exceed the protection limits of air-purifying respirator.

Methods for cleaning up

Large spill

Stop leak if without risk. Eliminate all ignition sources. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Small spill

Stop leak if without risk. Eliminate all ignition sources. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

7. Handling and storage

Handling

Do not ingest. Never siphon by mouth. If ingested, do not induce vomiting. Put on appropriate personal protective equipment (see section 8). Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material.

Storage

Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10). Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8. Exposure controls/personal protection

Occupational exposure limits

Ingredient name

Petroleum distillates

Occupational exposure limits

ACGIH TLV (United States). Absorbed through skin.

TWA: 100 mg/m³, (measured as total hydrocarbons) 8 hour(s). Issued/Revised: 1/2002 Form: Total hydrocarbons

Naphthalene

ACGIH TLV (United States).

STEL: 79 mg/m³ 15 minute(s). Issued/Revised: 5/1996

STEL: 15 ppm 15 minute(s). Issued/Revised: 5/1996

TWA: 52 mg/m³ 8 hour(s). Issued/Revised: 5/1996

TWA: 10 ppm 8 hour(s). Issued/Revised: 5/1996

OSHA PEL (United States).

TWA: 50 mg/m³ 8 hour(s). Issued/Revised: 6/1993

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While specific OELs for certain components may be shown in this section, other components may be present in any mist, vapor or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

Some states may enforce more stringent exposure limits.

Control Measures

Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing.

Personal protection

Eyes

Avoid contact with eyes. Safety glasses with side shields.

Skin and body

Avoid contact with skin and clothing. Wear suitable protective clothing.

Respiratory

Use only with adequate ventilation. Do not breathe vapor or mist. If ventilation is inadequate, use a NIOSH-certified respirator with an organic vapor cartridge and P95 particulate filter.

CAUTION: The protection provided by air-purifying respirators is limited. Use a positive pressure air-supplied respirator if there is any potential for an uncontrolled release, if exposure levels are not known, or if concentrations exceed the protection limits of air-purifying respirator.

Hands

Wear gloves that cannot be penetrated by chemicals or oil.

The correct choice of protective gloves depends upon the chemicals being handled, the conditions of work and use, and the condition of the gloves (even the best chemically resistant glove will break down after repeated chemical exposures). Most gloves provide only a short time of protection before they must be discarded and replaced. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Gloves should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

Consult your supervisor or Standard Operating Procedure (S.O.P) for special handling instructions.

9. Physical and chemical properties

Physical state

Liquid.

Color

Colorless. to Various Colors. (May be dyed Red., Light Green. ,Yellow.)

Odor

Petroleum

Flash point

Closed cup: >38°C (>100.4°F) [Pensky-Martens.]

Explosion limits

Lower: 0.6%
Upper: 7.5%

Auto-ignition temperature

257°C (494°F)

Specific gravity

<1 [Water = 1]

Density

820 to 875 kg/m³ (0.82 to 0.875 g/cm³)

Viscosity

Kinematic: 1.7 to 4.1 mm²/s (1.7 to 4.1 cSt) at 40°C

Solubility

negligible <0.1%

10. Stability and reactivity

Stability and reactivity

Stable under recommended storage and handling conditions (see section 7).

Possibility of hazardous reactions

Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid

Keep away from heat, sparks and flame. Avoid all possible sources of ignition (spark or flame).

Incompatibility with various substances

Reactive or incompatible with the following materials: oxidizing materials, acids and alkalis. halogenated compounds.

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Hazardous decomposition products	carbon oxides (CO, CO ₂) (carbon monoxide, carbon dioxide)
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.

11. Toxicological information

Acute toxicity

Classification

Product/ingredient name	IARC	NTP	OSHA
Naphthalene fuel, diesel no. 2	2B 3	Possible -	- -
IARC : 2B - Possible carcinogen to human. 3 - Not classifiable as a human carcinogen.			
NTP : Possible - Reasonably anticipated to be human carcinogens.			

Other Toxicity Data

Aspiration of this product into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Do not siphon by mouth.

Middle distillate: From skin-painting studies of petroleum distillates of similar composition and distillate range, it has been shown that these types of materials often possess weak carcinogenic activity in laboratory animals. In these tests, the material is painted on the shaved backs of mice twice a week for their lifetime. The material is not washed off between applications. Therefore, there may be a potential risk of skin cancer from prolonged or repeated skin contact with this product in the absence of good personal hygiene. This particular product has not been tested for carcinogenic activity, but we have chosen to be cautious in light of the findings with other distillate streams.

Occasional skin contact with this product is not expected to have serious effects, but good personal hygiene should be practiced and repeated skin contact avoided. This product can also be expected to produce skin irritation upon prolonged or repeated skin contact. Personal hygiene measures taken to prevent skin irritation are expected to be adequate to prevent risk of skin cancer.

Diesel exhaust particulates have been classified by the National Toxicological Program (NTP) to be a reasonably anticipated human carcinogen. Exposure should be minimized to reduce potential risk.

Naphthalene has been reported to cause developmental toxicity in mice after oral exposure to relatively high dose levels, but developmental toxicity was not observed in NTP (National Toxicology Program) sponsored studies in rats and rabbits. Ingestion or inhalation of naphthalene can result in hemolysis and other blood abnormalities, and individuals (and infants) deficient in glucose-6-phosphate dehydrogenase may be especially susceptible to these effects. Inhalation of naphthalene may cause headache and nausea. Airborne exposure can result in eye irritation. Naphthalene exposure has been associated with cataracts in animals and humans.

Other information

Potential chronic health effects

Carcinogenicity	Contains material which may cause cancer, based on animal data. Risk of cancer depends on duration and level of exposure.
------------------------	---

12. Ecological information

Ecotoxicity

No testing has been performed by the manufacturer.

Mobility	Spillages may penetrate the soil causing ground water contamination.
Bioaccumulative potential	This product is not expected to bioaccumulate through food chains in the environment.

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13. Disposal considerations

Waste information

The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

NOTE: The generator of waste has the responsibility for proper waste identification (based on characteristic(s) or listing), transportation and disposal

14. Transport information

International transport regulations

Regulatory information	UN number	Proper shipping name	Class	Packing group	Additional information
DOT Classification	NA 1993	Diesel fuel	3	III	-
TDG Classification	UN 1202	Gas oil	3	III	-
IMDG Classification	UN 1202	Gas oil	3	III	Remarks Marine pollutant
IATA/ICAO Classification	UN 1202	Gas oil	3	III	Remarks Environmentally hazardous substance mark.

15. Regulatory information

U.S. Federal Regulations

United States inventory (TSCA 8b)

All components are listed or exempted.

TSCA 12(b) one-time export: Naphthalene

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Naphthalene
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: DIESEL FUEL NO. 2: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements	Naphthalene	91-20-3	1.0035 - 3.0111
Supplier notification	Naphthalene	91-20-3	1.0035 - 3.0111
CERCLA Sections 102a/103 Hazardous Substances (40 CFR Part 302.4):	CERCLA: Hazardous substances.: o-Xylene: 1000 lbs. (454 kg); Naphthalene: 100 lbs. (45.4 kg); benzo[def]chrysene: 1 lb. (0.454 kg); Ethylbenzene: 1000 lbs. (454 kg); xylene: 100 lbs. (45.4 kg); Cumene: 5000 lbs. (2270 kg); Phenol: 1000 lbs. (454 kg); Benzene: 10 lbs. (4.54 kg); Alkylaryl sulfonic acid: 1000 lbs. (454 kg); Toluene: 1000 lbs. (454 kg); Methanol: 5000 lbs. (2270 kg); 2-Butoxyethanol;		

State regulations

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Massachusetts
Substances

The following components are listed: NAPHTHALENE

New Jersey Hazardous
Substances

The following components are listed: DIESEL FUEL; # 2 HEATING OIL; NAPHTHALENE; MOTH
FLAKES

Pennsylvania RTK
Hazardous Substances

The following components are listed: NAPHTHALENE

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer.
Naphthalene; Ethylbenzene; benzo[def]chrysene

WARNING: This product contains a chemical known to the State of California to cause birth
defects or other reproductive harm.
Toluene

WARNING: This product contains a chemical known to the State of California to cause cancer and
birth defects or other reproductive harm.
Benzene

Prop 65 chemicals will result under certain conditions from the use of this material. For example,
burning fuels produces combustion products including diesel exhaust, a Prop 65 carcinogen, and
carbon monoxide, a Prop 65 reproductive toxin.

Inventories

Canada inventory

Not determined.

Europe inventory

At least one component is not listed.

Australia inventory (AICS)

At least one component is not listed.

China inventory (IECSC)

Not determined.

Japan inventory (ENCS)

At least one component is not listed.

Korea inventory (KECI)

At least one component is not listed.

Philippines inventory
(PICCS)

At least one component is not listed.

16. Other information

Label requirements

WARNING !

COMBUSTIBLE LIQUID AND VAPOR.
VAPOR MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
ASPIRATION HAZARD.
HARMFUL OR FATAL IF LIQUID IS ASPIRATED INTO LUNGS.
MAY CAUSE RESPIRATORY TRACT IRRITATION.
INHALATION CAUSES HEADACHES, DIZZINESS, DROWSINESS, AND NAUSEA, AND MAY
LEAD TO UNCONSCIOUSNESS.

HMIS® Rating :

Health * 1
Flammability 2
Physical 0
Hazard
Personal X
protection

National Fire
Protection
Association (U.S.A.)



History

Date of issue

07/20/2010.

Date of previous issue

07/20/2010.

Prepared by

Product Stewardship

Notice to reader

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All reasonably practicable steps have been taken to ensure this data sheet and the health, safety and environmental information contained in it is accurate as of the date specified below. No warranty or representation, express or implied is made as to the accuracy or completeness of the data and information in this data sheet.

The data and advice given apply when the product is sold for the stated application or applications. You should not use the product other than for the stated application or applications without seeking advice from us.

It is the user's obligation to evaluate and use this product safely and to comply with all applicable laws and regulations. The BP Group shall not be responsible for any damage or injury resulting from use, other than the stated product use of the material, from any failure to adhere to recommendations, or from any hazards inherent in the nature of the material. Purchasers of the product for supply to a third party for use at work, have a duty to take all necessary steps to ensure that any person handling or using the product is provided with the information in this sheet. Employers have a duty to tell employees and others who may be affected of any hazards described in this sheet and of any precautions that should be taken.

Product name DIESEL FUEL NO. 2		Product code 11155	Page: 8/8
Version 2	Date of issue 07/20/2010.	Format US-COMP (US-COMP)	Language ENGLISH. (ENGLISH)

Safety Data Sheet



SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Chevron Supreme Motor Oil SAE 5W-20, 5W-30, 10W-30

Product Use: Automotive Engine Oil

Product Number(s): 220013, 220135, 220155

Company Identification

Chevron Products Company
a division of Chevron U.S.A. Inc.
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
United States of America
www.chevronlubricants.com

Transportation Emergency Response

CHEMTREC: (800) 424-9300 or (703) 527-3887

Health Emergency

Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623

Product Information

email : lubemsds@chevron.com

Product Information: 1 (800) 582-3835, LUBETEK@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Not classified as hazardous according to 29 CFR 1910.1200 (2012).

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 99 %wt/wt

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.

Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.

Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.

Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed

IMMEDIATE SYMPTOMS AND HEALTH EFFECTS

Eye: Not expected to cause prolonged or significant eye irritation.

Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.

Ingestion: Not expected to be harmful if swallowed.

Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

DELAYED OR OTHER SYMPTOMS AND HEALTH EFFECTS: Not classified.

Indication of any immediate medical attention and special treatment needed

Not applicable.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:

Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.

Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.

Reporting: Report spills to local authorities as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Do not get in eyes, on skin, or on clothing. Keep out of the reach of children. Wash thoroughly after handling.

General Handling Information: Avoid contaminating soil or releasing this material into sewage and

drainage systems and bodies of water.

Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.

Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:

Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.

Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Silver Shield, Viton.

Respiratory Protection: No respiratory protection is normally required.

If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge. Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	OSHA Z-1	5 mg/m3	--	--	--
Highly refined mineral oil (C15 -	OSHA Z-1	5 mg/m3	--	--	--

C50)					
------	--	--	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Amber

Physical State: Liquid

Odor: Petroleum odor

Odor Threshold: No data available

pH: Not Applicable

Vapor Pressure: <0.01 mmHg @ 37.8 °C (100 °F)

Vapor Density (Air = 1): >1

Initial Boiling Point: 315°C (599°F)

Solubility: Soluble in hydrocarbons; insoluble in water

Freezing Point: Not Applicable

Specific Gravity: 1 @ 15.6°C (60.1°F) / 15.6°C (60.1°F) (Approximate)

Density: 0.8599 kg/l @ 15°C (59°F) (Typical)

Viscosity: 9.6 mm²/s @ 100°C (212°F) (Min)

Evaporation Rate: No data available

Decomposition temperature: No Data Available

Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:

Flammability (solid, gas): No Data Available

Flashpoint: (Cleveland Open Cup) 200 °C (392 °F) Minimum

Autoignition: No data available

Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: This material is not expected to react.

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Incompatibility With Other Materials: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Hazardous Decomposition Products: None known (None expected)

Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.

Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:

This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B). These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen with unknown relevance to humans (A3).

During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is not expected to be harmful to aquatic organisms. The ecotoxicity hazard is based on an evaluation of data for the components or a similar material. The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY

No data available.

PERSISTENCE AND DEGRADABILITY

This material is not expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material. The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE

Bioconcentration Factor: No data available.

Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: PETROLEUM LUBRICATING OIL, NOT REGULATED AS A HAZARDOUS MATERIAL FOR TRANSPORTATION UNDER 49 CFR

IMO/IMDG Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: PETROLEUM LUBRICATING OIL; NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO TI OR IATA DGR

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:

Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:	1. Immediate (Acute) Health Effects:	NO
	2. Delayed (Chronic) Health Effects:	NO
	3. Fire Hazard:	NO
	4. Sudden Release of Pressure Hazard:	NO
	5. Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

No components of this material were found on the regulatory lists above.

CHEMICAL INVENTORIES:

All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), KECI (Korea), PICCS (Philippines), TSCA (United States).

One or more components is listed on ELINCS (European Union). Secondary notification by the importer may be required. All other components are listed or exempted from listing on EINECS.

One or more components does not comply with the following chemical inventory requirements: ENCS (Japan).

NEW JERSEY RTK CLASSIFICATION:

Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: PETROLEUM OIL (Motor oil)

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0

HMIS RATINGS: Health: 0 Flammability: 1 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

LABEL RECOMMENDATION:

Label Category : ENGINE OIL 1 - ENG1

REVISION STATEMENT: This revision updates the following sections of this Safety Data Sheet: 8,16

Revision Date: JULY 07, 2014

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.



MATERIAL SAFETY DATA SHEET

#1700, 407 2ND STREET S.W., CALGARY, ALBERTA T2P 2Y3
TELEPHONE: (403) 269-2242 FAX: (403) 269-2251
1-613-996-6666 – CANUTEC – Transportation Emergency

BENTONITE

SECTION I: IDENTIFICATION OF PRODUCT

Proper Shipping Name: BENTONITE
Product Name: BENTONITE
Chemical Family: Montmorillonite
WHMIS Classification: D2A
Workplace Hazard: Potential carcinogen, contains free silica.

Product Use: Drilling Fluid Additive
TDG Classification: Not regulated
Packaging Group: Not applicable
PIN: Not applicable
CAS #: 1302-78-9

SECTION II: HAZARDOUS INGREDIENTS

Ingredients	Percent	CAS Number	LD ₅₀ (Species/Route)	LC ₅₀ (Species/Route)
Crystalline Silica; Quartz	1-5 or 5-10*	14808-60-7	Not available	Not available
* The typical quartz content of western bentonite is between 2 and 6%				

SECTION III: TOXICOLOGICAL PROPERTIES

Route of entry: ☐ Skin ☐ Eye Contact ☒ Inhalation ☐ Ingestion

Effects of acute exposure: Mechanical irritant to the eyes. Possible drying of skin resulting in dermatitis. May cause irritation to the upper respiratory tract.

Effects of chronic exposure: This product contains crystalline silica. Breathing silica containing dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Chronic inhalation may cause silicosis, a progressive, disabling and sometimes fatal lung disease. Chronic inhalation exposure to crystalline silica quartz has been observed to cause lymph node effects, kidney effects and auto-immune disease.

Exposure limits:
ACGIH-TLV 0.025 mg/m³ respirable

Irritancy of product: Mechanical irritant to the eyes. May cause irritation to the upper respiratory tract.

Sensitization to product: Not available

Carcinogenicity: Bentonite is not listed by ACGIH, IARC, NTP or OSHA. Crystalline silica, when inhaled from occupational sources, is considered as a human carcinogen by IARC (Class 1) and by NTP. ACGIH classifies crystalline silica, quartz, as a suspected human carcinogen (A2).

Reproductive toxicity: No information available

Tetratogenicity: No information available

Mutagenicity: Crystalline silica has been shown to cause mutagenic effects in human cells in-vitro.

Name of toxicological synergistic products: No information available



SECTION IV: FIRST AID MEASURES

Skin contact: If irritation occurs, or when shift ends, wash with soap and water until clean.

Eye contact: Flush with gently flowing warm water until particles are removed. If irritation persists, contact a physician.

Inhalation: Move to area free from dust. If symptoms or irritation persist contact physician. Inhalation may aggravate existing respiratory illness.

Ingestion: No first aid required; material is non-toxic.

SECTION V: PHYSICAL DATA

Physical state: Solid

Appearance and odour: Light tan to grey powder; no odour

Odour threshold: Not applicable

Specific gravity (°C): 2.45 – 2.55

Vapor pressure (mmHG): Not applicable

Vapor density (Air=1): Not applicable

Evaporation rate: Not applicable

Boiling point (°C): Not applicable

Melting point (°C): ~1450

pH (%): 8.0 – 10.0 (5% aqueous suspension)

Solubility in Water: Insoluble



SECTION VI: FIRE AND EXPLOSION DATA

Conditions of flammability: Not flammable

Means of extinguishing: Use media suitable for surrounding materials and packaging.

Flash point: Not applicable

Upper flammable limit: Not applicable

Lower flammable limit: Not applicable

Auto-ignition temperature: Not applicable

Hazardous combustion products: Not known

Explosion data-sensitivity to mechanical impact: Not applicable

Explosion data-sensitivity to static discharge: Not applicable

SECTION VII: REACTIVITY DATA

Chemically unstable (conditions): Stable

Product incompatible with: None known

Conditions of reactivity: None known

Hazardous decomposition products: None know



SECTION VIII: PREVENTATIVE MEASURES

Personal protective equipment: NIOSH/MESA approved respirators for silica bearing dust. Safety glasses or goggles recommended.

Specific Engineering Controls: Use local exhaust ventilation, process enclosure or other engineering controls to maintain concentration of airborne dust below TLV.

Procedures for leak/spills: Wear an approved respirator. Vacuum if possible to avoid generating airborne dust. Collect uncontaminated material for repackaging. Collect contaminated material in an approved container for disposal. Avoid adding water; the product will become slippery when wet.

Waste disposal: Dispose in accordance with federal, provincial and local regulations. It is the responsibility of the end-user to determine if material meets the criteria of hazardous waste at the time of disposal. Empty packaging must be disposed of, or recycled, in accordance with local regulations.

Handling procedures and equipment: Avoid creating dust. Avoid breathing dust; wear an approved respirator. Practice reasonable caution and personal cleanliness. Avoid eye contact.

Storage requirements: Store in cool, dry area. Empty packages contain residual hazardous material and should be handled as if full.

Special shipping information: Not applicable

SECTION IX: PREPARATION

Date updated: January 14, 2014

Prepared by: Product Safety Committee

All the recommendations and suggestions herein concerning this product are based upon tests and data believed to be reliable, however it is the user's responsibility to determine the safety, toxicity and sustainability for their own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by Q'Max Solutions Inc. as to the effects of such use, the results to be obtained, or the safety and toxicity of the product nor does Q'Max Solutions Inc. assume any liability arising out of use by others. Nor is the information herein to be considered as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

ULTIMATE DATA

PORTLAND CEMENT

(BS EN 197: CEM I) **Health and Safety Information**

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION

An odourless white to grey powder mainly insoluble in water. When water is added it becomes a binder for construction applications. This datasheet applies to the following cements:

- PC-RM
- PC-CP
- PC
- Ferrocement
- Snowcrete (CEM I)
- Procem
- Microcem

1.2 Use of the substance/preparation

Common cement is used as a hydraulic binder for the production of concrete, mortars, grouts, etc.

1.3 Company identification

Lafarge Tarmac Cement

Portland House

Bickenhill Lane, Birmingham B37 7BQ

Technical helpdesk: 0845 812 6232

Email: info-cement@lafargetarmac.com

1.4 Emergency telephone

Emergency telephone number available during office hours:
Tel 0845 812 6232

Emergency telephone number available outside office hours: No

2. HAZARD IDENTIFICATION

When cement reacts with water, for instance when making concrete or mortar, or when the cement becomes damp, a strong alkaline solution is produced.

2.1 Hazard characterisation

R37/38 Irritating to respiratory system and skin

R41 Risk of serious damage to eyes

R43 May cause sensitisation by skin contact

2.2 Primary route(s) of entry

Inhalation: Yes

Skin - eyes: Yes

Ingestion: No, except in accidental cases



IRRITANT

2.3 Human health

Inhalation: Frequent inhalation of large quantities of cement dust over a long period of time increases the risk of developing lung diseases.

Eyes: Eye contact with cement (dry or wet) may cause serious and potentially irreversible injuries.

Skin: Cement may have an irritating effect on moist skin (due to transpiration or humidity) after prolonged contact. Prolonged skin contact with wet cement or fresh concrete may cause serious burns because they develop without pain being felt (for example when kneeling in fresh concrete even when wearing trousers). Repeated skin contact with wet cement may cause contact dermatitis. For more details see Reference (1).

2.4 Environment

Under normal use, the product is not expected to be hazardous to the environment.


3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Chemical composition

Common cement types according to the EN 197-1 (Common cements) and EN 197-4 (Blast furnace cements) standards. The principal constituents of these cements are calcium silicates, aluminates, ferro-aluminates and sulfates. Small amounts of alkalis, lime, magnesia and chlorides are also present together with trace amounts of chromium compounds. Additional constituents may also be present - eg, fly ash, limestone, clay and granulated blast furnace slag.

3.2 Components presenting a health hazard

Contains less than 1% crystalline silica.

Substance:	Portland Cement Clinker
Concentration range (by weight in cement):	5 – 100%
EINECS:	266-043-4
CAS:	65997-15-1
Symbol (C&L):	 IRRITANT
R:	R37 R38 R41 R43

4. FIRST AID MEASURES

When contacting a physician, take this safety datasheet with you.

4.1 After significant accidental inhalation

Move person to fresh air. Dust in throat and nasal passages should clear spontaneously. Contact a physician if irritation persists or later develops or if discomfort, coughing or other symptoms do not subside.

4.2 After contact with eyes

Do not rub eyes, as additional cornea damage is possible by mechanical stress. Remove any contact lenses and open the eyelid(s) widely to flush eye(s) immediately by thoroughly rinsing with plenty of clean water for at least 45 minutes to remove all particles. If possible, use isotonic water (0.9% NaCl). Contact a specialist of occupational medicine or an eye specialist.

4.3 After skin contact

For dry cement, remove and rinse abundantly with water. For wet cement, wash skin with water. Remove contaminated clothing, footwear, watches, etc. and clean thoroughly before re-using them. Seek medical treatment in all cases of irritation or burns.

4.4 After significant accidental ingestion

Do not induce vomiting. If person is conscious, wash out mouth with water and give plenty of water to drink. Get immediate medical attention or contact anti poison centre.

5. FIRE-FIGHTING MEASURES

5.1 Flashpoint and method

Cements are non-combustible and non-explosive and will not facilitate nor support combustion of other materials.

5.2 Extinguishing media

All types of extinguishing media are suitable.

5.3 Fire fighting equipment

Cement poses no fire-related hazards. No need for specialist protective equipment for fire fighters.

5.4 Combustion products

None.

5.5 Flammable limits: Lower explosion limit LEL – Upper explosion limit UEL

Not applicable.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal protective measures

Wear protective equipment as described under Heading 8 and follow the advice for safe handling and use given under Heading 7. Emergency procedures are not required.

6.2 Environment protection measures

Do not wash cement down sewage and drainage systems or into bodies of water (eg. streams).

6.3 Methods for cleaning up

Recover the spillage in a dry state if possible.

Dry cement: Use dry cleanup methods that do not cause airborne dispersion - eg:

- Vacuum cleaner (Industrial portable units, equipped with high efficiency particulate filters (HEPA filter) or equivalent technique).
- Wipe up the dust by mopping, wet brushing or water sprays or hoses (fine mist to avoid the dust becoming airborne) and remove slurry. If not possible, remove by slurring with water (see Wet cement).

When wet cleaning or vacuum cleaning is not possible and only dry cleaning with brushes can be done, ensure that the workers wear appropriate personal protective equipment and prevent dust from spreading.

Avoid inhalation of cement and contact with skin. Place spilled materials into a container. Solidify before disposal as described under Heading 13.

Wet cement: Clean up wet cement and place in a container. Allow material to dry and solidify before disposal as described under Heading 13.

7. HANDLING AND STORAGE

Do not handle or store near food and beverages or smoking materials.

7.1 Handling

Follow the recommendations as given under Heading 8.

Avoid dust development:

- For (bagged) cement used in open-ended mixers: first add the water and then carefully add the cement. Keep the height of the fall low. Start the mixing smoothly. Do not compress empty bags, except when contained in another clean bag.
- To clean up dry cement, see Heading 6.3.

Carrying cement bags may cause sprains and strains to the back, arms, shoulders and legs. Handle with care and use appropriate control measures.

7.2 Storage

Bulk cement should be stored in silos that are waterproof, dry (internal condensation minimised), clean and protected from contamination.

Engulfment hazard: To prevent burial or suffocation, do not enter a confined space, such as a silo, bin, bulk truck, or other storage container or vessel that stores or contains cement without taking the proper security measures. Cement can build up or adhere to the walls of a confined space. The cement can release, collapse or fall unexpectedly.

Packed product should be stored in unopened bags clear of the ground in cool, dry conditions and protected from excessive draught in order to avoid degradation of quality.

Bags should be stacked in a stable manner.

7.3 Control of soluble Cr (VI)

For product treated with a Cr (VI) reducing agent according to the regulations given in Heading 15, the effectiveness of the reducing agent diminishes with time. Therefore cement bags and/or delivery documents will contain information on the period of time ('shelf life') for which the manufacturer has established that the reducing agent will continue to maintain the level of soluble Cr (VI) below the imposed limit of 0.0002%, according to EN 197-10. They will also indicate the appropriate storage conditions for maintaining the effectiveness of the reducing agent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Exposure limit values (Workplace Exposure Limits (WEL))

WEL 8hr Time Weighted Average (TWA):

- Total inhalable dust 10mg/m³
- Respirable dust 4mg/m³

8.2 Exposure controls

8.2.1 Occupational exposure controls

General: During work avoid kneeling in fresh mortar or concrete wherever possible. If kneeling is absolutely necessary then appropriate waterproof personal protective equipment must be worn.

Do not eat, drink or smoke when working with cement to avoid contact with skin or mouth. Immediately after working with cement or cement-containing materials, workers should wash or shower or use skin moisturisers. Remove contaminated clothing, footwear, watches, etc. and clean thoroughly before re-using them.

Respiratory protection: When a person is exposed to dust above exposure limits, use appropriate respiratory protection. It should be adapted to the dust level and conform to the relevant EN standard. Suitable respiratory protection should be worn to ensure that personal exposure is less than the WEL.

Eye protection: Wear approved glasses or safety goggles according to EN 166 when handling dry or wet cement to prevent contact with eyes.

Skin protection: Use impervious, abrasion and alkali-resistant gloves (made of low soluble Cr (VI) containing material), internally lined with cotton, boots, closed long-sleeved protective clothing and additionally skin care products (including barrier creams) to protect the skin from prolonged contact with wet cement. Particular care should be taken to ensure that wet cement does not enter the boots. In some circumstances such as when laying concrete or screed, waterproof trousers or kneepads are necessary.

8.2.2 Environmental exposure controls

According to available technology.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 General information

Dry cement is a finely ground inorganic material (odourless, grey or white powder)

9.2 Physical data

Mean particle size: 5-30 µm

Solubility in water (T = 20 °C): slight (0.1-1.5 g/l)

Density: 2.75-3.20 g/cm³

Apparent density (ES): 0.9-1.5 g/cm³

pH (T = 20°C in water): 11-13.5

Boiling/melting point: > 1 250 °C

Vapour pressure, vapour density, evaporation rate, freezing point, viscosity: Not relevant.

10. STABILITY AND REACTIVITY

10.1 Stability

Dry cements are stable as long as they are stored properly (see Heading 7) and compatible with most other building materials. When mixed with water, cements will harden into a stable mass that is not reactive to normal environments.

10.2 Conditions to avoid

Humidity during storage may cause lump formation and loss of product quality.

10.3 Materials to avoid

Uncontrolled use of aluminium powder in wet cement should be avoided as hydrogen produced.

10.4 Hazardous decomposition products

Cements will not decompose into other hazardous by-products and do not polymerise.

11. TOXICOLOGICAL INFORMATION

11.1 Acute effects

Eye contact: Direct contact with cement may cause corneal damage by mechanical stress, immediate or delayed irritation or inflammation. Direct contact by larger amounts of dry cement or splashes of wet cement may cause effects ranging from moderate eye irritation (eg, conjunctivitis or blepharitis) to chemical burns and blindness.

Skin contact: Dry cement in contact with wet skin or exposure to moist or wet cement may cause thickening, cracking or fissuring of the skin. Prolonged contact in combination with abrasion can cause severe burns.

Acute dermal toxicity: Limit test, rabbit, 24 hours contact, 2 000 mg/kg body weight – no lethality [Reference (2)].

Ingestion: Swallowing large quantities may cause irritation to the gastrointestinal tract.

Inhalation: Cement may irritate the throat and respiratory tract. Coughing, sneezing, and shortness of breath may occur following exposures in excess of occupational exposure limits.

11.2 Chronic effects

Inhalation: Chronic exposure to respirable dust in excess of occupational exposure limits may cause coughing, shortness of breath and may cause chronic obstructive lung disease (COPD).

Carcinogenicity: A causal association between cement exposure and cancer has not been established [Reference (1)].

Contact dermatitis/Sensitising effects: Some individuals may exhibit eczema upon exposure to wet cement, caused either by the high pH which induces irritant contact dermatitis, or by an immunological reaction to soluble Cr (VI) which elicits allergic contact dermatitis [Reference (4)]. The response may appear in a variety of forms ranging from a mild rash to severe dermatitis and is a combination of those two mechanisms. An exact diagnosis is often difficult to assess. If the cement contains a soluble Cr (VI) reducing agent and as long as the mentioned period of effectiveness of the chromate reduction is not exceeded, a sensitising effect is not expected [Reference (3)].

11.3 Medical conditions aggravated by exposure

Inhaling cement dust may aggravate existing respiratory system disease(s) and/or medical conditions such as emphysema or asthma and/or existing skin and/or eye conditions.

12. ECOLOGICAL INFORMATION

12.1 Ecotoxicity

The product is not expected to be hazardous to the environment (LC50 aquatic toxicity not determined). The addition of large amounts of cement to water may, however, cause a rise in pH and may therefore be toxic to aquatic life under certain circumstances.

12.2 Mobility

Dry cement is not volatile but might become airborne during handling operations.

12.3 Persistence and degradability/Bio accumulative potential/Results of PBT assessment/Other adverse effects

Not relevant as cement is an inorganic material. After hardening, cement presents no toxicity risks.

13. DISPOSAL CONSIDERATIONS

13.1 Product - cement that has exceeded its shelf life

When demonstrated that it contains more than 0.0002% soluble Cr (VI): shall not be used/sold other than for use in controlled closed and totally automated processes or should be recycled or disposed of according to local legislation or treated again with a reducing agent.

13.2 Product - unused residue or dry spillage

Pick up dry. Mark the containers. Possibly reuse depending upon shelf life considerations and the requirement to avoid dust exposure. In case of disposal, harden with water and dispose according to 13.4.

13.3 Product – slurries

Allow to harden, avoid entry in sewage and drainage systems or into bodies of water (eg, streams) and dispose of as indicated in 13.4.

13.4 Product - after addition of water, hardened

Dispose of according to the local legislation. Avoid entry into the sewage water system. Dispose of the hardened product as concrete waste. Due to the inertisation, concrete waste is not a dangerous waste.

EWC entries: 10 13 14 (waste from manufacturing of cement – waste concrete or concrete sludge) or 17 01 01 (construction and demolition wastes - concrete).

13.5 Packaging

Completely empty the packaging and process it according to local legislation.

EWC entry: 15 01 01 (waste paper and cardboard packaging).

EWC entry: 15 01 02 (plastic packaging).

14. TRANSPORT INFORMATION

Cement is not covered by the international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID) and therefore no classification is required.

No special precautions are needed apart from those mentioned under Heading 8.

15. REGULATORY INFORMATION**15.1 Classification and labelling of cement according to 1999/45/EC****Risk phrases**

R37/38 Irritating to respiratory system and skin

R41 Risk of serious damage to eyes

R43 May cause sensitisation by skin contact

**IRRITANT****Safety phrases**

S2 Keep out of reach of children

S22 Do not breathe dust

S24/25 Avoid contact with skin and eyes

S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

S36/37/39 Wear suitable protective clothing, gloves and eye/face protection

S46 If swallowed, seek medical advice immediately and show this container or label

15.2 The marketing and use of cement is subject to a restriction on the content of soluble Cr (VI)

From 17 January 2005, those cements which naturally contain more than 2 ppm of soluble hexavalent chromium (chromium (VI)) by dry weight of cement, shall be treated with a chemical reducing agent (such as ferrous sulfate) that maintains the level of hexavalent chromium in the cement to below 2 ppm by dry weight of cement. The effectiveness of the reducing agent reduces with time, therefore cement bags and/or delivery documents will contain information on the period of time ('shelf life') for which the manufacturer has established that the reducing agent will continue to limit the level of hexavalent chromium to less than 2 ppm by dry weight of cement. They will also indicate the appropriate storage conditions for maintaining the effectiveness of the reducing agent.

15.3 National legislation/requirements

CONIAC Health Hazard Information Sheet No. 26 (CEMENT)

Health and Safety at Work etc Act 1974

Control of Substances Hazardous to Health (Regulations)

PORTLAND CEMENT DUST – criteria document for an occupational exposure limit. June 1994 (ISBN 07176 – 0763 – 1)

HSE Guidance Notes EH26 (Occupational Skin Diseases – Health and Safety Precautions)

HSE Guidance Note EH40 (Workplace Exposure Limits)

Any authorised manual on First Aid by St. John's/St. Andrew's/Red Cross

Manual Handling Operations Regulations

Environmental Protection Act

16. OTHER INFORMATION**Abbreviations**

- IMDG: International Maritime Dangerous Goods
- IATA: International Air Transport Association
- ADR/RID: Agreement on the transport of dangerous goods by road/Regulations on the international transport of dangerous goods by rail
- LC50 Lethal Concentration where 50% of the test animals dies.
- OEL : Occupational Exposure Limit
- TWA: Time Weighted Averages

References

- (1) Portland Cement Dust - Hazard assessment document EH75/7, UK Health and Safety Executive, 2006. Available from: <http://www.hse.gov.uk/pubns/web/portlandcement.pdf>
- (2) Observations on the effects of skin irritation caused by cement, Kietzman et al, Dermatosen, 47, 5, 184-189 (1999).
- (3) European Commission's Scientific Committee on Toxicology, Ecotoxicology and the Environment (SCTEE) opinion of the risks to health from Cr (VI) in cement (European Commission, 2002).
- (4) Epidemiological assessment of the occurrence of allergic dermatitis in workers in the construction industry related to the content of Cr (VI) in cement, NIOH, Page 11, 2003.

The information on this data sheet reflects the currently available knowledge and is reliable provided that the product is used under the prescribed conditions and in accordance with the application specified on the packaging and/or in the technical guidance literature. Any other use of the product, including the use of the product in combination with any other product or any other process, is the responsibility of the user. It is implicit that the user is responsible for determining appropriate safety measures and for applying the legislation covering his own activities.

The information in this data sheet is accurate at the time of printing, but Lafarge Tarmac Cement reserves the right to amend details as part of its product development programme.

DISCLAIMER:

This material safety data sheet (MSDS) is based on the legal provisions of the REACH Regulation (EC 1907/2006; article 31 and Annex II), as amended. Its contents are intended as a guide to the appropriate precautionary handling of the material. It is the responsibility of recipients of this MSDS to ensure that the information contained therein is properly read and understood by all people who may use, handle, dispose or in any way come in contact with the product. Information and instructions provided in this MSDS are based on the current state of scientific and technical knowledge at the date of issue indicated.

It should not be construed as any guarantee of technical performance, suitability for particular applications, and does not establish a legally valid contractual relationship. This version of the MSDS supersedes all previous versions.

For further information

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It's what Britain's built on.

Mercuric Chloride

Safety Data Sheet 75573

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 11/13/2007

Revision date: 09/03/2013

Supersedes: 08/26/2010

Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	: Substance
Substance name	: Mercuric Chloride
CAS No	: 7487-94-7
Product code	: LC16590
Formula	: HgCl ₂
Synonyms	: bichloride of mercury / dichloromercury / mercury bichloride / mercury perchloride / mercury (II) chloride
BIG no	: 10398

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	: Veterinary medicine Laboratory chemical Photographic chemical Chemical intermediate Disinfectant
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1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zellienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number	: CHEMTREC: 1-800-424-9300 or 011-703-527-3887
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SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Acute Tox. 2 (Oral)	H300
Skin Corr. 1B	H314
Muta. 2	H341
Repr. 2	H361
STOT RE 1	H372
Aquatic Acute 1	H400
Aquatic Chronic 1	H410

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US)



Signal word (GHS-US)

: Danger

Hazard statements (GHS-US)

: H300 - Fatal if swallowed
H314 - Causes severe skin burns and eye damage
H341 - Suspected of causing genetic defects
H361 - Suspected of damaging fertility or the unborn child
H372 - Causes damage to organs (central nervous system, kidneys) through prolonged or repeated exposure
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (GHS-US)

: P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust
P264 - Wash exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P273 - Avoid release to the environment
P280 - Wear protective gloves, protective clothing, eye protection, face protection
P301+P330+P331 - IF SWALLOWED: Rinse mouth. Do NOT induce vomiting
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing

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P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P308+P313 - IF exposed or concerned: Get medical advice/attention
P310 - Immediately call a POISON CENTER/doctor/...
P363 - Wash contaminated clothing before reuse
P391 - Collect spillage
P405 - Store locked up
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Mercuric Chloride (Main constituent)	(CAS No) 7487-94-7	100	Acute Tox. 2 (Oral), H300 Skin Corr. 1B, H314 Muta. 2, H341 Repr. 2, H361 STOT RE 1, H372 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water (15 minutes)/shower. Remove clothing before washing. Do not apply (chemical) neutralizing agents. Cover wounds with sterile bandage. Consult a doctor/medical service. If burned surface > 10%: take victim to hospital.

First-aid measures after eye contact : Rinse immediately with plenty of water for 15 minutes. Do not apply neutralizing agents. Take victim to an ophthalmologist.

First-aid measures after ingestion : Rinse mouth with water. Give nothing to drink. Immediately consult a doctor/medical service. Call Poison Information Centre (www.big.be/antigif.htm). Ingestion of large quantities: immediately to hospital. Take the container/vomit to the doctor/hospital.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation : Coughing. Irritation of the respiratory tract. Irritation of the nasal mucous membranes. ON CONTINUOUS EXPOSURE/CONTACT: Respiratory difficulties. Corrosion of the upper respiratory tract.

Symptoms/injuries after skin contact : Caustic burns/corrosion of the skin.

Symptoms/injuries after eye contact : Corrosion of the eye tissue.

Symptoms/injuries after ingestion : Nausea. Vomiting. Abdominal pain. Diarrhoea. Bleeding of the gastrointestinal tract. FOLLOWING SYMPTOMS MAY APPEAR LATER: Decreased renal function. Change in urine output. Change in urine composition.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Gastrointestinal complaints. Skin rash/inflammation. Brain affection. Affection of the renal tissue. Tremor. Affection/discolouration of the teeth. Inflammation/damage of the eye tissue.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : EXTINGUISHING MEDIA FOR SURROUNDING FIRES: All extinguishing media allowed.

Unsuitable extinguishing media : No unsuitable extinguishing media known.

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5.2. Special hazards arising from the substance or mixture

- Fire hazard : DIRECT FIRE HAZARD. Non combustible.
- Explosion hazard : DIRECT EXPLOSION HAZARD. No data available on direct explosion hazard. INDIRECT EXPLOSION HAZARD. No data available on indirect explosion hazard.
- Reactivity : On heating: release of toxic and corrosive gases/vapours (chlorine, hydrogen chloride, mercury vapours). Decomposes slowly on exposure to light. Reacts with (some) bases. Reacts with (some) metals.

5.3. Advice for firefighters

- Precautionary measures fire : Exposure to fire/heat: keep upwind. Exposure to fire/heat: consider evacuation. Exposure to fire/heat: have neighbourhood close doors and windows.
- Firefighting instructions : Cool tanks/drums with water spray/remove them into safety. Dilute toxic gases with water spray. Take account of toxic fire-fighting water. Use water moderately and if possible collect or contain it.
- Protection during firefighting : Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

- Protective equipment : Gloves. Face-shield. Corrosion-proof suit. Dust cloud production: compressed air/oxygen apparatus.
- Emergency procedures : Mark the danger area. Prevent dust cloud formation. No naked flames. Wash contaminated clothes.
- Measures in case of dust release : In case of dust production: keep upwind. In case of dust production: consider evacuation. Dust production: have neighbourhood close doors and windows.

6.1.2. For emergency responders

- Protective equipment : Equip cleanup crew with proper protection. Do not breathe dust.
- Emergency procedures : Stop release. Ventilate area.

6.2. Environmental precautions

Prevent soil and water pollution. Prevent spreading in sewers.

6.3. Methods and material for containment and cleaning up

- For containment : Contain released substance, pump into suitable containers. Consult "Material-handling" to select material of containers. Plug the leak, cut off the supply. Dam up the solid spill. Knock down/dilute dust cloud with water spray. Take account of toxic/corrosive precipitation water.
- Methods for cleaning up : Prevent dispersion by covering with dry sand. Scoop solid spill into closing containers. See "Material-handling" for suitable container materials. Carefully collect the spill/leftovers. Clean contaminated surfaces with an excess of water. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Additional hazards when processed : Pulverization rapidly increases toxic concentration.
- Precautions for safe handling : Must not be used without prior permission. Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Avoid raising dust. Keep away from naked flames/heat. Observe very strict hygiene - avoid contact. Keep container tightly closed. Measure the concentration in the air regularly. Carry operations in the open/under local exhaust/ventilation or with respiratory protection.
- Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

- Incompatible products : Strong bases. Strong oxidizers. metals. phosphates. Sulfites.
- Incompatible materials : Direct sunlight. Air and moisture sensitive.
- Heat and ignition sources : KEEP SUBSTANCE AWAY FROM: heat sources.
- Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: oxidizing agents. (strong) acids. (strong) bases. cellulosic materials. metals.
- Storage area : Store in a cool area. Keep out of direct sunlight. Store in a dry area. Store in a dark area. Keep container in a well-ventilated place. Keep locked up. Unauthorized persons are not admitted. Meet the legal requirements.
- Special rules on packaging : SPECIAL REQUIREMENTS: closing. dry. clean. opaque. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.

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Packaging materials : SUITABLE MATERIAL: steel. stainless steel. synthetic material. glass. stoneware/porcelain.
MATERIAL TO AVOID: aluminium. lead. iron. copper.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Mercuric Chloride (7487-94-7)		
USA ACGIH	ACGIH TWA (mg/m ³)	0.025 mg/m ³
USA OSHA	OSHA PEL (TWA) (mg/m ³)	0.1 mg/m ³

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate general and local exhaust ventilation.

Personal protective equipment : Protective clothing. Protective goggles. Gloves. Dust/aerosol mask with filter type P3.



Materials for protective clothing : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: No data available. GIVE LESS RESISTANCE: No data available. GIVE POOR RESISTANCE: No data available.

Hand protection : Gloves.

Eye protection : Face shield. In case of dust production: protective goggles.

Skin and body protection : Corrosion-proof clothing. In case of dust production: head/neck protection.

Respiratory protection : Dust production: dust mask with filter type P3. On heating: gas mask with filter type Hg. High dust production: self-contained breathing apparatus.

Environmental exposure controls : Avoid release to the environment.

Consumer exposure controls : Avoid contact during pregnancy/while nursing.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Solid
Appearance	: Crystalline solid. Crystalline powder. Grains.
Molecular mass	: 271.49 g/mol
Colour	: White or colourless.
Odour	: Odourless.
Odour threshold	: No data available
pH	: 3.2 (5.0 %)
pH solution	: 5.0 %
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: 277 °C
Freezing point	: No data available
Boiling point	: 302 °C
Flash point	: Not applicable
Self ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: 0.00010 hPa
Vapour pressure at 50 °C	: 0.0025 hPa
Relative vapour density at 20 °C	: 9.8
Relative density	: 5.4
Density	: 5440 kg/m ³
Solubility	: Moderately soluble in water. Substance sinks in water. Soluble in ethanol. Soluble in acetone. Soluble in dimethyl sulfoxide. Soluble in methanol. Soluble in hydrogenchloride. Soluble in glycerol. Soluble in acetic acid. Soluble in pyridine. Soluble in ethylacetate. Water: 6.9 g/100ml Ethanol: 33 g/100ml Ether: 4 g/100ml
Log Pow	: 0.1 - 0.22 (Calculated)

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Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: Not applicable.
Oxidising properties	: No data available
Explosive limits	: No data available

9.2. Other information

Saturation concentration	: 0.0011 g/m ³
VOC content	: Not applicable
Other properties	: Substance has acid reaction.

SECTION 10: Stability and reactivity

10.1. Reactivity

On heating: release of toxic and corrosive gases/vapours (chlorine, hydrogen chloride, mercury vapours). Decomposes slowly on exposure to light. Reacts with (some) bases. Reacts with (some) metals.

10.2. Chemical stability

Unstable on exposure to light.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Avoid dust formation. Direct sunlight. Moisture.

10.5. Incompatible materials

Strong oxidizers. Strong bases. Sulfites. metals.

10.6. Hazardous decomposition products

mercury. Chlorine.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Fatal if swallowed.

Mercuric Chloride (7487-94-7)	
LD50 oral rat	1 mg/kg (Rat)
LD50 dermal rat	41 mg/kg (Rat)

Skin corrosion/irritation : Causes severe skin burns and eye damage.
pH: 3.2 (5.0 %)

Serious eye damage/irritation : Not classified
pH: 3.2 (5.0 %)

Respiratory or skin sensitisation : Not classified

Germ cell mutagenicity : Suspected of causing genetic defects.

Carcinogenicity : Not classified

Mercuric Chloride (7487-94-7)	
IARC group	2B

Reproductive toxicity : Suspected of damaging fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Causes damage to organs (central nervous system, kidneys) through prolonged or repeated exposure.

Aspiration hazard : Not classified

Symptoms/injuries after inhalation : Coughing. Irritation of the respiratory tract. Irritation of the nasal mucous membranes. ON CONTINUOUS EXPOSURE/CONTACT: Respiratory difficulties. Corrosion of the upper respiratory tract.

Symptoms/injuries after skin contact : Caustic burns/corrosion of the skin.

Symptoms/injuries after eye contact : Corrosion of the eye tissue.

Symptoms/injuries after ingestion : Nausea. Vomiting. Abdominal pain. Diarrhoea. Bleeding of the gastrointestinal tract. FOLLOWING SYMPTOMS MAY APPEAR LATER: Decreased renal function. Change in urine output. Change in urine composition.

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Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Gastrointestinal complaints. Skin rash/inflammation. Brain affection. Affection of the renal tissue. Tremor. Affection/dicolouration of the teeth. Inflammation/damage of the eye tissue.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Dangerous for the environment.
Ecology - air : TA-Luft Klasse 5.2.2/I.
Ecology - water : Severe water pollutant (surface water). Ground water pollutant. Maximum concentration in drinking water: 0.0010 mg/l (mercury) (Directive 98/83/EC); 250 mg/l (chloride) (Directive 98/83/EC). Highly toxic to fishes. Very toxic to invertebrates (Daphnia). Inhibits photosynthesis of algae. Highly toxic to bacteria. pH shift.

Mercuric Chloride (7487-94-7)	
LC50 fishes 1	0.03 mg/l (96 h; Poecilia reticulata)
EC50 Daphnia 1	0.0081 mg/l (24 h; Daphnia magna)
LC50 fish 2	0.04 mg/l (96 h; Cyprinus carpio)
EC50 Daphnia 2	0.0052 mg/l (48 h; Daphnia magna)
TLM fish 1	0.82 mg/l (168 h; Carassius auratus)
Threshold limit other aquatic organisms 1	0.01 mg/l (Pseudomonas putida)
Threshold limit algae 1	0.08 mg/l (Selenastrum capricornutum)
Threshold limit algae 2	0.07 mg/l (Scenedesmus quadricauda)

12.2. Persistence and degradability

Mercuric Chloride (7487-94-7)	
Persistence and degradability	Biodegradability: not applicable.
Biochemical oxygen demand (BOD)	Not applicable
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

12.3. Bioaccumulative potential

Mercuric Chloride (7487-94-7)	
BCF fish 1	10000 (Pisces)
BCF fish 2	500 - 4620 (Cyprinus carpio; TEST DURATION: 10 WEEKS)
BCF other aquatic organisms 1	10000 (Ostreidae)
Log Pow	0.1 - 0.22 (Calculated)

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Remove waste in accordance with local and/or national regulations. Recycle/reuse. Remove for physico-chemical/biological treatment. Remove to an authorized dump (Class I). Do not discharge into surface water (2000/60/EC, Council decision 2455/2001/EC, O.J. L331 of 15/12/2001).
Additional information : LWCA (the Netherlands): KGA category 05. Hazardous waste according to Directive 2008/98/EC.
Ecology - waste materials : Avoid release to the environment. Hazardous waste due to toxicity.

SECTION 14: Transport information

In accordance with DOT

14.1. UN number

UN-No.(DOT) : 1624
DOT NA no. UN1624

14.2. UN proper shipping name

DOT Proper Shipping Name : Mercuric chloride
Department of Transportation (DOT) Hazard Classes : 6.1 - Class 6.1 - Poisonous materials 49 CFR 173.132

Mercuric Chloride

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Hazard labels (DOT)

: 6.1 - Toxic substances



Packing group (DOT)

: II - Medium Danger

DOT Special Provisions (49 CFR 172.102)

: IB8 - Authorized IBCs: Metal (11A, 11B, 11N, 21A, 21B, 21N, 31A, 31B and 31N); Rigid plastics (11H1, 11H2, 21H1, 21H2, 31H1 and 31H2); Composite (11HZ1, 11HZ2, 21HZ1, 21HZ2, 31HZ1 and 31HZ2); Fiberboard (11G); Wooden (11C, 11D and 11F); Flexible (13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, 13M1 or 13M2).

IP2 - When IBCs other than metal or rigid plastics IBCs are used, they must be offered for transportation in a closed freight container or a closed transport vehicle.

IP4 - Flexible, fiberboard or wooden IBCs must be sift-proof and water-resistant or be fitted with a sift-proof and water-resistant liner.

T3 - 2.65 178.274(d)(2) Normal..... 178.275(d)(2)

TP33 - The portable tank instruction assigned for this substance applies for granular and powdered solids and for solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass. Solid substances transported or offered for transport above their melting point are authorized for transportation in portable tanks conforming to the provisions of portable tank instruction T4 for solid substances of packing group III or T7 for solid substances of packing group II, unless a tank with more stringent requirements for minimum shell thickness, maximum allowable working pressure, pressure-relief devices or bottom outlets are assigned in which case the more stringent tank instruction and special provisions shall apply. Filling limits must be in accordance with portable tank special provision TP3. Solids meeting the definition of an elevated temperature material must be transported in accordance with the applicable requirements of this subchapter.

DOT Packaging Exceptions (49 CFR 173.xxx)

: 153

DOT Packaging Non Bulk (49 CFR 173.xxx)

: 212

DOT Packaging Bulk (49 CFR 173.xxx)

: 242

Marine pollutant

: P



14.3. Additional information

Other information

: No supplementary information available.

State during transport (ADR-RID)

: as solid.

Overland transport

Packing group (ADR)

: II

Class (ADR)

: 6.1 - Toxic substances

Hazard identification number (Kemler No.)

: 60

Classification code (ADR)

: T5

Danger labels (ADR)

: 6.1 - Toxic substances



Orange plates



Tunnel restriction code

: D/E

Transport by sea

DOT Vessel Stowage Location

: A - The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel.

EmS-No. (1)

: F-A

EmS-No. (2)

: S-A

Mercuric Chloride

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Air transport

DOT Quantity Limitations Passenger aircraft/rail : 25 kg
(49 CFR 173.27)

DOT Quantity Limitations Cargo aircraft only (49 : 100 kg
CFR 175.75)

SECTION 15: Regulatory information

15.1. US Federal regulations

Mercuric Chloride (7487-94-7)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on SARA Section 302 (Specific toxic chemical listings)
Listed on SARA Section 313 (Specific toxic chemical listings)

RQ (Reportable quantity, section 304 of EPA's
List of Lists) :

500 lb

SARA Section 302 Threshold Planning
Quantity (TPQ)

500 lb

SARA Section 311/312 Hazard Classes

Immediate (acute) health hazard
Delayed (chronic) health hazard

15.2. International regulations

CANADA

Mercuric Chloride (7487-94-7)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification

Class D Division 1 Subdivision A - Very toxic material causing immediate and serious toxic effects
Class D Division 2 Subdivision A - Very toxic material causing other toxic effects
Class E - Corrosive Material

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Muta. 2 H341
Repr. 2 H361f
Acute Tox. 2 (Oral) H300
STOT RE 1 H372
STOT RE 1 H372
Skin Corr. 1B H314
Aquatic Acute 1 H400
Aquatic Chronic 1 H410

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC or 1999/45/EC

Muta.Cat.3; R68
Repr.Cat.3; R62
T+; R28
T; R48/24/25
C; R34
N; R50/53

Full text of R-phrases: see section 16

15.2.2. National regulations

Mercuric Chloride (7487-94-7)

Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

Mercuric Chloride(7487-94-7)

U.S. - California - Proposition 65 - Developmental
Toxicity

Yes

Mercuric Chloride

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 16: Other information

Full text of H-phrases: see section 16:

Acute Tox. 2 (Oral)	Acute toxicity (oral), Category 2
Aquatic Acute 1	Hazardous to the aquatic environment — AcuteHazard, Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment — Chronic Hazard, Category 1
Muta. 2	Germ cell mutagenicity, Category 2
Repr. 2	Reproductive toxicity, Category 2
Skin Corr. 1B	Skin corrosion/irritation, Category 1B
STOT RE 1	Specific target organ toxicity — Repeated exposure, Category 1
H300	Fatal if swallowed
H314	Causes severe skin burns and eye damage
H341	Suspected of causing genetic defects
H361	Suspected of damaging fertility or the unborn child
H372	Causes damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

NFPA health hazard

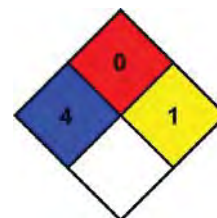
: 4 - Very short exposure could cause death or serious residual injury even though prompt medical attention was given.

NFPA fire hazard

: 0 - Materials that will not burn.

NFPA reactivity

: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.



HMIS III Rating

Health

: 4 Severe Hazard - Life-threatening, major or permanent damage may result from single or repeated overexposures

Flammability

: 0 Minimal Hazard

Physical

: 1 Slight Hazard

Personal Protection

: F

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 10/31/2013

Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
Product name : Nitric Acid, 6.0N (6.0M)
Product code : LC17870

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Met. Corr. 1 H290
Skin Corr. 1B H314
Eye Dam. 1 H318

2.2. Label elements

GHS-US labelling

Hazard pictograms (GHS-US) :



GHS05

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : H290 - May be corrosive to metals
H314 - Causes severe skin burns and eye damage

Precautionary statements (GHS-US) : P234 - Keep only in original container
P260 - Do not breathe mist, vapours, spray
P264 - Wash exposed skin thoroughly after handling
P280 - Wear protective gloves, protective clothing, eye protection, face protection
P301+P330+P331 - IF SWALLOWED: rinse mouth. Do NOT induce vomiting
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - IF INHALED: remove victim to fresh air and keep at rest in a position comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P363 - Wash contaminated clothing before reuse
P390 - Absorb spillage to prevent material damage
P405 - Store locked up
P406 - Store in corrosive resistant container with a resistant inner liner
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS-US)

No data available

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	68	Not classified
Nitric Acid, 70% w/w	(CAS No) 7697-37-2	32	Ox. Liq. 3, H272 Met. Corr. 1, H290 Skin Corr. 1A, H314 Eye Dam. 1, H318

SECTION 4: First aid measures

4.1. Description of first aid measures

- First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
- First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after skin contact : Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after eye contact : Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.
- First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Immediately call a POISON CENTER or doctor/physician.

4.2. Most important symptoms and effects, both acute and delayed

- Symptoms/injuries : Causes severe skin burns and eye damage.
- Symptoms/injuries after eye contact : Causes serious eye damage.

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.
- Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

- Reactivity : Thermal decomposition generates : Corrosive vapours.

5.3. Advice for firefighters

- Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.
- Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

- Protective equipment : Protective goggles. Protective clothing. Gloves. Combined gas/dust mask with filter type B/P3.
- Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

- Protective equipment : Equip cleanup crew with proper protection.
- Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

- Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials. Absorb spillage to prevent material damage.

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Additional hazards when processed : May be corrosive to metals.
- Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour. Do not breathe mist, vapours, spray.
- Hygiene measures : Wash exposed skin thoroughly after handling. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

- Technical measures : Comply with applicable regulations.
- Storage conditions : Keep only in the original container in a cool, well ventilated place away from : incompatible materials. Keep container closed when not in use.
- Incompatible products : Strong bases. Halogens. metals. aluminium. Strong reducing agents.
- Incompatible products : Sources of ignition. Direct sunlight.
- Packaging materials : Store in corrosive resistant/... container with a resistant inner liner.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Nitric Acid, 70% w/w (7697-37-2)		
USA ACGIH	ACGIH TWA (ppm)	2 ppm
USA ACGIH	ACGIH STEL (ppm)	2 ppm
USA OSHA	OSHA PEL (TWA) (mg/m ³)	5 mg/m ³
USA OSHA	OSHA PEL (TWA) (ppm)	2 ppm

8.2. Exposure controls

- Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Provide adequate general and local exhaust ventilation.
- Personal protective equipment : Avoid all unnecessary exposure. Combined gas/dust mask with filter type B/P3. Gloves. Protective clothing. Protective goggles.



- Hand protection : Wear protective gloves.
- Eye protection : Chemical goggles or face shield.
- Skin and body protection : Wear suitable protective clothing.
- Respiratory protection : Wear appropriate mask.
- Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

- Physical state : Liquid
- Appearance : Colorless to pale yellow liquid.
- Colour : Colourless to light yellow.
- Odour : characteristic. Pungent.
- Odour threshold : No data available
- pH : No data available
- Relative evaporation rate (butylacetate=1) : No data available
- Melting point : No data available
- Freezing point : No data available

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Boiling point	: No data available
Flash point	: No data available
Self ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Density	: 1.2 g/ml
Solubility	: Soluble in water.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: 1.13 cSt
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidising properties	: No data available
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Thermal decomposition generates : Corrosive vapours.

10.2. Chemical stability

Not established.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Strong reducing agents. Strong bases. metals. aluminium. Ammonia. combustible materials. Halogens.

10.6. Hazardous decomposition products

Nitrogen oxides. Thermal decomposition generates : Corrosive vapours.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Water (7732-18-5)

LD50 oral rat	≥ 90000 mg/kg
---------------	---------------

Skin corrosion/irritation	: Causes severe skin burns and eye damage.
Serious eye damage/irritation	: Causes serious eye damage.
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Potential Adverse human health effects and symptoms : Based on available data, the classification criteria are not met.
Symptoms/injuries after eye contact : Causes serious eye damage.

SECTION 12: Ecological information

12.1. Toxicity

Nitric Acid, 70% w/w (7697-37-2)	
LC50 fishes 1	25 - 36 mg/l (96 h; Lepomis macrochirus; Pure substance)
EC50 Daphnia 1	180 mg/l (48 h; Daphnia magna; Pure substance)
LC50 fish 2	72 ppm (Gambusia affinis; Pure substance)
Threshold limit algae 1	> 19 mg/l (Algae; Pure substance)

12.2. Persistence and degradability

Nitric Acid, 6.0N (6.0M)	
Persistence and degradability	Not established.

Nitric Acid, 70% w/w (7697-37-2)	
Persistence and degradability	Biodegradability: not applicable. No (test)data on mobility of the components of the mixture available.
Biochemical oxygen demand (BOD)	Not applicable
Chemical oxygen demand (COD)	Not applicable
ThOD	Not applicable
BOD (% of ThOD)	Not applicable

12.3. Bioaccumulative potential

Nitric Acid, 6.0N (6.0M)	
Bioaccumulative potential	Not established.

Nitric Acid, 70% w/w (7697-37-2)	
BCF fish 1	<= 1 (Pisces)
Log Pow	-2.3 (OECD 107: Partition Coefficient (n-octanol/water): Shake Flask Method)
Bioaccumulative potential	Bioaccumulation: not applicable.

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information : Avoid release to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Dispose of contents/container to comply with local, state and federal regulations.
Ecology - waste materials : Avoid release to the environment.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN2031 Nitric acid (other than red fuming, with more than 20% and less than 65 percent nitric acid), 8, II
UN-No.(DOT) : 2031
DOT NA no. : UN2031
DOT Proper Shipping Name : Nitric acid
other than red fuming, with more than 20% and less than 65 percent nitric acid
Department of Transportation (DOT) Hazard Classes : 8 - Class 8 - Corrosive material 49 CFR 173.136

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Hazard labels (DOT) : 8 - Corrosive substances



Packing group (DOT) : II - Medium Danger

DOT Special Provisions (49 CFR 172.102) :

- A6 - For combination packagings, if plastic inner packagings are used, they must be packed in tightly closed metal receptacles before packing in outer packagings.
- B2 - MC 300, MC 301, MC 302, MC 303, MC 305, and MC 306 and DOT 406 cargo tanks are not authorized.
- B47 - Each tank may have a reclosing pressure relief device having a start-to-discharge pressure setting of 310 kPa (45 psig).
- B53 - Packagings must be made of either aluminum or steel.
- IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized.
- IP15 - For UN2031 with more than 55% nitric acid, rigid plastic IBCs and composite IBCs with a rigid plastic inner receptacle are authorized for two years from the date of IBC manufacture.
- T8 - 4 178.274(d)(2) Normal..... Prohibited
- TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: $\text{Degree of filling} = 95 / (1 + a (tr - tf))$ Where: tr is the maximum mean bulk temperature during transport, tf is the temperature in degrees celsius of the liquid during filling, and is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (tf) and the maximum mean bulk temperature during transportation (tr) both in degrees celsius. b. For liquids transported under ambient conditions may be calculated using the formula: $a = (d_{15} - d_{50}) / 35 \cdot d_{50}$ Where: d15 and d50 are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively.

DOT Packaging Exceptions (49 CFR 173.xxx) : None

DOT Packaging Non Bulk (49 CFR 173.xxx) : 158

DOT Packaging Bulk (49 CFR 173.xxx) : 242

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : Forbidden

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 30 L

DOT Vessel Stowage Location : D - The material must be stowed "on deck only" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers or one passenger per each 3 m of overall vessel length, but the material is prohibited on passenger vessels in which the limiting number of passengers is exceeded.

DOT Vessel Stowage Other : 44 - Stow "away from" oxidizers, 66 - Stow "separated from" flammable solids, 74 - Stow "separated from" oxidizers, 89 - Segregation same as for oxidizers, 90 - Stow "separated from" radioactive materials

Additional information

Other information : No supplementary information available.

ADR

Transport document description :

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Nitric Acid, 6.0N (6.0M)

SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard
-------------------------------------	---------------------------------

Nitric Acid, 70% w/w (7697-37-2)

Listed on the United States TSCA (Toxic Substances Control Act) inventory
Listed on SARA Section 313 (Specific toxic chemical listings)

Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Nitric Acid, 70% w/w (7697-37-2)

RQ (Reportable quantity, section 304 of EPA's List of Lists) :	1000 lb
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard

15.2. International regulations

CANADA

Nitric Acid, 6.0N (6.0M)

WHMIS Classification	Class E - Corrosive Material
----------------------	------------------------------

Nitric Acid, 70% w/w (7697-37-2)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class E - Corrosive Material Class C - Oxidizing Material
----------------------	--

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Nitric Acid, 70% w/w (7697-37-2)

Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

No additional information available

SECTION 16: Other information

Other information : None.

Full text of H-phrases: see section 16:

Eye Dam. 1	Serious eye damage/eye irritation, Category 1
Met. Corr. 1	Corrosive to metals, Category 1
Ox. Liq. 3	Oxidising Liquids, Category 3
Skin Corr. 1A	Skin corrosion/irritation, Category 1A
Skin Corr. 1B	Skin corrosion/irritation, Category 1B
H272	May intensify fire; oxidiser
H290	May be corrosive to metals
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage

NFPA health hazard

: 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard

: 0 - Materials that will not burn.

NFPA reactivity

: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.

NFPA specific hazard

: OX - This denotes an oxidizer, a chemical which can greatly increase the rate of combustion/fire.



Nitric Acid, 6.0N (6.0M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

HMIS III Rating

Health	: 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given
Flammability	: 0 Minimal Hazard
Physical	: 1 Slight Hazard
Personal Protection	: H

SDS US (GHS HazCom 2012)

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

Sodium Thiosulfate, 0.1N (0.1M)

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 07/10/2013

Version: 1.0

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form : Mixture
 Product name. : Sodium Thiosulfate, 0.1N (0.1M)
 Product code : LC25060

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : For laboratory and manufacturing use only.

1.3. Details of the supplier of the safety data sheet

LabChem Inc
 Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
 16063 Zelienople, PA - USA
 T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number : CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not classified

2.2. Label elements

GHS-US labelling

No labelling applicable

2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substances

Not applicable

Full text of H-phrases: see section 16

3.2. Mixture

Name	Product identifier	%	GHS-US classification
Water	(CAS No) 7732-18-5	97.5	Not classified
Sodium Thiosulfate, Pentahydrate	(CAS No) 10102-17-7	2.48	Not classified
Sodium Carbonate, Anhydrous	(CAS No) 497-19-8	0.02	Skin Irrit. 2, H315 Eye Irrit. 2A, H319

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).
 First-aid measures after inhalation : Assure fresh air breathing. Allow the victim to rest.
 First-aid measures after skin contact : Remove affected clothing and wash all exposed skin area with mild soap and water, followed by warm water rinse.
 First-aid measures after eye contact : Rinse immediately with plenty of water. Obtain medical attention if pain, blinking or redness persist.
 First-aid measures after ingestion : Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : Not expected to present a significant hazard under anticipated conditions of normal use.

4.3. Indication of any immediate medical attention and special treatment needed

None.

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SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Foam. Dry powder. Carbon dioxide. Water spray. Sand.
Unsuitable extinguishing media : Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Not flammable.
Explosion hazard : Not available.
Reactivity : None.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Avoid (reject) fire-fighting water to enter environment.
Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : None.

6.1.1. For non-emergency personnel

Protective equipment : Safety glasses.
Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection.
Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Dam up the liquid spill.
Methods for cleaning up : Soak up spills with inert solids, such as clay or diatomaceous earth as soon as possible. Collect spillage. Store away from other materials.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapour.
Hygiene measures : Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Keep container closed when not in use.
Incompatible products : Strong oxidizers. Strong acids.
Incompatible materials : Direct sunlight.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

8.2. Exposure controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Personal protective equipment : Avoid all unnecessary exposure.
Hand protection : Wear protective gloves.
Eye protection : Chemical goggles or safety glasses.
Respiratory protection : Wear appropriate mask.
Other information : Do not eat, drink or smoke during use.

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SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Appearance	: Clear, colorless liquid.
Colour	: Colourless.
Odour	: None.
Odour threshold	: No data available
pH	: No data available
Relative evaporation rate (butylacetate=1)	: No data available
Melting point	: No data available
Freezing point	: No data available
Boiling point	: No data available
Flash point	: No data available
Self ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: No data available
Vapour pressure	: No data available
Relative vapour density at 20 °C	: No data available
Relative density	: No data available
Solubility	: Miscible with water.
Log Pow	: No data available
Log Kow	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available
Explosive properties	: Not applicable.
Oxidising properties	: None.
Explosive limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

None.

10.2. Chemical stability

Not established.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures.

10.5. Incompatible materials

Strong oxidizers. Strong acids.

10.6. Hazardous decomposition products

Sulfur compounds. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Sodium Thiosulfate, Pentahydrate (10102-17-7)

LD50 oral rat	5000 mg/kg
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Water (7732-18-5)

LD50 oral rat	≥ 90000 mg/kg
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Sodium Carbonate, Anhydrous (497-19-8)

LD50 oral rat	4090 mg/kg
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Skin corrosion/irritation : Not classified

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Serious eye damage/irritation	: Not classified
Respiratory or skin sensitisation	: Not classified
Germ cell mutagenicity	: Not classifiedBased on available data, the classification criteria are not met
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classifiedBased on available data, the classification criteria are not met
Specific target organ toxicity (single exposure)	: Not classified
Specific target organ toxicity (repeated exposure)	: Not classifiedBased on available data, the classification criteria are not met
Aspiration hazard	: Not classifiedBased on available data, the classification criteria are not met
Potential Adverse human health effects and symptoms	: Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1. Toxicity

Sodium Thiosulfate, Pentahydrate (10102-17-7)

LC50 fishes 1	≥ 10000
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Sodium Carbonate, Anhydrous (497-19-8)

LC50 fishes 1	300 mg/l
EC50 Daphnia 1	265 mg/l
LC50 fish 2	740 mg/l

12.2. Persistence and degradability

Sodium Thiosulfate, 0.1N (0.1M)

Persistence and degradability	Not established.
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Sodium Thiosulfate, Pentahydrate (10102-17-7)

Persistence and degradability	Not established.
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Sodium Carbonate, Anhydrous (497-19-8)

Persistence and degradability	Not established.
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12.3. Bioaccumulative potential

Sodium Thiosulfate, 0.1N (0.1M)

Bioaccumulative potential	Not established.
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Sodium Thiosulfate, Pentahydrate (10102-17-7)

Log Pow	-4.35
Bioaccumulative potential	Not established.

Sodium Carbonate, Anhydrous (497-19-8)

Bioaccumulative potential	Not established.
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12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Other information	: Avoid release to the environment.
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SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations	: Dispose in a safe manner in accordance with local/national regulations.
Ecology - waste materials	: Avoid release to the environment.

SECTION 14: Transport information

In accordance with ADR / RID / ADNR / IMDG / ICAO / IATA

14.1. UN number

Not applicable

14.2. UN proper shipping name

Not applicable

14.3. Additional information

Other information	: No supplementary information available.
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Overland transport

No additional information available

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Sodium Thiosulfate, Pentahydrate (10102-17-7)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

Sodium Carbonate, Anhydrous (497-19-8)

Listed on the United States TSCA (Toxic Substances Control Act) inventory

15.2. International regulations

CANADA

Sodium Thiosulfate, 0.1N (0.1M)

WHMIS Classification	Uncontrolled product according to WHMIS classification criteria
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Sodium Thiosulfate, Pentahydrate (10102-17-7)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Uncontrolled product according to WHMIS classification criteria
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Sodium Carbonate, Anhydrous (497-19-8)

Listed on the Canadian DSL (Domestic Substances List) inventory.

WHMIS Classification	Class D Division 2 Subdivision B - Toxic material causing other toxic effects
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EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Classification according to Directive 67/548/EEC or 1999/45/EC

Not classified

15.2.2. National regulations

Sodium Thiosulfate, Pentahydrate (10102-17-7)

Not listed on the Canadian Ingredient Disclosure List

Sodium Carbonate, Anhydrous (497-19-8)

Listed on the Canadian Ingredient Disclosure List

15.3. US State regulations

No additional information available

SECTION 16: Other information

Indication of changes : Revision - See : *

Other information : None.

Full text of H-phrases: see section 16:

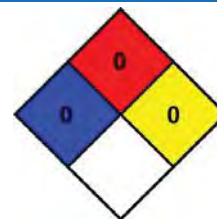
Eye Irrit. 2A	Serious eye damage/eye irritation, Category 2A
Skin Irrit. 2	Skin corrosion/irritation, Category 2
H315	Causes skin irritation
H319	Causes serious eye irritation

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NFPA health hazard	: 0 - Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
NFPA fire hazard	: 0 - Materials that will not burn.
NFPA reactivity	: 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	: 0 Minimal Hazard - No significant risk to health
Flammability	: 0 Minimal Hazard
Physical	: 0 Minimal Hazard
Personal Protection	: B

SDS US (GHS HazCom 2012)

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