



**NEW MEXICO ENVIRONMENT DEPARTMENT GROUND
WATER QUALITY BUREAU**



UNDERGROUND INJECTION CONTROL

GENERAL DISCHARGE PERMIT

Certified Mail- Return Receipt Requested

Facility Name: NMDOT Tierra Amarilla Patrol Yard

Facility Location: MM 273.3 U.S. Highway 84
Section 30, Township 29N, Range 4E
Rio Arriba

Legally Responsible Party: New Mexico Department of Transportation
1120 Cerrillos Road, Santa Fe, NM
(505) 670-4644

Remediation Oversight Agency Contact: Petroleum Storage Tank Bureau
Susan Von Gonten
(505) 372-8153

Remediation or Injection Plan Identification: Revised Work Plan for ORC Advanced Amendment
Injection Program

Permitting Action: New

PPS Contact Andrew Romero (505) 660-8624
andrewc.romero@state.nm.us

EFFECTIVE DATE: **TERM ENDS:**

Justin D. Ball

Chief, Ground Water Quality Bureau

[Subsection H of 20.6.2.3109 NMAC, NMSA 1978, § 74-6-5.I]

I. UIC GENERAL DISCHARGE PERMIT

The New Mexico Environment Department (NMED) Ground Water Quality Bureau (GWQB) issues this Underground Injection Control General Discharge Permit (UIC Permit) for the subsurface emplacement of additive fluids through a Class V UIC injection well for the purpose of facilitating vadose zone or groundwater remediation. The GWQB issues this UIC Permit to New Mexico Department of Transportation (Permittee) pursuant to the New Mexico Water Quality Act (WQA), NMSA 1978 §§74-6-1 through 74-6-17, and the New Mexico Water Quality Control Commission (WQCC) Ground and Surface Water Protection Regulations, 20.6.2 NMAC.

In issuing this UIC Permit, the GWQB has determined that the requirements of Subsection C of 20.6.2.3109 NMAC have been met. The activities authorized by this UIC Permit are principally governed by Tierra Amarilla Patrol Yard Injection Plan (Injection Plan), under the authority of NM State Clean up Program, with oversight by the Petroleum Storage Tank Bureau - Remedial Oversight Section. Compliance with this UIC Permit requires compliance with the terms, requirements, and conditions of the Injection Plan. The term of this UIC Permit shall be no longer than five years from the effective date of this UIC Permit.

The injection activities, the location of the injection site, the type of injection and quantities of additives being used are briefly described as follows:

Injection Activities (summary: including injection well type, number of wells, and injection frequency)

Copy of the Injection Plan Attached (required): ☒

Summary of Injection Plan: Injection of ORC-Advanced, a proprietary formulation of food-grade calcium oxy-hydroxide, is planned to treat residual dissolved-phase hydrocarbon contamination at this Petroleum Storage Tank Bureau release site. Chemicals will be mixed at the site in a 55-gallon drum and injected into the groundwater using direct-push technology. Steel rods will be driven into the ground using a GeoProbe track-mounted drill rig, and a hydraulic piston pump mounted on the GeoProbe rig will push materials into the subsurface through custom tooling. The amendment material is manufactured by Regenesys, who has participated in remedial action at more than 21,000 sites worldwide, and will consist of ORC-Advanced. The Regenesys design summary is attached.

Injection Site Information

Depth to most shallow groundwater (required): 10 ft

Existing concentration of total dissolved solids (TDS) in groundwater (required): 154 to 278 mg/L

Location (required): Mile Marker (MM) 273.3 U.S. Highway 84

County (required): Rio Arriba

Latitude: 36.709876

Longitude: -106.557487

Map Showing Area of Injection Sites Attached (required): ☒

Additives Being Used (including volumes, manufacturer, and mixing ratios)

ORC Advanced, 1,039 gal, 1.3 lb/yd³, Regenesi

Anticipated Precipitation, Dissolution, Adsorption, and Desorption Products

Upon contact with groundwater, this calcium oxy-hydroxide based material becomes hydrated producing a controlled-release of molecular oxygen (17% by weight) for periods of up to 12 months on a single application. No significant precipitation or desorption effects from the amendment are expected.

Public Notice Posting Locations

2 inch by 3 inch Newspaper Ad required for Renewal applications.

Newspaper: Rio Grande Sun

3 inch by 4 inch Newspaper Ad required for New, Modification, and Renewal/Modification applications.

Newspaper: Rio Grande Sun

2 feet by 3 feet sign posted for 30 days in a location conspicuous to the public at or near the facility required for New, Modification, and Renewal/Modification applications.

Sign Location: On the property fence line facing U.S. Highway 84.

8.5 inch by 11 inch or larger posted off-site location conspicuous to the public (e.g. public library). Required for New, Modification, and Renewal/Modification applications.

Flyer Location: Espanola Public Library, 313 N. Paseo De Onate, Espanola, New Mexico 87532

This UIC Permit consists of the complete and accurate completion of this UIC Permit form as determined by the GWQB.

Issuance of this UIC Permit does not relieve the Permittee of the responsibility to comply with the WQA, WQCC Regulations, and any other applicable federal, state and/or local laws and regulations, such as zoning requirements and nuisance ordinances.

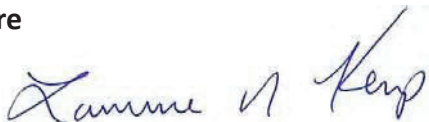
Signatures

Signature must be that of the person listed as the legally responsible party on this application.

I, the applicant, attest under penalty of law to the truth of the information and supporting documentation contained in this application for an Underground Injection Control General Discharge Permit.

Applicant's Signature

Signature: _____



Date: Nov. 12, 2021

Printed Name: Lawrence N. Kemp

Title: Geoscientist-A

Applicant Note that Submissions Must Include:

- 1- One electronic copy of the application delivered to the GWQB via email or other format
- 2- Two hardcopies of the application delivered to: Ground Water Quality Bureau
Harold Runnels Building
1190 Saint Francis Drive
P.O. Box 5469
Santa Fe, NM 87502-5469
- 3- Payment by check or electronic transfer of one application fee of \$100.00

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II. FINDINGS

In issuing this UIC Permit, GWQB finds:

1. The Permittee is injecting fluids so that such injections will move directly or indirectly into groundwater within the meaning of Section 20.6.2.3104 NMAC.
2. The Permittee is injecting fluids so that such fluids will move into groundwater of the State of New Mexico which has an existing concentration of 10,000 mg/L or less of TDS within the meaning of Subsection A of 20.6.2.3101 NMAC.
3. The Permittee is using a Class V UIC well as described in 20.6.2.5002(B)(5)(d)(ii) NMAC for in situ groundwater remediation by injecting a fluid that facilitates vadose zone or groundwater remediation.
4. The Permittee is injecting fluids into groundwater in order to achieve the remediation goals identified in the Injection Plan.

III. AUTHORIZATION TO DISCHARGE

The Permittee is authorized to inject chemical additives into groundwater in accordance with this UIC Permit and the Injection Plan under the oversight of Petroleum Storage Tank Bureau.

[20.6.2.3104 NMAC, Subsection C of 20.6.2.3106 NMAC, Subsection C of 20.6.2.3109 NMAC]

IV. CONDITIONS

The conditions of this UIC Permit shall be complied with by the Permittee and are enforceable by GWQB.

1. The Permittee shall perform remediation activities in accordance with the Injection Plan and shall notify GWQB of any changes prior to making them.

[20.6.2.3107 NMAC]

2. The Permittee shall monitor the injection activities and their effects on groundwater quality as required by the Injection Plan and shall provide GWQB with electronic copies of the required reporting and any pertinent documentation of activities at the site.

[20.6.2.3107.A NMAC, 20.6.2.3109.A NMAC]

3. If the GWQB or the Permittee identifies any failure of the Injection Plan or this UIC Permit to comply with 20.6.2 NMAC not specifically noted herein, GWQB may require the Permittee to submit a corrective action plan and a schedule for completion of corrective actions to address the failure.

Additionally, the GWQB may require the Permittee to submit a proposed modification to the Injection Plan, this UIC Permit, or both.

[20.6.2.3107.A NMAC, 20.6.2.3109.E NMAC]

4. ADDITIONAL MONITORING REQUIREMENTS – (RESERVED)
5. TERMINATION – Within 30 days of completion of activities authorized by this UIC Permit the Permittee shall submit a closure report and a request to terminate the UIC Permit to the GWQB for its approval. The closure report shall identify how the injection well(s) was (were) closed in accordance with the Injection Plan. The Permittee shall provide Petroleum Storage Tank Bureau with a copy of this closure report.

[20.6.2.5005 NMAC, 19.27.4 NMAC]

6. INSPECTION and ENTRY – The Permittee shall allow a representative of the NMED to inspect the facility and its operations subject to this UIC Permit and the WQCC regulations. The GWQB representative may, upon presentation of proper credentials, enter at reasonable times upon or through any premises in which a water contaminant source is located or in which are located any records required to be maintained by regulations of the federal government or the WQCC. The Permittee shall allow the GWQB representative to have access to, and reproduce for their use, any copy of the records, and to perform assessments, sampling or monitoring during an inspection for the purpose of evaluating compliance with this UIC Permit and the WQCC regulations.

Nothing in this UIC Permit shall be construed as limiting in any way the inspection and entry authority of GWQB under the WQA, the WQCC Regulations, or any other local, state, or federal regulations.

[20.6.2.3107.D NMAC, NMSA 1978, §§ 74-6-9.B and 74-6-9.E]

EFFECTIVE DATE: _____

7. MODIFICATIONS and/or AMENDMENTS – In the event the Permittee proposes a change to the injection plan that would result in a change in the volume injected; the location of the injections; or the concentration of the additives being injected by the facility, the Permittee shall notify GWQB prior to implementing such changes. The Permittee shall obtain approval (which may require modification of this UIC Permit) by GWQB prior to implementing such changes.

[20.6.2.3107.C NMAC, 20.6.2.3109.E and G NMAC]

8. COMPLIANCE with OTHER LAWS – Nothing in this UIC Permit shall be construed in any way as relieving the Permittee of the obligation to comply with all applicable federal, state, and local laws, regulations, permits, or orders.

[NMSA 1978, § 74-6-5.L]

9. PERMIT FEES – Payment of permit fees is due at the time of UIC Permit approval. Permit fees shall be paid in a single payment remitted to GWQB no later than 30 days after the UIC Permit effective date.

Permit fees are associated with issuance of this UIC Permit. Nothing in this UIC Permit shall be construed as relieving the Permittee of the obligation to pay all permit fees assessed by GWQB. A Permittee that ceases injecting or does not commence injecting during the term of the UIC Permit shall pay all permit fees assessed by GWQB. An approved UIC Permit shall be suspended or terminated if the facility fails to remit a payment by its due date.

[20.6.2.3114.F NMAC, NMSA 1978, § 74-6-5.K]

Appendix A

Work Plan and Specification Sheet

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Work Plan

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August 17, 2021

Mr. Larry Kemp
New Mexico Department of Transportation
Hazardous Materials Investigation Bureau
P.O. Box 1149, Room 201
1120 Cerrillos Road
Santa Fe, New Mexico 87504-1149

Re: Revised Work Plan for ORC Advanced Amendment Injection Program
Tierra Amarilla Patrol Yard
Tierra Amarilla, Rio Arriba County, New Mexico
Contract Number C06162

Dear Mr. Kemp:

Daniel B. Stephens & Associates, Inc. (DBS&A) is pleased to submit the enclosed work plan and cost estimate for completion of an amendment injection program at the Tierra Amarilla patrol yard, located at mile marker 273.3, U.S. Highway 84, Rio Arriba County, New Mexico. The scope of work and cost estimate has been developed in accordance with contract number C06162, as well as appropriate sections of the New Mexico Department of Transportation (NMDOT) Environmental Geology Section (EGS) *Hazardous Material Assessment Handbook* and in accordance with the New Mexico Petroleum Storage Tank Regulations (20.5.119 New Mexico Administrative Code [NMAC]).

Please contact us at (505) 353-9138 if you have any questions or need additional information.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

John R. Bunch, P.G.
Senior Scientist

Gundar Peterson, P.E.
Vice President

JRB/ed
Enclosure
cc: Susan von Gonten, NMED PSTB

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100

Albuquerque, NM 87109

505-822-9400

FAX 505-822-8877



**Work Plan to Treat Dissolved-Phase Contamination
NMDOT Tierra Amarilla Patrol Yard UST Site
Tierra Amarilla, New Mexico
Facility #26245, Release ID #225**

1. Introduction

On behalf of the New Mexico Department of Transportation (NMDOT), responsible party for the Tierra Amarilla Patrol Yard underground storage tank (UST) site, Daniel B. Stephens & Associates, Inc. (DBS&A) has prepared this work plan and cost estimate to treat residual dissolved-phase contamination. The site is located at mile marker 273.3, U.S. Highway 84, Rio Arriba County, New Mexico (Figure 1). All work will be performed under the direction from the NMDOT and New Mexico Environment Department (NMED) Petroleum Storage Tank Bureau (PSTB) project managers and in accordance with the New Mexico Petroleum Storage Tank Regulations (20.5.119 New Mexico Administrative Code [NMAC]).

Previous work at the site consisted of site investigations, monitor well installation, remediation system installation (including operations and maintenance) and ongoing groundwater monitoring. During UST removal in 1991 and initial investigations conducted in 1991 and 1992, it was discovered that the UST system contaminated soil and groundwater beneath the patrol yard. An air injection (AI) /soil vapor extraction (SVE) remediation system operated intermittently from when it was installed in 1994 until 2004 when the system was permanently shut down.

Although the operation of the system appeared to have reduced the hydrocarbon impact to the soil and groundwater, residual concentrations of benzene and other hydrocarbons continue to exceed the New Mexico Water Quality Control Commission (NMWQCC) standards on a seasonal basis in a number of monitor wells.

A total of six existing site monitor wells (TA-1, TA-10, TA-14, TA-20, TA-22, and TA-23) are located at the patrol yard. Monitor wells TA-2, TA-3, TA-5, TA-7, and TA-5R could not be



located and are presumed to be destroyed. A site map is included that shows the locations of the existing and presumed to be destroyed wells (Figure 2).

DBS&A conducted the last groundwater monitoring event at the site in November 2020 (DBS&A, 2020). Concentrations of contaminants of concern (COCs) in all sampled wells were below either the NMWQCC standards or laboratory reporting limits during this monitoring event, with the exception of well TA-10 that had a benzene concentration of 24 micrograms per liter ($\mu\text{g/L}$). The elevated benzene concentration noted in monitor well TA-10 during this and previous monitoring events is likely related to seasonal water table fluctuations. Currently the dissolved-phase contamination is most likely confined to the immediate vicinity of the maintenance shop.

2. Scope of Work

Based on direction from the New Mexico Department of Transportation (NMDOT), DBS&A will complete one groundwater treatment event at the site, which will include injection of an enhanced aerobic bioremediation compound using direct push drilling methods. The scope of work has been divided into the following tasks, (1) project planning, (2) pre-injection monitoring, (3) obtain discharge permit, (4) develop final remediation plan (FRP), (5) FRP implementation, and (6) post-injection monitoring. For the purposes of the scope of work detailed below, it is assumed that site conditions will allow for the performance of the proposed field activities. Monitor well replacement and groundwater monitoring activities associated with sampling site wells after the treatment event will be covered under a separate work plan.

Activities to be performed to accomplish the scope of work are outlined in the following sections. To ensure that the project objectives are achieved, an authorized representative of DBS&A will have direct supervisory control of all aspects of the project.

2.1 Task 1: Project Planning

Prior to mobilizing to the field, the following project planning activities will be completed:

- Develop this work plan and cost estimate



- Obtain a discharge permit
- Update the site-specific health and safety plan (HASP), as necessary
- Schedule site activities with the NMED and NMDOT
- Issue work orders and schedule subcontractors

The construction contractor is solely responsible for construction means, methods, sequence and techniques, and jobsite safety. For the purposes of the scope of work, it is assumed that access to the proposed injection locations will be granted by the NMDOT.

Subcontractor services will be negotiated and agreements will be obtained for injectable treatment materials, application of the materials via direct push technology, and appurtenances, such as water and equipment needed to mix materials on-site.

Prior to the performance of fieldwork, the site-specific HASP will be updated as necessary to address health and safety issues associated with the proposed project activities. DBS&A will contact the NMDOT to inform them of the proposed activities and to coordinate site access. The NMDOT and the NMED PSTB project managers will be notified at least four days prior to initiation of field work.

2.2 Task 2: Pre-injection Monitoring

Prior to implementing the amendment injection activities, one groundwater monitoring event will be conducted according to the procedures and protocols outlined below.

Depths to groundwater will be gauged in five of the existing six site wells (TA-1, TA-10, TA-14, TA-20, and TA-22) using an electronic interface probe. The interface probe will be decontaminated using a non-phosphate detergent solution and distilled water rinse prior to collecting each measurement.

Monitor wells (TA-1, TA-10, TA-14, TA-20, and TA-22) will be purged using a new dedicated, disposable bailer. DBS&A will attempt to sample wells from the least contaminated to the most contaminated well, based on data from the previous sampling event. A minimum of three casing volumes will be removed from each well prior to sampling to ensure that a representative



sample of groundwater is obtained. If a well is purged dry, it will be sampled once the well has recharged. During purging, groundwater field parameters, including dissolved oxygen, oxidation/reduction potential, electrical conductivity, pH, and temperature, will be measured using a YSI Professional, or equivalent device, and recorded in the field notes.

Purge and decontamination water will be disposed on the ground within the site boundaries, preferably on an impervious surface and near the well of origin. Purge water must not contain light nonaqueous-phase liquid (LNAPL), must not endanger public health or safety, and must not enter a surface water body or tributary, including an arroyo. Any purged fluids containing LNAPL will be containerized for future disposal at a licensed facility.

Once purged, the wells will be sampled for laboratory analysis. To minimize volatilization and ensure sample integrity, new dedicated, disposable, polyethylene bottom-emptying devices will be used to transfer groundwater samples from the bailers to the appropriate containers. Samples collected for volatile organic compound (VOC) analysis will be transferred from bailers into laboratory-prepared 40-milliliter (mL) glass sample bottles that contain mercuric chloride as a preservative. The groundwater samples will be labeled and preserved on ice in an insulated cooler for delivery to Hall Environmental Analysis Laboratory (HEAL) in Albuquerque, New Mexico, for analysis.

Groundwater samples will be analyzed for benzene, toluene, ethylbenzene, total xylenes, methyl tertiary-butyl ether (MTBE), 1,2-dichloroethane (EDC), 1,2-dibromoethane (EDB), and total naphthalenes (naphthalene plus methylnaphthalenes) in accordance with U.S. Environmental Protection Agency (EPA) method 8260B (full list). To assist with performance monitoring following implementation of the groundwater treatment program, samples will also be collected for analysis of biochemical oxygen demand (BOD) by standard method (SM) 5210B, chemical oxygen demand (COD) by EPA method 410 (modified), dissolved iron and manganese by EPA method 6010C, pH by SM 4500, and total dissolved solids (TDS) by SM 2540C (modified). Most of these additional analyses are assumed to be a condition of the NMED Groundwater Quality Bureau (GWQB) discharge permit.

Following completion of the groundwater monitoring event and upon receipt of laboratory analytical reports, DBS&A will prepare and submit to the NMDOT and NMED PSTB project



managers a one-page letter report. The laboratory report, chain of custody documentation, and field notes will be provided as appendices. Maps and tables discussing current site conditions will be provided in the FRP and FRP implementation reports.

2.3 Task 3: Discharge Permit Preparation

Prior to purchase of amendment injection materials, DBS&A will obtain a discharge permit from the NMED GWQB. DBS&A will submit a groundwater discharge permit application and provide maps, figures, logs, tables, and other data necessary to ensure the application is administratively and technically complete. DBS&A will pay the application filing fee and will pay for the initial public notice required by the NMED GWQB. Completing public notice will require posting a sign at the facility, posting a flyer off-site at a location approved by GWQB, mailing a public notice flyer to property owners within ½-mile radius of the site, and posting notice in a GWQB-approved newspaper. For similar activities on other sites, temporary permission to discharge for a one-time amendment injection event was granted after completion of the initial public notice required by the GWQB. If GWQB requires additional effort to demonstrate technical suitability of the industry-accepted materials, or additional permit fees, DBS&A will submit a change order to cover the additional costs.

2.4 Task 4: FRP Preparation

2.4.1 FRP Preparation and Submission

DBS&A will prepare an FRP in accordance with 20.5.119.1923 NMAC. The FRP will be prepared under the supervision of a New Mexico-licensed professional engineer and will minimally include:

- A site history summary, which includes current soil and groundwater conditions
- Site maps identifying roads, buildings, utilities, existing monitoring wells, groundwater contours, dissolved-phase contaminant distribution, and planned injection locations
- A discussion of the planned injection strategy, including the description of the planned injectate, rationale for the selected injectate, the injection process, target injection depth intervals, and calculations supporting planned injection point spacing and volumes



- An implementation schedule
- A discussion of planned observations and monitoring during injection
- Copies of required discharge permits and anticipated public and agency notifications
- Copies of sub-contractor/injection contractor's data sheets
- A health and safety plan

This FRP format was recently advertised by the PSTB for a similar scope of work (groundwater treatment using amendment injections to achieve no further action [NFA]). Therefore, DBS&A assumes this will be sufficient level of effort to receive technical approval from the PSTB. If additional effort or work is requested, DBS&A will work with the NMDOT and PSTB project managers to make reasonable, cost-effective, site-specific decisions to keep the work moving forward. If anticipated costs are exceeded, a change order will be submitted to NMDOT.

2.4.2 Public Notice

DBS&A will provide public notice in accordance with 20.5.12.36.D.10 NMAC. Two legal notices will be published of the submission or planned submission of the FRP in a newspaper of general circulation in Rio Arriba County. DBS&A will provide the PSTB with a certified Affidavit of Publication for each legal notice within 21 days after the FRP is submitted. The format for the legal notice will be in accordance with 20.5.12.36.D.10.b-d NMAC. A notice will be posted at the site containing the specified information listed in the regulation. DBS&A will also provide notice via certified mail to the owner and adjacent property owners within seven days of submission of the FRP in accordance with the above cited regulation.

2.5 Task 5: FRP Implementation

DBS&A worked with Regenesys and Vista GeoScience of Colorado Springs, Colorado, to develop a site-specific treatment design to achieve the remedial goals with a practical and cost-effective approach based on the available site data. The selected groundwater amendment is ORC-Advanced, a proprietary formulation of food-grade, calcium oxy-hydroxide that produces a controlled-release of molecular oxygen for periods of up to 12 months upon hydration. ORC-Advanced activates when hydrated, so it is important to apply the material at the



beginning of the irrigation season when the water table elevation is highest. This will ensure oxygen release in the subsurface for the longest period of time.

The application summary for ORC-Advanced, the selected amendment injection material, is provided as Appendix A and includes the following (depths listed below assume water is present at approximately 10 feet below ground surface [bgs]) during the summer irrigation season:

- The treatment area encompasses an approximate 4,000-square foot area on the east side of the maintenance building and includes the former tank pit and impacted wells TA-2 (destroyed) and TA-10; 34 total injection points on a 10-foot spacing over a 10-foot vertical interval (approximately 10 to 20 feet bgs) will be used for the injections (Figure 2). Regeneration estimates a total product quantity of ORC-Advanced of approximately 3,200 pounds or approximately 94 pounds per injection point.
- Materials will be injected using direct-push technology in accordance with manufacturer instructions. DBS&A intends to subcontract with Vista GeoScience, who will provide the direct-push and mixing equipment. Based on subsurface soils in the treatment zone, DBS&A anticipates using a bottom-up injection method for application of the amendment, although tooling will be available to switch to top-down methodology if field conditions necessitate the switch. A mechanical mixing pump will be used to mix ORC-Advanced materials with the manufacturer-specified quantities of water in a tank. Water will be obtained locally and stored in a water tank for daily use. A hydraulic piston pump mounted on a track-mounted GeoProbe rig will be used to inject materials into the subsurface through either GeoProbe tooling or the probe rods, depending on subsurface drilling conditions. Injection boreholes will be backfilled with bentonite and sealed at the surface with a quick-setting, high-early-strength concrete.
- Injection pressure is critical to this application, as it is the key to distributing amendment into the formation. Based on assumed dry and saturated unit weights of 100 and 125 pounds per cubic foot, respectively, and an assumed porosity of 20 percent (for an average sand), recommended maximum sustained injection pressures in the soil formation would be less than 100 pounds per square inch (psi). Pressure will be monitored between the injection pump and the probe rods to minimize surfacing of injected materials. The proposed piston



pump will also keep injection flow rates on the order of 35 gallons per minute (gpm). During and after injection activities, nearby monitor wells will be periodically monitored for increasing contaminant vapor concentrations using a photoionization detector (PID) or equivalent organic vapor meter. Work areas will be secured from vehicular and pedestrian traffic during injection activities.

Following completion of the amendment injection, a letter report detailing injection activities with photographic documentation will be submitted to the NMDOT and NMED PSTB.

2.6 Task 6: Post-Injection Monitoring

After implementing the amendment injection activities, one groundwater monitoring event will be conducted according to the procedures and protocols specified in section 2.2.

References

Daniel B. Stephens & Associates, Inc. (DBS&A), 2020. *Fourth quarter groundwater monitoring report, NMDOT Tierra Amarilla Patrol Yard Site, Tierra Amarilla, New Mexico, Facility #26245*. December 15, 2020.

DRAFT **Figures**



Explanation

Source: Aerial Photograph provided by Google Earth Pro., dated 2013



Daniel B. Stephens & Associates, Inc.
08/09/2011 JN ES07.0014.05

NMDOT TIERRA AMARILLA PATROL YARD Area Map

Figure 1



Source: Aerial Photograph provided by Google Earth Pro., dated 2013

Explanation

- Proposed ORC injection points
- Extent of soil contamination - 1991
- ⊕ Monitoring well
- ▲ Remediation system well
- ⬛ Destroyed monitoring well



Daniel B. Stephens & Associates, Inc.
5/13/2021 JN ES07.0014.05

**NMDOT TIERRA AMARILLA PATROL YARD
Site Map**

Figure 2

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Appendix A
ORC-Advanced
Application Summary



*Expert Environmental
Support Services for Site
Investigation & Remediation*

August 12, 2021

John Bunch
Daniel B. Stephens & Associates
6020 Academy Rd NE STE 100,
Albuquerque, NM 87109

E-Mail: jbunch@dbstephens.com

Re: Vista GeoScience Proposal No: 21122.01 REV 1
Application of RegenesiS ORC Advanced for In-Situ Remediation of Contaminants at:
NMDOT Tierra Amarilla Patrol Yard
US 84, Mile Marker 273.3
Tierra Amarilla, NM

Dear John:

Attached is our proposal to perform in-situ remediation services at the above-referenced site. Our proposal is based on the information provided to Vista GeoScience, LLC (VISTA). It includes a proposed technical approach, scope of work, and preliminary cost proposal.

If this proposal/quotation and the attached terms are found to be satisfactory and you would like to schedule the project, please send us a purchase order referencing this proposal number and date, or sign with your approval in the appropriate section in the proposal and return to Vista GeoScience.

Please feel free to call us if you have any questions. We look forward to working with you on this project.

Sincerely,

Peter Wethington
Field Operations Manager
Vista GeoScience

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Vista GeoScience Proposal No: 21122.01 REV 1

Application of Regenesis ORC Advanced for the In-Situ Remediation of Contaminants at: US84, Mile Marker 273.3, Tierra Amarilla, NM



Prepared for:



August 12, 2021

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1 INTRODUCTION

The information provided by Vista Geoscience LLC (VISTA) in this In-Situ Remediation proposal is in response to a request for proposal (RFP) by Daniel B. Stephens & Associates (CLIENT) and pertains only to the referenced site. The project scope is based on discussions with and limited site information provided by the CLIENT. The technical approach is considered an adaptable plan and may be modified and optimized prior to or during implementation.

1.1 Site Background

The CLIENT has not provided enough information for VISTA to produce a site background. However, there are known petroleum contaminants within the soil and groundwater.

Site lithology consists of sands and gravels with seasonal groundwater fluctuating between 10 and 20 feet bgs.

1.2 Technical Approach

The treatment area is 4,000 square feet and contains approximately 2,500 cubic yards of petroleum contaminated soil. The mix design calls for the mixing of 3,200 pounds of ORC advanced with potable water to create a 1,039-gallon slurry. This slurry will then be evenly distributed at 34 direct push (DPT) injection locations between 10 and 20 feet below ground surface.

For injections, VISTA will mobilize a Clean Inject injection trailer, a Geoprobe brand 7,000 series (or equivalent), track mounted, DPT/Auger combination drill rig and all necessary equipment to complete the project.

1.2.1 Proposed Equipment

- Drill Rig: Track mounted Geoprobe, 7822DT series (or equivalent) DPT/auger combination
- Injection Trailer: Two axle, enclosed trailer with dual pumps and 300-gallon stainless steel mixing tank
- Injection Pump: Hydra-Cell D-35 positive displacement pumps: 35 gpm and 1,200 psi
- Injection Monitoring: Digital pressure and flow gauge with integrated graphing software
- Injection Tooling: 1.5" OD drill rod with 4-6 port discrete interval lead rod or 2-foot retractable screen lead rod.
- Injection Hose: 1" ID 2,500 psi working pressure equipped with 1" quick disconnect fittings
- Power: 40kW (or equivalent) pull behind generator
- Water Procurement: Nearby hydrant using city rented metering equipment
- Cleanup supplies: 16-gallon wet/dry shop vacuum and pressure washer

VISTA will bring retractable screen tools, a common type of bottom-up injection tooling. The tools are drill rods equipped with a screened section in a protective sheath that is pushed to a desired depth, and then retracted, to expose the screen. The screened section of the tool can be made in lengths of one to five feet and can only be used in a bottom-up fashion for injection of multiple intervals. Once the screened section is exposed, it cannot be reversed as it would clog and possibly damage the tooling. Slider tools are most effective in coarse grain permeable soils where liquid products or very fine slurries are likely to flow



equally into the entire exposed interval. In some cases, large cobbles deflect the injection tooling and damage the screen tools. If screen tools prove to be unsuccessful, VISTA will come prepared with other types of injection tooling.

VISTA will also bring its custom built, pressure activated, discreet interval injection tips unique to Vista GeoScience. At the lead end of a 1.5" OD x 5' long tool, there are a set of 4 or more holes, with diameters between 3/32" and 5/32", drilled along the rod's circumference. Behind those holes are a spring and plunger that activate under pressure. When drilling, the spring holds the plunger in front of the holes to avoid clogging. When pressurized the, spring and plunger are pushed to a position that reveals the holes. This type of injection tooling will perform well in all soil types but is most effective in less permeable soils where fractures must be created for the placement of product. These tools allow for more accurate placement of the reagent in vertical intervals spaced one and two foot apart and are usually coupled with high pressure/high flow injection system. These tools tend to be more resilient in cobble formations.



VISTA plans to use an electric powered Hydra-Cell D-35 positive displacement pump with electronic speed controller (ESC) for injections. These pumps are capable of injecting at pressures and flows up 1200 psi and 37 gpm respectively. The ESC allows pressures and flows to easily be controlled. VISTA plans to inject with flows around 20 gallons per minute with anticipated pressures between 50-150 psi.

NOTE: VISTA does not endorse specific remediation products. Any remediation options offered by VISTA in this proposal are necessarily based on subsurface data provided by others as well as product claims and design protocols provided by the product vendor. As with all remediation technologies, pilot tests and treatability studies should be performed to verify that a recommended technology will actually work at a specific site.

2 INJECTION DESIGN DETAILS

2.1 Design Basis and Information Considered

Our proposal is based on site information (site maps, analytical data, boring logs, photos, etc.) provided in emails and telephone conversations between CLIENT and VISTA during May 2021. Information included

Any proposed injection designs provided by VISTA are necessarily based on data provided to VISTA. In some cases, a single application may provide sufficient reductions in contaminant concentrations within a reasonable time-frame. Other sites may require multiple applications or require longer periods of time before adequate reductions in contaminant concentrations are observed. In all cases, the reduction in contaminants will be affected by further releases, unidentified sources, and ongoing influences to the injection area by surrounding contaminant plumes.

2.2 Chemical Reagent Injection

This injection is proposed as a:

- ☐ Pilot Test / Treatability Study
- ☒ Full Scale Injection

2.3 Detailed Design

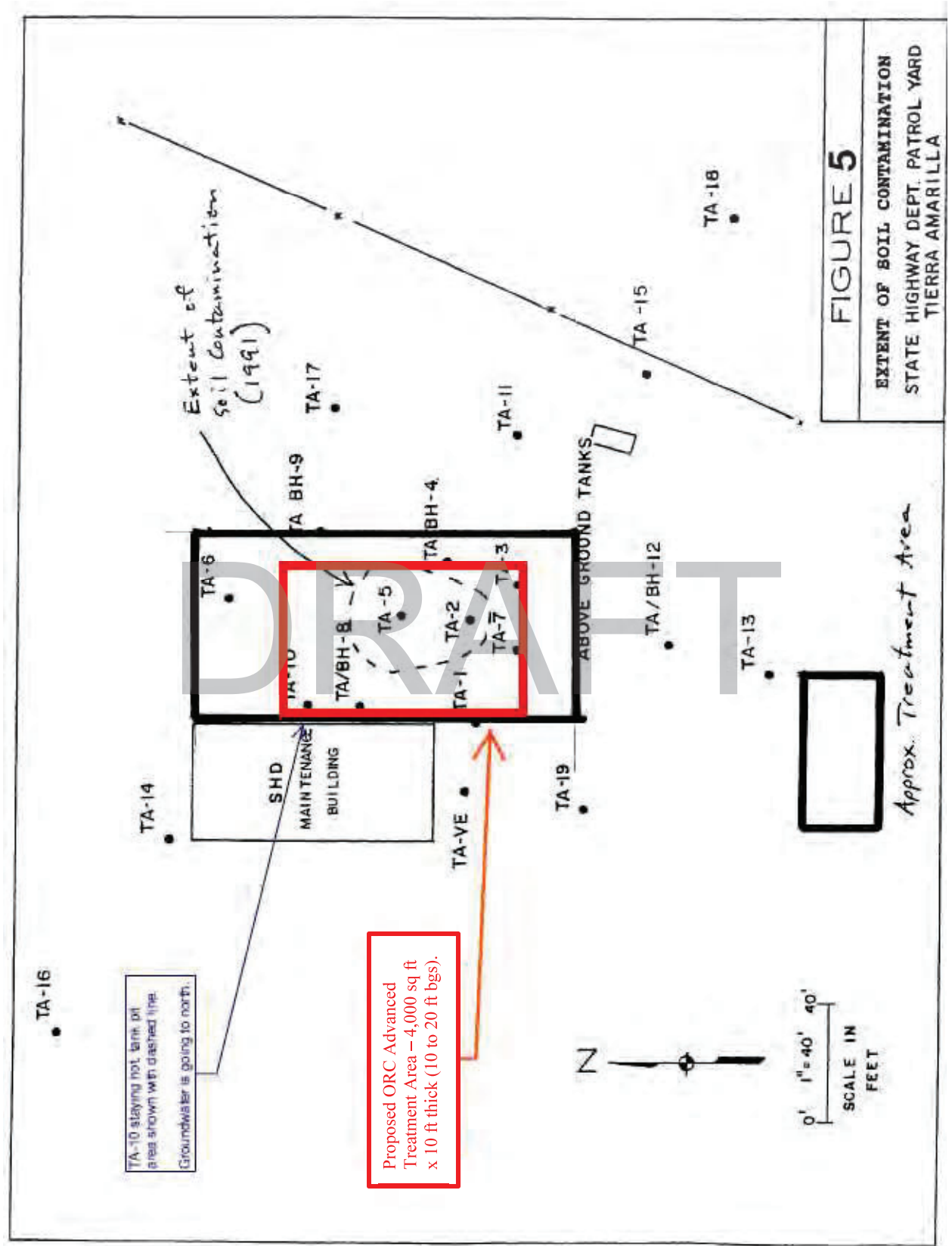
The treatment application table (2.3.1) summarizes the injection design dosing, depth intervals, pounds of reagent, injection volumes, interval and grid spacing, as well as presumed starting and ending points of the contaminant of concern (COC). The injection area map (2.3.2) shows the location of the treatment areas listed in the table. Field conditions may dictate modifications to the grid spacing and locations and will be discussed with CLIENT if modifications are required.

2.3.1 Treatment Application Table

ORC Advanced Grid Design Specifications NMDOT Tierra Amarilla Patrol Yard Vadose soil/dissolved plume		
Design Specifications	Quantity	Units
Treatment Area Size	4,000	ft ²
Depth to Top Treatment Interval	10	ft
Depth to Bottom Treatment Interval	20	ft
Vertical Treatment Thickness	10	ft
Number of Injection Points	34	---
Injection Point Spacing (within rows)	10	ft on center
Injection Point Spacing (between rows)	12	ft on center
Total Vertical Drilling	340	ft
Product Quantities	Quantity	Units
ORC Advanced per Point	94	lbs
Total ORC Advanced	3,200	lbs

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2.3.2 Treatment Area Map



3 SCOPE OF WORK

Based on the treatment design proposed in Section 2, the proposed scope of work (SOW) to complete the tasks is as follows:

3.1 Mobilization

Mobilization includes delivery to the job site or moving between job sites, equipment, tools, materials, supplies, PPE, miscellaneous articles, and personnel sufficient to commence and sustain temporary DPT sampling and subsurface logging activities to meet the project schedule.

VISTA proposes to mobilize the following equipment/systems to complete the require tasks:

- ☒ Geoprobe 7000 series track mounted DPT/Auger combo rig.
- ☐ DT22 or DT32 Continuous Core System for collection of RDC soil samples.
- ☐ Water & Soil Sampling Materials:
 - ☐ SP-16 Screen Point Water Sampling Tools for Water Sampling
 - ☐ Materials for Temporary ¾" PVC Water Sampling Wells
 - ☐ Materials for Temporary Water Sampling Tubing Implants
- ☒ Clean-Inject Electric Remediation System Trailer
 - ☒ 1200 psi, 35gpm Wanner Positive Displacement Pump setup
 - ☐ 1200 psi, 70gpm Wanner Positive Displacement Pump setup
- ☐ Chem Grout Injection Trailer (Dual 100-gallon mix tanks)
 - ☐ Three Stage Moyno Slurry Injection Pump, up to 350 psi, 25 gpm
 - ☐ Additional D-35 or DP-800 pump for fracturing if necessary
- ☐ Injection Trailer
 - ☐ Grundfos Stainless Steel Centrifugal Injection Pumps (25 gpm, 125 psi)
 - ☐ Multi-Port Injection Well Manifold with Valves,
 - ☐ Pressure & Digital Flow Monitoring Digital Pressure & Flow Monitoring
- ☒ Injection Tooling
 - ☒ Multi-Port Discrete Interval Jetting Injection Probe
 - ☒ Retractable Injection Screens (1' – 5' screen length options)
- ☒ Digital Pressure & Flow Monitoring
- ☐ Analog Pressure & Flow Monitoring

3.1 Utility Locates, Clearing, Daylighting

VISTA will notify the Utility Notification Center of New Mexico (UNCNM) at least 72-hours prior to our field work to obtain locates for public underground facilities, even if VISTA is a subcontractor on the job.

When locates are obtained through UNCNM, the various underground facility owners are only responsible for marking their lines from the property line to the meter. Any underground utilities that exist beyond or behind the meter are considered "private" utilities and may include irrigation/sprinkler lines or water, sewer, phone and/or electric lines from the metered building to an auxiliary building on a property. Private utilities may be located by ordering private utility locates and/or by exposing the proposed excavation areas by potholing ("daylighting"). VISTA can assist in providing private utility locates or daylighting services. Unless specifically noted below, this proposal does not include private utility locates or daylighting services. VISTA maintains the right to refuse to excavate and/or drill in any location that may be reasonably deemed unsafe to dig. VISTA will not be responsible for any utility repairs.

- ☒ Proposal includes 811 Utility Notification
- ☐ Proposal includes 811 Utility Notification and private utility locates.
- ☐ Proposal includes hand augering drill locations to 5 feet before drilling.
- ☐ Proposal includes potholing and/or utility daylighting using a hydro-vac system.

3.2 Investigation Derived Waste (IDW):

☐ Proposal includes daylighting services and assumes debris is impacted by contaminants such that disposal at an appropriate landfill or waste facility will be required. Proposed Disposal Location:

- ☐ ACI Services. Waste Treatment Facility [waste must be excluded waste as defined under 40 CFR 261.4(b) (10) Petroleum Contaminated Media & Debris from Underground Storage Tanks] CLIENT, as generator, will be required to sign necessary manifests.
- ☐ Other:

☒ CLIENT, as generator, is responsible for all sampling, analysis, and profiling. Costs for transportation and disposal are extra and not included in this proposal unless otherwise noted.

3.3 Traffic Control

Sufficient work area must be provided for our direct-push rig, injection equipment, generator and other equipment if our crews are to safely and efficiently provide the requested services. Additional charges may apply if we are required to move equipment to accommodate site owner-imposed restrictions or to compensate for heavy traffic conditions. We can assist you in providing traffic control. Unless specifically noted below, this proposal does not include traffic control services.

- ☒ Proposal does not include traffic control.
- ☐ Proposal includes traffic control.

3.4 Pavement Coring / Street Permits

Removal and patching of any concrete, asphalt, or other surface materials will be necessary if located in the intended work area. VISTA can provide coring and patching services if requested. Unless specifically noted below, this proposal does not include coring or patching services. Please note that even if we provide pavement patching services, we cannot guarantee against future settlement or damage to the patched areas due to conditions beyond our control such as poor surrounding pavement conditions,

drainage and heavy traffic. Our proposal does not include street cut permits, degradation fees or any related services unless specifically noted below.

- ☐ Proposal does not include pavement coring, patching services, or street cut permitting.
- ☒ Proposal includes pavement coring and patching (subject to the limitations noted above)
- ☐ Proposal includes street cut permitting, including the following specific tasks and estimated fees:

3.5 Equipment Storage & Frost Protection

If the project is anticipated to take more than one (1) day and is located more than 50 miles from VISTA's office, it may be necessary to store equipment in a secure location overnight. Also, if the project occurs during freezing weather, equipment must be protected from freezing. If the injection equipment cannot be stored inside a heated garage, a 120V/30A power supply must be available to operate space heaters inside the injection equipment. Our proposal anticipates the following.

- ☐ No equipment storage or frost protection will be required.
- ☒ Proposal assumes a storage location on site will be available, but no frost protection is necessary due to the anticipated weather conditions.
- ☐ Proposal assumes client will provide a secure location to store our equipment at night and a power supply of at least 120V/30A.
- ☒ VISTA will provide any necessary storage and frost protection and the associated costs are included in our proposal.

3.6 Water Supply

Sufficient clean water is necessary to mix most dry injectates. At many sites, a water spigot or nearby fire-hydrant is available. If necessary, VISTA can transport water to the site. If a water spigot is provided, the spigot must have a flow rate of at least 10 gpm and be located within 100 ft. of the injection equipment. If a fire-hydrant is available, permits and a backflow preventer connected to a hydrant meter must be provided. VISTA can obtain the necessary permits, backflow preventer and hydrant meter if requested. This proposal includes the following services.

- ☐ Proposal assumes a water spigot will be provided by the client within 100 ft. of our injection equipment and with a flow rate of at least 10 gpm.
- ☐ Proposal assumes a fire hydrant, backflow preventer, hydrant meter and all necessary permits will be provided by the client.
- ☒ Proposal assumes a fire hydrant, backflow preventer, hydrant meter and all necessary permits will be obtained by VISTA.
- ☐ Proposal assumes VISTA will transport water to the site.

3.7 Reagent Containment, Surfacing & Site Cleanup

Depending on the site conditions, injectate surfacing may occur. This may be the result of specific subsurface soil and groundwater conditions, nearby utility corridors, the pavement condition in the area of the injection, and the amount and flow rates of chemicals injected into the ground. In some circumstances we can lower the injection rates to minimize injectate surfacing but in many cases lowering the injection rates will only make the problem worse. Our proposal is based on the assumption that injection rates of at least 20 gpm can be maintained without injectate surfacing. If lower injection rates are required to prevent injectate surfacing, additional charges may apply. VISTA is not responsible for cleanup of injectates that surface at the site or enter nearby monitoring wells, utility corridors, nearby

properties buildings or other pathways. Also, depending on the magnitude of the proposed injection, a large number of injectate containers and other waste can be generated during the project. Unless specifically noted below, our proposal assumes no cleanup of injectate or other waste. Containment is recommended for hazardous chemicals, such as strong oxidants. Even though non-hazardous reagents may not require containment for surface spills, if a release occurs, they may still result in a nuisance or illegal discharge, especially if they enter a public right of way or storm drain, and containment may be recommended. Vista will provides costs for this service only if requested.

- ☐ Proposal assumes cleanup of any surfaced injectate, empty injectate containers and other waste will be provided by others.
- ☒ Proposal assumes VISTA will provide cleanup of surfaced injectate, where accessible
- ☐ VISTA will provide a vacuum trailer continuously during the project.
- ☐ Proposal assumes VISTA will provide cleanup of injectate in impacted monitoring wells.
- ☐ Proposal assumes VISTA will provide disposal of all empty injectate containers and other waste.
- ☐ Proposal includes costs for containment for pump systems, liquid storage, and mixing tanks
- ☒ Proposal assumes reagents are non-hazardous and containment is not requested.

3.8 Deliverables Summary Reports

Following completion of the proposed scope of work, VISTA will prepare a basic summary report of the injection activities (injection locations and depths, injected quantities, breakthrough and pumping pressures, etc.).

3.9 Other Project Assumptions

In order to assist the CLIENT in assuring all steps necessary to successfully and safely complete this project are addressed, please note the following assumptions made when preparing this proposal. If you have any questions or need our assistance in addressing any of the following, please advise VISTA prior to proceeding with the project.

- ☒ Client will review and approve all drilling and injection locations, as well as mark locations on the pavement or ground surface prior to VISTA potholing, coring, or drilling at a location.
- ☒ The anticipated work can be completed using Level D Personal Protection Equipment (PPE).
- ☒ Proposal assumes the work will be completed during normal, daytime working hours.
- ☒ Proposal assumes any permits not specified in this proposal will be obtained by the client.
- ☒ Site Lithology is conducive to direct push probing, and we will be able to push to the depths specified. The operator will call probe refusal. If the CLIENT's onsite representative insists on pushing beyond the operator's recommendation, the client is responsible for any resulting tool damage.
- ☒ Proposal assumes additional charges may apply due to rig refusal, frozen ground, or unanticipated slower penetration rates.
- ☐ Additional estimated time for pre-probing or pre-augering hole is included in this proposal.
- ☒ Boreholes will be abandoned with hydrated bentonite chips or crumbles and patched with like materials (concrete or asphalt).

☒ VISTA will not be responsible for any damage to pavements or landscaped areas resulting from our crews' operation of the track rig unless from negligence. The client recognizes that some damage may occur due to turning, leveling, and other normal operating procedures including stabilizing the rig to prevent movement during probing.

☐ Time and materials costs are included for repair to anticipated damaged pavements or landscaped areas resulting from our crews' operation of the track rig.

Decontamination of Tooling:


☐ All probe rod will be decontaminated between all boreholes.

☐ Only probe rod that is retrieved wet will be decontaminated between boreholes.

☒ Tooling will not be contaminated between boreholes, but will be decontaminated before leaving site.

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4 COST ESTIMATES

	Rocky Mountain Region Ph: 303-277-1694 Gulf Coast Region Ph: 281-310-5560 www.VistaGeoScience.com	Date: May 13, 2021 Vista Rep: Peter Wethington pwethington@vistageoscience.com	
Vista Quote No.: 21122.01			
For: John Bunch, Daniel B. Stephens & Associates, Inc.			
6020 Academy Road NE, Suite 100 · Albuquerque, New Mexico 87109 · Phone: (505) 822-9400 · Fax: 0			
Project Overview for: NMDOT Tierra Amarilla Patrol Yard ORC Advanced DPT Injections			
<p>Services: Geoprobe Dual-Technology Track Rig, Clean-Inject Remediation System, and 3 person crew.</p> <p>Pre-clearing of boring locations (pothole/hand auger) not included in this quote. Additional charges will apply for these services.</p> <p>Mix 3,200 pounds of ORC Advance with 884 gallons of potable water.</p> <p>Inject the 1,039 gallon slurry evenly at 34 injection locations between 10 and 20 feet bgs.</p> <p>Abandon each boring location with bentonite chips and patch to match existing surface.</p> <p>Complete a 811 One Call utility locate prior to mobilizing to the site.</p>			
Address/Location: US84, Mile Marker 273.3, Tierra Amarilla, NM			
Estimated Start Date: TBD		Estimated Duration (days): 2	
Site Description/Notes:			
Environmental Drilling & Labor Estimate:			
	QTY	PRICE	TOTAL
Geoprobe DPT/Auger Rig, Clean-Inject Pump Rig, Level D, per day (8 hours)	2	4995.00	\$9,990.00
Geoprobe DPT/Auger Rig, Clean-Inject Pump Rig, Level D, per day, Overtime (>8 hours)		575.00	
Site Setup and Breakdown	1	2000.00	\$2,000.00
Subtotal Environmental Sampling Services:			\$11,990
Rentals / Other Services:			
	QTY	PRICE	TOTAL
Injection Remediation Report, lump sum	1	500.00	\$500.00
Water Procurement, lump sum	1	250.00	\$250.00
Subtotal Rentals / Other Services:			\$750
Expendable Items/Materials Estimate:			
	QTY	PRICE	TOTAL
Granular or Chip Bentonite, per 50# bag	20	12.00	\$240.00
Subtotal Expendable Items:			\$240
Mobilization and Travel Expense Estimate:			
	QTY	PRICE	TOTAL
Lump Sum Mobilization and Setup	1	4,200.00	\$4,200.00
Per Diem, per person, per day	9	50.00	\$450.00
Lodging, per person, per day	9	100.00	\$900.00
Subtotal Mobilization Expenses:			\$5,550
Total Estimated Project Cost:			\$18,530
5% New Mexico Sales/Service Tax			\$926.50
Total Estimated Project Cost w/ Tax / Project Management:			\$19,456.50
Quotation valid for 90 days and subject to Vista GeoScience's Terms & Conditions, as attached.			

5 TERMS AND CONDITIONS

STANDARD TERMS AND CONDITIONS FOR FIELD SERVICES AGREEMENTS

Definitions: Vista GeoScience LLC (VISTA), a Colorado Corporation, is the company providing contracted consulting, field and/or laboratory services according to this price quotation and agreement. The named customer in the quotation is referred to as the CLIENT in these here terms and conditions. Acceptance of this price quotation is considered acceptance of these terms and conditions.

Quotation: Unless otherwise stated in the quote, this is a time and materials estimate. Actual quantities used will be invoiced according to the unit priced in the quote and quantities provided and used. Acceptance of this quotation includes acceptance of VISTA's Terms and Conditions by the CLIENT. A deposit or mobilization advance payment may be required for some projects depending on credit terms with the CLIENT. Pricing in this quotation is valid for 90 days.

Insurance: VISTA carries a \$5,000,000 liability insurance policy which includes general, pollution and professional liability at those limits. Workers compensation insurance and liability insurance certificates can be provided upon request naming the CLIENT or property owner as additionally insured. A certificate of insurance can be provided upon request.

Utilities: VISTA will not drill on a location without a completed and current utility locate. Call the national Utility Notification Center (UNC) at 811 to obtain public utility clearance. Most services require at least 48 hrs. notice prior to the date of drilling, and longer times are generally required to arrange for on-site appointments, which may be required. If the property includes private utilities, on private property may require a private locator. If provided drilling locations, VISTA will obtain clearance and/or meet with utility locators for a fee. When calling in locates, add VISTA's name to the ticket. Vista is not responsible for damage due to improperly or unlocated utilities or subsurface obstructions. Locates can be called in under VISTA's name with the contact person being the CLIENT's field contact for providing site information or conducting on site locates. Any unanticipated time for VISTA to meet with utility locators on site will be invoiced to CLIENT at standard rates.

Licensing, Test Holes & Monitoring Wells: In Colorado, monitoring holes, monitoring wells and certain test holes require notice (3 days prior) or permitting with the Colorado State Engineer's Office as well as construction reports. An "authorized individual" is allowed to file these reports. Please contact VISTA if you have any questions regarding the requirements or need assistance in filing these reports. Vista has on staff Authorized Individuals according to the rules. Each type of hole/well must be plugged by an "authorized individual" or licensed driller within a specific period of time based on the permitted use. Notice of plugging and abandonment may be required and is the responsibility of the well owner. Vista is also licensed to install water wells in NE, KS, OK and SD where other reporting rules apply. If VISTA is contracted by the CLIENT to work on sites in other states, the CLIENT must inform VISTA if additional licensing is required.

Daily Reports and Notifications: VISTA will provide the client's on-site representative daily field reports of all activities, time and materials used on the site including notification of any drilling issues, lost tooling or damages occurred during the day. The client will be required to sign the daily report, and can comment on any information provided on the report if so desired, and a copy of the report is provided at the end of the day or shift. Crews also maintain field notes which are available upon request after the project is completed.

Health & Safety: For environmental site services, VISTA employee's will have current OSHA certifications required for Hazardous Waste Operations (HAZWOPER) according to CFR 1910.120 and can provide current certification documents and required medical monitoring documents. VISTA maintains a general health and safety plan (HASP) and standard operating procedures (SOP) for its typical operations. A site-specific HASP is required for HAZWOPER operations and is the responsibility of the site owner, or site owner's representative, to provide a site-specific HASP and monitoring. VISTA can provide a site specific HASP if the client is able to provide VISTA with all required information regarding site specific and operational hazards for an additional charge if not already included in this price quote and agreement. VISTA's on site staff will hold daily "tailgate" safety meetings at the start of each work day on site in cooperation with the CLIENT's on site staff and will document such meetings.

Right to Stop Work: VISTA employee's and the CLIENT's on-site representative have the right to call a STOP WORK order if any party feels that any task or operation is a health or safety risk or that damage to any equipment or property may occur.

US DOT & FMCSA Regulations: VISTA follows all US Department of Transportation Regulations and the Federal Motor Carriers Association Rules and operates under US DOT number 1725929. All commercial vehicle operators are trained on the commercial driving rules and those driving vehicles over 26,000 lbs. GVW have a commercial driver's license. Most VISTA drivers have air-brake and tanker endorsements, but not Hazardous Materials endorsement. Therefore, VISTA is not permitted to transport hazardous cargo over DOT limits. It is understood by both that crews operating on sites mobilized away from our home office may be required to take 24-hour rest periods to continue operation of commercial vehicles on public roads according to MACS rules. Per diem and/or standby charges may apply.

Site Conditions, Tool & Equipment Damages: VISTA does not charge for normal wear and tear of tooling or equipment or breakage of work tooling or equipment. However, if site conditions are such that abnormal breakage occurs to tooling or other equipment, charges for such damage will be included in the invoice for replacement of such tooling and equipment. VISTA's on site representative will notify the CLIENT's on site representative if such damage is anticipated based on initial work on the site, or it if occurs on the site, and such damage will be noted with site conditions on the Daily Field Services Report.

Invoicing & Payment Terms: Invoices are sent either after project completions, at the end of a task or PO order, or at two week intervals on longer projects. Payment is due in Net 30 days from invoice date unless otherwise stipulated in this quote or an overriding contract or agreement. A mobilization advance payment/deposit may be required for some projects depending on credit terms with the client. Separate terms may apply to large material purchase, including remediation materials. Late payments will accrue interest at 2.0% per month finance charges accruing from the original invoice date. Any additional cost incurred on past due invoices will be added to the amount due including but not limited to collection agency fees, attorney fees and court fees.

6 APPROVALS

If this proposal, terms and conditions are satisfactory, please signify your acceptance by having an authorized person sign below and provide copy to VISTA. If the CLIENT wishes to provide their own subcontract, this entire proposal must be included at a referenced attachment with all assumptions and terms included.

We appreciate the opportunity to provide this proposal for our professional services. Please contact us if you have any questions.

Respectfully submitted,

Reviewed by,

Vista GeoScience, LLC

Peter Wethington
Field Operations Manager

John V. Fontana, P.G.
President/CEO

NOTICE TO PROCEED:

THE UNDERSIGNED SIGNATORY REPRESENTS AND WARRANTS THEY HAVE AUTHORITY TO ENTER INTO THIS AGREEMENT.

ACCEPTED BY (SIGN): _____ DATE: _____

PRINT NAME / TITLE: _____

7 PROPOSED EQUIPMENT



7.1 Clean-Inject™ Slurry Mixing and Pump System

Clean-Inject™ is a patent-pending Remediation System which is capable of injecting Powdered Activated Carbon or other powdered reagents mixed with water into the subsurface at narrow and precise targeted intervals to remediate impacted soil and groundwater. The positive displacement pump can generate up to 1200 psi at 35 gpm, which allows effective and highly targeted jetting of the reagents into any type of lithology. This system allows precise placement of all types of reagents, reduces surfacing issues, and significantly improves treatment performance by insuring the most contact of reagent and contaminants.

A new digital flow rate and pressure monitoring system assists in monitoring the subsurface behavior of the injections as they proceed, allowing the operator to make real time field adjustment when issues are observed.

The system also allows the use of super sacks of reagent, and pumps the reagent directly into the mixing tanks which removes the handling of 50 pound sacks of reagent, eliminates powder dust plumes on the site, and makes the operation cleaner, safer and more efficient.



All hosing and tools can be locked up in system trailer at night and the trailer can be kept heated overnight in freezing weather, allowing for quicker startups in the morning. Power on site will need to be provided. Specifications of the system are as follows:

Table 2. Clean-Inject System Specifications

System design	Clean-Inject
Injection flow rate	Up to 35 gallons per minute
Injection pressure	Up to 1,200 psi
Pump type	5 diaphragms, positive displacement
Injection pump horsepower required	30 hp, variable frequency drive; 0-1150 rpm
Pump compatibility	Stainless steel with Viton diaphragms
Blended injectate measuring	Float system
Mixing tank	200 to 300 gallons, stainless steel
Bulk carbon handling	1,000 lb. supersacks
Powder weighing system	Load cell, 5000 lb. capacity, 0.1 lb. accuracy
Mixing tank additive provisions	18" manway + liquid additive (oxidizers, nutrients)
On-board fresh water storage	500-gallon
Fresh water transfer rate	50 – 80 gpm
Fresh water inlet	3/4" threaded water supply or 2" camlock
Fresh water filtration	Y strainer, mesh straining element
Bulk powder transfer system	Double diaphragm
Dust suppression system	CleanInject proprietary, e-type, passive vent
Water supply requirements	≥ 10 gpm (recommended)
Power requirements	70 kva, 460 volts, 3-phase
On-board compressed air supply	7.5-10 hp screw or reciprocating compressor
On-board fresh water wash down	50-80 gpm
Operating environment	All conditions: rain, freezing, wind, snow

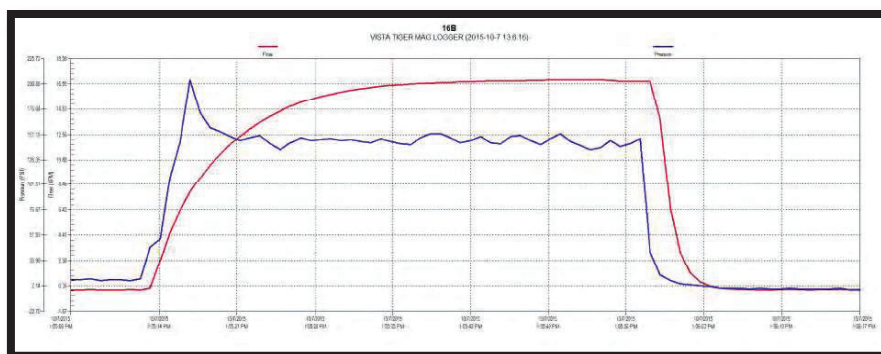
7.2 Top Down Injection Tooling

Specialized injection tooling that allows for continuous top-down injection will be used to provide precise targeted injection at specified intervals. This is a significant improvement over common bottom up methods that are often applied and is required when using slurried solids such as BOS200 since it remains relatively immobile once emplaced. Bottom up injection methods may be required where drilling and soil conditions become too difficult for the specialized tooling.



7.3 Pressure & Flow Monitoring

Pressure and flow rates are digitally monitored and recorded manually on log forms along with volume and weight totals for each injection interval. The operator can observe the pressure and flow graphs while injecting which identifies the subsurface injection behaviors and helps reduce surfacing issues.



8 STATEMENT OF QUALIFICATIONS

(Attachment)

DRAFT



*Expert Environmental Support Services for
Advanced Site Characterization &
Optimized In-Situ Remediation*

DRAFT Statement of Qualifications



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1 SUMMARY LIST OF CAPABILITIES

As leaders in the industry, the staff at Vista GeoScience has successfully served our client's evolving needs for environmental site characterization and remediation services since 1986. As the demands, costs, and challenges of your environmental investigation and remediation projects increase, we strive to continuously adapt and improve the diverse knowledge, skills, and abilities of our team to compliment the latest technologies and methods we use on your projects. This enables us to provide you with the most effective services available to make your job run smoother, on time, and on budget. In other words, *your* project goals become *our* project goals.

1.1 Dual-Technology Direct Push & Auger Combo Drilling Rigs

- **Geoprobe® Models** – 7822DT, 7730DT, 7720DT, 6610DT, 54DT & Limited Access Probes
- **Continuous Soil Coring using Dual-Tube Systems**
- **Screen-Point Groundwater Sampling** & Pneumatic Slug Testing
- **Monitor Well** Installation and Abandonment
- **Soil Gas** Active Sampling, Profiling and Monitoring Installations
- **Solid Stem and Hollow Stem Augering**

1.2 High Resolution Site Characterization (HRSC) & Subsurface Imaging Systems

- **4WD Carrier Vehicles**
- **Optical Interface Profiler** (OIP-UV and OIP-G) for NAPL Fluorescence Sensing with HPT and EC
- **Membrane Interface Probe** (MiHPT) – Combined Membrane Interface Probe (MIP) with HPT and EC
- **Hydraulic Profiling Tool** (HPT)
- **Electrical Conductivity** (EC)
- **HPT-GWP & HPT-GWS** – Groundwater Profiler/Sampler (discrete sampling with HPT)
- **3-D Data Visualization** with Data Interpretation and Conceptual Site Modeling

1.3 Soil Gas Specialists:

- **Active Soil or Passive Soil Gas** Sample Collection, Single or Nested Monitor Wells
- **Gas Migration Surveys** (methane or natural gas)
- **Landfill Tier-2 NMOC** Gas Sampling & Testing (Method 25C)
- **Hydra-Vac** (Potholing and Utility Daylighting)

1.4 Optimized In-Situ Remediation Design Support:

- **ISCO, ISCR, and ISBR Injections** – Low & High Volume Applications, Liquids, & Slurries
- **Clean-Inject Remediation System & Surgical Injection Tooling**
- **Environmental Hydraulic Fracturing:** Treatment Injections and SVE Systems.
- **Remedial Design Characterization (RDC)** Support Services
- **Collaborative** Treatment Selection and Design.
- **Optimized and Adaptive Field Applications**
- **Approved Installer** for all types of in-situ remediation products.

1.5 Specialized Laboratory Services: (Through our Partners)

- **Certified Mobile Laboratories**
- **TO-17 VOC analysis** of Sorbent Tubes for low level Air or Soil Gas
- **Passive Soil Gas Analysis** of VOCs (TO-17/8260)

2 SAFETY TRAINING AND OTHER PROGRAMS

2.1 General Company and Staff Qualifications

- Corporate and staff experienced since 1986
- Operated the first Direct Push, Mobile Laboratory Environmental and In-Situ Injection Services in the Rocky Mountain Region.
- Previously Operated as or DBA: Direct Geochemical, Global Environmental Consultants Inc., TEG Rocky Mountain, ESN Rocky Mountain.
- Small Business Enterprise classification under NAICS #562910
- Denver Certified Small Business Enterprise (SBE)
- All Field Staff are OSHA 1910.120 HAZWOPER 40HR certified
- Medical Monitoring compliant with OSHA 1910.120 HAZWOPER 40HR certified
- Respirator Fitness and Fit Testing compliant with OSHA 1910.134
- Fully compliant with all US-DOT regulations,
- Most staff and rig operators hold a Class A CDL.
- USDOT# 1725329
- USDOT Medical Clearance 29 CFR 391.41 - 391.49
- Comprehensive 3rd party (DISA) Drug and Alcohol Testing Program
- Background checks and annual MVR Review



2.2 3rd Party Auditing Services & Memberships

- PICS
- ISNetworld
- Avetta
- NCMS
- DISA (drug and alcohol)
- Gold Shovel Standard Certified



2.3 Training Programs

- Vista H&S Plan & Program Orientation
- Driller Safety Plan
- PEC (SafeLand, SafeGulf) Certification
- Loss Prevention System (LPS) Certification
- DISA Drug & Alcohol Supervisor Training
- Class A Commercial Driver's License, FMCSA training
- USDOT/TSI Driver's Guide to Hours of Service
- USDOT/TSI Driver's Guide to Inspection Requirements
- Various Railroad Training
- Forklift Safety
- Hearing Conservation
- Personal Protective Equipment (PPE)
- Hazard Communication
- Confined Space Awareness
- First Aid, Bloodborne Pathogens
- Asbestos Awareness



3 LICENSES, CERTIFICATIONS, MEMBERSHIPS

3.1 Professional Geologists

John Fontana, President & CEO, is an AIPG Certified Professional Geologist (CPG) and NGWA Certified Well Driller.



3.2 Drilling Licenses/Bonds

- Nebraska #39414 (driller & pump installer)
- Kansas #727
- South Dakota #718,
- Oklahoma DPC-#0788, OP-#1758
- New Mexico WD-#1790
- Texas #55014M
- Utah #



3.3 City Contractor Licenses/Bonds

Vista holds numerous local city and county licenses for work in right of way areas.

3.4 Member RPI Group

Vista GeoScience is an Approved Installer of BOS200®, BOS 100®, and Trap & Treat® Remediation Products.



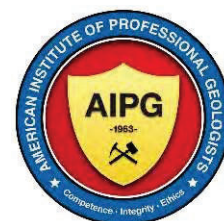
3.5 Interstate Technology Regulatory Council (ITRC)

Industry Affiliate Partner and Guidance Document Participant



3.6 Remediation Patents; U.S. Patent No's 5570973, 5626437, 5773067

Where hydraulic fracturing is required for emplacement of treatments in tight soils or bedrock formations, the referenced patents may apply. Vista GeoScience holds a master licensed to hydraulic fracturing services for in-situ remediation and can legally indemnify the site owner and prime contractors against any legal action regarding these patents. At the current time, Vista GeoScience is the only licensed holder of this patent in the region. A copy of the license and patent documents is available upon request.



4 INSURANCE

Vista maintains \$6,000,000 coverage in General, Pollution and Professional, Liability Insurance. Sample certificates are attached upon request and will be mailed, faxed or e-mailed directly to the client or site owner from our insurance company as requested.

5 KEY TECHNICAL STAFF SUMMARY

Vista maintains a diverse, well qualified trained staff of scientists, professional geologists, engineers, and technicians, including several veterans with previous military experience. Following is a list of senior and key staff in Vista's environmental field services division along with a brief resume of their related experience:

5.1 John Fontana, CPG, CWD, President & CEO

John is an AIPG Certified Professional Geologist and NGWA Certified Well Driller with over 35 years of experience, and over 25 years of experience in the operations and management of environmental soil and ground water investigation and in situ remediation services. John manages the largest fleet of Geoprobe® drilling rigs, HRSC, and custom remedial injection equipment in the Rocky Mountain region and was among the first to implement these technologies in the region. He oversees the development of new methods, tools and procedures for the application of site investigation and in-situ remediation technologies while assisting with the design of complex remediation projects. He has authored over 100 presentations and papers on these subjects including presenting full day workshops at the Battelle International Conferences on Remediation of Chlorinated and Recalcitrant Compounds. He is also experienced in HRSC log interpretation, statistical analysis of environmental and geochemical data including forensic and fingerprinting techniques, and 3D data modeling and visualization techniques. John has also been served as an expert witness in cases involving fugitive migration of natural gas and was recently appointed to serve as a member of EPA's Science Advisory Board (SAB) - Hydraulic Fracturing Research Advisory Panel. As an active member on two ITRC teams, he contributed to writing guidance on Implementing Advance Site Characterization Technologies and In-Situ Remediation Injection Strategies.



Education: BS Geology, Oceanography & Physics, Humboldt State University, Arcata, CA, 1981.

Professional Certifications & Licenses:

- AIPG Certified Professional Geologist CPG #11985
- NGWA Certified Well Driller CWD #122070
- Authorized Individual for installing monitoring wells and test holes in the State of Colorado.
- Licensed water well driller in: Kansas (#727), Nebraska (#39414), New Mexico (WD-1790), Oklahoma (DPC #0788, OP #1758), South Dakota (#718), Utah (#923).

Safety Training & Certificates:

- Geoprobe Direct Imaging System Training (MIP, HPT, MiHpt, LL-MIP, EC, OIP, etc.)
- OSHA HAZWOPER 40 hour, 8 hour refresher, Supervisor training
- PEC Basic Orientation, Loss Prevention System (LPS) Certification, H₂S, CPR & First Aid

Previous Experience:

- ESN Rocky Mountain (TEG Rocky Mountain); Vice President; 1996-2006
- Direct Geochemical Inc.; President - Geochemist 1986-1996
- Detex/GC Company; Geologist and Analytical Geochemist, 1984-1986
- Analox & GX Consultants; Consulting Geologist, Mudlogger 1981-1984

Professional Affiliations

- American Institute of Professional Geologists (AIPG)
- American Assoc. of Petroleum Geologist (AAPG); Div. of Environmental Geosciences Charter Member & Energy Minerals Div. Member
- Colorado Hazardous Waste Management Society (CHWMS) (served as President, Treasurer)
- Colorado Ground Water Assoc. (CGWA)
- Colorado Water Well Contractors Assoc. (CWWCA)
- National Ground Water Assoc. (NGWA) Assoc. of Ground Water Scientist & Engineers Div.
- Rocky Mountain Assoc. of Geologist (RMAG)
- Rocky Mountain Assoc. of Environmental Professionals (RMAEP)
- Solid Waste Assoc. of North America (SWANA) (Rocky Mountain Chapter)
- Society of American Military Engineers (SAME) (Denver Metro Post)
- American Assoc. of Petroleum Geochemical Explorationists, Former Secretary and Treasurer

5.2 Peter Wethington – Field Operations Manager; Remediation Specialist, Subsurface Imaging Specialist, Environmental Engineering Geologist

Peter joined Vista GeoScience after graduating from the Colorado School of Mines with a B.S. in Geological Engineering in the spring of 2017. During his time here, Peter has become highly specialized in the design and implementation of remediation injections. He gained extensive hands-on experience and in-depth knowledge of Subsurface Imaging Systems, Direct Push and Auger drilling, well installations, and brings dynamic teamwork when it comes to assessing projects. Peter is a highly skilled mechanic making it essential to keeping projects on their forecasted timelines. He is able to reduce any unforeseen drilling system downtimes by overseeing proper maintenance of equipment and is reliably skilled when it comes to 'on-the-fly' field fixes. In addition to his exceptional service in the field, he manages Vista's field operations, interprets data to create site specific designs and project summary reports, while promoting client-based teamwork from proposal phase to closure.



Education: BS Geological Engineering, Colorado School of Mines, Golden, CO

Certifications and Safety Training

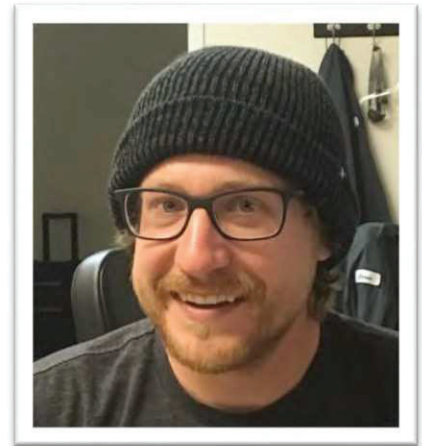
- OSHA HAZWOPER 40 and 8 hour
- CPR and First Aid
- H2S awareness
- PEC Basic Orientation, Safeland, Safegulf
- Loss Prevention System (LPS) Certification
- Kinder Morgan safety training
- BNSF contractor, Railroad Security Awareness
- Roadway worker protection
- Fork lift safety/operation training
- Class A Commercial Driver's License
- Railroad Contractor Safety training for all North American railways
- Gold Shovel Certification
- Fork lift safety/operation training

Field Experience

- In-Situ injection of Slurries, Oxidants, and Biologic Reagents, DHC and many more
- Geoprobe Direct Imaging System Experience (MIP, HPT, MiHpt, LL-MIP, EC, OIP, etc.),
- Direct-Push Drilling, Hollow Stem Auger Drilling
- Hydro-Vac Utility Clearance
- Dual-Tube Coring & Soil Sampling
- Discrete groundwater sampling using Screen-Point Samplers
- Monitoring well installation/abandonment
- Soil Gas Sampling, Sub-slab, Tier-2 Landfill Surveys
- Hydraulic Fracturing and Permeability Enhancement

5.3 Theodore Stockwell – Field Operations Manager; Environmental Geologist/Direct Imaging Specialist

Ted Stockwell arrived at Vista Geoscience in 2016 bringing previous experience as a Wellsite Geologist, Geospatial Operator, and has brought remarkable skills and knowledge in Geotechnical Engineering. Since joining Vista Geoscience, Ted has become highly proficient at operating our High Resolution Site Characterization systems, Direct Push drilling services, Solid and Hollow Stem Augering, Soil Gas Sampling services, and Remedial In Situ Injection projects. Having completed numerous Phase II Landfill sampling projects in ID, MT, WY, CO, AR, TX and NM, Ted is highly experienced in sampling landfills in unique geographical conditions. He has not only led injection events utilizing different pumps with a variety of remediation products, but has also led multiple HRSC (MiHPT, MIP, OIP) projects. Ted's intense knowledge on and off the field now lends support in team building efforts with clients through project planning, project oversight, and client satisfaction with overall jobs.



Education: BS Cum Laude Geology; Northern Illinois University, DeKalb, IL

Geoprobe Direct Image Training - Certified On:

- Membrane Interface Probe (MIP), Low Level MIP, MiHpt Combined Tool
- Hydraulic Profiling Tool (HPT), Electrical Conductivity (EC),
- Optical Image Profiler (OiHPT-UV) (LNAPL Fluorescence Tool)
- FID, PID and XSD Detectors, Instrumentation and Tool Troubleshooting

Certifications and Safety Training

- Class A Commercial Driver's License
- OSHA HAZWOPER 40
- PEC Basic Orientation, Safeland, Safegulf
- Loss Prevention System (LPS) Certification
- ISNetworkworld Kinder Morgan safety training
- Site Supervisor Training
- H2S awareness
- Class A CDL
- CPR and First Aid
- Gold Shovel Certification
- Fork lift safety/operation training

Field Experience

- Direct-Push Drilling, Hollow Stem Auger Drilling
- Hydro-Vac Utility Clearance
- Dual-Tube Coring & Soil Sampling
- Discrete groundwater sampling using Screen-Point Samplers
- Monitoring well installation/abandonment
- Soil Gas Sampling, Sub-slab, Tier-2 Landfill Surveys,
- Hi-Resolution Site Characterization (OiHPT, MiHPT, LL-MiHPT, HPT/EC)
- In-Situ injection of Slurries, Oxidants, and Biologic Reagents, DHC

5.4 David Fontana – Environmental Scientist, Direct Imaging Specialist, H&S Proctor

Mr. Fontana has been working with Vista GeoScience since his graduation from Colorado State University, where he studied Biological Sciences. While working with Vista GeoScience, he has become highly proficient in Direct-Push Drilling and Auger technologies including soil, groundwater and soil gas sampling technologies, . In-Situ remediation technologies and techniques, and has successfully completed remediation projects utilizing PersulfOX, Advanced Oxygen Release Compound (ORC-Advanced), BOS 200, Emulsified Vegetable Oil (EVO), and 3DME, among others. Mr. Fontana is also experienced and certified with Geoprobe Direct Imaging technologies including the Membrane Interface Probe, Optical Image Profiler, Hydraulic Profile Tool, and Electrical Conductivity, Macro Core, and Dual Tube sampling technologies. As Vista GeoSciences' Health and Safety Proctor, Mr. Fontana is familiar with all MSDS's for the products and chemicals that Vista GeoScience uses, and is also aware of other products offered by our remediation vendors. As a Field Service Technician, he also has valuable experience in well installation and abandonment, and is one of Vista Geoscience's most experienced Tier II Landfill Gas Sampling Technicians.



Education: BS Biological Sciences, Colorado State University, Fort Collins, CO

Geoprobe Direct Image Training - Certified On:

- Membrane Interface Probe (MIP), Low Level MIP, MiHpt Combined Tool
- Hydraulic Profiling Tool (HPT), Electrical Conductivity (EC),
- Optical Image Profiler (OiHPT-UV) (LNAPL Fluorescence Tool)
- FID, PID and XSD Detectors, Instrumentation and Tool Troubleshooting

Safety Training & Certificates:

- Class A CDL with Tanker Endorsement
- OSHA HAZWOPER 40 hour, 8 hour refresher, Supervisor training
- CPR and First Aid trained and certified
- PEC Basic Orientation, Safeland, Safegulf
- ISNetwork Kinder Morgan safety training
- Loss Prevention System (LPS) Certification
- Forklift Operator Certified
- GeoProbe Operator Training
- Railroad contractor safety training for all North American railways

Field Experience

- Direct-Push Drilling, Hollow Stem Auger Drilling
- Hydro-Vac Utility Clearance
- Dual-Tube Coring & Soil Sampling
- Discrete groundwater sampling using Screen-Point Samplers
- Monitoring well installation/abandonment
- Soil Gas Sampling, Sub-slab, Tier-2 Landfill Surveys,
- Hi-Resolution Site Characterization (OiHPT, MiHPT, LL-MiHPT, HPT/EC)
- In-Situ injection of Slurries, Oxidants, and Biologic Reagents, DHC

6 IN-SITU REMEDIATION TECHNOLOGIES OVERVIEW

An Experienced Provider

Due to the recent invention of many in-situ treatment chemicals and bio-amendments, *In-Situ Remediation* methods have replaced Ex-Situ methods at many sites. These methods include *In-Situ Chemical Oxidation (ISCO)*, *In-Situ Chemical Reduction (ISCR)*, *In-Situ Bio-Remediation (ISBR)*, *Surfactant Flushing*, or a combination of multiple methods. Vista GeoScience conducted the first chemical injections in the Rocky Mountain region in the early 1990's and has conducted in-situ projects from coast to coast ever since. Most recently, Vista acquired the *Clean-Inject®* mixing and injection system which has improved slurry reagent injections in most types of lithology with precise high-pressure placement, greatly increasing the effectiveness of all in-situ treatments. Working closely with our clients and vendors, we also provide expertise in characterizing the site specifically for in-situ remediation and design of the remediation program.



Vista does not sell or endorse any specific remediation product, but is experienced with the delivery and injection of all types of products and the different systems required to apply them including: *activated carbon, persulfates, permanganates, oxygen supplements, emulsified oils, lactates, nutrients, peroxides, iron (ZVI) slurries, and bacteria augmentation*, just to name a few.



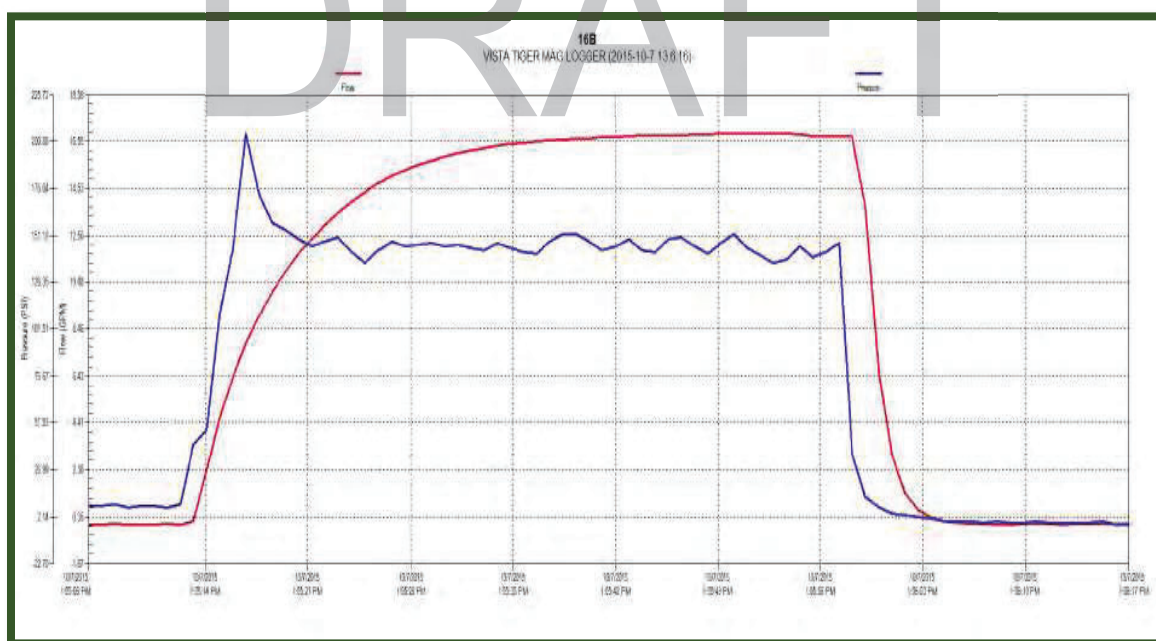
Custom Mixing, Pumping, and Delivery Systems

Vista found out early on in the injection business that a wide variety of product types and site conditions requires a wide variety of injection system designs. Pump and mixing system design vary greatly depending on the volume required, injection pressures, corrosivity or reactivity of the product, viscosity, etc. Therefore, we offer many types of pumps with pressure ratings ranging from 150 to 2000psi, and flow rates from 2 to 50 gallons per minute. Any number of portable mixing tanks can be arranged on support trucks and trailers, or setup on the site itself, depending on the access and logistical requirements at a given site. Our systems are designed to be flexible and can accommodate the varied site conditions and access issues we may encounter.

Vista has re-designed injection tooling and application methods resulting in improved vertical and lateral distribution of the treatment compounds, resulting in better contact with the contaminants. It's a Contact Sport! A wide variety of Direct-Push Technology (DPT) delivery systems are available to inject at depths up to 150'. In tight soils or bedrock formations where hydraulic fracturing is required, we use DPT or open boreholes with Straddle-Packer Technologies and *hold a license to provide these patented methods*. Our experienced staff can advise you on the advantages of *Bottom-Up or Top-Down methods*, helping to determine which will provide the best product contact and what parameters are critical to the success of the application. In cases where re-injection is anticipated, we may also recommend installing *permanent injection wells*, discrete or nested, PVC or steel construction.



Real-Time Pressure and Flow monitoring instruments are included on all injection systems to monitor performance and subsurface behaviors of the injection.



7 CLEAN-INJECT™ REMEDIATION SYSTEMS

Self-Contained Slurry Mixing and High Pressure Injection System



Our **Clean-Inject® System** provides a self-contained powerful mixing and injection system for many types of powdered reagents, such as activated carbons, oxidants, and other materials that require suspended slurry and precise injection methods in order to optimize their performance. Super sacks of reagents can be used and are pumped directly into the mixing tank eliminating unnecessary exposure to personnel and the surrounding property.

When combined with our **Surgical Injection Tooling**, this cost saving system allows precise placement of most slurry material at narrow depth intervals. High pressure and high flow rate pumps can overcome formations of all types from tight clays and claystone bedrocks to loose unconsolidated sands and gravels that are common problems for other types of pumping systems typically used for slurries. The injection tooling and methods have also been optimized to reduce surfacing, keeping material in the contaminated and saturated formation where it is needed.



Clean Inject System Specifications

Injection flow rate	Up to 35 gallons per minute
Injection pressure	Up to 1,200 psi
Pump type	5 diaphragm, positive displacement
Injection pump horsepower required	30 hp, variable frequency drive; 0-1150 rpm
Pump compatibility	Stainless steel with Viton diaphragms
Blended injectate measuring	Float system
Mixing tank	200 to 300 gallons, stainless steel
Bulk carbon handling	1,000 lb. super sacks
Powder weighing system	Load cell, 5000 lb. capacity, 0.1 lb. accuracy
Mixing tank additive provisions	18" manway + liquid additive (oxidizers, nutrients)
On-board fresh water storage	500 gallon
Fresh water transfer rate	50 – 80 gpm
Fresh water inlet	3/4" threaded water supply or 2" camlock
Fresh water filtration	Y strainer, mesh straining element
Bulk powder transfer system	Double diaphragm
Dust suppression system	Clean-Inject® proprietary e-tvne passive vent
Water supply requirements	≥ 10 gpm (recommended)
Power requirements	70 kva, 460 volt, 3-phase
On-board compressed air supply	7.5-10 hp screw or reciprocating compressor
On-board fresh water wash down	50-80 gpm
Operating environment	All conditions: rain, freezing, wind, snow

With top-down injection methods, the amount of material injected can be varied by as tight as one foot intervals from the top of the contaminated interval to the bottom utilizing expensive reagents more efficiently and ensuring their effectiveness. Combined with better Remedial Design Characterization (RDC) and best the practices, treatment placement and coverage is now Optimized.

8 HYDRAULIC FRACTURING REMEDIATION

U.S. Patents 5570973, 5626437, 5773067

Why would I need Hydraulic Fracturing?

Are you having trouble reaching your clean-up levels? Are tight soils/bedrock causing poor air sparging (AS), or are soil vapor extraction (SVE) results prohibiting closure? Is inadequate contact and retention time between remedial fluids and contaminants slowing the closure process at your sites? Then *hydraulic fracturing* may be the technology for your site.

Hydraulic fracturing is a proven and patented technology where combinations of slurried proppants, chemical treatments, or bio-amended solutions are injected into tight soils and bedrock under high pressures for the purpose of creating fractures. Creation of such fractures increases permeability, enhances the distribution and contact of remedial solutions, and is used extensively for In-Situ Chemical Oxidation (ISCO), Chemical Reduction (ISCR), and Bio-Remediation (ISBR), and SVE applications. Once created, the fractures are held open with a variety of proppants such as sand or a more porous synthetic material which also act as a host for various bacteria.

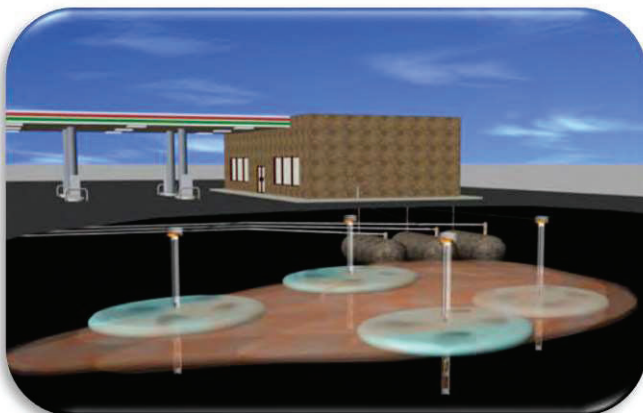


Vista GeoScience staff was the first in the Rocky Mountain area to provide hydraulic fracturing services in the 1990s, and currently holds a license to hydraulically emplace fractures for remediation. Vista is experienced at injecting a wide variety of products into these fractures, including permanganates, chemical oxygen enhancers, lactates, peroxides, ZVI-slurries, EVO-emulsions, and bacteria suspensions.

Customized Fracturing Equipment & Real-Time Monitoring Systems

Different geology, contaminants, and treatment solutions require a wide variety of fracturing and proppant injection system design. Depending on these variables, Vista implements various fracture techniques, and utilizes progressive cavity pumps, piston pumps, diaphragm pumps, and mixing systems.

Vista offers real-time monitoring during the creation of each fracture. Our system allows the engineer the ability to map and control propagation of the fracture while simultaneously plotting the fracture position with time. This is especially critical when fractures are emplaced underneath residential/commercial sites and where determination of effective ROIs is necessary for full-scale remedial designs and regulatory concurrence.



9 DIRECT-PUSH TECHNOLOGIES

9.1 Dual-Technology Direct Push & Auger Combination Rigs

- **Geoprobe** (7822DT, 7730DT, 7720DT, 6610DT)
- **High-Tech, High Frequency DPT hammers**
- **150' Sampling Depths**
- **48,000 lbs of pull-back**
- **4,000 ft-lb Augers**
- **Small foot-print with large capabilities**
- **Heavy Duty DPT push-rod, 1.5"–3.5"**
- **Hollow Stem Auger 3.25" - 4.25" ID**
- **Solid Stem Auger 3.5" - 4.5"**
- **Angle Drilling up to 45 degrees**



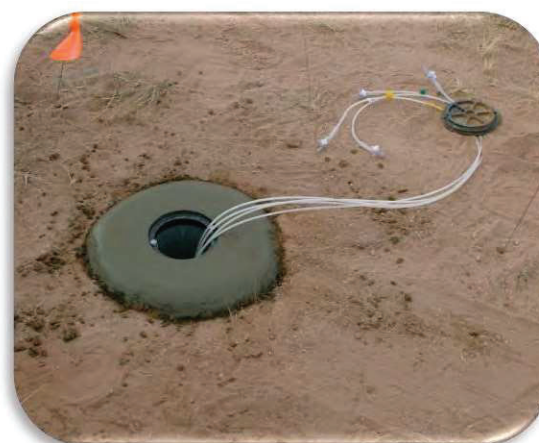
9.2 Limited Access & Medium Duty DPT Rigs

- **Track Mounted Rigs, Geoprobe 54DT**
- **Dolly Mounted** for tight indoor areas & horizontal drilling
- **Ideal for soil gas, shallow sampling, tight access areas, or inside buildings/basements**



9.3 Specialized Tooling & Applications

- **Ground Water: Grab, Discrete, and Profiling**
- **Soil Coring: Dual-Tube Cased Continuous & Discrete coring, up to 2.6" diameter core**
- **Soil Gas: Post-Run Tubing (PRT), Vertical Profiling**
- **Nested Vapor Wells: (Up to 150')**
- **Monitoring Wells: Install 0.5" to 2.0" monitoring, SVE, soil gas, discrete or nested**
- **Pre-Packed Well Screens: 0.5" to 2"**
- **Injection Tooling: Top-Down Surgical Injections**
- **Packers for Hydraulic-Fracturing/Injection**
- **High Pressure/High Flow Pumps**



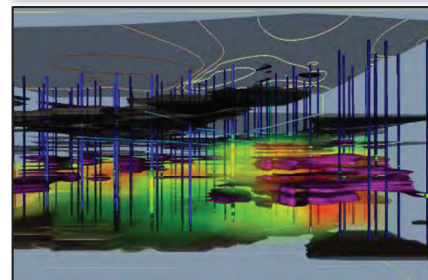
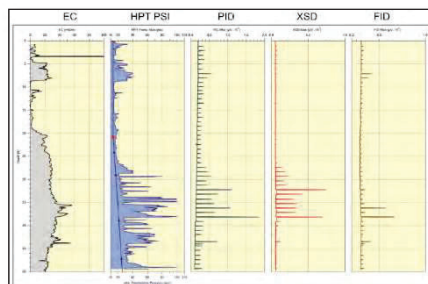
9.4 In-Situ Measurements

- **Membrane Interface Probe (MIP/MiHPT)**
- **Optical Image Profiler (OIP-UV and OIP-G)**
- **Tier-2 Landfill Testing: NMOC Soil Gas**
- **Cone Penetrometer**
- **Natural Gamma Ray: SlimLine™ tool**
- **Portable GCs or Field Instrumentation**
- **Real-Time Soil Gas Testing**

10 HIGH-RESOLUTION SITE CHARACTERIZATION (HRSC)

Vista GeoScience owns the latest versions Geoprobe Direct Imaging® Tooling and Software systems to provide the most advanced High Resolution Site Characterization (HRSC) technologies which is operated by our Geoprobe trained and certified specialists. This allows your field scientists to collect extremely high-resolution contaminant, lithologic and hydrostratigraphic data real time in the field for real time TRIAD decision making. In addition to mapping in 3-D the contaminant distribution, you also gain valuable information on flow zones, aquitards and other soil characteristics. We follow all QA/QC in the data acquisition process according to the Geoprobe SOP and ASTM methods. The following tools are available for your HRSC project:

- **OIP-UV and OIP-G** - Optical Image Profiler locates free phase petroleum NAPL fluorescence. This tool has a similar response to Dakota LIF/UVOST and LIF/TarGOST, but is now integrated with the HPT and EC.
- **MIP** - Membrane Interface Probe locates dissolved and sorbed mass VOCs. Vapors are analyzed on three stable and selective laboratory instrument grade detectors – PID, FID and XSD in a GC custom built for the MIP system.
- **LL-MIP** - Low Level Membrane Interface Probe increases the sensitivity of VOCs detected by at least a factor of 10x, getting you down into the ppb range of detection limits.
- **HPT** - Hydraulic Profiling Tool measures pressure and flow to obtain permeability characteristics and estimated hydraulic conductivity (K).
- **HPT-GWP & HPT-GWS** - Hydraulic Profiling Tool combined with discrete groundwater sampling capability.
- **EC** - Electrical Conductivity Dipole, integrated with all of the above tools, for soil lithology and grain size characteristics.
- **MiHPT** - Combined MIP + HPT Tools with EC.
- **OiHPT** - Combined OIP + HPT Tools with EC.
- **3D Visualization and Conceptual Site Models (CSM)** - Integration of HRSC data with other site data into impressive 3D visualization models to improve CSMs and remediation design.



For more details on HRSC – ask for our HRSC Tool Overview document.

11 LANDFILL GAS TESTING FOR THE SOLID WASTE INDUSTRY

Vista GeoScience has over 20 years' experience conducting Tier-II landfill gas surveys at Class II/III Solid Waste Facility and SWMUs across the United States. We developed and perfected the tooling and methods required to sample and analyze NMOCs by EPA Method 25C (40-CFR60). Key staff has more than 30 years' experience in sampling, soil gas testing, remediation, and laboratory analysis. Our expertise includes mapping and analysis of stray and fugitive gas in soil gas and ground water.



Gas and Leak Detection Methods



- Expert Tier-II (Method 25C) Landfill NMOC Gas Testing
- Proprietary SOPs for Tier-II and Soil Gas Testing
- Geoprobe® Direct-Push Track Rigs for Better Access
- MiHPT to Map Subsurface Methane Migration Pathways
- Active Soil Gas Sampling and Monitoring Point Installation
- Multi-Level Nested Soil Gas Monitoring Wells to 150'
- Passive Soil Gas Surveys
- Surface Leak Detection with Pedestrian FID-PID Surveys
- Soil Gas Flux Measurements - Fugitive & Stray Gas Mapping
- Interpretation & Analysis of Isotopic Gas Composition

Measuring soil gas and ambient air emissions of natural gas, hydrocarbons, solvents, and fixed gases has been a major focus at Vista GeoScience by its staff for over 30 years. Vista has developed many unique sampling and analytical solutions to gas migration, seepage, leakage, and analysis problems. Projects include the Municipal Waste, Oil and Gas Extraction, Mineral Extraction, Gas Pipeline, Landfill, Utility, Remediation, and Real Estate Development industries.

Unique Expertise



12 HIGH RESOLUTION SOIL GAS SAMPLING

Soil Gas Sorbent Tube / TO-17 Method Overview

Traditional soil gas screening methods typically utilize various containers such as Tedlar® bags, disposable syringes, etc., and rely on direct injection into a GC or, at best, injection of a larger sample into a standard purge and trap unit designed for soil and water analysis. These methods generally have reporting limits well above indoor air screening or action levels. Vista GeoScience has developed a soil gas sampling method, based on EPA Methods TO-17 and SW846-8260, using multi-bed sorbent tubes similar to those designed for use indoor air analysis. These sorbent tubes contain multiple packed layers of adsorbent materials that are designed to adsorb compounds over a wide range of boiling points. The main advantage is that larger volumes of air or soil gas can be pumped through the tube concentrating the analyses resulting in lower detection limits.



The sorbent tubes are thermally activated, batch tested, and sealed with brass swage-lock fittings prior to shipment to the field. The tubes remain sealed until readied for sampling, as the activated adsorbents will readily adsorb trace amounts of VOCs from the ambient air, and are quickly re-sealed after sampling is completed. As a control, unused and unopened sorbent tubes are preserved as trip blanks.

After the samples are collected on the sorbent tubes, they are shipped to the laboratory where they are loaded onto an automatic thermal desorption (ATD) unit that is connected to a GC/MS and configured to run EPA Methods TO-17 and SW846-8260. Method EPA Method TO-17 is the air VOC method equivalent to EPA Method SW846-8260, which is for water and solid wastes. This method is up to 1,000 times or more sensitive in detecting compounds of interest than conventional soil gas sampling

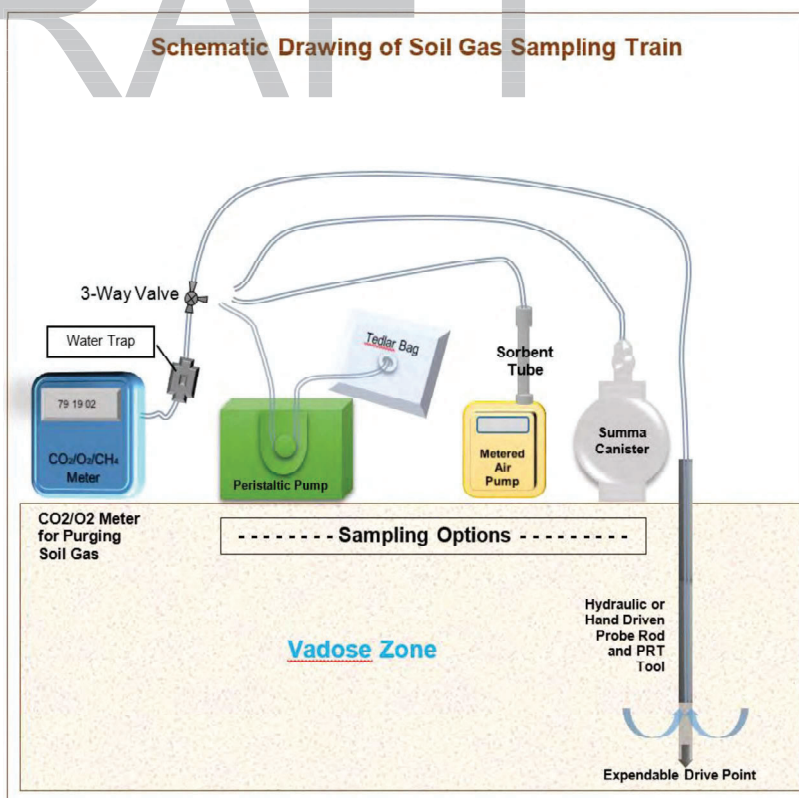


and analysis methods. The detection limit is lowered by simply concentrating a larger volume on the sorbent tube. Indoor air screening and action levels can be achieved for most compounds that may have previously gone undetected in other soil gas surveys. The VOC compounds are desorbed from the tubes at high temperature and are concentrated onto a “cold trap,” then desorbed again onto the GC/MS for separation and analysis of up to 70 target compounds by EPA SW846 method TO-17/8260B. The results are reported in nanograms (ng), and the reporting limit (RL) for

individual VOCs is 5 ng for all the compounds in the target list. The lowest calibration point is set at 5 ng which sets the official method reporting limit. However, values detected between 1 and 5 ng are also reported and flagged as estimated if deemed reliable detections on the GC/MS by the analytical chemist. These low estimated values can be useful for mapping the trends or detecting deeper or low concentration contaminant plumes. Detections below 1 ng are rejected and not reported. The volume collected on the sorbent tube determines the reporting limit concentration. For example, if 1 liter of air/soil gas is collected on a tube, the reporting limit is 5 ng/L of air, or 5 $\mu\text{g}/\text{m}^3$ of air. Trip blanks, pre-shipment blank checks, method blanks, surrogates, and spikes are run according to the method specifications.

Soil gas samples are collected using Vista GeoScience SOP NFSV101 “Standard Operating Procedure for Active Soil Gas Vapor Sampling Using Direct Push Probe and Post-Run Tubing (PRT) Adapter”. After driving the PRT tool, with an expendable drive-point, to the target sample depth, the probe rod is retracted to drop the drive point and expose the formation. (see Figure 1.) A Teflon® lined tube and threaded adaptor is inserted into the rod and is threaded into the PRT tool at the bottom of the hole. This tubing is then connected to a portable gas meter (Landtech GEM2000) to measure CO_2 , O_2 , and CH_4 during purging. At least 3 system volumes are removed and purging continues until CO_2 and O_2 readings are stable, indicating that ambient air in the system has been removed and only soil gas was entering the sampling system. At that point, the flow is switched over to the sampling apparatus where the soil gas is pulled through the loaded sorbent tube using a vacuum pump. The flow rate and volume is monitored with a flow meter and kept below 200cc/minute. After 1 liter of soil gas has flowed through the sorbent tube, the flow is shut off and the sorbent tube is removed, immediately resealed and tagged with the sample ID. All of the meter and flow parameters are recorded on a sampling log form.

A Thermo Foxboro-TVA1000B FID-PID vapor meter can also be used to screen the soil gas. The FID (Flame Ionization Detector) responds to all hydrocarbons, including methane. The PID (Photo Ionization Detector) responds selectively to aromatics, alkene hydrocarbons, and solvents and is less sensitive to alkane compounds.



Typical Soil Gas Sampling Train

Specification Sheet

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**OXYGEN
RELEASE
COMPOUND**

ORC Advanced® Technical Description

ORC Advanced® is an engineered, oxygen release compound designed specifically for enhanced, *in situ* aerobic bioremediation of petroleum hydrocarbons in groundwater and saturated soils. Upon contact with groundwater, this calcium oxyhydroxide-based material becomes hydrated producing a controlled release of molecular oxygen (17% by weight) for periods of up to 12 months on a single application.

ORC Advanced decreases time to site closure and accelerates degradation rates up to 100 times faster than natural degradation rates. A single ORC Advanced application can support aerobic biodegradation for up to 12 months with minimal site disturbance, no permanent or emplaced above ground equipment, piping, tanks, power sources, etc are needed. There is no operation or maintenance required. ORC Advanced provides lower costs, greater efficiency and reliability compared to engineered mechanical systems, oxygen emitters and bubblers.



Example of ORC Advanced

ORC Advanced provides remediation practitioners with a significantly faster and highly effective means of treating petroleum contaminated sites. Petroleum hydrocarbon contamination is often associated with retail petroleum service stations resulting from leaking underground storage tanks, piping and dispensers. As a result, ORC Advanced technology and applications have been tailored around the remediation needs of the retail petroleum industry and include: tank pit excavations, amending and mixing with backfill, direct-injection, bore-hole backfill, ORC Advanced Pellets for waterless and dustless application, combined ISCO and bioremediation applications, etc.

For a list of treatable contaminants with the use of ORC Advanced, view the [Range of Treatable Contaminants Guide](#)

Chemical Composition

- Calcium hydroxide oxide
- Calcium hydroxide
- Monopotassium phosphate
- Dipotassium phosphate

Properties

- Physical state: Solid
- Form: Powder
- Odor: Odorless
- Color: White to pale yellow
- pH: 12.5 (3% suspension/water)



**OXYGEN
RELEASE
COMPOUND**

ORC Advanced® Technical Description

Storage and Handling Guidelines

Storage

- Store in a cool, dry place out of direct sunlight
- Store in original tightly closed container
- Store in a well-ventilated place
- Do not store near combustible materials
- Store away from incompatible materials
- Provide appropriate exhaust ventilation in places where dust is formed

Handling

- Minimize dust generation and accumulation
- Keep away from heat
- Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces
- Observe good industrial hygiene practices
- Take precaution to avoid mixing with combustibles
- Keep away from clothing and other combustible materials
- Avoid contact with water and moisture
- Avoid contact with eyes, skin, and clothing
- Avoid prolonged exposure
- Wear appropriate personal protective equipment

Applications

- Slurry mixture direct-push injection through hollow rods or direct-placement into boreholes
- *In situ* or *ex situ* slurry mixture into contaminated backfill or contaminated soils in general
- Slurry mixture injections in conjunction with chemical oxidants like RegenOx or PersulfOx
- Filter sock applications in groundwater for highly localized treatment
- *Ex situ* biopiles

Health and Safety

Wash thoroughly after handling. Wear protective gloves, eye protection, and face protection. Please review the [ORC Advanced Safety Data Sheet](#) for additional storage, usage, and handling requirements.



www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

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Appendix B
Field Form

Amendment Injection Field Sheet

Page ____ of ____

Project Name:		Date:
Project No.:		Contractor:
Injection Type: Well <input type="checkbox"/> Direct push <input type="checkbox"/> Other <input type="checkbox"/>		Well ID:
Injection product:		
Static Water Level:	Observation Wells:	

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Notes:



**Daniel B. Stephens
& Associates, Inc.**