3R - 439

REPORT & WORK PLAN

04 / 16 / 2012

3R-439

Enterprise Products

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April 16, 2012

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7010 1870 0001 2945 3361

Mr. Glenn von Gonten, Senior Hydrologist
Environmental Bureau
ENMRD/Oil Conservation Division
1220 South St. Francis Drive
Santa Fe, NM 87505

RE: ***Limited Site Investigation & Corrective Action Work Plan***
K-17/K-Loop Pipeline Release Site
Enterprise Field Services, LLC
Section 23, Township 27 North, Range 8 West
San Juan County, New Mexico

Dear Mr. von Gonten,

Enterprise Field Services, LLC (Enterprise) is submitting the enclosed report entitled: *Limited Site Investigation & Corrective Action Work Plan*, dated April 4, 2012, for the above-referenced site. A condensate release occurred at a pigging station at this location during March 2010. During excavation of soils affected by this release, it was noted that deeper soils had apparently been affected by historical releases at the location. An initial investigation conducted by LT Environmental during June 2010 indicated soil impacts to a depth of approximately 20 feet below grade. This information has been summarized in the enclosed report.

Enterprise conducted a limited site investigation at the site during March 2012 to determine if groundwater impacts were present. A total of four soil borings and temporary monitor wells were installed during this investigation. Soil and groundwater samples obtained at one location, TSW-11, exceeded applicable OCD *Remediation Action Levels* for soils, and Water Quality Control Commission (WQCC) *Groundwater Quality Standards* for groundwater, respectively. Enterprise has not been able to verify if the original release was reported to the OCD. Therefore, an OCD Form C-141 was submitted to the OCD on April 11, 2012 to provide notification of the apparent groundwater impact. Due to the low groundwater benzene concentration (25 µg/L at TSW-11), additional groundwater samples will be obtained from a properly constructed monitor well to verify if the applicable OCD benzene groundwater standard (10 µg/L) has been exceeded.

The enclosed report presents these findings and provides recommendations for the installation of permanent monitor wells and limited remedial actions. If the OCD has no comments regarding the enclosed *Limited Site Investigation & Corrective Action Work Plan*, Enterprise will schedule the proposed work tasks.

P. O. BOX 4324
HOUSTON, TX 77210-4324
713.381.6500

1100 LOUISIANA STREET
HOUSTON, TX 77002-5227
www.epplp.com

If you have any questions regarding the site, or our proposed actions, please do not hesitate to contact me at (713) 381-2286, or via email at: drsmith@eprod.com.

Sincerely,

David R. Smith, P.G.
Sr. Environmental Scientist

Rodney M. Sartor, REM
Manager, Remediation

/dep
Enclosure - *Limited Site Investigation & Corrective Action Work Plan*

cc: Brandon Powell, New Mexico Oil Conservation Division, Aztec, NM
Mark Kelly, Bureau of Land Management, Farmington, NM

ec: Jim Griswold – New Mexico Oil Conservation Division, Santa Fe, NM
Scott Hall – Bureau of Land Management, Farmington, NM
Chris Mitchell - Southwest Geoscience, San Antonio, TX
Kyle Summers - Southwest Geoscience, Farmington, NM

LIMITED SITE INVESTIGATION
& CORRECTIVE ACTION WORK PLAN

Property:

K-17/K-Trunk Pipeline Release
Sec 23, T27N, R8W
San Juan County, New Mexico

April 4, 2012
SWG Project No. 0411015

Prepared for:

Enterprise Field Services, LLC
1100 Louisiana Street
Houston, Texas 77002-5227
Attn: Mr. David R. Smith, P.G.

Prepared by:

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Manager, Four Corners Office

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TABLE OF CONTENTS

LIST OF APPENDICES

LIMITED SITE INVESTIGATION &
CORRECTIVE ACTION WORK PLAN

K-17/K-Trunk Pipeline Release
Sec 23, T27N, R8W
San Juan County, New Mexico

SWG Project No. 0411015

1.0 INTRODUCTION

1.1 Site Description & Background

The Site is located in Section 23, Township 27 North, Range 8 West, in San Juan County, New Mexico. The Site consists of a pigging station utilized to collect liquids generated during pigging activities on the K-17 pipeline prior to discharge to the K-Trunk pipeline. In addition, corrosion inhibitor and methanol are injected into the K-Trunk pipeline at the Site to prevent corrosion and the freezing of liquids in the pipeline, which would limit the ability of the pig to proceed downstream during maintenance operations. Three (3) natural gas pipelines operated by Enterprise Field Services LLC (Enterprise) traverse the Site, which is surrounded by native rangeland. The objective of the Limited Site Investigation (LSI) was to further evaluate the presence, magnitude, and extent of petroleum hydrocarbons in on-Site soil and groundwater as a result of the documented release of natural gas condensate from the K-Trunk pipeline at the tie-in of the K-17 gathering line.

In August 2010, LT Environmental, Inc. (LTE) advanced ten (10) soil borings (BH1 through BH10) in the vicinity of the petroleum hydrocarbon impacted soils identified during maintenance activities. The soil borings were advanced to depths ranging from 20 to 28 feet below ground surface (bgs). Based on the results of the investigation activities completed by LTE, petroleum hydrocarbon affected soils were identified in the immediate vicinity of the K-17/K-Trunk tie-in.

A topographic map is included as Figure 1, a 2005 aerial photograph of the Site vicinity is included as Figure 2, and a Site plan is included as Figure 3 of Appendix A.

1.2 Site Investigation Scope of Work

SWG has conducted a LSI at the subject Site. The objective of the LSI was to further evaluate the presence, magnitude and extent of petroleum hydrocarbon constituents of concern (COCs) in on-Site soil and groundwater as a result of the documented release of natural gas condensate.

1.3 Standard of Care & Limitations

The findings and recommendations contained in this report represent SWG's professional opinions based upon information derived from on-Site activities and other services performed under this scope of work and were arrived at in accordance with currently acceptable professional standards. The findings were based upon analytical results provided by an independent laboratory. Evaluations of the geologic/hydrogeologic conditions at the Site for the purpose of this

investigation are made from a limited number of available data points (i.e. soil borings and ground water samples) and Site wide subsurface conditions may vary from these data points. SWG makes no warranties, express or implied, as to the services performed hereunder. Additionally, SWG does not warrant the work of third parties supplying information used in the report (e.g. laboratories, regulatory agencies, or other third parties).

This report is based upon a specific scope of work requested by Enterprise Field Services, LLC. The agreement between SWG and Enterprise Field Services, LLC outlines the scope of work, and only those tasks specifically authorized by that agreement or outlined in this report were performed. This report has been prepared for the intended use of Enterprise Field Services, LLC, and any authorization for use or reliance by any other party (except a governmental entity having jurisdiction over the Site) is prohibited without the express written authorization of Enterprise Field Services, LLC. and SWG.

2.0 SITE INVESTIGATION

2.1 Soil Borings & Temporary Sampling Wells

SWG's field investigation activities were conducted on March 19, 2012 by Mr. B. Chris Mitchell, a SWG environmental professional. As part of the approved scope of work, four (4) soil borings (TSW-11 through TSW-14) were advanced in the vicinity of the former pipeline release. Soil borings were advanced utilizing a direct push Geoprobe® drilling rig. Soil boring TSW-11 was advanced adjacent to the release source. Soil boring TSW-12 was advanced to the south, topographically up-gradient to the release source. Soil boring TSW-13 was advanced to the north, topographically down-gradient from the release source, and soil boring TSW-14 was advanced to the northwest, topographically down-gradient from the release source.

Figure 3 is a Site Plan that indicates the approximate location of the soil borings in relation to pertinent land features (Appendix A).

Soil samples were collected continuously utilizing four-foot core barrel samplers to the termination depth of each soil boring. Soil samples were observed to document soil lithology, color, moisture content, and visual and olfactory evidence of petroleum hydrocarbons. Upon retrieval of each core barrel from the borehole, each soil sample was immediately divided into portions designated for field screening or laboratory analysis. Field headspace analysis was conducted by placing the portion of the soil sample designated for field screening into a plastic ziplock bag. The plastic bag was sealed and then placed in a warm area to promote volatilization. The air above the sample, the headspace, was then evaluated using a photoionization detector (PID) capable of detecting volatile organic compounds (VOCs). The PID was calibrated utilizing an isobutylene standard prior to use in the field.

During the completion of each soil boring, an on-Site geoscientist documented the lithology encountered and constructed a continuous profile of the soil column from the surface to the boring terminus. Undisturbed soil samples from each boring location were visually inspected and logged in the field. The lithology encountered during the advancement of soil boring TSW-11 included tan sandy silt from the ground surface to a depth of approximately 12 feet bgs. The sandy silt stratum was

underlain by a tan sand with silt to a depth of approximately 16 feet bgs. The sand with silt stratum was underlain by a brown silty clay from a depth of approximately 16 to 22 feet bgs. The silty clay stratum was underlain by a sandy clay to a depth of approximately 24 feet bgs. A tan sand was encountered at a depth of 24 feet bgs to the terminus of the boring at approximately 28 feet bgs. The lithologies encountered during the advancement of soil borings TSW-12, TSW-13, and TSW-14 were generally similar to the lithology encountered while advancing soil boring TSW-11. More detailed lithologic descriptions are presented on soil boring logs included in Appendix B.

Petroleum hydrocarbon odors were detected in the field in soil samples collected from soil boring TSW-11. The PID readings from soil boring TSW-11 ranged from below detection to 293 parts per million (ppm), detected at depths of 16 to 20 feet bgs. The soil sample collected from soil boring TSW-14 at a depth of 18 to 20 feet bgs exhibited a PID reading of 6 ppm. Petroleum hydrocarbon odors and/or PID readings were not detected in the soil samples collected from soil borings TSW-12 and TSW-13. Field screening results are presented on soil boring logs included in Appendix B.

Subsequent to advancement, each of the soil borings were converted to temporary sampling wells. The temporary groundwater sampling wells were completed by inserting a 1-inch inside diameter PVC well casing with 10 feet of 0.010-inch slotted PVC into the boring annulus to allow the collection of a groundwater sample. Subsequent to the collection of the groundwater sample, the temporary casing was removed from the boring and the borehole was permanently plugged and abandoned in accordance with NMAC 19.27.4.30 *RULES AND REGULATIONS GOVERNING WELL DRILLER LICENSING; CONSTRUCTION, REPAIR AND PLUGGING OF WELLS.*

Temporary sampling well details are presented on the soil boring/temporary sampling well logs included in Appendix C.

2.2 Investigation Sampling Program

2.2.1 Soil Sampling Program

SWG's soil sampling program involved submitting one soil sample from each soil boring for laboratory analysis. Soil samples were collected from the zone exhibiting the highest PID reading, from a change in lithology, or from the bottom of the boring, based on the field professional's judgment. Soil sample intervals are presented with the soil sample analytical results (Table 1) in Appendix D and are provided on the boring logs included in Appendix C.

2.2.2 Groundwater Sampling Program

A groundwater sample was collected from each temporary sampling well. Prior to sample collection, each temporary sampling well was micro-purged utilizing low-flow sampling techniques. Low-flow refers to the velocity with which groundwater enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective was to

pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established Site sampling objectives. Flow rates on the order of 0.1 to 0.5 L/min were maintained during the sampling activities using dedicated sampling equipment.

The utilization of low-flow minimal drawdown techniques enables the isolation of the screened interval groundwater from the overlying stagnant casing water. The pump intake is placed within the screened interval such that the groundwater recovered is drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone.

The groundwater samples were collected from each monitoring well once produced groundwater was consistent in color, clarity, pH, dissolved oxygen (DO), oxidation/reduction potential (ORP), temperature and conductivity.

3.0 LABORATORY ANALYTICAL PROGRAM

3.1 Laboratory Analytical Methods

The soil and groundwater samples collected from the borings/temporary sampling wells were analyzed for total petroleum hydrocarbons (TPH) gasoline range organics (GRO) and diesel range organics (DRO) utilizing EPA SW-846 method #8015B and benzene, toluene, ethylbenzene and xylenes (BTEX) using EPA SW-846 method #8021B.

Laboratory results are summarized in the tables included in Appendix D. The executed chain-of-custody form and laboratory data sheets are provided in Appendix E.

3.2 Quality Assurance/Quality Control (QA/QC)

Sampling equipment was cleaned using an Alconox® wash and potable water rinse prior to the beginning of the project and before the collection of each sample.

Soil and groundwater samples were collected and placed in laboratory prepared glassware, sealed with custody tape and placed on ice in a cooler, which was secured with a custody seal. The sample coolers and completed chain-of-custody forms were relinquished to Hall Environmental Analysis Laboratory (Hall) in Albuquerque, New Mexico for standard turnaround.

Hall performed the analyses of samples under an adequate and documented quality assurance program to meet the project and data quality objectives. The laboratory's quality assurance program is generally consistent the quality standards outlined in the National Environmental Laboratory Accreditation Program, as amended. In addition, the data generated by Hall meets the intralaboratory performance standards for the selected analytical method and the performance standards are sufficient to meet the bias, precision, sensitivity, representativeness, comparability, and completeness, as specified in the project data quality objectives.

4.0 SITE CHARACTERIZATION

4.1 Geology & Hydrogeology

According to the New Mexico Bureau of Geology and Mineral Resource (Geologic Map of New Mexico 2003), the Site overlies the Nacimiento geologic formation. The Nacimiento geologic formation is a heterogeneous non-marine formation composed of sandstone, siltstone, and shale, comprised of sediment eroded from the San Juan and Brazos-Sangre de Cristo uplifts. The Paleocene-age Nacimiento Group includes the Puerco and Torrejon Formations. The lithology encountered at the Site during boring activities are composed of Quaternary alluvial deposits derived from erosion of the parent Nacimiento sandstones and siltstones which comprise the canyon walls. Based on the data collected during the completion of soil borings, the alluvia generally consist of brown silty sands and silty clays from the ground surface to at least 28 feet bgs.

The lithology encountered during the advancement of soil boring TSW-11 included tan sandy silt from the ground surface to a depth of approximately 12 feet bgs. The sandy silt stratum was underlain by a tan sand with silt to a depth of approximately 16 feet bgs. The sand with silt stratum was underlain by a brown silty clay from a depth of approximately 16 to 22 feet bgs. The silty clay stratum was underlain by a sandy clay to a depth of approximately 24 feet bgs. A tan sand was encountered at a depth of 24 feet bgs to the terminus of the boring at approximately 28 feet bgs. Detailed lithologic descriptions are presented on the soil borings logs included in Appendix B.

The major aquifer underlying the Site vicinity is listed as the Colorado Plateaus Aquifer, which is made up of four smaller aquifers, the Uinta-Animas, the Mesa Verde, the Dakota-Glen, and the Coconino-De Chelly. The Uinta-Animas is the shallowest of these aquifers, and is present in the San Juan Basin. The general composition of the aquifers is moderately to well-consolidated sedimentary rocks of an age ranging from Permian to Tertiary. Each aquifer is separated from the others by an impermeable confining unit. Two of the confining units are completely impermeable and cover the entire area of the aquifers. The other two confining units are less extensive and are thinner. These units allow water to flow between the principal aquifers. There are countless streams, rivers, and lakes that overlay the Colorado Plateaus Aquifers. The surface water bodies in this region provide a place for the aquifers to discharge. Some of the high altitude rivers and lakes may also provide recharge.

The initial groundwater-bearing unit (GWBU) at the Site was encountered at a depth of less than 20 feet bgs during the investigation activities.

4.2 Site Ranking

In accordance with the New Mexico Oil Conservation Division's (OCD's) *Guidelines for Remediation of Leaks, Spills and Releases*, SWG utilized the general site characteristics to determine the appropriate "ranking" for the Site. The ranking criteria and associated scoring are provided in the table below:

Ranking Criteria			Ranking Score
Depth to Groundwater	<50 feet	20	20
	50 to 99 feet	10	
	>100 feet	0	
Wellhead Protection Area • <1,000 feet from a water source, or; <200 feet from private domestic water source.	Yes	20	0
	No	0	
Distance to Surface Water Body	<200 feet	20	10
	200 to 1,000 feet	10	
	>1,000 feet	0	
Total Ranking Score			30

Based on SWG's evaluation of the scoring criteria, the Site would have a Total Ranking Score of 30. This ranking is based on the following:

- The depth to the initial groundwater-bearing zone is <50 feet at the Site.
- Largo wash, which is approximately 550 feet north of the Site, drains into the San Juan River and is the nearest surface water feature.

Based on a Total Ranking Score of 30, the *Remediation Action Levels* (RALS) for soil at the Site are: 10 mg/Kg for benzene, 50 mg/Kg for total BTEX and 100 mg/Kg for TPH GRO/DRO.

In addition, the Water Quality Control Commission (WQCC) *Groundwater Quality Standards* (GQSs) for groundwater are: 0.010 mg/L for benzene, 0.75 mg/L for toluene, 0.75 mg/L for ethylbenzene, and 0.62 mg/L for total xylenes.

5.0 DATA EVALUATION

The Site is subject to regulatory oversight by the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) OCD. To address activities related to crude oil/condensate related releases, the New Mexico EMNRD OCD utilizes the *Guidelines for Remediation of Leaks, Spills and Releases* as guidance, in addition to the EMNRD/OCD rules, specifically New Mexico Administrative Code (NMAC) 19.15.30 Remediation. These guidance documents establish investigation and abatement action requirements for sites subject to reporting and/or corrective action.

5.1 Soil Samples

SWG compared the TPH GRO/DRO and BTEX concentrations or practical quantitation limits (PQLs) associated with the soil samples collected from soil borings TSW-11 through TSW-14 to the OCD *Remediation Action Levels* for Sites having a total ranking score greater than 19.

The results of the soil sample analyses are summarized in Table 1 included in Appendix C.

Total Petroleum Hydrocarbons

The soil sample collected from soil boring TSW-11 exhibited a TPH GRO/DRO concentration of 206 mg/Kg, which is above the OCD's *Remediation Action Level* of 100 mg/Kg.

The soil samples collected from the remaining soil borings (TSW-12 through TSW-14) did not exhibit TPH GRO/DRO concentrations above the laboratory PQLs, which are below the OCD's *Remediation Action Level* of 100 mg/Kg.

Benzene and Total BTEX

The soil sample collected from soil boring TSW-11 exhibited a benzene concentration of 0.67 mg/Kg, which is below the OCD's *Remediation Action Level* of 10 mg/Kg, and a total BTEX concentration of 10.46 mg/Kg, which is below the OCD's *Remediation Action Level* of 50 mg/Kg.

The soil samples collected from the remaining soil borings (TSW-12 through TSW-14) did not exhibit benzene or total BTEX concentrations above the laboratory PQLs, which are below the OCD's *Remediation Action Level* of 10 mg/Kg or 50 mg/Kg, respectively.

Figure 4 is a *Remediation Action Level* Exceedance Zone Map that indicates the approximate distribution of TPH GRO/DRO in relation to pertinent land features (Appendix A).

5.2 Groundwater Samples

SWG compared BTEX concentrations or PQLs associated with the groundwater samples collected from temporary sampling wells TSW-11 through TSW-14 to the WQCC *Groundwater Quality Standards*.

The results of the groundwater sample analyses are summarized in Table 2 of Appendix D.

Total Petroleum Hydrocarbons

The groundwater sample collected from temporary sampling well TSW-11 exhibited a TPH GRO/DRO concentration of 0.83 mg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit TPH GRO/DRO concentrations above the laboratory PQLs.

Benzene, Toluene, Ethylbenzene, and Xylenes

The groundwater sample collected from temporary sampling well TSW-11 exhibited a benzene concentration of 25 µg/L which exceeds the WQCC *Groundwater Quality Standard* of 10 µg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit benzene concentrations above the laboratory PQLs, which are below the WQCC *Groundwater Quality Standard* of 10 µg/L.

The groundwater sample collected from temporary sampling well TSW-11 exhibited a toluene concentration of 75 µg/L which is below the WQCC *Groundwater Quality Standard* of 750 µg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit toluene concentrations above the laboratory PQLs, which are below the WQCC *Groundwater Quality Standard* of 750 µg/L.

The groundwater sample collected from temporary sampling well TSW-11 exhibited an ethylbenzene concentration of 11 µg/L which is below the WQCC *Groundwater Quality Standard* of 750 µg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit ethylbenzene concentrations above the laboratory PQLs, which are below the WQCC *Groundwater Quality Standard* of 750 µg/L.

The groundwater sample collected from temporary sampling well TSW-11 exhibited a xylenes concentration of 120 µg/L which is below the WQCC *Groundwater Quality Standard* of 620 µg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit xylenes concentrations above the laboratory PQLs, which are below the WQCC *Groundwater Quality Standard* of 620 µg/L.

Figure 5 is a *Groundwater Quality Standard* Exceedance Zone Map that indicates the approximate distribution of benzene in relation to pertinent land features (Appendix A).

6.0 SUPPLEMENTAL SITE INVESTIGAITON

6.1 Proposed Soil Borings & Monitoring Wells

During the completion of the proposed supplemental site investigation activities, four (4) soil borings will be advanced in the vicinity of the former pipeline release to further evaluate the magnitude and extent of petroleum hydrocarbons in groundwater at the Site. One (1) soil boring will be advanced in the vicinity of the release source. One (1) soil boring will be advanced topographically up-gradient from the release source, and two (2) soil borings will be advanced topographically down-gradient from the release source.

Each soil boring will be advanced utilizing a direct push Geoprobe® drilling rig. The soil borings will be advanced to a maximum depth of approximately 30 feet bgs, five feet below the initial water table, or auger refusal, whichever is more shallow. Sampling and drilling equipment will be decontaminated utilizing an Alconox® wash

and water rinse prior to commencement of the project and between the advancement of each soil boring.

Soil samples will be collected continuously using core barrels or split spoon samplers to document lithology, color, relative moisture content and visual or olfactory evidence of impairment. In addition, the samples will be scanned with a PID for the presence of VOCs.

Subsequent to advancement, each soil boring will be converted to a permanent groundwater monitoring well. The groundwater monitoring wells will be completed as follows:

- Installation of 10 feet of 2-inch diameter, machine slotted PVC well screen assembly with a threaded bottom plug;
- Installation of riser pipe to surface;
- Addition of graded silica sand for annular sand pack around the well screen from the bottom of the well to two feet above the top of the screen;
- Placement of 2 feet of hydrated bentonite pellets above the sand pack;
- Addition of cement/bentonite slurry to the surface; and
- Installation of a locking well cap and above grade well cover.

The monitoring wells will be developed by surging and removing groundwater until the fluid appears free of fine-grained sediment.

6.2 Investigation Sampling Program

6.2.1 Groundwater Sampling Program

SWG's groundwater sampling program will consist of the following:

1) Collection of one groundwater sample from each monitoring well utilizing low-flow minimal drawdown sampling techniques.

The monitoring well will be purged until produced groundwater is consistent in color, clarity, pH, dissolved oxygen (DO), oxidation/reduction potential (ORP), temperature and conductivity.

The groundwater samples will be collected in laboratory prepared glassware and placed on ice in a cooler, which will be secured with a custody seal. The samples will be transported to a selected analytical laboratory along with a completed chain-of-custody form.

6.2.2 Laboratory Analytical Program

The groundwater samples collected from the soil borings/monitoring wells will be analyzed for TPH DRO/GRO utilizing EPA Method SW-846 #8015B and BTEX utilizing EPA Method SW-846 #8021B. A summary of the analysis, sample type, sample frequency and EPA-approved methods are presented below:

Analysis	Sample Type	No. of Samples	EPA Method
TPH	Groundwater	4	SW-846#8015B DRO/GRO
BTEX	Groundwater	4	SW-846#8021B

7.0 CORRECTIVE ACTION

The primary objective of the proposed corrective actions is to 1.) reduce the concentration of TPH GRO/DRO in soil to below the OCD *Remediation Action Level* of 100 mg/Kg; and, 2.) reduce the concentration of benzene in groundwater to below the WQCC *Groundwater Quality Standard* of 10 µg/L. The corrective actions proposed for the Site include in-situ chemical oxidation (ISCO), which is an active (vs. passive) remediation alternative.

7.1 In-Situ Chemical Oxidation

The petroleum hydrocarbon impacted soil and groundwater identified in the immediate vicinity of the source area will be addressed utilizing in-situ chemical oxidation (ISCO) through the direct application of RegenOX™.

RegenOX™ is an advanced chemical oxidation technology that destroys contaminants through powerful, yet controlled chemical reactions and not through biological processes. This product maximizes in situ performance while using a solid alkaline oxidant that employs a sodium percarbonate complex with a multi-part catalytic formula. RegenOX™ directly oxidizes contaminants while its unique catalytic component generates a range of highly oxidizing free radicals that rapidly and effectively destroy petroleum hydrocarbons in high concentration source areas within the saturated and vadose zones. This process occurs as a result of the powerful desorption-surfactant like effect of RegenOX™ (principally the catalyst) that draws the contaminant off the soil surface and into solution. The contaminant then reaches the catalytic surface where localized free-radical generation occurs, leading to focused more efficient contaminant destruction. This also restricts the oxidant losses onto tightly bound and heavier soil organics such as humic, roots, and other natural or immobile fractions. For petroleum hydrocarbon treatment, RegenOX™ also produces a fair amount of oxygen as a result of its reactions providing for an advantageous and seamless transition from in-situ chemical oxidation to enhanced aerobic bioremediation.

RegenOX™ will be applied to the subsurface using direct injection techniques. The application process enables the two part product to be combined, then pressure injected into the zone of contamination and moved out into the aquifer media. The

RegenOX™ slurry will be injected into the geologic formation under pressure which will cause flow outward from the injection point along thin fractures or fissures that will be generally oriented horizontally with respect to the ground surface. The injection program is designed to create a three-dimensional network of material interlaced throughout the affected portion of the formation, such that it is unlikely that a significant volume of contaminants will not in direct contact with the injectate. Three (3) injection points will be located on approximate 10 foot centers immediately surrounding the release source, and targeted injection depths will be staggered from a depth of approximately 15 to 22 feet bgs to treat COCs adsorbed to subsurface soils as well as dissolved in groundwater. This will provide for some overlap and create seams of material that will not be separated by more than a few feet to ensure effective coverage. The design radius of influence of the injectate was estimated to be approximately 10 to 15 feet.

Once in the subsurface, RegenOX™ produces a cascade of efficient oxidation reactions via a number of mechanisms including: surface mediated oxidation, direct oxidation and free radical oxidation. These reactions destroy a range of organic contaminants, including petroleum hydrocarbons, and can be propagated in the presence of RegenOX™ for periods of up to 30 days on a single injection event.

Figures 4 and 5 depict the proposed location of injection points relative to the *Remediation Action Level* Exceedance Zone in soil and the *Groundwater Quality Standard* Exceedance Zone in groundwater at the Site.

8.0 CORRECTIVE ACTION EFFECTIVENESS

8.1 Groundwater Monitoring

To evaluate the effectiveness of the proposed corrective actions, SWG will conduct two (2) quarterly groundwater sampling events at the Site subsequent to the completion of injection activities.

SWG's groundwater sampling program will consist of the following:

1. Collection of one (1) groundwater sample from each monitoring well utilizing low-flow minimal drawdown sampling techniques during each of two (2) quarterly groundwater sampling events.

The monitoring wells will be purged until produced groundwater is consistent in color, clarity, pH, DO, ORP, temperature and conductivity.

The groundwater samples will be collected in laboratory prepared glassware and placed on ice in a cooler, which will be secured with a custody seal. The samples will be transported to a selected analytical laboratory along with a completed chain-of-custody form.

8.2 Laboratory Analytical Program

The groundwater samples collected from the monitoring wells will be analyzed for TPH GRO/DRO utilizing EPA method SW-846 #8015B and BTEX utilizing EPA Method SW-846 #8021B.

A summary of the analysis, sample type, sample frequency and EPA-approved methods are presented below:

Analysis	Sample Type	No. of Samples	EPA Method
TPH	Groundwater	8	SW-846#8015
BTEX	Groundwater	8	SW-846#8021B

8.3 Corrective Action Report

Upon completion of corrective action and groundwater monitoring activities, a Corrective Action Report will be prepared that will include documentation of corrective action activities, groundwater monitoring activities, a site plan detailing pertinent Site features, laboratory analytical results, an evaluation of sampling results and recommendations concerning further action, if necessary.

9.0 CONCLUSIONS

The Site is located in Section 23, Township 27 North, Range 8 West, in San Juan County, New Mexico. The Site consists of a pigging station utilized to collect liquids generated during pigging activities on the K-17 pipeline prior to discharge to the K-Trunk pipeline. In addition, corrosion inhibitor and methanol are injected into the K-Trunk pipeline at the Site to prevent corrosion and the freezing of liquids in the pipeline, which would limit the ability of the pig to proceed downstream during maintenance operations. Three (3) natural gas pipelines operated by Enterprise traverse the Site, which is surrounded by native rangeland. The objective of the LSI was to further evaluate the presence, magnitude, and extent of petroleum hydrocarbons in on-Site soil and groundwater as a result of the documented release of natural gas condensate from the K-Trunk pipeline at the tie-in of the K-17 gathering line.

On March 19, 2012, four (4) soil borings (TSW-11 through TSW-14) were advanced in the vicinity of the release source. Subsequent to advancement, each soil boring was converted to a temporary sampling well.

The soil sample collected from soil boring TSW-11 exhibited a TPH GRO/DRO concentration of 206 mg/Kg, which is above the OCD's *Remediation Action Level* of 100 mg/Kg. The soil samples collected from the remaining soil boring (TSW-12 through TSW-14 did not exhibit TPH GRO/DRO concentration above the OCD's *Remediation Action Level.*

The soil samples collected from soil borings TSW-11 through TSW-14 did not exhibit benzene or total BTEX concentration above the OCD's *Remediation Action Levels.*

The groundwater sample collected from temporary sampling well TSW-11 exhibited a benzene concentration of 25 µg/L which exceeds the WQCC *Groundwater Quality Standard* of 10 µg/L. The groundwater samples collected from the remaining temporary sampling wells (TSW-12 through TSW-14) did not exhibit BTEX concentrations above the WQCC *Groundwater Quality Standards.*

Prior to the initiation of corrective actions, four (4) soil borings will advanced in the vicinity of the former pipeline release. Each of the borings will be converted to monitoring wells to further evaluate the magnitude and extent of petroleum hydrocarbons in groundwater at the Site.

The corrective actions proposed for the Site include ISCO, which is an active (vs. passive) remediation alternative. The primary objective of the proposed corrective actions is to reduce the concentrations of TPH GRO/DRO in soil to below the OCD *Remediation Action Level* of 100 mg/Kg, and benzene in groundwater to below the WQCC *Groundwater Quality Standard* of 10 µg/L.

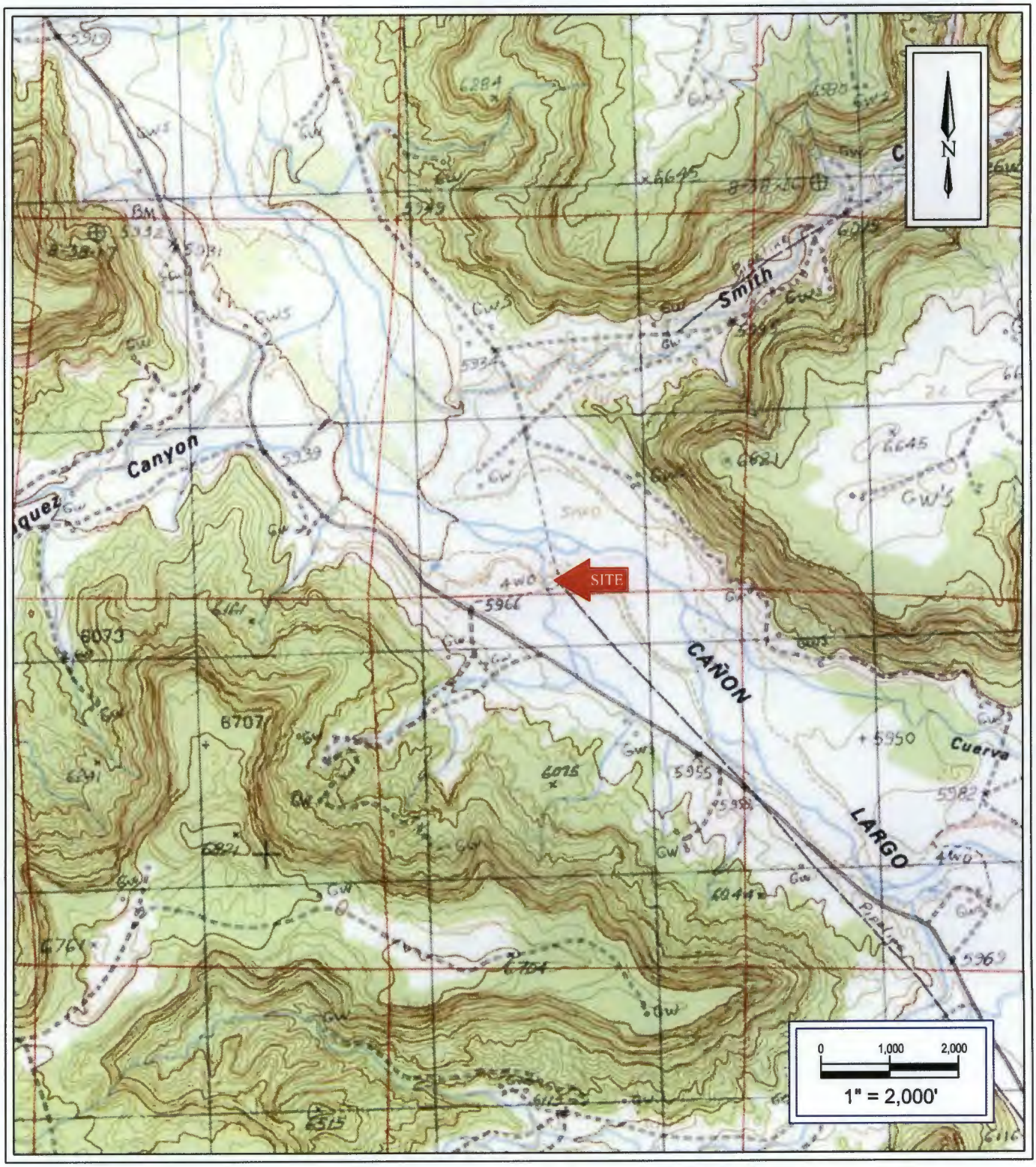
RegenOX™ will be applied to the subsurface using direct injection techniques. The application process enables the two part product to be combined, then pressure injected into the zone of contamination and moved out into the aquifer media. The injection program was designed to create a three-dimensional network of material interlaced throughout the affected portion of the formation, such that it is unlikely that a significant volume of contaminants will not in direct contact with the injectate. Three (3) injection points will be located on approximate 10 foot centers immediately surrounding the release source, and targeted injection depths will be staggered from a depth of approximately 15 to 22 feet bgs to treat COCs adsorbed to subsurface soils as well as dissolved in groundwater.

Subsequent to the completion of corrective actions, groundwater samples will be collected from each of the four (4) monitoring wells to be completed on-site during two (2) quarterly groundwater sampling events designed to evaluate the effectiveness of corrective actions.

Southwest GEOSCIENCE

APPENDIX A

Figures



K-17/K Trunk Release
S23 T27N R8W
N36.552209°; W107.652894°
San Juan County, New Mexico

SWG Project No. 0411015

Southwest GEOSCIENCE

Figure 1

USGS Topographic Map
Fresno Canyon, NM Quadrangle
Contour Interval = 20 Feet
1985

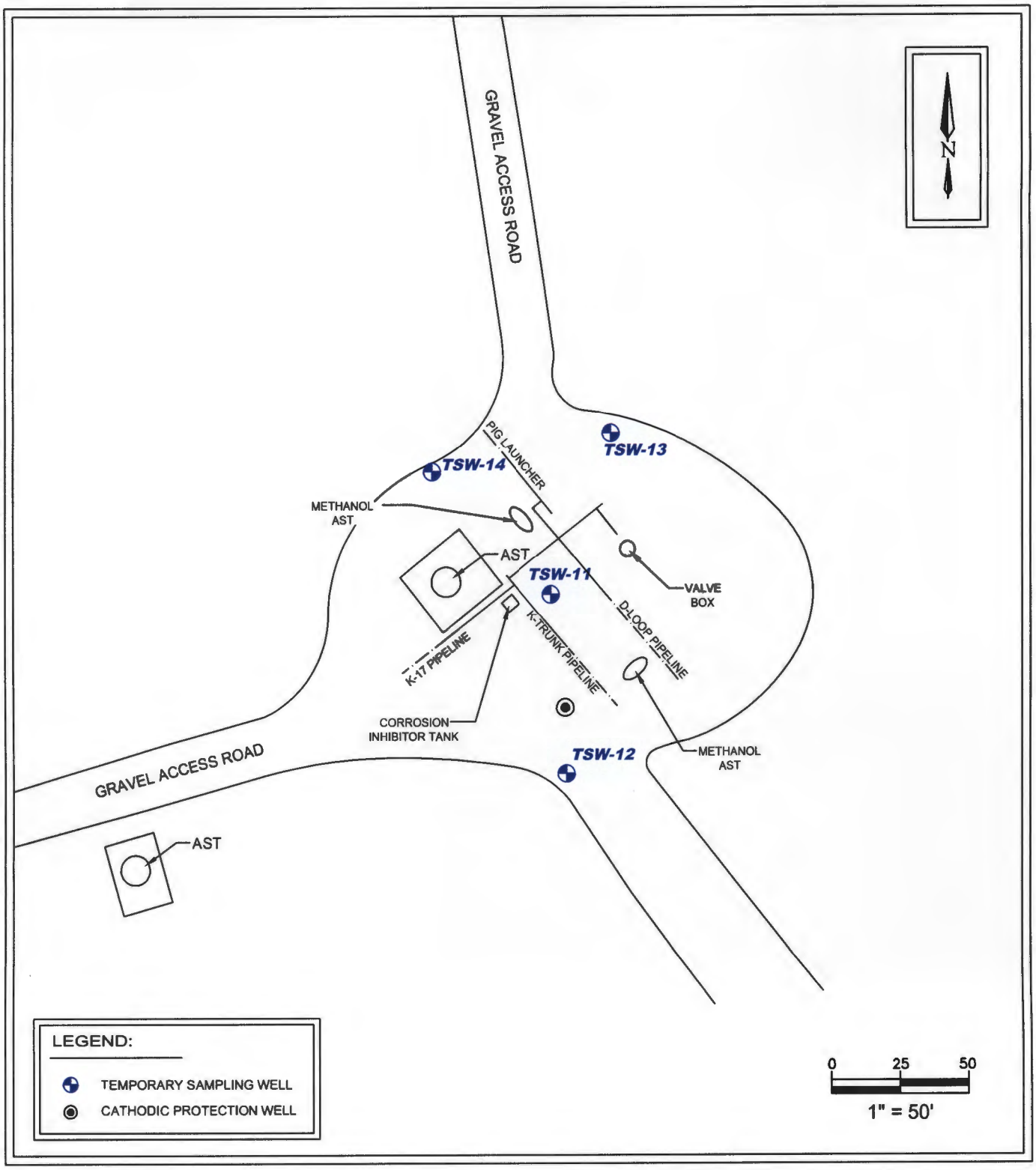
K-17/K Trunk Release
S23 T27N R8W
N36.552209°; W107.652894°
San Juan County, New Mexico

SWG Project No. 0411015

Southwest GEOSCIENCE

Figure 2

Site Vicinity Map



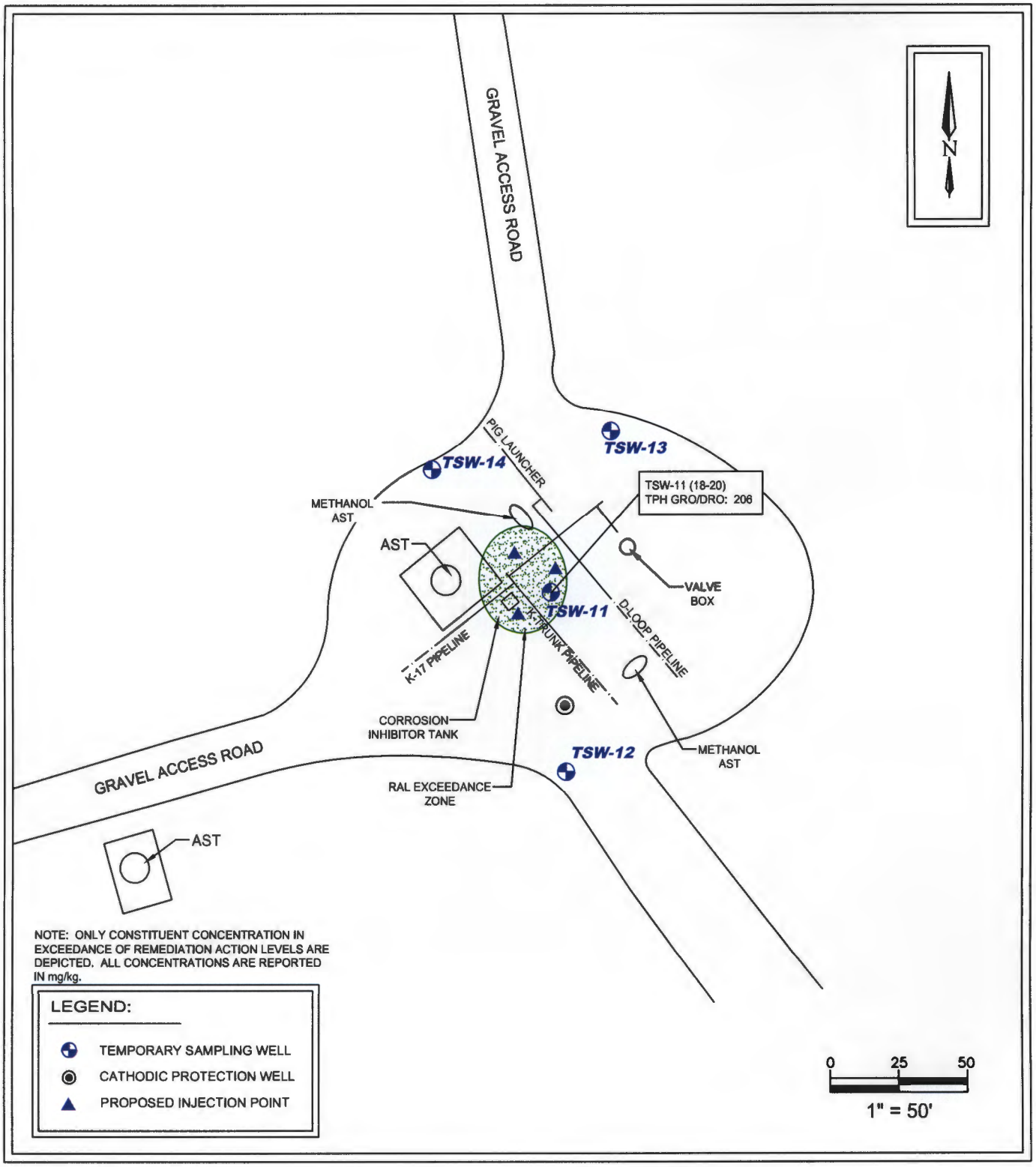
K-17/K Trunk Release
S23 T27N R8W
N36.552209°; W107.652894°
San Juan County, New Mexico

SWG Project No. 0411015

Southwest GEOSCIENCE

Figure 3

Site Map
With Temporary Sampling Well Locations



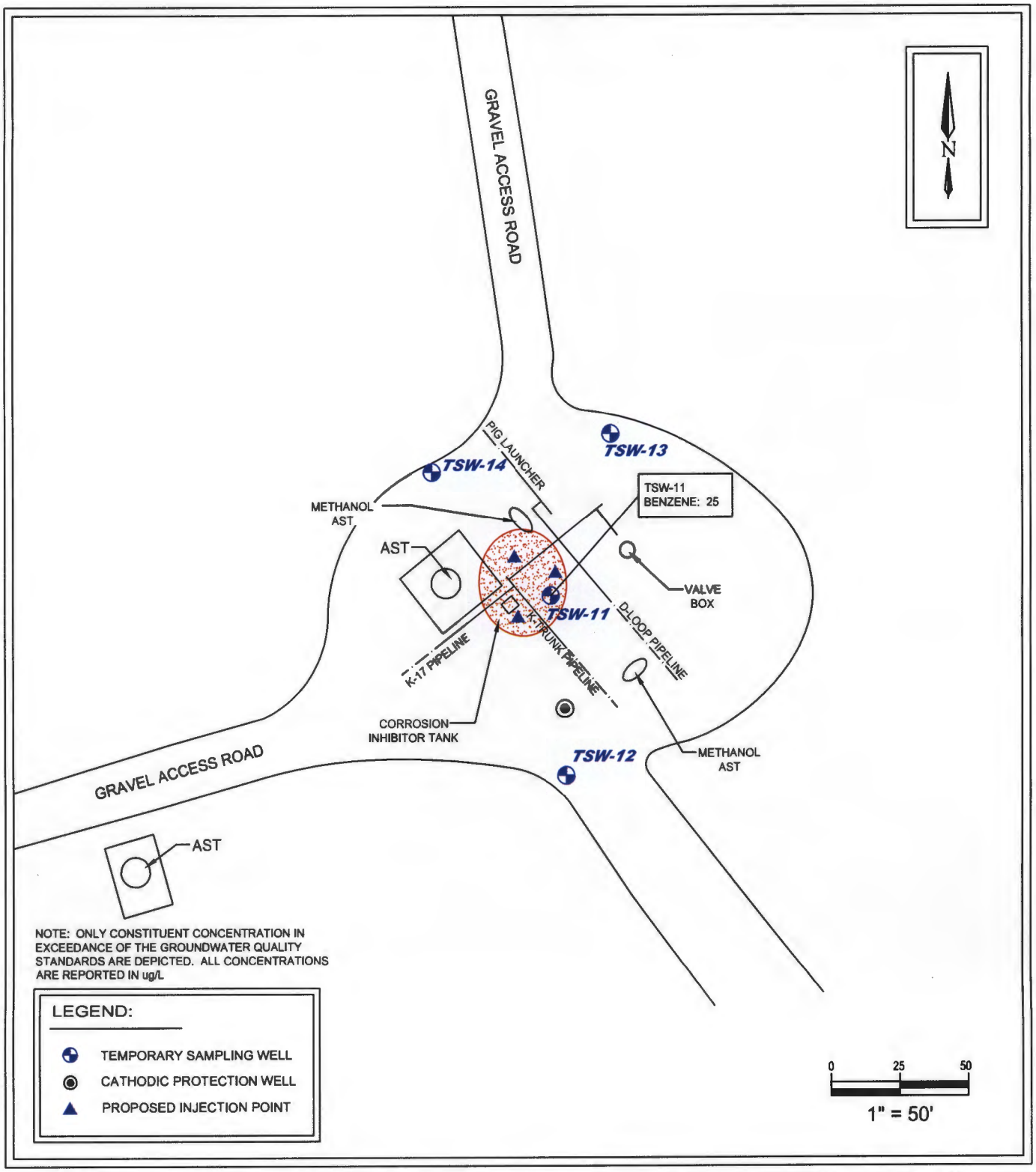
K-17/K Trunk Release
S23 T27N R8W
N36.552209°; W107.652894°
San Juan County, New Mexico

SWG Project No. 0411015

Southwest GEOSCIENCE

Figure 4

Remediation Action Level (RAL) Exceedance Zone in Soil



K-17/K Trunk Release
S23 T27N R8W
N36.552209°; W107.652894°
San Juan County, New Mexico

SWG Project No. 0411015

Southwest GEOSCIENCE

Figure 5

Groundwater Quality Standard (GQS) Exceedance Zone in Groundwater

Sample Date: 3.21.2012

Southwest GEOSCIENCE

APPENDIX B

Soil Boring &Temporary Sampling Well Logs

Client: Enterprise Field Services LLC
Project Name: K-17/K-Trunk Release
Project Location: CR 4990/379 Rio Arriba County
Project Manager: Kyle Summers

SOIL BORING / TEMPORARY SAMPLING WELL LOG

DRILLING & SAMPLING INFORMATION

Soil Boring / Monitoring Well Number: TSW-11
Date Started: 3.21.12
Project #: 04110I5
Date Completed: 3.21.12
Drawn By: BCM
Drilling Company: Earthworx
Approved By: BCM
Driller: Louis Trujillo
Geologist: B. Chris Mitchell
Well Diam: 1"
Boring Method: Geoprobe
Screen Size: 0.010"
Bore Hole Dia: 3.25"
Screen Length: 10'
Casing Length: 18'

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
GP - GEOPROBE
AR - AIR ROTARY

SAMPLER TYPE
CB - FIVE FOOT CORE BARREL
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE

GROUNDWATER DEPTH
▼ AT COMPLETION
▼ AT WELL STABILIZATION

Lithology Code	SOIL CLASSIFICATION	Stratum Depth	Depth Scale	Sample No.	Sample Interval	% Recovery	Groundwater Depth	Headspace Readings (ppm)	BORING AND SAMPLING NOTES
	SURFACE ELEVATION:								
	SANDY SILT, Tan, Dry, No Odor					100%		0	
			5			100%		0	
								0	
			10			100%		0	
								0	
	SAND with Silt, Tan, Dry, No Odor					100%		0	
			15					0	
	SILTY CLAY, Brown, Dry to Moist, Petroleum Hydrocarbon Odor					100%		170	
							▼	293	
			20			100%		10	
	SANDY CLAY, Tan, Moist to Wet, Petroleum Hydrocarbon Odor							0	
			25			100%		0	
	SAND, Tan, Wet, No Odor							0	
	Bottom of Boring @ 28'		30						

Southwest GEOSCIENCE

Client: Enterprise Field Services LLC
Project Name: K-17/K-Trunk Release
Project Location: CB 4900/379 Rio Arriba County
Project Manager: Kyle Summers

SOIL BORING / TEMPORARY SAMPLING WELL LOG

DRILLING & SAMPLING INFORMATION

Date Started: 3.21.12
Date Completed: 3.21.12
Drilling Company: Earthworx
Driller: Louis Trujillo
Geologist: B. Chris Mitchell
Boring Method: Geoprobe
Bore Hole Dia: 3.25"

Well Diam: 1"
Screen Size: 0.010"
Screen Length: 10'
Casing Length: 18'

Soil Boring / Monitoring Well Number: TSW-12
Project #: 04110I5
Drawn By: BCM
Approved By: BCM

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
GP - GEOPROBE
AR - AIR ROTARY

SAMPLER TYPE
CB - FIVE FOOT CORE BARREL
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE

GROUNDWATER DEPTH
AT COMPLETION
AT WELL STABILIZATION

Lithology Log	SOIL CLASSIFICATION SURFACE ELEVATION	Stratum Depth	Depth (ft)	Sample No.	Sample Interval	% Recovery	Groundwater Depth	PID/FID Readings (ppm)	BORING AND SAMPLING NOTES
	SANDY SILT, Tan, Dry, No Odor					100%		0	
			5			100%		0	
	SAND, Tan, Dry, No Odor		10			100%		0	
			15			100%		0	
	SILTY CLAY, Tan, Dry to Moist, No Odor					100%		0	
			20			100%		0	
	SANDY CLAY, Tan, Wet, No Odor		25			100%		0	
	SAND, Tan, Wet, No Odor							0	
	Bottom of Boring @ 28'		30						

Southwest GEOSCIENCE

Client: Enterprise Field Services LLC
Project Name: K-17/K-Trunk Release
Project Location: CR 4000/379 Rio Arriba County
Project Manager: Kyle Summers

SOIL BORING / TEMPORARY SAMPLING WELL LOG

DRILLING & SAMPLING INFORMATION

Soil Boring / Monitoring Well Number: TSW-13
Date Started: 3.21.12
Project #: 04110I5
Date Completed: 3.21.12
Drawn By: BCM
Drilling Company: Earthworx
Approved By: BCM
Driller: Louis Trujillo
Geologist: B. Chris Mitchell
Well Diam: 1"
Boring Method: Geoprobe
Screen Size: 0.010"
Bore Hole Dia: 3.25"
Screen Length: 10'
Casing Length: 18'

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
GP - GEOPROBE
AR - AIR ROTARY

SAMPLER TYPE
CB - DIVE ROOT CORE BARREL
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE

GROUNDWATER DEPTH
▼ AT COMPLETION
▼ AT WELL STABILIZATION

Water well detail	SOIL CLASSIFICATION SURFACE ELEVATION	Stratum Depth	Depth in Feet	Sample No.	Sample Interval	% Recovery	Groundwater Depth	PID/FID Readings (ppm)	BORING AND SAMPLING NOTES
	SANDY SILT, Tan, Dry, No Odor		0			100%		0	
			5			100%		0	
			10			100%		0	
	SAND with Silt, Tan, Dry, No Odor							0	
	SILTY CLAY, Brown, Dry to Wet, No Odor		15			100%		0	
	SANDY CLAY, Tan, Wet, No Odor		20			100%		0	
	SAND, Tan, Wet, No Odor		25			100%		0	
	Bottom of Boring @ 28'		30						

Southwest GEOSCIENCE

Client: Enterprise Field Services LLC
Project Name: K-17/K-Trunk Release
Project Location: CR 4900/379 Rio Arriba County
Project Manager: Kyle Summers

SOIL BORING / TEMPORARY SAMPLING WELL LOG

DRILLING & SAMPLING INFORMATION

Soil Boring / Monitoring Well Number: TSW-14
Date Started: 3.21.12
Project #: 0411015
Date Completed: 3.21.12
Drawn By: BCM
Drilling Company: Earthworx
Approved By: BCM
Driller: Louis Trujillo
Geologist: B. Chris Mitchell
Well Diam: 1"
Boring Method: Geoprobe
Screen Size: 0.010"
Bore Hole Dia: 3.25"
Screen Length: 10'
Casing Length: 18'

BORING METHOD
HSA - HOLLOW STEM AUGERS
CFA - CONTINUOUS FLIGHT AUGERS
GP - GEOPROBE
AR - AIR ROTARY

SAMPLER TYPE
CB - FIVE FOOT CORE BARREL
SS - DRIVEN SPLIT SPOON
ST - PRESSED SHELBY TUBE

GROUNDWATER DEPTH
▼ AT COMPLETION
▼ AT WELL STABILIZATION

Stratum Depth	SOIL CLASSIFICATION SURFACE ELEVATION:	Depth (ft)	Sample No.	Sample Interval	% Recovery	Groundwater Depth	Headspace (ppm)	BORING AND SAMPLING NOTES
	SANDY SILT, Tan, Dry, No Odor				100%		0	
		5			100%		0	
							0	
		10			100%		0	
							0	
	SILTY SAND, Tan, Dry, No Odor						0	
		15			100%		0	
	SILTY CLAY, Brown, Dry to Moist, No Odor						4	
		20			100%	▼	6	
	SANDY CLAY, Tan, Wet, No Odor						0	
	SAND, Tan, Wet, No Odor				100%		0	
		25					0	
	Bottom of Boring @ 28'						0	
		30						

Southwest GEOSCIENCE

Southwest GEOSCIENCE

APPENDIX C

Tables

Southwest GEOSCIENCE

TABLE 1
K-17/K-TRUNK PIPELINE RELEASE
SOIL ANALYTICAL SUMMARY

Sample I.D.	Date	Sample Depth (feet)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)	Total BTEX (mg/kg)	TPH GRO (mg/kg)	TPH DRO (mg/kg)
New Mexico Energy, Mineral & Natural Resources Department, Oil Conservation Division, Remediation Action Level			10	NE	NE	NE	50	100	
Soil Borings Installed by LTE									
BH1	6.9.10	28	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH2	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH3	6.9.10	28	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH4	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH5	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH6	6.9.10	20	0.68	8.1	1.7	21	31.48	**290**	42
BH6	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH6	6.9.10	Btwn Contam & GW	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH7	6.9.10	12	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH7	6.9.10	Btwn Contam & GW	0.069	<0.05	<0.05	<0.10	0.069 - 0.269	<5.0	<10.0
BH7	6.9.10	16	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH7	6.9.10	20	0.28	1.7	0.62	7.3	9.9	**130**	51
BH7	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH8	6.9.10	20	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH8	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH9	6.9.10	24	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	<10.0
BH10	6.9.10	20	<0.05	<0.05	<0.05	<0.10	<0.25	<5.0	42
Soil Borings Installed by SWG									
TSW-11	3.21.12	18-20	0.67	1.7	0.69	7.4	10.46	**170**	36
TSW-12	3.21.12	20-22	<0.049	<0.049	<0.049	<0.099	<0.246	<4.9	<10.0
TSW-13	3.21.12	18-20	<0.048	<0.048	<0.048	<0.095	<0.239	<4.8	<10.0
TSW-14	3.21.12	18-20	<0.047	<0.047	<0.047	<0.095	<0.236	<4.7	<9.7

Note: Concentrations in **bold** and yellow exceed the applicable OCD Remediation Action Level

NE = Not Established

Southwest GEOSCIENCE

TABLE 2
K-17/K-TRUNK PIPELINE RELEASE
GROUNDWATER ANALYTICAL SUMMARY

Sample I.D.	Date	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Xylenes (µg/L)	TPH GRO (mg/L)	TPH DRO (mg/L)
New Mexico Water Quality Control Commmission Groundwater Quality Standards		10	750	750	620	NE	NE
TSW-11	3.21.12	**25**	75	11	120	0.83	<1.0
TSW-12	3.21.12	<2.0	<2.0	<2.0	<4.0	<0.10	<1.0
TSW-13	3.21.12	<2.0	<2.0	<2.0	<4.0	<0.10	<1.0
TSW-14	3.21.12	<2.0	<2.0	<2.0	<4.0	<0.10	<1.0

Note: Concentrations in **bold** and yellow exceed the applicable OCD Remediation Action Level

NA = Not Analyzed

NE = Not Established

Southwest GEOSCIENCE

APPENDIX D

Laboratory Data Reports & Chain of Custody Documentation

HALL
ENVIRONMENTAL
ANALYSIS
LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

March 30, 2012

Kyle Summers

Southwest Geoscience
606 S. Rio Grande Unit A
Aztec, NM 87410
TEL: (214) 350-5469
FAX: (214) 350-2914

RE: K-Loop OrderNo.: 1203865

Dear Kyle Summers:

Hall Environmental Analysis Laboratory received 4 sample(s) on 3/22/2012 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1203865**
Date Reported: **3/30/2012**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Project: K-Loop
Lab ID: 1203865-001 **Matrix:** SOIL

Client Sample ID: TSW-11 (18'-20')
Collection Date: 3/21/2012 8:20:00 AM
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE ORGANICS						Analyst: **JMP**
Diesel Range Organics (DRO)	36	9.8		mg/Kg	1	3/25/2012 3:12:41 PM
Surr: DNOP	106	77.4-131		%REC	1	3/25/2012 3:12:41 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	170	9.3		mg/Kg	2	3/28/2012 3:23:29 PM
Surr: BFB	305	69.7-121	S	%REC	2	3/28/2012 3:23:29 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	0.67	0.093		mg/Kg	2	3/28/2012 3:23:29 PM
Toluene	1.7	0.093		mg/Kg	2	3/28/2012 3:23:29 PM
Ethylbenzene	0.69	0.093		mg/Kg	2	3/28/2012 3:23:29 PM
Xylenes, Total	7.4	0.19		mg/Kg	2	3/28/2012 3:23:29 PM
Surr: 4-Bromofluorobenzene	109	80-120		%REC	2	3/28/2012 3:23:29 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Client Sample ID: TSW-12 (20'-22')
Project: K-Loop
Collection Date: 3/21/2012 9:20:00 AM
Lab ID: 1203865-002 **Matrix:** SOIL **Received Date:** 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE ORGANICS						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	3/25/2012 4:18:03 PM
Surr: DNOP	96.3	77.4-131		%REC	1	3/25/2012 4:18:03 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	4.9		mg/Kg	1	3/28/2012 5:18:25 PM
Surr: BFB	104	69.7-121		%REC	1	3/28/2012 5:18:25 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	0.049		mg/Kg	1	3/28/2012 5:18:25 PM
Toluene	ND	0.049		mg/Kg	1	3/28/2012 5:18:25 PM
Ethylbenzene	ND	0.049		mg/Kg	1	3/28/2012 5:18:25 PM
Xylenes, Total	ND	0.099		mg/Kg	1	3/28/2012 5:18:25 PM
Surr: 4-Bromofluorobenzene	90.2	80-120		%REC	1	3/28/2012 5:18:25 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Project: K-Loop
Lab ID: 1203865-003 **Matrix:** SOIL

Client Sample ID: TSW-13 (18'-20')
Collection Date: 3/21/2012 9:55:00 AM
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE ORGANICS						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	3/25/2012 4:39:42 PM
Surr: DNOP	97.6	77.4-131		%REC	1	3/25/2012 4:39:42 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	4.8		mg/Kg	1	3/28/2012 5:47:14 PM
Surr: BFB	96.5	69.7-121		%REC	1	3/28/2012 5:47:14 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	0.048		mg/Kg	1	3/28/2012 5:47:14 PM
Toluene	ND	0.048		mg/Kg	1	3/28/2012 5:47:14 PM
Ethylbenzene	ND	0.048		mg/Kg	1	3/28/2012 5:47:14 PM
Xylenes, Total	ND	0.095		mg/Kg	1	3/28/2012 5:47:14 PM
Surr: 4-Bromofluorobenzene	91.5	80-120		%REC	1	3/28/2012 5:47:14 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Client Sample ID: TSW-14 (18'-20')
Project: K-Loop
Collection Date: 3/21/2012 10:40:00 AM
Lab ID: 1203865-004
Matrix: SOIL
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE ORGANICS						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	9.7		mg/Kg	1	3/25/2012 5:01:29 PM
Surr: DNOP	92.8	77.4-131		%REC	1	3/25/2012 5:01:29 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	4.7		mg/Kg	1	3/28/2012 6:16:05 PM
Surr: BFB	93.9	69.7-121		%REC	1	3/28/2012 6:16:05 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	0.047		mg/Kg	1	3/28/2012 6:16:05 PM
Toluene	ND	0.047		mg/Kg	1	3/28/2012 6:16:05 PM
Ethylbenzene	ND	0.047		mg/Kg	1	3/28/2012 6:16:05 PM
Xylenes, Total	ND	0.095		mg/Kg	1	3/28/2012 6:16:05 PM
Surr: 4-Bromofluorobenzene	91.3	80-120		%REC	1	3/28/2012 6:16:05 PM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203865**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **MB-1227**	SampType: **MBLK**			TestCode: **EPA Method 8015B: Diesel Range Organics**					
Client ID: **PBS**	Batch ID: **1227**			RunNo: **1666**					
Prep Date: **3/24/2012**	Analysis Date: **3/25/2012**			SeqNo: **47119**		Units: **mg/Kg**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Surr: DNOP	9.2		10.00		91.9	77.4	131			

Sample ID: **LCS-1227**	SampType: **LCS**			TestCode: **EPA Method 8015B: Diesel Range Organics**					
Client ID: **LCSS**	Batch ID: **1227**			RunNo: **1666**					
Prep Date: **3/24/2012**	Analysis Date: **3/25/2012**			SeqNo: **47120**		Units: **mg/Kg**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	45	10	50.00	0	89.2	62.7	139			
Surr: DNOP	4.3		5.000		85.7	77.4	131			

Sample ID: **1203865-001AMS**	SampType: **MS**			TestCode: **EPA Method 8015B: Diesel Range Organics**					
Client ID: **TSW-11 (18'-20')**	Batch ID: **1227**			RunNo: **1666**					
Prep Date: **3/24/2012**	Analysis Date: **3/25/2012**			SeqNo: **47122**		Units: **mg/Kg**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	83	9.9	49.26	36.48	94.5	57.2	146			
Surr: DNOP	4.9		4.926		99.6	77.4	131			

Sample ID: **1203865-001AMSD**	SampType: **MSD**			TestCode: **EPA Method 8015B: Diesel Range Organics**					
Client ID: **TSW-11 (18'-20')**	Batch ID: **1227**			RunNo: **1666**					
Prep Date: **3/24/2012**	Analysis Date: **3/25/2012**			SeqNo: **47123**		Units: **mg/Kg**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	70	9.9	49.50	36.48	68.6	57.2	146	16.4	26.7	
Surr: DNOP	4.9		4.950		99.1	77.4	131	0	0	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203865**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **MB-1222**	SampType: **MBLK**	TestCode: **EPA Method 8015B: Gasoline Range**							
Client ID: **PBS**	Batch ID: **1222**	RunNo: **1770**							
Prep Date: **3/23/2012**	Analysis Date: **3/28/2012**	SeqNo: **49724**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	920		1,000		92.1	69.7	121			

Sample ID: **LCS-1222**	SampType: **LCS**	TestCode: **EPA Method 8015B: Gasoline Range**							
Client ID: **LCSS**	Batch ID: **1222**	RunNo: **1770**							
Prep Date: **3/23/2012**	Analysis Date: **3/28/2012**	SeqNo: **49725**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	28	5.0	25.00	0	112	98.5	133			
Surr: BFB	1,100		1,000		112	69.7	121			

Sample ID: **1203871-001AMS**	SampType: **MS**	TestCode: **EPA Method 8015B: Gasoline Range**							
Client ID: **BatchQC**	Batch ID: **1222**	RunNo: **1770**							
Prep Date: **3/23/2012**	Analysis Date: **3/28/2012**	SeqNo: **49744**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	25	4.9	24.41	0	101	85.4	147			
Surr: BFB	940		976.6		96.1	69.7	121			

Sample ID: **1203871-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015B: Gasoline Range**							
Client ID: **BatchQC**	Batch ID: **1222**	RunNo: **1770**							
Prep Date: **3/23/2012**	Analysis Date: **3/28/2012**	SeqNo: **49745**	Units: **mg/Kg**						
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	24	4.7	23.72	0	101	85.4	147	3.60	19.2	
Surr: BFB	930		948.8		97.6	69.7	121	0	0	

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203865**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **MB-1222** SampType: **MBLK** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **PBS** Batch ID: **1222** RunNo: **1771**

Prep Date: **3/23/2012** Analysis Date: **3/28/2012** SeqNo: **49749** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	0.91		1.000		91.4	80	120			

Sample ID: **LCS-1222** SampType: **LCS** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **LCSS** Batch ID: **1222** RunNo: **1771**

Prep Date: **3/23/2012** Analysis Date: **3/28/2012** SeqNo: **49750** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.93	0.050	1.000	0	93.4	83.3	107			
Toluene	0.94	0.050	1.000	0	94.0	74.3	115			
Ethylbenzene	0.93	0.050	1.000	0	93.5	80.9	122			
Xylenes, Total	2.8	0.10	3.000	0	93.6	85.2	123			
Surr: 4-Bromofluorobenzene	0.94		1.000		94.0	80	120			

Sample ID: **1203865-001AMS** SampType: **MS** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **TSW-11 (18'-20')** Batch ID: **1222** RunNo: **1771**

Prep Date: **3/23/2012** Analysis Date: **3/28/2012** SeqNo: **49763** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.3	0.092	0.9242	0.6709	71.7	67.2	113			
Toluene	2.6	0.092	0.9242	1.664	98.6	62.1	116			
Ethylbenzene	1.4	0.092	0.9242	0.6888	81.6	67.9	127			
Xylenes, Total	9.8	0.18	2.773	7.386	88.3	60.6	134			
Surr: 4-Bromofluorobenzene	2.0		1.848		109	80	120			

Sample ID: **1203865-001AMSD** SampType: **MSD** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **TSW-11 (18'-20')** Batch ID: **1222** RunNo: **1771**

Prep Date: **3/23/2012** Analysis Date: **3/28/2012** SeqNo: **49764** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.7	0.092	0.9208	0.6709	111	67.2	113	23.9	14.3	R
Toluene	3.7	0.092	0.9208	1.664	222	62.1	116	36.0	15.9	SR
Ethylbenzene	1.9	0.092	0.9208	0.6888	134	67.9	127	28.5	14.4	SR
Xylenes, Total	14	0.18	2.762	7.386	234	60.6	134	33.8	12.6	SR
Surr: 4-Bromofluorobenzene	2.2		1.842		117	80	120	0	0	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: **Southwest Geoscience** Work Order Number: **1203865**

Received by/date: 03/22/12

Logged By: **Ashley Gallegos** 3/22/2012 9:30:00 AM

Completed By: **Ashley Gallegos** 3/22/2012 5:16:43 PM

Reviewed By: 03/22/12

Chain of Custody

1.	Were seals intact?	Yes	No	Not Present ✔	
2.	Is Chain of Custody complete?	Yes ✔	No	Not Present	
3.	How was the sample delivered?	Greyhound			

Log In

4.	Coolers are present? (see 19. for cooler specific information)	Yes ✔	No	NA	
5.	Was an attempt made to cool the samples?	Yes ✔	No	NA	
6.	Were all samples received at a temperature of >0° C to 6.0°C	Yes ✔	No	NA	
7.	Sample(s) in proper container(s)?	Yes ✔	No		
8.	Sufficient sample volume for indicated test(s)?	Yes ✔	No		
9.	Are samples (except VOA and ONG) properly preserved?	Yes ✔	No		
10.	Was preservative added to bottles?	Yes	No ✔	NA	
11.	VOA vials have zero headspace?	Yes	No	No VOA Vials ✔	
12.	Were any sample containers received broken?	Yes	No ✔		
13.	Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ✔	No	# of preserved bottles checked for pH:	
14.	Are matrices correctly identified on Chain of Custody?	Yes ✔	No	(<2 or >12 unless noted)	
15.	Is it clear what analyses were requested?	Yes ✔	No	Adjusted?	
16.	Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ✔	No	Checked by:	

Special Handling (If applicable)

17. Was client notified of all discrepancies with this order? Yes No NA ✔

Person Notified: Date:

By Whom: Via: eMail Phone Fax In Person

Regarding:

Client Instructions:

18. Additional remarks:

19. **Cooler Information**

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	2.5	Good	Not Present			

Chain-of-Custody Record

Client: ~~Enterprise~~ Southwest Geoscience

Mailing Address: Aztec, NM

Phone #: (903) 821-5603

email or Fax#: KSummers@southwestgeoscience.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other

☐ EDD (Type)

Turn-Around Time:
☒ Standard ☐ Rush

Project Name: K-LOOP

Project #: 04111015

Project Manager: K. SUMMERS

Sampler: C. Mitchell / T. Dubuisson

On Ice: [redacted]

Sample Temperature: [redacted]

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	[redacted]	BTEX + ~~MTBE + TMB~~'s (8021)6	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
3/21	0820	S	T3W-11 (18'-20')	1	Cool	-001	X		X													
	0920		T3W-12 (20'-22')			-002	X		X													
	0955		T3W-13 (18'-20')			-003	X		X													
↓	1040	↓	T3W-14 (18'-20')	↓	↓	-004	X		X													

NFE

Date:	Time:	Relinquished by:	Received by:	Date	Time
3/21	1325	[signature]	[signature]	3/21/12	1325
3/21/12	1552	[signature]	[signature]	03/22/12	0930

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

March 30, 2012

Kyle Summers
Southwest Geoscience
606 S. Rio Grande Unit A
Aztec, NM 87410
TEL: (214) 350-5469
FAX: (214) 350-2914

RE: K-Loop OrderNo.: 1203856

Dear Kyle Summers:

Hall Environmental Analysis Laboratory received 4 sample(s) on 3/22/2012 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1203856**
Date Reported: **3/30/2012**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Project: K-Loop
Lab ID: 1203856-001
Matrix: AQUEOUS
Client Sample ID: TSW-11
Collection Date: 3/21/2012 9:45:00 AM
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	3/23/2012 2:08:38 PM
Surr: DNOP	108	61.3-164		%REC	1	3/23/2012 2:08:38 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	0.83	0.10		mg/L	2	3/28/2012 3:52:46 AM
Surr: BFB	81.6	69.3-120		%REC	2	3/28/2012 3:52:46 AM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	25	2.0		µg/L	2	3/28/2012 3:52:46 AM
Toluene	75	2.0		µg/L	2	3/28/2012 3:52:46 AM
Ethylbenzene	11	2.0		µg/L	2	3/28/2012 3:52:46 AM
Xylenes, Total	120	4.0		µg/L	2	3/28/2012 3:52:46 AM
Surr: 4-Bromofluorobenzene	88.5	55-140		%REC	2	3/28/2012 3:52:46 AM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Client Sample ID: TSW-12
Project: K-Loop
Collection Date: 3/21/2012 10:20:00 AM
Lab ID: 1203856-002
Matrix: AQUEOUS
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	3/23/2012 2:30:03 PM
Surr: DNOP	113	61.3-164		%REC	1	3/23/2012 2:30:03 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	0.10		mg/L	2	3/28/2012 4:22:58 AM
Surr: BFB	89.6	69.3-120		%REC	2	3/28/2012 4:22:58 AM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	2.0		µg/L	2	3/28/2012 4:22:58 AM
Toluene	ND	2.0		µg/L	2	3/28/2012 4:22:58 AM
Ethylbenzene	ND	2.0		µg/L	2	3/28/2012 4:22:58 AM
Xylenes, Total	ND	4.0		µg/L	2	3/28/2012 4:22:58 AM
Surr: 4-Bromofluorobenzene	93.1	55-140		%REC	2	3/28/2012 4:22:58 AM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Client Sample ID: TSW-13
Project: K-Loop
Collection Date: 3/21/2012 11:05:00 AM
Lab ID: 1203856-003
Matrix: AQUEOUS
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	3/23/2012 2:51:24 PM
Surr: DNOP	112	61.3-164		%REC	1	3/23/2012 2:51:24 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	0.10		mg/L	2	3/28/2012 4:52:51 AM
Surr: BFB	87.3	69.3-120		%REC	2	3/28/2012 4:52:51 AM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	2.0		µg/L	2	3/28/2012 4:52:51 AM
Toluene	ND	2.0		µg/L	2	3/28/2012 4:52:51 AM
Ethylbenzene	ND	2.0		µg/L	2	3/28/2012 4:52:51 AM
Xylenes, Total	ND	4.0		µg/L	2	3/28/2012 4:52:51 AM
Surr: 4-Bromofluorobenzene	88.6	55-140		%REC	2	3/28/2012 4:52:51 AM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Southwest Geoscience
Client Sample ID: TSW-14
Project: K-Loop
Collection Date: 3/21/2012 11:50:00 AM
Lab ID: 1203856-004
Matrix: AQUEOUS
Received Date: 3/22/2012 9:30:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: DIESEL RANGE						Analyst: **JMP**
Diesel Range Organics (DRO)	ND	1.0		mg/L	1	3/23/2012 3:34:29 PM
Surr: DNOP	111	61.3-164		%REC	1	3/23/2012 3:34:29 PM
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	0.10		mg/L	2	3/28/2012 5:23:11 AM
Surr: BFB	73.4	69.3-120		%REC	2	3/28/2012 5:23:11 AM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Benzene	ND	2.0		µg/L	2	3/28/2012 5:23:11 AM
Toluene	ND	2.0		µg/L	2	3/28/2012 5:23:11 AM
Ethylbenzene	ND	2.0		µg/L	2	3/28/2012 5:23:11 AM
Xylenes, Total	ND	4.0		µg/L	2	3/28/2012 5:23:11 AM
Surr: 4-Bromofluorobenzene	74.5	55-140		%REC	2	3/28/2012 5:23:11 AM

Qualifiers:

*/X	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203856**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **MB-1212**	SampType: **MBLK**			TestCode: **EPA Method 8015B: Diesel Range**					
Client ID: **PBW**	Batch ID: **1212**			RunNo: **1634**					
Prep Date: **3/23/2012**	Analysis Date: **3/23/2012**			SeqNo: **46371**		Units: **mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	1.0								
Surr: DNOP	1.2		1.000		119	61.3	164			

Sample ID: **LCS-1212**	SampType: **LCS**			TestCode: **EPA Method 8015B: Diesel Range**					
Client ID: **LCSW**	Batch ID: **1212**			RunNo: **1634**					
Prep Date: **3/23/2012**	Analysis Date: **3/23/2012**			SeqNo: **46373**		Units: **mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	5.4	1.0	5.000	0	108	74	157			
Surr: DNOP	0.55		0.5000		111	61.3	164			

Sample ID: **LCSD-1212**	SampType: **LCSD**			TestCode: **EPA Method 8015B: Diesel Range**					
Client ID: **LCSS02**	Batch ID: **1212**			RunNo: **1634**					
Prep Date: **3/23/2012**	Analysis Date: **3/23/2012**			SeqNo: **46374**		Units: **mg/L**			
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	5.4	1.0	5.000	0	109	74	157	0.473	23	
Surr: DNOP	0.58		0.5000		115	61.3	164	0	0	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203856**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **5ML RB**	SampType: **MBLK**	TestCode: **EPA Method 8015B: Gasoline Range**
Client ID: **PBW**	Batch ID: **R1744**	RunNo: **1744**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49064** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	0.050								
Surr: BFB	19		20.00		93.2	69.3	120			

Sample ID: **2.5UG GRO LCS**	SampType: **LCS**	TestCode: **EPA Method 8015B: Gasoline Range**
Client ID: **LCSW**	Batch ID: **R1744**	RunNo: **1744**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49065** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	0.56	0.050	0.5000	0	113	101	123			
Surr: BFB	16		20.00		79.3	69.3	120			

Sample ID: **1203798-002AMS**	SampType: **MS**	TestCode: **EPA Method 8015B: Gasoline Range**
Client ID: **BatchQC**	Batch ID: **R1744**	RunNo: **1744**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49127** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	350	25	250.0	117.5	94.6	75.4	121			
Surr: BFB	9,700		10,000		97.0	69.3	120			

Sample ID: **1203798-002AMSD**	SampType: **MSD**	TestCode: **EPA Method 8015B: Gasoline Range**
Client ID: **BatchQC**	Batch ID: **R1744**	RunNo: **1744**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49128** Units: **mg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	350	25	250.0	117.5	93.2	75.4	121	0.965	10.5	
Surr: BFB	8,200		10,000		81.8	69.3	120	0	0	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1203856**

30-Mar-12

Client: Southwest Geoscience

Project: K-Loop

Sample ID: **5ML RB**	SampType: **MBLK**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBW**	Batch ID: **R1745**	RunNo: **1745**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49132** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	1.0								
Toluene	ND	1.0								
Ethylbenzene	ND	1.0								
Xylenes, Total	ND	2.0								
Surr: 4-Bromofluorobenzene	19		20.00		95.1	55	140			

Sample ID: **100NG BTEX LCS**	SampType: **LCS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSW**	Batch ID: **R1745**	RunNo: **1745**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49133** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	21	1.0	20.00	0	103	80	120			
Toluene	22	1.0	20.00	0	111	80	120			
Ethylbenzene	22	1.0	20.00	0	109	80	120			
Xylenes, Total	65	2.0	60.00	0	109	80	120			
Surr: 4-Bromofluorobenzene	18		20.00		91.8	55	140			

Sample ID: **1203740-001AMS**	SampType: **MS**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **BatchQC**	Batch ID: **R1745**	RunNo: **1745**
Prep Date:	Analysis Date: **3/27/2012**	SeqNo: **49148** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	210	10	200.0	4.500	103	70.1	118			
Ethylbenzene	270	10	200.0	53.50	107	73.5	117			
Xylenes, Total	840	20	600.0	194.7	107	73.1	119			
Surr: 4-Bromofluorobenzene	220		200.0		110	55	140			

Sample ID: **1203740-001AMSD**	SampType: **MSD**	TestCode: **EPA Method 8021B: Volatiles**
Client ID: **BatchQC**	Batch ID: **R1745**	RunNo: **1745**
Prep Date:	Analysis Date: **3/28/2012**	SeqNo: **49149** Units: **µg/L**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	200	10	200.0	4.500	99.6	70.1	118	2.95	16.4	
Ethylbenzene	270	10	200.0	53.50	107	73.5	117	0.613	13.5	
Xylenes, Total	830	20	600.0	194.7	106	73.1	119	0.682	12.9	
Surr: 4-Bromofluorobenzene	220		200.0		111	55	140	0	0	

Qualifiers:

- */X Value exceeds Maximum Contaminant Level.
- E Value above quantitation range
- J Analyte detected below quantitation limits
- R RPD outside accepted recovery limits
- B Analyte detected in the associated Method Blank
- H Holding times for preparation or analysis exceeded
- ND Not Detected at the Reporting Limit
- RL Reporting Detection Limit

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Southwest Geoscience

Work Order Number: 1203856

Received by/date: MG 03/22/2012

Logged By: Lindsay Mangin 3/22/2012 9:30:00 AM

Completed By: Lindsay Mangin 3/22/2012 3:29:09 PM

Reviewed By: MG 03/22/12

Chain of Custody

1.	Were seals intact?	Yes	No	Not Present ✔
2.	Is Chain of Custody complete?	Yes ✔	No	Not Present
3.	How was the sample delivered?	Courier		
		Tracking No.:		

Log In

4.	Coolers are present? (see 19. for cooler specific information)	Yes ✔	No	NA
5.	Was an attempt made to cool the samples?	Yes ✔	No	NA
6.	Were all samples received at a temperature of >0° C to 6.0°C	Yes ✔	No	NA
7.	Sample(s) in proper container(s)?	Yes ✔	No	
8.	Sufficient sample volume for indicated test(s)?	Yes ✔	No	
9.	Are samples (except VOA and ONG) properly preserved?	Yes ✔	No	
10.	Was preservative added to bottles?	Yes	No ✔	NA
11.	VOA vials have zero headspace?	Yes ✔	No	No VOA Vials
12.	Were any sample containers received broken?	Yes	No ✔	
13.	Does paperwork match bottle labels? (Note discrepancies on chain of custody)	Yes ✔	No	# of preserved bottles checked for pH:
14.	Are matrices correctly identified on Chain of Custody?	Yes ✔	No	(<2 or >12 unless noted)
15.	Is it clear what analyses were requested?	Yes ✔	No	Adjusted?
16.	Were all holding times able to be met? (If no, notify customer for authorization.)	Yes ✔	No	Checked by:

Special Handling (if applicable)

17. Was client notified of all discrepancies with this order? Yes No NA ✔

Person Notified: Date

By Whom: Via: eMail Phone Fax In Person

Regarding:

Client Instructions:

18. Additional remarks:

19. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	2.5	Good	Not Present			

Chain-of-Custody Record

Client: Southwest Geoscience

Mailing Address: Aztec, NM

Phone #: (903) 821-5603

email or Fax#: Ksummers@southwestgeoscience.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: K-Loop

Project #: 0411015

Project Manager: K. Summers

Sampler: J. Dubuisson

[redacted]

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type		BTEX + ~~MTBE + TMB's~~ (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
3/21	0945	W	TSW-11	4																		
↓	1020	↓	TSW-12	↓	HgCl	-002	X		X													
	1105		TSW-13		↓	-003	X		X													
↓	1150	↓	TSW-14	↓	↓	-004	X		X													

NFE

Date:	Time:	Relinquished by:	Received by:	Date	Time
3/21	1325	Josh Dubuisson	Christie Walters	3/21/12	1325
3/21/12	1552	Christie Walters	Michelle Garcia	03/22/12	0930

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Southwest GEOSCIENCE

APPENDIX E

Remediation Technologies Information

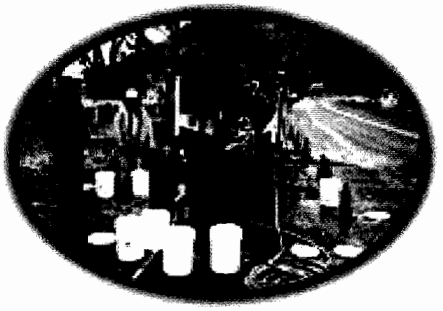
RegenOx™

CHEMICAL OXIDATION REDEFINED...

RegenOx™ is an advanced in situ chemical oxidation technology designed to treat organic contaminants including high concentration source areas in the saturated and vadose zones*

PRODUCT FEATURES:

- Rapid and sustained oxidation of target compounds
- Easily applied with readily available equipment
- Destroys a broad range of contaminants
- More efficient than other solid oxidants
- Enhances subsequent bioremediation
- Avoids detrimental impacts to groundwater aquifers



RegenOx product application

HOW IT WORKS:

RegenOx maximizes in situ performance using a solid alkaline oxidant that employs a sodium percarbonate complex with a multi-part catalytic formula. The product is delivered as two parts that are combined and injected into the subsurface using common drilling or direct-push equipment. Once in the subsurface, the combined product produces an effective oxidation reaction comparable to that of Fenton's Reagent without a violent exothermic reaction. RegenOx safely, effectively and rapidly destroys a wide range of contaminants in both soil and groundwater (Table 1).

ACHIEVES RAPID OXIDATION VIA A NUMBER OF MECHANISMS

RegenOx directly oxidizes contaminants while its unique catalytic complex generates a suite of highly charged, oxidative free radicals that are responsible for the rapid destruction of contaminants. The mechanisms by which RegenOx operates are:

- Surface- Mediated Oxidation: (see Figure 1 and description below)
- Direct Oxidation: $C_2Cl_4 + 2\ Na_2CO_3 \bullet 3\ H_2O_2 + 2\ H_2O \longleftrightarrow 2CO_2 + 4\ NaCl + 4\ H_2O + 2\ H_2CO_3$
- Free Radical Oxidation:
  - Perhydroxyl Radical ($HO_2\bullet$)
  - Hydroxyl Radical ($OH\bullet$)
  - Superoxide Radical ($O_2\bullet$)

Figure 1. RegenOx™ Surface-Mediated Oxidation

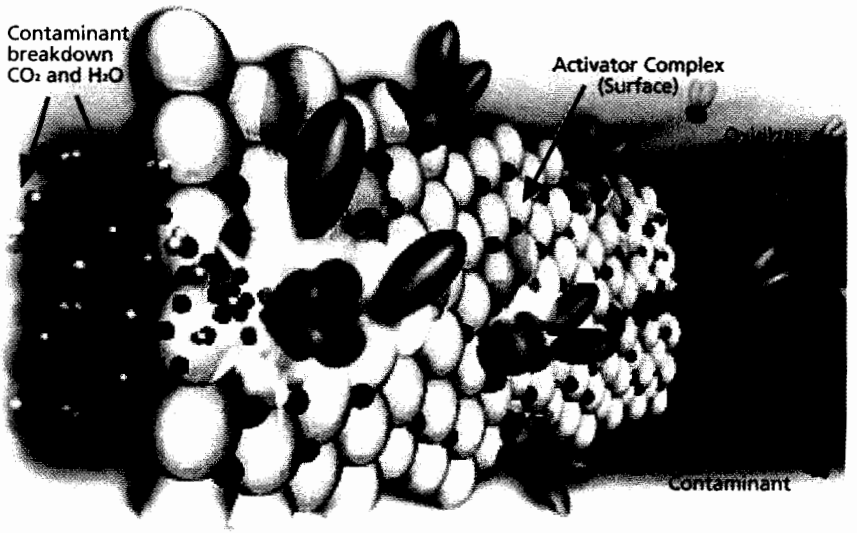


Figure 1. Surface-Mediated Oxidation is responsible for the majority of RegenOx contaminant destruction. This process takes place in two stages. First, the RegenOx activator complex coats the subsurface. Second, the oxidizer complex and contaminant react with the activator complex surface destroying the contaminant.

* Patent applied for

RegenOx™

From Mass Reduction to Bioremediation:

RegenOx™ is an effective and rapid contaminant mass reduction technology. A single injection will remove significant amounts of target contaminants from the subsurface. Strategies employing multiple Regenox injections coupled with follow-on accelerated bioremediation can be used to treat highly contaminated sites to regulatory closure. In fact, RegenOx was designed specifically to allow for a seamless transition to low-cost accelerated bioremediation using any of Regenesis controlled release compounds.

Significant Longevity:

RegenOx has been shown to destroy contaminants for periods of up to one month.

Product Application Made Safe and Easy:

RegenOx produces minimal heat and as with all oxidants proper health and safety procedures must be followed. The necessary safety guidance accompanies all shipments of RegenOx and additional resources are available on request. Through the use of readily available, highly mobile, direct-push equipment and an array of pumps, RegenOx has been designed to be as easy to install as other Regenesis products like ORC® and HRC®.

Effective on a Wide Range of Contaminants:

RegenOx has been rigorously tested in both the laboratory and the field on petroleum hydrocarbons (aliphatics and aromatics), gasoline oxygenates (e.g., MTBE and TAME), polyaromatic hydrocarbons (e.g., naphthalene and phenanthrene) and chlorinated hydrocarbons (e.g., PCE, TCE, TCA).

Oxidant Effectiveness vs. Contaminant Type:

Table 1

Contaminant	RegenOx™	Fenton's Reagent	Permanganate	Persulfate	Activated Persulfate	Ozone
Petroleum Hydrocarbons	**A**	**A**	B	B	B	**A**
Benzene	**A**	**A**	D	B	B	**A**
MTBE	**A**	B	**B**	C	B	B
Phenols	**A**	**A**	B	C	B	**A**
Chlorinated Ethenes (PCE, TCE, DCE, VC)	**A**	**A**	**A**	B	**A**	**A**
Chlorinated Ethanes (TCA, DCA)	**A**	B	C	D	C	B
Polycyclic Aromatic Hydrocarbons (PAHs)	**A**	**A**	B	B	**A**	**A**
Polychlorinated Biphenyls (PCBs)	B	C	D	D	D	B
Explosives (RDX, HMX)	**A**	**A**	**A**	**A**	**A**	**A**

Based on laboratory kinetic data, thermodynamic calculations, and literature reports.

Oxidant Effectiveness Key:

A = Short half life, low free energy (most energetically favored), most complete
B = Intermediate half life, low free energy, intermediate degree of completion
C = Intermediate half life, intermediate free energy, low degree of completion
D = Long half life, high free energy (least favored), very low degree of completion

REGENESIS
Advanced Technologies for Groundwater Resources
1011 Calle Sombra / San Clemente / California 92673-6244
Tel: 949/366-8000 / Fax: 949/366-8090 / www.regenesis.com

RegenOx® – Part A (Oxidizer Complex)

Material Safety Data Sheet (MSDS)

Last Revised: June 24, 2010

Section 1 – Supplier Information and Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673
Telephone: 949.366.8000
Fax: 949.366.8090
E-mail: info@regenesis.com

Chemical Description:	A mixture of sodium percarbonate [$2Na_2CO_3 \cdot 3H_2O_2$], sodium carbonate [Na_2CO_3], sodium silicate and silica gel.
Chemical Family:	Inorganic Chemicals
Trade Name:	RegenOx® – Part A (Oxidizer Complex)
Product Use:	Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Chemical Information/Other Designations

CAS No.	Chemical	Percentage
15630-89-4	Sodium Percarbonate	60 -100 %
5968-11-6	Sodium Carbonate Monohydrate	10 – 30 %
7699-11-6	Silicic Acid	< 1 %
63231-67-4	Silica Gel	< 1 %

Section 3 – Physical Data

Form:	Powder
Color:	White
Odor:	Odorless
Melting Point:	NA
Boiling Point:	NA

Section 3 – Physical Data (cont)

Flammability/Flash Point:	NA
Vapor Pressure:	NA
Bulk Density:	0.9 – 1.2 g/cm^3
Solubility:	Min 14.5g/100g water @ 20 ºC
Viscosity:	NA
pH (3% solution):	≈ 10.5
Decomposition Temperature:	Self-accelerating decomposition with oxygen release starts at 50 ºC.

Section 4 – Reactivity Data

Stability:	Stable under normal conditions
Conditions to Avoid/Incompatibility:	Acids, bases, salts of heavy metals, reducing agents, and flammable substances
Hazardous Decomposition Products:	Oxygen. Contamination with many substances will cause decomposition. The rate of decomposition increases with increasing temperature and may be very vigorous with rapid generation of oxygen and steam.

Section 5 – Regulations

TSCA Inventory Listed:	Yes
CERCLA Hazardous Substance (40 CFR Part 302)	
Listed Substance:	*No*
Unlisted Substance:	*Yes*
SARA, Title III, Sections 313 (40 CFR Part 372) – Toxic Chemical Release Reporting: Community Right-To-Know	
Extremely Hazardous Substance:	No
WHMIS Classification:	C, D2B
Canadian Domestic Substance List:	Appears

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Oxidizer. Store in a cool, well ventilated area away from all sources of ignition and out of the direct sunlight. Store in a dry location away from heat and in temperatures less than 40 °C. Keep away from incompatible materials and keep lids tightly closed. Do not store in improperly labeled containers. Protect from moisture. Do not store near combustible materials. Keep containers well sealed. Store separately from reducing materials. Avoid contamination which may lead to decomposition.
Handling:	Avoid contact with eyes, skin and clothing. Use with adequate ventilation. Do not swallow. Avoid breathing vapors, mists or dust. Do not eat, drink or smoke in the work area. Label containers and keep them tightly closed when not in use. Wash hands thoroughly after handling.

Personal Protective Equipment (PPE)

Engineering Controls:	General room ventilation is required if used indoors. Local exhaust ventilation, process enclosures or other engineering controls may be needed to maintain airborne levels below recommended exposure limits. Avoid creating dust or mists. Maintain adequate ventilation at all times. Do not use in confined areas. Keep levels below recommended exposure limits. To determine actual exposure limits, monitoring should be performed on a routine basis.
Respiratory Protection:	For many conditions, no respiratory protection is necessary; however, in dusty or unknown conditions or when exposures exceed limit values a NIOSH approved respirator should be used.
Hand Protection:	Wear chemical resistant gloves (neoprene, rubber, or PVC).

Section 6 – Protective Measures, Storage and Handling (cont)

Eye Protection:	Wear chemical safety goggles. A full face shield may be worn in lieu of safety goggles.
Skin Protection:	Try to avoid skin contact with this product. Chemical resistant gloves (neoprene, PVC or rubber) and protective clothing should be worn during use.
Other:	Eye wash station.
Protection Against Fire & Explosion:	Product is non-explosive. In case of fire, evacuate all non-essential personnel, wear protective clothing and a self-contained breathing apparatus, stay upwind of fire, and use water to spray cool fire-exposed containers.

Section 7 – Hazards Identification

Potential Health Effects

Inhalation:	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath, and irritations to mucous membranes, nose and throat.
Eye Contact:	Causes irritation, redness and pain.
Skin Contact:	Causes slight irritation.
Ingestion:	May be harmful if swallowed (vomiting and diarrhea).

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage:	Eliminate all ignition sources. Evacuate unprotected personnel and never exceed any occupational exposure limit. Shovel or sweep spilt material into plastic bags or vented containers for disposal. Do not return spilled or contaminated material to the inventory.
Extinguishing Media:	Water

First Aid

Eye Contact:	Flush eyes with running water for at least 15 minutes with eyelids held open. Seek a specialist.
Inhalation:	Remove affected person to fresh air. Seek medical attention if the effects persist.
Ingestion:	If the individual is conscious and not convulsing, give two-four cups of water to dilute the chemical and seek medical attention immediately. **Do Not** induce vomiting.

Section 8 – Measures in Case of Accidents and Fire (cont)

Skin Contact:	Wash affected areas with soap and a mild detergent and large amounts of water.

Section 9 – Accidental Release Measures

Precautions:	
Cleanup Methods:	Shovel or sweep spilt material into plastic bags or vented containers for disposal. Do not return spilled or contaminated material to the inventory.

Section 10 – Information on Toxicology

Toxicity Data	
LD50 Oral (rat):	2,400 mg/kg
LD50 Dermal (rabbit):	Min 2,000 mg/kg
LD50 Inhalation (rat):	Min 4,580 mg/kg

Section 11 – Information on Ecology

Ecology Data	
Ecotoxicological Information:	NA

Section 12 – Disposal Considerations

Waste Disposal Method	
Waste Treatment:	Dispose of in an approved waste facility operated by an authorized contactor in compliance with local regulations.
Package (Pail) Treatment:	The empty and clean containers are to be recycled or disposed of in conformity with local regulations.

Section 13 – Shipping/Transport Information

D.O.T. Shipping Name:	Oxidizing Solid, N.O.S. [A mixture of sodium percarbonate [$2Na_2CO_3 \cdot 3H2O_2$], sodium carbonate [Na_2CO_3], sodium silicate and silica gel.]
UN Number:	1479
Hazard Class:	5.1
Labels:	5.1 (Oxidizer)
Packaging Group:	III

Section 14 – Other Information

HMIS® Rating	Health – 1 (slight)	Reactivity – 1 (slight)
	Flammability – 0 (none)	Lab PPE – goggles, gloves, and lab coat

HMIS® is a registered trademark of the National Painting and Coating Association.

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.

RegenOx® – Part B (Activator Complex)

Material Safety Data Sheet (MSDS)

Last Revised: June 4, 2010

Section 1 – Supplier Information and Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673
Telephone: 949.366.8000
Fax: 949.366.8090
E-mail: info@regenesis.com

Chemical Description:	A mixture of sodium silicate solution, silica gel and ferrous sulfate
Chemical Family:	Inorganic Chemicals
Trade Name:	RegenOx® – Part B (Activator Complex)
Product Use:	Used for environmental remediation of contaminated soils and groundwater

Section 2 – Chemical Information/Other Designations

CAS No.	Chemical
1344-09-8	Silicic Acid, Sodium Salt, Sodium Silicate
63231-67-4	Silica Gel
7720-78-7	Ferrous Sulfate
7732-18-5	Water

Section 3 – Physical Data

Form:	Liquid
Color:	Blue/Green
Odor:	Odorless
Melting Point:	NA
Boiling Point:	NA
Flammability/Flash Point:	NA
Vapor Pressure:	NA

Section 3 – Physical Data (cont)

Specific Gravity	1.39 g/cm^3
Solubility:	Miscible
Viscosity:	NA
pH (3% solution):	11
Hazardous Decomposition Products:	Oxides of carbon and silicon may be formed when heated to decomposition.

Section 4 – Reactivity Data

Stability:	Stable under normal conditions.
Conditions to Avoid:	None.
Incompatibility:	Avoid hydrogen fluoride, fluorine, oxygen difluoride, chlorine trifluoride, strong acids, strong bases, oxidizers, aluminum, fiberglass, copper, brass, zinc, and galvanized containers.

Section 5 – Regulations

TSCA Inventory Listed: Yes

CERCLA Hazardous Substance (40 CFR Part 302)

Listed Substance: *No*

Unlisted Substance: *Yes*

SARA, Title III, Sections 302/303 (40 CFR Part 355) – Emergency Planning and Notification

Extremely Hazardous Substance: No

SARA, Title III, Sections 311/312 (40 CFR Part 370) – Hazardous Chemical Reporting: Community Right-To-Know

Hazard Category: Acute

SARA, Title III, Sections 313 (40 CFR Part 372) – Toxic Chemical Release Reporting: Community Right-To-Know

Extremely Hazardous Substance: No

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Keep in a tightly closed container (steel or plastic) and store in a cool, well ventilated area away from all incompatible materials (acids, reactive metals, and ammonium salts). Store in a dry location away from heat above 60 degrees C and colder than 10 degrees C. Do not store in aluminum, fiberglass, copper, brass, zinc or galvanized containers.
Handling:	Avoid contact with eyes, skin and clothing. Avoid breathing spray mist. Use with adequate ventilation. Do not use product if it is brownish-yellow in color.

Personal Protective Equipment (PPE)

Engineering Controls:	General room ventilation is required if used indoors. Local exhaust ventilation, process enclosures or other engineering controls may be needed to maintain airborne levels below recommended exposure limits. Safety shower and eyewash station should be within direct access.
Respiratory Protection:	Use NIOSH-approved dust and mist respirator where spray mist exists. Respirators should be used in accordance with 29 CFR 1910.134.
Hand Protection:	Wear chemical resistant gloves.
Eye Protection:	Wear chemical safety goggles. A full face shield may be worn in lieu of safety goggles.
Skin Protection:	Try to avoid skin contact with this product. Gloves and protective clothing should be worn during use.
Other:	
Protection Against Fire & Explosion:	Product is non-explosive and non-combustible.

Section 7 – Hazards Identification

Potential Health Effects

Inhalation:	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath, and irritations to mucous membranes, nose and throat.
Eye Contact:	Causes irritation, redness and pain.
Skin Contact:	Causes irritation. Symptoms include redness, itching and pain.
Ingestion:	May cause irritation to mouth, esophagus, and stomach.

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage (small):	Mop up and neutralize liquid, then discharge to sewer in accordance with local, state and federal regulations.
After Spillage/Leakage (large):	Keep unnecessary personnel away; isolate hazard area and do not allow entrance into the affected area. Do not touch or walk through spilled material. Stop leak if possible without risking injury. Prevent runoff from entering into storm sewers and ditches that lead to natural waterways. Isolate the material if at all possible. Sand or earth may be used to contain the spill. If containment is not possible, neutralize the contaminated area and flush with large quantities of water.
Extinguishing Media:	Material is compatible with all extinguishing media.
Further Information:	
First Aid	
Eye Contact:	Flush eyes with running water for at least 15 minutes with eyelids held open. Seek a specialist.
Inhalation:	Remove affected person to fresh air. Give artificial respiration if individual is not breathing. If breathing is difficult, give oxygen. Seek medical attention if the effects persist.
Ingestion:	If the individual is conscious and not convulsing, give two-four cups of water to dilute the chemical and seek medical attention immediately. **DO NOT** induce vomiting.
Skin Contact:	Wash affected areas with soap and a mild detergent and large amounts of water. Remove contaminated clothing and shoes.

Section 9 – Accidental Release Measures

Precautions:

PPE:	Wear chemical goggles, body-covering protective clothing, chemical resistant gloves, and rubber boots (see Section 6).
Environmental Hazards:	Sinks and mixes with water. High pH of this material may be harmful to aquatic life. Only water will evaporate from a spill of this material.
Cleanup Methods:	Pick-up and place in an appropriate container for reclamation or disposal. US regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities.

Section 10 – Information on Toxicology

Toxicity Data

Sodium Silicate:	When tested for primary eye irritation potential according to OECD Guidelines, Section 405, a similar sodium silicate solution produced corneal, iridal and conjunctival irritation. Some eye irritation was still present 14 days after treatment, although the average primary irritation score has declined from 29.7 after 1 day to 4.0 after 14 days. When tested for primary skin irritation potential, a similar sodium silicate solution produced irritation with a primary irritation index of 3 to abraded skin and 0 to intact skin. Human experience confirms that irritation occurs when sodium silicates get on clothes at the collar, cuffs, or other areas where abrasion may exist. The acute oral toxicity of this product has not been tested.
Ferrous Sulfate:	LD50 Oral (rat): 319 mg/kg not a suspected carcinogen.

Section 11 – Information on Ecology

Ecology Data

Ecotoxicological Information:	Based on 100% solid sodium silicate, a 96 hour median tolerance for fish of 2,320 mg/l; a 96 hour median tolerance for water fleas of 247 mg/L; a 96 hour median tolerance for snail eggs of 632 mg/L; and a 96 hour median tolerance for Amphipoda of 160 mg/L.

Section 12 – Disposal Considerations

Waste Disposal Method

Waste Treatment:	Neutralize and landfill solids in an approved waste facility operated by an authorized contactor in compliance with local regulations.
Package (Pail) Treatment:	The empty and clean containers are to be recycled or disposed of in conformity with local regulations.

Section 13 – Shipping/Transport Information

D.O.T.	This product is not regulated as a hazardous material so there are no restrictions.

Section 14 – Other Information

HMIS® Rating	Health – 2 (moderate)	Reactivity – 0 (none)
	Flammability – 0 (none)	Lab PPE – goggles, gloves, and lab coat
	Contact – 1 (slight)	

HMIS® is a registered trademark of the National Painting and Coating Association.

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person. Individuals receiving this information must exercise their independent judgment in determining its appropriateness for a particular purpose.