ConocoPhillips
76 Broadway
Sacramento, California 95818

November 17, 2005

Mr. Don Hwang
Alameda County Health Agency
1131 Harbor Bay Parkway
Alameda, California 94502

Re: **Report Transmittal**
Ozone Sparge Pilot Study Workplan
76 Service Station #5325
3220 Lakeshore Avenue
Oakland, CA

Dear Mr. Hwang:

I declare under penalty of perjury that to the best of my knowledge the information and/or recommendations contained in the attached report is/are true and correct.

If you have any questions or need additional information, please contact

Shelby S. Lathrop (Contractor)
ConocoPhillips
Risk Management & Remediation
76 Broadway
Sacramento, CA 95818
Phone: 916-558-7609
Fax: 916-558-7639

Sincerely,

Thomas Kosel
Risk Management & Remediation

Attachment

TRC

Customer-Focused Solutions

November 17, 2005 TRC Project No. 42013706

Mr. Don Hwang
Alameda County Health Services
1131 Harbor Bay Parkway
Alameda, CA 94502-6577

SITE: 76 SERVICE STATION NO. 5325
3220 LAKESHORE AVENUE
OAKLAND, CALIFORNIA

RE: OZONE SPARGE PILOT STUDY WORKPLAN

Dear Mr. Hwang:

On behalf of ConocoPhillips Company (ConocoPhillips), TRC has prepared this workplan to conduct an ozone sparge pilot study for the above-referenced site. This work plan includes a brief description of the site background, remediation status, site conditions, proposed scope of work, ozone sparging technology, conceptual design, pre-field activities, field activities, and reporting.

SITE BACKGROUND

The subject site is an operating 76 Service Station situated on the southeast corner of the intersection of Lakeshore Avenue and Lake Park Avenue in Oakland, California (Figure 1). The site is bounded to the north by Lakeshore Avenue, to the west and southwest by Lake Park Avenue, to the southeast by a supermarket parking lot, and to the east by a pharmacy. Current site facilities consist of the service station building with three service bays, three product dispenser islands, and two 12,000-gallon double-wall fiberglass gasoline underground storage tanks (USTs).

May 1990: Three exploratory soil borings (U-A, U-B, and U-C) were advanced adjacent to the UST complex to depths ranging from 10 to 12.5 feet below ground surface (bgs). Soil samples collected were analyzed for total petroleum hydrocarbons as gasoline (TPH-g) and benzene, toluene, ethylbenzene, and xylenes (BTEX). The samples contained TPH-g concentrations ranging from 2 to 7,500 parts per million (ppm) and benzene concentrations ranging from 0.14 to 13 ppm (GSI, June, 1990).

June 1990: Two 10,000-gallon gasoline USTs, one 550-gallon waste oil UST, and related product dispensers were replaced. Soil samples collected from the UST excavation sidewalls and bottom and product line trenches were reported to contain TPH-g and benzene at concentrations ranging from 12 to 2,800 ppm and 0.008 to 11 ppm, respectively. Approximately 250 cubic yards of soil and backfill material were aerated onsite to reduce concentrations to below 100 ppm TPH-g, then transported to an appropriate soil disposal facility. Groundwater was encountered at approximately 7.5 feet bgs (GSI, August, 1990).

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September 1990: Monitoring wells U-1, U-2, and U-3 were installed. TPH-g was detected in soil samples collected from the capillary fringe in well borings U-1 and U-2 at concentrations of 110 and 480 ppm, respectively. Benzene was detected in the soil sample from well boring U-1 at a concentration of 4.5 ppm. Petroleum hydrocarbons were not detected in soil or groundwater samples from U-3. Groundwater samples collected from wells U-1 and U-2 were reported to contain 690 and 38 parts per billion (ppb) TPH-g and 780 and 27 ppb benzene, respectively (GSI, December, 1990).

June 1990: Monitoring wells U-4, U-5, and U-6 were installed. TPH-g and benzene were detected in the capillary fringe soil sample collected from boring U-5 at concentrations of 400 and 1.9 ppm, respectively. TPH-g and benzene were not detected in soil samples collected from borings U-4 and U-6. Groundwater levels stabilized at depths between 8.8 and 9.2 feet bgs (GSI, August, 1994).

November 1996: One 550-gallon waste oil UST was removed and the product lines and dispensers were replaced. A soil sample collected from the sidewall of the waste oil UST excavation contained 1.5 ppm total petroleum hydrocarbons as diesel (TPH-d) and 78 ppm total oil and grease (TOG). TPH-g, benzene, methyl tertiary butyl ether (MTBE), halogenated volatile organic compounds (HVOCs), and semivolatile organic compounds (SVOCs) were not detected. Product line trench excavation and overexcavation samples were reported to contain petroleum hydrocarbon concentrations ranging from non-detect to 880 ppm TPH-g, non-detect to 3.6 ppm benzene, and non-detect to 23 ppm MTBE. Approximately 276 tons of excavated soil was transported to an appropriate disposal facility (GSI, January, 1997).

October 2003: Site environmental consulting responsibilities were transferred to TRC.

REMEDIATION STATUS

June 1990: Approximately 250 cubic yards of soil and backfill material generated during the removal of USTs were aerated onsite to reduce concentrations to below 100 ppm TPH-g, then transported to an appropriate soil disposal facility.

November 1996: Approximately 276 tons of contaminated soil that was excavated during the removal of a waste oil tank was transported to an appropriate disposal facility.

SITE CONDITIONS

The subject site is situated on estuarine deposits northeast of the Lake Merritt basin and southwest of the Piedmont Hills at an elevation of approximately 7 to 11 feet (City of Oakland datum). These estuarine deposits consist primarily of unconsolidated, water-saturated, dark plastic clay and silty clay rich in organic material (GSI, 1994).

Based on previous onsite subsurface investigations, silt and sand fill were observed in the vadose zone to varying depths up to 6 feet bgs. The site is underlain by fine-grained sediments, silts and clays to depths of approximately 25 feet bgs. The silts and clays contain from 10 percent to as much as 30 percent fine- to coarse-grained sand.

Within the predominantly fine-grained soil horizon are laterally discontinuous lenses of predominantly coarse-grained sediments, interbedded with fine-grained materials to the maximum depth explored of 26.5 feet bgs. The predominantly coarse-grained deposits vary in thickness and are encountered at varying depths across the site. These deposits consist of silty sand (SM), fine-to coarse-grained sand (SW and SP), and sandy gravel (GW). The predominantly coarse-grained sediments appear to be discontinuous across the site in an east-west orientation, and continuous across the site in a north-south orientation.

In the vicinity of well U-2, the coarse-grained sediments with observed hydrocarbon impacts are encountered between 6 and 9 feet bgs and are underlain by a clayey silt with sand (with observed hydrocarbon impacts) that extends to a depth of approximately 14 feet bgs. The clayey silt with sand is underlain by a stiff clay (with no observed hydrocarbon impacts) to the total depth explored of 21.5 feet bgs.

Groundwater is unconfined and is typically encountered at approximately 6 to 10 feet bgs. Groundwater flow has been predominantly toward the northwest with a hydraulic gradient ranging from 0.002 to 0.02 (Gettler-Ryan, Inc., June, 2000).

Quarterly groundwater monitoring has been performed on the site wells since their installation. Well U-1 contained floating product (0.01 to 0.55 feet) during 1996 to 1998. Well U-2 contained floating product (sheen to 0.03 feet) during 1997 and 1998. Total purgeable petroleum hydrocarbons (TPPH) and MTBE remain elevated in these wells. (TRC, July, 2005).

PROPOSED SCOPE OF WORK

In an effort to more actively remediate the subject site, TRC proposes an ozone sparging pilot test using a PulseOx 100 (P-100) mobile ozone sparge system, manufactured by Advanced Process Technologies Inc. (APT) be performed at the site. Task to be performed include the following:

- Obtain well installation and construction permits for installation of ozone sparge points and sparge line trenching (Figure 2).

- Install three ozone sparge points to intersect high-permeability soil types below the water table. Proposed well depths are approximately 12-14 feet bgs based on known conditions. The construction may be modified in the field based on observed conditions. Proposed locations are in the vicinity of site well U-2 (Figure 2).

- Complete a pre-event groundwater monitoring and sampling event. Pre-event monitoring will involve analysis of biodegradation parameters including: dissolved oxygen (DO), oxidation-reduction potential (ORP), manganese, nitrate, carbon dioxide, ferrous iron, phosphate and sulfate to determine the feasibility of natural attenuation for treating any residual hydrocarbons.

- Perform three-month ozone microsparge pilot study using a mobile unit ozone sparging unit (PulseOx P-100) to treat the western portion of the dissolved-phase hydrocarbon plume in the vicinity of well U-2.

- Complete up to six months (2 quarters) of post-event groundwater monitoring to evaluate the effectiveness of the three-month ozone microsparging event. Post-event monitoring will involve analysis of biodegradation parameters including: DO, ORP, manganese, nitrate, carbon dioxide, ferrous iron, phosphate and sulfate to evaluate the progress of natural attenuation in treating any residual hydrocarbons.

If ozone sparging is shown to be effective in treating the western portion of the dissolved-phase plume in the shallow water-bearing zone, the system may be expanded. System expansion will be consistent with the proposed system outlined in the previously submitted Workplan for Interim Remedial Measure/Feasibility Study (TRC, 2004).

OZONE SPARGING TECHNOLOGY (PULSEOX 100)

Ozone generation and delivery to the sparge points will be accomplished using the PulseOx 100 (P-100) in-situ chemical oxidation system designed by Applied Process Technology, Inc. The P-100 system can produce up to 2 pounds per day (lbs/day) of ozone and can deliver ozone to the subsurface at 20 pounds per square inch (psi) in up to 8 sparge points simultaneously. The P-100 system is a trailer-mounted mobile treatment system that can be operated in an unattended mode with minimal operations and maintenance. The P-100 system will be connected directly to the sparge points via Teflon lines buried within PVC conduit. The P-100 system will introduce microbubbles of encapsulated ozone into the area of impacted groundwater to rapidly oxidize contaminants. Ozone not consumed in the direct reaction with dissolved phase hydrocarbons rapidly decomposes to oxygen. The introduction of excess oxygen has an added benefit of stimulating the natural biological degradation by increasing dissolved oxygen levels.

PRE-FIELD ACTIVITIES

Well installation permits will be obtained from the County of Alameda Public Works Agency (CAPWA) for installation of the sparge points. A grout inspection will be arranged with the CAPWA prior to the sparge point installation activities. TRC will obtain any necessary permits from the City of Oakland, Alameda County or the Fire Department for operation of the mobile ozone sparging system. If necessary appropriate traffic control measures will be arranged prior to system installation activities. Underground Service Alert (USA) will be contacted at least 48 hours prior to the initiation of drilling activities. In addition, a private utility locator will be used to independently identify the locations of underground utilities.

A site and job specific health and safety plan that promotes personnel safety and preparedness will be prepared prior to the planned field activities. On the first day of field activities, a "tailgate" meeting will be conducted with all exclusion zone workers to discuss the health and safety issues and concerns related to the specific scope of work.

FIELD ACTIVITIES

Ozone Sparge Well Installation

A network of three sparge points will be installed onsite, in the vicinity of site well U-2, and spaced according to the general guidelines tabulated below. Based on the current depth to water and the proposed depth of the sparge point installations, TRC estimates a 14-foot radius-of-influence will be achieved from each sparge point.

Saturated Depth Above Sparge Point	Estimated Radius of Influence
5 feet	12 feet
10 feet	20 feet
20 feet	30 feet
50 feet	65 feet

Each of the three proposed sparge points will be installed to a total depth of approximately 12 -14 ft bgs or as indicated by field observations to intersect higher-permeability soil types using 8-inch diameter hollow-stem auger drilling equipment. Prior to drilling, a pilot hole will be cleared to a depth of 5 fbg using an air or water knife to further identify any buried utilities at each well location. Soil samples will be collected continuously from the surface to total depth in each of the proposed borings. This will insure the points are installed in permeable soils. Samples will be collected for soil description in accordance with the Unified Soil Classification System (ASTM D-2487), field hydrocarbon vapor testing, and analysis at a state-certified laboratory. The soil samples will be screened in the field using a hand-held organic vapor meter equipped with a photo-ionization detector (PID). If evidence of hydrocarbon impact is observed, selected soil samples will be submitted to a state-certified laboratory for analysis.

The selected soil samples will be properly preserved and transported to the laboratory under appropriate chain-of-custody protocol. The soil samples will be analyzed for TPPH, BTEX, and fuel oxygenates, including methyl tert-butyl ether (MTBE), tert-butyl ether (TBA), di-isopropyl ether (DIPE), tert-amyl ether (TAME), ethyl tert-butyl ether (ETBE) 1,2-dichloroethane (1,2-DCA) and 1,2-dibromoethane (EDB), and ethanol by EPA Method 8260B.

All borings will be converted to ozone sparge wells by the installation of 2-inch diameter sparge points placed at a depth determined during logging. Field procedures for the ozone sparge well installations are included in Attachment A. The placement of individual perforations may be modified based on the subsurface lithologies encountered during drilling activities.

Ozone Sparge System Setup

Connections will be made to the sparge points via conduit installed within a shallow trench to a depth of 6 inches below grade. The individual sparge lines will be routed from each sparge

point, within the trench conduit, to the location of the mobile ozone treatment system and terminated within a vault box located within the temporary treatment compound. The P-100 system and generator will be located within a temporarily fenced area located immediately over the vault box. Temporary fencing will be placed around the treatment unit to prevent public access to the vault box or treatment system.

LIMITED OZONE INJECTION PROGRAM SCHEDULE

Prior to system startup groundwater samples will be collected from well U-2. During the three-month ozone injection event a technician will visit the unit weekly to conduct system inspections and maintenance activities. Additional samples will be collected from well U-2 monthly during the test. All samples will be analyzed for DO, ORP, pH, conductivity, temperature, manganese, nitrate, phosphate, sulfate, total purgeable petroleum hydrocarbons as gasoline (TPPH), benzene, ethylbenzene, toluene, xylenes (BTEX), and methyl tertiary butyl ether (MTBE). Quarterly sampling of all site wells will continue during this period.

The groundwater samples will be appropriately preserved and submitted to a state-certified laboratory for analysis. Chain-of-Custody protocol will be followed, thereby providing a continuous record of sample possession before actual analysis.

REPORTING

An ozone injection pilot test report will be prepared and submitted after six months (two quarters) of post-event groundwater monitoring. At that time, the contaminant concentrations, dissolved oxygen levels, and other monitored parameters will be compared to the initial conditions for monitoring well U-2.

If mobile ozone microsparging is shown to be effective in treating the downgradient portion of the dissolved-phase plume in the shallow water-bearing zone, TRC will propose to expand the treatment system as described in the 2004 Feasibility Study.

REFERENCES

Gettler-Ryan Inc., 1999, Bio-Attenuation Parameters at Tosco (76) Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated November 15, 1999.

Gettler-Ryan Inc., 2000, Site Conceptual Model for Tosco (76) Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, dated June 19, 2000.

GeoStrategies Incorporated, 1997, Soil Boring and Well Installation Report, Unocal Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated August 4, 1997.

GeoStrategies Incorporated, 1997, Waste Oil Tank Removal and Product Line Replacement Report, Unocal Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated January 24, 1997.

GeoStrategies Incorporated, 1994, Monitoring Well Installation Report, Unocal Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated November 16, 1994.

GeoStrategies Incorporated, 1990, Tank Replacement Report, Unocal Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated August 31, 1990.

GeoStrategies Incorporated, 1990, Soil Boring Report, Unocal Service Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, Dated June 12, 1990.

TRC, Quarterly Monitoring Report, April through June, 2005, 76 Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, dated June 14, 2005.

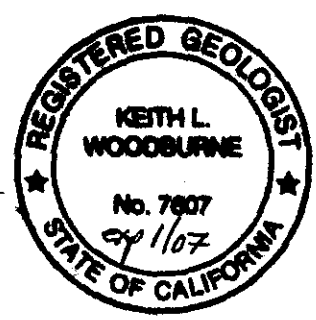
TRC, Workplan for Interim Remedial Measure/Feasibility Study, 76 Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, dated August 30, 2004.

Please call Keith Woodburne at (925) 688-2488 if you have any questions regarding this report.

Sincerely,
TRC

Mark Trevor
Project Geologist

Keith Woodburne, P.G.
Senior Project Geologist



Attachments: Figure 1 – Vicinity Map
Figure 2 – Site Plan Showing Proposed Spargepoints & Treatment System Layout
Appendix A – General Field Procedures

cc: Shelby Lathrop, ConocoPhillips (electronic upload only)

FIGURES

1 MILE 3/4 1/2 1/4 0 1 MILE

SCALE 1 : 24,000

N

SOURCE:

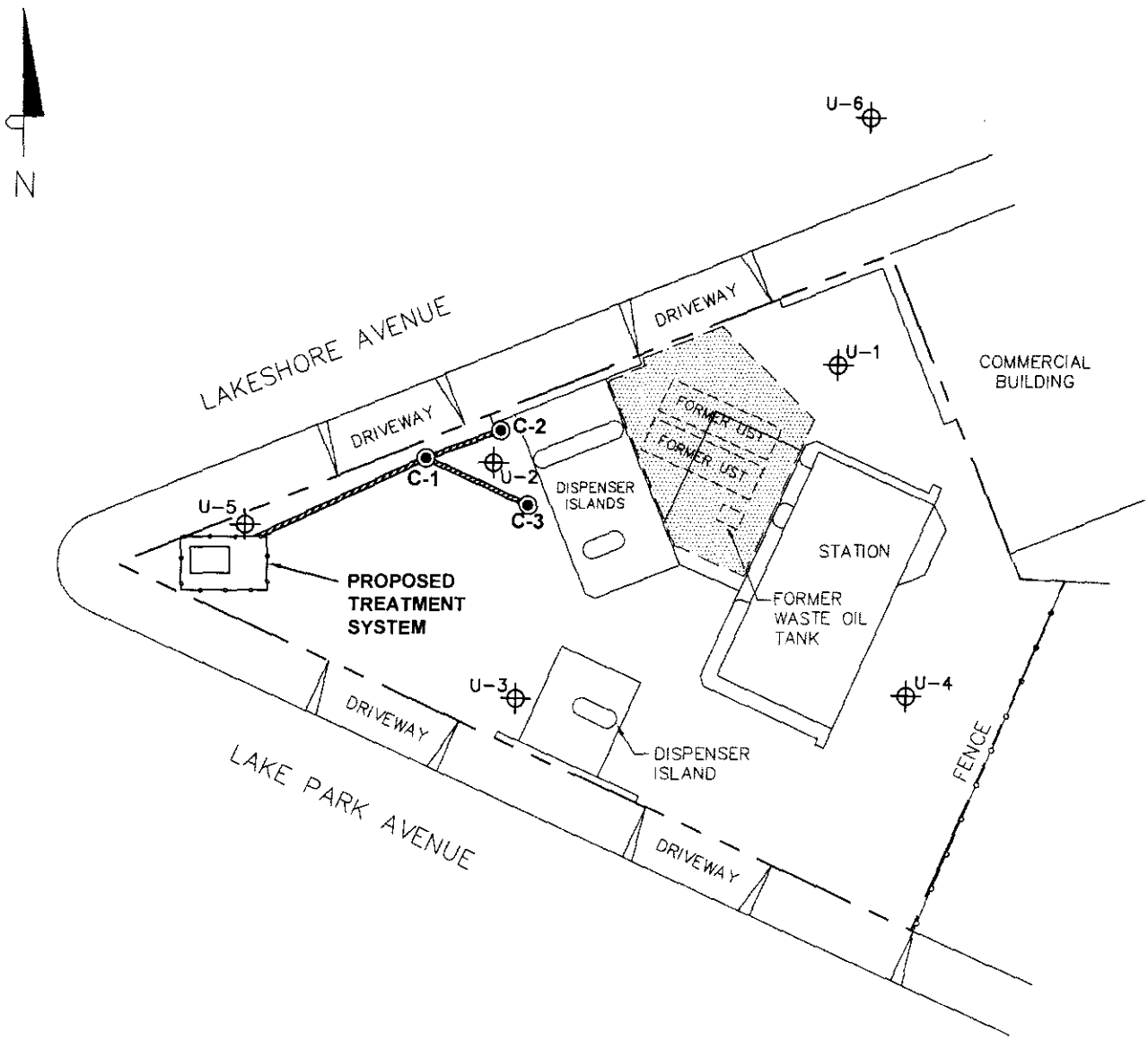
United States Geological Survey
7.5 Minute Topographic Maps:
Oakland East and Oakland West
Quadrangles, California

VICINITY MAP

76 Service Station #5325
3220 Lakeshore Avenue
Oakland, California

TRC

FIGURE 1



LEGEND

- Property boundary
- Fence
- Approximate location of 1990 UST excavation
- U-6 Monitoring well
- C-3 Proposed sparge point
- Proposed trenching

APPROXIMATE SCALE (FEET)

0 40 80

SOURCE: Site plan by Gettler-Ryan, November 2000.

PROPOSED SPARGE POINTS AND TREATMENT SYSTEM LAYOUT

76 Service Station #5325
3200 Lakeshore Avenue
Oakland, California

TRC

FIGURE 2

APPENDIX A

GENERAL FIELD PROCEDURES

GENERAL FIELD PROCEDURES

A description of the general field procedures used during site investigation and monitoring activities is presented below. For an overview of protocol, refer to the appropriate section(s).

DRILLING AND SOIL SAMPLING

Soil borings are drilled using continuous-flight, hollow-stem augers. Borings that are not completed as monitoring wells are grouted to within 5 feet of the ground surface with a cement/bentonite slurry. The remaining 5 feet is filled with concrete.

Soil samples are obtained for soil description, field hydrocarbon vapor screening, and possible laboratory analysis. Soil samples are retrieved from the borings by one of two methods: 1) continuously, using a 5-foot-long, continuous-core barrel sampler advanced into the soil with the lead auger; sample tubes are driven into the core with a mallet, or 2) at 2.5- or 5-foot intervals, using a standard split-spoon sampler lined with four 1.5-inch-diameter stainless steel or brass sample inserts. The split-spoon sampler is driven approximately 18 inches beyond the lead auger with a 140-pound hammer dropped from a height of 30 inches.

For hand auger borings and hand-held, power-driven auger borings, soil samples are retrieved using a hand-driven slide hammer lined with a 1.5-inch-diameter stainless steel sample tube.

During drilling activities, soil adjacent to the laboratory sample is screened for combustible vapors using a combustible gas indicator (CGI) or equivalent field instrument. For each hydrocarbon vapor screening event, a 6-inch-long by 2.5-inch-diameter sample insert is filled approximately 1/3 full with the soil sample, capped at both ends, and shaken. The probe is then inserted through a small opening in the cap, and a reading is taken after approximately 15 seconds and recorded on the boring log. The remaining soil recovered is removed from the sample insert or sampler, and described in accordance with the Unified Soil Classification System. For each sampling interval, field estimates of soil type, density/consistency, moisture, color, and grading are recorded on the boring logs.

SOIL SAMPLE HANDLING

Upon retrieval, soil samples are immediately removed from the sampler, sealed with Teflon sheeting and polyurethane caps, and wrapped with tape. Each sample is labeled with the project number, boring/well number, sample depth, geologist's initials, and date of collection. After the samples have been labeled and documented in the chain of custody record, they are placed in a cooler with ice at approximately 4 degrees Celsius (°C) prior to and during transport to a state-certified laboratory for analysis. Samples not selected for immediate analysis may be transported in a cooler with ice and archived in a frostless refrigerator at approximately 4°C for possible future testing.

OZONE SPARGE WELL INSTALLATION

Ozone sparge wells are constructed of 1-inch-diameter, flush-threaded Schedule 40 PVC blanks connected to a 2-inch-diameter x 30-inch Spargepoints® set on 1 foot of 60-mesh sand (diffusion pack). The annular space surrounding the screened casing is backfilled with diffusion pack to approximately 2 feet above the top of the Spargepoint®. A 3-foot-thick bentonite annular seal is placed above the diffusion pack. The remaining annular space is grouted with Portland cement and/or bentonite grout to the surface. The ozone sparge wells are finished with traffic rated utility access boxes installed slightly above grade. The top of the 1-inch PVC blank is capped with a water tight seal to limit infiltration of surface fluids pending connection to the C-Sparge® system.

FLUID LEVEL MONITORING

Fluid levels are monitored in the wells using an electronic interface probe with conductance sensors. The presence of liquid-phase hydrocarbons is verified using a hydrocarbon-reactive paste. The depth to liquid-phase hydrocarbons and water is measured relative to the well box top or top of casing. Well boxes or casing elevations are surveyed to within 0.02 foot relative to a county or city bench mark.

GROUNDWATER PURGING AND SAMPLING

Groundwater monitoring wells are purged and sampled in accordance with standard regulatory protocol. Typically, monitoring wells that contain no liquid-phase hydrocarbons are purged of groundwater prior to sampling so that fluids sampled are representative of fluids within the formation. Temperature, pH, and specific conductance are typically measured after each well casing volume has been removed. Purging is considered complete when these parameters vary less than 10% from the previous readings, or when four casing volumes of fluid have been removed. Samples are collected without further purging if the well does not recharge within 2 hours to 80% of its volume before purging.

The purged water is either pumped directly into a licensed vacuum truck or temporarily stored in labeled drums prior to transport to an appropriate treatment or recycling facility. If an automatic recovery system (ARS) is operating at the site, purged water may be pumped into the ARS for treatment.

Groundwater samples are collected by lowering a 1.5-inch-diameter, bottom-fill, disposable polyethylene bailer just below the static water level in the well. The samples are carefully transferred from the check-valve-equipped bailer to 1-liter and 40-milliliter glass containers. The sample containers are filled to zero headspace and fitted with Teflon-sealed caps. Each sample is labeled with the project number, well number, sample date, and sampler's initials. Samples remain chilled at approximately 40°C prior to analysis by a state-certified laboratory.

CHAIN OF CUSTODY PROTOCOL

Chain of custody protocol is followed for all soil and groundwater samples selected for laboratory analysis. The chain of custody form(s) accompanies the samples from the sampling locality to the laboratory, providing a continuous record of possession prior to analysis.
DECONTAMINATION

Drilling and Soil Sampling

Drilling equipment is decontaminated by steam cleaning before being brought onsite. The augers are also steam cleaned before each new boring is commenced. Prior to use, the sampler and sampling tubes are brush-scrubbed in a Liqui-nox and potable water solution and rinsed twice in clean potable water. Sampling equipment and tubes are also decontaminated before each sample is collected to avoid cross-contamination between borings.

Groundwater Sampling

Purging and sampling equipment that could contact well fluids is either dedicated to a particular well or cleaned prior to each use in a Liqui-nox solution followed by two tap water rinses.
A description of the general field procedures used during the site investigation is presented below. For an overview of protocol, refer to the appropriate section(s).