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TRC
Customer-Focused Solutions

August 30, 2004 TRC Project No. 42013702

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

SITE: CONOCOPHILLIPS SERVICE STATION NUMBER 5325
3220 LAKESHORE AVENUE
OAKLAND, CALIFORNIA

RE: WORKPLAN FOR INTERIM REMEDIAL MEASURE/FEASIBILITY STUDY

Dear Mr. Hwang:

On behalf of ConocoPhillips, TRC has prepared this workplan for interim remedial measure/feasibility study for the above mentioned 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, operation and maintenance schedule, 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

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7.5 feet bgs (GSI, August, 1990).

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 1994: 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 were 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 to as much as 30 percent fine- to coarse-grained sand. Underlying the predominantly fine-grained horizon, laterally discontinuous deposits of predominantly coarse-grained sediments are interbedded with fine-grained materials to the maximum depth explored of 26.5 feet bgs. The predominantly coarse-grained deposits vary in thickness, and 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.

The water-bearing zone is composed of sand, silty sand, silt, and gravel. Groundwater was typically first encountered at approximately 6 to 10 feet bgs, except during the installation of well U-4, where groundwater was first encountered at a depth of 19.2 feet bgs in June of 1994. Historically, static unconfined groundwater levels have typically been encountered at depths ranging from 7 to 9 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). This water-bearing zone is underlain by silt, clay, and gravel to the total depth explored. The well borings all terminate in clay or silt, which appears to be laterally continuous beneath the site.

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 purgable petroleum hydrocarbons (TPPH) and MTBE remain elevated in these wells. (TRC, July, 2004).

PROPOSED SCOPE OF WORK

In an effort to more actively remediate the subject site, TRC proposes an ozone sparging pilot test using a C-Sparger® system, manufactured by K-V Associates, Inc. (KVA) be performed at the site. Task to be performed include the following:

1. Installation of 11 on site ozone sparge wells as shown on Figure 2. Locations of the ozone spare wells are based on distribution of the hydrocarbon in the water-bearing zone. The ozone sparge well layout is designed to decrease concentrations of existing hydrocarbons and act as a barrier to the hydrocarbon migration.

2. Installation of the C-Sparger® control panel and associated ozone conveyance piping.

3. Operation of the ozone sparge system for a period of approximately six months and collection of field data for evaluation of the effectiveness of the system.

Additional descriptions of the proposed activities are presented below. The field procedures to be used are described in Appendix A.

OZONE SPARGING TECHNOLOGY (C-SPARGER®)

C-Sparger® by KVA is equipment that introduces ozone and air into the subsurface through specially designed Spargepoints® to create "microbubbles" (i.e., bubbles with a much smaller diameter than those created by sparging through typical well screens). As these microbubbles rise through the water column, they strip volatile organic compounds (VOCs), such as benzene, MTBE, and other gasoline constituents. The VOCs are rapidly oxidized by the ozone microbubbles, and any ozone not consumed directly in the reaction rapidly decomposes to oxygen, thereby stimulating natural biodegradation activity. C-Sparger® can be used to remediate the source area and provide plume migration control at the site boundaries. Typically, low flow rates (e.g., 3 to 6 cubic feet per minute) are used for this microsparging. The Spargepoints® and control panel to complete the C-Sparger® system are available from KVA.

CONCEPTUAL DESIGN

The basic design for a C-Sparger® system is similar to the design of an air sparging system. Key to the design is an estimate of the radius of influence of the ozone sparge wells and a determination of the appropriate depth of the Spargepoints®. According to a design guideline from KVA, the radius of influence can be estimated based on the saturated depth above the Spargepoint® (see Table 1).

Table 1

Saturated Depth above Spargepoint®	Radius of Influence
5 feet	12 feet
10 feet	20 feet
20 feet	30 feet
50 feet	65 feet

Based on current groundwater monitoring data and assuming the Spargepoints® are set at 17.5 feet bgs, TRC estimates that the saturated depth above the Spargepoints® will be approximately 8.5 to 10.5 feet. The radius of influence is estimated to be approximately 15 to 20 feet. Based on the boring logs and hydrogeology data from previous on-site investigations, approximately 10 to 15 feet of the top of the water-bearing zone consists of predominantly fine-grained sediments which may limit the ozone flow in the saturated zone. To be conservative, the ozone sparge wells will be spaced approximately 20 feet apart. The proposed locations of ozone sparge wells (C-1 to C-11) are presented on Figure 2.

PRE-FIELD ACTIVITIES

All required permits from the City of Oakland will be obtained for work to be performed at the subject site. Well installation permits will be obtained from the Alameda County Public Works Agency (ACPWA). A grout inspection by ACPWA will be arranged during the well installation activities. Appropriate traffic control measures will be arranged prior to start of system installation activities. A site-specific health and safety plan will be prepared and Underground Service Alert (USA) will be contacted at least 48 hours prior to the initiation of drilling activities.

FIELD ACTIVITIES

Ozone Sparge Well Installation

Each of the 11 proposed well borings will be drilled to a total depth of approximately 18.5 feet bgs, using 8-inch diameter hollow-stem auger drilling equipment. Soil samples will be collected at 5-foot maximum depth intervals in each of the proposed borings, except in gravel backfill in the UST excavation.

All on-site borings will be converted to ozone sparge wells by the installation of 2-inch diameter Spargepoints®, placed at a depth of 17.5 feet bgs. Field procedures for the ozone sparge well installations are included in Appendix A. The placement of individual Spargepoints® may be modified based on the subsurface lithologies encountered during drilling activities.

A ozone sparge well construction diagram is included as Figure 3.

Ozone Sparge System Installation

The key design system element is a KVA C-Sparger® master control panel that regulates the flow of ozone to the eight Spargepoints® distributed on the site. The control panel will be enclosed in a fenced area.

OPERATION AND MAINTENANCE SCHEDULE

Following initial trouble-shooting and system inspection, maintenance activities will be performed on a monthly basis. Samples will be taken monthly at wells U-1, U-2 and U-6 to monitor ozone sparge system performance. All samples will be analyzed for dissolved oxygen, oxygen-reduction potential, pH, electroconductivity, temperature, total purgeable petroleum hydrocarbons as gasoline, benzene, ethyl-benzene, toluene, xylenes, and MTBE. Quarterly sampling of all site wells will continue during this period.

After measuring fluid levels to the nearest 0.01 feet, the wells will be purged and sampled. A groundwater sample will be collected from the well using a clean new disposable PVC bailer following standard sampling procedures in Appendix A. 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

A C-Sparger® system performance report will be prepared and submitted after six months of operation. Based on the changes in contaminant concentration and the dissolved oxygen level at the monitoring wells, operation parameters (i.e., ozone dosage, flow rate) will be adjusted to optimize system performance. A final system performance report will be prepared and submitted after twelve months of operation. At that time, the contaminant concentration, dissolved oxygen level, and other monitored parameters measured will be compared to the initial conditions from the monitoring well. The effectiveness of the C-Sparger® system will be evaluated and a recommendation will be made to continue operation or evaluate other treatment options.

REFERENCES

U.S. Geological Survey, 1959, Oakland East Quadrangle, California, 7.5 Minute Series (Topographic): Scale 1:24,000, photorevised 1980.

State Water Resources Control Board, 2000, Draft Guidelines for Investigation and Cleanup of MTBE and Other Ether-Based Oxygenates, dated February 23, 2000.

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, 2004, 76 Station No. 5325, 3220 Lakeshore Avenue, Oakland, California, dated July 16, 2004).

If there are any questions or concerns please contact Roger Batra at (925) 688-2466.

Sincerely,
TRC

Kirk Tracy
Project Engineer

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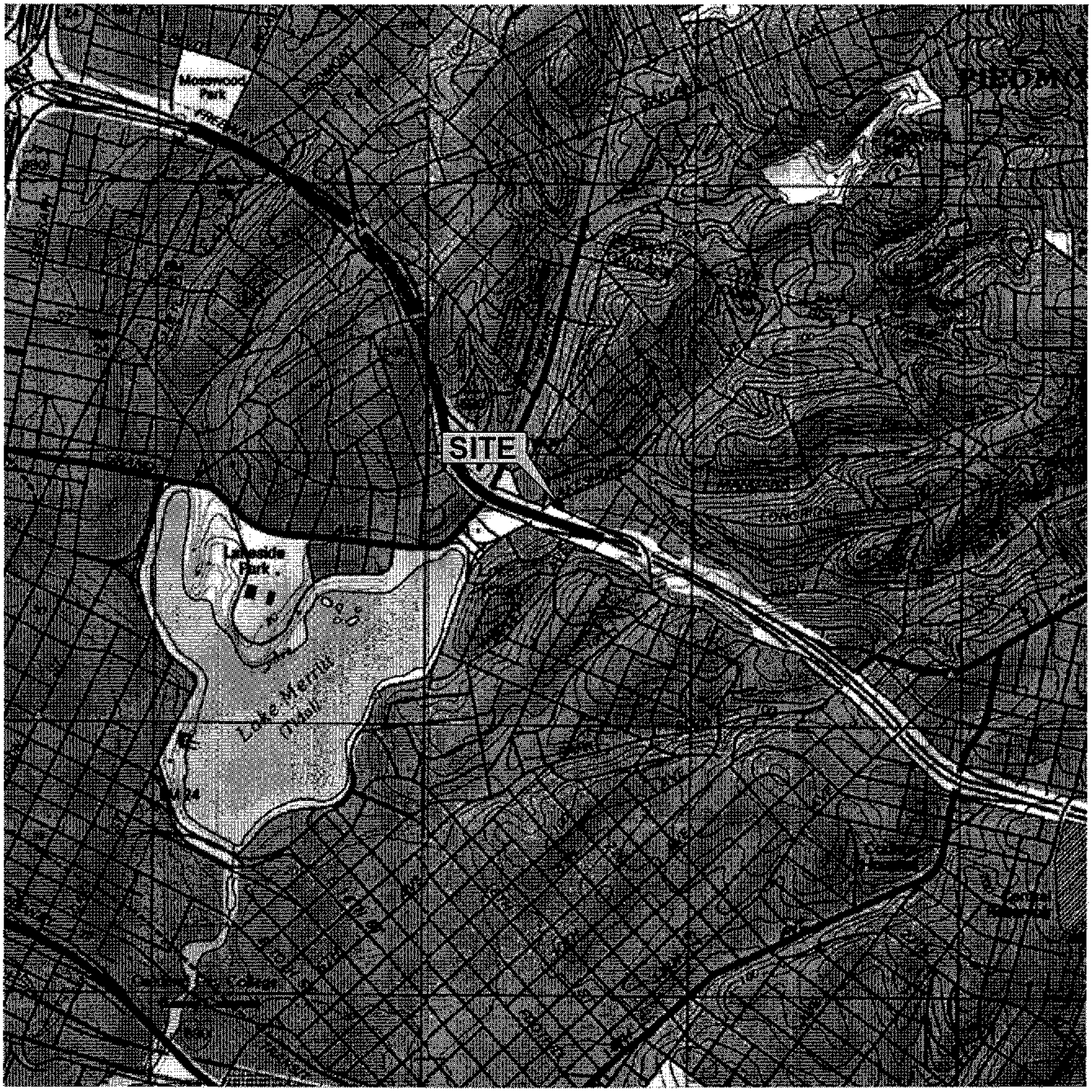
Amy Wilson, P.E.
Senior Staff Engineer

Roger Batra
Senior Project Manager

Attachments: Figure 1 – Vicinity Map
Figure 2 – Site Plan Showing Proposed Spargepoints
Figure 3 – Ozone Sparge Well Construction
Appendix A – General Field Procedures

cc: Thomas Kosel, ConocoPhillips (electronic upload only)



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SCALE 1 : 24,000

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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

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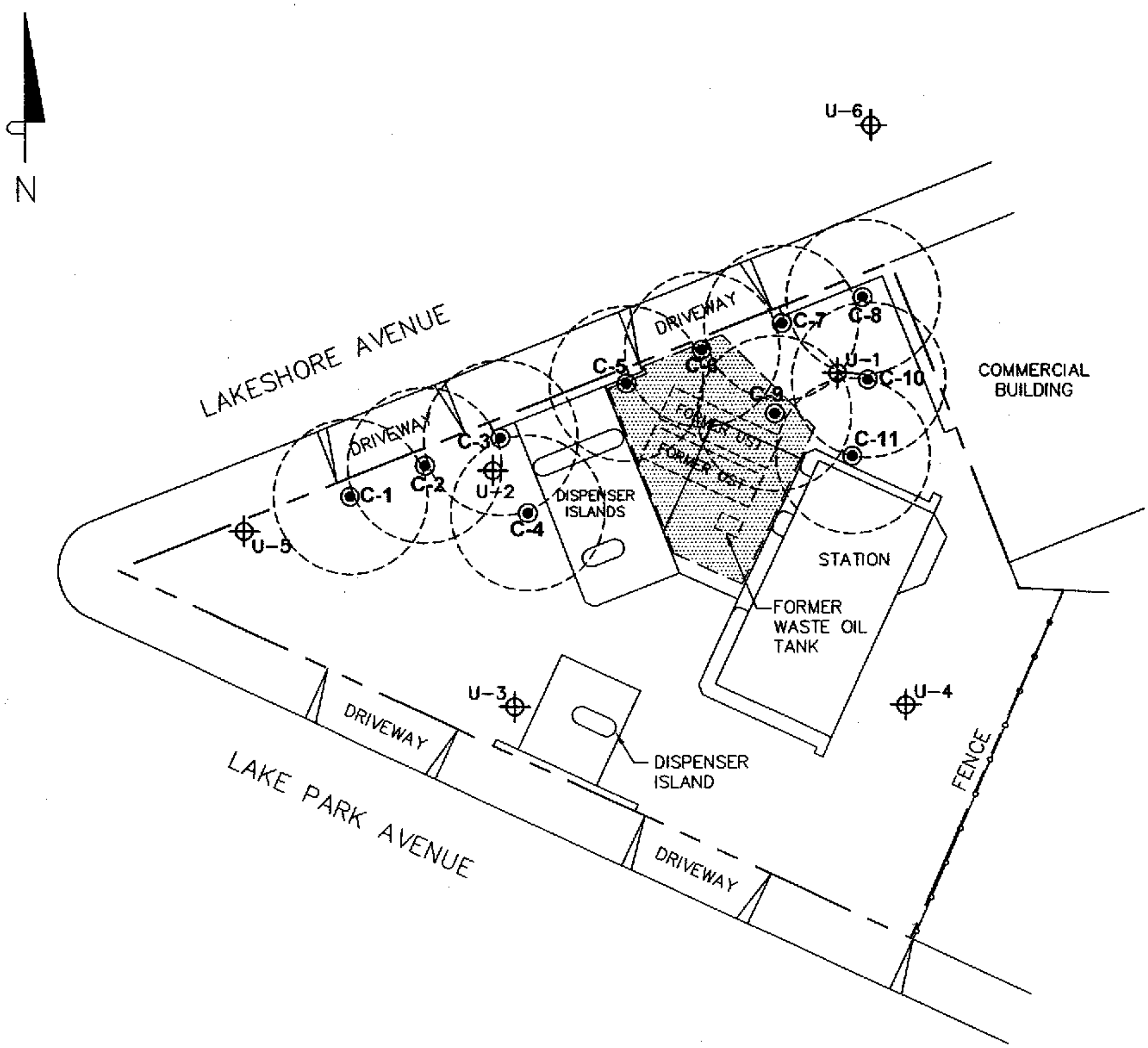
FIGURE 1



LEGEND

Property boundary

Fence

Approximate location of 1990 UST excavation

U-6 Monitoring well

C-11 Proposed sparge point with 18' radius of influence

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

APPROXIMATE SCALE (FEET)

0 40 80

PROPOSED SPARGE POINTS

76 Service Station #5325
3200 Lakeshore Avenue
Oakland, California

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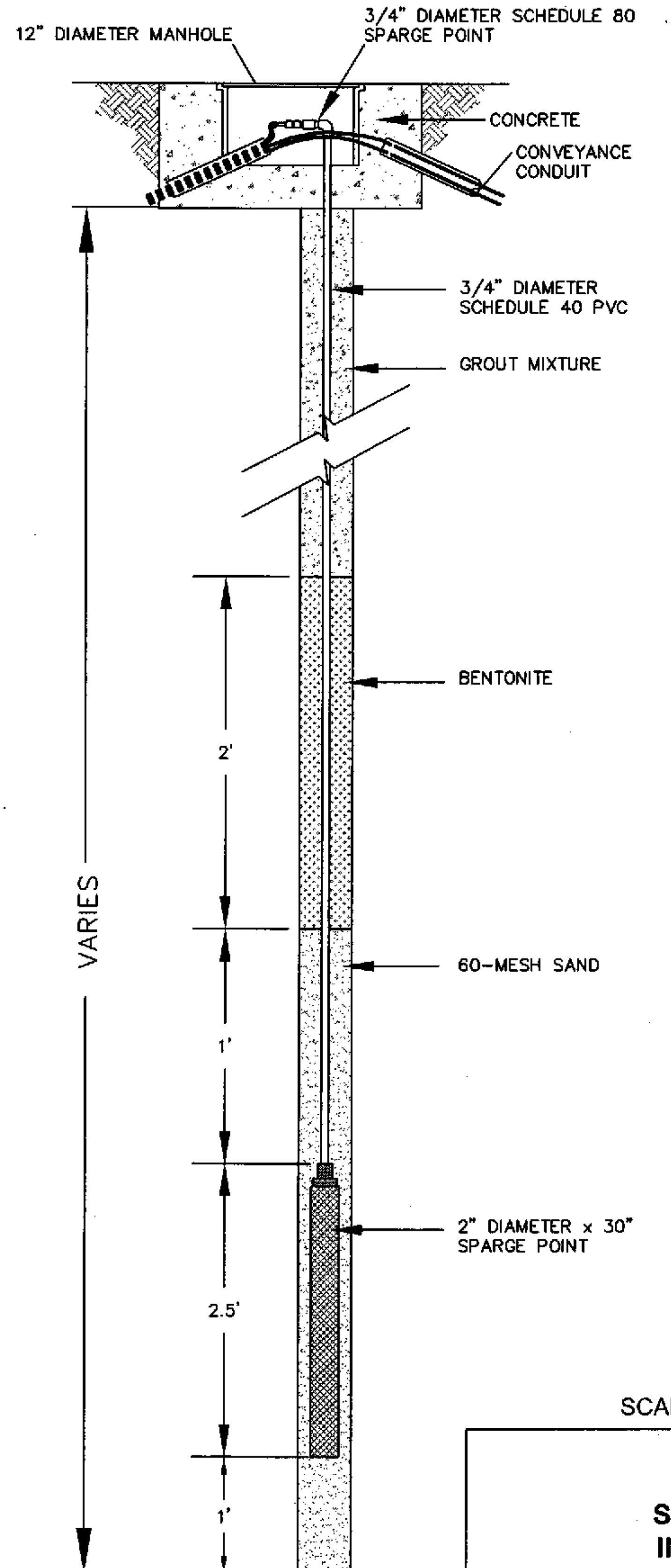
FIGURE 2



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SPARGE POINT INSTALLATION DIAGRAM

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FIGURE 3

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).