KAPREALIAN ENGINEERING, INC.
Consulting Engineers
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KEI-P90-1103.P2
November 13, 1991

Unocal Corporation
2000 Crow Canyon Place, Suite 400
P.O. Box 5155
San Ramon, California 94583

Attention: Mr. Rick Sisk

RE: Work Plan/Proposal
Unocal Service Station #0752
800 Harrison Street
Oakland, California

INTRODUCTION

In Kaprealian Engineering, Inc's. (KEI) first quarterly report (KEI-P90-1101.QR1) dated November 13, 1991, KEI recommended the installation of additional monitoring wells at the site in order to further define the extent of ground water contamination at the site. This work plan/proposal for the installation of additional monitoring wells is presented for your review and consideration. The site background information, recent field activities, and a discussion of our recommendations is included in the above referenced report.

PROPOSED FIELD WORK

PHASE II - DEFINING THE EXTENT OF SUBSURFACE CONTAMINATION

1. KEI proposes to install three additional two-inch diameter monitoring wells, designated as MW4, MW5, and MW6 on the attached Site Plan, using hollow-stem auger equipment. Permits will be obtained from the Alameda County Flood Control and Water Conservation District, and the City of Oakland, as necessary, prior to beginning work.

   The wells will be drilled approximately 10 to 15 feet into the saturated zone of the first encountered ground water, unless a significant clay aquitard (greater than or equal to 5 feet in thickness) is encountered first, at which time drilling will be terminated.

2. Soil samples will be collected at a maximum spacing of 5 foot intervals, at significant changes in lithology, at obvious areas of contamination, and at/or within the soil/ground water interface, beginning at a depth of about 4 to 5 feet below

grade. Sampling for laboratory analyses and lithologic logging purposes will continue until the first water table is encountered. Sampling for lithologic logging purposes only will continue below the water table to the total depth drilled. A representative soil sample of the saturated zone may be collected and submitted to a laboratory for a particle size analysis (sieve and hydrometer analysis) for verification of casing slot size and filter pack design. Classification of soil will be done using the Unified Soils Classification System (USCS) by KEI's field engineer or geologist. Samples will be collected in a California modified split-spoon sampler with two-inch diameter brass liners. The sampler will be advanced ahead of the drilling augers at designated depths by dropping a 140 pound hammer 30 inches. Blow counts will be recorded. Samples will be removed from the sampler and retained in brass liners. The liners will be sealed with aluminum foil, plastic caps, and tape. They will be labeled and stored on crushed ice or "blue ice" for delivery to a State certified laboratory.

3. During drilling operations, all soil materials will be stored on-site in DOT-approved 55-gallon drums, or covered by visqueen. Each drum (if used) will be properly labeled and will include, at a minimum, the date, the interval that soil materials were obtained from, a contact individual, and the phone number at KEI.

4. Finalized Boring Logs will be prepared from field logs and submitted to the Alameda County Health Care Services Agency, the Alameda County Flood Control and Water Conservation District, and to the Regional Water Quality Control Board (RWQCB), San Francisco Bay Region.

5. Ground water is anticipated at a depth of approximately 22 feet below grade, based on the ground water level found in the existing monitoring wells.

6. <u>Well Construction</u>:

   Casing Type: Schedule 40 PVC, flush threaded joints, 0.02 inch factory slot, two-inch diameter. Screen to run from total depth of the well to approximately five feet above the depth of the first encountered ground water. Monterey sand (#3) will fill the annular space from total depth to 2 feet above the perforated casing interval. A two foot thick bentonite seal will be placed in the annular space on top of the sand pack. Neat cement grout or 9-sack cement/sand slurry will be placed on top of the bentonite seal to the surface.

Well casings will be secured with a waterproof cap and a padlock. A round, watertight, flush-mounted well cover will be concreted in place over the top of each casing.

7. Water levels will be measured with an electronic sounder. The wells will be developed by the use of a surface pump in conjunction with a surge block, approximately one week after well completion. Wells will be pumped until expelled water is clear and free of turbidity. A turbidity measurement will be taken upon completion of well development activities. Effluent generated during well development will be contained in DOT-approved drums and hauled from the site by a licensed hazardous materials hauler.

   Casing elevations will be surveyed by a licensed land surveyor to Mean Sea Level (MSL) and to a vertical accuracy of 0.01 feet.

8. Ground Water Sampling:

   The wells will be purged (with a surface bailer) of approximately four casing volumes prior to sampling, at least 72 hours after development. During purging operations, the field parameters pH, temperature, and electrical conductivity will be monitored. After a minimum of four casing volumes have been purged and the field parameters have been observed to stabilize, water samples will be collected from the wells by the use of a clean Teflon bailer. The samples will be decanted into clean VOA vials, which will then be sealed with Teflon-lined screw caps and stored in a cooler, on ice, until delivery to the State certified hazardous waste testing laboratory. A copy of the field parameter data sheets collected during well purging will be presented in the technical report as Appendix A.

   Wells will be checked for free product and sheen (using an interface probe and/or paste tape) prior to development and sampling.

   Properly executed Chain of Custody documentation will accompany all samples.

9. Laboratory Analyses:

   Water and selected soil samples will be analyzed by Sequoia Analytical Laboratory in either Concord or Redwood City, California, both State certified laboratories, for TPH as gasoline using EPA method 5030 in conjunction with modified

8015, and BTX&E using EPA method 8020, as recommended by the RWQCB, and as specified in the Tri-Regional Guidelines.

Analytical results will be presented in tabular form, showing sample depths, results, and detection limits.

The analytical results will be used to delineate the vertical and lateral extent of the contaminants in soil and ground water.

10. Hydrology:

Ground water flow direction will be determined from the survey data and water table depths from both the new and existing wells.

11. Ongoing Pumping, Monitoring and Sampling:

11.1 All existing monitoring wells will be monitored on a monthly basis. The elevation of the water table and any abnormal conditions noted during inspection will be recorded, including presence of product.

11.2 Ground water from all existing monitoring wells will be purged, sampled, and analyzed for TPH as gasoline and BTX&E on a quarterly basis. In addition, ground water from MW1 (adjacent to the waste oil tank), will be analyzed for TPH as diesel, total oil and grease (TOG), EPA method 8010 constituents, and the metals cadmium, chromium, lead, nickel, and zinc. Prior to sampling, water table elevation will be recorded, as well as the presence of any free product and/or sheen.

11.3 Quarterly technical reports will be prepared that summarize the field activities (including the water sampling and analyses), and that include discussion and recommendations.

12. Conclusions:

Conclusions and results of Phase II will be described in a technical report.

The technical report will be submitted to the ACHCS, Alameda County Flood Control and Water Conservation District and to the RWQCB, San Francisco Bay Region.

LIMITATIONS

Soil deposits and rock formations may vary in thickness, lithology, saturation, strength and other properties across any site. In addition, environmental changes, either naturally-occurring or artificially-induced, may cause changes in the extent and concentration of any contaminants. Our studies assume that the field and laboratory data are reasonably representative of the site as a whole, and assume that subsurface conditions are reasonably conducive to interpolation and extrapolation.

The results of this study are based on the data obtained from the field and laboratory analyses obtained from a state certified laboratory. We have analyzed this data using what we believe to be currently applicable engineering techniques and principles in the Northern California region. We make no warranty, either expressed or implied, regarding the above, including laboratory analyses, except that our services have been performed in accordance with generally accepted professional principles and practices existing for such work.

Should you have any questions regarding this work plan/proposal, please do not hesitate to call me at (707) 746-6915.

Approved by:

Joel G. Greger
Certified Engineering Geologist

License No. 1633
Exp. Date 6/30/92

Timothy R. Ross
Project Manager

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Attachments: Location Map
Site Plan
Typical Well Completion Diagram
QA/QC Plan

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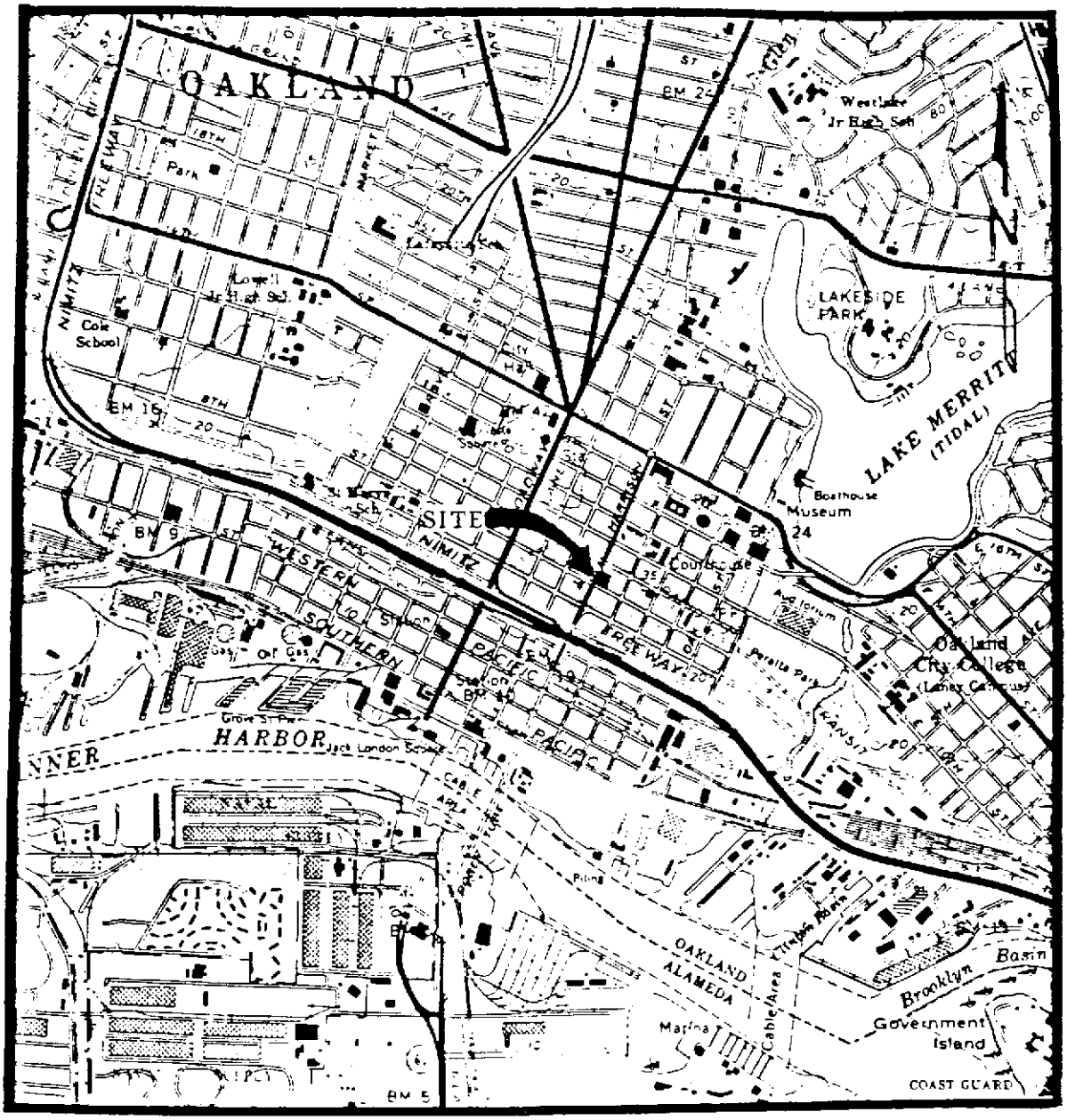

LOCATION MAP

Base from U.S.G.S. 7.5 minute Oakland West Quadrangle (photorevised 1980)

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800 Harrison Street
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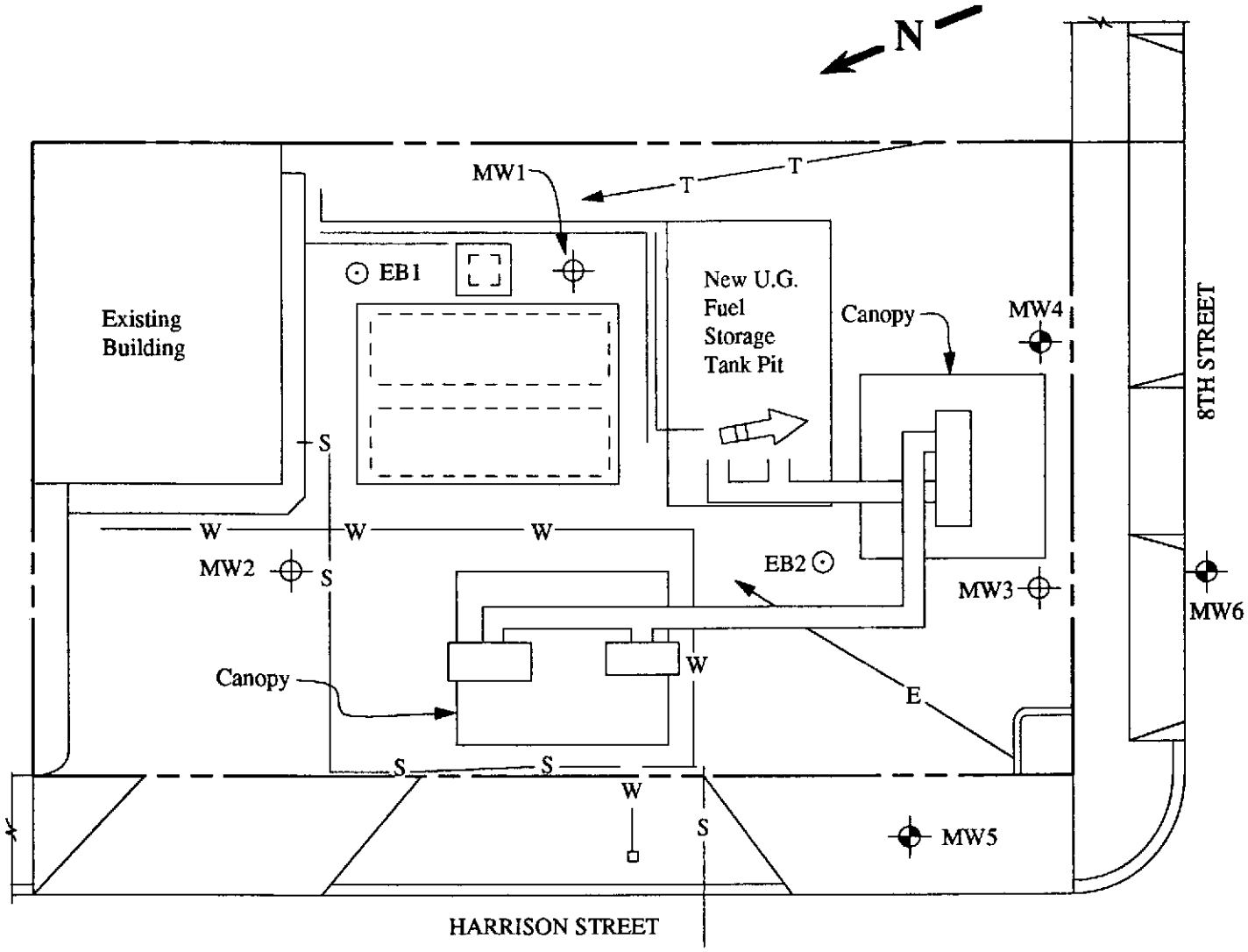

LEGEND

- Monitoring well (Existing)
- Exploratory boring (Existing)
- Monitoring well (Proposed)
- Direction of ground water flow

E,T = Electrical and telephone lines
W,S = Water and sewer lines

SITE PLAN

0 20 40
Approx. scale feet

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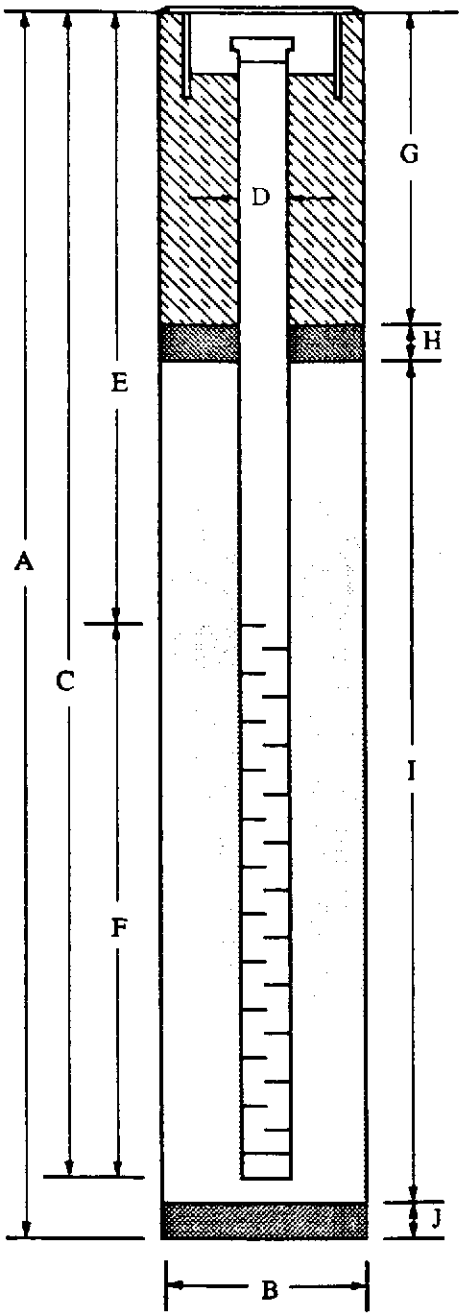
800 Harrison Street
Oakland, CA

WELL COMPLETION DIAGRAM
(SCHEMATIC)

Flush-mounted Well Cover



WELL DETAILS*

1. Well will be terminated 10 to 15 feet into first ground water unless a five foot thick aquitard is encountered below the water table, in which case the aquitard will be backfilled with bentonite pellets and the well terminated at the top of this aquitard [A].

2. Boring diameter [B] is 9 inches for 2 inch wells and 12 inches for 4 inch wells.

3. Perforated interval [F] will extend from bottom of casing to five feet above first ground water table (unless water <5 feet deep).

4. Schedule 40, PVC casing, 2 inch in diameter [D], will be used [C]. Screen is 0.020 or 0.010 inch factory machined slots, depending on filter pack grain size.

5. Filter pack will be placed from bottom of casing to two feet above perforated interval [I]. (Bottom seal [J] is not installed unless required.) One foot of bentonite [H] will be placed above the filter pack. Concrete grout [G] will be placed from top of bentonite seal to the surface (unless modified due to shallow water). Blank casing [E] will extend from the top of the perforated casing to the top of the hole.

6. The well will be installed with a waterproof cap, padlock and a flush-mounted well cover.

* See text for additional information.

KEI GROUND WATER LEVEL MEASUREMENT AND SAMPLE COLLECTION QA PLAN

Depth to Water Level Measurement

Monitoring well reference elevations are measured to the center of the protective Christy box lid. When the lid is removed and depth to water measurements are desired, a rigid instrument, such as a ruler, is placed across the top of the now open Christy box. Depth to water is measured using an electric water level indicator and referenced to the middle and bottom edge of the rigid instrument spanning the top of the Christy box. Alternatively, a steel or aluminum yardstick covered with water finding paste is attached to a steel tape and lowered until part of the yardstick encounters the water layer. The measured length of the steel tape is added to the unaffected length of the yardstick as measured from the top of the yardstick to the point where the discoloration of the water finding paste begins. Depth to water level measurements are made to the nearest 0.01 feet.

Water levels are measured prior to development, purging or sampling.

Free Product Thickness Measurement

Free product measurements are made to the same reference point as described above for water level measurements. Free product thickness measurements are accomplished in one of several ways.

Depth measurement to the top of the free product layer may be performed using an electric petroleum hydrocarbon indicator. Alternatively, a steel or aluminum yardstick covered with product finding paste is attached to a steel tape and lowered until part of the yardstick encounters the free product layer. The measured length of the steel tape is added to the unaffected length of the yardstick as measured from the top of the yardstick to the point where discoloration of the product finding paste begins.

The total product thickness is determined by finding the difference between the measured depth to product and the measured depth to water.

In most instances, it is possible to place both water finding paste and product finding paste on the yardstick and directly measure the thickness of the discolored product finding paste from the yardstick. Depth to free product or free product thickness measurements are made to the nearest 0.01 feet.

Determination of Sheen

After depth to water and free product measurements are performed, a test for the presence of sheen is conducted. A transparent bailer is lowered into the well in a manner such that only part of the bailer is submerged. The bailer is withdrawn from the well and the surface of the water in the bailer is observed for the presence of sheen as determined by the presence of iridescence or emulsification. Presence of sheen is not investigated if it is determined that free product is present in the well.

Total Well Depth Measurement

Once the test for sheen presence has been conducted, the total depth of the well is measured. Total well depth is determined by measuring from the reference elevation described in the section for Depth to Water level Measurement, above, to the depth at which tension in the tape measure to which the electric probe is attached or the steel tape to which the yardstick is attached becomes slack. Total well depth measurements are made to the nearest 0.05 feet.

Well Purging

In order to obtain a representative sample of the water in the aquifer being sampled, stagnant water in the well casing must be removed to permit well recharge with non-stagnant aquifer water. The removal of stagnant water will be accomplished by the removal of the water to the surface where it will be either disposed of or stored for future disposal.

The purging rate used at a particular monitoring well will depend on the expected or known hydraulic yield of the well.

In moderate to high yield formation wells the purging device will be placed near the top of the screened interval of the well to ensure that non-stagnant formation water will move upward in the screened interval. When purging low yield formation wells, water will be removed from the bottom of the screened interval.

When purging low-yield wells (wells which yield less than 3 casing volumes), the wells will be purged to dryness once. As soon as the well has recovered to a volume sufficient for sampling, samples will be collected. At no time will a well be purged to dryness if the rate of recharge is such that formation water will cascade down the sides of the casing.

During purging operations, the yield parameters of pH, temperature, electrical conductivity (EC) and turbidity will be monitored in the purged water.

Ground water samples will be removed from the monitoring well only after a minimum of five (5) casing volumes have been purged from the well casing, and purging has been of sufficient duration to result in the stabilization of pH, temperature, and EC readings. A well purging/sampling log will be maintained for purging of each monitoring well.

The field parameters of pH, temperature, and EC parameters will be monitored and recorded during the purging operations at a minimum rate of two (2) readings per casing volume purged. Stabilization of the parameters of pH, temperature and EC will be used to indicate that the well has been sufficiently purged for sampling. Parameter stabilization will be indicated by at least three near-constant pH, temperature, and EC values for a minimum of one (1) casing volume. The acceptable range of values for stabilization of the field parameters are ±0.5°C for temperature, ±0.2 for pH, and ±10 percent of the total value of EC.

Standardization of field equipment will be done at the beginning of each use, according to manufactures' specifications and consistent with methods described in EPA SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods.

Sample Collection

Samples of non-stagnant formation water will be collected only after the minimum of five (5) casing volumes of water have been purged from the casing and field parameters have stabilized. In low yield formation wells which were purged to dryness, the sample(s) will be collected as soon as the well has recovered sufficiently for sample collection.

All samples will be collected in an order such that those parameters most sensitive to volatization will be sampled first. A general order of collection for some common ground water parameters follows:

- Volatile Organics Compounds (VOC's)
- Total Organic Halogens (TOX)
- Total Organic Carbon (TOC)
- Total Metals
- Dissolved Metals
- Phenols
- Sulfate and Chloride
- Turbidity
- Nitrate and Ammonia

All samples will be collected in such a manner as to minimize the volatilization or oxidation of a sample due to agitation during transference from pump or bailer to sample container. When a bladder pump is used for the collection of volatile compounds, the flow rate will be adjusted to provide a constant flow stream of approximately 100 milliliters/minute. After samples for volatile compounds have been collected, higher flow rates may be used, particularly if large volumes are necessary. The sampling flow rates will never exceed the flow rate during the purging process.