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ENVIRONMENTAL
CONSULTING INC.

91 SEP -3 AM 11:49

August 30, 1991

PRO# 675.91

Ms. Marcelina Bell
Contracting Officer
U.S. Veteran's Administration Medical Center
4951 Arroyo Road
Livermore, CA 94550

Dear Ms. Bell:

Attached is a cost estimate for the quarterly sampling and appropriate report for the monitoring wells at the Livermore Veteran's Administration Medical Center Fire Station. The estimate is for one (1) event. Regulatory agencies generally require a minimum of four (4) to complete a hydrologic cycle.

The estimate is based upon the assumption that the wells are positioned so that they conform to the Tri-Regional Board's "Staff Recommendations" document. If it becomes necessary to install an additional well or wells we will submit a report explaining the rational and include an estimate.

We are pleased to be of service to you. If you have any questions or wish to discuss the estimate, please call us at (800) 447-0171.

Sincerely,

Harold J. Slavik Jr.
Senior Geologist

Dr. Stan L. Klemetson, Ph.D., P.E.
Vice President

HJS:clk

Enclosure

140 West Industrial Way
Benicia, California 94510

Ofc (707) 745-0171
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ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

Dennis Burns
Larry Seto

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March 27, 1991

DEPARTMENT OF ENVIRONMENTAL HEALTH
Hazardous Materials Program
80 Swan Way, Rm. 200
Oakland, CA 94621
(415)

Ms. Marcelina Bell
U.S. Veterans Administration Medical Center
4951 Arroyo Rd.
Livermore, CA 94550

Re: **599/90C V599C-473/599C04011, groundwater assessment and soil treatment at USVA Medical Center, Livermore**

Dear Ms. Bell:

Thank you for submitting the Augeas Corp. Source Removal Report dated February 14, 1991. This office has completed its review of the report, and concur with the approach presented for soil treatment. However, in order for the USVA to reuse the excavated soil on-site following remediation, oil & grease and TPH-diesel levels in this soil must be reduced to 50 ppm and 10 ppm, respectively, or to the analytical method detection limit in each case, whichever is lower. (1)

It is acceptable for the USVA to leave the small amount of contaminated soil beneath the fire station in place, as long as there is a monitoring well directly downgradient of this area to detect any groundwater degradation that might result from this soil. According to the Augeas report, MW-1 would appear to meet this requirement. However, should the direction of groundwater flow in this area change significantly, one or more additional monitoring wells may have to be installed. (2) (3)

Please be sure that this office and the Regional Water Quality Control Board in Oakland are apprised in a timely manner of work performed at the site or work intended to be performed. If you have any questions about this letter, please contact the undersigned at 271-4320.

Sincerely,

Gilbert M. Wistar

Gil Wistar
Hazardous Materials Specialist

cc: Kent Murray, Augeas Corp. (2252 Fort Point Dr., Gold River, CA 95670)
Howard Hatayama, DOHS
Lester Feldman, San Francisco Bay RWQCB
Rafat Shahid, Asst. Agency Director, Environmental Health
files

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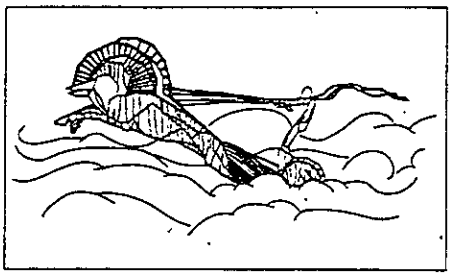

AUGEAS CORPORATION

Source Removal Report
VA Medical Center
Livermore, California

SOURCE REMOVAL REPORT

Medical Center
Livermore, California

for
Department of Veterans Affairs
January 20, 1991

Prepared by
Augeas Corporation
2252 Fort Point Drive
Gold River, CA 95670
(916) 635-0839
FAX (916) 852-1411

I hereby certify that this
Source Removal Report
for the
VA Medical Center
was prepared under my direct supervision

Kent S. Murray, Ph.D., R.G. REA
Project Manager
Augeas Corporation

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1 SUMMARY

Augeas Corporation was retained by the Department of Veterans Affairs to assess specific environmental concerns associated with the leakage of fuel oil from two 12,000 gallon underground storage tanks. The 12,000 gallon storage tanks were excavated and removed from the VA Medical Center located at 4951 Arroyo Road in Livermore, California between November 5 and 16, 1990 in accordance with Alameda County procedures for tank abandonment. According to the facility's records, the tanks were used to store No. 5 fuel oil. Although Department records indicate that the tanks have not been used since approximately 1965, leakage from the tanks has led to contamination of the subsurface soils and groundwater beneath the site. No inventory records were available for review to determine the approximate volume of material which has leaked.

The VA Medical Center consists of approximately 118 acres in Township 3 and 4 South, Range 2 East, located in the eastern part of Alameda County. The facility was originally built in 1923, and is currently owned by the United States Federal Government, Department of Veterans Affairs. Figure 1 is a location map of the facility, the Medical Center is approximately five miles south of the central business district of Livermore. Figure 2 is a topographic map of the site vicinity showing the relationship of the Medical Center to the foothills south and east of the facility and Arroyo Valle the major local drainage located one mile to the east. Figure 3 is a plot plan of the facility which shows the location of ancillary buildings, asphalt or concrete cover, and the location of former underground fuel storage tanks. A Tank Excavation Report and Proposed Corrective Action Plan was prepared by Augeas Corporation and forwarded to the Alameda County Health Care Services Agency in November, 1990.

Due to the nature and depth of the contamination, immediate source removal was recommended by Augeas Corporation and initiated by Semco, an excavation and licensed tank removal company under contract with the Department of Veterans Affairs. Following a brief assessment of the vertical and areal extent of contamination (Figure 4), approximately 4,000 yd^3 of soil was excavated and stored on-site. The contaminated soil is to be treated on-site by biological means.

The zone of contaminated soil varied from 12 to 15 feet below the surface and extended to a maximum depth of 25 feet. The depth to groundwater varied during the excavation activities, but was initially encountered at a depth of 15 feet. To facilitate the excavation of contaminated soil below the water table, a temporary groundwater extraction well was installed and approximately 20,000 gallons of marginally contaminated water was removed.

Initial hydrocarbon concentrations in the soil following tank removal included 9,000 mg/Kg of oil and grease and 3,700 mg/Kg of diesel. The complex site geology, and clay-rich nature of the soil at a depth of 25 feet precluded the deeper migration of the fuel oil despite periodic lowering of the water table during dry years. The relatively high viscosity of the fuel also prevented the contamination from spreading away from the actual tank excavation area. In addition, the nature of the fuel i.e., the high molecular weight of the respective hydrocarbon compounds present, also prevented large-scale dissolution of the oil once it came into contact with the water table. The limited areal extent of contamination, caused by the adsorption tendency of the fuel, enabled the soil to be readily excavated and removed for eventual treatment. The immediate removal of contaminated soil and concurrent withdrawal of visible product floating on the groundwater surface is expected to lessen the potential impact on groundwater quality at the site.

Approximately 20 soil samples were collected from the walls and base of the excavation as verification that most contamination had been removed. Initial soil samples were submitted for chemical analysis on a rush basis to determine whether all contamination had been removed. Additional soil removal took place in several areas of the excavation following the initial round of sampling to ensure that as much of the contaminated soil as possible had been removed. However, due to the magnitude of the excavation and its proximity to the Medical Center's fire station, it was decided to leave in-place a thin zone of contamination which extended under the building (Figure 5). The locations of the soil samples collected to verify the removal of the contaminated soil are shown in Figure 5.

Groundwater extracted during the dewatering activities was contained and stored on-site. The initial concentration of free floating hydrocarbon constituents in the water (0.28 mg/L), declined to non-detectable levels (in the excavation) once the contaminated soil had been removed. Only minor aromatic constituents were detected in any of the water samples

collected either during dewatering activities or following source removal. The low aqueous solubility of the fuel oil coupled with a low percentage of aromatic compounds initially present fuel suggest that dissolution of the oil will not be an important factor affecting groundwater quality.

Although it is expected that the extraction of groundwater from the immediate vicinity of the excavation has eliminated the primary concern of groundwater contamination, Augeas Corporation has proposed a full site hydrogeologic monitoring study to ensure that groundwater quality will not continue to be degraded. To this end, three groundwater monitoring wells have been installed near the excavation to evaluate both initial conditions up-gradient of the former tanks, as well as down-gradient of the excavation. These wells were initially developed and sampled following the excavation backfill and compaction activities. These analytical results will be presented in a separate report which will summarize information on groundwater elevation and movement and will recommend additional work necessary to fully evaluate groundwater concerns at the VA Medical facility.

Specific work performed during this phase of investigation included:

1. Preparation of a Tank Removal Report and a Proposed Corrective Action Plan, and subsequent approval of the plan by the Alameda County Health Care Services Agency.

2. Drilling of 16 soil borings to determine the lateral and vertical extent of soil contamination.

3. Screening of collected soil samples in the borings both visually and with a photoionization detector (PID) to determine the vertical extent of contamination.

4. The excavation of over 4,000 yd^3 of soil including the removal of approximately 2,000 yd^3 of relatively clean soil to enable the excavation of the underlying contaminated soil.

5. Installation of a groundwater extraction sump and the collection of water samples.

6. The stockpiling on-site of 4,000 yd^3 of contaminated soil.

7. The collection of 20 soil samples from the walls and floor of the excavation to verify that source removal had been completed.

8. Analysis of water samples for benzene, toluene, total xylenes and ethylbenzene (BTXE), which are minor constituents of diesel, and total petroleum hydrocarbon (TPH) products in the diesel range. Analysis of soil samples for BTXE, oil and grease and TPH-diesel.

9. The collection of soil samples from near the base of the excavation for a particle size analysis (ASTM Method 422).

10. Completion of a Bay Area Air Pollution Control District Application for the on-site aeration of soil.

11. Installation, development and sampling of three groundwater monitoring wells.

12. Preparation of this report.

The 12,000 gallons of groundwater extracted from the excavation during the dewatering process will be used during the back-filling process to facilitate compaction. Although this water initially contained low levels of dissolved ethyl benzene, this hydrocarbon constituent has been degraded by biodegradation to below detection levels. The use of this contained water during the back-filling process is a desirable alternative to the use of 12,000 gallons of freshwater, particularly at a time when water conservation in Alameda County is being stressed.

2 CONCLUSIONS AND RECOMMENDATIONS

Based on the work completed during this investigation, the following conclusions were developed:

1. An undetermined amount of No. 5 fuel oil has been allowed to seep down through the vadose zone soils from two 12,000 gallon underground fuel storage tanks. The tanks were excavated and removed in November, 1990. The tanks were quite deteriorated and showed obvious signs of leakage.

2. The downward leaching of the fuel oil leaked from the tanks has reached the water table at a depth of 15 feet, and has locally contaminated the groundwater beneath the site.

3. The chemical nature of the aliphatic hydrocarbon compounds present and the lower percentage of aromatic compounds found in the high viscosity fuel oil suggests that contamination of soil by adsorption was the dominant contamination process. Due to the low aqueous solubility of the fuel oil, dissolution is not considered to be an important factor. As a result, groundwater quality should not significantly be degraded.

4. Although the areal extent of the groundwater contamination is believed to be minor and limited to the areal extent of the soil contamination, it has not been completely defined. As a result, it is recommended that a more thorough hydrogeologic study be implemented to monitor groundwater quality.

5. Groundwater was removed during dewatering activities required to remove contaminated soil from below the water table. During groundwater extraction, fuel oil leaching from the walls of the excavation was visibly seen floating on the surface of the water. This water was removed, stored and treated in on-site holding tanks to below detectable levels for BTXE and TPH. The contained water was subsequently used in the backfilling and compaction process.

6. The source of the contamination has been eliminated and the majority of the contaminated soils removed.

7. Soil samples collected from the walls and the base of the excavation range from nondetectable levels to 6,500 mg/Kg of TPH-diesel in an isolated zone beneath the fire house. All contaminated soil has been removed except for a two-foot thick lens in the north wall of the excavation. This lens thins to the north and extends beneath the fire house. Based on geologic mapping of the excavation, Augeas Corporation concludes that this lens extends no further than 4 or 5 feet under the fire station.

8. Since the area of the excavation will be resurfaced with asphalt and/or concrete, the resurfacing will be from an impermeable barrier preventing the downward migration of meteoric water.

4 EXCAVATION ACTIVITIES

4.1 Site Description

Approximately 4,000 yd^3 of soil was excavated from the southeast side of the VA Medical Facility's fire station during the months of November and December, 1990. The excavation was completed in an attempt to remove soil contaminated with No. 5 fuel oil as a result of leaking underground fuel storage tanks. The site of the excavation was formerly occupied by two 12,000 gallon fuel oil tanks. In addition, it is possible that product lines, leading to the underground tanks and extending westward across the site also leaked.

4.2 Geologic Setting

The subject property is on a moderate incline which slopes gently to the east toward Arroyo Del Valle Creek. Surface drainage on the property appears to be good and generally flows toward the creek. Most of the present day buildings have been constructed on cut slopes with substantial amounts of fill material used to form level building sites. The present drainage system includes the storm drains surrounding the property. Los Banos Creek lies approximately 5 miles east of the facility. The near surface soils are a sandy, gravelly loam formed from the weathering of the Tertiary marine sandstones, shales and minor conglomerates which comprise the hills to the south and east of the facility. These consolidated sedimentary units above the VA Medical Center have been mapped as the Cierbo Sandstone, a marine unit with a dip of 35 to 45 degrees to the northwest. Eastward across Arroyo Del Valle, the Livermore Formation, a nonmarine unit consisting of mostly conglomerates with some claystones and minor sandstones, unconformably overlies the Cierbo Sandstone.

The presence of marine units is significant, because seawater trapped in these units is generally of poorer quality. In addition, boron concentrations are noticeably higher than in the younger continental sediments.

The terraces underlying the VA Medical Center property are Quaternary alluvial formations. These deposits overlie the consolidated sedimentary units and are characterized as moderate to highly permeable on soil survey maps. The saturated thickness of the terrace deposits underlying the VA Medical Center sewage treatment facilities, located to the north of the tank excavation, varies between zero along the edges of the terrace to an average of about 12 feet at the center of the well field.

Fault lines in the area may significantly influence groundwater flow, especially flow from deeper zones to the surface. A projection of this fault line under the terrace deposits to the northeast places it in the vicinity of the facility's sewage disposal system, approximately 0.25 miles to the north of the tank excavation.

4.3 Groundwater Movement

Within the terrace deposits, groundwater flows from higher to lower terrace levels. Water levels in the observation wells at the tank excavation were used to provide a more detailed picture of flow patterns in the vicinity of the former underground tanks.

A major uncertainty in the groundwater regime is the influx of water from the sedimentary units below. A deep fault (as discussed above in the Geologic Setting) could allow water to move vertically upward into the overlying terrace deposits. In addition, the existence of pressure at a sufficient depth to force deeper water to the surface has been indicated by an old well at the Wente Winery about 2,000 feet southeast of the sewage system's well field, which flows 100 gpm at the surface under artesian conditions. Vertical continuity between upper and lower aquifers would also be of concern should dissolved aromatic constituents be found in the groundwater monitoring wells.

The water table at the site has fluctuated extensively from approximately 15 to 20 feet below the surface, but is primarily confined to a coarse sand and gravel zone located between these depths. A thick clay sequence underlies the sand and gravel zone and apparently serves as an impermeable barrier to the downward migration of groundwater in the immediate vicinity of the excavation.

4.4 Soil Contamination

Visual and physical observations as well as a PID organic vapor analyzer were used in the field to screen soil samples for hydrocarbon contamination during the excavation of the contaminated soil. Although the exploratory soil borings and the monitoring wells defined the overall extent of the area to be excavated, care was taken not to over-excavate. As a result, Augeas personnel worked closely with Semco to locate small plumes and zones of contamination as well as "clean" zones within the affected area.

Figure 4 represents the approximate areal extent of the fuel oil contamination defined by the soil borings. Within this area, contamination was encountered at depths ranging from 15 to 20 feet below the surface. The removal of this zone of contamination required the excavation of over 4,000 yd^3 of soil. Several hundred cubic yards of clean soil was excavated and stockpiled separately from the contaminated soil. This material was reused as backfill. The remainder of the backfill material was derived from imported fill and native soil sources at the Medical Facility.

4.5 Verification Sampling

During the course of soil removal, Augeas personnel under the supervision of a California registered geologist collected soil samples from the walls and floor of the excavation. Samples were collected on a 15-foot interval by driving brass tubes into the wall or floor and collecting a semi-disturbed sample suitable for detecting aromatic volatile organic compounds. Once collected, each sample tube was sealed with plastic end caps, wrapped in duct tape, labeled and placed in a refrigerator until transported to a certified analytical laboratory under chain of custody.

The goal of the source removal program was to develop a cost-effective method for the removal of contamination without over-excavating. The confirmation samples were collected from the locations shown in Figure 5. The samples collected from the walls of the excavation were obtained directly from the contaminated zone at a depth of approximately 5 feet above the floor of the final excavation.

4.6 Groundwater Extraction

To facilitate the removal of contaminated soil below the fluctuating water table, Semco installed a temporary groundwater extraction sump to dewater the floor of the excavation. The well casing was constructed of a single 20-foot section of 18-inch diameter, Schedule 80 PVC pipe. Vertical slots were cut in the lower 10-feet of the casing and staggered to allow maximum flow. A 10-foot deep hole was opened in the floor of the excavation and the casing installed by backfilling the hole and placing pea-gravel around the base and sides of the slotted part of the casing. A submersible pump was used to lift the water to the top of the casing and a centrifugal pump was used to push the water approximately 50 feet upward from the floor of the excavation to two 10,000 gallon holding tanks located at the surface, adjacent to the excavation. The combined system was able to pump approximately 100 gallons per minute, but could only pump for 20 minutes before cavitating. Over a three week period however, approximately 20,000 gallons of water was removed from the excavation, lowering the water table about 7 feet.

The extraction of water facilitated the additional excavation of approximately 5 to 7 feet of soil. The lowering of the water table also enabled the floor of the excavation below the normal water table to be partially backfilled and compacted back to 90 to 95 percent of maximum density.

4.7 Water Sample Collection

Four water samples were collected during the excavation dewatering activities. Two of the samples were collected directly from the excavation. During the dewatering activities the samples were collected from the first 10,000 gallons of water extracted. All samples were collected using disposable polyurethane bailers. Two one-liter glass jars and two 40 ml VOA vials were filled for each water sample collected. Care was taken to ensure that no headspace was incorporated in the 40 ml vials. All samples were placed into separate chilled ice chests to avoid the potential for cross contamination. The samples were transported under chain-of-custody to a California certified analytical laboratory within 24 hours of collection.

4.8 Proposed Biological Treatment Activities

Treatment of contaminated soil will take place on-site by a combination of bioremediation and soil venting techniques. Since the volume of soil is quite large, approximately 4,000 yd^3, and has a significant component of rock (coarse gravel and bedrock), conventional landfarming techniques would have limited success and thus would not be cost-effective. As a result, Augeas Corporation has proposed a form of soil bioremediation referred to as the Treatment Cell Concept (TCC). The TCC is preferable to conventional landfarming methods at sites characterized by limited space, restricted air emission standards, or other factors of either economic or logistical concern. The TCC does not require tilling, and occupies up to 70 percent less surface area than that required by landfarming, while treating the same amount of soil. The cell is fully enclosed, eliminating emissions of untreated vapors to the atmosphere, and can be operated effectively year round. A treatment "cell" is built by mounding the contaminated soil over a network of perforated PVC pipe. The piping allows fresh air to circulate through the mounded soil, providing the necessary aerobic conditions to keep the hydrocarbon-degrading bacteria functioning properly. The forced aeration of the soil, created by a pump/blower assembly also provides agitation to the soil particles which increases the oil/water interface surface area dramatically.

The hydrocarbon-degrading bacteria, and nutrients to support its growth are added to the soil at the time of cell construction. The fuel oil adsorbed onto the individual soil particles will be used as food and energy sources with the consequential end-products being carbon dioxide, water, cell mass and biological waste products. No adverse air quality emissions will/can occur.

A series of photographs provided in Appendix 2 displays the step by step process in the construction of the treatment cell. The cell that is shown in the photographs was constructed in Kern County which has adopted Bay Area air quality standards. The cell was constructed from soil contaminated with waste oil, grease and diesel fuel with total petroleum hydrocarbon concentration in excess of 55,000 ppm. Within a period of 12 months the average concentration in the soil had declined to below 100 ppm. Since the average concentration of petroleum products in the soil at the VA Medical Center is less

than 1,000 ppm fuel oil, it is expected that a target level of 100 ppm total petroleum hydrocarbon products can be achieved within six months.

Due to the volume of soil to be treated it is expected that two treatment cells will be constructed. Each cell will be surrounded by a berm of clean soil to prevent the migration of leachate away from the treatment area. The cells themselves will be constructed on 12 mills of polyurethane plastic to avoid contamination of native soils. Once construction is complete each cell will be completely enclosed in plastic to reduce emissions and to prevent rain from reaching the contaminated soil.

Background samples of the native soil will be obtained from the property prior to construction of the cells. The samples will be analyzed for total petroleum hydrocarbon products and will be compared to analytical results of soil samples obtained from the same area following the completion of the treatment program. This comparison will be used to verify that no contamination of the native soil has taken place as a result of the treatment program.

Augeas Corporation will monitor the soil treatment process on a regular basis to ensure that the treatment program is working effectively. We propose a bi-monthly sampling plan based on EPA-SW846 methodology (*Test Methods for Evaluating Solid Waste*). Each treatment cell will be roughly rectangular in shape, approximately 100 feet long by 60 feet wide. The sides of the cells will be constructed with a 60 degree slope to compensate for the angle of repose of the soil to be treated. Maximum height of each cell will be 10 feet.

For sampling purposes the surface of each cell will be divided into a grid with eight sample locations. Each location will be designated with an alphanumeric code to facilitate sample identification (Figure 6). Two soil samples will be collected within each sample location. The "a" sample (see Figure 6) will be collected from a depth of 6 inches below the surface of the cell while the "b" sample from each location will be collected from a depth of approximately 4 feet below the surface. A total of 16 soil samples will therefore be collected and analyzed from each cell on a bi-monthly basis. The analytical results of this sampling will enable Augeas Corporation to verify that the treatment process is functioning properly, or to correct deficiencies in the system as they arise. For example, if a particular part of the

cell is not degrading as quickly as the rest of the cell, the TCC design enables additional bacteria or nutrients to be added to that specific location as necessary.

During each round of sampling a small diameter borehole will be created using a rotary hammer and drill assembly to reach the appropriate sampling depth. Soil samples will be collected using a slide hammer and a stainless steel driven-tube sampler. Data on soil moisture, pH and nutrient levels will also be obtained while in the field. Soil samples will be placed into clean glass jars sealed with teflon-lined lids, and place in a chilled ice chest until transported to a California certified analytical laboratory. Each soil sample will be properly labeled and logged on a chain of custody form prior to transport. The samples will be analyzed for total petroleum hydrocarbon products. Specific hydrocarbon compound such as Pristane and Phytane will be used to monitor the degradational process.

5 ANALYTICAL RESULTS AND DISCUSSION

5.1 Soil Samples

Twenty-one soil samples were collected from the walls and floor of the excavation. Each sample was submitted to a certified analytical laboratory and was evaluated for total petroleum hydrocarbon (TPH) compounds, oil and grease, and BTXE (although aromatic hydrocarbons were not expected in this fuel oil, early soil samples collected from beneath the former tanks did indicate the presence of minor toluene, ethyl benzene and xylenes). The laboratory results are summarized and presented in Table 1. Complete analytical reports are located in Appendix 3.

The analytical results show that only the soil samples collected from the north wall of the excavation still contained significant levels of petroleum products including diesel fuel, oil and grease and minor aromatic compounds. As a result, the perimeter of the excavation now defines a clean zone around the former underground tanks on three of the four sides. Virtually all of the samples collected show non-detectable levels of TPH, oil and grease and BTXE. The soil contamination remaining in the north wall of the excavation is confined to a thin zone which projects beneath the existing fire station. The north wall of the excavation was extended to within 2 feet of the fire station in an attempt to remove as much contaminated soil as possible. Further excavation however would require removal of the existing structure. Based on the results of the excavation and mapping of the contaminated zone within the wall of the excavation, it is believed that the 2 foot layer of petroleum hydrocarbon contamination thins to the north and extends an additional 4 to 5 feet beneath the fire station. The contamination is restricted to a layer of sand and gravel at a depth of approximately 17 feet beneath the surface. Beneath the sand and gravel is a thick sequence of low-permeability clay that has prevented the downward migration of the fuel oil. A soil particle analysis of the clay unit shows this material to be a silty clay and of low transmissivity (Appendix 4). Since the contaminated zone is periodically located above the water table, it is subjected to oxidizing conditions conducive to the slow methodical breakdown of the long-chain hydrocarbon molecules characteristic of fuel oil by natural biodegradation. Since the surface area surrounding the former tanks will be covered with

either asphalt or concrete, the surface will be essentially impermeable to the downward migration of meteoric water. It is therefore expected that the small amount of contamination left in the soil will not represent a serious threat to either public health or adversely impact water quality. However, because a small percentage of the total contamination is being left in place, Augeas Corporation will initiate a groundwater monitoring program to evaluate the long term affects on groundwater quality.

Table 1
Analytical Results -- Soil Samples

Sample ID	Constituents					
	Benzene ug/kg	Toluene ug/kg	Ethylbenzene ug/kg	Xylenes ug/kg	Diesel #2 mg/kg	Oil & Grease mg/kg
SE Corner	ND	ND	ND	ND	ND	ND
NE Corner	ND	ND	ND	4	ND	ND
CE Bottom	ND	ND	ND	ND	ND	ND
NW Bottom	ND	ND	ND	ND	ND	ND
West Wall	ND	ND	ND	ND	ND	ND
SW Corner	ND	ND	ND	ND	ND	ND
North Wall (R)	ND	ND	ND	ND	1,900	2,100
North Wall (C)	ND	ND	280	440	6,500	22,000
North Wall (W)	ND	ND	96	310	930	140
SE Wall	ND	ND	ND	6	ND	ND
NE Wall	ND	ND	ND	4	ND	ND
NW Wall	ND	ND	ND	ND	ND	ND
West Wall (C)	ND	ND	ND	ND	ND	ND
SW Wall	ND	ND	ND	4	ND	ND
South Wall	ND	ND	ND	ND	ND	ND
East Bottom	ND	ND	ND	ND	ND	ND

ND = Not detected.

5.2 Water Samples

Two water samples were collected directly from the groundwater of the excavation during the construction dewatering activities. A summary of the analytical results is presented in Table 2. Detailed analytical reports can be found in Appendix 2. Both analyses however, indicate the low aqueous solubility of the fuel oil. Two additional water sample were collected from the two 10,000 gallon holding tanks used for the collection of groundwater during the dewatering activities. All four of these samples were analyzed for total petroleum hydrocarbon products as well as aromatic constituents. Virtually no dissolved aromatic constituents were found in any of the samples collected.

Since the leakage of fuel oil from the underground fuel tanks has reached the water table resulting in visible free floating product, a hydrogeologic study of the site will be proposed as a part of the site remedial plan. This study will include the installation of three groundwater monitoring wells, two of which will be located down-gradient of the excavation. These wells will be used to evaluate the need for further groundwater assessment or remediation. However, since most of the visible free-floating product has been removed during the excavation's dewatering activities, and the contributing source has been removed, it is believed that no further groundwater remediation will be required.

Need to test for TOG, CL-HC, Lead, Cr, Cd

Table 2
Analytical Results -- Water Samples

Sample ID	Benzene ug/L	Toluene ug/L	Ethylbenzene ug/L	Xylene ug/L	TPH-diesel mg/L
VA Exc.	ND	ND	ND	ND	0.3
Bottom	ND	ND	0.3	ND	0.28
L. Water	ND	ND	ND	ND	0.68
U. Water	ND	ND	ND	ND	0.27

6 LIMITATIONS

This report was prepared in general accordance with the accepted standard practice and state of the art knowledge of the fields of environmental geology and groundwater hydrology. It should be recognized that definition and evaluation of environmental conditions is a difficult and inexact science. Judgements leading to conclusions and recommendations are generally made with an incomplete knowledge of the conditions present. More extensive excavation would have tended to reduce the inherent uncertainties associated with removal of contamination found during this study, but would have resulted in exponentially higher costs for remediation. It is our belief that the additional safeguards achieved by this additional excavation could not be justified.

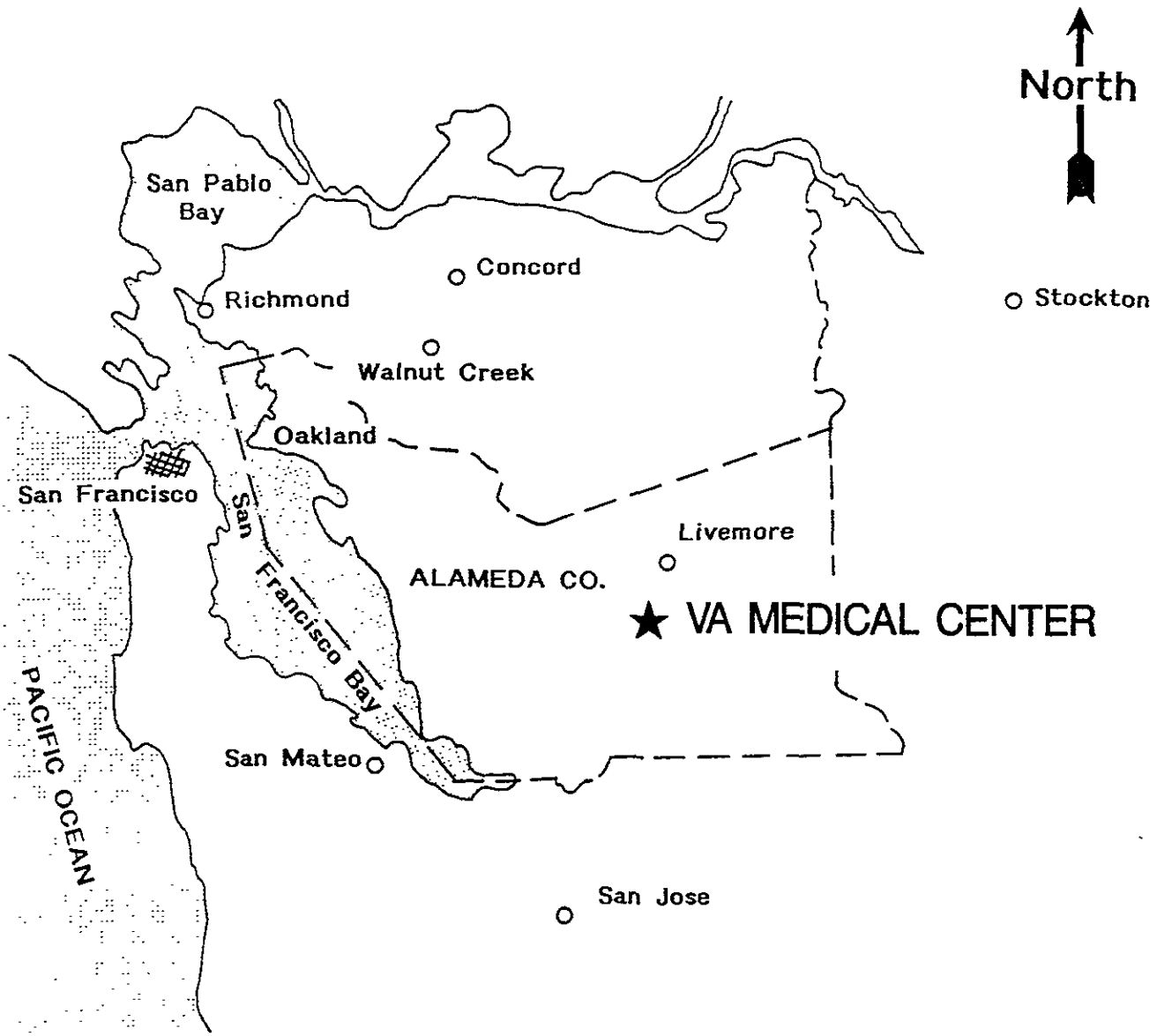

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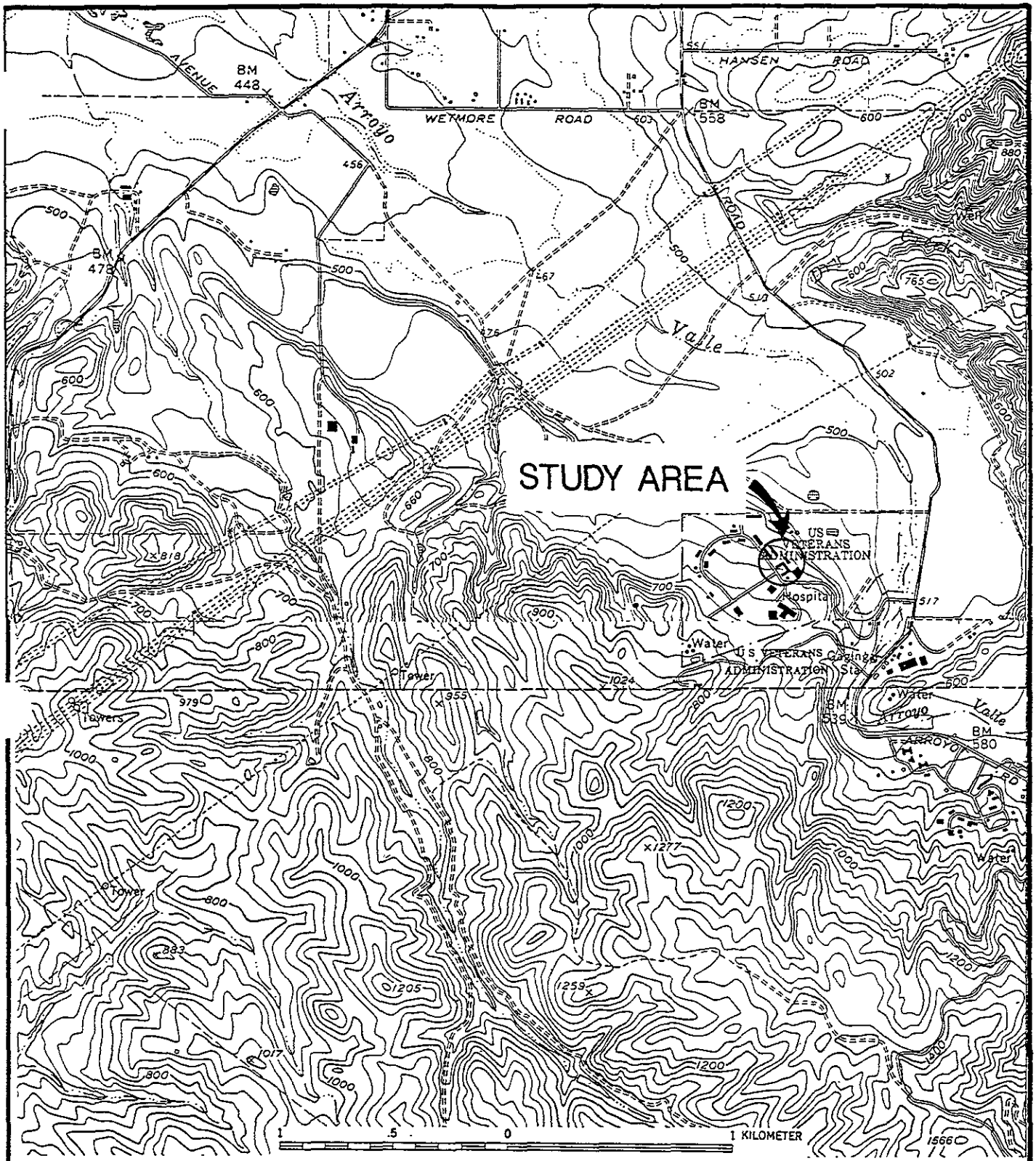
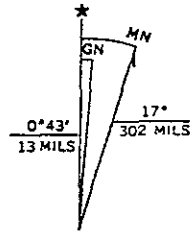
FIGURE 1
LOCATION MAP

VA MEDICAL CENTER, LIVERMORE, CALIFORNIA





UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

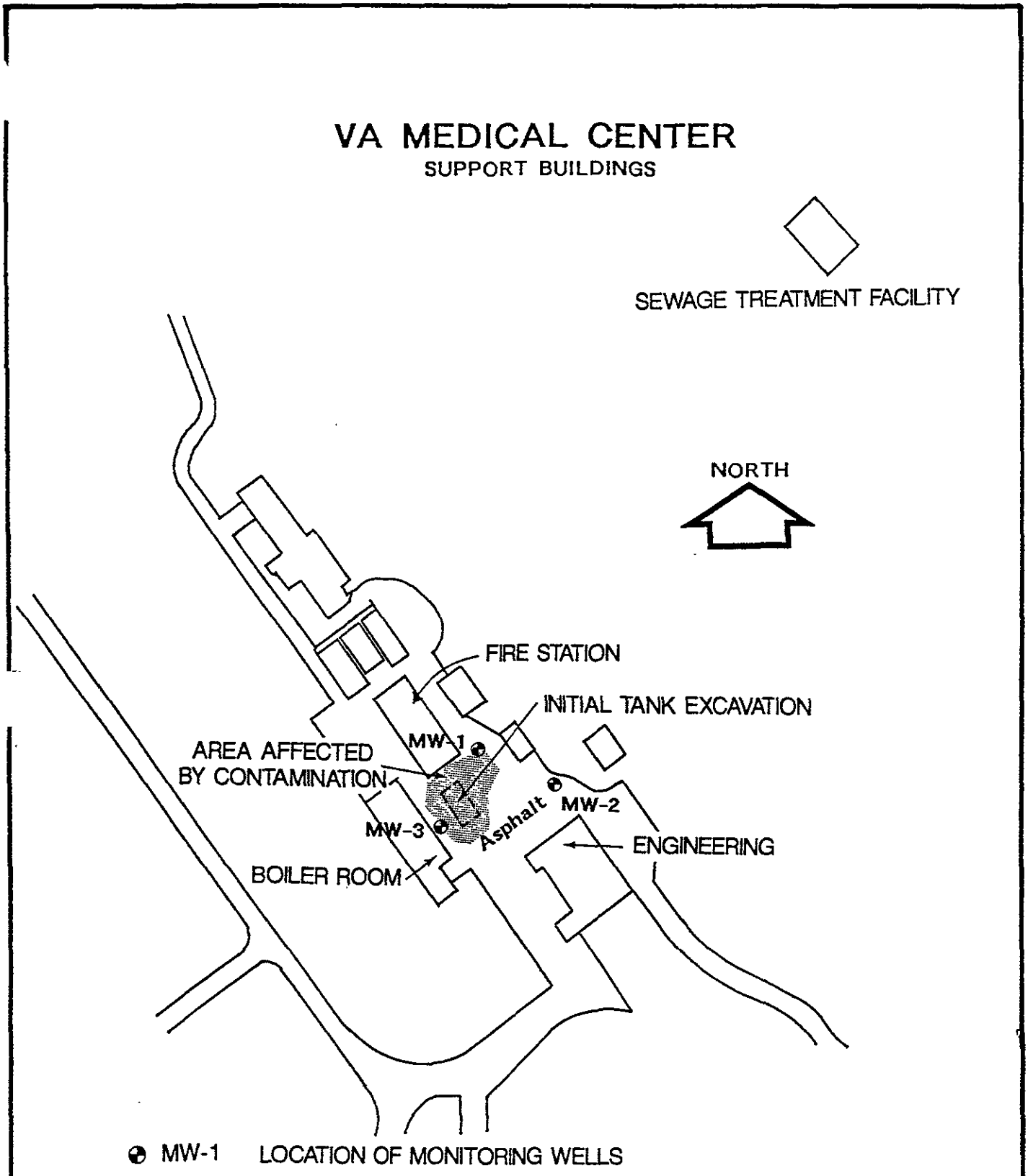
AUGEAS CORPORATION

FIGURE 2

SITE VICINITY MAP

VA MEDICAL CENTER, LIVERMORE, CALIFORNIA

DRAWN BY:	DATE: 4/22/91	PROJECT NO.

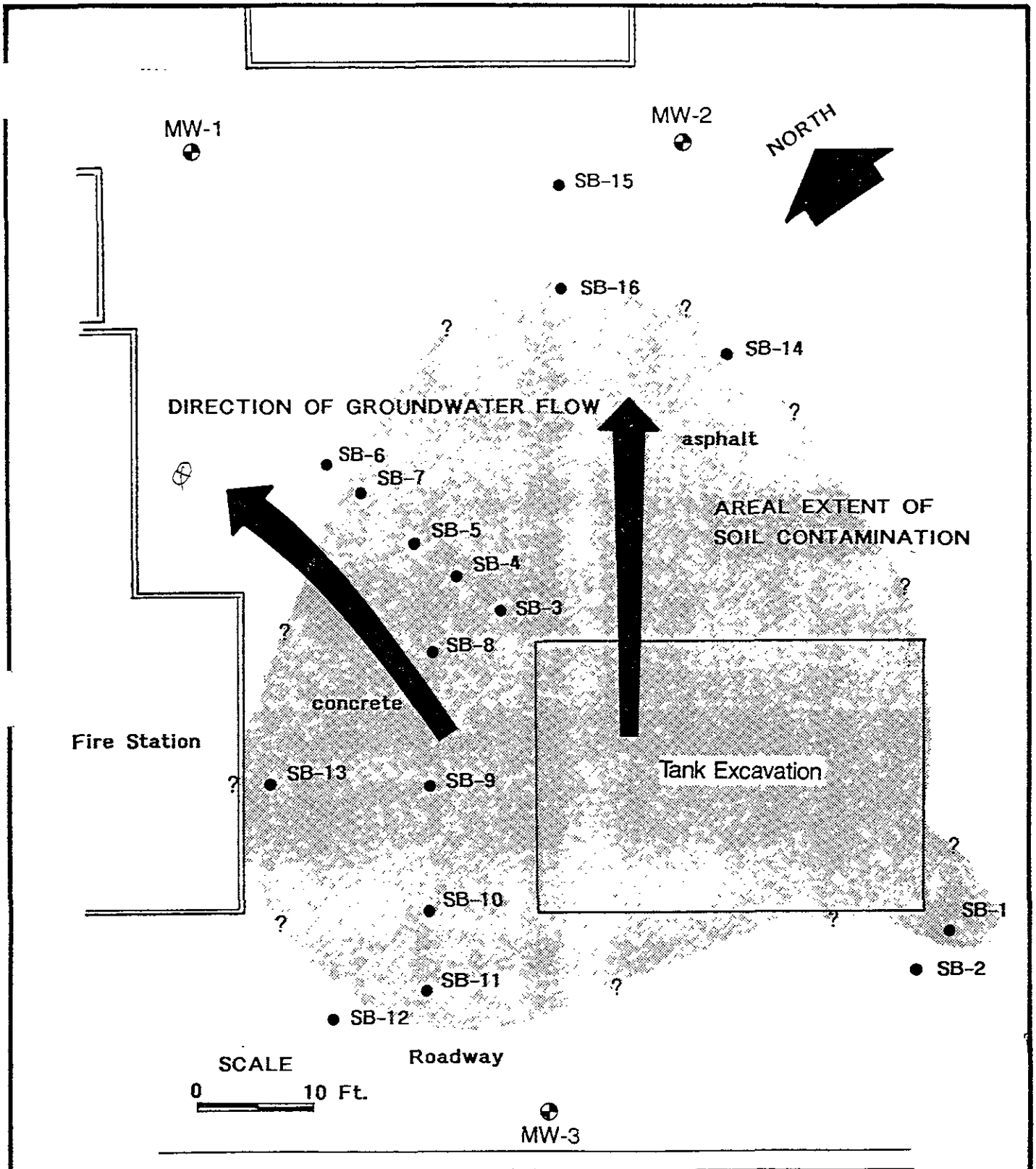


AUGEAS CORPORATION

FIGURE 3

SITE PLAN OF STUDY AREA

VA MEDICAL CENTER, LIVERMORE, CALIFORNIA

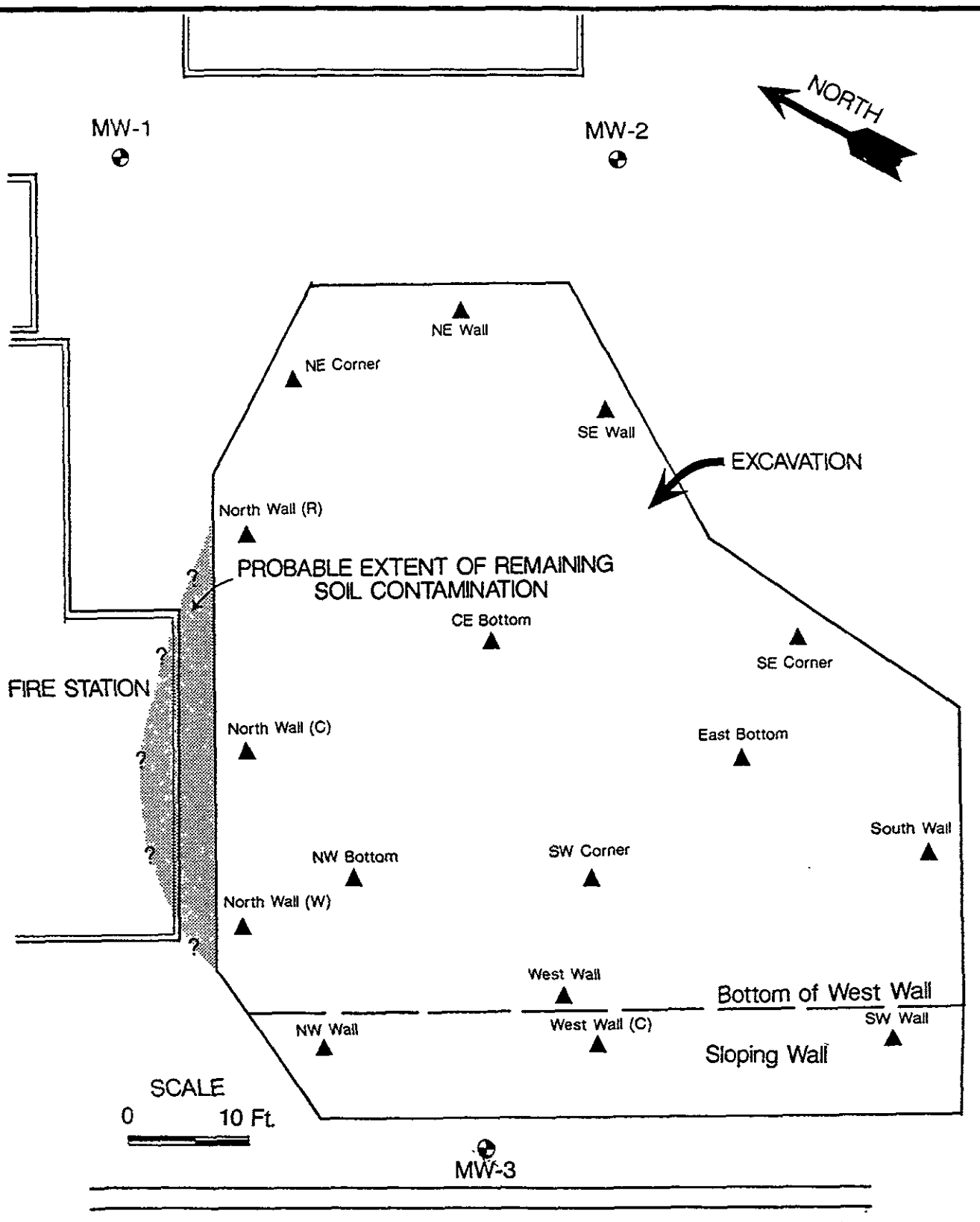


AUGEAS CORPORATION

FIGURE 4

EXPLORATORY BORING LOCATION MAP

VA MEDICAL CENTER, LIVERMORE, CALIFORNIA



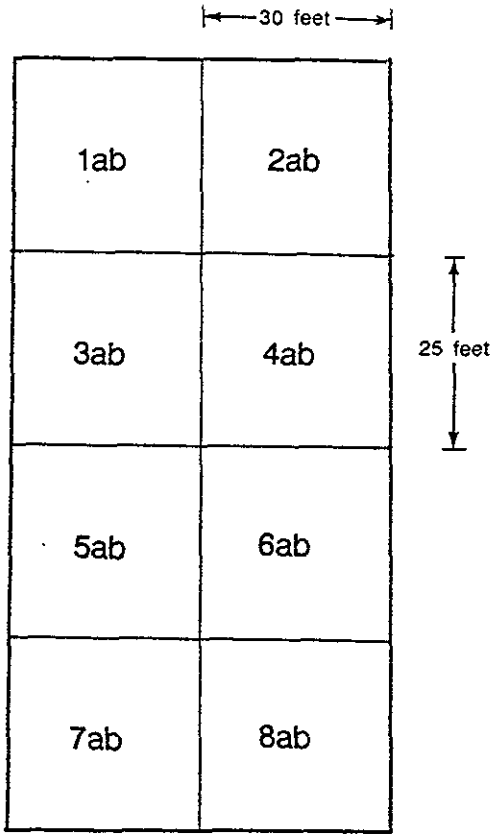
▲ VERIFICATION SAMPLE

AUGEAS CORPORATION

FIGURE 5
VERIFICATION SAMPLE LOCATION MAP

VA MEDICAL CENTER, LIVERMORE, CALIFORNIA

DRAWN BY:	DATE:	PROJECT NO.
[illegible]	1/20/91	



SAMPLE DEPTHS

a = 6-inches
b = 4-feet

DEPTHS MEASURED FROM UPPER SURFACE OF THE CELL

AUGEAS CORPORATION

FIGURE 6
PROPOSED VERIFICATION SAMPLE LOCATIONS
BIODEGRADATIONAL TCC
VA MEDICAL CENTER, LIVERMORE, CALIFORNIA

APPENDIX 1

FIELD LITHOLOGIC LOGS

Project VA Hospital Job No. _____ BORING MW-1 Sheet 1 of 1

Date Started 11/24 Completed 11/24 Surface Elevation _____

Total Depth 25' Location Livermore

Logged By KAM Drilled By Cascade

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Silty sand (SM) minor gravel, clasts subrounded to 1" max. diameter, Moderate brown (5YR 3/4)	CONCRE
	5	SS	1	12/26/28	5-6½	100%		Silty sand (SM) no gravel, moderate yellowish brown (10YR 5/4)	
								interbedded thin layers of very stiff clay (CL) 10YR 5/4	BENTO SEAL
	10	SS	2	15/18/25	10-11½	100%			#3 SAND
								Gravel (GC) with minor clay, clasts subrounded to well rounded derived from stream bed. Clay very stiff, 10YR 5/4 and minor silt	TO SCREE
					initial ▽				
	15	SS	3	100/6"	15-16	33%		Gravelly sand (SG) with minor clay gravel clasts well rounded, sand to coarse gravel, moist to saturated conditions at 15'	
								Clay (CL) moderate brown (5YR 3/4) stiff, moist, gradually changing color to bluish gray 5B 5/1	
	20	SS	4	41/50/5"	21-22½				SOLID
	25							Terminate hole @ 25'	2"

Project VA Hospital Job No. ______ BORING MW-2 Sheet 1 of 1

Date Started 11/29 Completed 11/29 Surface Elevation ______

Total Depth 20' Location Livermore

Logged By KIM Drilled By Enelco

Remarks

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Silty clay (CL) moderate yellow-ish brown 10YR 5/4, moist, no odor. Minor large cobbles in upper 2' of soil column.	grout
5		SS	(1)	15/25	5-6	100%			bentonite seal; #3 sand; 0.02 slot
10		SS	(2)	25/50/5"	10-11	80%		Gravel (GC) w/minor clay, moderate yellow brown clay, gravel clasts subrounded to well rounded. No odor	
					initial ▽				
15		SS	(3)	50/5"	15-15½	30%		to clayey silt (ML) Dense clay (CL) diverse! from marine sediments/bedrock. bluish gray 5B 5/1	
20		SP	(4)	21/38/56/5"				Terminate hole at 20' sampled from 20-21½	
25									

Project VA Hospital Job No. ________ BORING MW-3 Sheet 1 of 1

Date Started 11/29 Completed 11/30 Surface Elevation ________

Total Depth 25' Location Livermore

Logged By [illegible] Drilled By Enejer

Remarks ________

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete/asphalt. Silty clay (CL) moderate yellowish brown 10YR 5/4 no odor, clean	2' of post; 2' of bent. seal; 5' of blank casing; 21' of sand; 15' of 0.02" screen
	5	SS	1	15/25	5-5.5 / 50				
	10	SS	2	27/36	10-11			Gravel and clay (GC) clasts subrounded alluvial origin, clay (CL) moderate yellowish brown, no odor. Gravel consists of meta. rock fragments, mostly greenstone	
	15	SS	3	38/36/50 5	15-16				
	20	SP	4	85/	20-20.5			Gravel and sand w/ minor clay (GS) [illegible] [illegible] - w/in fluctuating water table sand is med to coarse grain. Gravel clast subrounded to subang. meta rock fragments mostly greenstone	5' of blank casing
	25	SP	6	55 6"	25-25.5			Terminate boring at 25'	

Project VA HOSPITAL Job No. _____ BORING SB-1 Sheet 1 of 1

Date Started 11/20 Completed 11/20 Surface Elevation _____

Total Depth _____ Location _____

Logged By K. IRVIN Drilled By Enexco

Remarks Drilling to locate areal extent of buried oil leak

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								asphalt parking area	
								silty clay (CL) / Moderate yellowish brown 10YR 5/4 no odor	
5									
					10-11.5'				
10		SS	(1)	21/65	1-	80%			
								Clayey gravel (GC) clasts subrounded to subangular, cuttings 1/2" in diameter metamorphic rock fragments. Appears to be alluvial gravel.	
						▽		Water table at 14' thin film of free product on surface	
15		SS	(2)	50/50/3"	15-14.5'	75%		sandy gravel w/ clay (Greenish black 5G 2/1) appears to be weathered greenstone. Saturated w/ oil	
20		SS	(3)	62/65/5"	20-21.5'			Dense weathered bedrock - Very stiff (marine sediments) clay to claystone, Medium bluish gray 5B 5/1	
								Terminate hole at 20.9'	

Project VA Hospital Job No. _____ BORING S8-2 Sheet 1 of 1

Date Started 11/20 Completed 11/20 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By KMV Drilled By Cuevas

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								appears fairly well	
								silty clay (CL) moderate yellowish brown (10YR 5/4) fresh appearance, no odor or stains	
5									
10									
								clayey gravel (GC) clasts subrounded alluvial gravel, well indurated layer minor odor at 14' slight change in color from predominantly brown to blue gray	
15		SS	①	30/1"	R	—	—		
								silty clay w/gravel gray green 5B1/1 very minor odor	
		SS	②		R	0%		clayey gravel no odor	
20								terminate hole @ 20'	

Project VA Hospital Job No. _____ BORING SB-3 Sheet 1 of 1

te Started 11/20 Completed 11/21 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By KMM Drilled By Cascade

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete surface 4" thick	
								silty clay (CL) Moderate yellowish brown (10YR 5/4) no staining, no odor	
	5								
	10							Gravelly clay to clayey gravel (GC) Clasts? surrounded, alluvial in origin	
	15	SP	(1)	21/37/40/3"	15-16'	75%		Slight odor at 15' sample from 15 to 16 showed significant contamination	
	20	SP	(2)	24/35/105	20-21.5			Claystone, blue green blueish gray 5B 3/1, well indurated very dense. Terminate hole at 20' Dry hole, no standing water, even after leaving open overnight. Most of the cuttings exhibited signs of saturation	

Project VA Hospital Job No. _____ BORING SB-4 Sheet 1 of 1

Date Started 11/21 Completed 11/21 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By K/M Drilled By Cinesco

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								concrete surface	
								silty clay (CL) moderate yellowish brown (10 YR 5/4) no staining no odor	
	5								
	10								
								clayey gravel, clasts well rounded alluvial gravel ranging in size from 1/4" to 2"	
	15	SB	1	32/43	50/4"	15-17½		silty clay at 17' dark brown as a result of staining - strong odor. Sample consisted of clayey gravel - oil oozing from sample	
								Claystone, gray green - blue 5B 5/1 at 17' very dense and well indurated - clean no oil	
	20							Encountered water at 20' dry hole - no standing water, moist saturation of material	

Project VA Hospital Job No. ______ BORING SB-5 Sheet 1 of 1

Date Started 11/21 Completed 11/21 Surface Elevation ______

Total Depth 20' Location Livermore

Logged By KAM Drilled By Enprec

Remarks drizzling rain cool temperature, rained last night

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete surface area	
								Silty clay (moderate yellowish brown (10YR 5/4) no staining, no odor, interbedded w/ lenses of fine clayey sand and silty sand (SC and SM)	
	5							↓	
	10								
								Clayey Gravel (GC) dry slightly moist, start gravel after 12.5' subrounded alluvium	
	15	SP	1	50/2 R	15	40%		sample collected at 15-16' contained oil.	
								contamination comes right to the top of the clay	
								claystone @ 18' dense, well indurated, bluish gray 5B 8/1	
	20	SP	2	26/50	20-2			Terminate hole @ 20'	

Project VA Hospital Job No. _____ BORING SB-6 Sheet 1 of 1

Date Started 11/21 Completed 11/21 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By KWN Drilled By Enefco

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete at surface & silty sand to silty clay (SM & CL) Moderate yellowish brown (10YR 5/4)	
	5								
	10							Clayey Gravel (GC) subrounded clasts typical of fluvial alluvium, zones of silty clay free gravel alternate w/ lg amounts of clay - no odor in sample	
	15	SP	(1)	30/6"	15-16	80%		Well consolidated clay blueish gray (5B 8/1)	
								No water at the time of drilling	
	20	SP	(2)	22/24	20-21	92%		Terminate hole at 20'	

Project VA Hospital Job No. _____ BORING SB-7 Sheet 1 of 1

Date Started 11/30 Completed 11/30 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By K/My Drilled By Cascade

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Silty sand (SM) w/ minor clay, moderate yellowish brown (10 YR 5/4). PID reading 0	
5		SS	(1)	50/30/5"	4½-8	100%		sample was clean, no odor	
10		SS	(2)	53/4"	10-11	100%		Gravel w/ sand and minor clay (GS-GC) brown, med to coarse sand, gravel subrounded to subangular, alluvial origin, clasts are metamorphic rock fragments, granodiorite? pebbles. sample at 10-11 contained no odor	
15		SS	(3)		15-16½			PID reading 0. Contamination in gravel at 16½' 15½' thin (must be at edge of plume) Completed	
20								Terminate hole at 20'	

Project VA Hospital Job No. ______ BORING SB-8 Sheet 1 of 1

Date Started 11/20 Completed 11/30 Surface Elevation ______

Total Depth 11½' Location Livermore

Logged By [illegible] Drilled By [illegible]

Remarks

higher elevation on N side of shed - bottom of tank should be approx 9' below grade

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								concrete at surface	
								silty sand w/minor clay (SM) moderate yellowish brown (10YR 5/4)	
	5								
	10	CS	1	27/47/42	10-11½			clean sample no odor PID reading 0	
								Clayey Gravel zone	
	15							contamination present at 15½'	
	20							Clayey shale bedrock	

Project VA Hospital Job No. _____ BORING SB-9 Sheet 1 of 1

te Started 11/24 Completed 11/24 Surface Elevation _____

otal Depth 20' Location _____

Logged By KM Drilled By Enviro-

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete @ surface approx 4"	
								silty sand to silty clay	
	5								
	10							Clayey ground zone	
	15							Contamination discovered at ≈ 15½'	
	20							bedrock, Hole ended at ≈ 20½'	

Project VA Hospital Job No. _____ BORING SB-10 Sheet 1 of 1

te Started 11/20 Completed 11/24 Surface Elevation _____

Total Depth 20' Location _____

Logged By [illegible] Drilled By Enecon

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete at surface	
								silty sand to silty clay	
5									
10								Clayey Gravel Zone	
								contamination	
15						▽			
								shale bedrock	
20								Terminate at 20'	

Project VA Hospital Job No. _____ BORING SB-11 Sheet 1 of 1

te Started 11/25 Completed 11/25 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By [illegible] Drilled By Cascade

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								asphalt at surface (from roadway)	
								silty sand	
	6								
	10							Clayey Gravel	
	16					▽		thin zone of contamination	
	20							shale bedrock beginning at about 18½'	

Project VF Haverhill Job No. _____ BORING SB-12 Sheet 1 of 1

Date Started 11/25 Completed 11/26 Surface Elevation _____

Total Depth 20' Location Commons

Logged By KMH Drilled By Enerco

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								asphalt at surface silty clay	
	6								
	10							Clayey Gravel w/ coarse sand no contamination, no odor no discoloration - clean soil	
	15							Shale Bedrock @ 17'	
	20								

Project VA Hospital Job No. _____ BORING _____ Sheet _____ of _____

Date Started 11/26 Completed 11/26 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By KLM Drilled By Binco

Remarks Drilled in adjacent to fire station (approx 2' away from structure)

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete sidewalk w/ reinforcement	
								silty sand	
5									
10								Clayey Gravel zone	
15								Contamination at 15'	
								Shale bedrock at 18'	
20									

Project VA Hospital Job No. _____ BORING SB-14 Sheet 1 of 1

Date Started 11/26 Completed 11/26 Surface Elevation _____

Total Depth 20' Location Concourse

Logged By KK/MM Drilled By Greer

Remarks _____

ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	GRAPHIC LOG	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete at surface silty sand	
5									
10								Clayey Gravel Zone	
16								minor contamination to 16' probably near edge of plume	
								Shale bedrock at 17½'	
20									

Project VA Hospital Job No. _____ BORING SB-15 Sheet 1 of 1

Date Started 11/27 Completed 11/27 Surface Elevation _____

Total Depth 20' Location _____

Logged By KM Drilled By Enerco

Remarks _____

FEET ELEV.	FEET DEPTH	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE BLOWS PER FT	SAMPLE DEPTH RANGE	SAMPLE RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								concrete at surface	
								silty sand to silty clay	
	5								
	10							clayey gravel zone	
								no odor, no discoloration	
	15								
								shale bedrock	
	20								

Project VA Hospital Job No. _____ BORING SB16 Sheet 1 of 1

Date Started 11/27 Completed 11/27 Surface Elevation _____

Total Depth 20' Location Livermore

Logged By KMM Drilled By Cascade

Remarks _____

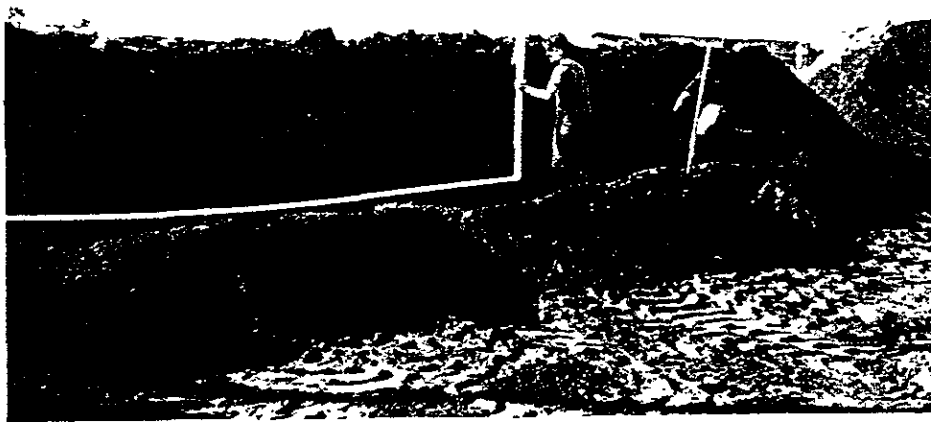
ELEV. FEET	DEPTH FEET	SAMPLE TYPE	SAMPLE NUMBER	BLOWS PER FT	DEPTH RANGE	RECVRY	LOG GRAPHIC	SAMPLE DESCRIPTION	EQUIPMENT INSTALLED
								Concrete at surface	
								silty sand	
	5								
	10							Clayey Gravel Zone	
	15					4		minor contamination found at 16' must be right at the edge of the plume	
								Weathered bedrock	
	20								

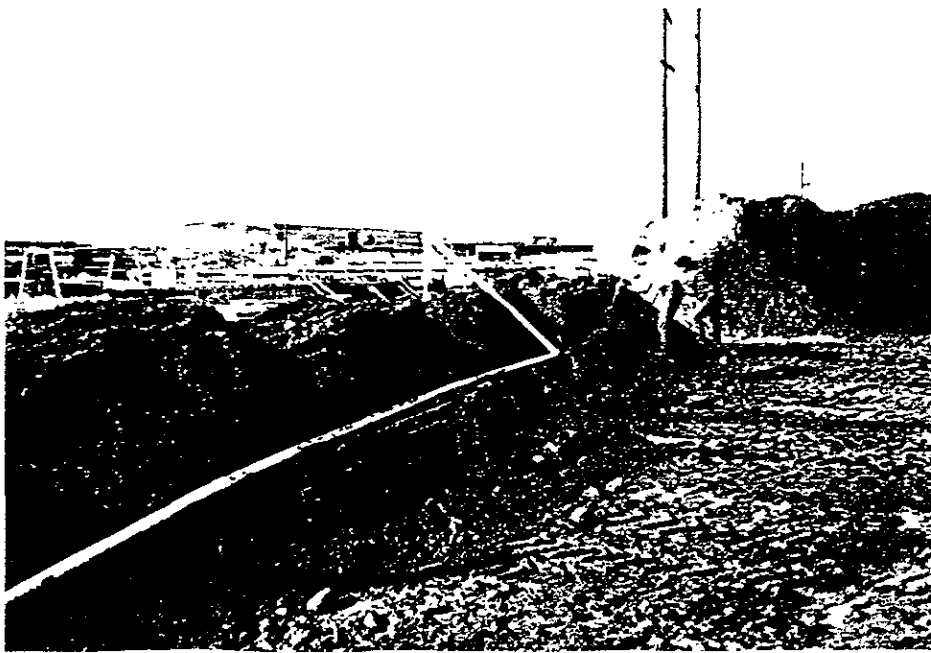
APPENDIX 2

PHOTOGRAPHIC DOCUMENTATION OF TREATMENT CELL CONSTRUCTION

Initial Cell Development. Front-end loader distributes contaminated soil while technician washes soil with a water-based slurry mix containing bacterial cultures and fertilizer

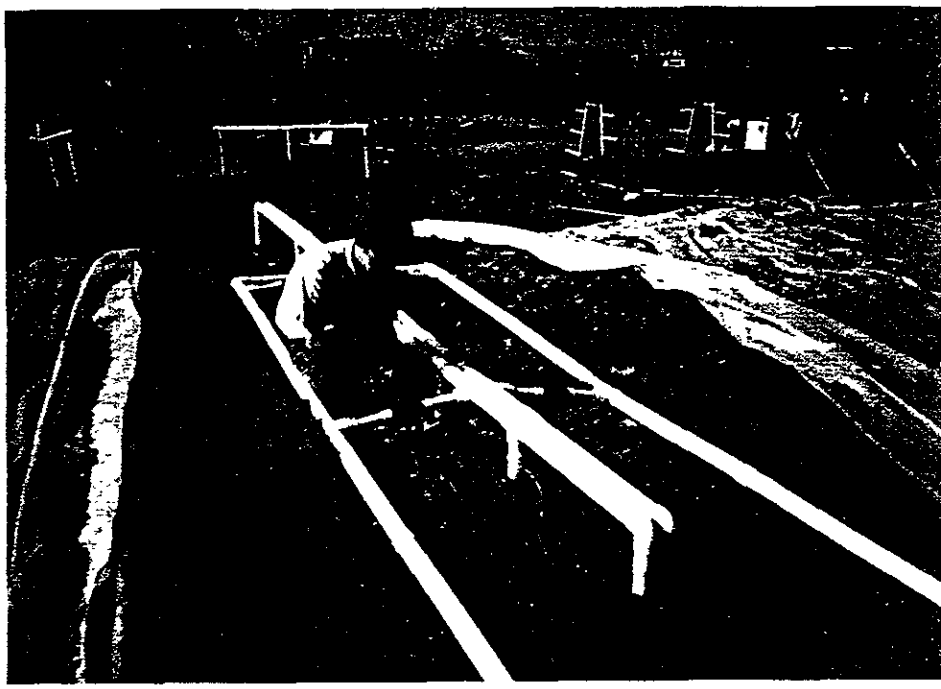
Loader places soil in stages. Vented pipe is laid horizontally near the base of the cell. A vertical "riser" connects two sections of horizontal pipe.

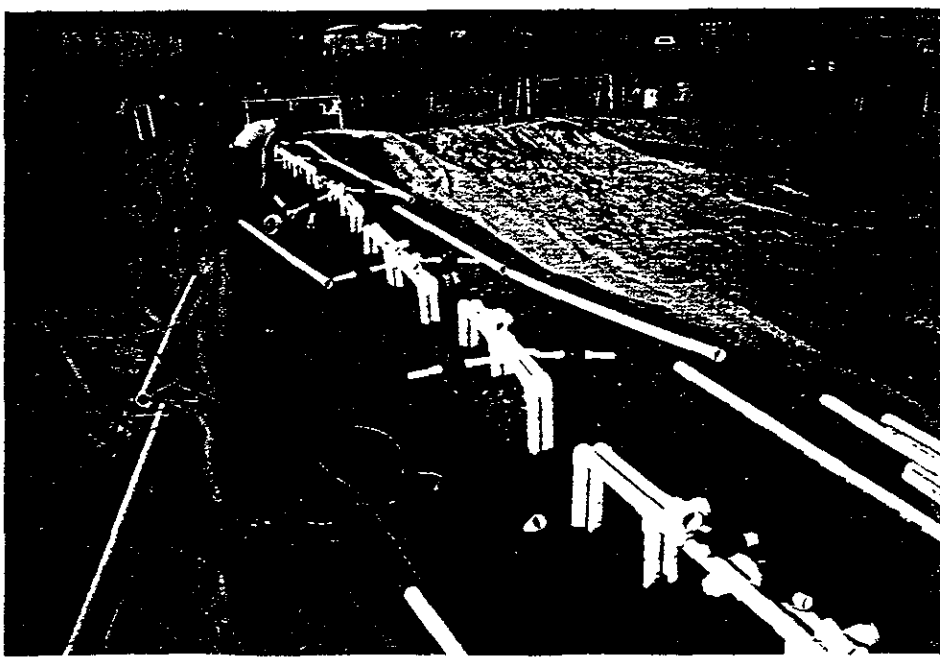


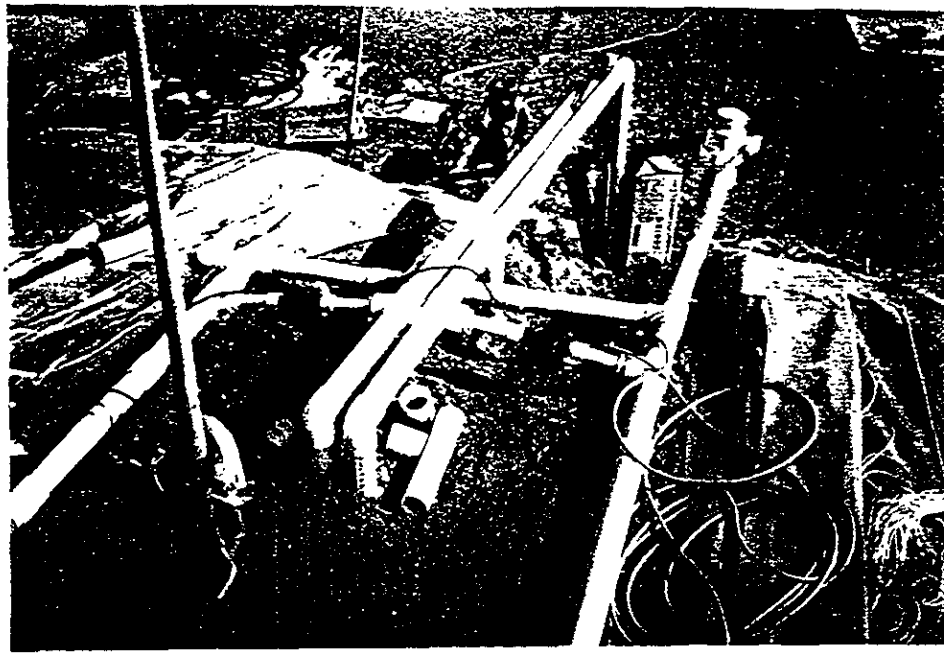


The cell is completed to a height of approximately eight feet. Soil is constantly kept moist during cell construction.

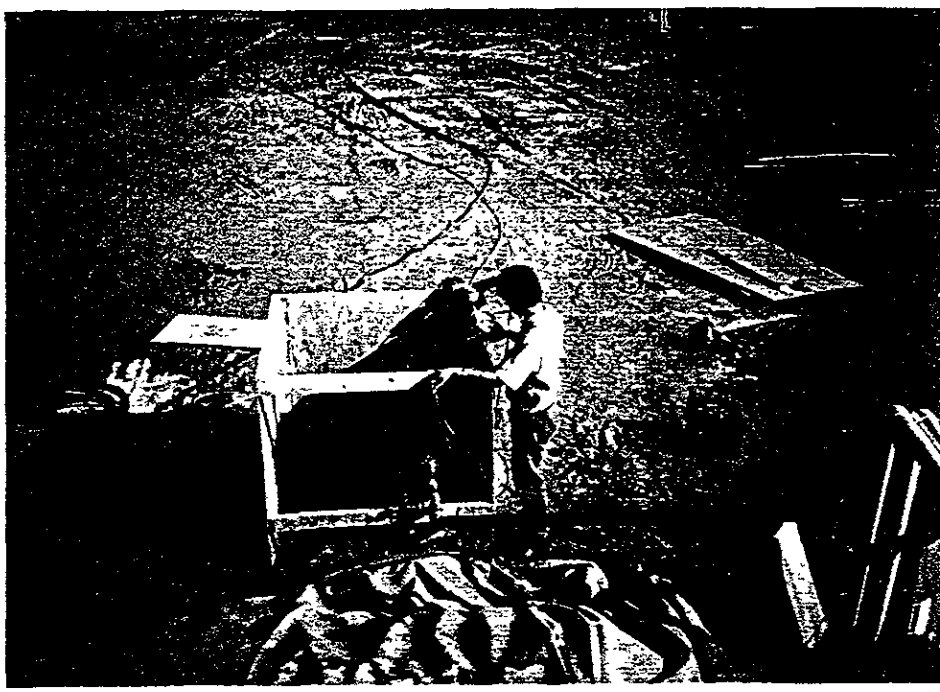
Risers are manifolded together and attached to main lines leading from pump/blower assembly. Electronic timers and switches are added to control the flow of air to each section of the cell.







A pump/blower assembly is attached to circulate fresh air through the cell



Once complete, the cell is completely covered with plasic and the blower is turned on.

Samples from the cell are periodically collected and analyzed to evaluate the cells effectiveness in degrading the petroleum products present.

APPENDIX 3

DETAILED ANALYTICAL RESULTS

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 81978
CLIENT: AUGEAS CORP
CLIENT JOB NO.: V.A.HOSPITAL

DATE RECEIVED:11/26/90
DATE REPORTED:12/03/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	Lower water level	ND<0.3	ND<0.3	ND<0.3	ND<0.3
2	Upper water level	ND<0.3	ND<0.3	ND<0.3	ND<0.3

ug/L - parts per million (ppm)

Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 81%: Duplicate RPD = <7

Richard Srna, Ph.D.

Robert Watson for
Laboratory Manager

Above WW

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 81978
CLIENT: AUGEAS CORP
CLIENT JOB NO.: V.A.HOSPITAL

DATE RECEIVED: 11/26/90
DATE REPORTED: 12/03/90

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/L) Diesel Range
1	Lower water level	0.68
2	Upper water level	0.27

mg/L - parts per million (ppm)

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline = NA
RPD Diesel = 6
MS/MSD Average Recovery = 131%: Duplicate RPD = 0.3

Richard Srna, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 81978
CLIENT: AUGEAS CORP
CLIENT JOB NO.: V.A.HOSPITAL

DATE RECEIVED:11/26/90
DATE REPORTED:12/03/90

ANALYSIS FOR TOTAL OIL AND GREASE
by Standard Method 5520F

LAB #	Sample Identification	Concentration(mg/L) Oil & Grease
1	Lower water level	62
2	Upper water level	ND<5

mg/L - parts per million (ppm)

Method Detection Limit for Oil and Grease in Water: 5mg/L

QAQC Summary: Duplicate RPD : 9

Richard Srna, Ph.D.

Laboratory Manager

Chain of Custody Record

Project No. _____
Project Name V.A. HOSPITAL
Samplers DON Light
P.O. No. AUGEAS CORP.

Superior Analytical Laboratory
825 Arnold Dr. Bay 2
Martinez, CA 94553
(415) 229-1512

Sample Number	Date	Time	Location	Matrix	Number of Containers	Sample Preservation	TPH as Gasoline	BTXE	TPH as Diesel	Oil & Grease	8010	8240			
	11/26/90	1400	LOWER WATER LEVEL	W	3			X	X	X					
	11/26/90	1430	UPPER WATER LEVEL	W	3			X	X	X					

Relinquished By (Signature)	Date/Time	Received By (Signature)	Date/Time
1. DON Light	11/26/90 1709	1.	
2.		2.	
3.		3.	
4.		4.	11/26/90 1709

REMARKS:
Normal T.A.T.

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82097
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VAHOSPITAL

DATE RECEIVED:12/12/90
DATE REPORTED:12/19/90

ANALYSIS FOR TOTAL OIL AND GREASE
by Standard Method 5520F

LAB #	Sample Identification	Concentration(mg/kg) Oil & Grease
1	MW-1.15'	ND<50
2	MW-1.20'	ND<50
3	MW-2.15'	ND<50
4	MW-3.15'	ND<50
5	SB-1.10	ND<50
9	SB-1-15	2800

mg/kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 50mg/Kg

QAQC Summary: Duplicate RPD : 5%

Richard Srna, Ph.D.

Laboratory DIrector

SUPERIOR ANALYTICAL LABORATORIES, INC.

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C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 82097
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VAHOSPITAL

DATE RECEIVED: 12/12/90
DATE REPORTED: 12/19/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/kg) Benzene	Toluene	Ethyl Benzene	Xylenes
6	SB-A-10-11	ND<3	ND<3	ND<3	ND<3
7	SB-A-6-8	ND<3	ND<3	ND<3	ND<3
8	SB-B-10-11	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery =103%: Duplicate RPD = <9%

Richard Srna, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD. STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82097
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VAHOSPITAL

DATE RECEIVED: 12/12/90
DATE REPORTED: 12/19/90

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 5030 and 8015

LAB #	Sample Identification	Concentration (mg/kg) Gasoline Range
6	SB-A-10-11	ND<1
7	SB-A-6-8	ND<1
8	SB-B-10-11	ND<1

mg/kg - parts per million (ppm)

Method Detection Limit for Gasoline in Soil: 1 mg/Kg

QAQC Summary:

Daily Standard run at 2mg/L: RPD Gasoline = <15%
MS/MSD Average Recovery = 87%: Duplicate RPD = 8%

Richard Srna, Ph.D.

Laboratory Manager

82097

California Water Labs

12/12/90

P.O. Box 4249
Modesto, CA 95352
(209) 527-4050

Ship samples to:
1430 Carpenter Lane
Modesto, CA 95351

SAMPLE CHAIN OF CUSTODY RECORD

(please print)

Record 1 of 1

Client _____
Address _____
Phone No. _____
Proj. Mgr./Contact _____

Pink - Field Copy
White and Yellow - To Laboratory with Samples
Yellow - Return to Client

PROJECT/SITE NAME: VA HOSPITAL - LIVERMORE

PROJECT/CONTRACT/PO NO.:

NAME OF SAMPLER: KENT MUREAY

ANALYSIS REQUESTED

REMARKS/SPECIAL INSTRUCTIONS

PLEASE FAX RESULTS TO DR. K. MU @ 916 652-1411
BILL TO: AUGEAS CORP. 8901 RODDEN RD OAKDALE CA

LAB USE ONLY LAB I.D.	SAMPLE I.D.	DATE	TIME	COMP.	GRAB	NUMBER OF CONTAINERS	OIL + GREASE	BTXE	TPH - GAS
	MW-1, 15'	12/5					X		
	MW-1 20'	12/5					X		
	MW-2, 15'	↓					X		
	MW-3, 15'						X		
	SB-1, 10'						X		
	SB-1, 15'						X		
	SB-A 10-11'							X	X
	SB-A 6-8'							X	X
	SB-B 10-11'							X	X

RELINQUISHED BY (SIGN)	DATE/TIME	RECEIVED BY (SIGN)	DATE/TIME
Kent Murray	12/12/90 3:00	Catherine Martin	12/12/90 3:00
		Richard Flint	12/12/90 1130

SHIP VIA: ☐FED X ☐UPS ☐OTHER:_____ SHIPPER NO.:_____

RECEIVED FOR LABORATORY
BY (SIGN) _____ DATE/TIME _____
RECEIVED:
☒COLD AND INTACT OTHER PRESERVATIVE ☐YES ☒NO
☐OTHER: _____
TURN AROUND TIME:
☐24-Hr ☐2-Day ☒5-Day J-Day

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825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82185
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 12/28/90
DATE REPORTED: 12/28/90

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/Kg) Diesel Range
1	S.E.Corner #1	ND<10
2	N.E.Corner #2	ND<10
3	C.E.Bottom #3	ND<10
4	N.W.Bottom #4	ND<10
5	West Wall #5	ND<10
6	S.W.Corner #6	ND<10

mg/kg - parts per million (ppm)

Method Detection Limit for Gasoline and Diesel in Soil: 10 mg/Kg

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline =NA
RPD Diesel = 8
MS/MSD Average Recovery =128 %: Duplicate RPD =3

Richard Srna, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.
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DOHS #319
DOHS #220

C E R T I F I C A T E O F A N A L Y S I S

LABORATORY NO.: 82185
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 12/28/90
DATE REPORTED: 01/03/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS by EPA METHOD 418.1

LAB #	Sample Identification	Concentration (mg/Kg) Oil & Grease
1	S.E.Corner #1	ND<20
2	N.E.Corner #2	ND<20
3	C.E.Bottom #3	ND<20
4	N.W.Bottom #4	ND<20
5	West Wall #5	ND<20
6	S.W.Corner #6	ND<20

mg/Kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 20mg/Kg

QAQC Summary: Duplicate RPD : 0

Richard Srna, Ph.D.
Laboratory DIrector

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82185
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:12/28/90
DATE REPORTED:12/28/90

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/Kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	S.E.Corner #1	ND<3	ND<3	ND<3	ND<3
2	N.E.Corner #2	ND<3	ND<3	ND<3	4
3	C.E.Bottom #3	ND<3	ND<3	ND<3	ND<3
4	N.W.Bottom #4	ND<3	ND<3	ND<3	ND<3
5	West Wall #5	ND<3	ND<3	ND<3	ND<3
6	S.W.Corner #6	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery =114 %: Duplicate RPD =<3

Richard Scott, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82197
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:01/02/91
DATE REPORTED:12/29/90

ANALYSIS FOR TOTAL OIL AND GREASE
by Standard Method 5520F

LAB #	Sample Identification	Concentration(mg/Kg) Oil & Grease
1	S,E,WALL	2300
2	N,E,WALL	4000
3	North Wall Right	2500
4	North Wall Center	13000
5	North West Wall	820
6	West Wall Center	3500
7	South West Wall	2000

mg/kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 50mg/Kg

QAQC Summary: Duplicate RPD : 17

Richard Srna, Ph.D.

Laboratory Director

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
431 W. Hatch Rd. Modesto, Calif 95351
General & Engineering Contractors
(800) 533-9293
FAX (209) 524-0503

82185

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
1741 Leslie St. San Mateo, Calif 94402
General & Engineering Contractors
(415) 572-8033
FAX (415) 572-9734

CHAIN OF CUSTODY RECORD

PROJECT NAME: 4751 ARROYO ROAD V.A. HOSPITAL LIVERMORE, CA.

SAMPLERS (signature): DON LIGHT

Station Number	Date	Time	Comp.	Grab	Station Location	Number of Containers	TPH-DIESEL	418.1	BTXE	RCI	OIL/GREASE	REMARKS
	12/28/1990	1015		X	S.E. CORNER # 1	1	X	X	X	X		
		1034		X	N.E. CORNER #2	1	X	X	X	X		
		1025		X	C.E. BOTTOM # 3	1	X	X	X	X		
		1045		X	N.W. #4	1	X	X	X	X		
		1055		X	WEST WALL # 5	1	X	X	X	X		
	D.L.	1110		X	S.W. CORNER # 6	1	X	X	X	X		

Please initial:
Samples Stored in ice. ✓
Appropriate containers. ✓
Samples preserved. N/A
VOA - without headspace. N.D.
Comments:

AS

Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by(signature):	Date / Time	Received by (signature):
Don Light	12/28 1990 1200				
Company or Agency: AMGEAS		Company or Agency:	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by:	Date / Time	Received by (signature):
Company or Agency: N/A		Company or Agency:	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received for Laboratory by: (signature)	Date / Time	Remarks/Shipping Information	
Company or Agency:			12/28/90 1:40		

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DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82197
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/02/91
DATE REPORTED: 12/29/90

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/Kg) Diesel Range
1	S,E,WALL	1300
2	N,E,WALL	1500
3	North Wall Right	1900
4	North Wall Center	6500
5	North West Wall	930
6	West Wall Center	490
7	South West Wall	770

Method Detection Limit for Gasoline and Diesel in Soil: 10 mg/Kg

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline = NA
RPD Diesel = 2
MS/MSD Average Recovery =128 %: Duplicate RPD =3

Richard Srna, Ph.D.

Robert Watson (for)
Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.

825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512

DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82197
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:01/02/91
DATE REPORTED:01/02/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/Kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	S,E,WALL	ND<150	420	810	2100
2	N,E,WALL	ND<150	ND<150	ND<150	ND<150
3	North Wall Right	ND<150	ND<150	ND<150	ND<150
4	North Wall Center	ND<150	ND<150	280	440
5	North West Wall	ND<30	ND<30	96	310
6	West Wall Center	ND<150	ND<150	ND<150	ND<150
7	South West Wall	ND<15	71	150	370

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery =106%: Duplicate RPD = <6

Richard Srna, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82197
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/02/91
DATE REPORTED: 01/02/91

ANALYSIS FOR PETROLEUM HYDROCARBONS, TOTAL RECOVERABLE
by Method 418.1

LAB #	Sample Identification	Concentration (mg/Kg) Oil & Grease
1	S,E,WALL	1300
2	N,E,WALL	1500
3	North Wall Right	2100
4	North Wall Center	22000
5	North West Wall	140
6	West Wall Center	2500
7	South West Wall	71

mg/kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 20mg/Kg

QAQC Summary: Duplicate RPD : 21

Richard Srna, Ph.D.

Laboratory DIrector

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82197
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:01/02/91
DATE REPORTED:12/29/90

ANALYSIS FOR TOTAL OIL AND GREASE
by Standard Method 5520F

LAB #	Sample Identification	Concentration(mg/Kg) Oil & Grease
1	S,E,WALL	2300
2	N,E,WALL	4000
3	North Wall Right	2500
4	North Wall Center	13000
5	North West Wall	820
6	West Wall Center	3500
7	South West Wall	2000

mg/kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 50mg/Kg

QAQC Summary: Duplicate RPD : 17

Richard Srna, Ph.D.

Laboratory Director

SEMCO
JA . BATEMAN PETROLEUM SERVICES, INC.
431 W. Hatch Rd., Modesto, Calif. 95351
General & Engineering Contractors
(800) 533-9293
FAX (209) 524-0503

Send to Ft Geno
nv 1 1990

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES
1741 Leslie St. San Mateo, Calif. 94402
General & Engineering Contractors
(415) 572-8033
FAX (415) 572-9734

CHAIN OF CUSTODY RECORD

82197

PROJECT NAME: V.A. HOSPITAL
4951 ARROYO ROAD, LIVERMORE CA.

SAMPLERS (signature): DON LIGHT

Station Number	Date	Time	Comp.	Grab	Station Location	Number of Containers	TPH-DIESEL	BTXE	418.1	OIL + GREASE	REMARKS
	12/31 1990	1630		X	S.E. WALL (1)	1	X	X	X	X	30" ABOVE FLOOR BOTTOM
		1646		X	N.E. WALL (2)	1	X	X	X	X	32"
		1700		X	NORTH WALL RIGHT (3)	1	X	X	X	X	34"
					~~NORTH WALL~~	~~1~~	X	X			D.L.
		1710		X	NORTH WALL CENTER (4)	1	X	X	X	X	18"
		1724		X	NORTH WEST WALL (5)	1	X	X	X	X	36"
		1733		X	WEST WALL CENTER (6)	1	X	X	X	X	26"
	D.L.	1744		X	SOUTH WEST WALL (7)	1	X	X	X	X	34"

Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by(signature):	Date / Time	Received by (signature):
Company or Agency: DON LIGHT AUBERS	12/29 1990 1824	Company or Agency: AUBERS	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by:	Date / Time	Received by (signature):
Company or Agency:		Company or Agency:	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received for Laboratory by:	Date / Time	Remarks/Shipping Information	
Company or Agency: AUBERS	2/1/91 0836	(signature)	1/2 0837	SAME DAY TURN AROUND	

FAX Results to 209 847-1958

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82206
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/03/91
DATE REPORTED: 01/04/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	Bottom of pit	ND<0.3	ND<0.3	0.3	ND<0.3

ug/L - parts per billion (ppb)

Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 107%: Duplicate RPD = 1

Richard Srna, Ph.D.
Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #318
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82206
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/03/91
DATE REPORTED: 01/04/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/l) Diesel Range
1	Bottom of pit	0.28

mg/L - parts per million (ppm)

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Gasoline = 0
RPD Diesel = 8
MS/MSD Average Recovery = 111%: Duplicate RPD = 3

Richard Srna, Ph.D.

Laboratory Manager

^Z

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
431 W. Hatch Rd. Modesto, Calif. 95351
General & Engineering Contractors
(800) 533-9250
FAX (209) 524-0503

SEMO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
1741 Leslie St. San Leo, Calif. 94402
General & Engineer Contractors
(415) 57213
FAX (415) 53734

CHAIN OF CUSTODY RECORD

PROJECT NAME: V.A. HOSPITAL
4951 ARROYO ROAD
LIVERMORE, CA.

SAMPLERS (signature): DON LIGHT

Station Number	Date	Time	Comp.	Grab	Station Location	Number of Containers	Analysis Required: TPH-DIESEL	Analysis Required: BTXE	REMARKS
	1/3 1991	0910		X	BOTTOM OF PIT	1	X	X	2-LITRES 2-V.O.A.S
									*24 HOUR (RUSH)

Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by(signature):	Date / Time	Received by (signature):
DON Light Company or Agency: AUGERS	1/3 990 1000	Company or Agency: EXPRESS-IT	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by:	Date / Time	Received by (signature):
Company or Agency:		Company or Agency:	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received for Laboraty by: (signature)	Date / Time	Remarks/Shipping Information	
Company or Agency:					

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82230
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/07/91
DATE REPORTED: 01/14/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (ug/L) Diesel Range
1	VA EXCAVATION	0.3

ug/L - parts per billion (ppb)

Method Detection Limit for Diesel in Water: 0.05 mg/L

QAQC Summary:

Daily Standard run at 200mg/L: RPD Diesel = 14

MS/MSD Average Recovery = 110%: Duplicate RPD = 2

Richard Srna, Ph.D.

Laboratory Manager

SUPERIOR ANALYTICAL LABORATORIES, INC.
825 ARNOLD, STE. 114 • MARTINEZ, CALIFORNIA 94553 • (415) 229-1512
DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82230
CLIENT: AUGEAS CORP
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/07/91
DATE REPORTED: 01/14/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/L) Benzene	Toluene	Ethyl Benzene	Xylenes
1	VA EXCAVATION	ND<0.3	ND<0.3	ND<0.3	ND<0.3

ug/L - parts per billion (ppb)

Method Detection Limit in Water: 0.3 ug/L

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 117%: Duplicate RPD = <12%

Richard Srna, Ph.D.

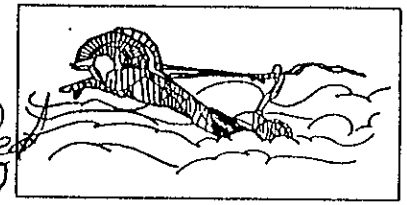
Laboratory Manager

Augeas Corporation Chain of C[illegible], and Analysis Request Form 82230

Section I [illegible]ation For Laboratory Sunnyvale - Martinez (Give La[illegible]ry Name)

oject Name/Identification: VA Hospital Livermore
Project Manager: Kent Murray
Alternate Contact: JOE ERLE
Samplers: Joe Erle
Regulatory Agency: None as of Amended 1/91-N

urn Around Time (Select One): Same Day 24 Hours 48 Hours 72 Hours 5 Day



Augeas Corporation

8901 Rodden Road
Oakdale, CA 95361
209/848-1122
FAX 209/847-1958

Section II Analysis Request

Section III Sample Information

mple Identification	A=Air S=Soil W=H_2O Matrix	G&D TPH	Low Level D TPH	G TPH	BTXE	O&G	8010	8240	Metals	Subject to Sub-contracting Others	Date	Time	Containers Quantity	Containers Preserve	Remarks
VA Excavation	W		X		X						6/1/91	1430	2		

Please initial:
Samples Stored in ice. JDE
Appropriate containers. JDE
Samples Preserved. N/A
VOA's w/out headspace. N/A
Comments:

nquished by:		Date/Time:	Received by:
Organization:	Augeas	1-7-91 15:15	Organization: Express-IT
inquished by:	Express-IT	Date/Time:	Received by:
Organization:	Express-IT	1-7-91 16:00	Organization:
inquished by:		Date/Time:	Received by:
Organization:			Organization: SAL MART

Please Initial
Samples Stored In Ice: JDE
Samples Preserved: JDE
VOA's w/out Headspace: JDE
Comments:

SUPERIOR ANALYTICAL LABORATORIES, INC.

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DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82244
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/09/91
DATE REPORTED: 01/16/91

ANALYSIS FOR TOTAL PETROLEUM HYDROCARBONS
by Modified EPA SW-846 Method 8015

LAB #	Sample Identification	Concentration (mg/Kg) Diesel Range
1	S.E,WALL	ND<10
2	N.E,WALL	ND<10
3	N.W,WALL	ND<10
4	W.WALL,CENTER	ND<10
5	S.W,WALL	ND<10
6	South WALL	ND<10
7	EAST BOTTOM	ND<10

Method Detection Limit for Diesel in Soil: 10 mg/Kg

QAQC Summary:

Daily Standard run at 200mg/L: RPD Diesel = 13
MS/MSD Average Recovery = 102%: Duplicate RPD = 3

Richard Srna, Ph.D.

Laboratory Manager

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DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82244
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED: 01/09/91
DATE REPORTED: 01/16/91

ANALYSIS FOR BENZENE, TOLUENE, ETHYL BENZENE & XYLENES
by EPA SW-846 Methods 5030 and 8020

LAB #	Sample Identification	Concentration(ug/Kg) Benzene	Toluene	Ethyl Benzene	Xylenes
1	S.E,WALL	ND<3	ND<3	ND<3	6
2	N.E,WALL	ND<3	ND<3	ND<3	4
3	N.W,WALL	ND<3	ND<3	ND<3	ND<3
4	W.WALL,CENTER	ND<3	ND<3	ND<3	ND<3
5	S.W,WALL	ND<3	ND<3	ND<3	4
6	South WALL	ND<3	ND<3	ND<3	ND<3
7	EAST BOTTOM	ND<3	ND<3	ND<3	ND<3

ug/kg - parts per billion (ppb)

Method Detection Limit in Soil: 3 ug/Kg

QAQC Summary:

Daily Standard run at 20ug/L: RPD = <15%
MS/MSD Average Recovery = 102%: Duplicate RPD = <6

Richard Srna, Ph.D.

Laboratory Manager

OUTSTANDING QUALITY AND SERVICE

SUPERIOR ANALYTICAL LABORATORIES, INC.
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DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82244
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:01/09/91
DATE REPORTED:01/16/91

ANALYSIS FOR PETROLEUM HYDROCARBONS
by Method 9071/418.1

LAB #	Sample Identification	Concentration(mg/Kg) Petroleum Hydrocarbons
1	S.E,WALL	ND<20
2	N.E,WALL	ND<20
3	N.W,WALL	ND<20
4	W.WALL,CENTER	ND<20
5	S.W,WALL	ND<20
6	South WALL	ND<20
7	EAST BOTTOM	ND<20

g/kg - parts per million (ppm)

Method Detection Limit for Petroleum Hydrocarbons in Soil: 20 mg/Kg

QAQC Summary:

MS/MSD Average Recovery = 101%: Duplicate RPD = 2

Richard Srna, Ph.D.

Laboratory Manager

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DOHS #319
DOHS #220

CERTIFICATE OF ANALYSIS

LABORATORY NO.: 82244
CLIENT: SEMCO
CLIENT JOB NO.: VA HOSPITAL

DATE RECEIVED:01/09/91
DATE REPORTED:01/16/91

ANALYSIS FOR TOTAL OIL AND GREASE
by Standard Method 5520F

LAB #	Sample Identification	Concentration(mg/Kg) Oil & Grease
1	S.E,WALL	ND<50
2	N.E,WALL	ND<50
3	N.W,WALL	ND<50
4	W.WALL,CENTER	ND<50
5	S.W,WALL	ND<50
6	South WALL	ND<50
7	EAST BOTTOM	ND<50

g/kg - parts per million (ppm)

Method Detection Limit for Oil and Grease in Soil: 50mg/Kg

QAQC Summary: Duplicate RPD : 7

Richard Srna, Ph.D.

Laboratory DIrector

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
431 W. Hatch Rd. Modesto, Calif. 95351
General & Engineering Contractors
(800) 533-9293
FAX (209) 524-0503

SEMCO
JAMES C. BATEMAN PETROLEUM SERVICES, INC.
741 Leslie St. San Mateo, Calif. 94402
General & Engineering Contractors
(415) 572-8033
FAX (415) 572-9734

CHAIN OF CUSTODY RECORD

PROJECT NAME: V.A. HOSPITAL 4951 ARROYO ROAD LIVERMORE CA.

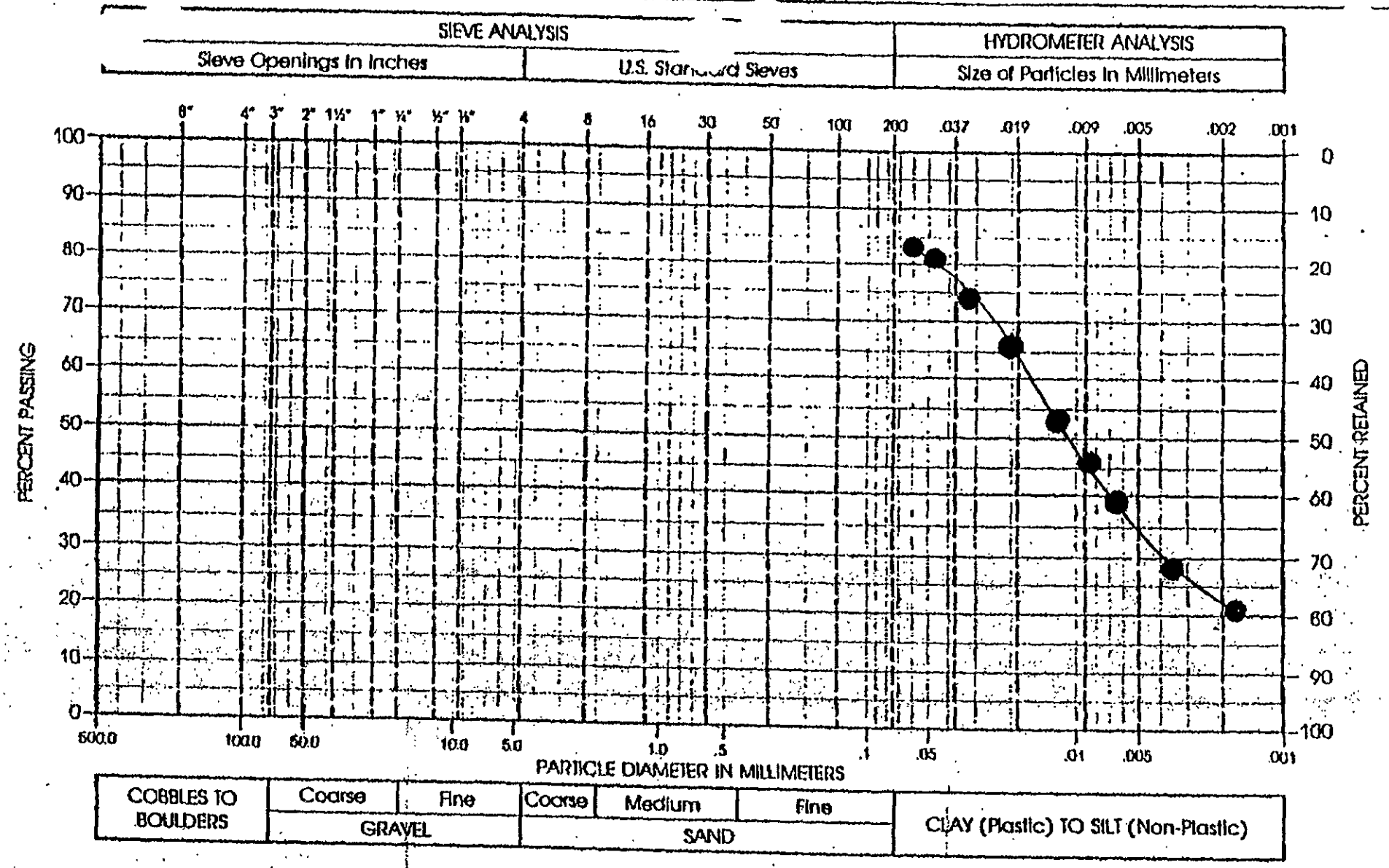
SAMPLERS (signature): DON LIGHT

Station Number	Date	Time	Comp.	Grab	Station Location	Number of Containers	Analysis Required: TPH DIESEL, BTEX, TRPH, OIL & GREASE	REMARKS
	1/5 1991	0815		X	S.E. WALL	1	X	34" ABOVE FLOOR BOTTOM
		0900		X	N.E. WALL	1	X	30"
		1003		X	N.W. WALL	1	X	34"
		1012		X	W. WALL CENTER	1	X	30"
		1030		X	S.W. WALL	1	X	31"
		1040		X	SOUTH WALL	1	X	33"
	1/6	1100		X	EAST BOTTOM	1	X	0" D.L.
								NORMAL TURNAROUND
								FAX RESULTS TO;
								916 852 1411 ATTN: KENT

Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by(signature):	Date / Time	Received by (signature):
Company or Agency: DON LIGHT AUGERS	1/7 1991 1800	Company or Agency: Greyhound	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received by (signature):	Relinquished by:	Date / Time	Received by (signature):
Company or Agency:		Company or Agency:	Company or Agency:		Company or Agency:
Relinquished by(signature):	Date / Time	Received for Laboratory by: (signature)	Date / Time	Remarks/Shipping Information	
Company or Agency:					

APPENDIX 4

SOIL PARTICLE ANALYSIS
(ASTM Method 422)



APN O.	BORING NO.	SAMPLE NO.	DEPTH (FEET)	NATURAL DRY DENSITY (PCF)	NATURAL MOISTURE (%)	PL	PI	LL	SOIL DESCRIPTION
1			40						SILTY CLAY
2									

Quality Control Inspection

GRADATION ANALYSIS

DRAWN BY: DJ
CHECKED BY: JW
DATE: 12/19/90

JOB NO. 90-231

PLATE 1

Table 1.

Sample No.	Sample Description	Specific Gravity
#1	Silty Clay	2.65

Table 2.

Hydrometer analysis

Sample #1	
Particle Diameter (mm)	Percentage Finer By Weight
0.0580	83.0
0.0427	80.9
0.0309	74.7
0.0203	65.4
0.0121	53.9
0.0088	45.6
0.0063	39.4
0.0032	29.0
0.0014	20.7

Table 3.

Sample No. 1 Sample Wt. 48.2 gm

Sieve Size	Retained Mass (gm) Sieve	Retained Mass (gm) Cumulative	Retained % Sieve	Retained % Cumulative	Passing %
# 16	0.1	0.1	0.2	0.2	99.8
# 30	0.2	0.3	0.2	0.4	99.6
# 50	0.5	0.8	0.6	1.0	99.0
# 100	1.3	2.1	1.7	2.7	97.3
# 200	3.2	5.3	4.9	6.6	93.2