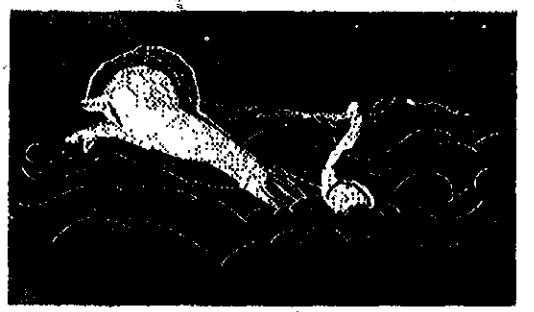
12/05/90 15:30 1 209 848 1122 AUGEAS CORP. P.01

logical & necessary procedure (to Jim Pitzer)
NEED LETTER
- removal of contam. soil
- on-site remediation of soil (in concept)
- installation of monitoring wells



Review / verbal OK ASAP

Kent Murray
2252 Fort Bragg
Gold River, CA
95670


**AUGEAS CORPORATION**
**8901 Rodden Road**
**Oakdale, California 95361**

Telephone Number: 209/ 848-1122 FAX: 209/ 847-1958


Date: 12/4/90

To (Company Name): DEH

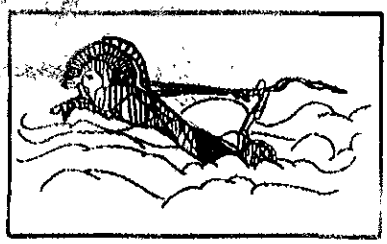
FAX Number: 415/568-3706

Attn: Gil Maistar

Plan for soil remediation: 12/6/90

- no diagram / schematic of bioremediation "cell."
- what are dimensions of cell? 7-10' high 2,000 yds³ in one cell??
- System maintenance & nutrient addition - how often?
- means of testing treated soil to ensure that results are sufficient and representative?

phone conversation Kent Murray, 12/18/90 - Augeas will provide all of the detail, whether the firm decides to go with the cell technique or landfarming



**AUGEAS CORPORATION**

ROSANNA GARRISON,
PRESIDENT

8901 RODDEN ROAD, SUITE 200
OAKDALE, CALIFORNIA 95361

TELEPHONE: (209) 848-1122

December 4, 1990

Mr. Gil Wistar
Alameda County Department of Environmental Health
80 Swan Way, Suite #200
Oakland, California 94621

VIA FAX TRANSMISSION

Dear Mr. Wistar:

I am sending you text from our proposed Corrective Action Plan (CAP), addressing contamination discovered during the removal of two 12,000-gallon underground storage tanks at the V.A. Medical facility in Livermore, California. The entire document, including detailed analytical data, will also be sent today.

At this time, excavation equipment is on stand-by at the site. Upon receipt of acceptance of the CAP, the contaminated soils will be removed and stockpiled for treatment. This work will be performed under the existing tank removal contract held by SEMCO, thus accomplishing these tasks in the most cost-effective manner.

Field observations and logging of borings indicate the areal and vertical extent of the plume as detailed in Figure 2. Analytical results of samples taken during the installation of soil borings will be available later in the week. Three groundwater monitoring wells were installed November 29–30. Analyses of samples from the wells will be available in one week.

Sequoia Analytical Laboratories, a DHS-certified analytical laboratory, will provide onsite laboratory services during excavation activities. Confirmation samples will be taken on a "grid" to confirm all contaminated soil has been removed. Water removed from the excavation will be held onsite in tanks for characterization and proper offsite disposal.

Excavation of the contaminated zone requires re-routing of power lines and traffic within the facility. Preparation for excavation activities will be completed today. As we have discussed, the V.A. staff would like to have the excavation activities completed as soon as possible. We appreciate your helpfulness in expediting this project.

I am also sending you information on our personnel directly involved in bioremediation. We have extensive experience in the treatment of soils contamianted with heavy oils and are confident we can successfully remediate soils at the V.A. site.

Sincerely,

Rosanna Garrison

Rosanna Garrison

AUGEAS CORPORATION

November, 1990

# Department of Veterans Affairs

# Tank Excavation Report and Proposed Corrective Action Plan

## Livermore, California

Contents

# 1.0 INTRODUCTION

Augeas Corporation has been authorized to prepare this workplan describing a proposed correction action plan for the Department of Veteran Affairs Medical Center, located at 4951 Arroyo Road in Livermore, Alameda County.

## 1.1 Proposed Corrective Actions

This action plan is being initiated to remove and biologically treat the contamination which occurred as a result of leaks from two 12,000-gallon underground fuel storage tanks.

## 1.2 Site Location

The property is located at 4951 Arroyo Road in Alameda County (See *Site Location Map* Figure 1). The facility is approximately five miles south of the central business district of Livermore.

## 1.3 Site History

The facility was originally built in approximately 1923. The facility is owned by the United States federal government, Department of Veteran Affairs. The two underground storage tanks have not been in use for over 25 years.

## 1.4 Previous Work

Leakage from the tanks has led to the extensive contamination of subsurface soils and the contamination of groundwater beneath the site. As a result, immediate source removal is proposed by Augeas Corporation. The prime contractor, SEMCO, in coordination with Augeas Corporation, will excavate the remainder of all contaminated soils left in the ground following tank removal.

An asses of the vertical and areal extent of tam has been completed. The locas of borings used to determine both rea rtic nt of the contamination are shown in Figure 2. Figure 2 also provides a view of the additional area to be excavated relative to the former tank excavation.

Approximately 500 yd3 of co nated so were initially removed and stockpiled onsite during tank removal operations. An additional 1,500 yd3 of contaminat l will be removed from areas along the nor and west walls of the original excavation. The excavated soil will consist of approximately 2,000 yd3 "fuel oil #5" or "Bunker oil" contaminated soil to be treated on site, and clean soil to be used as backfill material.

Initial laboratory analytical results from samples taken during the excavation indicate the stockpiled soil contains hydrocarbon products with levels greater than 1,000 ppm TPH. The highest levels of hydrocarbon contamination (9,000 ppm) were found in the southeast corner of the excavation.

# 2.0 SITE DESCRIPTION

## 2.1 Vicinity Description

The site consists of approximately 118 acres. The former tank location is covered by asphalt pavement or concrete. Figure 3 is a site plan of the facility which shows the location of buildings, asphalt or concrete cover and the location of the former underground fuel tanks. Figure 2 shows boring locations. The tanks were found to lie beneath an 8" asphalt slab. Depth to the top of the tanks was approximately 3 1/2 feet. (See *Site Photography* in Appendix 2)

## 2.2 Adjacent Land Use

Land use surrounding the site is predominantly agricultural/rural. The Lake Del Valle State Recreation area is approximately 2 1/2 miles southeast of the site. The hospital lies approximately four miles east of Highway 84 (E. Vallecitos Road).The facility has several underground storage tanks.

## 2.3 Surface Water Characteristics

The subject property is on a moderate incline which slopes gently to the east toward the 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 day drainage system includes the storm drains surrounding the property. Los Banos Creek lies approximately 5 miles east of the facility.

# 3.0 EXCAVATION AND REMOVAL OF FUEL STORAGE TANKS

Two (2) 12,000-gallon underground fuel storage tanks were excavated and removed from the site between November 5 and 16, 1990 in accordance with proper procedures for tank abandonment. According to the facility's records, the tanks were used to store No. 5 fuel oil. Department records indicate the tanks have not been used since approximately 1965. No inventory records were available for review.

A copy of the tank removal notification/registration is provided in Appendix 3.

It was determined that the tanks held water and some residual oil before removal procedures were begun. Tank contents were evacuated by vacuum truck: 1,825 gallons of liquid waste were taken by Allied Petroleum, a licensed transporter, to Ramos Environmental Service, 1515 South River Road, West Sacramento, California. An additional 3,400 gallons (approximately 60% water) were evacuated and disposed offsite at Refinery Services, 13331 North Highway 33, Patterson, California. Transportation was provided by Kern Vacuum Services. Solid carbon dioxide (dry ice) was placed in the tanks followed by a water rinse before removal to eliminate any explosive vapors that may have existed. The tanks appeared to be in good condition with no obvious signs of severe rusting or pitting. The piping and filler vents were not deteriorated.

An Alameda County representative was present at the time of tank removal. SEMCO personnel collected seven soil samples from the native soils surrounding the tanks (approximately 12-

foot depth). Samples were collected from within one and a half feet from the original tank cradle. Samples representative of each tank consisted of soil from either end of the tank, and a sample from the center of the tank cradle. An additional composite soil sample was obtained from the stockpiled soil. Grab samples were collected, contained in brass tubes, labeled, then stored in an ice container. Chain-of-custody procedures were observed. On November 9, SEMCO delivered the samples to Superior Laboratory, Martinez, California, a DHS-certified laboratory, for analysis. Semco requested the laboratory to analyze samples from the base of the excavation for total petroleum hydrocarbons as diesel and as gasoline (EPA Method 8015 (modified)), Oil and Grease (EPA Methods 418.1 and 5520F), Polychlorinated Biphenyls (PCB's) (EPA Method 8080) and BTXE (EPA Method 8020/5030). Analysis for volatile organics (EPA Method 8240) was performed on the composite taken from the stockpiled soils.

## RESULTS

A summary of the analytical results from samples taken during tank removal operations are presented in Table 1 and Table 2.

Results of analyses of all samples for PCB's were all below detection limits. The composite sample analyzed for volatile organics showed all analytes to be below detection limits. Analyses of all samples by EPA Method 8015, TPH as gasoline, were also below detection limits.

Analyses by EPA Method 5520F, Oil and Grease, indicated concentrations of oil and grease ranging from 2,100 ppm to a high of 8,200 ppm (stockpiled soils composite). Total petroleum hydrocarbon analyses showed TPH in the diesel range at concentrations of 1,600 ppm to 3,700 ppm.

Following tank removal, four borings were installed to a depth of approximately 12 1/2 feet, to assess the extent of lateral contamination. Borings were accomplished with a backhoe-mounted hollow-stem auger. An impermeable gravel layer prevented sampling beneath the 12 foot depth. No odors or discoloration of soils was noted in the borings installed on November 14, 1990.

Starting on November 26, a series of geotechnical borings were drilled to further evaluate the areal and vertical extent of contamination. Figure 2 shows the locations of Soil Borings 1–16. Additionally, three groundwater monitoring wells were completed the week of November 26.

Table 1
Samples Taken During Tank Removal

| Sample Identification | TPH as Diesel (mg/kg) | Oil and Grease (Method5520 F) (mg/kg) | Oil and Grease (Method 9071/418.1) (mg/kg) |
|---|---|---|---|
| 1–North end, west tank | 2,400 | 3,400 | 930 |
| 2–North end, east tank | 2,100 | 2,400 | 4,200 |
| 3–South end, east tank | 3,700 | 6,300 | 9,000 |
| 4–Middle, east tank | 2,200 | 2,800 | 4,700 |
| 5–Middle, west tank | 1,900 | 2,100 | 3,200 |
| 6–South end, west tank | 3,100 | 4,000 | 4,700 |
| 7–Composite, spoils | 1,600 | 8,200 | 2,900 |
| Samples 1–6 taken at 15' depth | | | |

Table 2

| Sample Identification | Benzene (µg/kg) | Toluene (µu/kg) | Ethyl benzene (µg/kg) | Xylene (µu/kg) |
|---|---|---|---|---|
| 1–North end, west tank | ND | 37 | 180 | 210 |
| 2–North end, east tank | ND | ND | 120 | 200 |
| 3–South end, east tank | ND | 180 | 610 | 840 |
| 4–Middle, east tank | ND | 35 | 230 | 320 |
| 5–Middle, west tank | ND | 57 | 190 | 290 |
| 6–South end, west tank | ND | 85 | 370 | 380 |
| 7–Composite spoils | ND | ND | 10 | 48 |
| Samples 1–6 taken at 15' depth | | | | |

## 4.0 SCOPE OF WORK

Augeas Corporation proposes to excavate the contaminated material at the D.V.A. site in Livermore and treat the soil on-site. The treatment of soil will be accomplished by the use of natural hydrocarbon degrading bacteria. Since the volume of the soil is relatively large, (approximately 2,000 cubic yards), Augeas Corporation proposes the development of a treatment cell rather than using simple landfarming techniques. The Treatment Cell Concept (TCC) is a bioremediation technique that is preferable to conventional landfarming methods at sites characterized by limited space, restricted air emissions, or other features which may deem the site "sensitive". The TCC occupies up to 70 percent less surfacer area than that required by conventional landfarming methods while treating the same amount of soil. The cell is fully enclosed, eliminating emissions of untreated vapors to the atmosphere, and can be operated year round.

The cell is built by mounding the contaminated soil over vented PVC pipe. The vented pipe allows fresh air to circulate through the mounded soil, providing the necessary aerobic conditions to keep the hydrocarbon degrading bacteria functioning property. The forced aeration created by a pump/blower assembly also provides agitation which dramatically increases the oil/water interface surface area.

Most of the hydrocarbons 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 can or will occur.

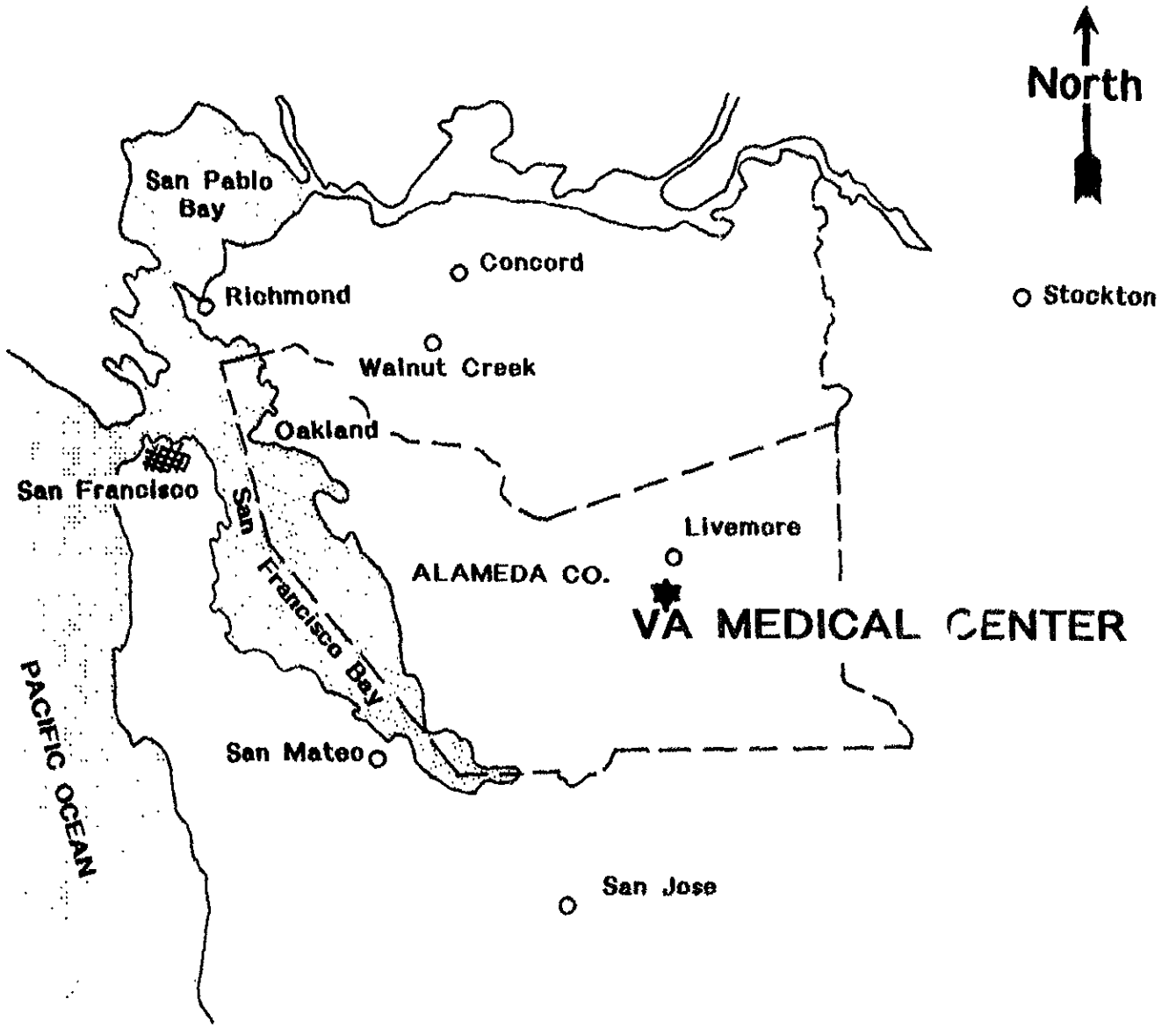
A series of photographs provided in Appendix 1 displays the step by step process in the construction of the treatment cell. The cell that is shown in the photographs was constructed in Kern county which has adopted Bay Area air quality regulations. The cell was constructed from soil contaminated with waste oil, grease and diesel fuel with TPH concentrations up to 55,000 ppm. After seven months, the material had been degraded to levels less than 3,000 ppm and is expected to be under 100 ppm in a total of 10 months. Althopugh the petroleum product in the soils at the V.A. facility is primarily bunker oilits average concentration is only 4,200 ppm. As a reslut, it is expected that the target level of non-detectable petroleum hydrocarbons can be achieved in approximately six months.

The cell will be constructed on 12-mils of polyurethane plastic to avoid contamination of native soils. Once constructed, an impermeable berm of clean soil will be placed around the cell to prevent possible leachate from migrating away from the treatment area. In addition, the entire cell will be covered with 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 cell. The samples will be analyzed for total petroleum hydrocarbon products and will be compared to the analytical results 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.

# Figure 1

## Location Map




AUGEAS CORPORATION

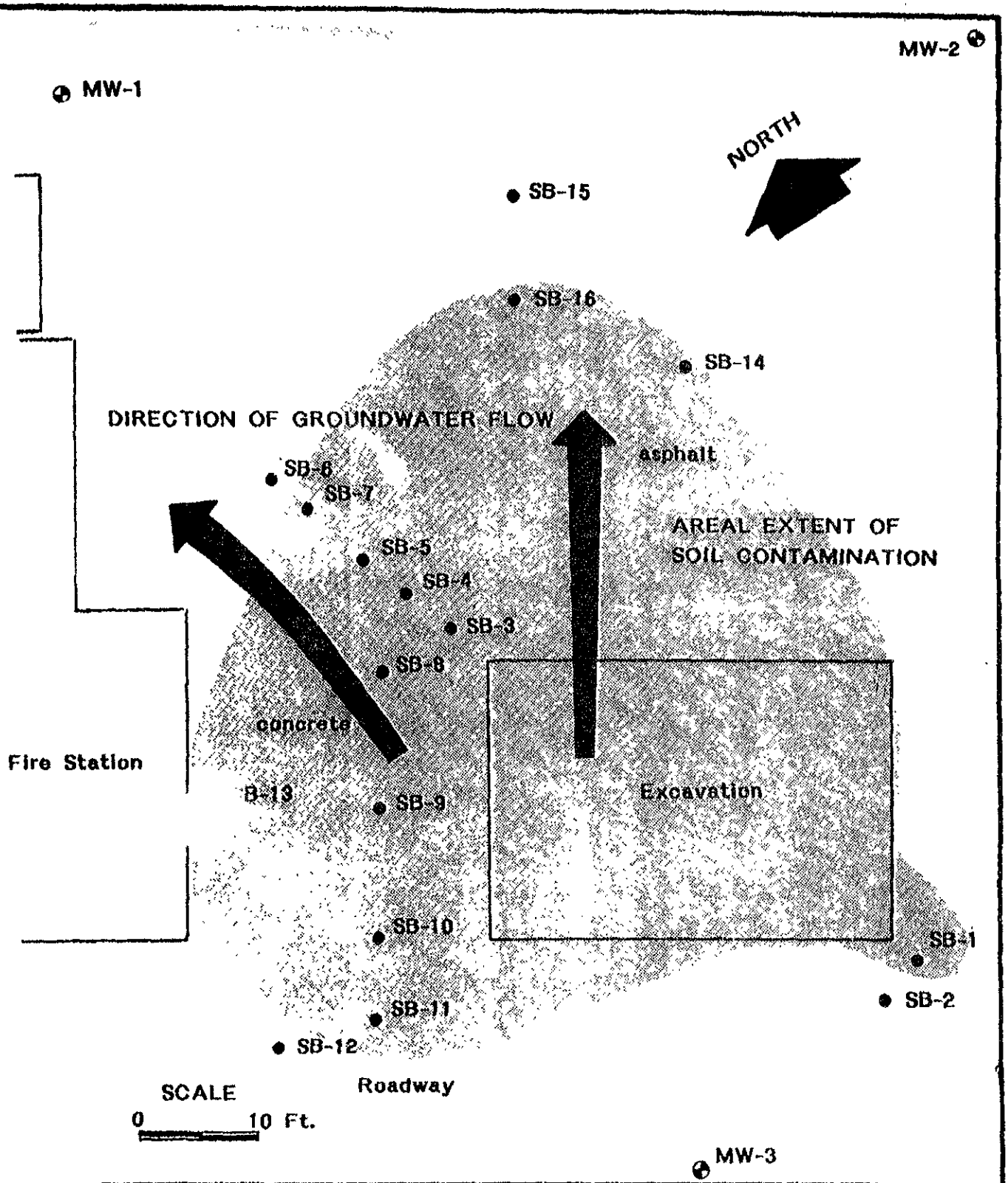
FIGURE 1

LOCATION MAP

| DRAWN BY: | DATE: | PROJECT NO. |
|---|---|---|

# Figure 2

## Soil Boring Location Map




LEGEND

- ● SOIL BORING
- ⊕ MONITORING WELL

AUGEAS CORPORATION

FIGURE 2

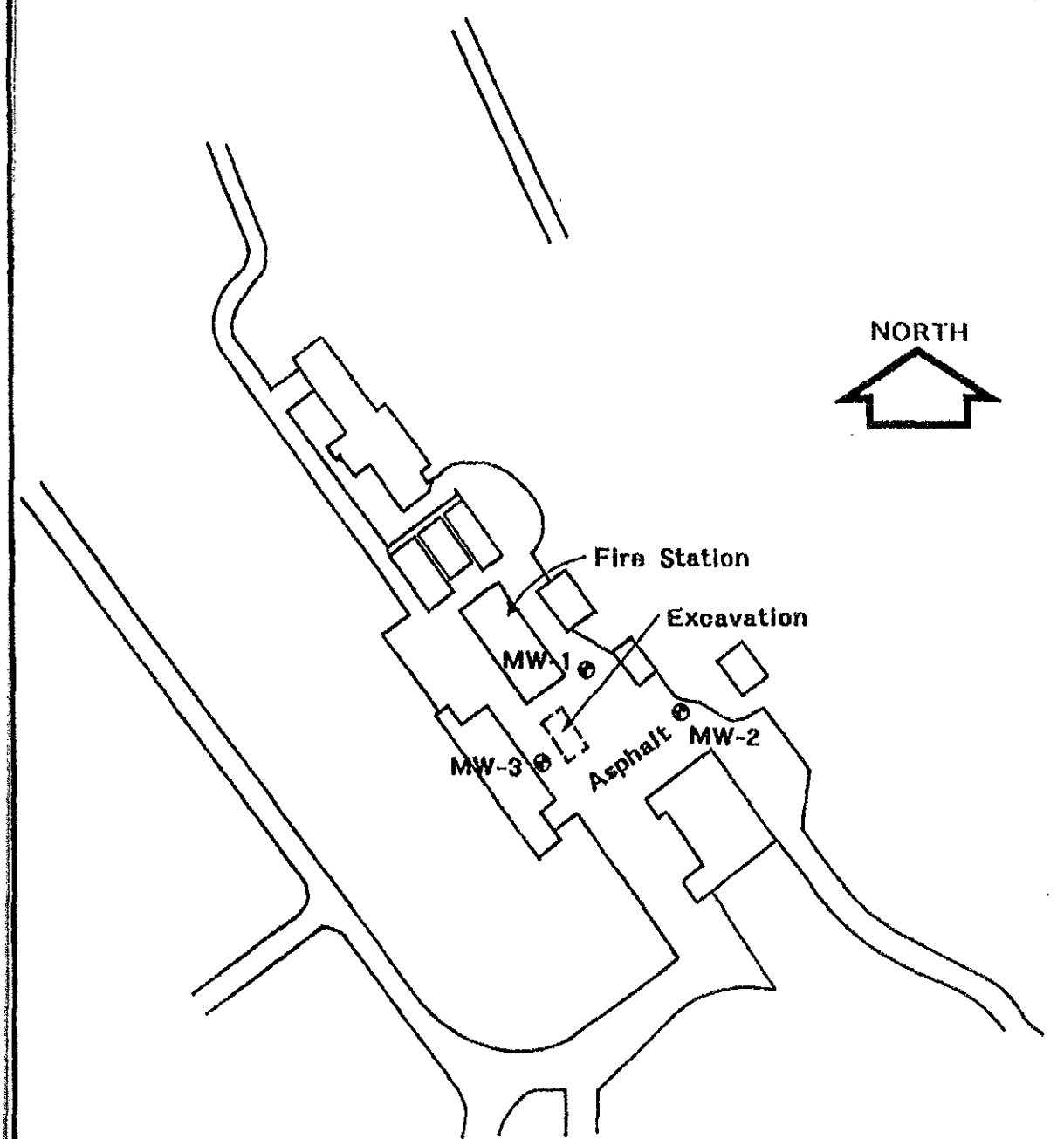
SOIL BORING LOCATION MAP

| DRAWN BY: | DATE: | PROJECT NO. |
|---|---|---|

# Figure 3

# Site Plan

# VA MEDICAL CENTER
## SUPPORT BUILDINGS




0 100 200 Feet

AUGEAS CORPORATION

FIGURE 3

SITE PLAN

| DRAWN BY: | DATE: | PROJECT NO. |
|---|---|---|

# A U G E A S

## Bioremediation Team

**Project Coordinator:** Ms. Ros[illegible]rrison, President of Augeas Corporation, will coordinate the individual efforts of the *treatment cell team. Ms. Garrison is* [illegible]onsible for all phases of the bioremediation project and will supervise the compilation of information and the final generation of the report.

Before founding Augeas Corporation, Ms. Garrison had a 10-year career in management of corporate environmental departments, enforcement of state agency regulatory programs and, as a petroleum industry specialist for the EPA's Office of Water Quality, developed regulations for the oil and gas industry.

**Geohydrologist/Contamination Specialist:** Dr. Kent Murray is the team's project manager. He specializes in the area of environmental geology and soil remediation. Dr. Murray is an environmental geologist/hydrologist with 20 years experience in comprehensive assessments of contaminated groundwater at hazardous waste sites, and is a former Professor of Environmental Geology at California State University in Sacramento. Dr. Murray has pioneered research in the biotreatment of PNA's and has over five years experience in the managing of biotreatment projects. He will direct all site construction activities and will lead a staff of highly experienced, dedicated engineers and technicians. Dr. Murray is a registered environmental assessor and registered geologist in the state of California.

**Environmental Engineer:** Mr. Joseph Erdie is a mechanical engineer with over five years in process and design of bioremediation cells. He has broad experience in supervising complex field investigations throughout the West. Through environmental investigations and remediation projects for both financial institutions and industry, Mr. Erdie has gained significant experience in site assessments, compliance, and associated remediation tasks. Mr. Erdie has U.S. Department of Defense training in site remediation and handling of hazardous materials. Mr. Erdie is an EPA accredited asbestos contractor and a registered environmental assessor in the state of California: REA-02329.

**Corporate Counsel:** Mr. Gregg S. Garrison, J.D., of the law firm of Normoyle & Newman, provides regulatory review of the appropriate environmental statutes, laws, and regulations concerning the project. He will coordinate with other members of the ESA team in their area of environmental expertise and analyze their field observations and analytical results under applicable state and federal regulations. Mr. Garrison has extensive experience in the generation of evidence for the purpose of litigation of liabilities associated with site remediation. Additionally, he has substantial experience in representing industry and lending institutions in avoiding environmental liability in corporate mergers and acquisitions and other forms of property transfer. Mr. Garrison is a licensed attorney and a registered environmental assessor in the state of California.

**Environmental Specialist:** Mr. Don Light is knowledgeable in the areas of waste classification and packaging; permit, labeling, and manifesting procedures; container transport; and lab pack preparation. Mr. Light will coordinate construction and sampling activities. He will supervise the laboratory testing and ensure QA/QC standards are maintained. Mr. Light holds accreditation as an OSHA trained Health and Safety Supervisor for Hazardous Waste Workers.

Augeas Corporation

Environmental Management and Engineering Services

A U G E A S

# KENT S. MURRAY

**EDUCATION**
University of California, Ph.D., Geology, 1981
Northern Arizona University, M.S., Geology, 1974
Western Michigan University, B.S., Geology, 1970
Expert Witness Training, McGeorge School of Law, 1979

**PROFESSIONAL REGISTRATIONS**
Geologist: California, Oregon
Certified Geologist: Oregon
Environmental Assessor: California

**REPRESENTATIVE EXPERIENCE**
Dr. Murray has served in senior technical and management capacities on a variety of multidisciplinary projects in the areas of waste management, groundwater hydrology, and environmental geology. He has over 15 years experience in site assessments, hydrogeologic studies, and waste management evaluations, including the planning and implementation of remedial action programs.

Dr. Murray has directed more than 100 waste management projects involving petroleum contamination of soil and groundwater. On several of these projects the contaminants of concern have included petroleum hydrocarbons, organic solvents, heavy metals, herbicides and pesticides, PCPs and PCBs, and asbestos. Examples of specific projects for Augeas Corporation include:

**Bulk Oil Terminal.** In San Jose, California, leakage from fuel product lines and a cracked pump housing led to the extensive contamination of subsurface soils and groundwater. Over 11,000 yd3 of contaminated soil was excavated and stockpiled onsite. Initial hydrocarbon concentrations in the soil ranged from 22,000 mg/kg of gasoline and over 4,000 mg/kg of diesel. The complex site geology and clay-rich soils precluded the use of in-situ forms of remediation, thus necessitating excavation and the eventual on-site treatment of the contaminated soil as the most cost-effective approach to source removal.

Management of the site remediation program included design, permitting and construction of bioremediation treatment cells. In this process, air is pumped through a pile of excavated soil to oxygenate bacteria inoculated into the soil pile. Continual introduction of oxygen, nutrients and water accelerates the biodegradation of the heavier fractions of petroleum contamination. In the first month of operation, TPH contamination was reduced by 30% – 80%.

**Railroad Maintenance Facility:** Directed the investigation of soil and groundwater contamination at a railroad facility in the vicinity of a large petroleum residue impoundment adjacent to an old railroad spur in Stockton, California. Soil borings and groundwater monitoring wells were used to delineate the extent of the sludge-like residues and to evaluate the likelihood of migration. A monitoring well network was devised to identify the spread of contamination.

**Natural Gas Refinery:** Conducted a hydrologic evaluation of a major natural gas refinery. The project entailed the assessment of the areal and vertical extent of massive contamination of two separate groundwater aquifers. Soil gas surveys were used as a screening tool for the cost-efficient selection of the placement of the deep vertical monitoring well. The remedial action consisted of designing the system to recover free product from the surface of both aquifers for reuse and the removal and cleanup of over 100,000 gallons of contaminated groundwater.

**Oilfield Services Company:** Directed and conducted the assessment of 15 separate facilities in California, Texas, Louisiana, and Oklahoma. Past disposal and operating practices at these facilities had led to significant contamination of soil and groundwater. Common problems included hydrocarbon and lead contamination of soils, and heavy metals contamination of groundwater. Often, contamination resulted from poorly managed PSTs, both aboveground and underground tanks. Developed cost-effective assessment programs designed to meet the different regulatory requirements of each state. Several sites included surface and/or groundwater investigations. Remediation alternatives ranged from disposal, to capping and monitoring to remediation of 3,500 cubic yards of waste-oil contaminated soils.

**Equipment Rental Company:** Conducted environmental inspections of over 40 facilities for a nation-wide construction equipment rental company, the majority of the sites having two or more PSTs. Identified violations of local, state, and federal environmental regulations and recommended measures designed to reduce and/or eliminate waste streams. These investigations included tank integrity testing, magnetometer surveys, UST removals, petroleum contaminated soils remediation, and groundwater investigations.

ADDITIONAL EXPERIENCE

**Hospital:** Directed the assessment and remediation of a 10,000 gallon diesel spill at a large urban hospital. Site assessment work included groundwater monitoring wells and the use of a cone penetrometer to obtain subsurface stratigraphic and soil resistance information. Alternative remedial recovery recommendations vacuum extraction and onsite bioremediation as well as free product removal.

**Zinc Galvanizing Plant:** Directed the investigation of the quality of surface water, groundwater, and soil at a 10-acre hazardous waste site in Davis, California where the contaminants of concern were high concentrations of arsenic and chromium VI in the soil and groundwater which threatened public drinking water supplies.

**Iron Works Plant:** Directed the assessment of hydrocarbon contamination of groundwater at an iron works plant located within an industrial complex at the Santa Barbara Airport in California. The hydrocarbon contamination derived from city-owned fuel storage tanks located at the airport was remediated by using five deep trenches to extract the shallow groundwater which was then treated to drinking water standards.

**Tractor Sales and Service:** Directed the assessment and bioremediation of 5,000 cubic yards of soil contaminated by diesel fuel and polyaromatic hydrocarbons (PNAs) in Sacramento, California.

**Aerial Applicator:** Conducted the assessment of soil and groundwater contamination at three aerial applicator facilities in the Central Valley of California. The rinsing of tanks, used to spray agricultural fields with herbicides and pesticides, had led to significant but localized contamination of the soil and groundwater with a variety of organochlorine and organophosphorus compounds and carbamates. Site assessment determined the areal extent of both the soil and groundwater contamination and led to the development of remedial actions which included the onsite treatment of the soils and disposal of the groundwater.

**Battery Recycling Shop:** Conducted the assessment of a one-acre site in Sacramento, California where the uncontrolled draining of battery casing had resulted in highly elevated [illegible]ration and low pH in the soil. Located in a residential area, the combination of low [illegible]h lead was destroying vegetation on adjacent properties. Remedial action included [illegible]ng with citizen groups and immediate neighbors to alleviate fears and remove the lead contaminated soils.

**Large Hardware Distribution Facility:** Directed the assessment of the yard at a large agriculturally-oriented hardware in Sacramento, California. The leakage of both above ground and underground storage tanks had led to extensive contamination of both soil and groundwater with diesel fuel and pesticides as well as heavy metals. Assessment activities included the use of a soil-gas survey for off-site delineation of the groundwater plume.

**Food Processing Facility:** Directed the investigations and cleanup of solvent contamination at a 100-acre site of a famous producer of tomato products in Sacramento, California. Implemented programs to define groundwater plume which required an extensive evaluation of the hydrogeological region and agricultural practices of the area. The facility is located above usable groundwater with large volume pumping at various times of the year.

**AFFILIATIONS**

American Association of Groundwater Scientists and Engineers
Geological Society of America
[illegible]ssociation of Engineering Geologist (Faculty Advisor CSUS, 1986 - 1989)
[illegible]ermal Resources Council
Inte[illegible]al Association of Hydrologists
National Association of Geology Teachers

**PROFESSIONAL HISTORY**

Augeas Corporation, Vice President and Principle Scientist, 1987 - Present
American Environmental Management Corporation, Supervising Hydrologist, 1987
California State University - Sacramento, Adjunct Professor, 1982 - 1989
Oregon State University, Visiting Professor, 1981
California Energy Commission, Staff Scientist, 1976 - 1987
Fugro Inc., Consulting Engineers and Geologists, Project Geologist, 1973 - 1976
U.S. Geological Survey, Staff Scientist, 1972 - 1973