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GROUNDWATER TECHNOLOGY, INC.

OIL RECOVERY SYSTEMS

Tim Watchers

REMEDIATION WORK PLAN

FORMER TEXACO SERVICE STATION

424 MARTIN LUTHER KING JR. WAY

OAKLAND, CALIFORNIA 94612

SEPTEMBER 1988

GROUNDWATER TECHNOLOGY, INC.
CONCORD, CALIFORNIA

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REMEDIATION WORK PLAN

FORMER TEXACO SERVICE STATION

424 MARTIN LUTHER KING JR. WAY

OAKLAND, CALIFORNIA

September 23, 1988

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FORMER TEXACO SERVICE STATION

424 MARTIN LUTHER KING JR. WAY

OAKLAND, CALIFORNIA

September 23, 1988

INTRODUCTION

This report presents the proposed work plan for remediation of subsurface hydrocarbons at the former Texaco Service Station located at 424 Martin Luther King Jr. Way in Oakland, California (Figure 1). Also included are the results of groundwater monitoring and soil sample analyses conducted on July 27, 1988. The remediation work plan presented in this report is based on the information presented in previous reports, as well as the new data presented herein.

WORK PERFORMED

Work performed at the site subsequent to the April 22, 1988 report included the following:

- Groundwater monitoring of on-site wells.
- Analysis of soil samples from selected locations on the site by both a mobile G.C. laboratory and a state-certified laboratory.
- Preparation of this remediation work plan.

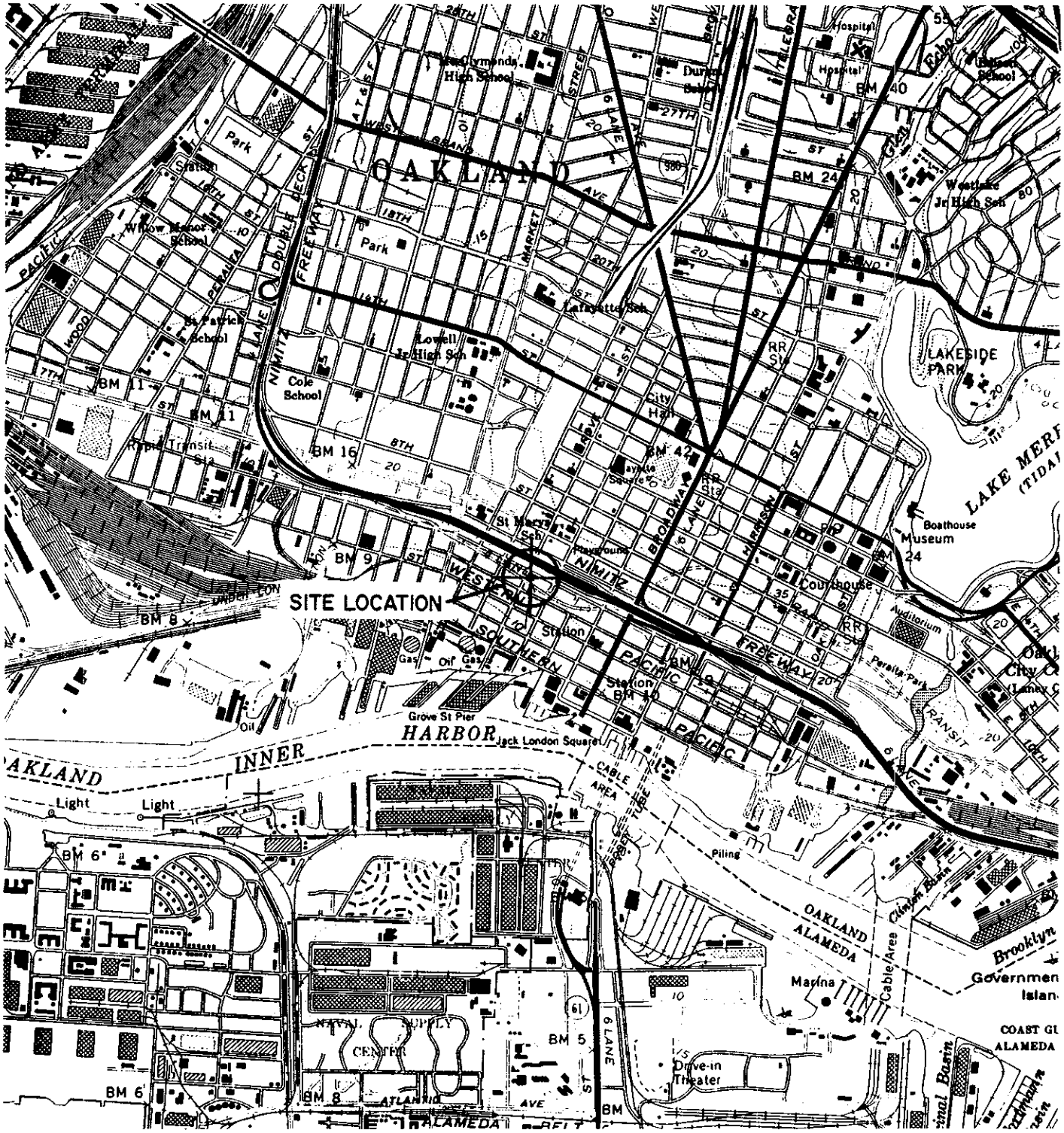

FIGURE 1

SITE LOCATION MAP

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MARTIN LUTHER KING JR. DR.
OAKLAND, CALIFORNIA

0 MILES 1

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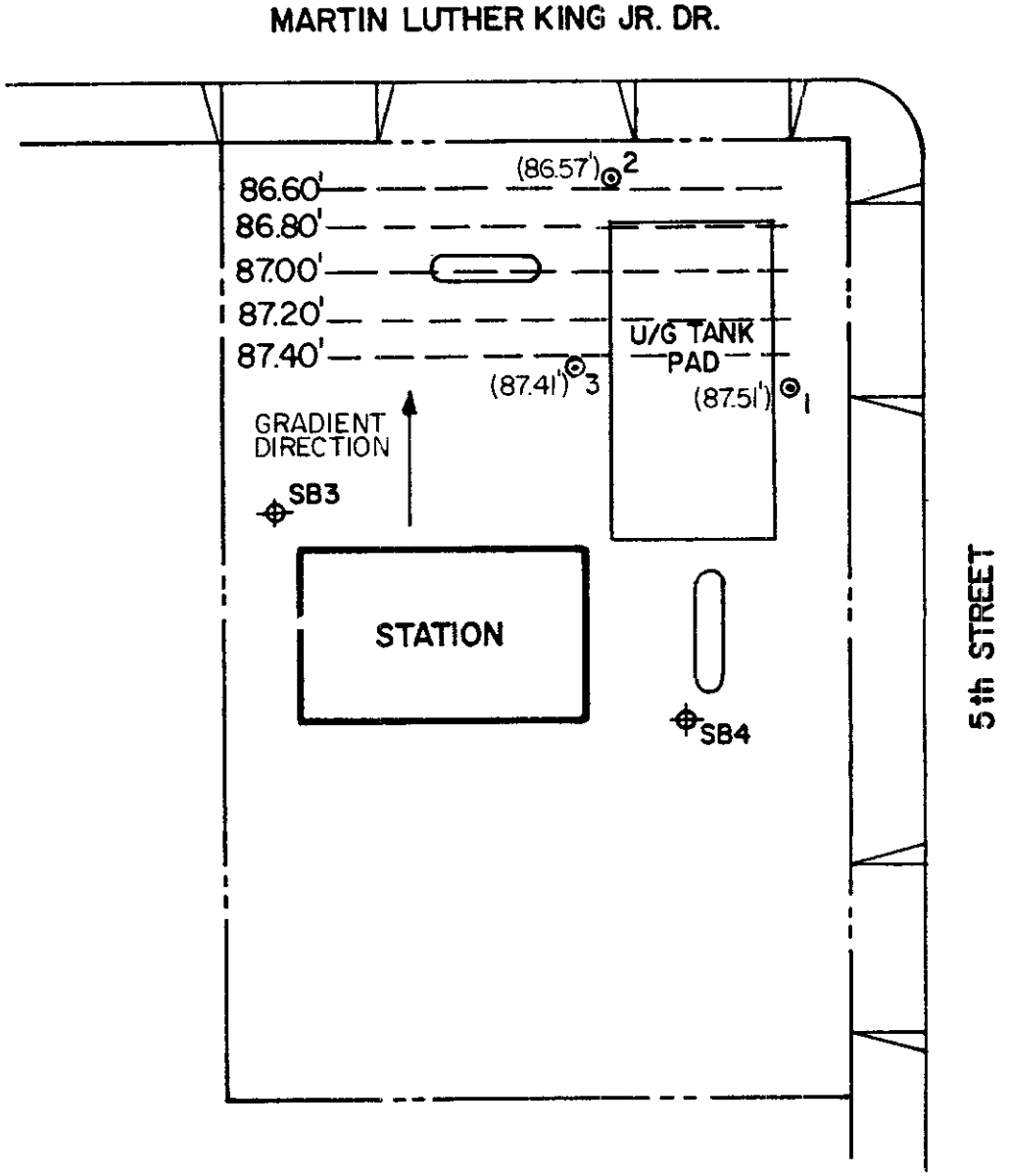
GROUNDWATER MONITORING

The most recent groundwater monitoring at the site was conducted on July 27, 1988. Depth-to-water was approximately 12 feet and slightly lower than in previous months. The July 1988 monitoring data were used to prepare a groundwater-gradient map (Figure 2). This map depicts a groundwater-flow direction to the northwest at a gradient of approximately 0.03-foot-per-foot (ft/ft). A summary of monitoring data collected at the site from September 1, 1987 to July 27, 1988 is presented in Table 1.

SOIL SAMPLING AND ANALYSES

In order to help define the extent of hydrocarbons in the soils underlying the site, a mobile laboratory was contracted on July 27, 1988 to immediately analyze soil samples obtained from various probe locations around the former tank-pit and pump-island areas. A total of nine soil-probe locations were selected and sampled for analyses of total volatile hydrocarbons (TVH)-as-gasoline in the soil by the laboratory. The sampling locations were based in part by the analytical results provided y the mobile laboratory. Each new location was based on the results of the previous sample. Duplicate samples were obtained from three of the locations and submitted to a state-certified laboratory for analysis.

Each soil-probe hole was created by driving a 3/4-inch, outside-diameter (O.D.), solid-steel rod to depths of approximately 11 feet, using an electric hammer. The rod was then removed and a smaller, 5/8-inch O.D. steel rod, equipped with a 3/8-inch O.D. by 6-inch-long stainless-steel sampling tube, was lowered to the bottom of the hole. The sampling tube was then



LEGEND

- ⊙ MONITORING WELL
- ⊕ SOIL BORING
- ( ) GROUNDWATER ELEVATION
- – – GROUNDWATER CONTOUR

FIGURE 2
GROUNDWATER GRADIENT MAP
7/27/88

N

0 FEET 30

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GROUNDWATER TECHNOLOGY

TABLE 1

MONITORING DATA

		MW-1	MW-2	MW-3
WELLHEAD ELEV. (ft)		100.00	98.45	99.65
DATE				
9/01/87	DTW	11.98	11.40	11.77
	DTP	-	-	-
	PT	-	-	-
11/05/87	DTW	-	-	11.92
	DTP	-	-	-
	PT	-	-	-
01/29/88	DTW	11.60	11.07	11.37
	DTP	-	-	-
	PT	-	-	-
03/03/88	DTW	11.81	11.32	11.52
	DTP	-	-	-
	PT	-	-	-
07/27/88	DTW	12.49	11.88	12.24
	DTP	-	-	-
	PT	-	-	-

DTW = Depth To Water (FT)
DTP = Depth To Product (FT)
PT = Product Thickness (FT)

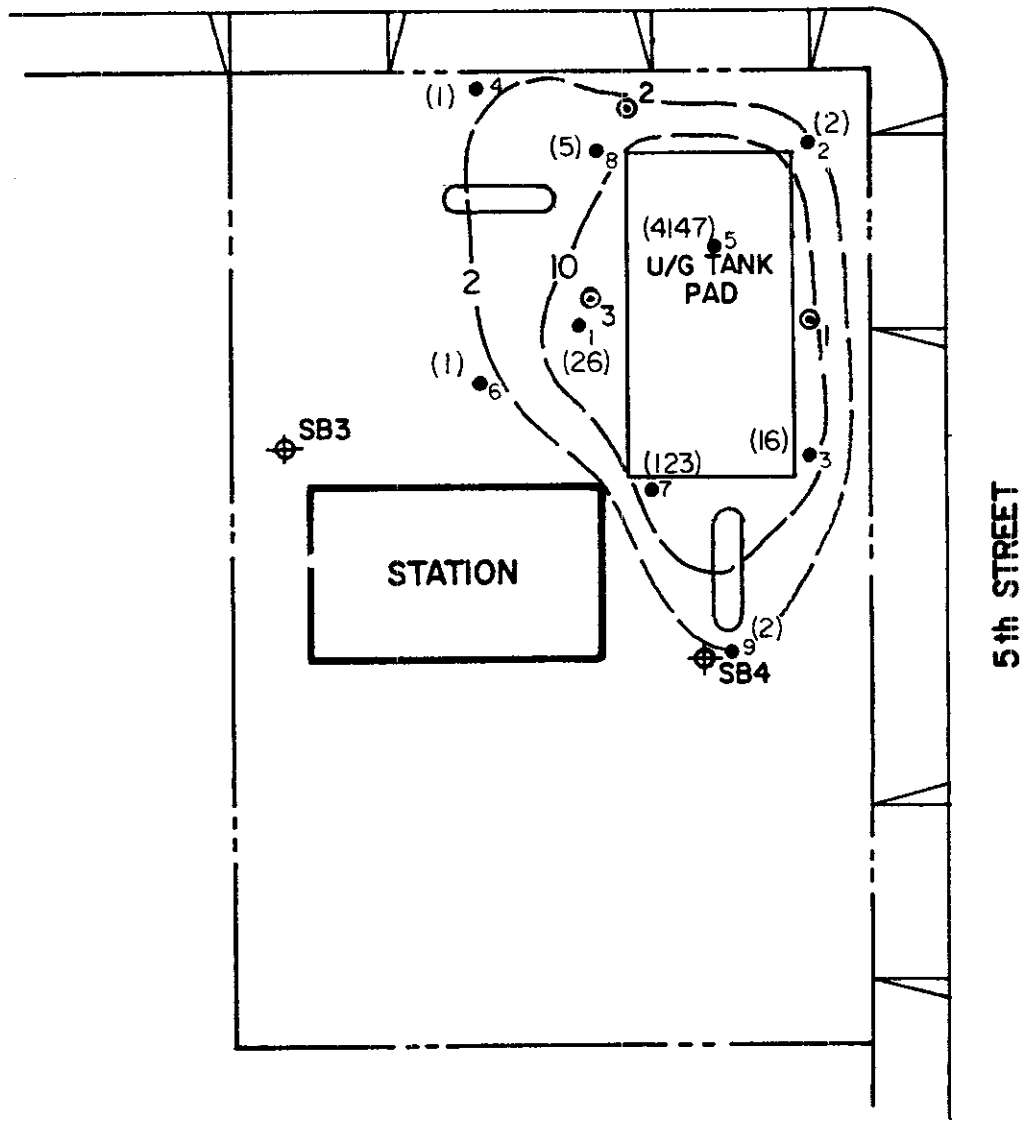
driven 6 inches beyond the bottom of the hole, removed and given to the mobile laboratory for analysis.

The results of the soil analyses performed by the mobile laboratory and duplicate sample analyses performed by the state-certified laboratory, are presented in Appendix A. These results were used to develop a map of TVH-as-gasoline in the soils (Figure 3). As depicted on the map, the hydrocarbons appear to be predominately contained within the former underground-tank pit and diminish rapidly away from it.

REMEDIATION WORK PLAN

Due to the fact that the soils impacted by hydrocarbons appear to be confined primarily to the former tank pit and because Texaco Refining and Marketing Inc.'s has expressed a desire to remediate the subsurface hydrocarbons as quickly as possible, excavation and above-ground treatment of the impacted soil was deemed the best method for remediation. The excavation will be approximately 30-feet by 60-feet in plan dimensions (Figure 4). Total depth will be approximately 12 to 15 feet. The soils will be excavated until levels of total petroleum hydrocarbons (TPH)-as-gasoline fall below 10 parts per million (ppm). A technician will be on site at all times during the excavation to monitor levels of volatile hydrocarbons in the soils and air and to obtain soil samples for laboratory analyses. All work will be performed in compliance with the Health and Safety Procedures presented in Appendix B.

It is anticipated that up to 1,000 cubic yards of soil will be treated on site by controlled aeration and Enhanced Natural Degradation (END^{TM}) to reduce the levels of hydrocarbons



LEGEND

- ⊙ MONITORING WELL
- ⊕ SOIL BORING
- • SOIL-PROBE LOCATION
- ( ) TVH CONCENTRATION (ppm)
- – – – TVH CONTOUR

FIGURE 3

TVH AS GASOLINE IN SOIL

7/27/88

N

0 FEET 30

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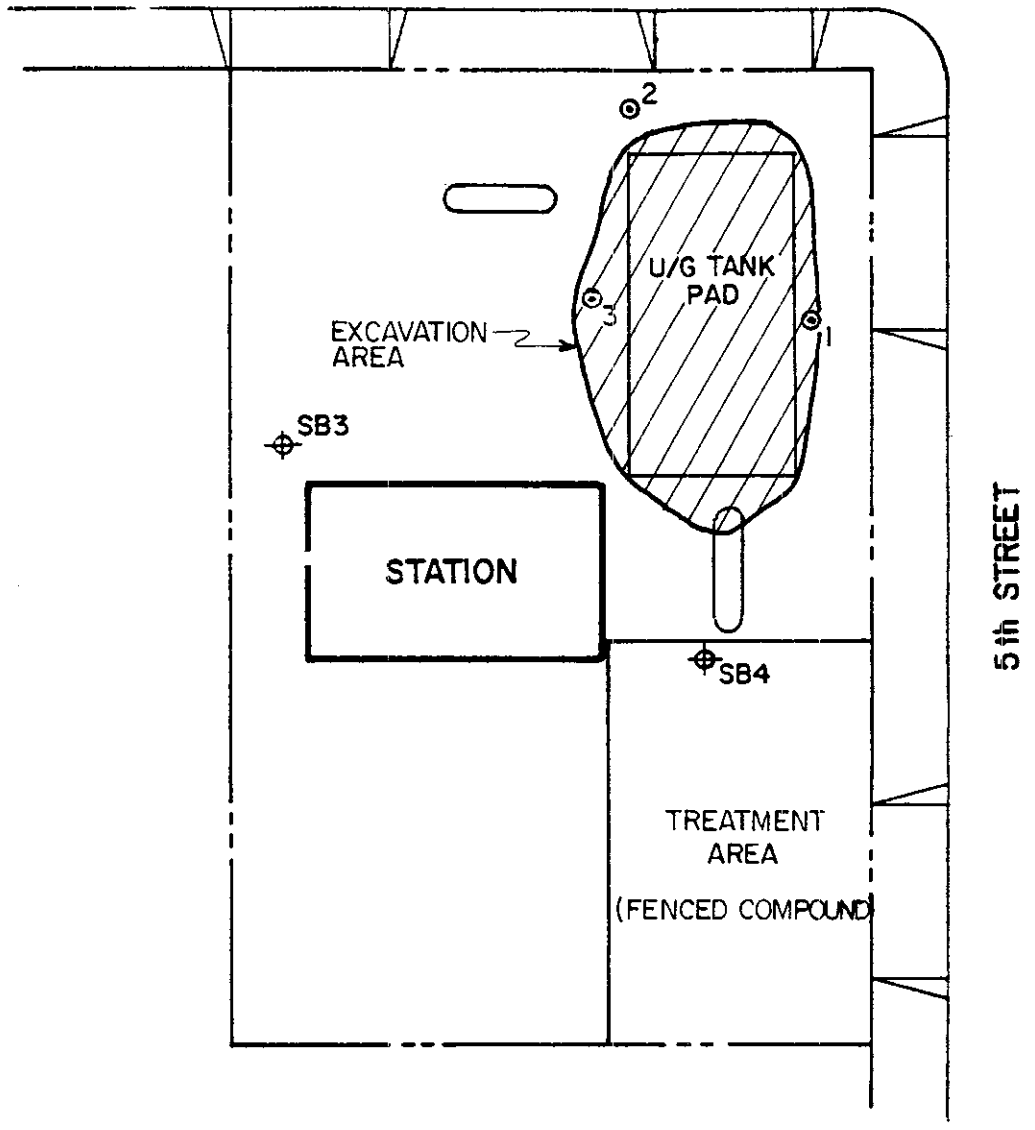
GROUNDWATER TECHNOLOGY



LEGEND

⊙ MONITORING WELL

⊕ SOIL BORING

FIGURE 4

EXCAVATION PLAN

N

0 FEET 30

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GROUNDWATER TECHNOLOGY

impacting the soils to levels suitable for disposal in a Class III landfill. Treatment will be performed on the eastern portion of the property within a fenced compound (Figure 4).

After the soils that contain hydrocarbons above acceptable levels are excavated, a vacuum truck will be mobilized to remove hydrocarbon-impacted water from the open excavation. The removal of water from the tank pit will serve two purposes:

1. To further remediate subsurface hydrocarbons at the site and,

2. prepare the excavation for placement of clean backfill.

In order to remediate the site as quickly as possible, the excavation will be backfilled with clean, imported soil. When the concentration of hydrocarbons in the excavated soils are reduced to acceptable levels, the soil will be disposed of at a Class III landfill.

Prior to beginning the excavation, existing monitoring wells MW-1 and MW-3 will be destroyed in accordance with Alameda County Flood Control and Water Conservation District guidelines, as they will otherwise interfere with the excavation. Well MW-2 will be left in place to monitor groundwater quality after the excavation project is complete.

SOIL TREATMENT SYSTEM

BACKGROUND

The treatment process described herein combines controlled aeration and END™ to reduce the level of hydrocarbon contamination in soils impacted by gasoline and diesel fuels. Liquid-phase hydrocarbons become adsorbed onto the surface of soil particles in the unsaturated soil due to surface tension. Volatile components of the liquid-phase vaporize until equilibrium is established in the air space between soil particles. Once equilibrium is established, the thickness of the liquid film on the soil remains constant. To reduce the film thickness and the amount of trapped hydrocarbon liquid, the volatilized-hydrocarbon concentration in the air space must be lowered. This may be achieved passively by agitating the soil, or actively, by mechanically pulling air through the soil (flushing via controlled aeration).

Although aeration achieves reduction of liquid-phase contaminants in soil, it is effective only in the removal of volatile components. In addition, surface tension causes an adsorbed phase on the surface of the soil which is not treated by either method. To treat both the non-volatile and adsorbed-phase hydrocarbons, END™ methods are used in combination with controlled aeration. Naturally-occurring microbial flora, which can breakdown hydrocarbons, are stimulated to do so at a maximum rate by addition of nutrients normally scarce in soil, but required for the degradation to occur. Since the degradation is an aerobic process, constant renewal of air is required to achieve the fastest degradation rates. With this method, reduction of

hydrocarbons to residual levels is obtained in a relatively shorter period of time than either passive- or active-aeration treatment methods.

SOIL PILE

The hydrocarbon-impacted soils will be placed in a pile for treatment in the fenced compound area on-site (Figure 4). The soil pile will be constructed by first placing alternating open-ended and closed-ended PVC vent-pipes on a high-density polyethylene liner. The purpose of this piping is to supply fresh air to the pile and vacuum lines, respectively. Approximately 4 feet of hydrocarbon-impacted soil will then be placed on the liner and sprayed with a nutrient solution. After the final spraying, the pile will be covered with a high-density polyethylene liner and secured with sand bags. A schematic of the soil pile with venting system is shown on Figure 5.

CONTROLLED AERATION

Blank pipe will be connected to the uncapped ends of the closed-end slotted vent-pipe. All the pipes will then be manifolded to a single pipeline and connected to a high-vacuum blower. Two 55-gallon carbon canisters will be piped in series from the blower. The purpose of the second carbon canister will be to prevent discharge of hydrocarbon emissions to the atmosphere should the first canister reach break-through.

SYSTEM OPERATION AND MONITORING

As previously discussed, up to 1,000 cubic yards of hydrocarbon-impacted soil will be treated on-site. TPH concentrations

Figure 5

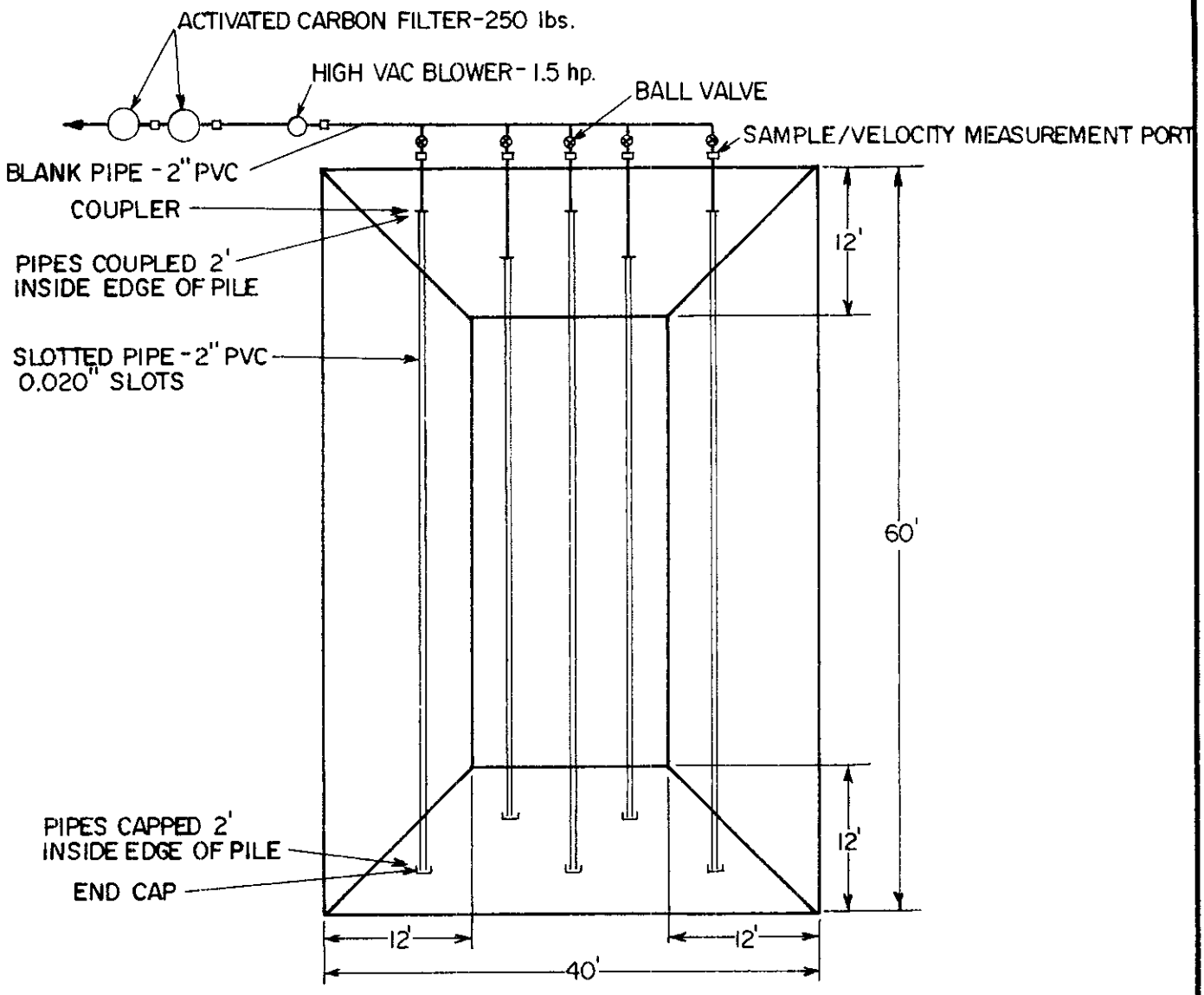

FIGURE 5
SOIL TREATMENT SYSTEM

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in the soil will range between 10 and 4,000 parts per million (ppm). The maximum air-discharge rate will be 127 cubic feet per minute (CFM). It is estimated that the system will be in operation for up to 10 weeks.

During the first three days of operation, the inlet and outlet to the carbon canisters will be monitored using a portable, photo-ionization detector (PID) to verify at least 90 percent reduction in emissions and to calculate the time for breakthrough. Thereafter, the system will be monitored with the PID at least once a week.

Soil samples will be obtained during the first, middle, and last weeks of operation and analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX), and TPH-as-gasoline. In addition, soil samples will be taken for microbial analyses. The microbial analyses will indicate the degree of microbial degradation of hydrocarbons.

Records of system operation will be maintained and will include:

1. Monitoring and analyses results and their dates of collection.
2. Dates of carbon-canister changeout.
3. Field notes.
4. Emissions calculations.

SCHEDULE

The project is scheduled to start the week beginning September 26, 1988. It is anticipated that the excavation will require two to three days to complete. Backfilling will require an additional three days to complete. Treatment of the excavated soils should be completed within eight to ten weeks. All treated soils will be removed from the site once the hydrocarbon levels are reduced to levels acceptable for disposal at a Class III landfill.

CLOSURE

We appreciate the opportunity to have been of service on this project. Please contact us if you have any questions, or require additional information.