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REVISED WORKPLAN FOR SUPPLEMENTAL SOIL AND GROUNDWATER INVESTIGATION FORMER BOYSEN PAINT UNDERGROUND STORAGE TANK 41ST STREET EMERYVILLE, CALIFORNIA

PREPARED FOR
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HAZARDOUS MATERIALS DIVISION
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AND

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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JULY 14, 1992
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Reston VA • Boxborough, MA • Pittsburgh, PA • Chester, UK • London, UK

Contents

Introduction

This workplan has been prepared by Environmental Strategies Corporation (ESC) on behalf of Grow Group, Inc. for submission to Alameda County Department of Environmental Health (DEH) and the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region. The workplan presents a supplemental soil and groundwater investigation of the area near the former Boysen Paint underground storage tank located on 41st Street, between Adeline and Linden Streets in Emeryville, California. The objective of the investigation is to determine whether or not there was a release from the former Boysen Paint tank and to develop additional information concerning the area-wide groundwater quality, flow direction and other possible sources of contamination. This workplan satisfies the information request for field work, sampling, and analyses contained in the RWQCB's letter of October 25, 1991 to Mr. David B. Russell of Grow Group, Inc.

This workplan presents information on the existing surface and subsurface conditions on the site, a summary of previous site investigations, a survey of adjacent properties, and supplemental soil and groundwater investigation. A separate submittal provides a workplan for in-place closure of the tank.

Survey of Potential Contaminant Sources

In the October 25, 1991 letter, the RWQCB requested that an underground storage tank (UST) at the former Boysen Paint site located on 41st Street be permanently closed. The RWQCB stated that the owner of the UST may select to close the tank in-place or remove it from the site and that the applicable provisions of Chapter 6.5 of Division 20 of the California Health and Safety Code must be complied with. In addition, the above referenced section 2672 (d) states that "the owner of an underground storage tank.....shall demonstrate to the satisfaction of the local agency (Alameda County Department of Environmental Health) that no unauthorized release has occurred...".

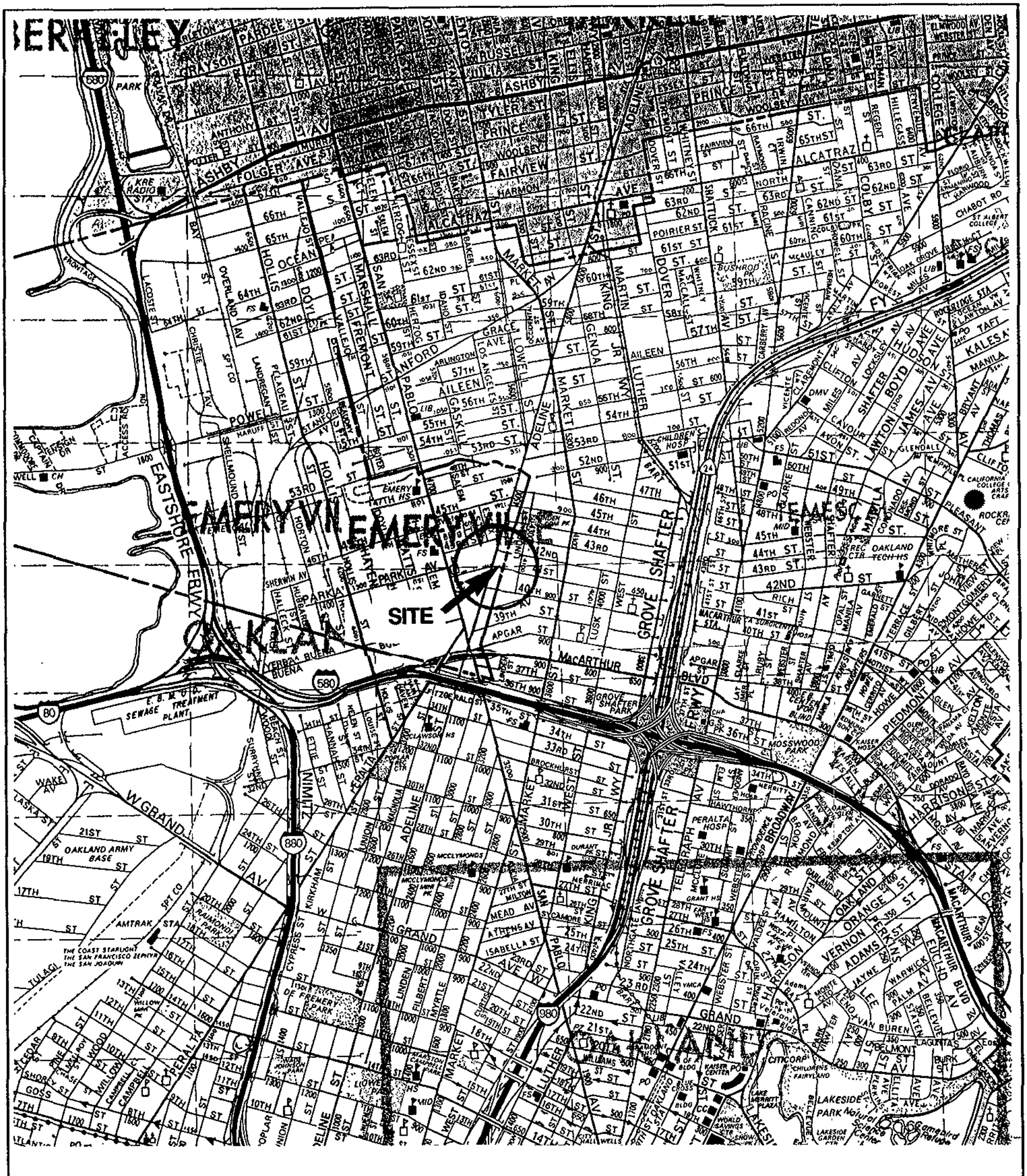
Site Description

The site was formerly owned by Boysen Paint Company, a sister subsidiary to Ameritone Paint Corporation (a wholly owned subsidiary of Grow Group, Inc.). The site is now owned by Edward R. and Elizabeth A. Kozel, operated by Oakland National Engravers, and also contains a furniture restoration shop. There is an underground storage tank that is located on the north side of 41st, approximately 125 feet east of its intersection with Adeline Street, in Emeryville, California (Figure 1). The approximately 5000-gallon tank was installed at an unknown date under the sidewalk between the rear of the brick building occupied by Oakland National Engravers and the northern curb for 41st Street (Figures 2 and 3). Boysen used the tank for storing mineral spirits.

Local Geology and Hydrogeology

San Francisco Bay lies in a low area in the central Coast Range geomorphic province of California. The Coast Range is a region of northwest trending faults, hills, and valleys. The former Boysen Paint tank site is located on the flatlands of east San Francisco Bay, approximately one mile east of the edge of the Bay in Emeryville (Figure 4). The Bay is a drowned valley which is thought to have originally formed by erosion by the ancestral Sacramento River (Jenkins, 1951) and subsequently widened by subsidence and a rise in sea level. Quaternary (Pleistocene to recent) sediments deposited in what is now the Bay, include both shallow marine and continental deposits.

The youngest surficial deposit in the area is known as "Bay Mud" and generally occurs in the low lying areas adjacent to the Bay. Bay Mud is composed of unconsolidated, olive gray, blue gray, or black silty clay. Bay Mud is typically highly plastic and varies from soft to stiff in consistency. Organic remains, such as shells and peat,



Source: The Thomas Guide, 1988, Alameda and Contra Costa Counties Street & Directory

Scale: 1 inch = 2,200 feet

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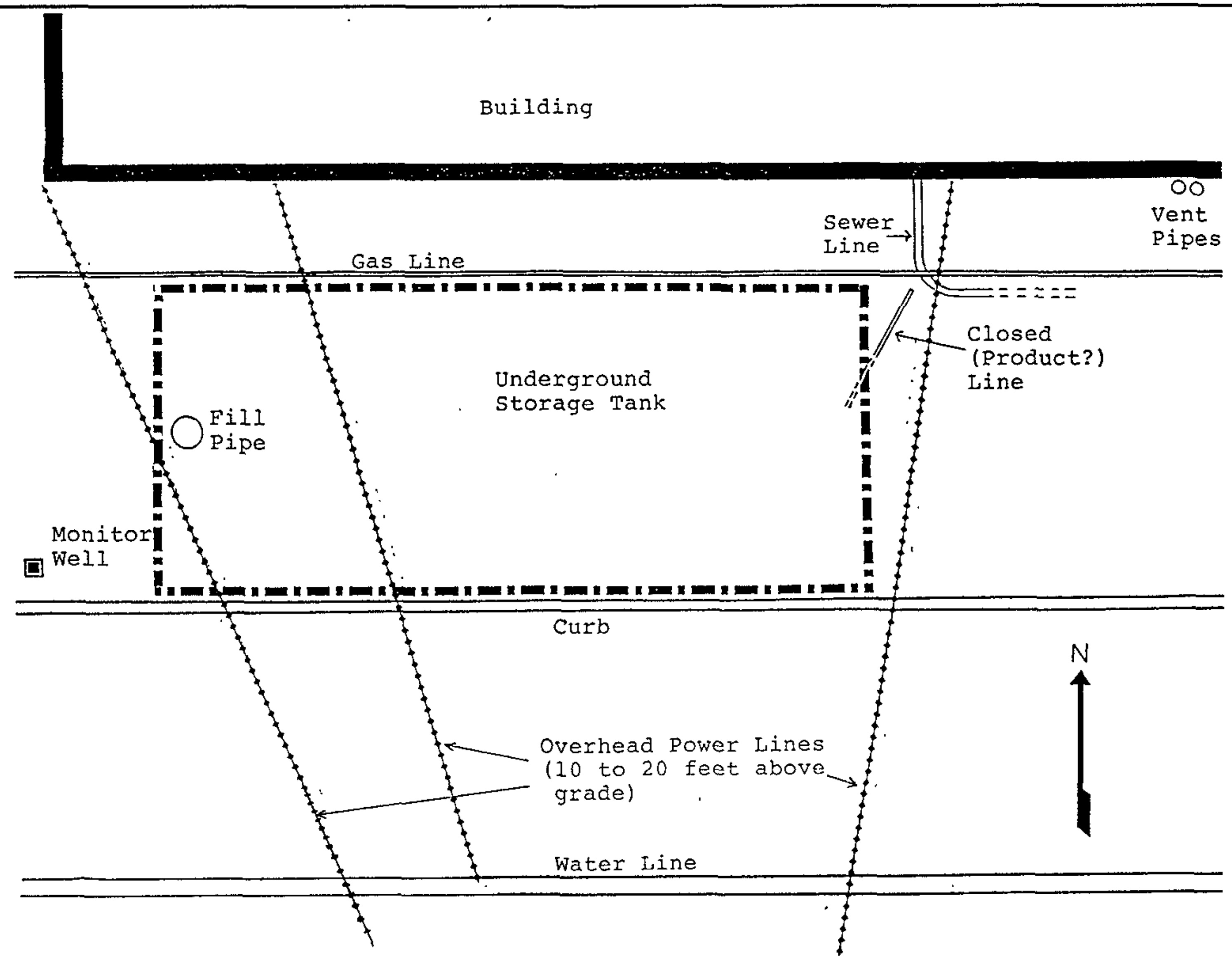
Figure 1
Location Map,
Former Boysen Paint Company,
Emeryville, California



Source: UHM Remedial Services Corp., 1991.

Scale: 1 inch = 4 feet

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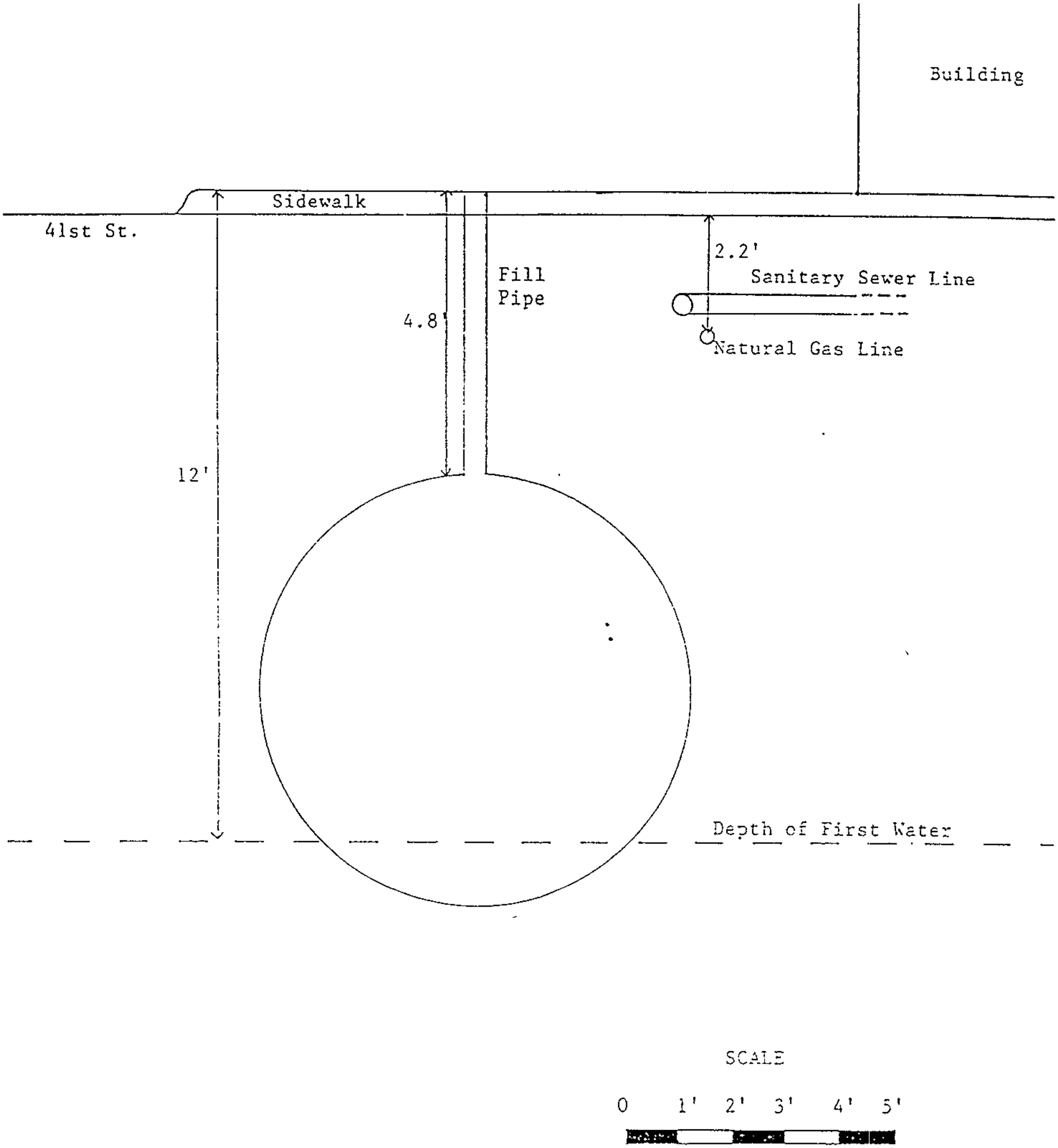
Figure 2
Locations of Undeground Storage Tank and Proximity to Utility Lines, Former Boysen Paint Company, Emeryville, California



Source: UHM Remedial Services Corp., 1991.

Scale: 1 inch = 2.75 feet

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Figure 3
Cross-Section of Underground Storage Tank and Proximity to Utility Lines,
Former Boysen Paint Company,
Emeryville, California

Source: USGS, 1980, Oakland West, 7.5 Minute Quadrangle, California.

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Figure 4
Topographic Map of the Emeryville/Oakland Area
Former Boysen Paint Company,
Emeryville, California

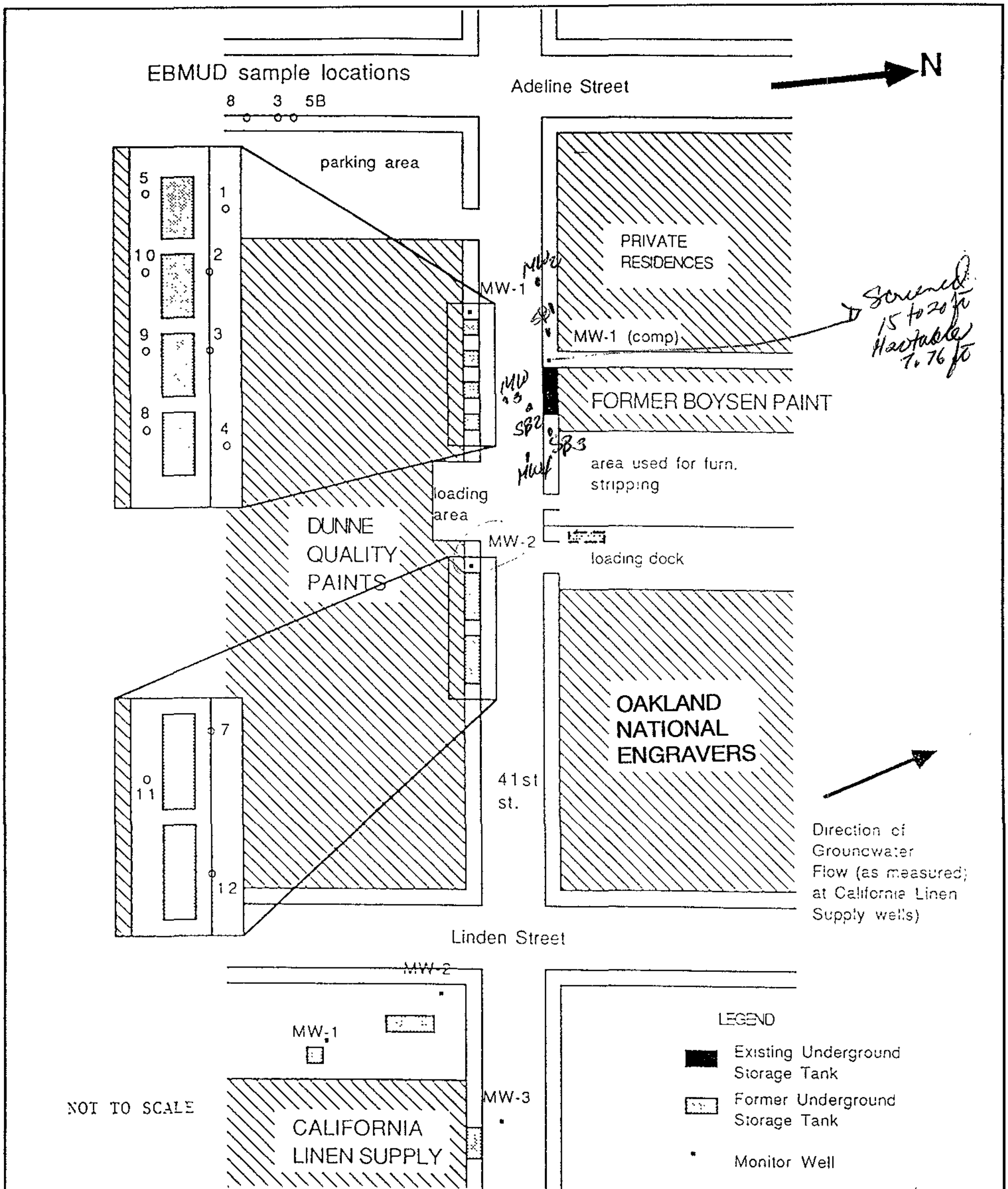
are not uncommon. Permeability is generally low except where lenses of sand occur. Bay Mud is mainly derived from the sediment load carried by the Sacramento and San Joaquin Rivers and has been deposited in the Bay for almost 10,000 years (Helley et al., 1987) and continues to be deposited today.

In the Oakland area, rocks of the Franciscan Complex form the basement rock in the area and have been reported underlying the Bay Mud at 12th and Clay Streets, approximately 2 miles south of the site (Woodward & Clyde, 1987). The Franciscan Complex is an assemblage of deformed and altered sediments and volcanic rocks which commonly form the basement rock in the San Francisco Bay region.

In May 1990, OHM Remedial Services Corporation (OHM) installed a permanent monitoring well on behalf of Ameritone Paint Corporation at the western end of the former Boysen Paint tank. The permanent well was installed after a temporary well encountered methylene chloride in the groundwater in the area of the tank. According to the lithology of the monitoring well (MW-1), the material at the site consists of stiff silty clay to a depth of approximately 9.5 feet that grades to sandy silt to the final depth of the boring at 22 feet. These silty clays are consistent with Bay Mud, as described earlier. First water was encountered at a depth of approximately 13 feet, then rose and stabilized at 7.76 feet. The groundwater flow direction as determined at the California Linen Rental Company, approximately 200 feet east-southeast of the site, has been reported as flowing in a northwest direction (Miller Environmental Company, 1991).

Summary of Previous Site Investigations

In May 1981, Mr. & Mrs. Edward Kozel purchased the property located at 1001 42nd Street in Oakland, California from the Boysen Paint Company and subsequently Oakland National Engravers began operating on the site. As part of the sale conditions, Boysen Paint removed all tanks known to exist on the property except for a tank that was located in the truck loading area. At the Kozel's request, this tank was left in place. In February, 1987, the tank in the truck loading area was removed by Oakland National Engravers (ONE). Reportedly, floating organic contamination was observed on the surface of groundwater that entered the excavation during tank removal. After the tanks were removed, a monitoring well (LD4) was installed by ONE adjacent to the loading dock (Figure 5). Details of the removal of this tank and the date of well installation are unknown.



Source: OHM Remedial Services Corp., 1991.

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Figure 5
Locations of Present and Former Underground Storage Tanks, Former Boysen Paint Company, Emeryville, California

In August 1986, the site owners informed Grow Group, Inc. there existed under the sidewalk on the north side of 41st Street, an underground storage tank reportedly used by the former Boysen Paint Company. In January 1987, Grow Group, Inc. agreed, without admission of liability, to proceed with closure of the subject tank.

In May 1987, OHM conducted a ground penetrating radar (GPR) survey of the site to identify buried structures that may affect proper closure of the tank. The survey identified the limits of the tank and three underground utility lines: a gas line running parallel to the side walk and approximately two feet south of the building; a water pipeline running parallel to the sidewalk approximately seven feet south of the curb; and, an unidentified structure at the eastern end of the tank side (see Figures 2 and 3).

On February 9, 1988, OHM installed a temporary groundwater monitoring well adjacent to the former Boysen Paint tank and collected a groundwater sample for chemical analysis. Based on the presence of methylene chloride in the temporary well at 0.72 mg/l and total petroleum hydrocarbons at 610 mg/l, OHM recommended that a permanent groundwater monitoring well be installed on the site, the inspection of associated piping at the east end of the tank, and the removal and disposal of the contents of the tank.

On April 4, 1990, approximately 610 gallons of various materials, including solvents, petroleum hydrocarbons, sludge, and water, were pumped from the tank with a vacuum truck and transported to Solvent Services Inc., in San Jose, California for recycling or disposal at a licensed facility. OHM then removed a portion of the sidewalk to accurately locate the utility lines and structures observed during the 1987 GPR survey. A 2-inch diameter gas line was located 2.75 feet south of and parallel to the building at a depth of 2.2 feet. Other utility lines located during the excavation are shown on Figures 2 and 3.

On May 15, 1990, OHM installed a 22 foot deep groundwater monitoring well at the western end of the underground storage tank (see Figure 2). A composite soil sample of cuttings removed from the borehole contained total petroleum hydrocarbons of 250 mg/kg near the former tank. However, part of the soil sample was collected from below the water table and may have been affected by the migration of target constituents in groundwater (OHM, 1991). The soil sample was not analyzed for other constituents. After the well was installed and developed, a groundwater sample was collected and analyzed for total petroleum hydrocarbons (TPH, EPA method 8015) and volatile organic compounds (VOC, EPA method 624). Groundwater contaminants detected in the sample were total petroleum hydrocarbons (57 mg/l), methylene chloride (0.0114 mg/l), and other constituents per EPA method 624 (<0.0025 mg/l; Table 1).

TABLE 1
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS (mg/l)
VICINITY OF FORMER BOYSEN PAINT FACILITY
EMERYVILLE, CALIFORNIA

Site	Location	Date	TPH			meth. chloride	benzene	toluene	ethyl-benzene	xylene	Kerosene
			gasoline	diesel	waste oil						
Boysen	MW-1	9/30/91	18,000					.0056	.250	.980	29,000 ppm
	MW-1	5/90	57	NA	NA	0.0114	nd	nd	nd	nd	
	MW-1(*)	2/88	610	NA	NA	0.72	nd	nd	nd	nd	
CA-Lin	MW-1	1/91	99	1.7	3	NA	4.4	7.4	1.8	8.6	
		10/90	50	1.1	nd	NA	3.3	4.0	4.2	4.7	
		7/90	34	nd	1	NA	2.0	0.67	0.12	1.5	
		2/20	73	2.2	3	NA	7.5	5.9	0.68	5.3	
		10/89	70	0.61	nd	NA	2.8	2.4	2.3	4.8	
	MW-2	89-91	nd	nd	nd	NA	nd	nd	nd	nd	
	MW-3	89-91	nd	nd	nd	NA	nd	nd	nd	nd	
Dunne	MW-1	3/90	nd	NA	NA	NA	nd	nd	0.004	0.0013	
		4/89	1.6	NA	NA	NA	nd	nd	nd	0.0011	
		1/89	NA	NA	NA	NA	nd	nd	nd	0.0018	
	MW-2	3/90	0.3	NA	NA	NA	nd	nd	0.003	0.0015	
		4/89	1.0	NA	NA	NA	nd	nd	nd	0.0015	
		1/89	NA	NA	NA	NA	nd	nd	nd	0.012	
EBMUD	#3(**)	1/31/91	NA	NA	NA	nd	nd	nd	nd	nd	

* Sample collected from temporary monitor well at approximate location of existing monitor well MW-1.

** Sample of groundwater seeping into trench during piping installation.

On September 30, 1991, Aqua Terra Technologies (ATT) collected groundwater samples from MW-1 (referenced to as "41st" in ATT's report, dated January 8, 1992) and LD4 on ONE's property. The groundwater samples collected from MW-1 were analyzed for total petroleum hydrocarbons (TPH) as gasoline (TPH-G, EPA Method 5030) and as diesel (TPH-D, EPA Method 3510), purgeable hydrocarbons (CLHC, EPA Method 601), and total dissolved solids (TDS, EPA Method 160.1). The groundwater sample in MW-1 contained TPH-G (18,000 mg/l), kerosene (29,000 mg/l), toluene (5.6 ug/l), ethylbenzene (250 ug/l), and total xylenes (980 mg/l). The TDS in MW-1 was reported at 526,000 ug/l. The groundwater sample collected from LD4 was analyzed for BTEX and TDS only. The groundwater sample from LD4 contained benzene (2.0 ug/l), toluene (3.1 ug/l), ethylbenzene (9.0 ug/l), and total xylenes (24 ug/l). The TDS from LD4 was reported at 695,000 ug/l.

Survey of Adjacent Properties

A survey of adjacent facilities was conducted to compile data on potential offsite sources of contamination. Agency lists of contaminated or potentially contaminated sites were examined and files searched.

According to the Alameda County Department of Environmental Health's list of Leaking Underground Storage Tanks dated July 1, 1991, the following sites are under investigation in the vicinity of the site: Dunne Quality Paints, 1007 41st Street in Oakland, is located south and across the street of the subject site (Figure 5). In February, 1988, Dunne filed an Underground Storage Tank Unauthorized Release (Leak)/Contamination Site Report with RWQCB. In August of 1988, six underground storage tanks were removed. The steel tanks ranged in size from 2000 gallons to 6000 gallons and were apparently used to store paint thinner. Before the tanks were removed, an investigation was performed to characterize the soils contamination adjacent to the tanks. Undisturbed soil samples that were collected from 12 soil borings to depths of 17 feet indicated the presence of TPH as paint thinner at concentrations as high as 27,391 mg/kg.

Three of the four tanks located west of the Dunne loading area were removed intact. A small leak was noted in the westernmost of the four tanks during removal. The two tanks located east of the Dunne loading area were damaged during removal. Grab soil samples were collected from the sidewalls and were analyzed for TPH and benzene, toluene, xylene, and ethyl benzene using EPA Methods 8015 and 8020 at depths of 6.5 to 9 feet below the ground surface. The samples contained TPH concentrations as high as 14,100 mg/kg (see Table 1). This indicates that not all contamination was removed during the removal of the tank. As part of the tank removal, 60 cubic yards of contaminated soil were excavated. The soil was aerated on-site and disposed at a Class II landfill.

After the tanks were removed, two monitoring wells were installed in the excavations on the Dunne site (Figure 5). The bottoms of the monitoring wells were set approximately four feet below the tank bottom elevation. Pea gravel was placed in the excavations and compacted to sub-grade. The wells were sealed with concrete slurry and fitted with a locking well cap and box. The wells were installed so that the groundwater could be sampled after the tank excavation holes were closed. Results of groundwater samples collected from the wells in August 1988, January and April 1989, and March 1990 indicated the presence of TPH (0.3 to 1.6 mg/l), xylene (0.0013 to 0.012 mg/l), and ethylbenzene (0.003 to 0.004 mg/l; Table 2).

In February 1991, East Bay Metropolitan Utility District (EBMUD) encountered contaminated soil during construction of the Adeline Street Interceptor. The utility trench crossed 41st Street along the eastern edge of Adeline Street (see Figure 5). Grab soil and groundwater samples were collected and selected samples were analyzed using EPA Methods 8240, 8270, and 624. One soil sample (no. 8, see Figure 5) contained TPH at a concentration of 2,000 mg/kg (see Table 1). Further examination of laboratory results determined that the TPH detected was consistent with Stoddard Solvent. Groundwater collected at a depth of 15 feet had no contaminants above minimum detection levels (see Table 2). Soil and groundwater samples collected during this investigation were not analyzed for methylene chloride. EBMUD removed the contaminated soil from this area and disposed the material at a local landfill. EBMUD reviewed Agency files and identified Dunne, California Linen, and Oakland National Engravers as potential sources of the EBMUD-identified contamination. On April 2, 1991, EBMUD submitted a letter to Dunne requesting that Dunne remove the contaminated soil from the local landfill and properly dispose of the material. EBMUD indicated in this letter that it had informed California Linen and Oakland National Engravers of the contamination, but that Dunne was the closest potential source to the Adeline Intercepter and that the composition of contaminants were similar to those identified at the Dunne site. On April 6, 1991, Dunne entered into an agreement with EBMUD to dispose of the contaminated soil while denying any liability.

Based on Dunne's location with respect to the subject site and the groundwater flow direction in the immediate area, evidence that a contaminant source may remain in subsurface soils at Dunne, and groundwater contamination found in monitoring wells at the Dunne site, past releases from the Dunne site may be affecting soil or groundwater at the subject site (see Figure 5).

TABLE 2
SUMMARY OF SOIL ANALYTICAL RESULTS (mg/kg)
VICINITY OF FORMER BOYSEN PAINT FACILITY
EMERYVILLE, CALIFORNIA

Site	Location	Depth	Date	TPH light (C8–C15)	TPH heavy (diesel)	waste oil	benzene	toluene	ethyl-benzene	xylene
Boysen	comp	0–15'	5/90	250	NA	NA	NA	NA	NA	NA
CA-Lin	MW-1	4'	10/89	140	36	41	5.3	2.2	2.9	16
	MW-2	4'	10/89	nd	nd	190	nd	nd	nd	nd
Dunne	1	3'	1/88	<20	NA	NA	NA	NA	NA	NA
		8'	1/88	<20	NA	NA	NA	NA	NA	NA
		10'	1/88	41	NA	NA	NA	NA	NA	NA
	2	9'	1/88	10,080	NA	NA	NA	NA	NA	NA
	3	3'	1/88	<20	NA	NA	NA	NA	NA	NA
		10'	1/88	226	NA	NA	NA	NA	NA	NA
		14'	1/88	<20	NA	NA	NA	NA	NA	NA
	4	6'	1/88	150	NA	NA	NA	NA	NA	NA
		10'	1/88	638	NA	NA	NA	NA	NA	NA
	5	6'	1/88	<20	NA	NA	NA	NA	NA	NA
		10'	1/88	586	NA	NA	NA	NA	NA	NA
	6	6'	1/88	986	NA	NA	NA	NA	NA	NA
		10'	1/88	102	NA	NA	NA	NA	NA	NA
	7	6'	1/88	27,362	NA	NA	NA	NA	NA	NA
		10'	1/88	8,362	NA	NA	NA	NA	NA	NA
	8	6'	1/88	27,391	NA	NA	NA	NA	NA	NA
		10'	1/88	13,845	NA	NA	NA	NA	NA	NA
	9	6'	1/88	3,472	NA	NA	NA	NA	NA	NA
		10'	1/88	1,193	NA	NA	NA	NA	NA	NA
	10	6'	1/88	5,549	NA	NA	NA	NA	NA	NA
		10'	1/88	6,491	NA	NA	NA	NA	NA	NA
	11	6'	1/88	503	NA	NA	NA	NA	NA	NA
		10'	1/88	120	NA	NA	NA	NA	NA	NA
	12	6'	1/88	15,140	NA	NA	NA	NA	NA	NA
		10'	1/88	284	NA	NA	NA	NA	NA	NA
EBMUD	5B	13.5'	1/91	NA	NA	NA	nd	nd	nd	nd
	8	5.75'	1/91	2,000	NA	NA	nd	nd	nd	nd

California Linen Rental Company, 989 41st Street in Oakland, is located southeast (up gradient) of the site. The RWQCB list indicates that California Linen Rental Company (California Linen) had three underground storage tanks removed in February 1989. The tanks consisted of a 10,000 gallon gasoline tank, a 2,500 gallon #5 fuel oil tank, and a 550 gallon unleaded gasoline fuel tank (see Figure 5).

Upon removal of the tanks, soil and groundwater were collected from the excavation for chemical analysis using EPA methods 418.1 and 8015. The water sample contained concentrations of oil and grease at 14 mg/l and TPH as diesel at 0.520 mg/l. In February 1989, California Linen filed an Underground Storage Tank Unauthorized Release (Leak)/Contamination Site Report for the site.

In September, 1989, three monitoring wells were installed on the site, one adjacent to each former storage tank (see Figure 5). Soil samples collected from wells MW-1 and MW-2 contained TPH (36 to 140 mg/kg), waste oil (41 to 190 mg/kg), benzene (5.3 mg/kg), toluene (2.2 mg/kg),xylene (16 mg/kg), and ethylbenzene (2.9 mg/kg; see Table 2). Groundwater samples collected from MW-1 contained concentrations of TPH (gasoline, 34 to 99 mg/l; diesel, non-detectable (ND) to 2.2 mg/l; waste oil, ND to 3 mg/l), benzene (2.0 to 7.5 mg/l), toluene (0.67 to 7.4 mg/l), ethylbenzene (0.12 to 4.2 mg/l), and xylene (1.5 to 8.6 mg/l; Table 1). Groundwater samples collected from MW-2 and MW-3 had no contaminants above the minimum detection limit. Soil and groundwater samples collected for the California Linen investigation were not analyzed for methylene chloride. Measurement of groundwater levels in the California Linen monitoring wells indicate an apparent northerly flow direction.

On April 15, 1991, Alameda County Health Care Services Agency suggested that California Linen remove and treat or dispose of groundwater from MW-1 before closure. No further information is available concerning any ongoing remedial activities at the site.

<u>**Supplemental Site Investigation**</u>

Environmental Strategies Corporation (ESC) has reviewed available data on the adjacent sites as summarized in the preceding sections and has identified several data gaps that need to be addressed. ESC has developed the following investigation plans to characterize any soil contamination and to further delineate the groundwater contamination in the immediate area of the former Boysen Paint tank. These plans address the following major issues and possible source areas:

- determine the effects of releases, if any, from the Boysen tank on soils in the tank's immediate vicinity.
- determine the possible effects on soil and groundwater from any releases from the former Dunne underground storage tanks across 41st Street, south of the Boysen tank, and California Linen, east-southeast of the site.

Soil Investigation - Former Boysen Tank

In 1988, a temporary groundwater monitoring well revealed the presence of TPH and methylene chloride in the well. In April 1990, approximately 610 gallons of tank materials (i.e., solvents/petroleum hydrocarbons, sludge, and water) were pumped from the tank. In May 1990, soil and groundwater samples collected during the installation of a permanent monitoring well indicated the continuing presence of TPH and methylene chloride near the tank.

Soil and groundwater studies performed by others indicate that there are potential offsite sources of contamination in the vicinity of the site.

These findings indicate that contamination sources for TPH and VOCs are not well delineated and require further investigation near and in the vicinity of the tank near the former Boysen Plant.

ESC proposes the following investigation plan to provide further delineation of the existing soil and groundwater conditions in the area.

- Three borings, B-1, B-2, and B-3 (Figure 6) will be drilled to the groundwater table with soil sampling on the western, southern, and eastern edges of the tank (Figure 6). The purpose of the borings will be to determine if soil contamination exists adjacent to the former Boysen tank. Soil samples will be collected continuously for geologic characterization and every five feet for chemical analysis using EPA methods 8240 and 8015.

- At least three borings, MW-2, MW-3, and MW-4, will be drilled approximately 15 to 20 feet south and southeast of the tank with soil sampling to the groundwater table (Figure 6). Groundwater monitoring wells will be installed in these borings and groundwater samples will be collected and analyzed. Groundwater samples will also be collected from the existing well on Oakland National Engravers property and the two wells on the Dunne property. The purpose of the borings will be to establish soil and groundwater contaminant levels in the area and determine if upgradient source(s) may be impacting the area of the former Boysen Paint tank. Soil samples will be collected every five feet for geologic characterization and chemical analysis using EPA methods 8240 and 8015. Appropriate permits will have to be acquired for all work within the public right-of-way.

Field Methods

Borings will be drilled using a truck or trailer-mounted solid or hollow-stem auger rig fitted with 6 or 8.25 inch outside diameter (O.D.) augers. Augers, samplers, and drilling tools will be steam-cleaned before drilling each boring. Samples will be obtained using either a 3 inch inside diameter (I.D.), five-feet-long continuous sampler or closely spaced split-spoon sampler drives. When drive samplers are used, a 140-pound hammer falling 30 inches will be used to drive the sampler, and blow counts will be recorded for every six inches of penetration to help evaluate the consistency of the materials. All efforts will be made to maximize the recovery of sampled intervals. Soil cores will be logged in the field by an ESC geologist using the Unified Soil Classification System, under the supervision of a California Registered Geologist or Professional Engineer.

Samples for chemical analyses will be taken at 5-foot intervals, generally beginning at the ground surface. At depths where laboratory samples are desired, the split-spoon will be fitted with brass sleeves. The sleeves will be removed from the two-foot-long sampler, and the selected interval sleeve will be prepared by covering the open ends with aluminum foil or Teflon material, capped, taped, labeled, and placed on ice.

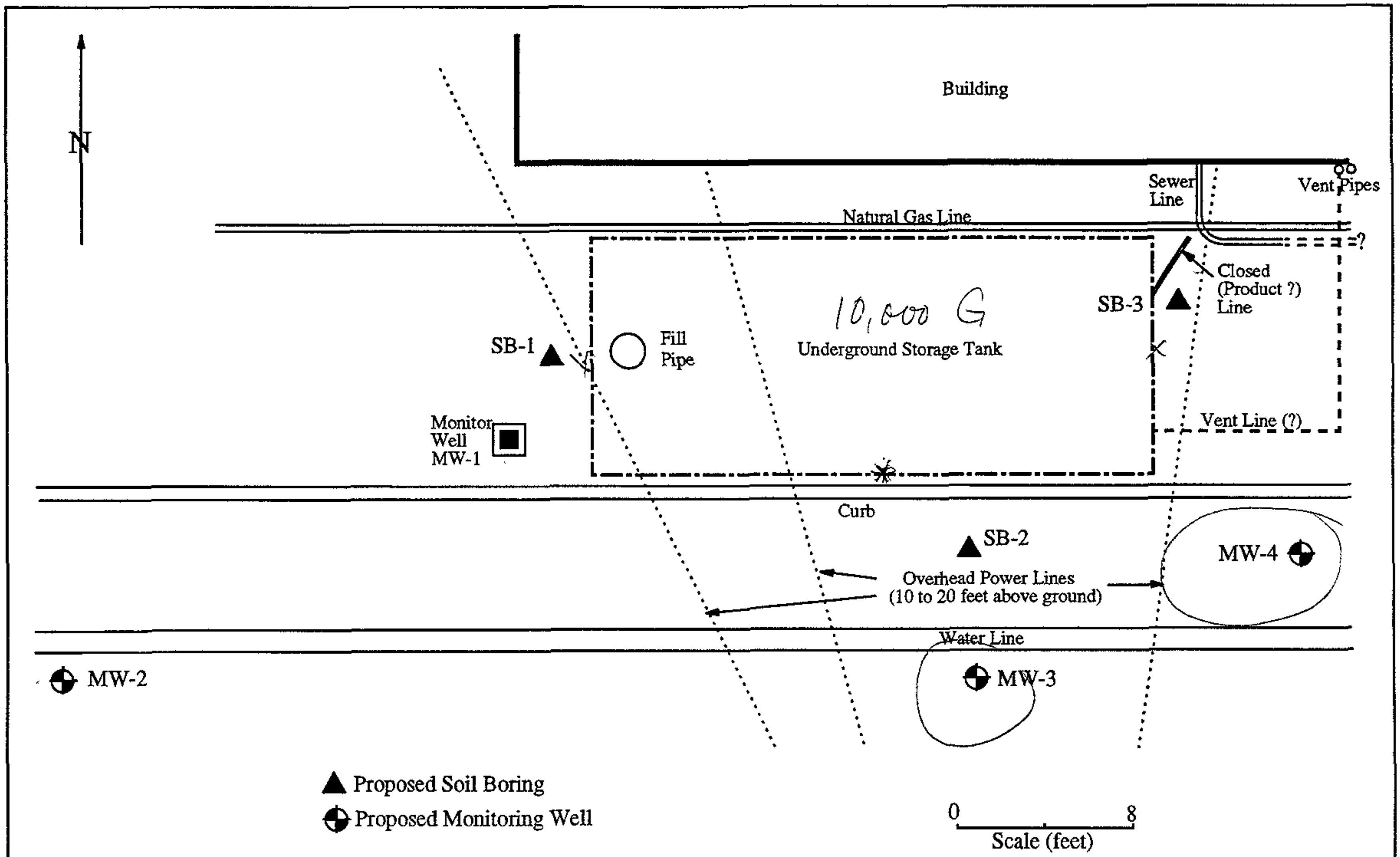

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Figure 6
Locations of Proposed Soil Borings and Monitoring Wells,
Former Boysen Paint Company
Emeryvile, California

These samples will be screened in the field for VOCs using a photoionization detector (PID). Each sample will be labeled and placed in an ice chest for shipment to a California-certified laboratory. Duplicate and field blank samples will be collected in accordance with EPA quality assurance and quality control protocols. Chain-of-custody documentation will be recorded for each sample and shipped with the sample container. Samples will be shipped to the laboratory at the end of each day of field work. Laboratory analyses will be performed on selected soil samples for VOCs using EPA Method 8240. All cuttings will be drummed, labeled, and properly disposed of based on laboratory analyses.

Three boreholes, MW-2, MW-3, and MW-4, will be advanced into the saturated zone for the installation of a 2-inch-diameter monitoring well with filter pack. Monitoring well screen length and placement will be determined upon evaluating the lithology and groundwater depth during drilling and reviewing logs from the soil borings and from existing monitoring wells. A construction schematic diagram for the proposed monitoring wells is shown on Figure 7. All monitoring wells will be constructed and borings will be abandoned in conformance with the Alameda County Water District Groundwater Protection Program (1988).

The monitoring well locations will be selected to establish a network with the existing monitoring well to resolve questions concerning groundwater flow direction, as discussed later. Geologic cross-sections will be developed using the boring information as well as previous monitoring well logs.

The installation of the borings to determine possible offsite sources of soil and groundwater contamination will be supplemented with information from the investigation of subsurface conduits as potential migration pathways for contamination.

Groundwater Site Assessment Plan

Results of previous groundwater sampling through May 1990 are included in Table 2 and the existing monitoring well, adjacent to the underground tank, is shown on Figure 3. From review of the data, MW-1 nearest to the underground tank near the former Boysen Plant is the most contaminated well (up to 610 mg/l TPH and 0.72 mg/l methylene chloride in the February 1988 sampling).

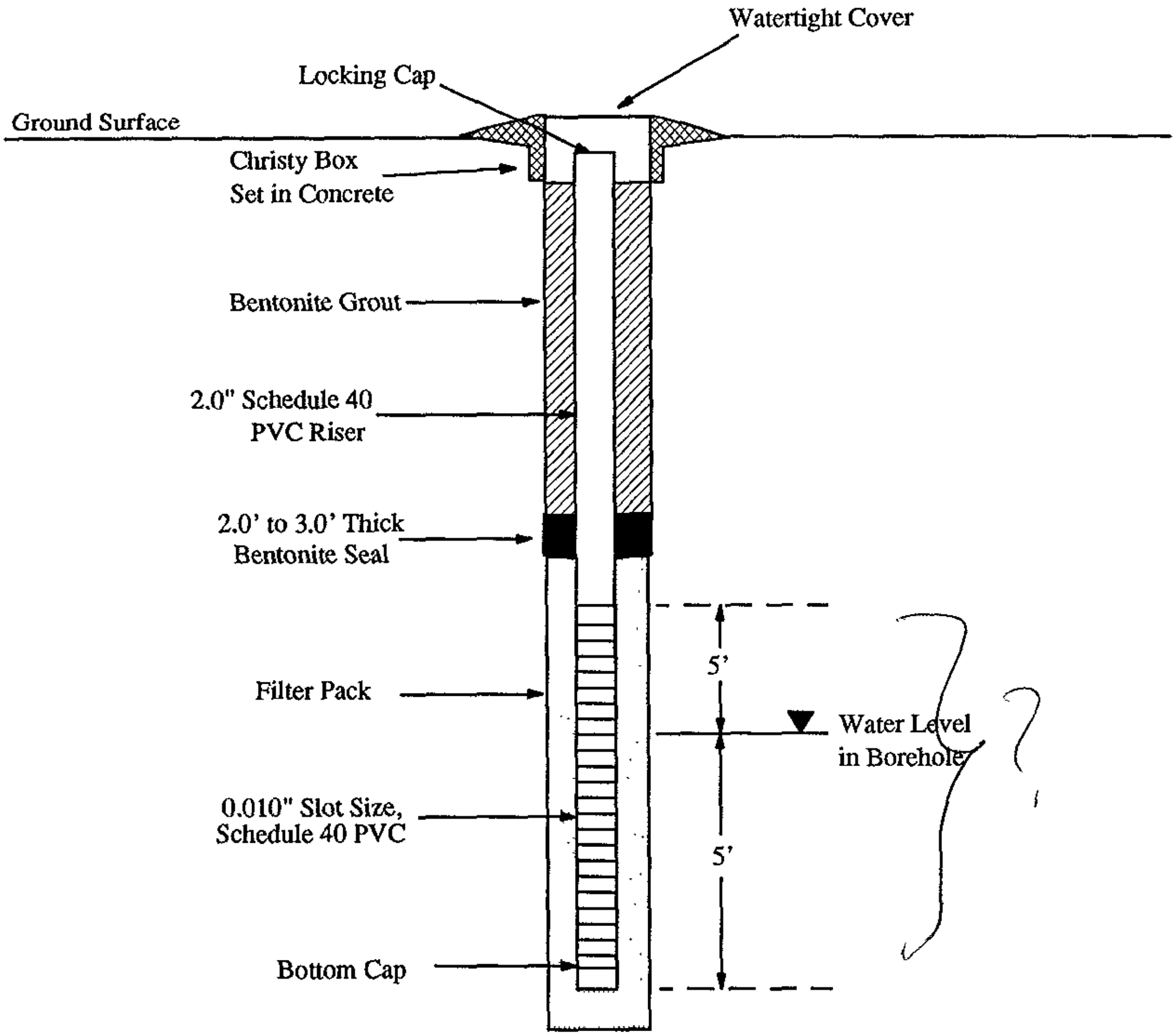

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Figure 7
Construction Schematic for
Groundwater Monitoring Wells.
Former Boysen Tank,
Emeryville, California

Based on the most recent groundwater elevation data from nearby sites, it would appear that the groundwater flow direction is generally northwesterly. If this is true, contamination found in MW-1 may be from an offsite source(s).

In order to further evaluate groundwater flow direction and address the extent and source of the existing groundwater contamination, three borings, MW-2, MW-3, and MW-4, will be completed as monitoring wells (as described earlier) in order to obtain water level measurements. Groundwater collected from these monitoring wells and from the Oakland National Engravers well and the Dunne wells will be analyzed for TPH and VOCs to help determine the source of groundwater contamination in the area.

The existing and new monitoring well network will be surveyed and referenced to a bench mark in order to provide an established datum. This is necessary so that groundwater elevation data from existing and future wells (if necessary) can be compared.

Analytical Methodology

A California-certified laboratory will be retained to analyze all soil and groundwater samples. All sample containers will be provided by the laboratory.

Soil samples collected from selected depths will be analyzed for total petroleum hydrocarbons using EPA Method 8015 and volatile organic compounds using EPA Method 8240 as referenced in the EPA Test Methods for Evaluating Hazardous Wastes (SW-846). Groundwater samples obtained from the monitoring wells will be analyzed for TPH using EPA Method 8015 and VOCs using EPA Method 624. Detection limits for all analyses will meet the EPA practical quantitation limits.

Quality Assurance and Quality Control

ESC's Quality Assurance Officer (QAO) will be responsible for establishing data quality requirements and detection limits for the analyses. Before field work begins, ESC will submit a Data Collection Quality Assurance and Management Plan and a Health and Safety Plan to the RWQCB. The QAO is responsible for ensuring that quality assurance goals are met during the investigation. He serves as the overall quality control coordinator for sampling and analysis. The QAO will work closely with the contract analytical laboratory to facilitate the planned sampling and analytical activities. The QAO's overall responsibilities include, but are not limited to sampling quality control, laboratory quality control, data processing quality control, data quality review, performance auditing, systems auditing, and overall quality assurance. The QAO will specify the protocol for duplicate samples, equipment blanks, and field blanks. A QA/QC report will be included in the field investigation report.

Proposed Schedule

The following schedule and dates are based on the completion of review and approval of this submittal by the Alameda County DEH and the RWQCB.

- Within two weeks of approval - Soil boring/monitoring well installation on and off site. Submission of the Data Collection Quality Assurance and Management Plan.
- Topographic survey of well/piezometer network. Water level measurements will be taken monthly for a minimum six-month period.
- Within six weeks of completion of field work - A Preliminary Report on the investigation results will be submitted to the Alameda DEH and RWQCB. This Report will include hydrogeologic cross-sections with soil and groundwater contaminant results and groundwater elevation isopleth maps. The results and interpretations, together with outstanding issues, will be further discussed with the Alameda County DEH and RWQCB. Agreement will be sought on the direction of any future work.

Appendix A - Health and Safety Plan

ENVIRONMENTAL STRATEGIES CORPORATION
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HEALTH AND SAFETY PLAN FOR FORMER BOYSEN UNDERGROUND STORAGE TANK PROJECT IN EMERYVILLE, CALIFORNIA

PREPARED

BY

ENVIRONMENTAL STRATEGIES CORPORATION

NOVEMBER 10, 1992

Reston VA • Boxborough, MA • Pittsburgh, PA • Chester, UK • London, UK

Contents

Introduction

This Health and Safety Plan provides an overview of conditions at the facility and describes the safety procedures to be employed and the rationale for their selection. This Health and Safety Plan has been prepared to address any potentially health threatening contingencies. All personnel working at the site will be briefed by the site Health and Safety Coordinator and will be required to become familiar with the following sections of this plan:

- Contingency Plan and Emergency Procedures
- Safety Rules and Personal Hygiene - Appendix A
- Field Standard Operating Procedures for Putting On and Decontaminating Personal Protective Equipment - Appendix B
- Heat Stress and Heat Stress Monitoring - Appendix C
- Cold Stress Prevention for Winter Months - Appendix D

ESC personnel are included in a medical monitoring program that is described in Appendix E.

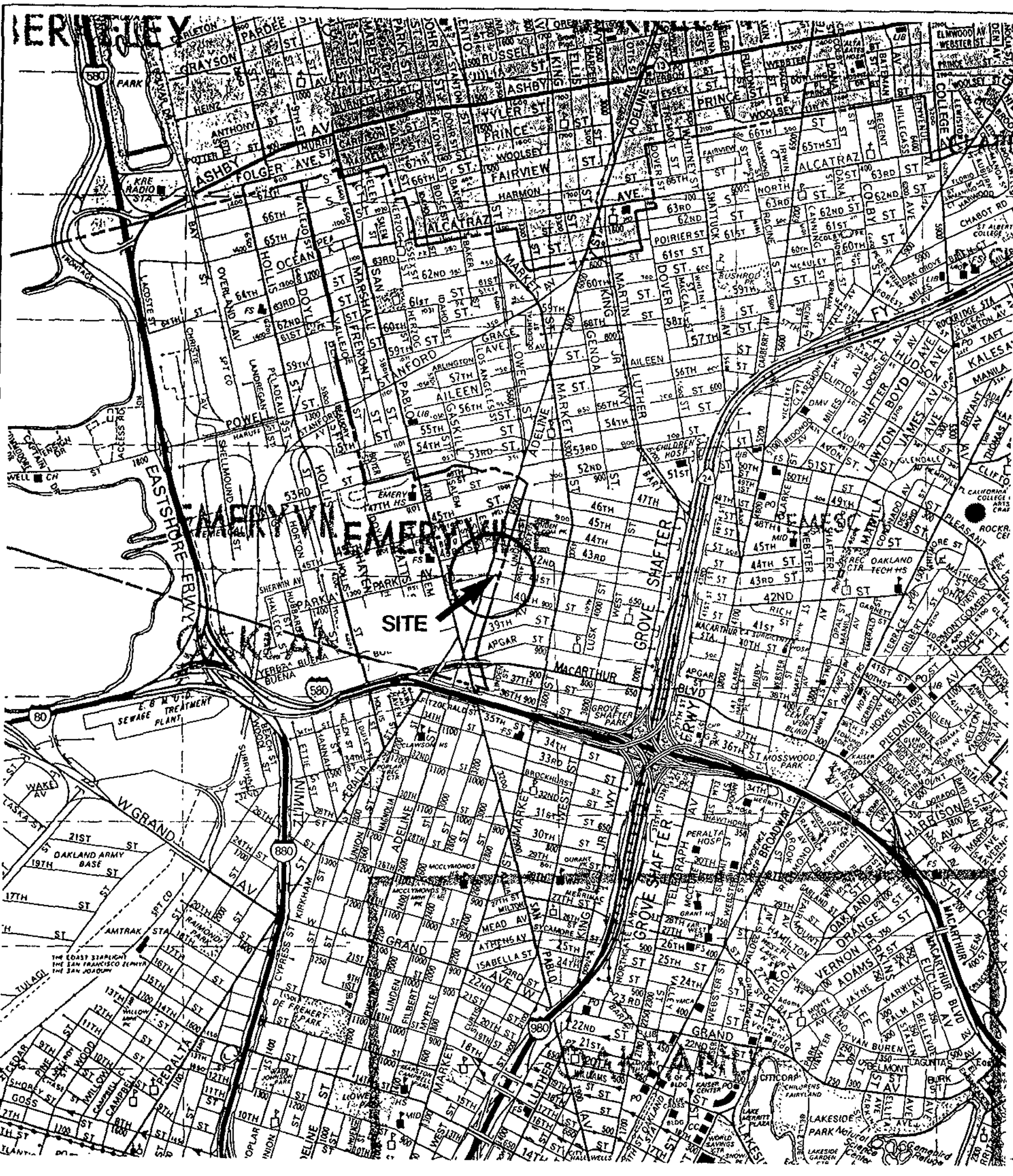
This Health and Safety Plan will be used to ensure that adequate site safety practices are used during the following field activities:

- In-place tank closure
- Drilling of boreholes
- Installation of monitoring wells
- Soil and groundwater sample collection and analysis

All onsite personnel performing these field activities, including ESC and contractors working under the direction of ESC, will be subject to the standards, procedures, and requirements specified in this plan. Contractors wanting to follow their own companies' health and safety protocols may do so if they are at least equivalent to the safety guidelines contained in this plan. Such a determination of equivalency will be made solely by ESC. For the in-place closure and soil and groundwater investigation, Tom Sparrowe has been assign as the health and safety officer. His pager number is (408) 951-2989.

Site Description

The site located at 1001 42nd Street, EmerYville, California was formerly owned by Boysen Paint Company, a sister subsidiary to Ameritone Paint Corporation (a wholly owned subsidiary of Grow Group, Inc.). The site is now owned by Mr. and Mrs. Kozel, operated by Oakland National Engravers (ONE) and also contains a furniture restoration shop. There is an underground storage tank that is located on the north side of 41st Street, approximately 125 feet east of its intersection with Adeline Street, in Emeryville, California (Figures 1 and 2). The 5000-gallon tank was installed under the sidewalk between the rear of the brick building occupied by ONE and the northern curb for 41st Street. Boysen used the tank for storing mineral spirits.



Source: The Thomas Guide, 1988, Alameda and Contra Costa Counties Street & Directory

Scale: 1 inch = 2,200 feet

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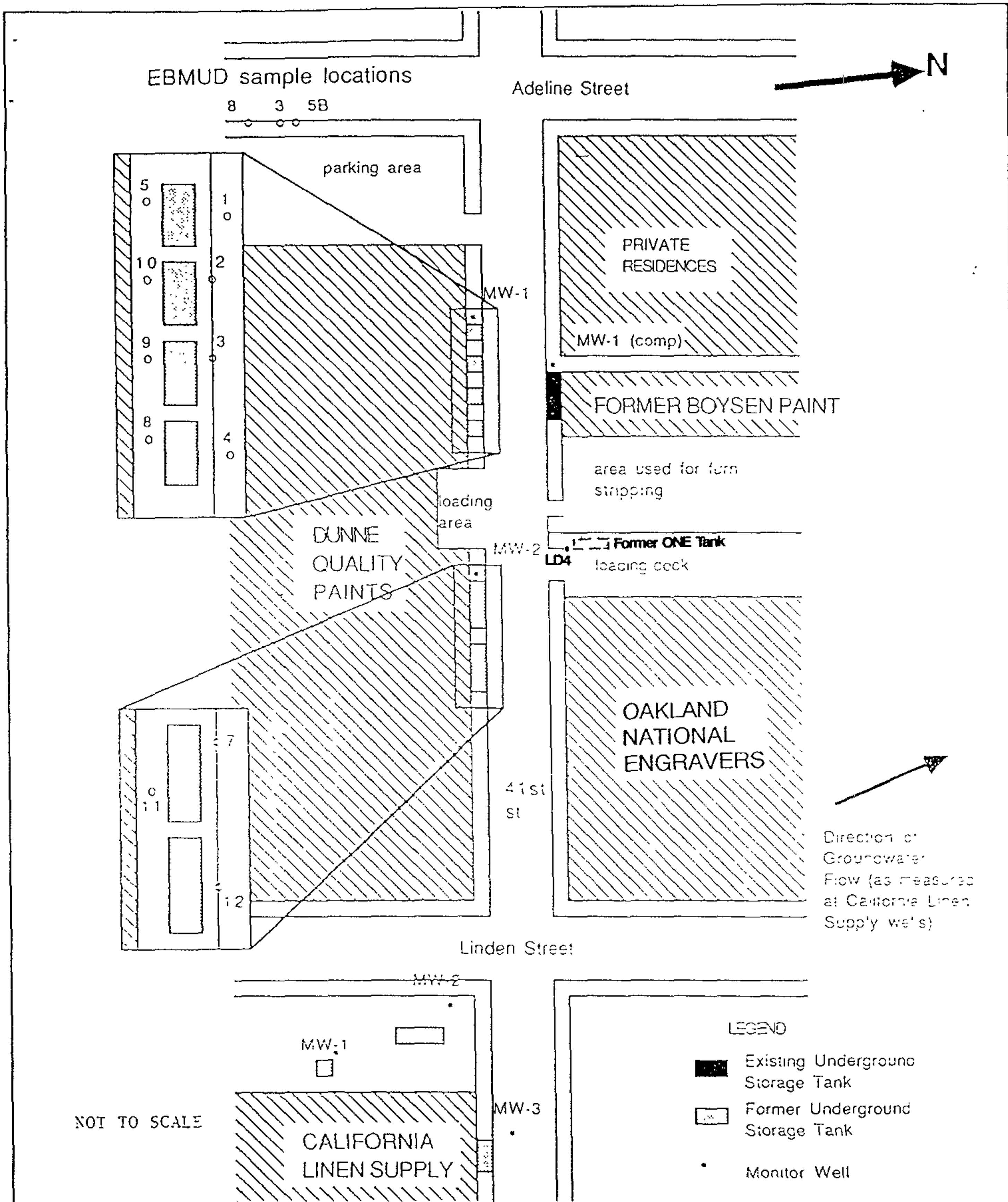
Figure 1
Location Map,
Former Boysen Paint Company,
Emeryville, California



Source: OHM Remedial Services Corp., 1991.

Not to Scale

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Figure 2
Locations of Present and Former Underground Storage Tanks, Former Boysen Paint Company, Emeryville, California

Exposure to Toxic Substances

The primary constituents of concern at the site are total petroleum hydrocarbons as gasoline (TPH-G), benzene, toluene, ethylbenzene, and xylene (BTEX), and methylene chloride (MC). Brief toxicological profiles of the major constituents of concern are included in Appendix E.

Personnel performing sampling, drilling, and excavation activities will be handling equipment that contacts soil and liquid residue from contaminated soil and that may give off volatile organic fumes from these materials. These workers also may be exposed to airborne dust that may contain some hazardous materials and to solvents that will be used in decontamination procedures. To protect these workers from skin contact and breathing fumes and dust, they will use Level D protection and upgrade to Level C protection as described in the **Personal Protective Equipment** section of this plan.

Hazard Assessment

Exposure limit data are expressed as time weighted averages (TWA) or ceiling limits. TWAs promulgated in OSHA regulations are referred to as permissible exposure limits (PELs). TWAs found in NIOSH publications are recommended exposure limits (RELs). The American Conference of Governmental and Industrial Hygienists (ACGIH) adopts values for exposure limits referred to as threshold limit values (TLVs). ACGIH further divides TLVs into TWAs, ceiling limits, and short-term exposure limits (STELs).

The ionization potentials (IPs), odor thresholds, exposure limits, and concentrations that are immediately dangerous to life and health (IDLH) for contaminants at the site are listed in Table 1.

The potential for injuries inherent in operating heavy equipment represents another hazard, especially because operators may be wearing restrictive clothing. The use of excavation equipment creates the potential for contact with overhead electric lines and underground utility lines. Underground utility lines will be located and avoided.

If an accident occurs, the nearest medical assistance will be sought as specified in the section entitled **Contingency Plan and Emergency Procedures.**

Table 1

Contaminants Detected at the Site

	Ionization Potential (eV)	Exposure Limits (ppm) PEL	TVL (STEL)	IDLH (ppm)
BENZENE	9.25	1	NA	3,000
METHYLENE CHLORIDE	11.32	100	NA	5,000
TOLUENE	8.82	200	150	2,000
XYLENES (total)	8.56	100	150	1,000

NA=Not available

Site Controls

An exclusion area will be established using caution tape or another suitable physical barrier if it is deemed necessary to restrict access while sampling or other field activity is being performed. If necessary, a fence will be erected between the street and the area to be sampled to restrict access and visibility. Inside the exclusion area, a contamination reduction area (CRA) will be established through which all workers must enter and exit. Personnel leaving the exclusion area will undergo the decontamination procedures outlined in item 13 of Appendix B while in the CRA. The CRA also will have a caution tape barrier around it. Lined garbage cans, buckets, wash basins, nonphosphate soap solutions, rinse water, and scrub brushes will be provided in the CRA.

Licensed waste hauler trucks will be loaded preferably next to excavation areas. The trailer beds must be lined with polyethylene before being loaded. Attempts will be made to put polyethylene sheeting on the pavement or ground surface of truck loading areas before positioning the trucks. This will prevent needing to wash down truck tires before departure from the facility. If a liner cannot be placed under the truck, a separate truck wash down area will be necessary to prevent contaminated soil from being carried out by truck tires. Trailer bed covers must be secured before the trucks can leave the facility. Heavy equipment, such as backhoes, loaders, and bulldozers must be decontaminated before leaving the facility. Wash down areas for trucks and heavy equipment will be designed and set up as required.

Level of Protection

Staff members and contractors of ESC responsible for the project have completed a 40-hour health and safety training course fulfilling initial instruction requirements specified in 29 CFR 1910.120(e)(2).

An HNu photoionization detector (PID) or equivalent with a 10.5 eV probe will be used to establish baseline conditions before operations begin. Readings will be taken upwind and downwind from work areas to determine background levels of volatile compounds in the air. Organic vapor levels will be monitored above the surface of sampling points to determine if sampling activities are allowing volatile compounds to escape. The PID will also be used to measure the vapor levels in the breathing zone of onsite personnel. Breathing zone PID readings will be used to establish the level of personal protective equipment (PPE) to be used. Sustained readings from 5 to 50 ppm will require an upgrade from Level D to Level C protection. Sustained readings from greater than 5 ppm above background in the breathing zone dictate that personnel should be withdrawn temporarily from the work zone pending characterization of the contaminants present.

When the workplace atmosphere has been characterized, this information, along with data on the toxicity of the contaminants present, will be used to determine the level of PPE required in the work area.

It is not ESC policy to have its staff perform work requiring Level B protection. If it is determined that conditions warrant Level B protection, work will stop until the contractor's previous experience conducting drilling, sampling, or removal operations in Level B protection is verified or until training for Level B work is given to contractors by qualified personnel and until ESC determines if a separate subcontractor will be retained to conduct Level B operations or whether to have the current contractors conduct the operations with ESC maintaining an oversight role (observing from outside the immediate work zone).

The PID will be calibrated at least once at the start of each operating day or when the instruments supply erratic readings. In case of a malfunction, backup equipment will be delivered to the site. Calibration procedures are given in Appendix H.

Personal Protective Equipment

Level C personal protective equipment (PPE) will consist of the following equipment:

- dual canister full face air purifying respirator (NIOSH approved)
- organics, dust, and pesticide respirator cartridges (MSA cartridges GMA-H, GMC-H, GMC-S)
- Tyvek or Saranex-coated Tyvek coveralls
- steel-toed work boots
- outer latex booties
- inner PVC surgical or latex gloves
- outer nitrile, viton, neoprene, or butyl gloves
- hardhats, required when heavy equipment is being used

Level D PPE will consist of the same items as those for Level C. Respirators will be available but not worn unless organic vapors exceed established background levels. Contractors will provide their own PPE.

The fit of the facepiece-to-face seal of the respirator affects its performance. The Site Health and Safety Coordinator will be responsible for ensuring that a good seal is maintained. After each day's use, the respirator will be inspected, cleaned, and stored.

PPE that is damaged will be immediately replaced. Backup equipment will be kept onsite for replacement as necessary.

The following protective equipment will be discarded and replaced daily:

- respirator cartridges
- Tyvek coveralls
- outer booties
- inner surgical gloves
- outer gloves

New outer gloves should be used for each sample. Procedures for putting on PPE are given in Appendix B. Item 15 in Appendix B outlines procedures for containerizing PPE and personal decontamination wastes.

Onsite Safety Equipment

Several pieces of safety equipment will be provided near the work area. A PID meter will be used to detect organic vapors. A first aid kit will be kept onsite near the work area.

Emergency showers or water hoses will be located onsite to wash down personnel rapidly in emergency situations.

Contingency Plan and Emergency Procedures

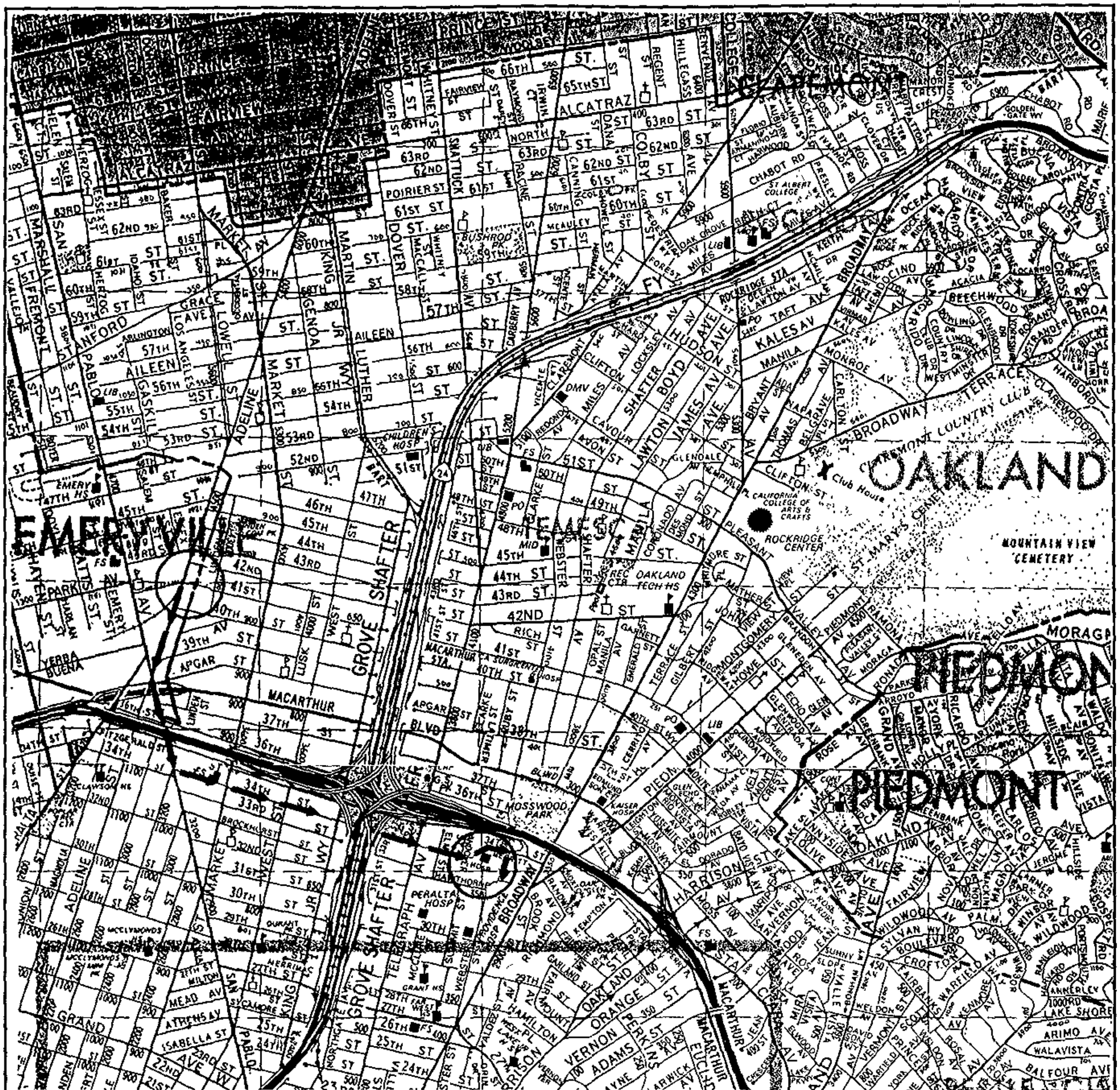
If PID readings indicate a sudden increase of constituents in the breathing zone to levels exceeding IDLH levels or if other threatening hazards are noted, ESC and its contractors will evacuate the area. No personnel will return unless instrumentation, engineering judgment, or an emergency response official indicates that it is safe and proper to do so.

To obtain medical assistance as soon as possible in case of an emergency, the following telephone numbers, addresses, and directions for the nearest medical treatment facilities will be posted at the site:

Ambulance:	911
Police:	Emeryville Police Department 2449 Powell 911/(510) 596-3737
Fire department:	Emeryville Fire Department 4331 San Pablo Avenue 911/(510) 652-2222
Poison control center:	911
Hospital:	Merritt Hospital Hawthorn Avenue & Webster (510) 655-4000
Directions to hospital:	Go west on 41st Street, turn left (south) onto Adeline Street. Turn left onto San Pablo Avenue. Turn left onto 34th street, turn right onto Webster. Merritt Hospital is located at the corner of Hawthorn and Webster.

A map showing the route to the hospital is included as Figure 3.

In an emergency, the primary concern is to prevent the loss of life or severe injury to site personnel. If immediate medical treatment is required, decontamination will be delayed until the condition of the victim has stabilized. If decontamination can be performed without interfering with first aid or if a worker has been contaminated with an extremely toxic or corrosive material that could cause severe injury, decontamination will be performed immediately. If an emergency caused by a heat-related illness develops, protective clothing will be removed from the victim as soon as possible to reduce heat stress.



Source: Thomas Brothers Map Guide, 1988 Edition

Scale: 1" = 2,200'

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Figure 3
Hospital Route Map
Merritt Hospital
Oakland, California

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Appendix A - Safety Rules and Personal Hygiene

Safety Rules and Personal Hygiene

1. Remove all facial hair that interferes with a satisfactory fit of respiratory protective equipment.
2. Do not wear contact lenses while wearing full-face respirators.
3. Do not take prescribed drugs unless specifically approved by a physician.
4. In the work zone, do not eat, drink, smoke, chew gum or tobacco, or engage in any other practice that increases the probability of hand-to-mouth transfer or ingestion of material.
5. Wash hands and face thoroughly after leaving the work area and before eating, drinking, or any other activities.
6. Thoroughly wash entire body as soon as possible after removing Level C protective garments.
7. Whenever possible, avoid contact with contaminated or suspected contaminated surfaces.

Appendix B - Field Standard Operating Procedures for Putting On and Decontaminating Personal Protective Equipment

Field Standard Operating Procedures for

Putting On and Decontaminating

Personal Protective Equipment

1. Park vehicles outside the site boundaries.

2. During the pre-work safety meeting, the site manager will provide the following information:

   A. a description of the site and known problem areas

   B. the level of protection required

   C. emergency medical information

   D. the locations of the first aid kit, showers, telephones, nearest water supply, ice, and lavatory

3. Use the nearest lavatory.

4. Lay out and check safety gear.

5. Put on safety gear in the following order:

   A. Saranex or Tyvek coveralls.

   B. Steel-toed work boots.

   C. Connect suit and boots with tape.

   D. Outer booties, if used.

   E. Air purifying respirators (APRs), if required.

6. Put on APRs as follows:

   A. Inspect.

      (1) Inspect before each use to ensure that they have been cleaned adequately.

      (2) Check material conditions for signs of pliability, deterioration, or distortion.

      (3) Examine cartridges and ensure that they are the correct type for the intended use, that the expiration date has not passed, and that they have not been opened or used previously.

      (4) Check face shields for cracks or fogginess.

   B. Loosen all harness strap adjustments.

C. Place chin in chin cup and draw back evenly on strap adjustments - the two bottom straps first, then the two top straps, and the center top strap last.

D. Check that the respirator is centered evenly on the face and that the straps are not uncomfortably tight.

E. Check for leaks or proper facial seals.

(1) To conduct a negative-pressure test, close the inlet part with the palm of the hand so it does not pass air, and gently inhale for about 10 seconds. Any inward rush of air indicates a poor fit. Note that a leaking facepiece may be drawn tightly to the face to form a good seal, giving a false indication of adequate fit.

(2) To conduct a positive-pressure test, gently exhale while covering the exhalation valve to ensure that a positive pressure can be built up. Failure to build a positive pressure indicates a poor fit.

7. Put on the rest of the gear in the following order:

A. Raise hood

B. Hardhat

C. Surgical gloves

D. Outer gloves

E. Connect gloves and suit with tape

8. Select a buddy to act as a safety backup.

9. Check your buddy's equipment and have your buddy check yours for rips, tears, or malfunctions. Pay special attention to respirators, making sure that seals are good and that cartridges are securely in place.

10. If any equipment or gear gets damaged or if your suit tears badly, GO BACK.

11. If you experience physical discomfort, breathing difficulties, light-headedness, dizziness, or other abnormalities, GO BACK.

12. When you return, have your buddy check for external accumulation of contamination and remove it. Also check gear for damage.

13. Decontamination will be performed in steps appropriate to site conditions as required, as follows:

Step 1 - Segregated Equipment Drop: Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) in different containers with plastic liners. Each may be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination. This equipment may be reused if properly decontaminated.

Equipment: various sizes of containers
plastic drop cloths

Step 2 - Boot Cover and Outer Glove Wash and Rinse: (Optional - will be used at the Site Health and Safety Coordinator's discretion.)

Equipment: pesticide sprayer with nozzle
two wash basins or tubs
scrub brush
water
liqui-nox nonphosphate soap solution (1%)

Step 3 - Tape Removal: Remove tape around boots and gloves, and deposit in container with plastic liner. Remove boot covers, then outer gloves, and place them in the container.

Equipment: container (30-50 gallons)
plastic liners
folding chairs

Step 4 - Safety Boot Wash and Rinse: (Optional - will be used at discretion of ESC field team members.)

Equipment: two wash basins or tubs
scrub brush
water
liqui-nox solution (1%)

Step 5 - Protective Coverall Removal: With the assistance of a helper, remove protective coverall. Deposit in container with plastic liner.

Equipment: container (30-50 gallons)

folding chairs

plastic liners

Step 6 - Respirator Removal: Remove facepiece. Avoid touching face with gloves. If work is completed for the day, discard cartridges in lined container, and wash and rinse respirator following the procedures on page B-5.

Equipment: container (30-50 gallons)

plastic liners

Step 7 - Inner Glove Removal: Remove inner gloves and deposit in container with plastic liner.

Equipment: container (20-30 gallons)

plastic liners

14. Respirators will be cleaned daily by hand washing with MSA cleaner-sanitizer solution followed by a thorough rinse and air drying. NEVER ALLOW A RESPIRATOR TO DRY WITH THE STRAPS PLACED FORWARD ACROSS THE FACESHIELD BECAUSE THIS MAY CAUSE CHANGES IN THE FACE-TO-RESPIRATOR SEAL SURFACE. The specific procedures to be employed are as follows:

A. Remove all cartridges (canisters) and filters plus gaskets and seals not permanently affixed to their seats.

B. Loosen harness adjustment straps.

C. Remove exhalation valve cover.

D. Remove inhalation and exhalation valves.

E. Remove protective faceshield cover.

F. Wash facepiece in MSA cleaner/sanitizer powder mixed with warm water, preferably at a temperature of 120° F. Wash components separately from facepiece. Heavy soil may be removed from the facepiece surface using a medium-soft handbrush.

G. Remove all parts from the wash solution, and rinse twice in clean, warm water.

H. Air dry all parts in a designated clean area.

I. Pat facepieces, valves, and seats to remove any remaining soap residue, water, or other foreign material with a clean, damp, lint-free cloth.

J. Reassemble respirator.

K. Place respirator in a plastic bag and the respirator box or otherwise store the respirator to prevent exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact.

15. Investigation-derived waste material will be handled as follows:

A. Expendable material, such as tape, boot covers, inner and outer gloves, coveralls, and expendable sampling items, will be placed in a lined 30- to 33-gallon garbage can. When the container is full, the garbage sack will be removed and promptly placed in a contaminated soil stockpile or placed directly into licensed hazardous waste hauler trucks for offsite disposal.

B. Wash and rinse waters from personal and equipment decontamination will be containerized in 55-gallon drums.

C. All drummed wastes will be labeled "Property of [company name]." Drummed liquids will be pumped into a tank truck approved for hazardous waste transport if it is cost effective to do so. If drums must be transported offsite, they will be labeled in accordance with DOT shipping regulations contained in 49 CFR Parts 171-179 and transported offsite by a licensed waste hauler.

Appendix C - Heat Stress and Heat Stress Monitoring

Heat Stress and Heat Stress Monitoring

Heat is one of the most common (and potentially serious) illnesses at hazardous waste sites where PPE is worn; therefore, regular monitoring and other preventive precautions are vital. Shelter from the sun will be provided during rest periods. If necessary, work will be performed during the cooler night hours. Table A lists the signs and symptoms of heat stress. Initial work schedules will be approximately 90 minutes of work followed by 15 minutes of rest. These schedules will be modified based on the following monitoring stated in NIOSH, et al. (1985).

- Heart rate. Heart rate will be measured during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, the next work cycle will be shortened by one-third without changing the rest period. If the heart rate still exceeds 110 beats per minute at the next rest period, the following work cycle will be shortened by one-third.
- Oral temperature. A clinical thermometer (three minutes under the tongue) or similar device will be used to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6° F (37.6° C), the next work cycle will be reduced by one-third without changing the rest period. If oral temperature still exceeds 99.6° F (37.36° C) at the beginning of the next rest period, the following work cycle will be shortened by one-third. A worker will not be permitted to wear a semipermeable or impermeable garment when his or her oral temperature exceeds 100.6° F (38.1° C).
- Body water loss, if possible. Weight will be measured on a scale accurate to ±0.25 lb at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Table A

Signs and Symptoms of Heat Stress

- **Heat rash** may result from continuous exposure to heat or humid air.

- **Heat cramps** are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

  muscle spasms

  pain in the hands, feet, and abdomen

- **Heat exhaustion** occurs from increased stress on various body organs, including inadequate blood circulation caused by cardiovascular insufficiency or dehydration. Signs and symptoms include:

  pale, cool, moist skin

  heavy sweating

  dizziness

  nausea

  fainting

- **Heat stroke** is the most serious form of heat stress. Temperature regulation fails, and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms include:

  red, hot, usually dry skin

  lack of or reduced perspiration

  nausea

  dizziness and confusion

  strong, rapid pulse

  coma

Source: National Institute of Occupational Safety and Health/Occupational Safety and Health Administration/U.S. Coast Guard/U.S. Environmental Protection Agency. 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.

Appendix D - Cold Stress Prevention for Winter Months

Cold Stress Prevention for Winter Months

The types of cold-related stress are frostbite, hypothermia, and immersion or trench foot. Personnel performing field tasks in the winter months should be aware of the signs and symptoms of cold-related stress so they can take precautionary measures to avoid cold-induced injury and illness. The following is a brief synopsis of each type of cold-related stress.

Frostbite results when cells are cooled until ice crystals form inside them. Most injuries from frostbite are localized to the exposed part of the body. First degree frostbite or frostnip usually strikes the tips of fingers, toes, ears, nose, and chin or cheeks. It is usually painless, and the victim is often unaware of it. The skin turns pale or white from first degree frostbite. Second degree frostbite can occur in skin and its underlying tissue. The skin becomes firm and white, waxy, or translucent. As the injured area warms, it will become numb, and then will turn blue or purple and swell. The superficial capillaries have been injured, and edema fluid will leak out into the tissue. Stinging and burning pain and superficial blisters may develop. The throbbing, aching, and burning may last for some weeks, and the body part may become permanently red and be extremely sensitive if again exposed to the cold. Third degree frostbite involves freezing not only the skin and subcutaneous tissue but even muscle and bone. This serious injury usually involves the hands and feet. The tissues are cold, pale, and frozen to the touch. The injured area usually turns purple or blue and is extremely painful after thawing. Large blisters and tissue death (gangrene) may occur within the first day or two.

Generalized, severe, progressive body cooling is known as systemic hypothermia. This may occur at outside temperatures above freezing as well as below freezing. It occurs when the core temperature of the body falls below 95° F (35° C) and results when the body temperature controlling mechanism is overwhelmed. At 96.8° F, the body attempts to compensate for the cold. As core temperatures fall below 95° F, the body is unable to rewarm itself without outside assistance because of the failure of the temperature control system.

Hypothermia may be of acute duration if someone is suddenly immersed in cold water. Subacute hypothermia may occur in otherwise healthy people, such as skiers, mountain climbers, or lost hunters, subject to prolonged cold exposure and physical exertion. Chronic hypothermia may occur in old people or those who are ill.

Hypothermia may be mild to moderate, when the core temperature is between 81° and 95° F and the patient is conscious, or it may be severe, when the core temperature is below 80° F and the patient is unconscious.

The symptoms of hypothermia depend on the core temperature and become progressively more severe as the core temperature drops. Between 95° and 98.6° F, the first symptom is shivering, a subconscious attempt of the body to generate more heat through muscular action. In addition, certain semiconscious activities will occur, such as stamping the foot and dancing up and down. Below 95° F, difficulty in speaking, incoordination, stumbling, falling, and an inability to use the hands are seen. It is at this point that the loss of temperature control occurs and the body is unable to rewarm itself. Below 90° F, shivering decreases and the muscles become progressively rigid. Below 85° F, the victim becomes irrational and may fall into a coma. The pulse and respirations slow. Below 80° F, unconsciousness occurs. The pulse is weaker, and cardiac arrhythmias may be noted. Below 78° F, the respiratory and cardiovascular centers fail, with resulting pulmonary edema and ventricular fibrillation and then cardiac standstill. Ventricular fibrillation is the usual cause of death in these victims.

Even without a thermometer, the level of hypothermia may be noted by observing the victim's mental state. With a few degrees' drop in core temperature, the victim may become withdrawn, discouraged, or mildly depressed. As the temperature drops a few degrees more, to 94° F or below, the victim may become indecisive, confused, or disoriented and may make incorrect decisions. Below 86° F, sleepiness, lethargy, and confusion are obvious. These progressively become more severe until coma occurs. The comatose state, if allowed to continue, results in death. The stages of hypothermia may progress rapidly after the victim's temperature falls below 90° F.

Trench foot or immersion foot occurs from the wet cooling of an extremity over hours or days at a temperature just above freezing while remaining relatively immobile. It used to be seen commonly in shipwrecked sailors or soldiers forced to remain in trenches for days at a time. The extremity is cold, swollen, waxy, mottled, and may be numb.

Preventive Work Guidelines

1. Exposure to cold will be terminated immediately when severe shivering becomes evident.
2. When air temperature falls below 30° F, dry bulb temperature and wind speed should be measured

periodically and the wind chill factor should be calculated. (Weather radios are an adequate substitute.)

3. All work except for emergencies will be terminated when the wind chill is below -18° F.

4. Metal tool handles should be covered with thermal insulating material at temperatures below 30° F.

5. When work is performed continuously in the cold at a wind chill of below 20° F, heated shelter should be made available. A vehicle can be used for shelter if it is kept idling with the heater on.

6. Work will be arranged in such a way that sitting or standing still for long periods of time is minimized.

7. Keep warm, dry, and keep moving, but do not become overheated while working in the cold. Exercise fingers and toes.

Appendix E - ESC Medical Monitoring Program

ESC Medical Monitoring Program

The workers most likely to be exposed to contaminated materials at the site are sampling and inspection personnel. These personnel are included in a Medical Monitoring Program established by ESC.

The purposes of the Medical Monitoring Program are to identify any illness or problem that would put an employee at an unusual risk from exposures; to ensure that each employee can use negative-pressure respirators safely and withstand heat or cold stress; and to establish and maintain a medical data base for employees to monitor any abnormalities that may be related to work exposure and that could increase injury risk for the employee or others in the performance of job functions. The Medical Monitoring Program includes:

- a baseline physical examination
- a medical determination of fitness of duty, including work restrictions after any job-related injury or illness or nonjob-related absence lasting more than three working days
- the review of each site-specific Health and Safety Plan and potential exposure list to determine the need for specific biological and medical monitoring
- annual and exit physical examinations with attention given to specific exposures or symptoms

Baseline Physical Examination

A baseline physical examination will be performed on each employee engaged in hazardous waste activities. The purposes of this examination are to identify any illness or problem that would put an employee at unusual risk from certain exposures; to certify the safe use of negative-pressure respirators (OSHA Safety and Health Standard 29 CFR 1910.134); and to develop a data base for the assessment of exposure-related events detected through periodic medical monitoring. Variable data, such as age, sex, race, smoking, prior employment and exposure history, that may have a bearing on the occurrence of subsequent events after employment begins will be gathered.

The content of the Baseline Physical Examination will include:

- medical, occupational, and fertility histories
- a physical examination, stressing neurological, cardiopulmonary, musculoskeletal, and skin systems
- an electrocardiogram

- PA and lateral chest x-rays
- a pulmonary function test (FEV1, FVC, FEV 25-75)
- an audiogram
- a multichemistry blood panel, including kidney and liver function tests, CBC with differential, and urinalysis
- tests deemed necessary by symptoms or exposure history
- a red blood cell cholinesterase
- physical parameters, including blood pressure and visual acuity testing

Annual Physical Examination

An examination and updated occupational history will be performed on an annual basis during the anniversary month of the baseline physical examination. This annual examination serves to identify and prevent illness caused by cumulative exposure to toxic substances.

The Annual Physical Examination will include:

- a personal work history (based on specific project histories)
- a physical examination, stressing neurological, cardiopulmonary, musculoskeletal, and skin systems
- pulmonary function test (FEV1, FVC, FEV 25-75)
- a multichemistry blood panel, including kidney and liver function test
- an audiogram
- tests deemed necessary by symptoms or exposure history
- an optional wellness profile

Return to Work Examination

Any job-related illness or injury will be followed by a medical examination to determine fitness for duty or possible job restrictions based on the physical findings of the medical examiner. A similar examination will be performed following three missed workdays caused by a nonjob-related illness or injury requiring medical intervention.

Exit Physical Examination

The content of the Exit Physical Examination will include:

- a personal work history (based on specific project histories)
- medical, exposure, and fertility histories
- a physical examination, stressing neurological, cardiopulmonary, musculoskeletal, and skin systems
- a pulmonary function test (FEV1, FVC, FEV 25-75)
- an electrocardiogram
- PA and lateral chest x-rays
- an audiogram
- a multichemistry blood panel, including kidney and liver function tests, CBC with differential, and urinalysis
- tests deemed necessary by symptoms or exposure history
- a red blood cell cholinesterase
- physical parameters, including blood pressure and visual acuity testing

Appendix F - Properties of Materials and Toxicological Profiles

Properties of Materials and Toxicological Profiles

Benzene

Benzene is a colorless liquid that is used as an industrial solvent and is a common component of gasoline and other petroleum derived fuels and oils. Although benzene can be absorbed through the gastrointestinal tract and slowly through the skin, most exposures occur by inhalation. Up to 50% of the benzene inhaled is absorbed. Benzene can accumulate in lipid tissues but also is metabolized and excreted readily. It appears that many of benzene's toxic properties are due to its metabolites.

Benzene can have a defatting action on the skin, causing irritation. Inhalation of 500 ppm can cause headaches, while 20,000 ppm can be fatal in 5-10 minutes. Acute inhalation exposure causes depression of the central nervous system with symptoms including drowsiness, vertigo, and delirium. Oral ingestion of 9-12 grams results in similar symptoms of toxicity and vomiting. Ingestion of about 30 grams can be fatal. The lowest reported ingested dose at which toxic effects were found in humans is 130 mg/kg. The LD_{50}s for oral exposure were 4,894 mg/kg for rats and 4,700 mg/kg for mice. For inhalation exposures, they were 10,000 ppm for rats and 9,980 ppm for mice. In September 1987, the OSHA TWA for benzene was reduced from 10 ppm to 1 ppm.

Chronic exposure to benzene can cause pronounced changes in the hematopoietic system (which manufactures blood cells), problems with the central nervous system, and cardiac sensitization. Hematological effects from chronic benzene exposure can include blood clotting defects, followed by a decrease in the blood cell production activity of the bone marrow, disturbances of iron metabolism, internal hemorrhaging, and a cessation of bone marrow activity and leukemia.

Benzene's leukemic action in humans is widely accepted. The IARC has classified the compound as a suspect human carcinogen, and the EPA carcinogen assessment group has determined that the 10^{-6} cancer risk level is 1.5 ug/l. As such, the EPA has set the recommended maximum contaminant level for benzene at zero.

While benzene has not been found to be a mutagen in laboratory tests, reproductive effects have been found. Exposed rats have shown a decrease in fertility and the number of offspring, and their offspring have displayed skeletal abnormalities.

The behavior of benzene in the environment varies. The compound is very volatile and highly flammable, with a flash point of 12° F. Benzene can be explosive at concentrations of 1.4-8.0% in air. Volatilized benzene will photodecompose. Benzene also is biodegraded readily in the soil. It is somewhat soluble in water (1,780 mg/l), so benzene will tend to travel with groundwater.

Gasoline

Gasoline is a mixture of more than 200 C_5-C_9 hydrocarbons. More than 325 organic and inorganic additives are added to gasoline. The gasoline itself consists largely of aromatics (35%-55% in premium grades) and alkanes. The aromatics present include benzene (4%), toluene (10%-16%), C_8 compounds (12%-18%), and higher aromatics (17%-20%). The additives include antiknock compounds, antioxidants, surfactants, and deposit modifiers. Tetraethyl lead was formerly one of the most common additives, occurring at about 77 ppm. Its use has been severely curtailed because of the severe decline in the use of leaded gasolines.

As would be expected from its composition, gasoline is a central nervous system depressant. Exposure to high levels can cause respiratory failure and sensitization of the heart muscles. The presence of benzene in gasoline means that chronic inhalation exposure can be carcinogenic. Inhalation of 900 ppm of gasoline for one hour by humans can cause dizziness and irritation of the eyes, nose, and throat. Inhalation of 2,000 ppm can cause irritation of the mucous membranes and anesthesia. At levels of 10,000 ppm, the response is rapid, occurring in two to four minutes. Ingestion of gasoline can cause upsets of the gastrointestinal system. If ingested gasoline is aspirated, it can damage the lungs, leading to pneumonitis. Ingestion of 10-15 grams can be lethal in children, while ingestion of 20-50 grams is toxic to adults. The threshold limit value for gasoline vapors has been set at 250-500 mg/cu m.

In the environment, gasoline will volatilize readily. As expected, it is fairly flammable, having a flash point of 100°-150° F. Gasoline can be biodegraded in the soil but may be persistent, floating on groundwater.

Methylene Chloride

Methylene chloride, also known as dichloromethane, is a highly volatile, colorless liquid. As such, most reported exposures to the compound are through inhalation. Methylene chloride can be an irritant of the skin, eyes, and mucous membranes. In addition to inhalation, it can be absorbed by ingestion or through the skin. In the body, methylene chloride is metabolized to carbon monoxide. This compound binds with the hemoglobin in the red blood cells forming carboxyhemoglobin, a form of the compound that is considerably less efficient at transporting oxygen.

The major effect from exposures to high concentrations of methylene chloride through inhalation is narcosis. Headaches, numbness, and tingling in the limbs also can result. The LD_{50} for oral exposure of rats is 2,524 mg/kg. Rats and mice exposed by inhalation showed LC_{50}s of 88,000 m/cu m for 30 minutes and 14,400 ppm for 7 hours. The National Institute of Occupational Safety and Health has established a time-weighted average for the compound of 75 ppm.

There is little evidence of severe damage from chronic exposure to methylene chloride. Damage to the liver and central nervous system has been reported from such exposures. The data regarding carcinogenicity are equivocal at present. The International Agency for Research on Cancer has classified the compound as an indefinite carcinogen. There is no evidence reported that the compound is carcinogenic in humans, and many laboratory studies have produced negative results. Methylene chloride has been found to be mutagenic in tests with bacterial systems. Inhalation exposures of pregnant rats and mice have resulted in developmental abnormalities of the muscles, skeleton, and urogenital system as well as effects on the behavior of the offspring.

Its high volatility means that methylene chloride does not persist in many environmental situations. It is somewhat soluble in water but dissolves at a limited rate. The compound readily evaporates from water bodies. In the air, methylene chloride photodecomposes.

Toluene

Toluene is a colorless liquid widely used as an industrial solvent. Toluene can be an irritant of the skin and eyes. Its defatting action on the skin leads to drying and cracking in chronic exposures. Toluene is readily absorbed dermally and by ingestion and inhalation. Most absorbed toluene is metabolized to benzoic acid, which is conjugated with glycine in the liver to form hippuric acid. The hippuric acid is excreted in the urine. Toluene is a central nervous system depressant. At concentrations of 200-500 ppm, headaches, lassitude, and impairment of coordination have been found. Acute poisoning from inhalation only occurs at very high concentrations and is reportedly very rare. The oral LD_{50} for rats was found to be 5 g/kg. For inhalation exposures of mice, it was 5,320 ppm for eight hours. An LD_{50} of 14 g/kg was found for dermal exposures of rabbits. The Occupational Safety and Health Administration time-weighted average for toluene is 200 ppm.

Toluene is not highly toxic in chronic exposures. Prolonged exposure has led to reversible kidney and liver damage. Chronic exposure also results in central nervous system depression. There is no evidence that toluene is a carcinogen. There is some evidence of mutagenicity in microorganisms and cell cultures, but the evidence is reportedly equivocal. The compound can pass across the placenta, but there is no report of embryotoxic effects in humans. Inhalation exposures of pregnant mice have produced fetotoxicity and developmental abnormalities of the musculoskeletal system, and oral exposures of mice also have produced craniofacial abnormalities. Benzene, a frequent contaminant of commercial grade toluene, can cause more severe toxic effects.

Toluene is fairly volatile and will tend to evaporate from surficial soils and surface water bodies. The compound is insoluble but will tend to be mobile in saturated soils. Toluene can be biodegraded somewhat by soil microorganisms and will degrade photochemically in the atmosphere. Toluene has been classified by the U.S. Department of Transportation as a flammable liquid. It has a flash point of 40° F. The federal water quality criteria level for toluene has been set at 17,500 ug/l in fresh water. An acceptable daily intake of 29.5 mg/l has been established. The reportable quantity under CERCLA and the Clean Water Act for spills of toluene is 1,000 pounds.

Xylenes

Xylene solvent, as commercially sold, is a mixture of the three xylene isomers and usually contains ethyl benzene as a contaminant. Xylenes are absorbed most readily by inhalation; however, they also can be absorbed dermally and through ingestion. Much of the absorbed xylene is eliminated in the urine as toluric acid. The compounds have a high affinity for fat and, therefore, can accumulate in adipose tissues.

Xylenes can be irritating to the eyes, skin, nose, and mucous membranes. In high concentrations, severe breathing difficulties can result, leading to dizziness and unconsciousness. Loss of appetite, nausea, and abdominal pain have been reported from exposure as has reversible damage to the liver and kidneys. In laboratory animals, xylenes have been reported to be mildly toxic to the hematopoietic system, which is responsible for the production of red blood cells. The lowest lethal concentration reported for human inhalation exposure is 10,000 ppm for six hours. The LD_{50} for oral administration to the rat was reported as 4.3 g/kg and for inhalation exposure was 5.0 g/kg for four hours. The Occupational Safety and Health Administration time-weighted average is set at 100 ppm (435 mg/cu m).

Chronic exposure to xylenes can have a depressive effect on the central nervous system. Skin problems can result from frequent exposure because of the solvent's defatting action. There is apparently no evidence that xylenes are carcinogenic, teratogenic, or mutagenic. Inhalation exposures of pregnant rats produced developmental abnormalities of the musculoskeletal system, while oral exposure of pregnant mice increased fetotoxicity and postimplementation mortality. No such effects have been reported for humans.

Xylenes are fairly volatile and flammable, having a flash point of about 100° F. They are insoluble in water and biodegrade slowly. Thus, they will be persistent in some environmental situations.

The long-term, suggested no-adverse-response level for exposure to xylenes has been set at 0.62 mg/l. The reportable quantity for spills under CERCLA is 1,000 pounds.

Appendix G - Site Health and Safety Coordinator Responsibilities

Site Health and Safety Coordinator Responsibilities

A Site Health and Safety Coordinator will be designated.

The responsibilities of the Site Health and Safety Coordinator will include the following:

- briefing personnel on the hazards at the site, the standard operating procedures to be employed, and emergency procedures
- conducting onsite health monitoring
- coordinating access control and site security
- monitoring work practices and decontamination to ensure that required procedures are being followed
- being available to document and respond to any concerns or complaints made by personnel onsite
- documenting unsafe work practices or conditions
- documenting any accidents or incidents that result in illness or injury to personnel
- evaluating and amending the Health and Safety Plan daily to remedy deficiencies and post entry briefings

Appendix H - Calibration Procedures for the HNu

Calibration Procedures for the HNu

The calibration of the HNu PID can be checked by using a cylinder containing isobutylene with a regulator as follows:

1. Connect the analyzer to the regulator and cylinder with a short piece (butt connection) of tubing. The calibration gas in the cylinder consists of a mixture of 100 ppm isobutylene and zero air. Isobutylene is nontoxic and safe to use in confined areas. There are no listed exposure levels at any concentration.

   The regulator sets and controls the flow rate of gas at a value preset at the factory. This will be about 250 cc/min.

   It is important for the tubing to be clean because contaminated tubing will affect the calibration reading. Do not use the cylinder below about 200 psi because readings below that level can deviate up to 10% from the rated value. Zero the unit on standby.

2. Open the valve on the cylinder until a steady reading is obtained. If a 10.2 eV lamp is being used, the unit should read 55 ppm. If an 11.7 eV lamp is being used, the reading should be 67 ppm.

3. If the analog display of the HNu is not the same as the proper calibration value, adjust the SPAN setting until the analog display shows the calibration value. The SPAN setting is adjusted by moving the locking hub in a counterclockwise direction to unlock it, rotating the SPAN control dial until the correct reading is obtained, and moving the locking hub back in a clockwise direction to lock it.

4. Turn off the cylinder, and remove the tubing connection from the end of the HNu probe. Keep the HNu on until the analog display reaches 1 ppm or less. This indicates that the calibration gas has been purged from the instrument.

5. Turn off the unit and record this new SPAN setting.