SOURCE AREA SOIL REMEDIATION PLAN

CROLEY & HERRING INVESTMENT COMPANY
5800 CHRISTIE STREET
EMERYVILLE, CALIFORNIA

APRIL 5, 1989

McLaren Environmental Engineering

McLaren Environmental Engineering

Mr. Dennis Byrne
Alameda County Department of Health Services (ACDOHS)
80 Swan Way, Room 200
Oakland, CA 94621

Dear Mr. Byrne:

SOIL REMEDIATION PLAN, 5800 CHRISTIE STREET, EMERYVILLE, CALIFORNIA

As per our phone conversation, we are please that ACDOHS is willing to take on the jurisdiction of the proposed soil remediation and closure effort at the subject facility. McLaren is acting on behalf of Croley & Herring Investment Company as the prime abatement contractor for the subject work.

Attached please find a copy of the subject plan which includes previous investigation data and the health and safety plan for your review and consideration. We look forward to meet with you at the site on Thursday, April 6, 1989 at 1:00 P.M. to get acquainted with the history and planned activities at the facility.

Furthermore, the California Department of Health Services (Ms. Janis Thomas) will be notified of the proposed activities as well as the property owner of the adjacent parking lot (F. P. Lathrop Construction Company) as to minimize exposure of organic vapor emission from the proposed soil excavation activities. The Bay Area Air Quality Management District will also be notified prior to the soil excavation activities.

We appreciate your prompt attention to this matter.

Sincerely,

Walter Loo, CEG
Principal Geohydrologist

0405LGT1

Attachment

980 Atlantic Avenue, Suite 100, Alameda, CA 94501 (415) 521-5200
Headquarters: 11101 White Rock Road, Rancho Cordova, CA 95670 (916) 638-3696

SOURCE AREA SOIL REMEDIATION PLAN

CROLEY & HERRING INVESTMENT COMPANY
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

APPENDIX A - ROBERT GILS ASSOCIATES, INC. SOIL ASSESSMENT REPORT

APPENDIX B - HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

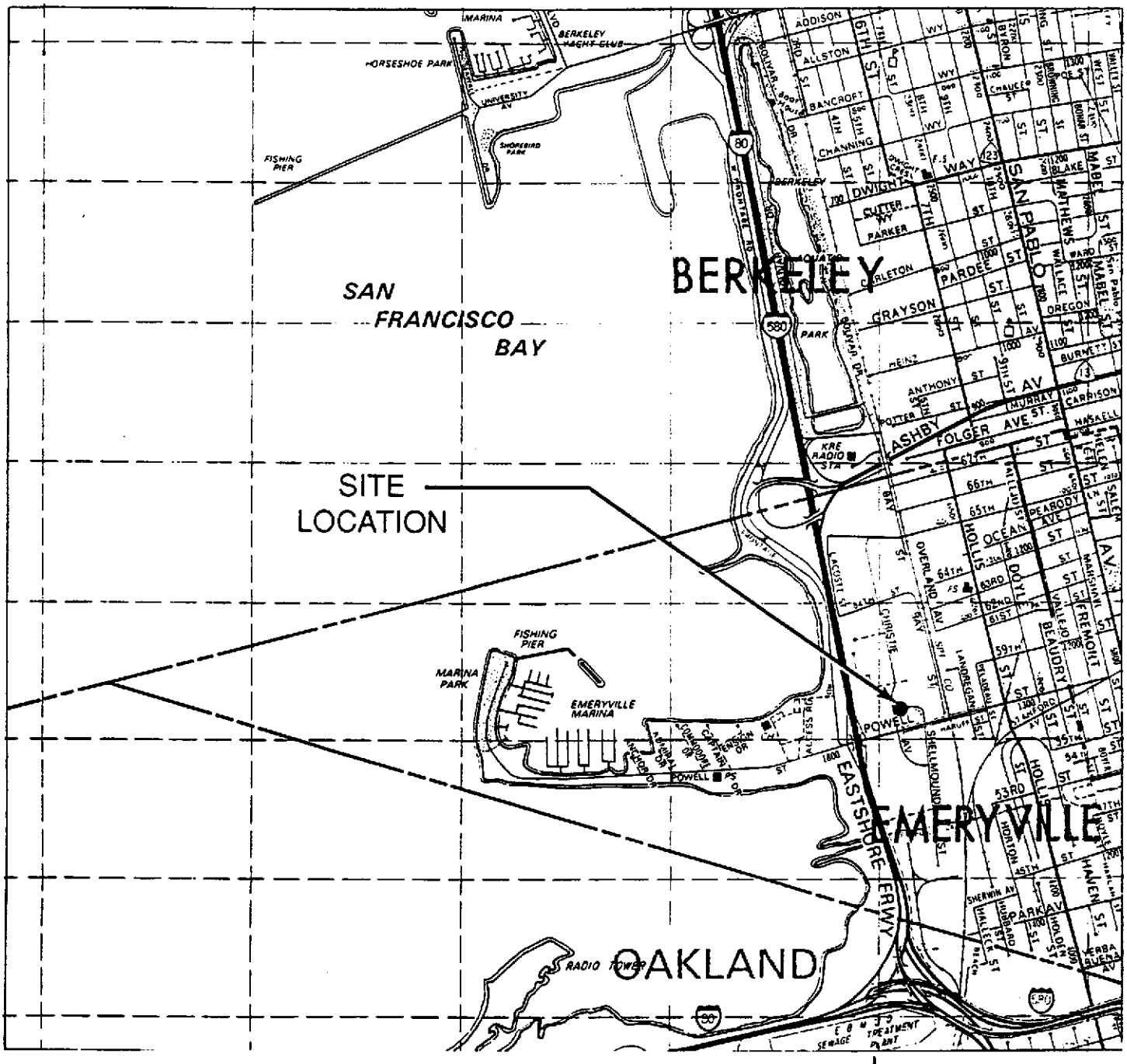
The site is a 0.82 acre property located on the southeast corner of Christie Street and Shellmound Avenue in Emeryville, California (Figure 1-1). A one-story, 22,800 square foot industrial warehouse is the only building located on the property. The building was constructed approximately twenty (20) years ago. Croley and Herring Investment Company (CHIC) purchased the property from Milligan Spika Company in 1980. Space in the building is leased to various tenants. All tenants have been evicted as of January 1989, to clear the building for a new lease. Concrete or asphalt slabs cover the entire site except for the alley to the east of the building and a thin border between the building and Christie and Powell Streets. These areas are unpaved.

The last tenants to occupy the building were Fisher Berkeley (a manufacturer of communication equipment for health care applications), Flexo Packaging (a manufacturer of printing plates for commercial packaging applications) and Data Plus (a computer software firm). These three tenants were evicted in late 1988/early 1989. Past tenants include Milligan-Spika (a distributor of auto parts), CRT (a computer and office machine repair business) and PRT (a distributor of phonograph records). Fisher Berkeley was an original tenant.

F. P. Lathrop Company, a construction firm, owns the adjacent property to the east. In the past F. P. Lathrop Construction used the property as its corporate yard (Figure 1-2). Currently, a Sherwin-Williams wholesale paint store and the California Department of Health Services leases it.

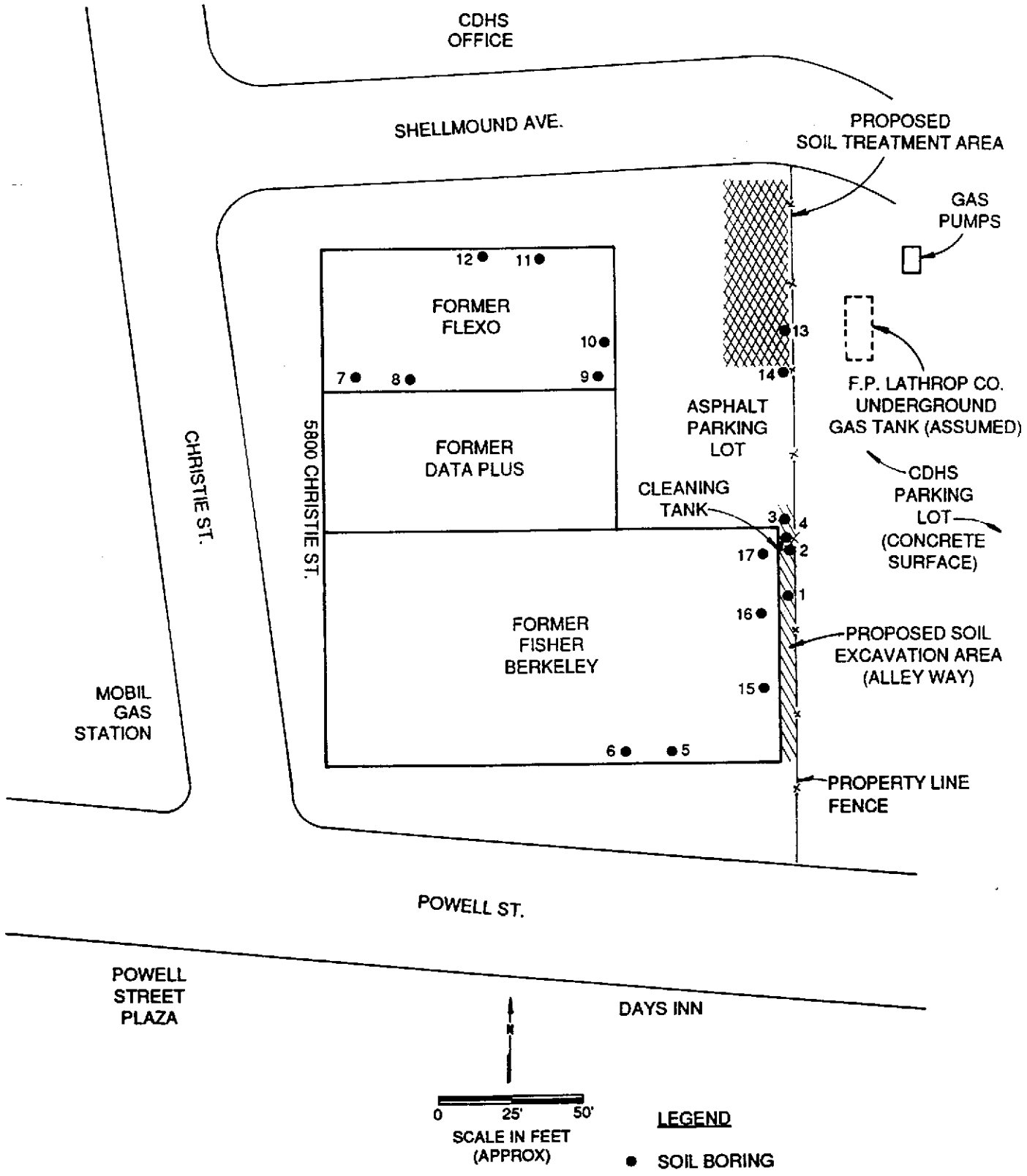
A Mobil gas station is located to the west of the site on the opposite corner of Powell and Christie (Figure 1-2). A new shopping center, the Powell Street Plaza, is located south of the site across Powell Street.

FIGURE 1-1
SITE LOCATION MAP



McLaren Environmental Engineering

FIGURE 1-2
SOIL BOREHOLE
LOCATION MAP



2.0 SOIL CONTAMINATION

A soil investigation was conducted by Robert Gils Associates, Inc. (RGA). A total of 17 soil borings (see Figure 1-2 for location) were drilled both outside and inside of the building. The site assessment report prepared by RGA is included in Appendix A. The following paragraphs are a summary of RGA soil sampling program.

Present tenant activities were examined to determine sites of probable soil contamination. The location of equipment, machinery and sites of obvious surface contamination (i.e., splatter marks) are areas with the potential for soil contamination and were therefore sampled.

An extendible hand auger, with a solid spoon coring device were used for the actual sampling for the shallow holes (less than four feet). For the deeper holes a mechanical rotary drill was used for the drilling and the samples were taken with the solid spoon coring device. Soil cores are two inches in diameter and six inches long and are contained in brass sleeves. The sleeves are capped at both ends with aluminum foil and plastic caps then wrapped with duct tape. Each core is assigned a unique number. Cores were stored in an ice chest in the field and a refrigerator in the office. A same day courier transported the samples to the laboratory.

Fireman's Fund Insurance Companies Environmental Laboratory in Petaluma (the name has recently been changed to AccuLab) analyzed the samples. This lab is certified by the American Industrial Hygiene Association (AIHA #103) and by the California Department of Health Services (DOHS) to analyze hazardous waste materials. EPA Method 8240 was used for samples analyzed for solvents. EPA Methods 5020/8015/8020 were used for samples analyzed for gasoline and BTEX".

Tables 2-1, 2-2 and 2-3 summarize the chemical analyses of the soil samples and the organic compounds detected at various depths in the soil borings. As indicated in Table 2-2, the soil containing significant concentration of VOC compounds is limited to borings number 1, 2, 3 and 4 area.

3.0 GROUNDWATER CONTAMINATION

The RGA report indicated groundwater was first encountered at about 10 to 12 feet below grade for most soil borings. However, field observation in open boreholes showed groundwater level at less than five feet below grade. This may be indicative of slow recharge due to the presence of Bay Mud.

Based on the presence of organic compounds in soil samples taken below the groundwater table, 10 to 12 feet deep, (Table 2-1 through Table 2-3), and field observation of an oily sheen in open boreholes, it is concluded that the shallow groundwater ~~is likely~~ to contain dissolved organic compounds of which the gasoline type compound may have been contributed from off-site source.

A groundwater investigation and interim groundwater remediation plan will be submitted under separate cover.

TABLE 2-1

SUMMARY OF SOIL CHEMICAL ANALYSIS NEAR
F.P. LATHROP COMPANY GASOLINE TANK

Boring No.	Sample Depth	Organic Compounds Detected	Concentration (PPM)
13	6'	None Detected	ND
	11'	Gasoline	3.2
14	11'	Gasoline	5.4
		Xylene	0.057

TABLE 2-2

SUMMARY OF SOIL CHEMICAL ANALYSIS NEAR
ALLEY WAY AND CLEANING TANK

Boring No.	Sample Depth	Organic Compounds Detected	Concentration (PPM)
1	4'	Carbon Tetrachloride	23.0
		Ethyl Benzene	3.0
		Toluene	1400.0
		1,1,1-Trichloroethane	190.0
		Trichloroethene	960.0
		Xylenes	8.4
	6'	Toluene	26.0
		1,1,1-Trichloroethane	3.7
		Trichloroethene	19.0
2	7'	Carbon Tetrachloride	12.0
		1,1-Dichloroethane	4.2
		Toluene	87.0
		1,1,1-Trichloroethane	76.0
		Trichloroethene	160.0
	12'	Carbon Tetrachloride	11.0
		Toluene	56.0
		1,1,1-Trichloroethane	69.0
		Trichloroethene	93.0
		Gasoline	35.0
3	5'	Toluene	33.0
		1,1,-Trichloroethane	7.3
		Trichloroethene	88.0
	12'	Toluene	0.81
		1,1,1-Trichloroethane	0.49
		Trichloroethene	2.9
		Gasoline	1.4
4	2'5"	Carbon Tetrachloride	27.0
		Ethyl Benzene	28.0
		Toluene	2800.0
		1,1,1-Trichloroethene	280.0
		Trichloroethene	3600.0

NOTE: Borings #1, #2, #3, and #4 are located in the Alley Way and near the cleaning tank.

TABLE 2-2
(Continued)

SUMMARY OF SOIL CHEMICAL ANALYSIS NEAR
ALLEY WAY AND CLEANING TANK

Boring No.	Sample Depth	Organic Compounds Detected	Concentration (PPM)
15	6'	Benzene	0.053
		Tetrachloroethene	0.0043
		Toluene	0.0077
		Xylenes	0.0042
	12'	Benzene	0.023
		Ethyl Benzene	0.0026
		Tetrachloroethene	0.0041
		Xylenes	0.0050
16	6'	Benzene	0.074
		1,1-Dichloroethane	0.078
		Ethyl Benzene	0.0037
		Toluene	0.027
		Vinyl Chloride	0.150
		Xylenes	0.0053
	12'	Benzene	0.021
		1,1-Dichloroethane	0.0045
		Tetrachloroethene	0.0048
		Toluene	0.011
		Vinyl Chloride	0.078
		Xylenes	0.0032
17	6'	Benzene	0.0041
		Chloroethane	0.071
		1,1-Dichloroethane	0.003
		Tetrachloroethene	0.004
		Toluene	0.0063
		Vinyl Chloride	0.420
	12'	Non Detected	ND

NOTE: Borings #15, #16 and #17 are located inside the building formerly occupied by Fisher Berkeley.

TABLE 2-3

SUMMARY OF SOIL CHEMICAL ANALYSIS INSIDE FORMER FISHER BERKELEY AND FLEXO OFFICES

Boring No.	Sample Depth	Organic Compounds Detected	Concentration (PPM)
5	3'5"	None Detected	ND
6	3'	1,1-Dichloroethane	0.0076
		Tetrachloroethene	0.034
		Toluene	0.006
		1,1,1-Trichloroethane	0.077
		Trichloroethene	0.140
		Xylenes	0.0049
7	3'	None Detected	ND
8	3'4"	None Detected	ND
9	2'	Tetrachloroethene	0.012
		Toluene	0.0032
		Trichloroethene	0.012
10	6'3"	Toluene	0.004
		1,1,1-Trichloroethane	0.0036
		Trichloroethene	0.0091
11	4'	Toluene	0.0055
		Trichloroethene	0.0086
12	2'	Toluene	0.0028
		Trichloroethene	0.0078

4.0 SOIL REMEDIATION PLAN

The proposed soil remediation plan includes excavation of contaminated soil, and construction and operation of a treatment system to remediate the contaminated soil. The work includes baseline sampling of the soils during construction of the treatment system and before system start-up to establish the soil contamination levels prior to commencement of treatment. After treatment, sampling will also be performed to confirm that the soils are clean. The treated soil will be declassified, a soil closure report will be prepared, and the treatment system and soil will be removed. Total soil volume to be remediated is expected to be less than 100 cubic yards.

4.1 Excavation of Contamination Soil

In-situ contaminated soil will be excavated and stockpiled into a soil treatment unit. Because the contaminated soil is in an area with difficult access, a subcontractor specializing in tight access excavation will be used.

The soil to be excavated is situated in a four foot wide alley way between the east side of the existing building and the eastern property line, along which there is a five foot high fence (Figure 1-2). Soil will be excavated down to a depth of five feet below existing grade, along the length of the alley way. This depth corresponds to the water table elevation and the depth at which a six inch concrete slab was poured during foundation construction. Because the excavation will be immediately adjacent to the existing building foundation, soil will be excavated in two phases to mitigate the possibility of foundation movement due to removal of supporting soils. Each excavation phase will consist of removing alternating sections of soil. Each section of soil will be approximately five feet long, 4 feet wide, and five feet deep. The first phase of excavation will be backfilled with properly compacted fill consisting of imported sand/gravel, before the second phase of excavation proceeds. Total volume of soil to be excavated is expected to be than 100 cubic yards. The Bay Area Air Quality Management District (BAAQMD) will be informed one week in advance of the excavation.

Once excavation and backfill operations are completed, the ground surface in the alley way will be sloped to drain away from the building and paved with at least three inches of concrete. If excessive contamination is found on the walls of excavation, an organic vapor recovery system will be installed in the backfill to evacuate the residual VOC left in the soil. The emission of the vent system vapor will be filtered by vapor phase activated carbon prior to atmospheric emission.

4.2 Construction of the Soil Treatment Unit

Excavated soil will be stockpiled into a soil treatment unit which will be located in the parking lot. The soil treatment pile will be approximately 20 feet by 45 feet in plan dimensions and approximately three feet high. A conceptual design is presented as Figure 4-1. The sequence of construction will be as follows:

1. A high density polyethylene (HDPE) liner will be placed along the full length of the treatment unit bottom. Berm support will be placed underneath the edges of the liner to contain fluids which may accumulate at the bottom of the soil unit during treatment.

2. The soil will be placed on top of the liner using wheel barrows.

3. Three two-inch diameter aeration pipes will be installed during placement of the soil at the locations indicated on the cross section of the soil unit, shown on Figure 4-1.

4. A header pipe will connect the aeration pipes to a blower.

5. A black tarp will be placed over the surface of the soil treatment unit to minimize volatilization of the soil contaminants.

6. The air circulation system will consist of a blower, and a vapor phase carbon treatment unit. A humidifier and heater are optional depending on the need to enhance bacterial degradation of the contaminants. These various features of the circulation system are shown on the treatment system schematic, Figure 4-2. An air emission permit will be obtained from the Bay Area Air Quality Management Board (BAAQMD).

FIGURE 4-1
CONCEPTUAL PLAN
SOIL TREATMENT UNIT

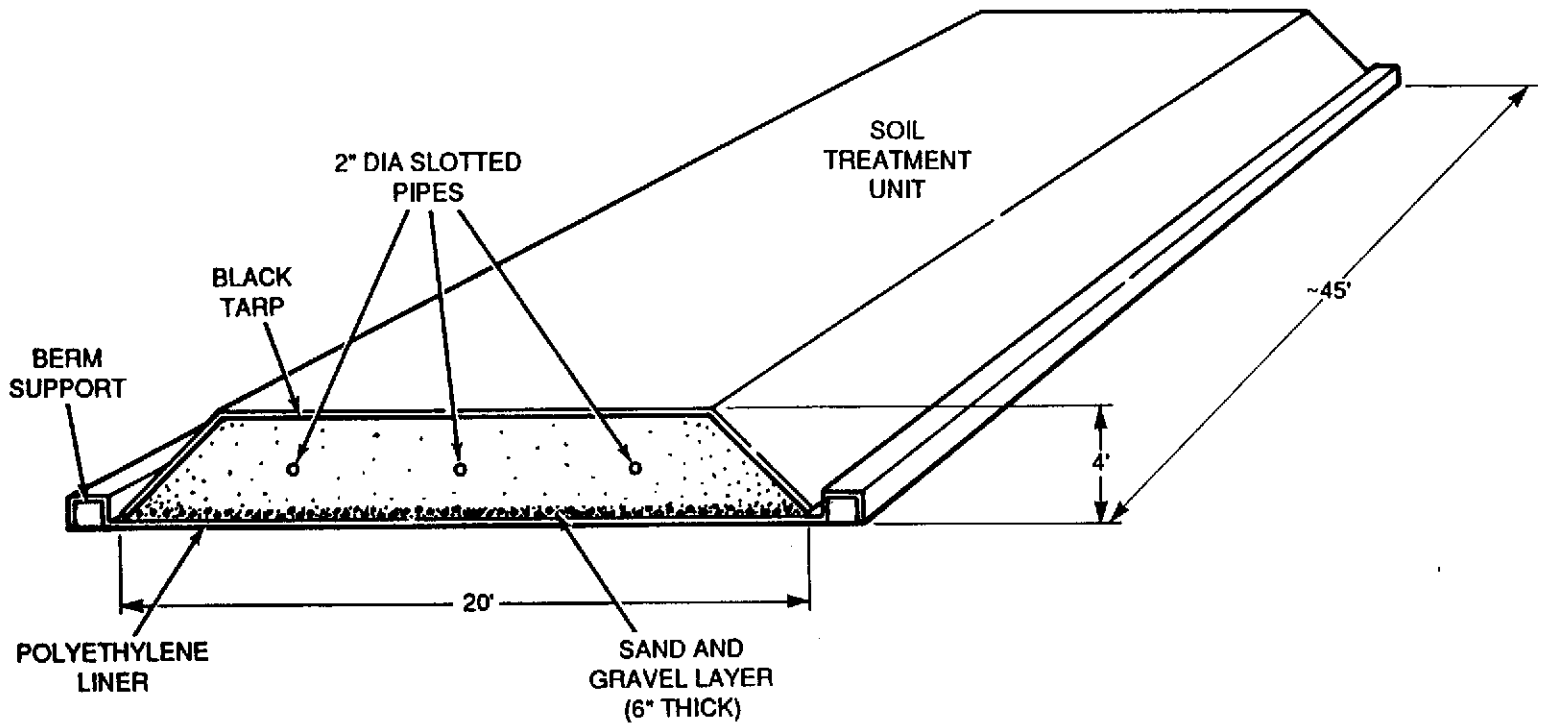
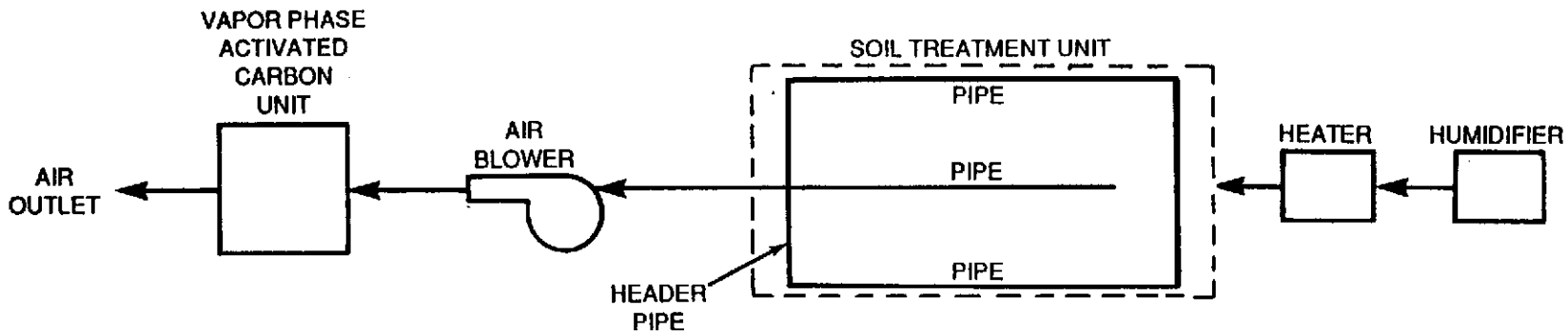


FIGURE 4-2
SOIL TREATMENT
SYSTEM SCHEMATIC



4.3 Baseline Soil Sampling

This task will consist of initial baseline sampling of the soil treatment unit for soil characterization prior to operation of the bioremediation system. For baseline characterization of the soil unit, the soil will be sampled and analyzed for field parameters, biological parameters, inorganic parameters, and organic parameters. One statistical representative sample will be analyzed for each 50 cubic yards of soil.

Field parameters which will be determined include soil pH, moisture content, soil temperature, and soil classification. Biological parameters to be analyzed for include biological oxygen demand (BOD), chemical oxygen demand (COD), microbial plate counts and bacteria identification. Inorganic parameters to be analyzed for include trace metals, total nitrogen, phosphate, and nitrate. Organic parameters to be analyzed for include volatile organic compounds by EPA Method 8240 and Total Organic Carbon.

4.4 Treatment System Start-Up and Operation and Maintenance

After start-up of the treatment system, all system operating parameters will be monitored on a daily basis. During this period, mechanical equipment and instrumentation will be closely checked to insure proper operation. Parameters that indicate the activity of bacteria within the soil units will be carefully checked. These parameters include temperature within the soil pile as well as carbon dioxide, and oxygen content of the extracted vapor.

Use of the constructed liner and ventilation system will provide the capability to enhance the microbial ecology in the soil pile for optimal biodegradation of the hydrocarbon compounds. Factors which may be enhanced are moisture, nutrients, temperature, and air (oxygen) supply. The moisture content in the soil pile will be maintained between 15 and 30 percent, initially by watering, and subsequently through humidity control. For nutrient enhancement, nutrients such as phosphate and nitrogen will be supplemented if baseline nutrient levels are deficient. For nitrogen, the level is defined as five to ten percent by weight of total organic carbon. For phosphate, the level is defined as one percent by weight of total organic carbon. If required, nutrients will be added as a one-time supplement blended into the soil during the construction of the soil treatment units.

Temperature enhancement can be achieved by retention of heat entrapped by the black tarp, oxidation due to biodegradation, and passive solar heating, if necessary. Over heating of the soil unit will be controlled by air cooling. The lower limit of explosion (LEL) will be monitored from the air leaving the soil pile and will be operating below LEL to prevent explosion.

The air supply will be maintained to keep the soil treatment at an aerobic environment. A mass balance will be calculated prior to implementation of the treatment process to assure adequate air flow to maintain an oxygen rich environment. A positive vacuum will be kept on the soil unit at all times.

The proposed clean up level of total volatile organic hydrocarbons (VOCs) is 50 parts per million (ppm). The duration of treatment is estimated at two months.

4.5 Perform Cleanup Confirmation Soil Sampling

Prior to closure of the bioremediation system, soil sampling and analysis will be performed to confirm that soil treatment is complete. Samples will be analyzed for inorganic and organic parameters.

Inorganic parameters to be analyzed include trace metals, total nitrogen, phosphate, and nitrate. Organic parameters will include volatile organic compounds by EPA Method 8240, and Total Organic Carbon.

Approximately one soil sample for every 50 cubic yards of soil within the treatment units will be collected for analysis. Collection of the soil samples will be performed according to EPA protocol using a hand auger. A random sampling methodology will be used to collect representative samples from the soil treatment unit. The proposed clean up level of VOC is 50 ppm.

4.6 Soil Declassification

After the soil is biotreated to an acceptable cleanup level, there will be one round of soil declassification sampling prior to disposal to the Class III landfill. The procedure of declassification of the soil to non-hazardous and non-toxic will be in accordance with Title 22, Article 11. One representative sample will be analyzed for each 50 cubic yards of soil. This step is necessary because Class III landfills will not accept the treated soil unless they have been tested for declassification.

4.7 Closure Report

Upon completion of the cleanup confirmation soil sampling and analysis, a closure report will be prepared with recommendations for decommissioning the treated soil and treatment areas. The report will describe the fulfillment of the objectives of the soil remediation effort.

4.8 Soil Treatment Unit Decommissioning

After agency approval of the soil treatment report, the soil treatment system will be disassembled. Mechanical and electrical equipment, and piping (excluding piping installed within the soil units) will be dismantled and placed in a storage area on the site.

The HDPE membrane and tarp will be cut to facilitate removal. The membrane and tarp will be disposed of at the Class III landfill.

The soil removed from treatment units is expected to be chemically suitable for disposal at a Class III landfill or used as fill beneath the new parking lot.

There is a possibility that liquids will accumulate in the bottom of the treatment unit. These liquids will be collected, and recycled back into the soil pile.

5.0 SITE SAFETY AND HEALTH PLAN

McLaren's Site Safety and Health Plan is presented as Appendix B. It has been written for the use of McLaren, its employees and subcontractors for the specific site conditions, purposes, dates, and personnel specified; therefore, the plan must be amended if these conditions change.

6.0 SCHEDULE

The proposed duration of soil treatment is about eight weeks depending on the initial VOC concentration in soil treatment unit and the final negotiated cleanup level. The soil declassification testing and approval from California Department of Health Services may take about four to eight weeks. The decommissioning of the treated soil will be about one week.

The actual schedule will depend on permit approvals and equipment/supply availability.

APPENDIX A

ROBERT GILS & ASSOCIATES
SOIL ASSESSMENT REPORT

APPENDIX B

HEALTH AND SAFETY PLAN

APPENDIX A

ROBERT GILS & ASSOCIATES
SOIL ASSESSMENT REPORT

Site Assessment
5800 Christie Street
Emeryville, California
January 20, 1989

ROBERT E. GILS & ASSOCIATES

Environmental Health Consultants • Certified Industrial Hygienists
San Francisco • Dallas

Site Assessment
5800 Christie Street
Emeryville, California
January 20, 1989

The following report is the result of a soil survey program conducted by Robert Gils Associates Inc. (RGA) at the captioned location between October and December of 1988. Steve Croley of Croley and Herring Investment Company, provided all historical information regarding the site, past owners, past tenants and neighbors.

Executive Summary

The results of the survey conducted by RGA are summarized as follows:

1. Significant levels of organic solvents are found in the alley between the building and the adjacent property to the east. Solvent contamination extends to a depth of at least twelve feet. As the depth of groundwater at this site is twelve feet, one must assume that groundwater quality has been affected and that remedial actions will be necessary. The discovered solvents are: Carbon Tetrachloride, Ethyl Benzene, Toluene, 1,1,1-Trichloroethane, Trichloroethene and Xylenes.

2. The solvents discovered in the alley are most likely a result of spills associated with a cleaning tank located in the alley. Possible illegal disposal of solvents by unknown parties may have contribruted to the contamination.

3. Low levels of gasoline discovered at depths greater than ten feet suggest that an underground gasoline tank located in the adjacent property to the east has leaked gasoline onto the site.

Site Description

The site is a 0.82 acre property located on the southeast corner of Christie Street and Shellmound Avenue in Emeryville California (see Location Map). A one story, 22,800 square foot industrial warehouse is the only building located on the property. The building was constructed approximately twenty (20) years ago. Croley and Herring Investment Company purchased the property from Milligan Spika Company in 1980. Space in the building is leased to various tenants. All tenants have been evicted as of January 1989 to clear the building for a new lease. Concrete or asphalt slabs cover the entire site except for the alley to the east of the building and a thin border between the building and Christie and Powell Streets. These areas are unpaved.

The last tenants to occupy the building were Fisher Berkeley (a manufacturer of communication equipment for health care applications), Flexo Packaging (a manufacturer of printing plates for commercial packaging applications) and Data Plus (a computer software firm). These three tenants were evicted in late 1988/early 1989. Past tenants include Milligan-Spika (a distributor of auto parts), CRT (a computer and office machine repair business) and PRT (a distributor of phonograph records). Fisher Berkeley was an original tenant.

F.P. Lathrop Company owns the adjacent property to the east. In the past F.P. Lathrop Construction used the property as its corporate yard. Currently, a Sherwin-Williams wholesale paint store and the California Department of Health Services leases it.

A Mobil gas station is located to the west of the site on the opposite corner of Powell and Christie. A new shopping center called the Powell Street Plaza is located south of the site across Powell Street.

Geologic Setting

Four to six feet of mixed alluvial and fill material (generally poorly sorted silty sand with cobbles) overlays an unknown thickness of black organic bay mud.

Research conducted at the Regional Water Quality Control Board (RWQCB) indicates that the groundwater flow at nearby sites is generally south to south-west towards the San Francisco Bay. No groundwater flow data for this particular piece of property exists.

Groundwater was encountered in our borings at approximately twelve feet.

Methods and Sampling Strategy

Present tenant activities were examined to determine sites of probable soil contamination. The location of equipment, machinery and sites of obvious surface contamination (i.e., splatter marks) are areas with the potential for soil contamination and were therefore sampled.

An extendible hand auger, with a solid spoon coring device were used for the actual sampling for the shallow holes (less than four feet). For the deeper holes a mechanical rotary drill was used for the drilling and the samples were taken with the solid spoon coring device. Soil cores are two inches in diameter and six inches long and are contained in brass sleeves. The sleeves are capped at both ends with aluminum foil and plastic caps then wrapped with duct tape. Each core is assigned a unique number. Cores were stored in an ice chest in the field and a refrigerator in the office. A same day courier trasported the samples to the laboratory.

Fireman's Fund Insurance Companies Environmental Laboratory in Petaluma (the name has recently been changed to AccuLab) analyzed the samples. This lab is certified by the American Industrial Hygiene Association (AIHA #103) and by the

California Department of Health Services (DOHS) to analyze hazardous waste materials. EPA method 8240 was used for samples analyzed for solvents. EPA methods 5020/8015/8020 were used for samples analyzed for gasoline and BTEX.

Sample Results - Solvents

Complete laboratory results may be found at the end of this report.

Significant levels of organic solvents were found in the soil located in the narrow alley between the building and the property to the east. Solvents found in the soil are Carbon Tetrachloride, Ethyl Benzene, Toluene, 1,1,1-Trichloroethane, Trichloroethene and xylenes. The maximum concentration of these contaminants are as follows:

Carbon Tetrachloride	27 ppm
Ethyl Benzene	28 ppm
Toluene	2800 ppm
1,1,1-Trichloroethane	280 ppm
Trichloroethene	3600 ppm
Xylenes	42 ppm

These results are from a soil sample taken at a depth of 2' 6" east of the cleaning tank mounted on the exterior of the building in the unpaved alley (Hole 4-Sample 9653). The tank is approximately four feet long one foot wide and three feet deep. The cleaning tank is indicated on both the Site Plan, the Bore Hole Location Drawing and the Alley Sample Location Chart.

In the same location (Hole 2-Sample 9667) at a depth of twelve feet (the approximate depth of groundwater) the solvent concentrations are as follows:

Carbon Tetrachloride	11 ppm
Ethyl Benzene	<2.5 ppm
Toluene	56 ppm
1,1,1-trichloroethane	69 ppm
Trichloroethene	93 ppm
Xylenes	<2.5 ppm

These levels of solvent are found at groundwater depth. Furthermore the water in the bottom of the borehole is shiny and smells of solvent. A sample (Sample 9668) taken at a depth of six feet in the same area shows solvent levels between the levels found in the above two samples.

Fifteen feet to the south, (Hole 1) samples were taken at three feet (Sample 9665) and five feet (Sample 9666). At five feet the drill bit was refused (probably a buried piece of concrete or steel). The solvent levels at three feet are:

Carbon Tetrachloride	23 ppm
Ethyl Benzene	3 ppm
Toluene	1400 ppm
1,1,1-Trichloroethane	190 ppm
Trichloroethene	960 ppm
Xylenes	8.4 ppm

At this distance from the cleaning tank, the solvent levels fall off quickly with depth. For example at a depth of five feet in the same borehole the solvent levels are:

Carbon Tetrachloride	<2.5 ppm
Ethyl Benzene	<2.5 ppm
Toluene	26 ppm
1,1,1-Trichloroethane	3.7 ppm
Trichloroethene	19 ppm
Xylenes	<2.5 ppm

The last location of concern with regards to solvents is Hole 3. Sample 9669 is at a depth of five feet six inches and sample 9670 is at a depth of twelve feet. Carbon Tetrachloride and Ethyl Benzene are less than detectable in both of these samples (detection limits of 2.5 ppm for sample 9669 and 0.25 ppm for sample 9670). Toluene is found at 33 ppm in sample 9669 and 0.81 ppm in sample 9670. 1,1,1-Trichloroethane is found at 7.3 ppm in sample 9669 and 0.49 ppm in sample 9670. Trichloroethene follows a similar pattern (88 ppm in sample 9669 and 2.9 ppm in sample 9670). Xylenes were not detected (same detection limits as for Carbon Tetrachloride and Ethyl Benzene).

Finally, the samples taken from boreholes inside the building showed less than detectable levels or, at the most, concentrations in the low parts per billion range (again, see the laboratory reports for details).

Discussion - Solvents

At least some of the solvent contamination is due to spills from around the cleaning tank. Evidence includes the far greater depth of penetration near the tank (Hole 2) as compared with the depth of penetration in Hole 3 and Hole 1. This indicates that a greater volume of material has been spilled near the tank than the other areas. Also, if the anticipated groundwater gradient (south to southwest) is correct, we would expect to find significantly lower solvent concentrations directly north of the spill point. The results from Hole 3 confirm this.

Splash marks on the wall in the alley and the shallow nature of the contamination south of the cleaning tank, indicate that dumping by unknown parties has probably contributed to the contamination. Solvent contamination a distance from

the cleaning tank entirely due to spills near the tank would exhibit concentrations increasing with depth because of the tongue-like nature of point source plumes. This is the opposite of the pattern found in the alley (contamination decreases with depth). We expect that the concentration of shallow solvent contamination will continue to decrease as one moves south in the alley because the access to the alley is from the north and materials seem to be dumped near the entrance. The lateral extent of shallow contamination is unknown.

To summarize, we believe that the bulk of the solvent contamination found in the soil is due to spills related with the cleaning tank. Coupled with the contamination caused by the cleaning tank activities a component of the plume may be due to solvent disposal in the alley by unknown parties.

Sample Results - Gasoline

A gasoline pump is located on the F.P. Lathrop Company property to the east of the site. The gas pump is shown on the Site Plan and on the Bore Hole Location Map. It is unknown if the underground tank associated with the pump has ever been registered or whether or not it is still in place. The pump does not appear to be in service at this time. The location of the tank as drawn on the Site Plan and Bore Hole Location Map is inferred from surface evidence. This evidence includes the location of the vent and filler holes and the appearance of the slab.

Two holes (Holes 13 and 14) were drilled on the Croley and Herring Investment Company side of the property line as close to the assumed location of the tank as possible in order to assess the possibility of a leak. Samples from these holes were tested for Total Fuel Hydrocarbons + BTX (EPA Method 5020/8015/8020) Additionally, the twelve foot depth samples (Samples 9667 and 9670) from Hole 2 and Hole 3 were tested for Total Fuel Hydrocarbons.

The sample results are as follows (the holes are in order of north to south):

Hole #	Sample#	Depth	Results
13	9663	6'	None Detected
13	9664	11'	Gasoline 3.2 ppm
14	9662	11'	Gasoline 5.4 ppm Xylene 0.057 ppm
3	9670	12'	Gasoline 1.4 ppm
2	9667	12'	Gasoline 35 ppm

Discussion - Gasoline

The concentration of gasoline found on the Croley and Herring property is less than 100 ppm, but there is still detectable gasoline present. With the absence of evidence of other tanks in the area we have to assume that the plume is

emanating from the tank on the F.P Lathrop property. We do not believe that gasoline found in the soil on the Croley and Herring property is the result of a spill or surface dumping because the gasoline concentration increases with depth and is generally not detectable near the surface.

Without sampling on the F.P. Lathrop property the extent of contamination cannot be assessed nor can the source of the gasoline be proven.

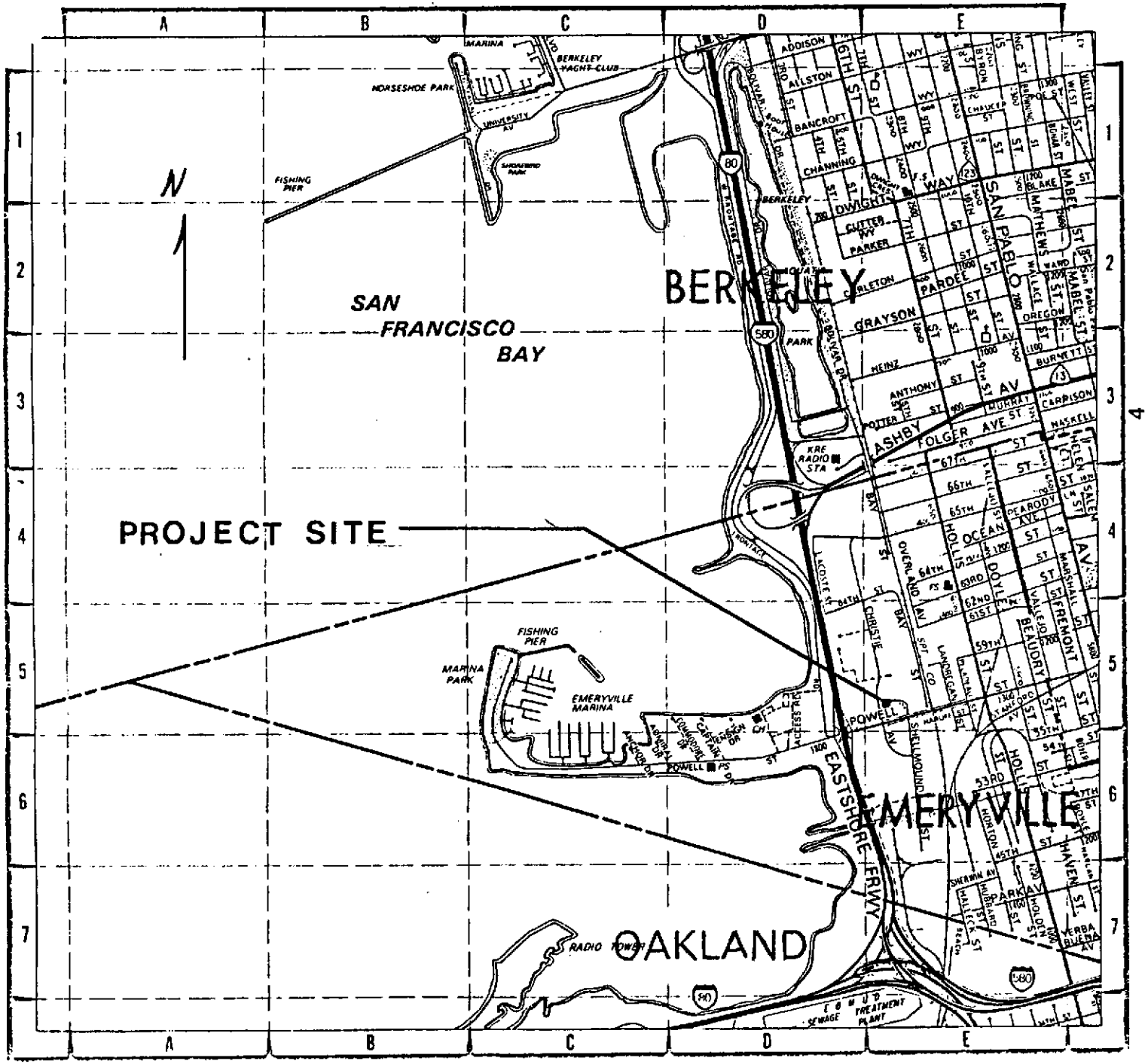
Conclusion

Significant levels of solvent contamination were found in the alley between the warehouse building and the adjacent property to the east. The levels are high enough at twelve feet (the groundwater depth on this property) to insure that the groundwater has been impacted.

The solvent contamination is probably due to a combination of activities related to the cleaning tank on the northeast corner of the building and dumping of solvents into the alley itself.

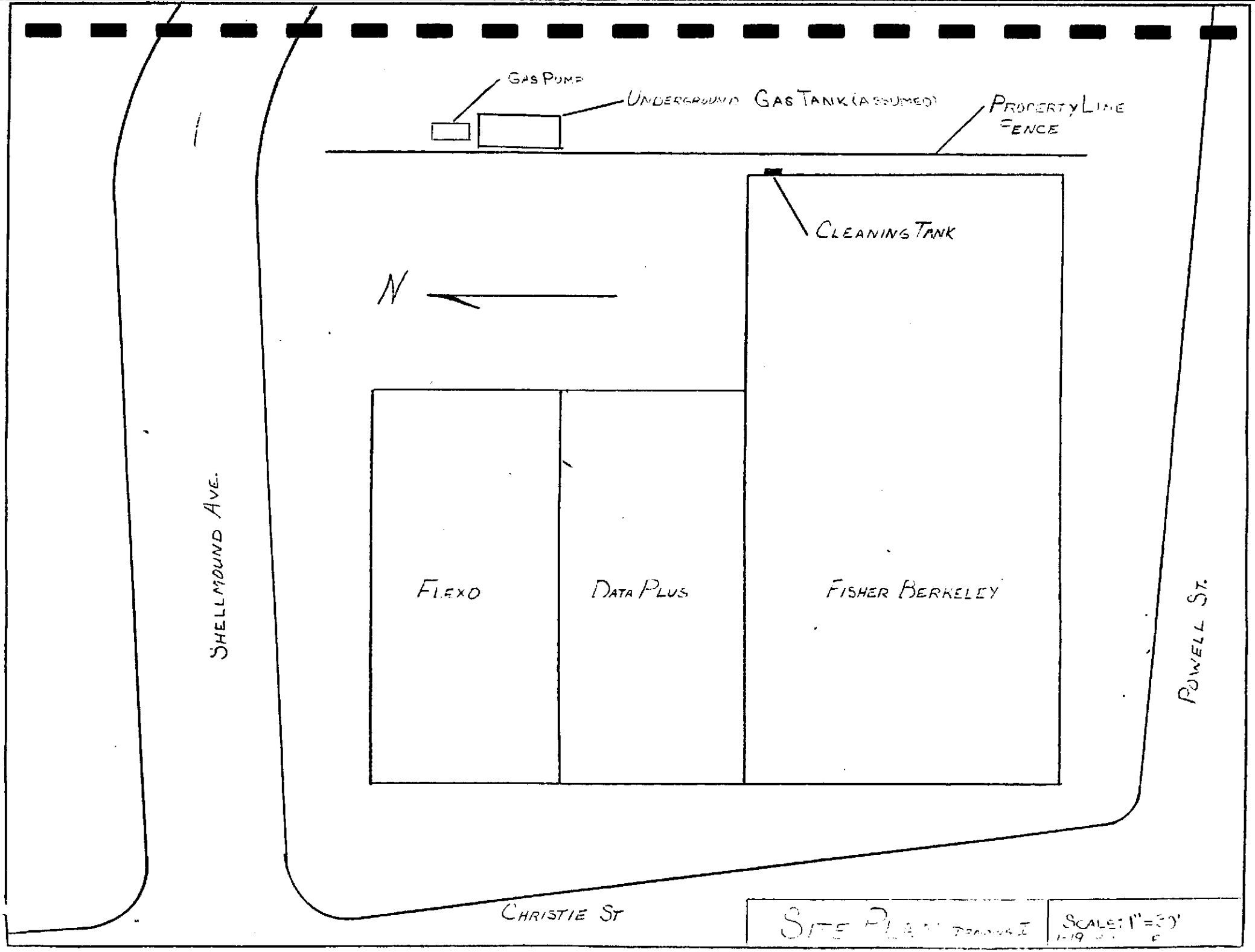
Evidence suggests that the gasoline tank located on the F.P. Lathrop property (the property adjacent to the east) is leaking (or has leaked) gasoline into the soil and onto the Croley and Herring property.

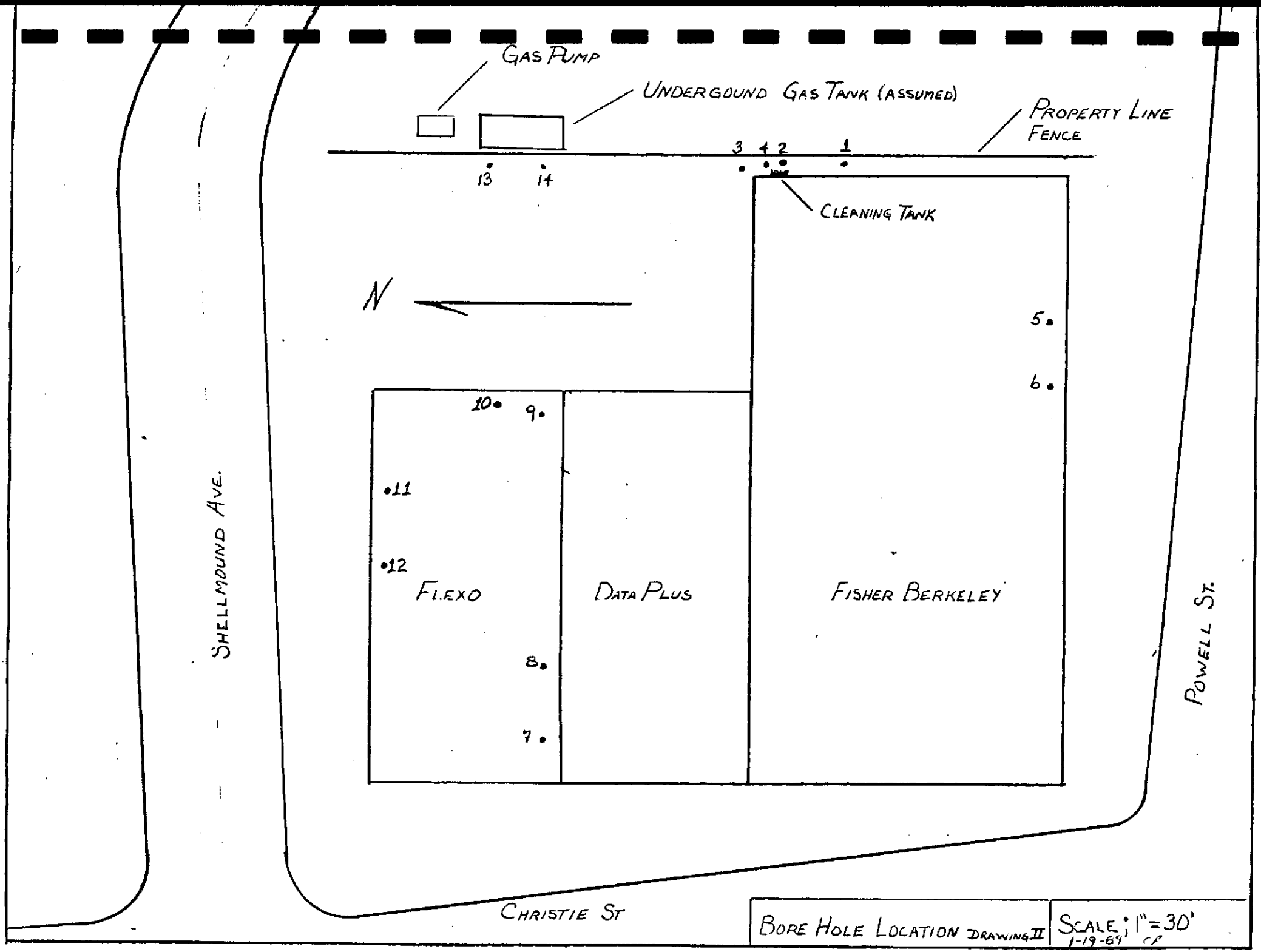
The industrial history of the area will complicate the cleanup of the site. Overlapping plumes from several sources over a long period of time will make it difficult to determine whose responsibility stops where. Also, unless a cleanup on the site is accompanied by cleanups on adjacent properties, any gains made in soil and ground water quality will possibly be lost due to migration of plumes from other areas.



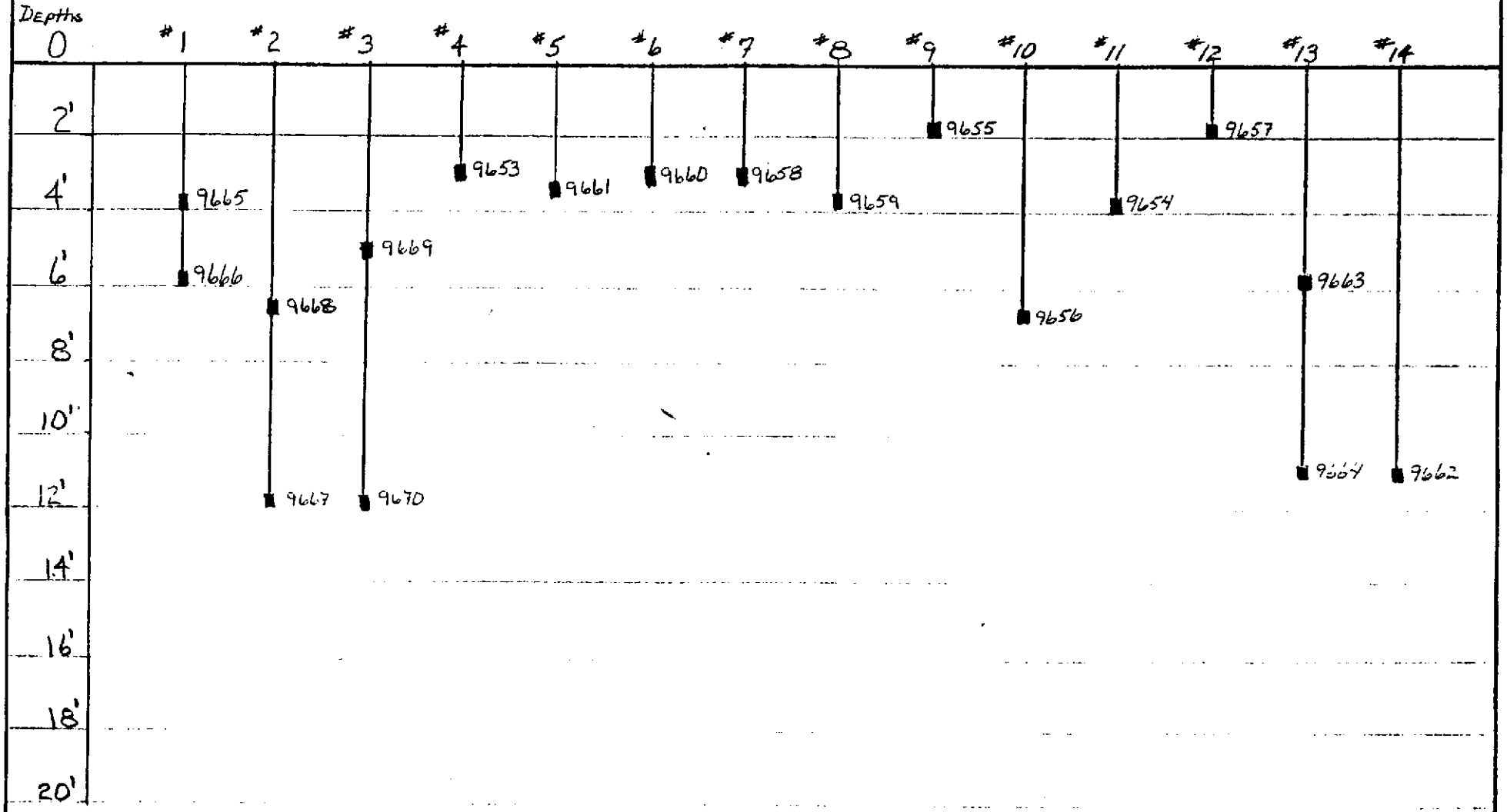
LOCATION MAP

SCALE: 1" = 2200'


GAS PUMP
UNDERGROUND GAS TANK (ASSUMED)
PROPERTY LINE
FENCE
CLEANING TANK
N
FLEXO
DATA PLUS
FISHER BERKELEY
SHELLMOUND AVE.
POWELL ST.
CHRISTIE ST
SITE PLAN
SCALE: 1" = 30'

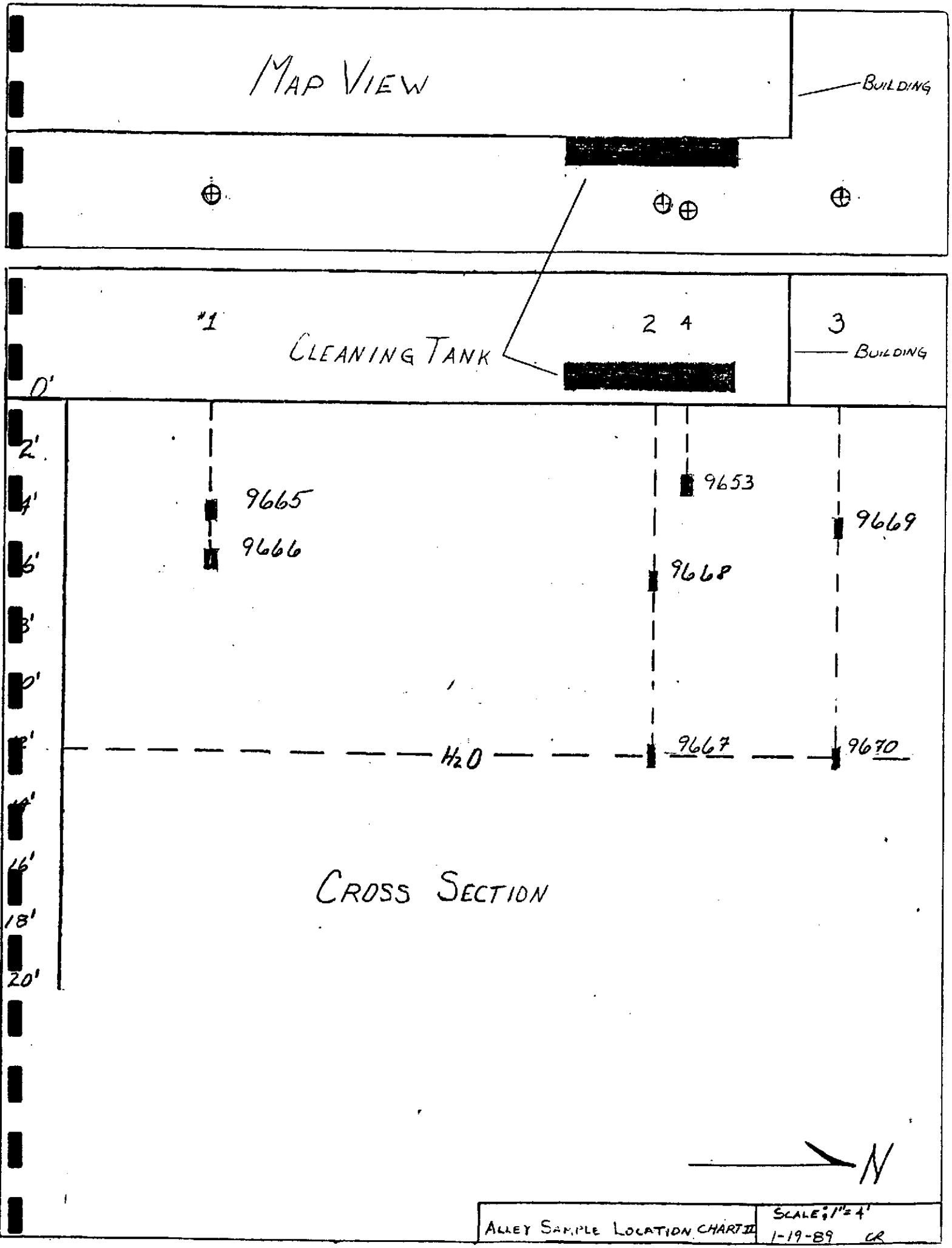

GAS PUMP
UNDERGOUND GAS TANK (ASSUMED)
PROPERTY LINE
FENCE
3
4
2
1
13
14
CLEANING TANK
N
5
6
10
9
11
12
8
7
FLEXO
DATA PLUS
FISHER BERKELEY
SHELLMOUND AVE.
POWELL ST.
CHRISTIE ST
BORE HOLE LOCATION DRAWING II
SCALE: 1"=30'
1-19-69

Bore Hole Numbers



NOTES;
1) Hole Numbers 1-3 and 13-14 were drilled with a Mechanical Rotary Drill.
2) Hole Numbers 4-12 were drilled with a hand auger.
3) See Drawing II for Bore Hole Locations.

Schematic of Sample Depths Chart I	Vertical Scale 1" = 4' 1-19-89 CR


MAP VIEW
BUILDING
#1
CLEANING TANK
2 4
3
BUILDING
0'
2'
4'
6'
8'
10'
12'
14'
16'
18'
20'
9665
9666
9653
9668
9669
H2O
9667
9670
CROSS SECTION
N
ALLEY SAMPLE LOCATION CHART II
SCALE: 1" = 4'
1-19-89 CR

Summary of Soil Sample Results

All organic solvent sample by EPA 8240.
Gasoline + BTEX samples were by EPA 5020/8015/8020
Only detected compounds are reported here. See laboratory reports for detection limits and non-detected compounds.

Units: mg/kg (ppm)
ug/kg (ppb)

Hole	Sample	Depth	Results
1	9665	4'	Carbon Tetrachloride 23 ppm Ethyl Benzene 3.0 ppm Toluene 1400 ppm 1,1,1-Trichloroethane 190 ppm Trichloroethene 960 ppm Xylenes 8.4 ppm
	9666	6'	Toluene 26 ppm 1,1,1-Trichloroethane 3.7 ppm Trichloroethene 19 ppm
2	9668	7'	Carbon Tetrachloride 12 ppm 1,1-Dichloroethane 4.2 ppm Toluene 87 ppm 1,1,1-Trichloroethane 76 ppm Trichloroethene 160 ppm
	9667	12'	Carbon Tetrachloride 11 ppm Toluene 56 ppm 1,1,1-Trichloroethane 69 ppm Trichloroethene 93 ppm Gasoline 35 ppm
3	9669	5'	Toluene 33 ppm 1,1,1-Trichloroethane 7.3 ppm Trichloroethene 88 ppm
	9670	12'	Toluene 0.81 ppm 1,1,1-Trichloroethane 0.49 ppm Trichloroethene 2.9 ppm Gasoline 1.4 ppm
4	9653	2'5"	Carbon Tetrachloride 27 ppm Ethyl Benzene 28 ppm Toluene 2800 ppm 1,1,1-Trichloroethane 280 ppm Trichloroethene 3600 ppm
5	9661	3'5"	None Detected

6	9660	3'	1,1-Dichloroethane 7.6 ppb Tetrachloroethene 34 ppb Toluene 6.0 ppb 1,1,1-Trichloroethane 77 ppb Trichloroethene 140 ppb Xylenes 4.9 ppb
7	9658	3'	None Detected
8	9659	3'4"	None Detected
9	9655	2'	Tetrachloroethene 12 ppb Toluene 3.2 ppb Trichloroethene 12 ppb
10	9656	6'3"	Toluene 4.0 ppb 1,1,1-Trichloroethane 3.6 ppb Trichloroethene 9.1 ppb
11	9654	4'	Toluene 5.5 ppb Trichloroethene 8.6 ppb
12	9657	2'	Toluene 2.8 ppb Trichloroethene 7.8 ppb
13	9663	6'	None Detected
	9664	11'	Gasoline 3.2 ppm
14	9662	11'	Gasoline 5.4 ppm Xylene 0.057ppm

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ENVIRONMENTAL LABORATORY

Jackie Daly
Robert Gils Associates Inc.
6400 Hollis Street, Suite 3
Emeryville, CA 94608

Client Code: GILS4
Survey # JC:CH 1882

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 884861
Date Received: 10/12/88
Date Reported: 10/27/88

Date Analyzed: 10/21/88

PURGEABLES BY GC/MS(EPA8240)

COMPOUNDS: PURGEABLES	LAB# 67101 SMP# 9653	DET. LIM. UG/GM	67102 9654	DET. LIM. UG/KG	67103 9655	DET. LIM. UG/KG
BENZENE	ND	25.0	ND	2.5	ND	2.5
BROMODICHLOROMETHANE	ND	25.0	ND	2.5	ND	2.5
BROMOFORM	ND	25.0	ND	2.5	ND	2.5
BROMOMETHANE	ND	25.0	ND	2.5	ND	2.5
CARBON TETRACHLORIDE	27	25.0	ND	2.5	ND	2.5
CHLOROBENZENE	ND	25.0	ND	2.5	ND	2.5
CHLOROETHANE	ND	25.0	ND	2.5	ND	2.5
2-CHLOROETHYLVINYL ETHER	ND	50.0	ND	5.0	ND	5.0
CHLOROFORM	ND	25.0	ND	2.5	ND	2.5
CHLOROMETHANE	ND	25.0	ND	2.5	ND	2.5
DIBROMOCHLOROMETHANE	ND	25.0	ND	2.5	ND	2.5
1,2-DICHLOROBENZENE	ND	25.0	ND	2.5	ND	2.5
1,3-DICHLOROBENZENE	ND	25.0	ND	2.5	ND	2.5
1,4-DICHLOROBENZENE	ND	25.0	ND	2.5	ND	2.5
1,1-DICHLOROETHANE	ND	25.0	ND	2.5	ND	2.5
1,2-DICHLOROETHANE	ND	25.0	ND	2.5	ND	2.5
1,1-DICHLOROETHENE	ND	25.0	ND	2.5	ND	2.5
TRANS-1,2-DICHLOROETHENE	ND	25.0	ND	2.5	ND	2.5
1,2-DICHLOROPROPANE	ND	25.0	ND	2.5	ND	2.5
CIS-1,3-DICHLOROPROPENE	ND	25.0	ND	2.5	ND	2.5
TRANS-1,3-DICHLOROPROPENE	ND	25.0	ND	2.5	ND	2.5
ETHYL BENZENE	28	25.0	ND	2.5	ND	2.5
METHYLENE CHLORIDE	ND	25.0	ND	2.5	ND	2.5
	DUPLICATE					

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L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 884861

COMPOUNDS:	LAB#	67101	DET.	67102	DET.	67103	DET.
	SMP#	9653	LIM.	9654	LIM.	9655	LIM.
PURGEABLES		UG/GM		UG/KG		UG/KG	
1,1,2,2-TETRACHLOROETHANE		ND	25.0	ND	2.5	ND	2.5
TETRACHLOROETHENE		ND	25.0	ND	2.5	12	2.5
TOLUENE		2800	25.0	5.5	2.5	3.2	2.5
1,1,1-TRICHLOROETHANE		280	25.0	ND	2.5	ND	2.5
1,1,2-TRICHLOROETHANE		ND	25.0	ND	2.5	ND	2.5
TRICHLOROETHENE		3600	25.0	8.6	2.5	12	2.5
TRICHLOROFLUOROMETHANE		ND	25.0	ND	2.5	ND	2.5
VINYL CHLORIDE		ND	50.0	ND	5.0	ND	5.0
XYLENES		42	25.0	ND	2.5	ND	2.5
		DUPLICATE					

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ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 884861

COMPOUNDS: PURGEABLES	LAB# 67104 SMP# 9656	DET. LIM. UG/KG	67105 9657	DET. LIM. UG/KG	67106 9658	DET. LIM. UG/KG
BENZENE	ND	2.5	ND	2.5	ND	2.5
BROMODICHLOROMETHANE	ND	2.5	ND	2.5	ND	2.5
BROMOFORM	ND	2.5	ND	2.5	ND	2.5
BROMOMETHANE	ND	2.5	ND	2.5	ND	2.5
CARBON TETRACHLORIDE	ND	2.5	ND	2.5	ND	2.5
CHLOROBENZENE	ND	2.5	ND	2.5	ND	2.5
CHLOROETHANE	ND	2.5	ND	2.5	ND	2.5
2-CHLOROETHYLVINYL ETHER	ND	5.0	ND	5.0	ND	5.0
CHLOROFORM	ND	2.5	ND	2.5	ND	2.5
CHLOROMETHANE	ND	2.5	ND	2.5	ND	2.5
DIBROMOCHLOROMETHANE	ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROBENZENE	ND	2.5	ND	2.5	ND	2.5
1,3-DICHLOROBENZENE	ND	2.5	ND	2.5	ND	2.5
1,4-DICHLOROBENZENE	ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHANE	ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROETHANE	ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHENE	ND	2.5	ND	2.5	ND	2.5
TRANS-1,2-DICHLOROETHENE	ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROPROPANE	ND	2.5	ND	2.5	ND	2.5
CIS-1,3-DICHLOROPROPENE	ND	2.5	ND	2.5	ND	2.5
TRANS-1,3-DICHLOROPROPENE	ND	2.5	ND	2.5	ND	2.5
ETHYL BENZENE	ND	2.5	ND	2.5	ND	2.5
METHYLENE CHLORIDE	ND	2.5	ND	2.5	ND	2.5
1,1,2,2-TETRACHLOROETHANE	ND	2.5	ND	2.5	ND	2.5
TETRACHLOROETHENE	ND	2.5	ND	2.5	ND	2.5
TOLUENE	4.0	2.5	2.8	2.5	ND	2.5
1,1,1-TRICHLOROETHANE	3.6	2.5	ND	2.5	ND	2.5
1,1,2-TRICHLOROETHANE	ND	2.5	ND	2.5	ND	2.5
TRICHLOROETHENE	9.1	2.5	7.8	2.5	ND	2.5
TRICHLOROFLUOROMETHANE	ND	2.5	ND	2.5	ND	2.5
VINYL CHLORIDE	ND	5.0	ND	5.0	ND	5.0
XYLENES	ND	2.5	ND	2.5	ND	2.5
	DUPLICATE					

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ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 884861

COMPOUNDS:	LAB#	67107	DET.	67108	DET.	67109	DET.
	SMP#	9659	LIM.	9660	LIM.	9661	LIM.
	dil.	1		1		1	
PURGEABLES		UG/KG		UG/KG		UG/KG	
BENZENE		ND	2.5	ND	2.5	ND	2.5
BROMODICHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
BROMOFORM		ND	2.5	ND	2.5	ND	2.5
BROMOMETHANE		ND	2.5	ND	2.5	ND	2.5
CARBON TETRACHLORIDE		ND	2.5	ND	2.5	ND	2.5
CHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
CHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
2-CHLOROETHYLVINYL ETHER		ND	5.0	ND	5.0	ND	5.0
CHLOROFORM		ND	2.5	ND	2.5	ND	2.5
CHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
DIBROMOCHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,3-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,4-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROETHANE		ND	2.5	7.6	2.5	ND	2.5
1,1-DICHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
TRANS-1,2-DICHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROPROPANE		ND	2.5	59	2.5	ND	2.5
CIS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	2.5
TRANS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	2.5
ETHYL BENZENE		ND	2.5	ND	2.5	ND	2.5
METHYLENE CHLORIDE		ND	2.5	ND	2.5	ND	2.5
1,1,2,2-TETRACHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
TETRACHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
TOLUENE		ND	2.5	34	2.5	ND	2.5
1,1,1-TRICHLOROETHANE		ND	2.5	6.0	2.5	ND	2.5
1,1,2-TRICHLOROETHANE		ND	2.5	77	2.5	ND	2.5
TRICHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
TRICHLOROFLUOROMETHANE		ND	2.5	140	2.5	ND	2.5
VINYL CHLORIDE		ND	2.5	ND	2.5	ND	2.5
XYLENES		ND	5.0	ND	5.0	ND	5.0
		ND	2.5	4.9	2.5	ND	2.5
				DUPLICATE			

Lab Reports

FIREMAN'S FUND
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ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 884861

COMPOUNDS:	LAB#	67107	DET.	67108	DET.	67109	DET.
	SMP#	9659	LIM.	9660	LIM.	9661	LIM.
	dil.	1		1		1	
PURGEABLES		UG/KG		UG/KG		UG/KG	

ND: NOT DETECTED

NOTE: SAMPLE 9653 (LAB NUMBER 67101) IS REPORTED IN UG/GM (PPM). ALL OTHER SAMPLES ARE REPORTED IN UG/KG (PPB).

ANALYST:PAUL MILLS

DUPLICATE

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ENVIRONMENTAL LABORATORY

Jackie Daly
Robert Gils Associates Inc.
6400 Hollis Street, Suite 3
Emeryville, CA 94608

Client Code: GILS4
Survey # CHI-883

L A B O R A T O R Y R E S U L T S

Date Extracted: 11/01/88
Date Analyzed: 11/02/88

Laboratory Job No.: 885141
Date Received: 10/27/88
Date Reported: 11/09/88

ASSAY:TPH/GASOLINE & BTEX EPA 5020/8015/8020
MATRIX:SOIL

LABNO	SMPLNO-ID	RESULTS	DET.LIM
78595	9662 GASOLINE	5.4 mg/kg	1.2 mg/kg
78596	9663 GASOLINE	ND	1.2 mg/kg
78597	9664 GASOLINE	3.2 mg/kg #	1.2 mg/kg

#=Detected below accurate method quantitation limit(below 3.3-det.lim.).
ANALYST:ROBERT REMLINGER

THIS REPORT HAS BEEN REVIEWED
AND APPROVED FOR RELEASE.

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-FFIC-LAB

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 885141
Date Extracted: 11/01/88
Date Received: 10/27/88
Date Analyzed: 11/02/88
Date Reported: 11/09/88

MATRIX:SOIL

LABNO SMPLNO-ID	RESULTS	DET.LIM
78595 9662		
BENZENE	ND	0.04 mg/kg
TOLUENE	ND	0.04 mg/kg
ETHYLBENZENE	ND	0.04 mg/kg
XYLENE	0.057 mg/kg #	0.04 mg/kg
78596 9663		
BENZENE	ND	0.04 mg/kg
TOLUENE	ND	0.04 mg/kg
ETHYLBENZENE	ND	0.04 mg/kg
XYLENE	ND	0.04 mg/kg
78597 9664		
BENZENE	ND	0.04 mg/kg
TOLUENE	ND	0.04 mg/kg
ETHYLBENZENE	ND	0.04 mg/kg
XYLENE	ND	0.04 mg/kg

#=Detected below accurate method quantitation limit(below 3.3-det.lim.).
ANALYST:ROBERT REMLINGER

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-FFIC-LAB

ENVIRONMENTAL LABORATORY

Rich Halket
Robert Gils Associates Inc.
6400 Hollis Street, Suite 3
Emeryville, CA 94608

Client Code: GILS5
Survey # CHI-884

L A B O R A T O R Y R E S U L T S

Date Extracted: 01/11/89
Date Analyzed: 01/12/89

Laboratory Job No.: 885953
Date Received: 12/28/88
Date Reported: 01/12/89

ASSAY:TPH/GASOLINE (EPA 5020/8015)
MATRIX:SOIL

LABNO	SMPLNO-ID	RESULTS	DET.LIM
83378	9667		
	GASOLINE	35 mg/kg	5.7 mg/kg
83381	9670		
	GASOLINE	1.4 mg/kg #	1.2 mg/kg

NOTE:TCE DETECTED IN 83378.
#=Detected below accurate method quantitation limit(below 3.3-det.lim.).
ANALYST:ROBERT REMLINGER

THIS REPORT HAS BEEN REVIEWED
AND APPROVED FOR RELEASE.

FIREMAN'S FUND
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Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-FFIC-LAB

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 885953
Date Extracted: 12/28/88
Date Received: 12/28/88
Date Analyzed: 12/29/88
Date Reported: 01/12/89

PURGEABLES BY GC/MS(EPA8240)

COMPOUNDS:	LAB#	83376	DET.	83377	DET.	83378	DET.
	SMP#	9665	LIM.	9666	LIM.	9667	LIM.
	dil.	1000		1000		1000	
PURGEABLES		MG/KG		MG/KG		MG/KG	
BENZENE		ND	2.5	ND	2.5	ND	2.5
BROMODICHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
BROMOFORM		ND	2.5	ND	2.5	ND	2.5
BROMOMETHANE		ND	2.5	ND	2.5	ND	2.5
CARBON TETRACHLORIDE		23	2.5	ND	2.5	11	2.5
CHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
CHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
2-CHLOROETHYLVINYL ETHER		ND	5.0	ND	5.0	ND	5.0
CHLOROFORM		ND	2.5	ND	2.5	ND	2.5
CHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
DIBROMOCHLOROMETHANE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,3-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,4-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
1,1-DICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
TRANS-1,2-DICHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
1,2-DICHLOROPROPANE		ND	2.5	ND	2.5	ND	2.5
CIS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	2.5
TRANS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	2.5
ETHYL BENZENE		3.0	2.5	ND	2.5	ND	2.5
METHYLENE CHLORIDE		ND	2.5	ND	2.5	ND	2.5
1,1,2,2-TETRACHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
TETRACHLOROETHENE		ND	2.5	ND	2.5	ND	2.5
TOLUENE		1400*	2.5	26	2.5	56	2.5

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-FFIC-LAB

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 885953

COMPOUNDS:	LAB#	83376	DET.	83377	DET.	83378	DET.
	SMP#	9665	LIM.	9666	LIM.	9667	LIM.
PURGEABLES	dil.	1000 MG/KG		1000 MG/KG		1000 MG/KG	
1,1,1-TRICHLOROETHANE		190*	2.5	3.7	2.5	69	2.5
1,1,2-TRICHLOROETHANE		ND	2.5	ND	2.5	ND	2.5
TRICHLOROETHENE		960*	2.5	19	2.5	93	2.5
TRICHLOROFLUOROMETHANE		ND	2.5	ND	2.5	ND	2.5
VINYL CHLORIDE		ND	5.0	ND	5.0	ND	5.0
XYLENES		8.4	2.5	ND	2.5	ND	2.5
ACETONE		ND	5.0	ND	5.0	ND	5.0
2-BUTANONE		ND	5.0	ND	5.0	ND	5.0
CARBON DISULFIDE		ND	5.0	ND	5.0	ND	5.0
2-HEXANONE		ND	5.0	ND	5.0	ND	5.0
4-METHYL-2-PENTANONE		ND	5.0	ND	5.0	ND	5.0
STYRENE		ND	5.0	ND	5.0	ND	5.0
VINYL ACETATE		ND	5.0	ND	5.0	ND	5.0

FIREMAN'S FUND
INSURANCE COMPANIES
Environmental Laboratory
3700 Lakeville Highway
Petaluma, CA 94952
800-FFIC-LAB

ENVIRONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 885953

COMPOUNDS:	LAB#	83379	DET.	83380	DET.	83381	DET.
	SMP#	9668	LIM.	9669	LIM.	9670	LIM.
PURGEABLES	dil.	1000		1000		100	
		MG/KG		MG/KG		MG/KG	
BENZENE		ND	2.5	ND	2.5	ND	0.25
BROMODICHLOROMETHANE		ND	2.5	ND	2.5	ND	0.25
BROMOFORM		ND	2.5	ND	2.5	ND	0.25
BROMOMETHANE		ND	2.5	ND	2.5	ND	0.25
CARBON TETRACHLORIDE		12	2.5	ND	2.5	ND	0.25
CHLOROBENZENE		ND	2.5	ND	2.5	ND	0.25
CHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
2-CHLOROETHYLVINYL ETHER		ND	5.0	ND	5.0	ND	0.5
CHLOROFORM		ND	2.5	ND	2.5	ND	0.25
CHLOROMETHANE		ND	2.5	ND	2.5	ND	0.25
DIBROMOCHLOROMETHANE		ND	2.5	ND	2.5	ND	0.25
1,2-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	0.25
1,3-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	0.25
1,4-DICHLOROBENZENE		ND	2.5	ND	2.5	ND	0.25
1,1-DICHLOROETHANE		4.2	2.5	ND	2.5	ND	0.25
1,2-DICHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
1,1-DICHLOROETHENE		ND	2.5	ND	2.5	ND	0.25
1,1-DICHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
1,2-DICHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
TRANS-1,2-DICHLOROETHENE		ND	2.5	ND	2.5	ND	0.25
1,2-DICHLOROPROPANE		ND	2.5	ND	2.5	ND	0.25
CIS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	0.25
TRANS-1,3-DICHLOROPROPENE		ND	2.5	ND	2.5	ND	0.25
ETHYL BENZENE		ND	2.5	ND	2.5	ND	0.25
METHYLENE CHLORIDE		ND	2.5	ND	2.5	ND	0.25
1,1,2,2-TETRACHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
TETRACHLOROETHENE		ND	2.5	ND	2.5	ND	0.25
TOLUENE		87 **	2.5	33	2.5	0.81	0.25
1,1,1-TRICHLOROETHANE		76	2.5	7.3	2.5	0.49	0.25
1,1,2-TRICHLOROETHANE		ND	2.5	ND	2.5	ND	0.25
TRICHLOROETHENE		160**	2.5	88	2.5	2.9	0.25
TRICHLOROFLUOROMETHANE		ND	2.5	ND	2.5	ND	0.25
VINYL CHLORIDE		ND	5.0	ND	5.0	ND	0.5

EM[illegible]'S FUND
[illegible]ANCE COMPANIES
[illegible]mental Laboratory
[illegible]kev[illegible] Highway
[illegible]no, [illegible] 94952
[illegible]C-LAB

VI[illegible]ONMENTAL LABORATORY

L A B O R A T O R Y R E S U L T S

Laboratory Job No.: 885953

POUNDS:	LAB#	83379	DET.	83380	DET.	83381	DET.
	SMP#	9668	LIM.	9669	LIM.	9670	LIM.
ABLES	dil.	1000		1000		100	
		MG/KG		MG/KG		MG/KG	
CS		ND	2.5	ND	2.5	ND	0.25
IE		ND	5.0	ND	5.0	ND	0.5
ANONE		ND	5.0	ND	5.0	ND	0.5
L SULFIDE		ND	5.0	ND	5.0	ND	0.5
NC E		ND	5.0	ND	5.0	ND	0.5
YL-2-PENTANONE		ND	5.0	ND	5.0	ND	0.5
E		ND	5.0	ND	5.0	ND	0.5
AC TATE		ND	5.0	ND	5.0	ND	0.5

ING UNITS ARE MILLIGRAMS/KILOGRAM (PPM)

SE COMPOUNDS WERE QUANTITATED ON A 1 TO 10000 DILUTION ANALYSIS.

T: AUL MILLS

APPENDIX B

HEALTH AND SAFETY PLAN

CROLEY AND HERRING INVESTMENT COMPANY

SITE SAFETY AND HEALTH PLAN

CLIENT: Croley and Herring Investment Company

DATE: March 22, 1989

EXPIRATION DATE: June 22, 1989

	Name	Signature	Date
IH REVIEW:	Dave Durst	Sonja Echevenia for	4/4/89
PROJECT MANAGER:	Walter Loo		4/4/89
FIELD TEAM LEADER:	Amy Brownell	amy Brownell	4/4/89
REHSC:	Glen Fishler	Sonja Echevenia for	4/4/89
SUBCONTRACTOR:			

0327dan1

TABLE OF CONTENTS

G. **Minimum Training and Medical Surveillance Requirements for Site Personnel**

All site personnel are required to have

1. 40 hour hazardous waste operations training
2. Complete Respiratory Protection Program
3. Current Participates in Medical Surveillance

H. **Initial Site Entry:** Has this been performed? Yes If so, when? October-December 1988

Information obtained:

Robert Gils Associates, Incorporated, conducted a site assessment at 5800 Christie Avenue from October to December 1988. Organic solvents were detected in subsurface soil samples to a depth of twelve feet. The predominant chemical hazards include carbon tetrachloride, ethyl benzene, toluene, 1,1,1-trichloroethane, trichloroethene and xylenes.

I. **Purpose of Field Work:** (descriptive paragraph)

McLaren will excavate soil to a depth of five feet and stockpile the soil in the parking lot. Soil will be excavated in five foot increments in order to preserve the integrity of existing structures. Fill will be placed in excavated areas.

J. **Description of Specific Tasks Planned:** (Number each separate task in order of progression. The task numbers assigned here will be referred to throughout the plan.) List on separate sheet if necessary.

1. Perform utility clearance
2. Excavate soil
3. Stockpile soil
4. Obtain soil sample

E. **Contaminant Description:** Provide a summary paragraph detailing sample type (soil, water, air, etc.) and sample collection methods. Identify sources of information (i.e. document source). Complete table below.

Organic solvents were detected in on-site samples obtained from an alley between the building and the fence. Solvent contamination was found to extend to a depth of at least twelve feet in some locations.

	Substance	Source of Contamination	Source of Sample	Maximum Sample Concentration
1.	Carbon tetrachloride	Cleaning tank	Subsurface soil (depth of 2.6 feet)	27 ppm
2.	Ethyl Benzene	Cleaning tank	Subsurface soil (depth of 2.6 feet)	28 ppm
3.	Toluene	Cleaning tank	Subsurface soil (depth of 2.6 feet)	2,800 ppm
4.	1,1,1 Trichloroethane	Cleaning tank	Subsurface soil (depth of 2.6 feet)	280 ppm
5.	Trichlorethene	Cleaning tank	Subsurface soil (depth of 2.6 feet)	3,600 ppm
6.	Xylenes	Cleaning tank	Subsurface soil (depth of 2.6 feet)	42 ppm
7.	Vinyl Chloride	Cleaning tank	Subsurface soil sample from inside building (depth 6 feet)	.4 ppm
8.	Gasoline	Underground gasoline tank	Subsurface soil (depth of 12 feet)	35 ppm

F. **Site Status:**

Abandoned (Yes/No): NO

Occupied (Yes/No): NO

Other McLaren work on-site? (Yes/No): NO

If Yes:

Historical dates: _____

Ongoing: _____

What type: _____

Description of previous McLaren work:

No applicable

III. WASTE CHARACTERISTICS

A. Waste Generation (Type(s)/Quantities)

Anticipated: Yes _X_ No ____

Types: Liquid_____ Solid_X_ Sludge_____ Gas_____

Quantity: Expected Volume 50 cubic yards

B. Characteristics

Corrosive____ Ignitable _____ Radioactive_____ Volatile_X_

Toxic_____ Reactive____Unknown_____ Carcinogenic_X_

Other (specify) _____

C. D.O.T. Classification (Anticipated): _____

Unknown, pending analysis.

D. Type(s) of labels required for waste shipment: _____

Unknown, pending analysis.

E. Packaging requirements for waste material:

open head 55-gallon drum _____
closed head 55-gallon drum _____
overpack drum _____
baker tanks _____
lined waste bins _____
stock piled and lined _X_

F. Disposal and/or Treatment Methods Proposed:

See Section V. Site Safety and Health Standard Operating Procedures, Subpart M, Disposal of Waste Materials Generated On-site.

Contaminated soils will be stockpiled and aerated on-site prior to being transported for disposal. Upon aeration, it is anticipated that levels of contaminants will be such that "hazardous" classifications will not be required. Soil samples will be obtained prior to transportation and disposal.

IV. TASK SPECIFIC

Safety and Health Risk Analysis
(Section to be completed by an industrial hygienist)

A. **Overall Hazard Rating:** (copy rating scheme from Section I, general information Subsection IV, overall hazard rating.)

Moderate

B. **Chemical Hazards:** (include paragraph summarizing predominant chemical exposure hazards anticipated during site activity)

Field team members may be potentially exposed to elevated levels of chlorinated hydrocarbons, up to 3,600 ppm trichloroethene and up to 2,800 ppm toluene.

C.

Task #	Task Specific Hazard Rating	Identified/Anticipated Hazards
1. Perform utility clearance	Low Moderate	On-site visual clearance physical hazards appear to be minimal. Potential exposure to contaminated surface soils. Appropriate protective clothing will be worn.
2. Excavate soil	Moderate	Physical hazards are associated with heavy equipment (i.e. noise, moveable parts, etc). Chemical hazards may include potential exposure to chemical vapors, potential for explosive atmospheres and potential from contact with contaminated soil and/or water. Appropriate personal protective clothing will be donned. Monitoring methods will be employed.
3. Stockpile Soils	Moderate	Physical hazard may include lifting. Direct contact with potentially contaminated soil and water may occur. Appropriate personal protective clothing will be donned. Appropriate monitoring methods will be employed, and are identified in Section 7.5.6.

C.	Task #	Task Specific Hazard Rating	Identified/Anticipated Hazards
	4. Obtain soil samples	Low/Moderate	Physical hazards appear to be minimal. Chemical hazards may include potential exposure to chemical vapors and contaminated soil. Appropriate personal protective clothing will be donned. Monitoring methods will be employed.

D. Identification and Assessment of Predominant Site Chemical Hazards:

Chemicals (or class)	PEL/TLV*	Other Pertinent Limits (Specify)	Warning Properties (if any)	Routes of Exposure	Acute Health Effects	Chronic Health Effects
1. Carbon Tetrachloride	5/5 ppm		---	1,2	CNS depression, lapatic & renal damage, nausea coma, convulsion	Liver & kidney damage, teratogen suspect carcinogen
2. Ethyl benzene	100/100 ppm		Odor	1,2,3	Eye, skin, mucous membrane teratogen irritant, dizziness	Experimental
3. Toluene	200/100 ppm		Odor	1,2,3	Skin & eye irritant, CNS psychotropic effects	Mutagenic data
4. 1,1,1-Trichloroethane	350/350 ppm		Odor	1,2,3	Skin & eye irritant, CNS depression, narcotic	not available
5. Trichloroethylene (TCE)	100/50 ppm		Odor	1,3	Eye, skin, irritation; narcosis; anesthesia; headache; drowsiness	Liver damage possible carcinogen, teratogen

References:
1 = Inhalation
2 = Ingestion
3 = Dermal

Chemicals (or class)	PEL/TLV*	Other Pertinent Limits (Specify)	Warning Properties (if any)	Routes of Exposure	Acute Health Effects	Chronic Health Effects
6. Xylene	100/100 ppm		Odor	1,3	Respiratory irritation, blurred vision, dizziness, nausea, collapse, coma contact burn.	Not available
7. Vinyl Chloride	1 ppm/5 ppm		None	1,2,3	Weakness, abdominal pain, hematomegaly	Liver damage CNS depression, Blood disorders, carcinogen
8. Gasoline	---/300		Odor	1,2,3	Irritant of eyes, nose & throat	CNS effects

*OSHA Permissible Exposure Limit/American Conference of Governmental Industrial Hygienists Threshold Limit Value.

References:

1 = Inhalation
2 = Ingestion
3 = Dermal

E. Non-chemical Hazards

	YES	NO
Electrical hazard		X
Overhead power lines		X
Underground cable/power lines		X
Gas lines		X
Equipment hazards	X	
Drilling		X
Excavation	X	
Machinery		X
Heat exposure		X
Cold exposure		X
Oxygen deficiency		X
Confined spaces		X
Noise	X	
Ionizing radiation		X
Non-ionizing radiation		X
Lasers		X
Infrared		X
Ultraviolet		X
Fire		X
Biologic		X

	YES	NO
Safety	X	
Holes/ditches	X	
Steep grades		X
Slippery surfaces	X	
Uneven terrain	X	
Unstable surfaces		X
Elevated work surfaces	X	
Explosive Atmosphere	X	
Shoring/Scaffolding		X
Other: _____		

V. SITE SAFETY AND HEALTH STANDARD OPERATING PROCEDURES

A. **MAPS - Site Map and Hospital Location Map** (Attachments 3 & 6, respectively): Site map must include location of nearest phone, dual fixture eyewash, and deluge shower. Hospital location map - hospital route must be highlighted.

B. **Site Security:** Project Manager or designee is responsible for preventing unauthorized entry into the site and for knowing who is on site at all times.

1. Access to the work site[1] will be controlled in the following manner:

   On-site personnel will log in with the security officer. A temporary chain link fence will limit access to site.

   Personnel entry and logging procedures controls:

   Personnel will log in with the security officer.

   Work Site Area Perimeter identification method (describe equipment and procedures to be used)

   Work site area perimeter will be demarcated with cones, barriers or tape.

   Work Area Security (on and off-hours)

   The site will be enclosed within a chain link fence. The fence will be locked during off hours.

2. Location of the on-site command post (if applicable, ensure that it is located upwind from sources, give prevailing winds, locate/identify on-site map.)

   Not applicable

3. On-site personnel can be contacted by off-site personnel by pager.

[1]Work Site herein shall be defined as: The areas enclosed within the chain link fence.

C. **Perimeter Identification**

Complete the table below indicating the type of zone boundaries required for this job. Mark zone boundaries on Site Map, Attachment 3.

Task No./Task Description[1]	Zone Boundaries Required[2]	Level of Protection Required for Each Zone[3]
1/Perform utility clearance	d	D
2/Excavate soil	d	C
3/Stockpile soils	d	C
4/Obtain soil sample	d	C

---

[1]As identified in Section I. General Information, Subpart J.

[2]This job will require one or all of the following "zones" or "boundaries" to be established during work.

a. Exclusion Zone - Typically required when workers within that zone must wear specialized personnel protective equipment.

b. Contamination Reduction or Decontamination Zone - Required when decontamination of people and equipment leaving the Exclusion Zone is required.

c. Support Zone - The location where administrative and other support activities are conducted.

d. Work Area Boundary - Excludes non-workers from entering a potentially hazardous environment.

[3]Level A - SCBA, totally encapsulating suit, two-way radio communications.

Level B - SCBA or supplied air respirator with an escape bottle, chemically resistant ppe, two way radio communications.

Level C - Full and half-face air purifying respirators, chemically resistant clothing.

Level D - No respiratory protection, coveralls, safety glasses, eye, hardhat, steel-toe boots and gloves specified under Level C if hazardous materials contact is necessary.

D. Personal Protective Equipment (PPE) Requirements

Task # (see Section I, Subpart J) __1__.

Task description Perform Utility Clearance.

Level of protection __D__.

1. Respiratory Protection

   a. SCBA _____
      • Pressure demand _____
      • Continuous flow _____

   b. Supplied Air _____
      • Pressure demand _____
      • Continuous flow _____
      • Escape breathing air _____

   c. Air Purifying
      • Powered _____
      • Full face _____
      • Half-mask _____
      • Type of cartridge____

      • Other _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type:

   b. Suit type:

   c. Boot type: PVC Bootie[1]

3. Reusable PPE

   a. Boot type: Steel toe

   b. Glove type:

   c. Other:

4. Safety Equipment

   a. Head Protection type:

   b. Hearing Protection type:

   c. Eye Protection type:

If upgraded, level of protection _____.

1. Respiratory Protection

   a. SCBA _____
      • Pressure demand ____
      • Continuous flow ____

   b. Supplied Air _____
      • Pressure demand _____
      • Continuous flow _____
      • Escape breathing air _____

   c. Air Purifying
      • Powered ___
      • Full face _____
      • Half-mask ____
      • Type of cartridge ____

      • Other: _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type:

   b. Suit type:

   c. Boot type:

3. Reusable PPE

   a. Boot type:

   b. Glove type:

   c. Other:

4. Safety Equipment

   a. Head Protection type:

   b. Hearing Protection type:

   c. Eye Protection type:

[1] If contact with moist soil is anticipated

D. Personal Protective Equipment (PPE) Requirements

Task # (see Section I, Subpart J) __2__.

Task description Excavate Soil.

Level of protection __C__.

1. Respiratory Protection

   a. SCBA _____
      - Pressure demand _____
      - Continuous flow _____

   b. Supplied Air _____
      - Pressure demand _____
      - Continuous flow _____
      - Escape breathing air _____

   c. Air Purifying
      - Powered _____
      - Full face ____
      - Half-mask __X__
      - Type of cartridge____ Organic vapor with dust prefilter
      - Other _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type: Nitrile (thick)[1]
   b. Suit type: PE Tyvek[1]
   c. Boot type: PVC Bootie[1]

3. Reusable PPE

   a. Boot type: Steel toe
   b. Glove type:
   c. Other:

4. Safety Equipment

   a. Head Protection type: Hard hat
   b. Hearing Protection type: Ear plugs
   c. Eye Protection type: Safety glasses or goggles

If upgraded, level of protection _____.

1. Respiratory Protection

   a. SCBA _____
      - Pressure demand ____
      - Continuous flow ____

   b. Supplied Air _____
      - Pressure demand _____
      - Continuous flow _____
      - Escape breathing air _____

   c. Air Purifying
      - Powered ___
      - Full face _____
      - Half-mask ____
      - Type of cartridge ____
      - Other: _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type:
   b. Suit type:
   c. Boot type:

3. Reusable PPE

   a. Boot type:
   b. Glove type:
   c. Other:

4. Safety Equipment

   a. Head Protection type:
   b. Hearing Protection type:
   c. Eye Protection type:

1 If contact with Moist soil or water is anticipated

D. Personal Protective Equipment (PPE) Requirements

Task # (see Section I, Subpart J) 3.

Task description Stockpile Soil.

Level of protection C.

1. Respiratory Protection

   a. SCBA _____
      - Pressure demand _____
      - Continuous flow _____

   b. Supplied Air _____
      - Pressure demand _____
      - Continuous flow _____
      - Escape breathing air _____

   c. Air Purifying
      - Powered _____
      - Full face ____
      - Half-mask X
      - Type of cartridge____ Organic vapor with dust prefilter
      - Other _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type: Nitrile (thick)[1]
   b. Suit type: PE Tyvek[1]
   c. Boot type: PVC Bootie[1]

3. Reusable PPE

   a. Boot type: Steel toe
   b. Glove type:
   c. Other:

4. Safety Equipment

   a. Head Protection type: Hard hat
   b. Hearing Protection type:
   c. Eye Protection type: Safety glasses or goggles

If upgraded, level of protection _____.

1. Respiratory Protection

   a. SCBA _____
      - Pressure demand ____
      - Continuous flow ____

   b. Supplied Air _____
      - Pressure demand _____
      - Continuous flow _____
      - Escape breathing air _____

   c. Air Purifying
      - Powered ___
      - Full face _____
      - Half-mask ____
      - Type of cartridge ____
      - Other: _____

   d. NONE REQUIRED

2. Disposable PPE

   a. Glove type:
   b. Suit type:
   c. Boot type:

3. Reusable PPE

   a. Boot type:
   b. Glove type:
   c. Other:

4. Safety Equipment

   a. Head Protection type:
   b. Hearing Protection type:
   c. Eye Protection type:

1 If contact with Moist soil or water is anticipated

D. Personal Protective Equipment (PPE) Requirements

Task # (see Section I, Subpart J) __4__.

Task description Obtain Soil Sample.

Level of protection __C__.

1. Respiratory Protection

a. SCBA _____
- Pressure demand _____
- Continuous flow _____

b. Supplied Air _____
- Pressure demand _____
- Continuous flow _____
- Escape breathing air _____

c. Air Purifying
- Powered _____
- Full face ____
- Half-mask __X__
- Type of cartridge____ Organic vapor with dust prefilter
- Other _____

d. NONE REQUIRED

2. Disposable PPE

a. Glove type: Nitrile (thick)[1]

b. Suit type: PE Tyvek[1]

c. Boot type: PVC Bootie[1]

3. Reusable PPE

a. Boot type: Steel toe

b. Glove type:

c. Other:

4. Safety Equipment

a. Head Protection type: Hard hat

b. Hearing Protection type:

c. Eye Protection type: Safety glasses or goggles

If upgraded, level of protection _____.

1. Respiratory Protection

a. SCBA _____
- Pressure demand ____
- Continuous flow ____

b. Supplied Air _____
- Pressure demand _____
- Continuous flow _____
- Escape breathing air _____

c. Air Purifying
- Powered ___
- Full face _____
- Half-mask ____
- Type of cartridge ____
- Other: _____

d. NONE REQUIRED

2. Disposable PPE

a. Glove type:

b. Suit type:

c. Boot type:

3. Reusable PPE

a. Boot type:

b. Glove type:

c. Other:

4. Safety Equipment

a. Head Protection type:

b. Hearing Protection type:

c. Eye Protection type:

1 If contact with Moist soil or water is anticipated

E. Safety Equipment and Materials Requirements: (harnesses, lanyards, etc.)

No special safety equipment will be required.

F. **Monitoring Equipment Requirements** (Monitoring is to be conducted by the Site Safety Officer or his designee. The results shall be interpreted by the Site Safety Officer. Monitor results and calibration logs are to be completed and sent to the Regional Environmental Health and Safety Officer to be filed with the Site Safety and Health Plan - see Attachments 7 and 8.)

		Task Nos.*	Frequency
1.	Direct reading instruments TIP LEL	2,3, 4	During task Prior to task
2.	Personal exposure monitoring	----	-----
3.	Colorimetric tubes	----	-----
	Draeger tubes: A. Ethyl Benzene B. Toluene C. Trichloroethane D. Trichloroethene E. Xylene	2,3 4	During task Prior to task
	Sensidyne tube: A. Carbon Tetrachloride B. Vinyl Chloride	2,3 4	During task Prior to task
4.	Other equipment	_____	_____

G. **Equipment Preparation/Calibration Requirements**

		Task Nos.*	Frequency
1.	Direct reading instruments: TIP LEL	2,3,4	Beginning of work day
2.	Personal exposure monitoring	----	-----
3.	Colorimetric tubes Draeger and Sensidyne	2,3,4	Test pumps prior to each use
4.	Other equipment	----	-----

*See Section I, Subpart J.

H. **Site Procedures and Requirements:**

- o Locate nearest available telephone. Indicate location on Site Map (Attachment 3) - POST SITE MAP.
- o Confirm and post emergency telephone numbers and route to hospital. (See Attachment 6 & 9)
- o Designate at least one vehicle for emergency use.
- o Determine wind direction, establish hotline, and set up decontamination facilities. Note wind direction and location of decontamination facilities on site map (Attachment 3) - POST SITE MAP.
- o If toilet facilities are not located within a 5-minute walk from the decontamination facilities, either provide a chemical toilet and hand washing facilities or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.
- o Prior to working onsite, an inspection for hazards, (i.e., spiders, electrical hazards) will be made.
- o Vent wells from an upwind position.
- o Try to remain upwind when collecting samples.
- o Indicate procedures for estimating and avoiding risk. (Examples include use of safe work practices, SOP's, tailgate safety meetings, monitoring, designation of Action Levels, use of ppe[1]; use attachments for confined space entry, excavations, demolitions and/or heat stress when applicable.)

1. Conduct utility clearance prior to <u>any</u> site activity.
2. First aid kit will be available in the McLaren Truck.
3. hold tailgate safety meetings daily throughout job to identify potential hazards and explain safe work practices.
4. Review Drilling Safety Guidelines (see Attachment 12).
5. No eating, drinking or smoking in work area.

---

[1]ppe = personal protective equipment

I. Action Level Table for Chemical Monitoring

Contaminant	Monitoring Equipment	Monitoring Protocol	Monitored Level for** Mandatory Respirator Use	Monitored* for Mandatory Work Stoppage
1. Explosive Atmosphere	LEL	During Task 2,3	---	10%ppm
2. Organic Vapor	TIP	During activities (Task 2,3) and Prior to Task 4	Any significant upward meter fluctuation	
3. Vinyl Chloride	Sensidyne Tube	"	.25ppm	1.0ppm
4. Carbon Tetrachloride	Sensidyne Tube	"	1ppm	5ppm
5. Trichloroethene	Dreager Tube	"	10ppm	50ppm
6. Ethyl Benzene	Dreager Tube	"	20ppm	100ppm
7. Toluene	Dreager Tube	"	20ppm	100ppm
8. Xylene	Dreager Tube	"	20ppm	100ppm
9. Trichloroethane	Dreager Tube	"	70ppm	350ppm

NOTE: Don respirator and document initial levels of contamination at source prior to excavation. If during any task, there is a significant upward fluctuation in the TIP readings, don respirator and test for specific chemical with detector tubes, in the order specified, at the source. If source measurement is greater than the mandatory level for respirator use or mandatory level for work stoppage, document source measurements and take additional reading at the breathing zone. Call an IH immediately after documenting breathing zone and source zone readings, if source readings are above the level for mandatory work stoppage. Respirator levels can be down graded if all detector tubes indicate levels of airborne contamination at the source lower than the chemical specific action level for respirator use. If any chemical mandates respirator use, then a respirator must be donned.

*Call the Regional Environmental Health and Safety Coordinator for consultation.

**Monitoring performed at source.

TABLE OF CONTENTS

K. **Decontamination Procedures** (complete as necessary)

1. Personnel - specify materials (e.g. detergents, solvents, rinses, etc.) which will be used to decontaminate personnel protective gear; provide a brief summary paragraph outlining decontamination procedures.

   Disposable clothing will be disposed of with excavated soils.

2. Samples - specify materials and procedures to be used for decontamination.

   Not applicable

3. Sampling Equipment: outline decontamination procedures for equipment and material to be used for decontamination. Identify equipment which will be disposed of instead of decontaminated.

   Not applicable

4. Heavy equipment: outline unique decontamination procedures for heavy equipment.

   Back hoe, front end loader, tiller will steam cleaned.

L. **Disposal of Waste Materials Generated on Site**

1. This project will __X__ will not _____ generate hazardous wastes. These wastes will be:

   __X__ stored ____ treated
   ____ transported ____ manifested

   in the following manner: (ADDRESS INTERIM LABELING. If you are not going to label stored material, please describe materials to be stored, where they will be stored, what accessibility this area has, and why you believe this material is exempt from labeling requirements if you do not plan to label.)

2. Labeling Methods:

   To be determined based upon analytical results

3. Storage Methods:

   Contaminated soils will be stockpiled on-site and covered with a line.

4. TSD Facility to be used: To be determined

   Name: _____

   EPA I.D. Number: _____

5. Waste Transporter: To be determined

   Name: _____

   EPA I.D. Number: _____

VI. CONTINGENCY PLAN

If an injury occurs, take the following action:

- Get medical attention for the injured person immediately.
- Notify the Site Safety Officer and Site Team Leader.
- Depending on the type and severity of the injury, notify the Corporate Consulting Physician or the occupational physician for the injured person.
- Notify the injured person's personnel office.
- Prepare the incident report. The Site Safety Officer is responsible for its preparation and submittal to the Health and Safety Direction and corporate personnel office within 24 hours.
- The Site Safety Officer will assume charge during a medical emergency.

A. Local

Emergency Phone Numbers are to be posted: (please identify location of signs in site map, see Section I General Information, Subpart B, Site Map.

- Ambulance and Hospital: see Attachment 9
- Poison Control Center and Sheriff: See Attachment 9
- Fire Stations and Hazardous Waste Fire Sections: See Attachment 9

B. Emergency Routes

See Hospital Location Map - Attachment 6

C. Regional Environmental Health and Safety Coordinator

Name: Glen Fishler
Phone: (415) 521-5200

D. Regional Occupational Physician

Name: Lewis and Fishman
Phone: (415) 451-4840

E. Project Manager

Name: Walter Loo
Phone: (415) 521-5200

F. Client Contact

Name: Steve Croley
Phone: (415) 652-1276

G. Site Contact

Name: Steve Croley
Phone: (415) 652-1276

H. Regional Manager

Name: Del Christianson
Phone: (415) 521-5200

I. Site Safety Officer

Name: Amy Brownell
Phone: (415) 521-5200

J. Alternate Site Safety Officer

Name: Contractor
Phone:

K. Corporate Human Resources Department

Name: Mary Lynn Hollingsworth/Paulette Richards
Phone: (916) 638-3696

L. Governmental Contacts

1. Federal

Agency: N/A
Name:
Phone:

2. State

Agency: Department of Health Services
Name:
Phone: (415) 540-2998

3. Local

Agency: California Water Quality Control Board
Name:
Phone: (415) 268-2747

Keith Walsh and Associates, Inc.

Certificate of Completion

This Is To Certify That

JEAN HUGHES

Has Completed 40 ***Hours Of:***

DEPARTMENT OF LABOR CFR 29 1910.120 TRAINING

JANUARY 24, 25, 26, AND 27, 1989
Date

McLAREN ENVIRONMENTAL ENGINEERING
Location

Keith Walsh
President

Keith Walsh and Associates, Inc.

Certificate of Completion

This Is To Certify That

HERB HIRSHFELD

Has Completed 40 ***Hours Of:***

DEPARTMENT OF LABOR CFR 29 1910.120 TRAINING

DECEMBER 15, 16, 19, 20, 1988
Date

McLAREN ENVIRONMENTAL ENGINEERING
Location

Keith Walsh
President

Keith Walsh and Associates, Inc.

Certificate of Completion

This Is To Certify That

AMY BROWNELL

Has Completed 40 ***Hours Of:***

DEPARTMENT OF LABOR CFR 29 1910.120 TRAINING

DECEMBER 15, 16, 19, 20, 1988
Date

McLAREN ENVIRONMENTAL ENGINEERING
Location

Keith Walsh
President

ATTACHMENT 2

SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

McLAREN ENVIRONMENTAL ENGINEERING

SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

PROJECT: _____

CONTRACTOR _____

1. Contractor certifies that the following personnel to be employed on the subject project have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards. (See attached)

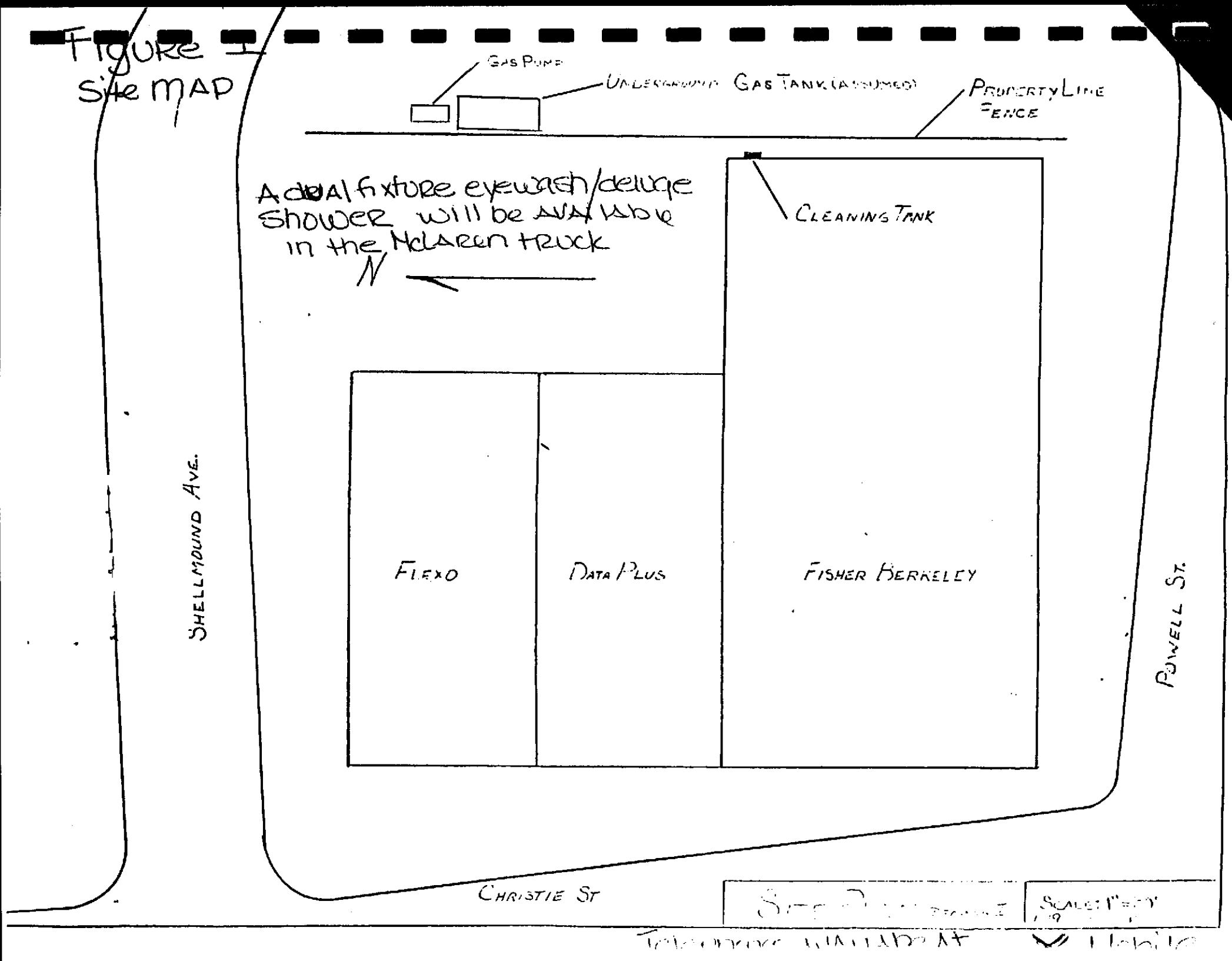
Contractor Personnel	Training	Respirator Certification	Medical Examinatio

2. Contractor certifies that it has received a copy of the Site Safety and Health Plan and will ensure that its employees are informed and will comply with its requirements.

3. Contractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement with McLaren Environmental Engineering with regard to all applicable occupational safety and health codes, standards, and regulations.

Signed _____ Date _____

Figure 1
Site MAP



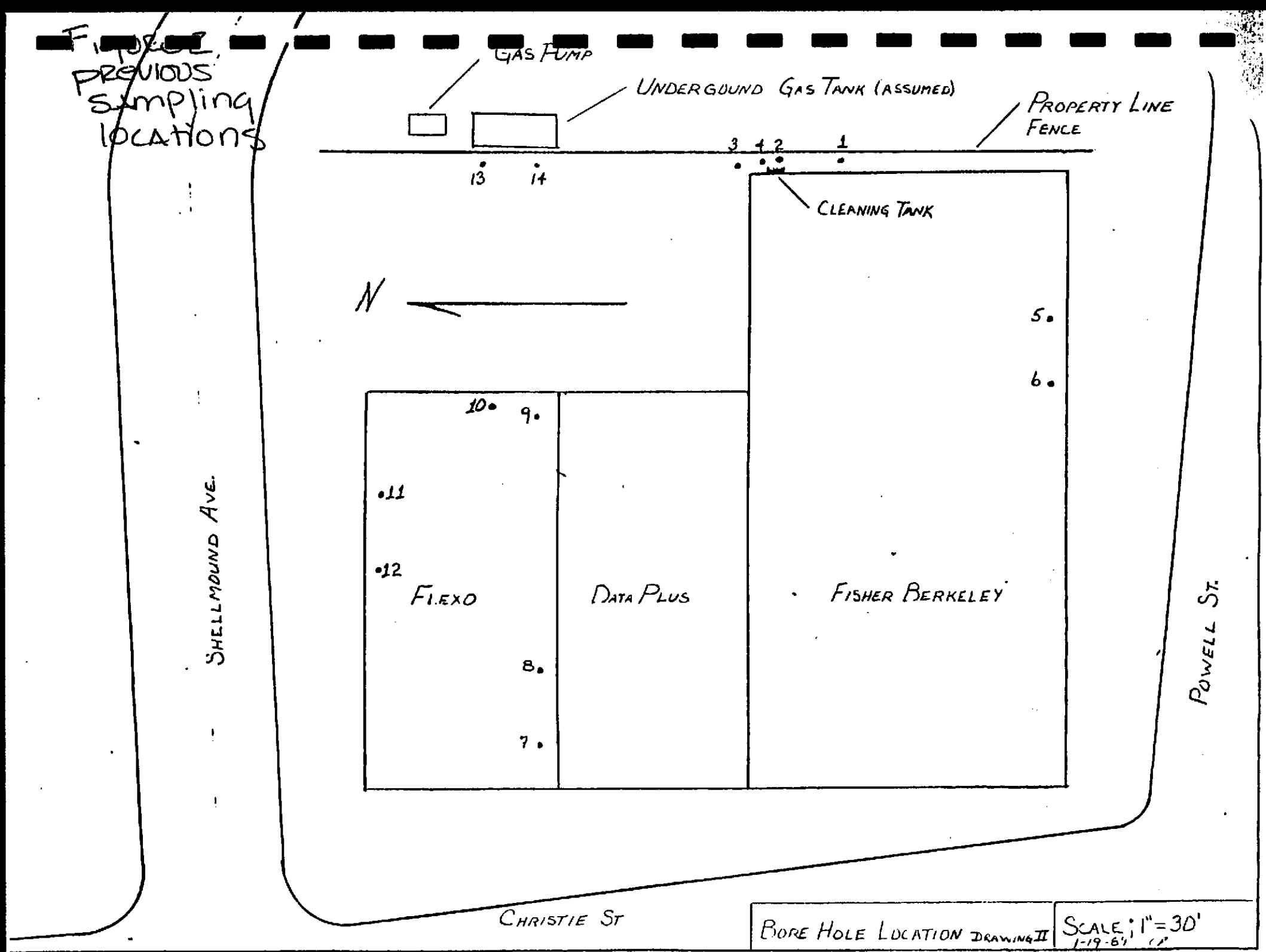
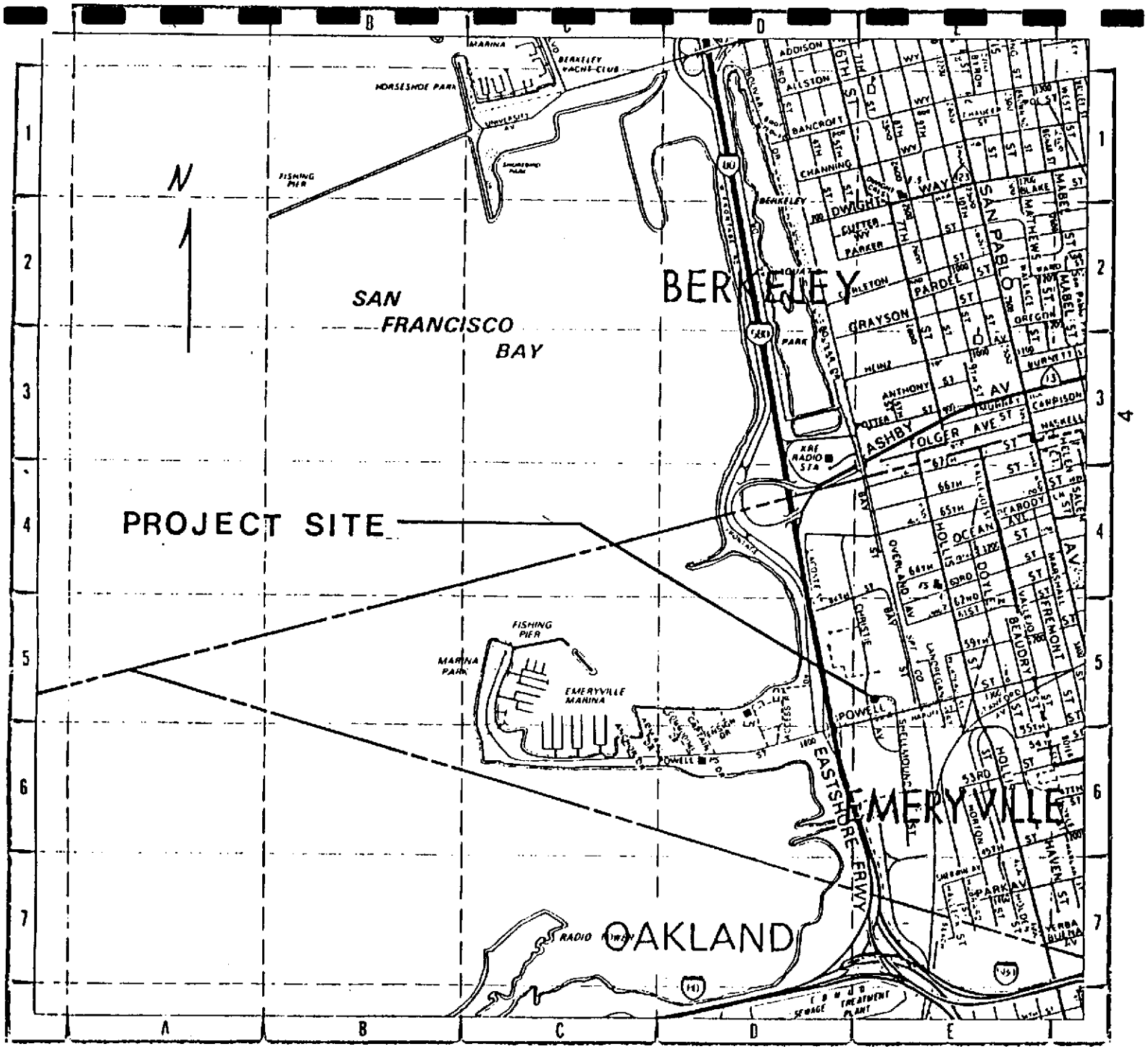


Figure 2
Previous sampling locations
Gas Pump
Underground Gas Tank (assumed)
Property Line Fence
3
4
2
1
13
14
Cleaning Tank
N
5
6
10
9
11
12
8
7
Flexo
Data Plus
Fisher Berkeley
Shellmound Ave.
Powell St.
Christie St
Bore Hole Location Drawing II
Scale: 1" = 30'
1-19-61



LOCATION MAP

SCALE: 1" = 2200'

USA Contact Date: ____/____
1-(800) 642-2444
USA Ticket Number: _____

UTILITY CLEARANCE CHECK

Task Number: _____

Task Descriptions:
(well drilling, trenching, _____

Project Location: _____

_____

_____

Project Start Date: ____/____ Clearance Request ____/____

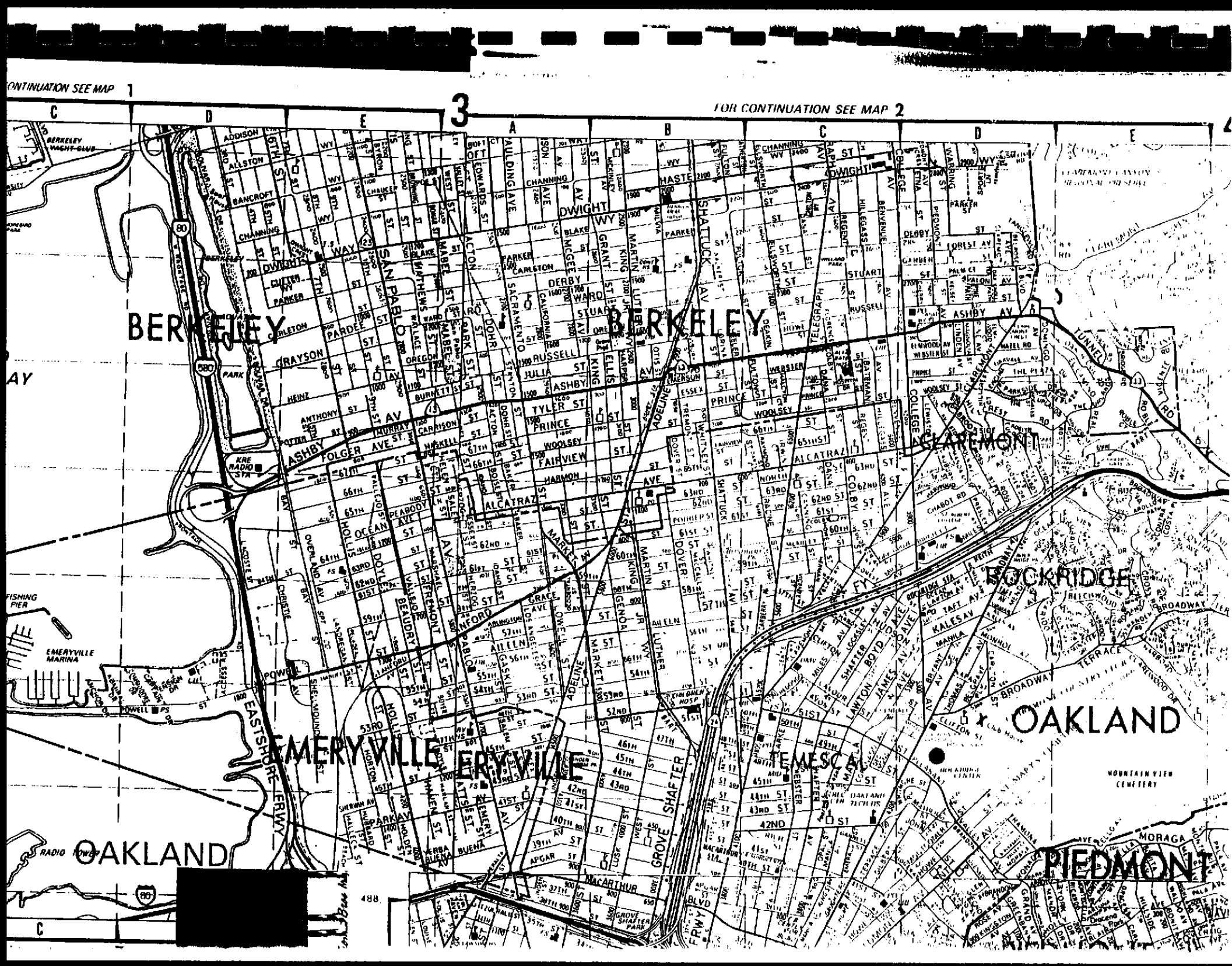
McLaren Project Manager: _____

Drilling / Construction Supervisor: _____

Clearance Engineer: _____/_____
(signature and date)

Supervising Engineer Verification: (after utility clearance) _____/_____
(signature and date)

FACILITY DRAWINGS INSPECTION (INITIALS and DATE)		FIELD VERIFICATION (INITIALS and DATE)	
A._____	Water Main	A._____	Water Main
B._____	Sanitary Sewer	B._____	Sanitary Sewer
C._____	Storm Drain	C._____	Storm Drain
D._____	Telephone	D._____	Telephone
E._____	Electrical	E._____	Electrical
F._____	Gas Lines	F._____	Gas Lines
G._____	Steam Lines	G._____	Steam Lines
H._____	Liquid Fuel	H._____	Liquid Fuel
I._____	Compressed Air	I._____	Compressed Air
J._____	Overhead Lines	J._____	Overhead Lines


CONTINUATION SEE MAP 1
FOR CONTINUATION SEE MAP 2
3
BERKELEY
BERKELEY
CLAREMONT
ROCKRIDGE
OAKLAND
EMERYVILLE
EMERYVILLE
TEMESCAL
OAKLAND
PIEDMONT
BERKELEY YACHT CLUB
EMERYVILLE MARINA
FISHING PIER
RADIO TOWER
KRE RADIO STA
EASTSHORE FWY
SHATTUCK AV
ASHBY AV
DWIGHT WY
ALCATRAZ
MARKET ST
GROVE SHAFTER FWY
MACARTHUR BLVD
MOUNTAIN VIEW CEMETERY
488

ATTACHMENT 7

DIRECT READING REPORT/MONITOR LOG REPORT

DIRECT READING REPORT

DEPT. NO.	BLDG. NO.	COL.	PLT.	SHIFT	WORKSHEET_____OF_____

PERSON PERFORMING SAMPLING

EMPLOYEE NAME

JOB TITLE

PPE (TYPE AND EFFECTIVENESS)

WEATHER CONDITIONS

INTERFERENCES

JOB DESCRIPTION, OPERATION, WORK LOCATION(S), VENTILATION AND CONTROLS

DIRECT READING DATA

SUBSTANCE/AGENT	TIME	READING	LOCATION AND REMARKS

CALIBRATION DATA

INSTRUMENT (TYPE, MFG., MODEL NO., SERIAL NO.)		
CALIBRATION METHOD AND RESULTS (ATTACH CALIBRATION SHEETS)		
CALIBRATED BY	EXPIRATION DATE	CALIBRATOR MODEL, SERIAL NO.

COMMENTS

ATTACHMENT 9

LOCAL EMERGENCY TELEPHONE NUMBERS

	NAME	TELEPHONE NUMBER
Hospital	Alta Bates	(415) 540-1303
Ambulance		911
Poison Control Center	Bay Area Poison Control Center	(415) 476-6600
Sheriff	Emeryville Police Department	(415) 596-3700
Fire Stations	Emeryville Fire Department	(415) 652-4575
Hazardous Waste Fire	Emeryville Fire Department	(415) 652-4575

APPENDIX 1

MEDICAL SURVEILLANCE PROGRAM

HEALTH AND SAFETY POLICY AND PROCEDURE

HS 10.0 MEDICAL SURVEILLANCE

1.0 SUBJECT: Physical Examinations/Biological Monitoring Program

2.0 EFFECTIVE DATE:

3.0 APPLICABILITY: All McLaren employees,including ChemRisk, Western Laboratory employees, and any other employees of entities acquired.

4.0 APPLICABLE REGULATIONS:

OSHA Regulation 29 CFR 1910.20
OSHA Regulation 29 CFR 1926.23
OSHA Regulation 29 CFR 1926.50
OSHA Regulation 29 CFR 1910.120
OSHA Regulation 29 CFR 1910.134
OSHA Regulation 29 CFR 1910.151
OSHA Regulation 29 CFR 1910.1001 - 1047
OSHA Regulation 29 CFR 1910.1904

Cal-OSHA Title 8 General Industry Safety Orders Group 16 Article 107 Section 5144
Cal-OSHA Title 8 General Industry Safety Orders, Article 4, Section 1531
Cal-OSHA Title 8 General Industry Safety Orders, Article 4, Section 5208-5220
Cal-OSHA Title 8 General Industry Safety Orders, Article 4, Section 3204.

5.0 DOCUMENTS ATTACHED:

Medical Questionnaire 29 CFR 1910.1001; Medical Clearance Form; Medical Surveillance Program Waiver Form; Medical Record Access Notice; Medical Record Release Form.

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Rev. 02/28/89

6.0 DEFINITIONS:

A. Medical Surveillance Program: A program designed to systematically collect and analyze health information on employees potentially exposed to harmful agents for the purpose of identifying health effects at an early, and possibly reversible, stage.

B. Biological Monitoring: The analyses of exhaled air, biological fluids, such as blood or urine, and X-rays to evaluate past exposure to a chemical and/or radioactive material.

C. Asbestos: Refers to the following materials; asbestos, anthophyllite, actinolite and tremolite.

7.0 GENERAL POLICY STATEMENT:

It is the policy of McLaren to insure healthy and safe employees. McLaren pursues this goal by providing a Medical Surveillance Program to assess employees' ability to perform responsibilities effectively (fitness of duty) and monitor employees potentially exposed to hazardous agents for adverse health effects.

In addition to Hazardous Waste Operations and Emergency Response, 29 CFR 1910.120 requirements, the Respiratory Protection regulations, 29 CFR 1910.134, Asbestos regulations 29 CFR 1910.1001 and 29 CFR 1926.58, and Regulated Chemicals regulations, 29 CFR 1910.1001 through 1910.1047 all require medical monitoring programs. McLaren has combined these medical monitoring programs into one encompassing all requirements, the Medical Surveillance Program.

8.0 RESPONSIBILITIES:

A. The company is responsible for providing physical examinations at no cost to employees, including travel cost to the medical facility.

B. The Corporate Environmental Health and Safety Coordinator (CEHSC) will develop and amend all policies and procedures of the Medical Surveillance Program as necessary.

C. The Regional Environmental Health and Safety Coordinator (REHSC) will insure that reputable medical facilities and physician's Board Certified in Occupantional Medicine perform physical examinations of employees.

The REHSC or designee will administer this program in accordance with the stated procedure.

D. The Vice President, Regional Manager, Project Manager will insure that only those employees participating in the Medical Surveillance Program will perform activities or have responsibilities at a hazardous waste, asbestos or otherwise regulated site.

The Vice President, Regional Manager, Project Manager will comply with physician's request of an employee's work limitations.

E. The Corporate Human Resources Department will provide the CEHSC a list of all employees participation in the Medical Surveillance Program quarterly, with special designation for asbestos workers.

The Corporate Human Resources Department is responsible for scheduling all physical examinations.

F. The Occupational Clinic/Physician will be responsible for completing McLaren's Medical Clearance Form (Attachment 1) for each employee.

G. Any McLaren contractors must establish, maintain, and adhere to an equivalent medical surveillance program of their own.

9.0 PROCEDURES:

A. Employees required to participate in the Medical Surveillance Program include:

1.0 All employees who are or may be exposed to hazardous substances or health hazards at or above the established permissible exposure limits for these substances, without regard to the use of respirators, for 30 days or more a year.

1.1 Those employees who wear a respirator for 30 days or more a year must participate in the Medical Surveillance Program.

1.2 Those employees exposed to a regulated chemical, as established in 29 CFR 1910.1001-1047, at the action levels, i.e., time and concentration, where medical monitoring, biological or otherwise, is required.

1.3 Those employees recommended to participate in the Medical Surveillance Program by the CEHSC or REHSC.

B. Scheduling Medical Appointments

1.0 The Corporate Human Resource Department will schedule a physical examination for each employee, usually within the first few days of employment.

1.1 The location and time of the examination will be at employee's convenience and during work hours.

1.2 If employee refuses to undergo any or all parts of the medical evaluation, action such as prevention from hiring or exclusion from a work activity (i.e., reassignment) may be advised by the Regional Manager, but at a minimum, the employee will be required to sign a waiver of liability (attachment 2).

C. Baseline Medical Examination

1.0 All new employees will be required to have a physical examination to serve as a baseline to compare with future examinations and to determine their fitness for duty.

1.1 If a new employee had an exit examination from his/her previous employer, the medical records will be reviewed by McLaren's physician to determine if medical examination is acceptable and if an additional examination is required.

1.2 The physical examination includes:

a) medical and occupational history review

b) physical examination

c) vision test

d) audiometric test - conducted in a 29 CFR 1910.95 approved testing booth, every 5 years.

e) biological monitoring tests:

- blood tests
- urine tests
- Physician identified biological exposure indexes (BEI's) which are recognized and validated.

f) identification of relevant lifestyle habits (e.g., cigarette smoking, alcohol and drug use) and hobbies

g) Pulmonary Function Test (Spirometry)

c) Chest X-ray - (14" x 17" PA) B-Reader interpretation/ILO classification by a Board Certified Radiologist - Record interpretation on Form CSD/NIOSH (M) 2.B. (see chart below).

FREQUENCY OF CHEST ROENTGENOGRAMS

Years from First Exposure	Age of Employee		
	15 to 35	35+ to 45	45+
0 to 10	Every 5 years	Every 5 years	Every 5 years
10+	Every 5 years	Every 5 years	Every 5 years

d) Pulmonary Function Tests (FVC and FEV_1) by a technician trained in a professional spirometry course.

e) The CEHSC must provide the examining physician with the following:

- Copy of asbestos Standard and Appendices D and E.
- Employee's job description relative to exposure.
- Asbestos exposure level.
- Description of personal protective and respiratory equipment.
- Information from prior medical exams.

F. Special Monitoring/Examination

1.0 Specific chemicals regulated by California or Federal OSHA (29 CFR 1910.1001-1047) will be selectively monitored if known or suspected regulated chemical exposure exists. All exposure information related to the regulated chemicals will be forwarded to physician. Specific biological monitoring tests will be determined by the physicians.

G. Termination Examination

1.0 An exit examination is recommended for employees leaving McLaren to insure a clean bill of health. This examination can be limited depending on if the last examination was within 6 months, no exposures occurred since the last examination, or no symptoms associated with exposure occurred since the last examination.

H. Medical Clearance

1.0 The physician will review the examination results of each employee. A written assessment of the employee's overall fitness and ability to wear respiratory protection will be submitted to the CEHSC and the Corporate Human Resources Department.

1.1 No employee will be assigned to a task that requires the use of a respirator unless the physician has issued a medical clearance that confirms that the person is physically able to perform under on-site working conditions.

1.2 Individuals who are clearly unable to perform based on the medical history and physical exam (e.g., those with severe lung disease, heart disease, or back or orthopedic problems) will not receive a physician's clearance and will be prohibited from field work.

1.3 Any employee who is planning a pregnancy or who becomes pregnant, must report this information to the Corporate Human Resources Department as soon as possible. The Corporate Human Resources Department will consult the REHSC, who will serve as the liaison with the physician. The physician will ultimately determine if an employee will be issued a medical clearance, i.e., prohibited from field work.

1.4 McLaren will comply with the recommendations of the employees personal physician, accommodating the employee whenever possible.

I. Physician Treatment

1.0 If an employee experiences a non-emergency occupational-related illness, the physician is required to notify the employee and the Corporate Human Resources of the illness and recommended treatment.

1.1 If an employee experiences an urgent occupational-related illness, the physician is required to provide the employee emergency treatment.

a) Provisions for emergency treatment are delineated in the site specific safety and health plan.

1.2 The physician will determine if illness is a job-related symptom evaluated in the context of the employee exposure.

1.3 Nonoccupational-related illness or problems will only be treated by employee's personal physician.

1.4 Any occupational-related illness must be reported according to the Accident Investigation and Reporting Policy, (HS 8.0).

J. Program Evaluation

1.0 The CEHSC will periodically inspect medical records to insure proper organization, maintenance, and file security (confidentiality from unauthorized personnel).

1.1 The CEHSC will evaluate the efficacy of specific medical testing in the context of potential site exposures.

1.2 The CEHSC will review the Medical Surveillance Program for improvements annually.

10.0 MEDICAL SURVEILLANCE: Delineated within this policy.

11.0 TRAINING REQUIREMENTS: NONE

12.0 RECORDKEEPING REQUIREMENTS:

A. Employee medical records will be maintained for the duration of employee's employment and retained for 30 years after employee's termination date.

B. All employee medical records are confidential and are maintained for company use only. Medical records will not be released without approval of the employee. Copies can be dispersed by the CEHSC or the Corporate Human Resources Department, when employee signs a release form (Attachment 5).

C. Employee medical records will be kept with the Corporate Human Resources Department and a copy will be filed with the CEHSC.

D. In the event McLaren ceases business, all medical records must be sent to employees future employer and occupational clinic, or to the Director of the National Institute for Occupational Safety and Health.

E. The REHSC will post a notice (Attachment 4) to inform employees of the right to request copies of their medical records.

1.0 If an employee submits a written request (attachment 5) to the REHSC to access or a copy of his/her medical record, the REHSC will coordinate a written response to insure employee's request is made within 15 days after the request date.

Attachment 1

McLAREN MEDICAL CLEARANCE FORM

In accordance with McLaren's Medical Surveillance Program and State and Federal Regulations (CCR Title 8 GISO Article 4, Section 1531; Section 5144; and 29 CFR 1910.120 and 1910.134), the examining physician is required to provide the employee and employer a written assessment of the employee's overall fitness and ability to wear respiratory protection while performing field activities.

This is to certify that _____
Employee's name

(__ __ __ - __ __ - __ __ __) has been examined by
Social Security Number

_____ and he/she [__] is / [__] is not
Physician's Name

physically able to perform responsibilities in the field while wearing respiratory protection, [__] has / [__] has no significant change in audiometric exam from previous exam, and an eye exam showed a [__] / no need [__] for corrective lenses.

The physician has the following recommendations and/or limitations for employee:

_____

_____

Comments:

_____

_____

_____ _____
Physician's Signature Date

Rev. 02/28/89

CONFIDENTIAL

Attachment 2

McLAREN'S MEDICAL SURVEILLANCE PROGRAM WAIVER FORM

As an employee of McLaren, I _____
Employee's Name

(_ _ _ - _ _ - _ _ _ _) refuse to undergo any or all parts of the Medical
Social Security Number

Surveillance Program. I acknowledge and agree to perform my responsibilities at McLaren and understand that McLaren waives all liability for harm which may arrive to me as a result of not participating in the Medical Surveillance Program.

_____ _____
Employee's Signature Date

_____ _____
Witness' Signature Date

Rev. 02/28/89

Part 1
INITIAL MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___
(1 2 3 4 5 6 7 8 9)

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
(10 11 12 13 14 15)

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
(16 17 18 19 20 21)

11. Date of Birth _____ ___ ___ ___ ___ ___ ___
Month Day Year (22 23 24 25 26 27)

12. Place of Birth _____

13. Sex
1. Male ___
2. Female ___

14. What is your marital status?
1. Single ___
2. Married ___
3. Widowed ___
4. Separated/ Divorced ___

15. Race
1. White ___
2. Black ___
3. Asian ___
4. Hispanic ___
5. Indian ___
6. Other ___

16. What is the highest grade completed in school? _____
(For example 12 years is completion of high school)

OCCUPATIONAL HISTORY

17A. Have you ever worked full time (30 hours per week or more) for 6 months or more? 1. Yes __ 2. No __

IF YES TO 17A:

B. Have you ever worked for a year or more in any dusty job? 1. Yes __ 2. No __ 3. Does Not Apply __

h) Electrocardiogram (EKG) - baseline EKG only. Individuals at age 40 and above should have EKG every 2 years, unless individual is covered by asbestos standard.

i) Chest X-rays should be repeated only at five year intervals, unless individual is covered by asbestos standard. (see asbestos medical monitoring).

D. Periodic Examination

1.0 An annual medical examination is required of employees who participate in the Medical Surveillance Program. The Corporate Human Resources Department schedules all annual medical examinations.

1.1 If employee has not worked at a hazardous waste site since the baseline examination, this examination is optional.

1.2 More frequent or specific examinations may be necessary, depending on the extent of potential or known exposure at a site. The CEHSC and REHSC in consultation with the physician will determine if more frequent examinations are warranted on a project-to-project basis.

1.3 Examinations include:

a) yearly update of medical and occupational history
b) yearly physical examinations
c) yearly biological monitoring test

- The extent of these tests will depend on:

i) examination results
ii) exposures, and
iii) job tasks

E. Asbestos Medical Monitoring

1.0 Physical examination requirements:

a) Medical/occupational history - must use OSHA questionnaire Part I for preplacement/initial evaluation and Part II for subsequent/annual periodic exams. (attachment 3) (The OSHA questionnaire Part I and Part II are published in Appendix D of the Asbestos Standard.)

b) emphasis on respiratory and cardiovascular systems, digestive tract, and skin on hands.

Specify job/industry _____ Total Years Worked ___

Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

C. Have you ever been exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

Specify job/industry _____ Total Years Worked ___

Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

D. What has been your usual occupation or job--the one you have worked at the longest?

1. Job occupation _____

2. Number of years employed in this occupation _____

3. Position/job title _____

4. Business, field or industry _____

(Record on lines the years in which you have worked in any of these industries, e.g. 1960-1969)

Have you ever worked:

	YES	NO
E. In a mine?.....	[__]	[__]
F. In a quarry?.....	[__]	[__]
G. In a foundry?.....	[__]	[__]
H. In a pottery?.....	[__]	[__]
I. In a cotton, flax or hemp mill?.....	[__]	[__]
J. With asbestos?.....	[__]	[__]

18. PAST MEDICAL HISTORY

	YES	NO
A. Do you consider yourself to be in good health?	[__]	[__]

If "NO" state reason _____

B. Have you any defect of vision?.....	[__]	[__]

If "YES" state nature of defect _____

C. Have you any hearing defect?.....	[__]	[__]

If "YES" state nature of defect _____

D. Are you suffering from or have you ever suffered from:

a. Epilepsy (or fits, seizures, convulsions)?	[__]	[__]
b. Rheumatic fever?	[__]	[__]
c. Kidney disease?	[__]	[__]
d. Bladder disease?	[__]	[__]
e. Diabetes?	[__]	[__]
f. Jaundice?	[__]	[__]

19. CHEST COLDS AND CHEST ILLNESSES

19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time) 1. Yes __ 2. No __ 3. Don't get colds __

20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes __ 2. No __

IF YES TO 20A:

B. Did you produce phlegm with any of these chest illnesses? 1. Yes __ 2. No __ 3. Does Not Apply __

C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses __ No such illnesses __

21. Did you have any lung trouble before the age of 16? 1. Yes __ 2. No __

22. Have you ever had any of the following?

1A. Attacks of bronchitis? 1. Yes __ 2. No __

IF YES TO 1A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age was your first attack? Age in Years __ Does Not Apply __

2A. Pneumonia (include bronchopneumonia)? 1. Yes __ 2. No __

IF YES TO 2A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did you first have it? Age in Years __ Does Not Apply __

3A. Hay Fever? 1. Yes __ 2. No __

IF YES TO 3A:

B. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

C. At what age did it start? Age in Years __ Does Not Apply __

23A. Have you ever had chronic bronchitis? 1. Yes __ 2. No __

IF YES TO 23A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

24A. Have you ever had emphysema? 1. Yes __ 2. No __

IF YES TO 24A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

25A. Have you ever had asthma? 1. Yes __ 2. No __

IF YES TO 25A:

B. Do you still have it? 1. Yes __ 2. No __ 3. Does Not Apply __

C. Was it confirmed by a doctor? 1. Yes __ 2. No __ 3. Does Not Apply __

D. At what age did it start? Age in Years __ Does Not Apply __

E. If you no longer have it, at what age did it stop? Age stopped __ Does Not Apply __

26. Have you ever had:

A. Any other chest illness? 1. Yes __ 2. No __

If yes, please specify _____

B. Any chest operations? 1. Yes __ 2. No __

If yes, please specify _____

C. Any chest injuries? 1. Yes __ 2. No __

If yes, please specify _____

27A. Has a doctor ever told you that you had heart trouble? 1. Yes __ 2. No __

IF YES TO 27A:

B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

28A. Has a doctor ever told you that you had high blood pressure? 1. Yes __ 2. No __

IF YES TO 28A:

B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes __ 2. No __ 3. Does Not Apply __

29. When did you last have your chest X-rayed? (Year) __ __ __ __ (25 26 27 28)

30. Where did you last have your chest X-rayed (if known)? _____

What was the outcome? _____

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had chronic lung condition such as:

	FATHER			MOTHER		
	1. Yes	2. No	3. Don't Know	1. Yes	2. No	3. Don't Know
A. Chronic Bronchitis?	___	___	___	___	___	___
B. Emphysema?	___	___	___	___	___	___
C. Asthma?	___	___	___	___	___	___
D. Lung cancer?	___	___	___	___	___	___
E. Other chest conditions	___	___	___	___	___	___
F. Is parent currently alive?	___	___	___	___	___	___
G. Please Specify	___ Age if Living ___ Age at Death ___ Don't Know			___ Age if Living ___ Age at Death ___ Don't Know		

H. Please specify cause of death

_____ _____

COUGH

32A. Do you usually have a cough? (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) [If no, skip to question 32C.] 1. Yes __ 2. No __

B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually cough at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF ABOVE (32A, B, C, or D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had the cough? Number of years __ Does not apply __

33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C) 1. Yes __ 2. No __

B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes __ 2. No __

C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes __ 2. No __

D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes __ 2. No __

IF YES TO ANY OF THE ABOVE (33A, B, C, or D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes __ 2. No __ 3. Does not apply __

F. For how many years have you had trouble with phlegm? — Number of years _ Does not apply _

EPISODES OF COUGH AND PHLEGM

34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year? *(For persons who usually have cough and/or phlegm) — 1. Yes __ 2. No

If YES TO 34A

B. For how long have you had at least 1 such episode per year? — Number of years _ Does not apply

WHEEZING

35A. Does your chest ever sound wheezy or whistling

1. When you have a cold? — 1. Yes __ 2. No
2. Occasionally apart from colds? — 1. Yes __ 2. No
3. Most days or nights? — 1. Yes __ 2. No

IF YES TO 1, 2, or 3 in 35A

B. For how many years has this been present? — Number of years Does not apply

36A. Have you ever had an attack of wheezing that has made you feel short of breath? — 1. Yes __ 2. No

IF YES TO 36A

B. How old were you when you had your first such attack? — Age in years Does not apply

C. Have you had 2 or more such episodes? — 1. Yes __ 2. No 3. Does not apply

D. Have you ever required medicine or treatment for the(se) attack(s)? — 1. Yes __ 2. No 3. Does not apply

BREATHLESSNESS

37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 39A. Nature of condition(s)_____

38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? — 1. Yes __ 2. No

IF YES TO 38A

B. Do you have to walk slower than people of your age on the level because of breathlessness?
1. Yes __
3. Does not

C. Do you ever have to stop for breath when walking at your own pace on the level?
1. Yes __
3. Does not a

D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level?
1. Yes __
3. Does not a

E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs?
1. Yes __
3. Does not a

TOBACCO SMOKING

39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.)
1. Yes __

IF YES TO 39A

B. Do you now smoke cigarettes (as of one month ago)
1. Yes __
3. Does not a

C. How old were you when you first started regular cigarette smoking?
Age in yea
Does not a

D. If you have stopped smoking cigarettes completely, how old were you when you stopped?
Age stopped
Check if still sm
Does not apply

E. How many cigarettes do you smoke per day now?
Cigarettes per da
Does not apply

F. On the average of the entire time you smoked, how many cigarettes did you smoke per day?
Cigarettes per da
Does not apply

G. Do or did you inhale the cigarette smoke?
1. Does not apply
2. Not at all
3. Slightly
4. Moderately
5. Deeply

40A. Have you ever smoked a pipe regularly? (Yes means more than 12 oz. of tobacco in a lifetime.)
1. Yes __ 2

IF YES TO 40A:
FOR PERSONS WHO HAVE EVER SMOKED A PIPE

B. 1. How old were you when you started to smoke a pipe regularly? — Age __

2. If you have stopped smoking a pipe completely, how old were you when you stopped? — Age stopped __ / Check if still smoking pipe __ / Does not apply __

C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? — __ oz. per week (a standard pouch of tobacco contains 1 1/2 oz.) / __ Does not apply

D. How much pipe tobacco are you smoking now? — oz. per week __ / Not currently smoking a pipe __

E. Do you or did you inhale the pipe smoke?
1. Never smoked __
2. Not at all __
3. Slightly __
4. Moderately __
5. Deeply __

41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year) — 1. Yes __ 2. No __

IF YES TO 41A
FOR PERSONS WHO HAVE EVER SMOKED CIGARS

B. 1. How old were you when you started smoking cigars regularly? — Age __

2. If you have stopped smoking cigars completely, how old were you when you stopped. — Age stopped __ / Check if still smoking cigars __ / Does not apply __

C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week? — Cigars per week __ / Does not apply __

D. How many cigars are you smoking per week now? — Cigars per week __ / Check if not smoking cigars currently __

E. Do or did you inhale the cigar smoke?
1. Never smoked __
2. Not at all __
3. Slightly __
4. Moderately __
5. Deeply __

Signature _____ Date _____

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

1. NAME _____

2. SOCIAL SECURITY # ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
1 2 3 4 5 6 7 8 9

3. CLOCK NUMBER ___ ___ ___ ___ ___ ___
10 11 12 13 14 15

4. PRESENT OCCUPATION _____

5. PLANT _____

6. ADDRESS _____

7. _____
(Zip Code)

8. TELEPHONE NUMBER _____

9. INTERVIEWER _____

10. DATE _____ ___ ___ ___ ___ ___ ___
16 17 18 19 20 21

11. What is your marital status? 1. Single ___ 4. Separated/ Divorced ___
2. Married ___
3. Widowed ___

12. OCCUPATIONAL HISTORY

12A. In the past year, did you work full time (30 hours per week or more) for 6 months or more? 1. Yes ___ 2. No ___

IF YES TO 12A:

12B. In the past year, did you work in a dusty job? 1. Yes ___ 2. No ___ 3. Does Not Apply ___

12C. Was dust exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12D. In the past year, were you exposed to gas or chemical fumes in your work? 1. Yes ___ 2. No ___

12E. Was exposure: 1. Mild ___ 2. Moderate ___ 3. Severe ___

12F. In the past year, what was your: 1. Job/occupation? _____
2. Position/job title? _____

13. RECENT MEDICAL HISTORY

13A. Do you consider yourself to be in good health? Yes ___ No ___

If NO, state reason _____

13B. In the past year, have you developed:

	Yes	No
Epilepsy?	___	___
Rheumatic fever?	___	___
Kidney disease?	___	___
Bladder disease?	___	___
Diabetes?	___	___
Jaundice?	___	___
Cancer?	___	___

14. CHEST COLDS AND CHEST ILLNESSES

14A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time)

1. Yes ___ 2. No ___
3. Don't get colds ___

15A. During the past year, have you had any chest illnesses that have kept you off work, indoors at home, or in bed?

1. Yes ___ 2. No ___
3. Does Not Apply ___

IF YES TO 15A:

15B. Did you produce phlegm with any of these chest illnesses?

1. Yes ___ 2. No ___
3. Does Not Apply ___

15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more?

Number of illnesses ___
No such illnesses ___

16. RESPIRATORY SYSTEM

In the past year have you had:

	Yes or No	Further Comment on Positive Answers
Asthma	_____	
Bronchitis	_____	
Hay Fever	_____	
Other Allergies	_____	

	Yes or No	Further Comment on Positive Answers
Pneumonia	_____	
Tuberculosis	_____	
Chest Surgery	_____	
Other Lung Problems	_____	
Heart Disease	_____	

Do you have:

	Yes or No	Further Comment on Positive Answers
Frequent colds	_____	
Chronic cough	_____	
Shortness of breath when walking or climbing one flight or stairs	_____	

Do you:

Wheeze	_____	
Cough up phlegm	_____	
Smoke cigarettes	_____	Packs per day ___ How many years ___

Date _____ Signature _____

MEDICAL RECORD ACCESS NOTICE

In accordance with McLaren's Health and Safety Policies and Procedures, State and Federal Regulations (CCR Title 8 and 29 CFR 1910), McLaren is required to post a notice informing McLaren employees of their right to access personal medical records.

All medical records are confidential and are maintained for company use only. Medical records will not be released without approval of the employee. Copies can be dispersed by the Corporate Environmental Health and Safety Coordinator (CEHSC) or the Corporate Human Resources Department, only when employee signs a Medical Record release form.

All employees are allowed to view and/or have copies of personal medical records. To request access or a copy of medical records, the employee is required to inform the Regional Environmental Health and Safety Coordinator (REHSC) or CEHSC in writing and sign the Medical Record Release Form. Medical Record Release Forms can be obtained from the REHSC or CEHSC. The REHSC or CEHSC will coordinate a written response to insure employee's request is made possible within 15 days after the request date.

Rev. 02/28/89

Attachment 5

McLAREN'S MEDICAL RECORD RELEASE FORM

As an employee of McLaren, I _____,
Employee's Name

(__ __ __ - __ __ - __ __ __) request on _____ :
Social Security Number Date

|___| a copy of my medical records.

|___| a copy of my medical records sent to:

_____

_____

_____

This request was submitted to:

_____ _____
CEHSC or REHSC Date

This request was completed on _____
Date

by _____.
CEHSC or REHSC

Rev. 02/28/89

APPENDIX 2

INSTRUMENT CALIBRATION AND MONITORING PROCEDURES

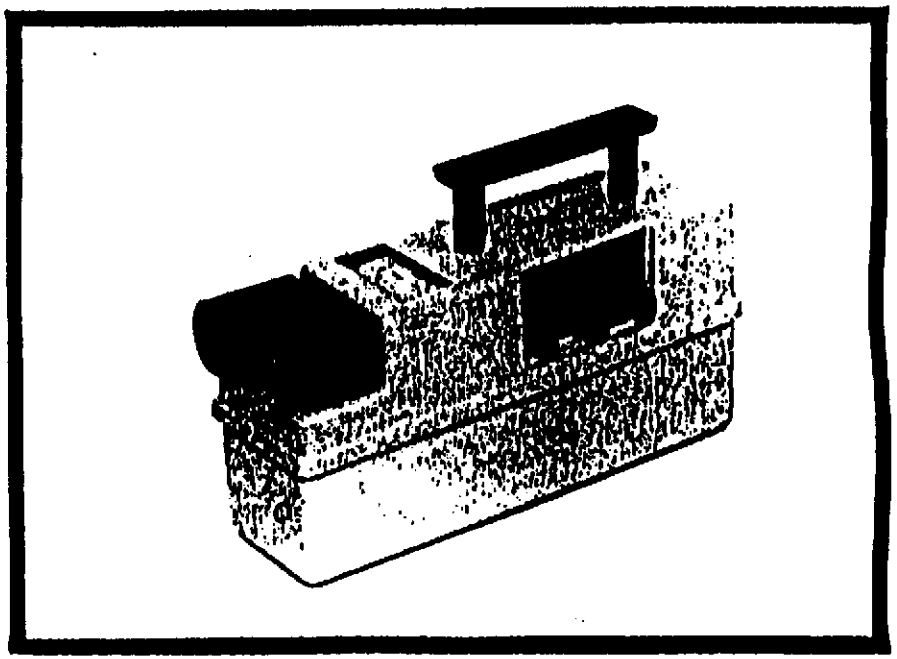
GASTECH (LEL) CALIBRATION
AND MAINTENANCE INSTRUCTIONS

GASTECH

MODEL 1214
GASTECHTOR

INSTRUCTION MANUAL

GASTECH



MADE BY

GASTECH INC.

SERVICE POLICY

GasTech Inc. maintains an instrument service facility at the factory. Some GasTech distributors also have repair facilities; however, GasTech assumes no liability for service performed by other than GasTech personnel. Should your instrument require non-warranty repair, you may contact the distributor from which it was purchased, or you may contact GasTech directly.

If GasTech is to do the repair work for you, you may send the instrument, prepaid, to GasTech Inc. 8445 Central Avenue, Newark, CA 94560, Attn: Service Department. Always include your address, purchase order number, shipping and billing information and a description of the defect as you perceive it. If you wish to set a limit to the authorized repair cost, state a "not to exceed" figure. If you must have a price quotation before you can authorize the repair cost, so state, but understand that this involves extra cost and extra handling delay. GasTech's policy is to perform all needed repairs to restore the instrument to full operating condition, including reactivation of all out-of-warranty electrochemical cells.

To expedite the repairs operation, it is preferable to call in advance to GasTech Customer Service, (415)794-6200, obtain a Return Authorization Number (RA#), describe the nature of the problem and provide a purchase order number.

If this is the first time you are dealing directly with the factory, you will be asked to provide credit references or prepay, or authorize COD shipment.

Pack the instrument and all its accessories (preferably in its original packing). Enclose your Purchase Order, shipping and billing information, RA#, and any special instructions.

6/87

INSTRUCTION MANUAL

MODEL 1214 and 1214S

COMBINATION COMBUSTIBLE GAS/OXYGEN INDICATOR AND ALARM

COMBUSTIBLES ALARM SETTING : 20% LEL

OXYGEN ALARM SETTING : 19.5 and 25% OXYGEN

CONTENTS

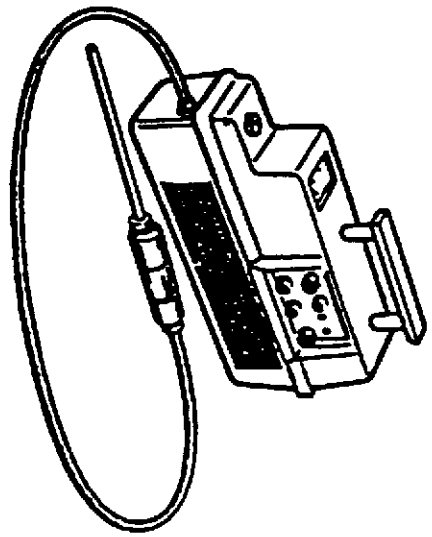
CAUTION

Explosive gas mixtures can maim, disfigure and kill, and oxygen deficient atmospheres can cause instant death. It is essential that users of this instrument read, understand and follow the instructions for operation and maintenance, and the precautions contained in this manual to ensure that the instrument will warn of explosive or oxygen deficient atmospheres.

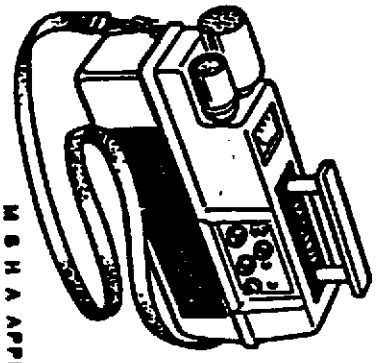
DO NOT USE FOR DETECTION OF TOXIC GAS OR
FOR COMBUSTIBLE GASES IN THE TOXIC RANGE.
DO NOT USE ON OXYGEN-ACETYLENE MIXTURES.

FOR APPLICATION INFORMATION,
ACCESSORIES, SPARE OR REPLACEMENT PARTS, CONTACT:

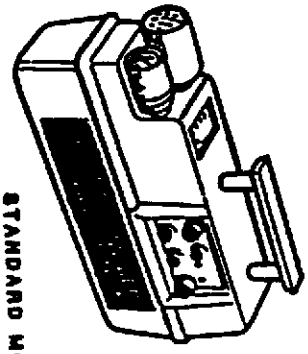
GASTECH INC.
8445 CENTRAL AVENUE
NEWARK, CALIFORNIA 94560 USA
PHONE: (415) 794-6200
FAX: (415) 794-6210
TELEX: 334-462



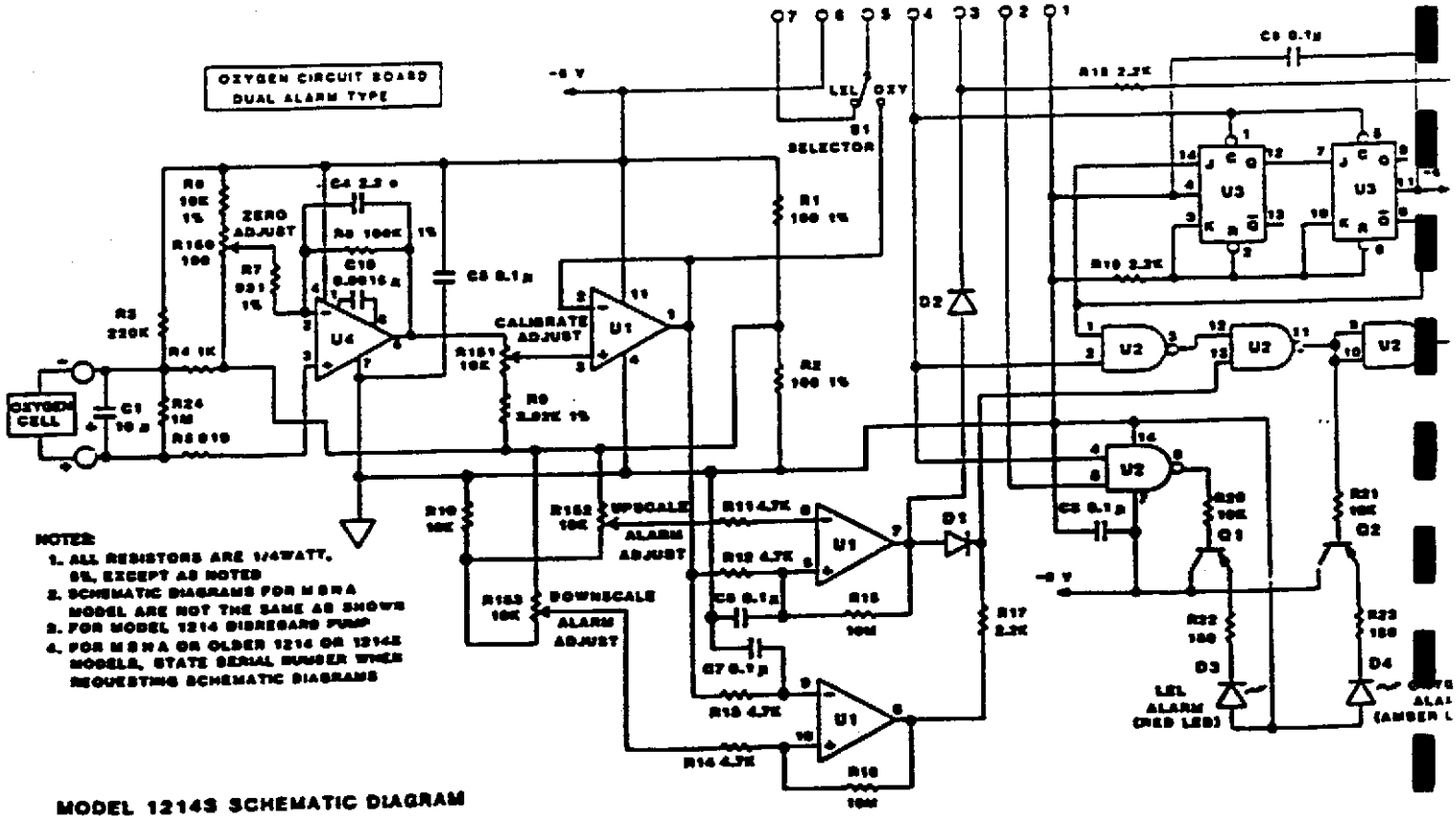
SAMPLE-DRAWING MODEL 1214S



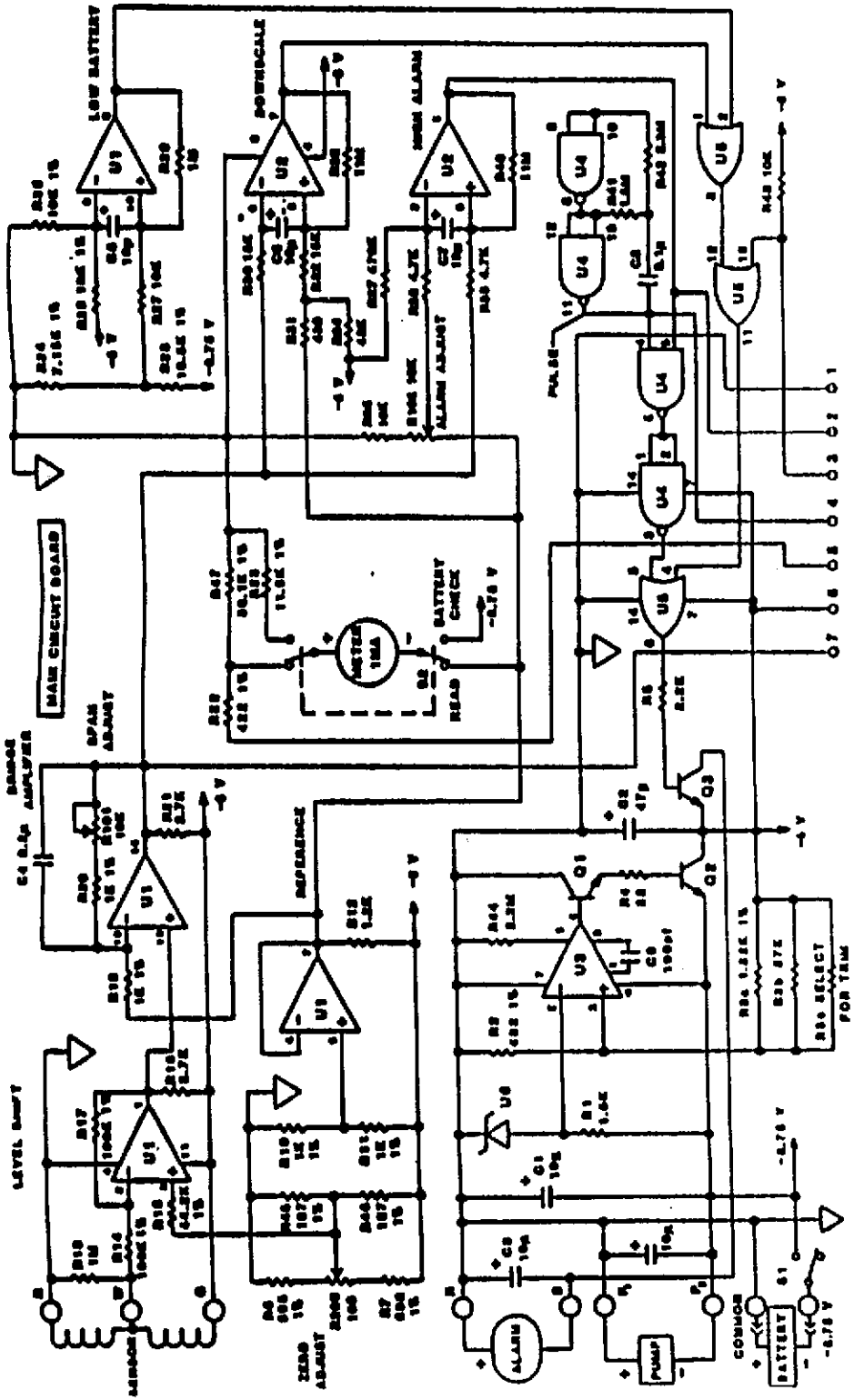
M S H A APPROVED MODEL 1214



STANDARD MODEL 1214



MODEL 1214S SCHEMATIC DIAGRAM



INSTRUCTION MANUAL

GasTechtor Portable Gas Alarm Model 1214 and 1214S

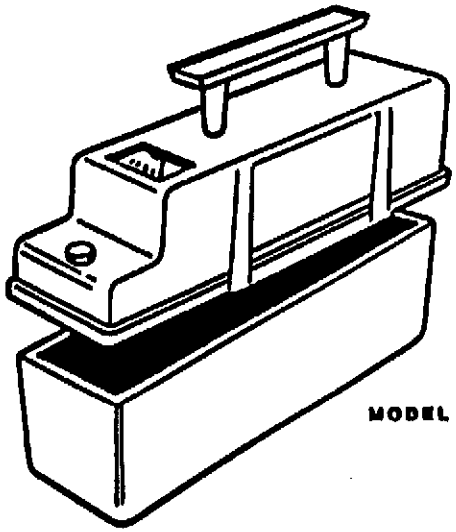
I. INTRODUCTION

The Model 1214 GasTechtor Gas Alarm is a portable instrument designed primarily for detection of combustible gases and of oxygen deficiency in confined work spaces, such as natural gas or depleted oxygen in utility manholes. It can detect and indicate gas concentrations up to the lower explosive limit and actuate a characteristic audible signal if concentration exceeds a preset level. It also analyses for oxygen over a range of 0 to 25%, and actuates a different audible signal if oxygen concentration drops below a preset level. In later models, a third characteristic audible signal is actuated if for any reason the oxygen concentration exceeds 25%. Instrument is designed to withstand rough handling and severe exposure, and is intrinsically safe for use in the National Electrical Code Class I Group C and D atmospheres of combustible gases in air.

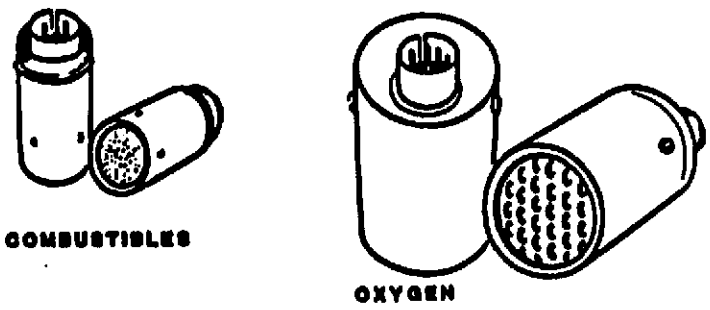
In the Model 1214, combustible gas is detected by a diffusion head containing a heated catalytic element and a matching reference element. Oxygen detection is by a second diffusion head containing an electrochemical oxygen cell. A solid-state amplifier is used to increase output of the sensors to give adequate voltage to drive the meter and the alarm circuits. Power for the instrument is provided by a built-in rechargeable battery with sufficient capacity to operate for an entire working day. An audible alarm, active in both the combustibles range and the oxygen range, sounds whenever gas concentration reaches a preset level, and an audible signal is given also in case of malfunction or a dead battery.

In the diffusion Model 1214, both sensor heads are plug-in type, which are mounted to the front of the instrument, or alternatively may be used on an extension cable. In use, the instrument with heads plugged-in or the cable with heads attached is placed in a suspect area for detection.

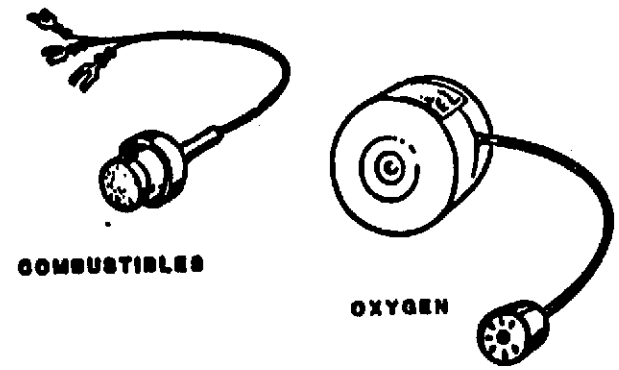
In the sample-drawing Model 1214S examples of the atmosphere under test are drawn continuously, by means of a built-in pump, over a combustibles detector and an oxygen detector, both similar to those used in the 1214. Thus, every test for combustible gas is automatically accompanied by a test for oxygen deficiency. In use, an extension hose permits withdrawal of samples from specific points or enclosed spaces.



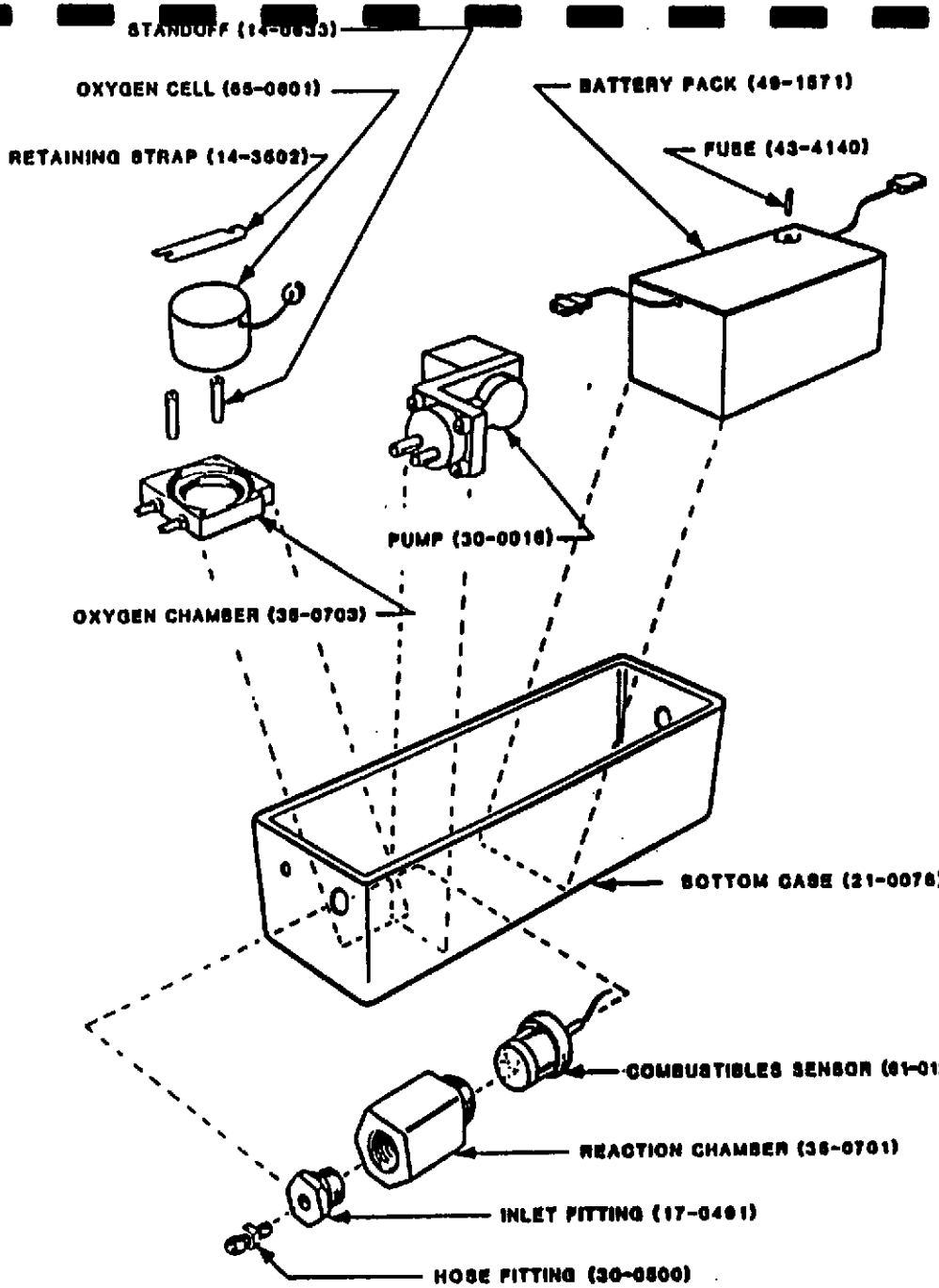
MODEL 1214 HOUSING



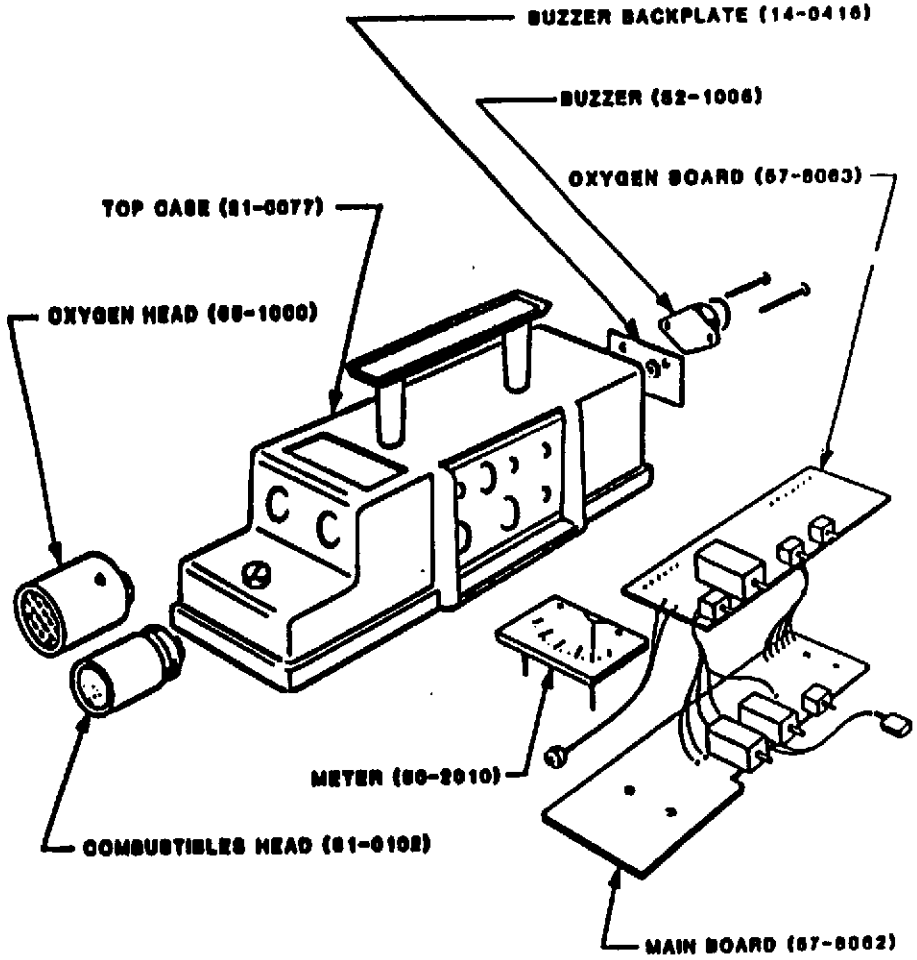
DIFFUSION SENSORS



SAMPLE-DRAWING SENSORS



PARTS LOCATION -1214S LOWER HALF



PARTS LOCATION - TOP HALF

II. DESCRIPTION

A. Housing

The Model 1214 is housed in a fiberglass case which is durable, shock-resistant, and protected against entry of water. The lower half, containing the batteries, has no openings near the bottom and hence can safely be placed in mud or water up to 4 cm depth without hazard to the internal components.

The upper half contains all of the electronic circuitry, and is provided with a substantial carrying handle. The lip of the upper case overlaps the lower, to shed water. Upper half is clamped to lower by means of a heavy-duty knurled thumbscrew.

On models approved by the Mine Safety and Health Administration (MSHA), an adjustable shoulder strap is provided which attaches to rings on the front and the rear of the instrument by means of safety clips. The shoulder strap furnishes a convenient means for carrying the instrument, leaving the hands free. It may be removed when not required. The same feature is provided on all new non-MSHA models delivered since January 1987.

MSHA models are further identified by a distinctive MSHA approval label beneath the carrying handle on the instrument.

B. Sensors - Diffusion

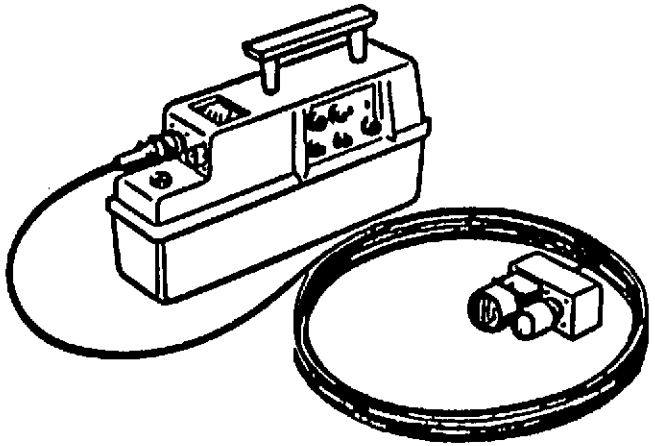
Sensors for the diffusion model are mounted externally at the front in removable detector heads.

1. Combustible Gas Sensor

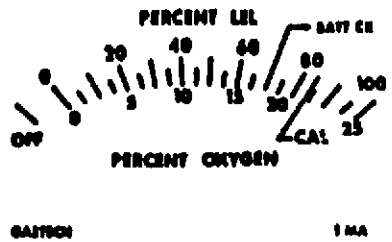
The gas-sensitive detector head is a plug-in assembly which mounts on a 3-pin socket at the front. The detector element is of the platinum catalyst type, and an electrically identical but non-catalytic reference element mounted in the same environment serves to stabilize the measurement and compensate for effects of non-combustible gases, temperature variations, etc. Elements are protected by a sintered stainless steel flame arrestor, which permits access of surrounding atmosphere by diffusion, but prevents outward propagation of flame should an explosive atmosphere be sampled. The detector is provided with an anodized aluminum protective guard.

2. Oxygen Sensor

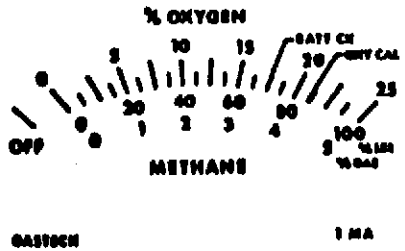
The oxygen-sensitive detector head is a similar plug-in assembly which mounts in a 6-pin socket at the front. The oxygen-sensing portion is an electrochemical cell in which gold and lead electrodes are immersed in a gel-type electrolyte, and covered by a permeable fluorocarbon membrane. Oxygen from the surrounding atmosphere diffuses through the membrane and enters into an electrochemical reaction whose rate is directly proportional to the partial pressure of oxygen, the end product of this reaction being lead oxide. The current generated by this



MODEL 1214 WITH DETECTOR HEADS ON EXTENDER CABLE



STANDARD METER DIAL



M S H A METER DIAL

Standard Warranty

Gas Detection Instruments

We warrant gas alarm equipment manufactured and sold by us to be free from defects in materials, workmanship and performance for a period of one year from date of shipment to ultimate user. Any parts found defective within that period will be repaired or replaced, at our option, free of charge, f.o.b. factory. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired or replaced on a routine basis. Such items may include:

a) Lamp bulbs and fuses

b) Pump diaphragms and valves

c) Absorbant cartridges

d) Filter elements

e) Batteries

f) Most catalytic and electrochemical sensors are covered by a separate warranty of 6, 12, or 24 months.

Warranty is voided by abuse including rough handling, mechanical damage, alteration or repair procedures not in accordance with instruction manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs or contingent expenses incurred without our prior approval.

GasTech Inc.'s obligation under this warranty shall be limited to repairing or replacing any product which GasTech Inc. Material Review Board examination shall disclose to its satisfaction to have been defective. To receive warranty consideration, all products must be returned to GasTech Inc. at its manufacturing facilities with transportation charges prepaid.

This warranty is expressly in lieu of any and all other warranties and representations, expressed or implied, and all other obligations or liabilities on the part of GasTech Inc. including but not limited to, the warranty of fitness for a particular purpose. In no event shall GasTech Inc. be liable for direct, incidental or consequential loss or damage of any kind connected with the use of its products or failure of its product to function or operate properly.

This warranty covers instruments and parts sold (to users) only by authorized distributors, dealers and representatives as appointed by Gas Tech.

Rev. 12/86

Stock No.	Description
61-0102E	Combustibles detector assembly, exchange (1214, 1214 MSHA)
61-0120	Combustibles detector assembly (1214S)
65-0601	Oxygen cell, new (1214S) (replaces 35-0610)
65-0601E	Oxygen cell, reactivated (exchange) (1214S) (replaces 35-0610R)
65-0611	Oxygen cell only (1214, 1214MSHA)
65-0611E	Oxygen cell, reactivated (exchange) (1214, 1214MSHA)
65-1000	Oxygen detector assembly, complete (1214, 1214 MSHA)
65-1000E	Oxygen detector assembly, exchange (reactivated cell) (1214, 1214 MSHA)
70-0203	Packing carton for GasTechtors, complete with foam
71-0105	Instruction Manual, Model 1214
80-0002	Hose, Teflon-lined, 6' (1214S)
80-0010	Hose, polyethylene-lined, 10' (1214S)
80-0025	Hose, polyethylene-lined, 25' (1214S)
80-0150	Probe with filter, 10" plastic (1214S)
80-0203	Moisture trap (1214S)
80-0221	Hydrophobic filter, 1214S
81-0203	Calibration Kit, with one cylinder of 2.5% natural gas and one cylinder of 100% nitrogen plus valve, gas-collecting bag and coupling hose in carrying case (1214S)
81-0203C	Calibration Kit, nitrogen and combustible gas plus valve, flowmeter and cup for diffusion detectors (1214, 1214 MSHA)
81-1102	Sample drawing attachment, with bulb, probe, hose (1214, 1214 MSHA)
81-1109	Calibration test cup and tube (1214, 1214 MSHA)

alarm circuit. The detector is provided with a cylindrical plastic protective shell, with perforations in the end to permit free access of the surrounding atmosphere to the active face of the cell.

Both detector heads can be extended to a remote point by use of the cable and socket assembly. The cable, 20' in length, plugs into the oxygen detector socket, after removal of the detector, and both detectors in turn plug into similar sockets at the end of the cable. Retaining clips hold the oxygen head in place; the combustibles head is held by a threaded locking ring.

An optional 50' cable assembly is available.

C. Sensors - Sample-Drawing

The sensors for the sample-drawing model are mounted internally, attached to their respective chambers, and remain fixed.

1. Combustible Gas Sensor

The same gas-sensitive detector element as used in the diffusion head described above, is used in a replaceable assembly which is installed within an anodized aluminum enclosure or reaction chamber at inner front of instrument. Detector is retained in the chamber by means of a threaded ring, and sealed by an O-ring gasket. Sample enters chamber from the front, flows over the detector, through the pump, then over the oxygen detector and finally is exhausted externally. The sintered stainless steel flame arrestor not only permits access of sampled atmosphere to the elements but also acts as a diffuser to isolate the sensitive elements from flow fluctuations. Detector assembly connects electrically to circuit board by means of three color-coded wires to screw terminals, accessible when upper half of housing is removed.

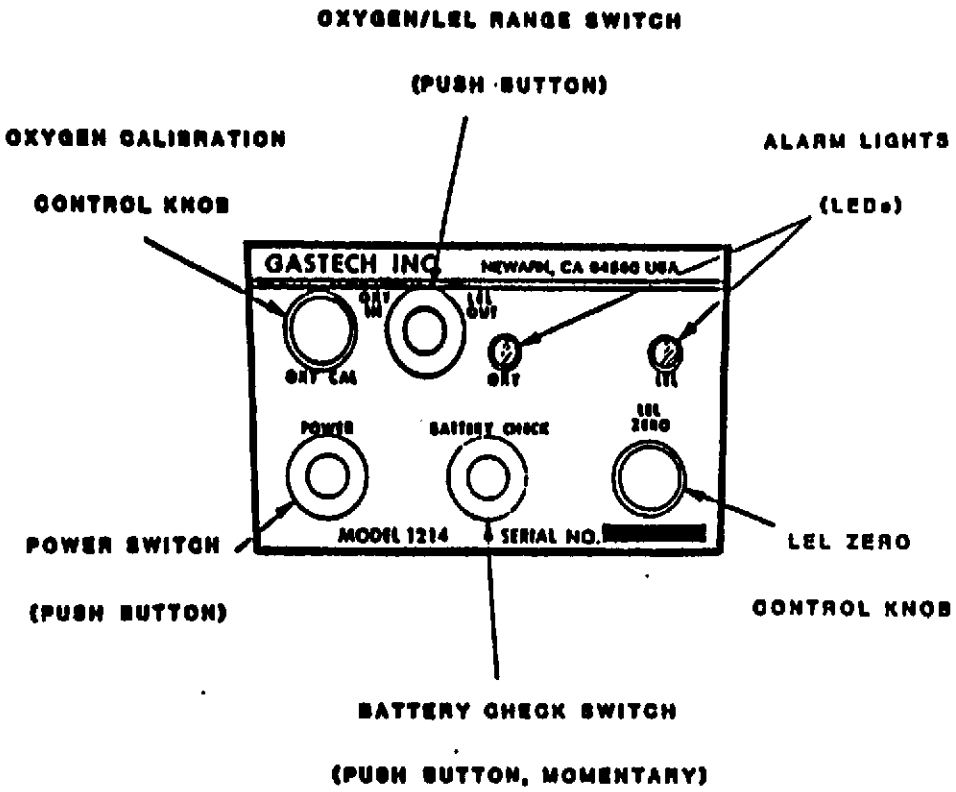
2. Oxygen Sensor

The same type of oxygen cell as used in the diffusion head described above, is clamped into a cavity in an anodized aluminum block, through which the sample flows after it leaves the combustibles detector. Oxygen cell connects to circuit board by a 7-pin plug connector.

D. Meter

Indications of the instrument are displayed on a meter, visible through a window on top face of instrument case. Meter indicates combustible gas or oxygen concentration directly, depending upon whether the range switch is in the LEL (Combustibles) or OXY (Oxygen) position. Two sets of graduations are provided:

1. In combustibles range, meter indicates gas concentration in units of explosibility, 0-100% LEL, where 100% LEL represents the minimum concentration of combustible gas



CONTROLS AND INDICATORS

Stock No.	Description
43-0449A	Switch lens assembly, green
43-0449B	Switch lens assembly, orange
43-4140	Fuse, battery, 3AG 1A
45-2012	Socket, charger
45-2013	Dust cap
45-8051	Battery pack, replaceable rechargable cell, less batteries (1214, 1214S)
45-8052	Battery pack, replaceable disposable cell, less batteries (1214, 1214S)
46-9011	Knob (1214, 1214S)
47-1501	Continuous Operation Adapter, 12V DC
47-1523	Detector cable/socket assembly, 20' (1214, 1214MSHA)
47-1523M	Detector cable/socket assembly, 50' (1214, 1214MSHA)
49-1201	Battery, alkaline size D (for 45-8052 pack)
49-1501	Rechargeable cell, nickel-cadmium, D-Size (for 45-8051 pack)
49-1571	Battery pack, nickel-cadmium (1214, 1214S)
49-1571MS	Battery pack (1214MSHA)
49-2037	Continuous Operation Adapter, 115V AC
49-2133	Battery charger, 115V, dual rate, time-controlled
49-2134	Battery charger, 230V, dual rate, time-controlled
50-1228	Meter, combination scale (1214, 1214S)
50-5019	Meter (1214MSHA)
52-1005	Buzzer
57-2001	Recorder output for any GasTechtor, 0-50 mV, added to instrument (1214, 1214S)
57-805X	Circuit board, combustibles (specify model)
57-8055	Circuit board, oxygen (1214MSHA)
57-8063	Circuit board, oxygen (1214, 1214S)
60-0301	Sensor only (to be soldered into detector assembly) (1214, 1214MSHA)
61-0102	Combustibles detector assembly, complete (1214, 1214MSHA)

VIII. PARTS LIST

Stock No.	Description
13-0032	Handle, complete with label & screws (specify model)
13-0110	Strap, carrying
13-1075	Front hold-down screw
13-1076	Retainer, for hold-down screw
13-1102	Case latch
14-0419	Instrument case catch bar
20-1010	Carrying case, padded, with space for accessories
21-0078	Case, lower, (drilled for 1214, 1214 MSHA)
21-0083	Case, upper, compl. w/window & handle, (1214)
21-0084	Case, upper, compl. w/window & handle, (1214MSHA)
21-0085	Case, upper, compl. w/window & handle, (1214S)
21-0094	Case, lower, (drilled for 1214S)
21-1025	Meter window
30-0016	Pump, rotary DC (1214S)
30-0340	Pump head, replacement (1214S)
30-0341	Diaphragm, pump (1214S)
30-0342	Valves, pump, set of 2 (1214S)
30-0500	Inlet fitting (1214S)
33-1031	Filter element, cotton, replacement, package of 14 (1214S)
41-1443	Zero pot, combustibles (1214, 1214S)
41-2711	Cal pot, oxygen (1214, 1214S)
43-0441	Switch, ON-OFF and Range
43-0442	Switch, volt test

A mark on scale, "BATT CK", represents the minimum permissible battery voltage, as an indication of state of charge of the battery. A separate mark below "0" on the meter scale, marked "OFF", is the rest or off position of the meter. A glance at the meter then shows when the instrument is on or off.

MSHA approved models have an added scale on meter dial of 0-5% methane. This scale is in direct proportion to the LEL scale, i.e., 5% methane by volume is 100% LEL.

2. In the oxygen range, meter indicates in units of percent oxygen, 0-25%. A mark on scale, "CAL", corresponds to the normal oxygen content of atmospheric air, 21%.

E. Controls and Indicators

The five controls that are used in normal operation of the instrument are arranged on the left side of instrument as viewed from the rear. These controls are recessed to minimize possibility of accidental operation.

1. POWER switch, an alternate-action push button switch which energizes circuit when pressed. An orange indicator dot is exposed when the switch is in the ON position, serving as a mechanical pilot light.

2. BATTERY CHECK switch, a momentary push button switch, when pressed connects meter as a voltmeter for battery condition check.

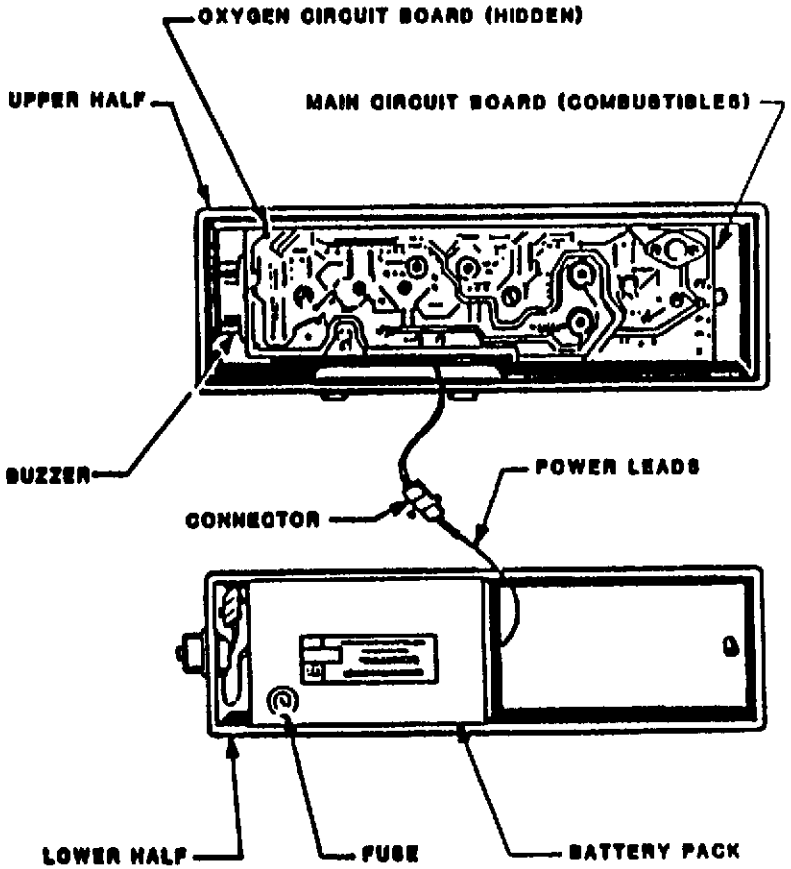
3. LEL ZERO, a potentiometer knob which is used to adjust combustibles circuit to read zero in the absence of combustible gas.

4. Range, an alternate-action push button switch which selects the operating range, either combustibles (LEL) in the "out" position or oxygen (OXY) in the "in" position. A colored indicator dot shows when the switch is "in".

5. OXY CAL, a potentiometer knob which is used to adjust circuit to read 21% when detector is surrounded by known normal air.

6. Alarm lights, red (LEL) and amber (OXY), illuminate when the corresponding section of instrument is in alarm condition. Red light blinks in an on-off pattern of equal length pulses, to show that instrument is in combustible gas alarm condition. Amber light blinks in a short-long pattern to show that instrument is in abnormal oxygen condition.

On the MSHA approved models, screwdriver type adjustments are installed for the LEL ZERO and the OXY CAL controls, instead of knobs. This feature is available on request, for non-MSHA models as well.



MODEL 1214 INTERIOR

Other calibration gases are available. Of particular interest is a combination cylinder containing 2.5% methane and 17% oxygen. This cylinder will give a simultaneous check and calibration test on the combustibles and oxygen sections, in one operation. Other cylinders containing propane-air, hydrogen-air, hexane-air and ethylene-air mixtures are all available to suit particular requirements.

For the diffusion models, the calibration kit includes an adapter test cup, which has provision for coupling either to the combustibles or to the oxygen detector, and a flowmeter to assure proper flow. For the 1214S, a short length of hose is provided, complete with fitting to couple to instrument inlet, together with a gas-collecting bag to give visual verification of adequate flow.

To make a response test, first turn on and adjust the instrument to zero and 21% in the normal way. Couple valve to cylinder. For Model 1214, connect the flowmeter and adapter cup to valve, open valve and set flow to 1.5 while holding flowmeter vertical, then place cup over the detector head under test and allow to flow until steady reading is obtained. For Model 1214S, connect the plastic Y with gas-collecting bag between instrument and cylinder valve, and open valve until bag remains partly distended.

Watch meter carefully, noting final reading; if it does not correspond to known concentration marked on cylinder, then recalibrate as outlined in Section IV.

NOTE

For general purpose use, including tests for hydrocarbon vapors such as those from gasoline, toluene or hexane, standard practice is to adjust calibration to read higher than true reading on methane, since the heavier hydrocarbons tend to read lower than methane. We recommend that calibration be set to 75% LEL on 2.5% methane to give the best average response.

H. Sample-Drawing Adapter (1214 and 1214 MSHA only)

Sometimes it is more convenient to use the sample-drawing method to take a sample from an inaccessible, remote, hot or dusty environment. For example, it may be useful to sample a manhole through one of the small holes in the cover, before lifting it. For this purpose, a Sample-Drawing Adapter is available (Stock No. 81-1102). It consists of an adapter cup to fit either detector, plus an aspirator bulb, a 6' hose and a probe. The hose and probe are similar to those furnished as standard with the Model 1214S.

I. Carrying Case

A convenient foam-padded plastic carrying case is available for use with the 1214 series. It has plastic foam recesses to store the instrument and the standard accessories, and it insures that all components are available and protected. Order Stock No. 20-1010.

J. Recorder Output

If specified, the 1214 or 1214S can be fitted with recorder output jacks, to give a signal of 0-50 mV DC, proportional to meter deflection. A pair of banana jacks on standard spacing are installed at rear of housing. Recorder used must be of the high-impedance type. Specify Stock No. 57-2001. This must be installed at the factory.

D. Probe (1214S only)

The standard 10" probe supplied with the 1214S is convenient for general-purpose use in checking for leaks and probing through tank openings, manhole covers and access ports. For frequent tests at ground level, in manholes and in tanks, a 30" aluminum probe is available. Probe is cross-drilled 4" from the end, so that water will not be drawn into instrument even if end of probe is inadvertently immersed. Same filter arrangement is provided in handle of probe as with 10" probe. Order Stock No. 80-0155.

All probes include a cavity in the transparent plastic handle to accommodate a cotton filter element. The filter should be inspected frequently, and replaced when it becomes discolored. Order Stock No. 33-1031.

E. Extension Hoses (1214S only)

A standard 6' teflon-lined hose is provided with the instrument. Additional lengths of hose may be used, up to approximately 50', for sampling from deep tanks and manholes. The polyethylene-lined hoses (80-0015 and 80-0025, see Parts List) are satisfactory for most samples including natural gas, hydrogen, propane, and gasoline vapors. Some of the more complex hydrocarbons, such as xylene and styrene, tend to be adsorbed on the walls of the polyethylene hose. For these samples, consult factory for the most appropriate hose selection.

F. Moisture Trap (1214S only)

Where there is danger of water being drawn into instrument, a moisture trap should be used. This glass-bodied trap with sintered metal filter couples to instrument inlet and will collect water that is drawn into or condensed in sample hose. Inspect trap periodically while in use, and empty or clean bowl and filter whenever visible water or dust accumulate. Regular sample hoses connect to inlet of trap when it is installed on instrument. Order Stock No. 80-0203.

A more positive water barrier is provided by the Hydrophobic Filter, a disposable assembly with fluorocarbon element which is not wet by water and hence will not pass through into instrument. It couples to instrument inlet. Order Stock No. 80-0221.

G. Calibration Test Kit (Optional for all models)

Dependable results from any gas detection instrument are best assured by periodic tests for response. The Stock No. 81-0103 Calibration Test Kit provides a convenient means for making such tests. It consists of two cylinders of compressed gas, a control valve and a hose for coupling valve to instrument, all stored in a convenient carrying case. One gas cylinder is filled with a mixture of 2.5% natural gas in air, which should produce a reading of 60% LEL on the combustibles meter scale. The other cylinder is 100% nitrogen, for testing the oxygen section.

Natural gas (primarily methane) is used because this is the most critical material for catalytic activity on a platinum filament. If the instrument gives a normal response on natural gas, it will also give a normal response to almost all other combustible gases and vapors.

F. Buzzer

A solid-state electronic buzzer located at the rear, is mounted inside the instrument, behind perforations which permit transmission of sound. The buzzer gives a pulsed tone on detection of gas, and a continuous tone in case of malfunction, either low battery voltage or downscale drift of meter. The pulses on alarm sound in unison with the pulses of the corresponding light.

G. Batteries

The battery pack, consisting of seven 3.5 ampere-hour nickel-cadmium cells in series, is secured within lower half of case. The cells are encapsulated as a unit, with threaded bushings in bottom for clamping to instrument case. Power output leads (red, orange and black) extend from front end of pack, and terminate in a plastic plug connector which mates with a connector on the main circuit board. Current limiting resistors encapsulated into the pack limit maximum current that can be drawn on short circuit. Battery pack will power the instrument for approximately 10 hours. A protective fuse (type 3AG 1A) is installed in a recessed fuseholder set into top surface of pack, and serves as an added protection against short circuit or overload.

GasTechtor instruments may be supplied with the 49-8051 Battery Pack with replaceable rechargeable cells. This design was developed for the convenience of replacing any rechargeable cell that may fail, in lieu of having to replace an entire battery pack. This battery pack is permanently secured by two screws through the bottom of the case. The 49-8051 Battery Pack has not been submitted to MSHA and hence is not approved for use in MSHA instruments. It is, however, the only pack submitted to UL and hence is the only one that may be used in UL-classified Model 1214S instruments.

An optional pack (49-8052) designed specifically for disposable batteries is also available. This battery pack will take alkaline or carbon flashlight type cells.

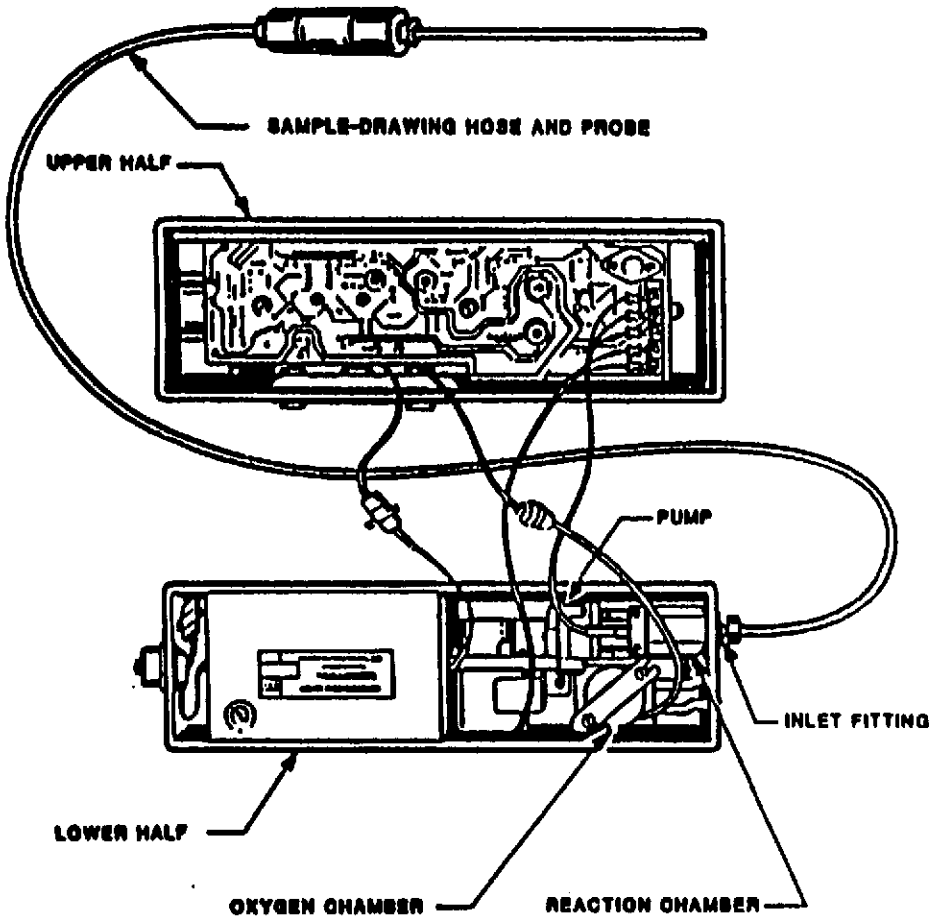
H. Circuit Board

All circuit components are arranged on two epoxy-glass printed circuit boards., The main board includes the voltage regulator, the combustibles amplifier and alarm circuits and associated controls. A second board is installed above the main board and is related to the oxygen detection system with similar circuits. It is inaccessible while instrument is assembled, except for the two potentiometers which are reached through access holes on main board.

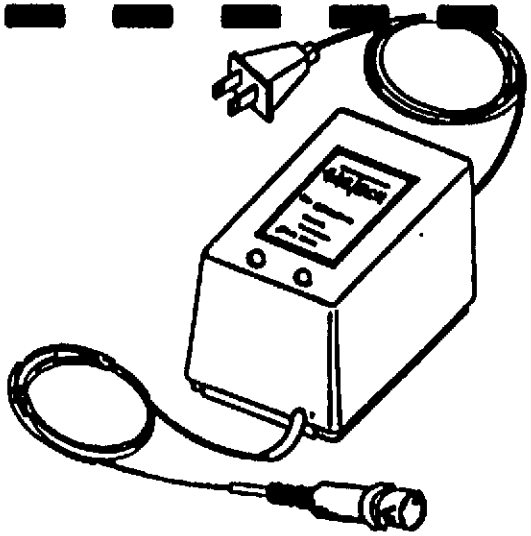
1. The two adjustment potentiometers provided on underside of main circuit board, available for user adjustment when case is opened, are:

   a) LEL SPAN, to set sensitivity of combustibles circuit to required value to produce a correct reading on a known calibrating sample.

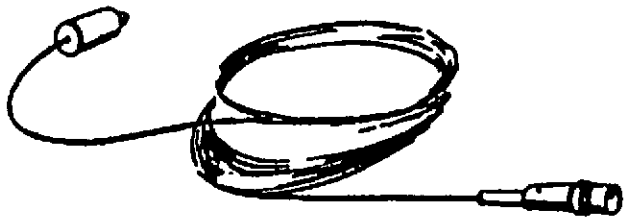
   b) [illegible] to set the gas concentration at



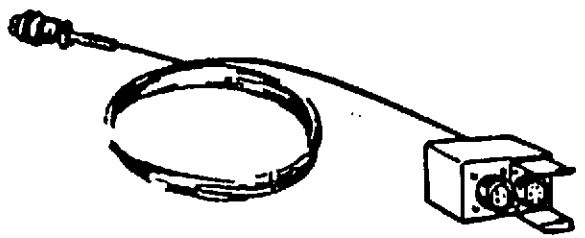
MODEL 1214S INTERIOR



BATTERY CHARGER



CONTINUOUS OPERATION ADAPTER



EXTENSION CABLE

ELECTRICAL ACCESSORIES

VII. ACCESSORIES

A. Charger (All models)

A separate battery charger is provided, which plugs into socket in rear of case. Charger provides current at a rate sufficient to recharge batteries overnight. Current tapers down to the point that it can be left connected for several days without damaging battery; however, avoid charge periods longer than 24 hours if possible.

Charger is wired for 115V AC or for 230V AC 50/60 Hz power source (see nameplate for voltage rating of charger supplied with this instrument).

Later instruments are provided with the No. 49-2133 (49-2134 for 220-240V AC) dual rate time-controlled charger, which provides a full charge over a 16 hour period, then automatically cuts back to a sustaining rate. An amber light shows that battery is receiving a charge; when complete, the green light indicates that the battery is ready to use. This charger is also available as a replacement charger for any GasTechtor.

B. Continuous Operation Adapter (Optional for all models)

Instrument can be operated continuously from a 12 volt DC source, such as a 12 volt vehicle battery, by use of a Continuous Operation Adapter. This is a power cord with voltage-dropping diodes built in, and with a mating plug to fit charger socket. When connected to instrument and to a 12 volt source, it will carry the load and tend to recharge the battery. It may also be used as a DC charger.

The adapter is furnished with a cigarette lighter plug to fit any negative-grounded vehicle with 12 volt battery, Stock No. 47-1501.

A Continuous Operation Adapter for 115V AC operation is also available, Stock No. 49-2037.

NOTE

The intrinsic safety rating of the GasTechtor does not apply while being operated from an external power source.

C. Extension Cable (Diffusion Models 1214 and 1214 MSHA only)

When remote detection is desired, the extension cable should be plugged into the oxygen detector socket, after unplugging the oxygen detector. Then plug the oxygen detector into the socket at the end of the cable.

The combustibles detector may be plugged into the corresponding socket at end of cable, or left in position on the instrument, if only oxygen is to be detected at the remote point.

A repeater buzzer in the socket housing produces the same audible signal as emitted by the internal buzzer, so that signals are repeated at the detector location. Thus, a worker in a tank or manhole will immediately be notified of an abnormal condition, while at the same time a companion outside the space will receive the alarm directly from the instrument.

The standard 20' cable is included with the Model 1214 and the 1214 MSHA. A 50' cable (Stock No. 47-1423H) is available

2. Two adjustment potentiometers are provided on underside of upper (oxygen) circuit board, also accessible when case is opened, by use of a screwdriver through the two holes in main board.

   a) ZERO, to balance the oxygen circuit for zero output when the detector is surrounded by oxygen-free gas such as nitrogen. This is the control closest to the rear.

   b) ALARM threshold, to set the oxygen concentration at which the oxygen alarm is actuated. Access hole for this control is adjacent to the LEL alarm adjustment, marked ALARM.

   c) The high oxygen alarm (25%), provided on some later models, is factory set, and can be readjusted only when the main board is removed.

I. Sample-Drawing Model (1214S)

This instrument uses the flowing sample method rather than the diffusion sampling as found in the 1214. The sample system consists of the flow path, from hose to sample inlet to reaction chamber to pump to oxygen detector to exhaust. These components are further described below.

1. Inlet fitting, on front of instrument, is screwed directly into reaction chamber. It is the point for connection of the sample hose and probe normally used with the 1214S.

2. Reaction chamber, housing combustibles detector, is an anodized aluminum block with threaded neck and lock nut to retain detector in flow path of sample. An outlet nipple and flexible tube connect chamber to the pump.

3. Pump is of the motor driven diaphragm type, with a brushless DC motor having no commutator or sparking contacts. It operates directly from the battery output whenever power switch is on. Flexible tubes are attached to draw the sample from the reaction chamber and supply it to the oxygen chamber.

4. Oxygen chamber, holding oxygen detector, is an anodized aluminum block with a cavity into which oxygen cell is clamped. An O-ring seal is provided to prevent leakage from chamber, and a spring clamp bar maintains pressure against the seal but can be swung aside and removed when changing cell. A flexible tube exhausts the sample gas to the exterior of the instrument.

III. PLACING IN OPERATION

A. Normal Operation

To use instrument, carry out the following steps:

1. a) 1214

   Determine whether sensors are to be used directly in instrument or on end of extension cable. Plug them in at desired position (diffusion).

   b) 1214S

   Connect hose and probe to fitting on front of instrument (sample-drawing).

2. Press POWER switch to turn instrument on. Meter needle will normally rise upscale briefly and pulsing alarm signal may sound. Sometimes downscale (steady tone) LEL alarm may sound during warm up. Alarm condition can be identified by the blinking lights. In sample-drawing models the audible hum of the pump operation may be heard.

3. Press BATTERY CHECK button and note meter reading. If reading is close to or below BATT CK mark on meter, recharge batteries.

4. With instrument switched to LEL (out) range, allow to warm up until meter needle stabilizes (about a minute). Then, with detector (or probe) in a gas-free location, turn LEL ZERO control to bring meter needle to "0".

5. Next, put switch in OXY (in) position. Verify that detector (or probe) is in a normal-air location; then turn OXY CAL control to bring meter needle to CAL (21%) indication.

   Verify normal operations by breathing out through your mouth, over the perforated end of the oxygen detector or over the end of the probe, and watch meter. Reading should move downscale and activate the alarm at 19.5%. With a little effort a reading of 16-17% can be obtained. This confirms normal operation of oxygen detection section.

6. To check for gas, expose detector (or probe) to atmosphere to be monitored. Exposure may be continuous throughout an entire 8-hour period. Meter will indicate gas concentration continuously. If reading rises above alarm setting (normally 20%), pulsed red light and audible alarm will commence, and will continue until source of gas is removed.

7. To check for oxygen, expose detector (or probe) to atmosphere to be monitored. Meter will indicate oxygen concentration continuously. If reading drops below alarm setting (normally 19.5%), pulsed amber light and audible alarm will commence, and will continue until normal oxygen content is restored.

I. Alarm threshold adjustment, to set the point at which gas alarm is actuated. (ALARM)

J. Meter, reads output of amplifier, in units of percent explosibility.

K. Malfunction alarm switching circuit, turns on alarm due to amplifier output below zero.

L. Battery test switch, to connect meter as a voltmeter momentarily, to check battery voltage. (BATTERY CHECK)

M. Buzzer, a solid-state electronic sounder which delivers a continuous tone when energized.

N. Multi-vibrator, an oscillating circuit to give a pulsating signal to buzzer, as an identification of alarm condition.

O. Voltage-sensing circuit, to detect low battery voltage and actuate alarm signal.

P. Logic circuit, to accept signals of various types and direct them to buzzer circuit.

Q. Pump, diaphragm type (1214S only), to draw sample continuously from source, through sample system and over combustibles and oxygen detectors.

R. Oxygen sensor, a plug-in (1214) or a fixed (1214S) assembly, which supplies a signal voltage proportional to oxygen concentration.

S. Amplifier, oxygen, to increase output of sensor to a suitable level for indication and alarm actuation.

T. Zero, oxygen, a potentiometer used to balance output of amplifier to zero in the absence of oxygen. (ZERO)

U. Span, oxygen, a potentiometer used to set gain of amplifier to give desired sensitivity on a known calibrating sample. (OXY CAL)

V. Alarm switching circuit, to turn on oxygen alarm signal when amplifier output drops to or rises above preset points.

W. Alarm threshold adjustment, to set the point at which oxygen alarm comes on. (ALARM)

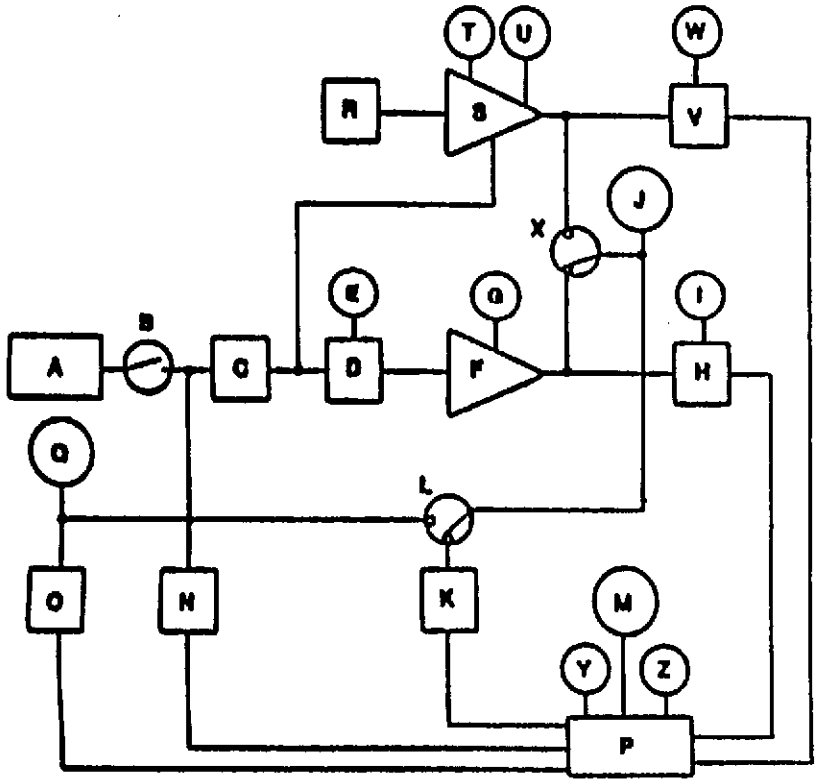
X. Range switch, to select range for readout of meter, either oxygen or combustibles. (OXY IN - LEL OUT)

Y. Alarm light, oxygen, which blinks on and off whenever system is in low oxygen alarm condition.

Z. Alarm light, LEL, which blinks on and off whenever system is in combustibles alarm condition.

VI. CIRCUIT DESCRIPTION

Referring to block diagram:



A. Battery pack, rechargeable, nickel-cadmium, giving 8 hours of operation.

B. On-off switch, push on/push off. (POWER)

C. Voltage regulator, input 8.0 - 10 volts, output 6.0±0.05 volts.

D. Combustibles sensor, active (catalytic) and reference (non-catalytic), in plug-in (1214) or fixed (1214S) assembly, forming half of Wheatstone bridge measuring circuit. Two fixed resistors complete bridge.

E. Zero adjust, a potentiometer in the fixed side of the bridge used to bring the bridge to balance in the absence of gas. (LEL ZERO)

F. Amplifier, signal differential, to increase output of bridge to a suitable level for indication and alarm actuation.

G. Span adjust, to set meter reading to desired value for a known sample. (LEL SPAN)

An atmosphere containing more than the normal 21% oxygen content will produce an increased oxygen reading. If instrument is provided with a high oxygen alarm, then it will sound in a steady tone when reading reaches or exceeds 25%.

H. Monitoring for combustible gas and for oxygen is continuous and simultaneous, independent of range switch position. If either condition goes off-normal, corresponding alarm light and audible signal will sound. If both abnormal gas conditions exist simultaneously, both lights will blink in their normal pattern but the buzzer will sound continuously.

B. Abnormal Indication

1. If battery voltage drops below the designed value (about 8.2 volts) the low battery alarm will sound. This is a continuous audible tone. To verify the cause of the alarm, press BATTERY CHECK switch and note that meter reads below check mark. Alarm will sound for at least a half hour, giving ample warning prior to actual failure. If low battery alarm occurs, turn switch off to prevent possible battery damage.

2. If combustibles reading drifts or moves below 0 by 10% or more, the low limit alarm will sound. This is also a continuous tone, and the cause can be recognized by a glance at the meter, in the LEL (out) range.

   The following are possible causes for downscale meter movement:

   a) Incorrect zero adjustment.

   b) Detector disconnected.

   c) Break in detector element.

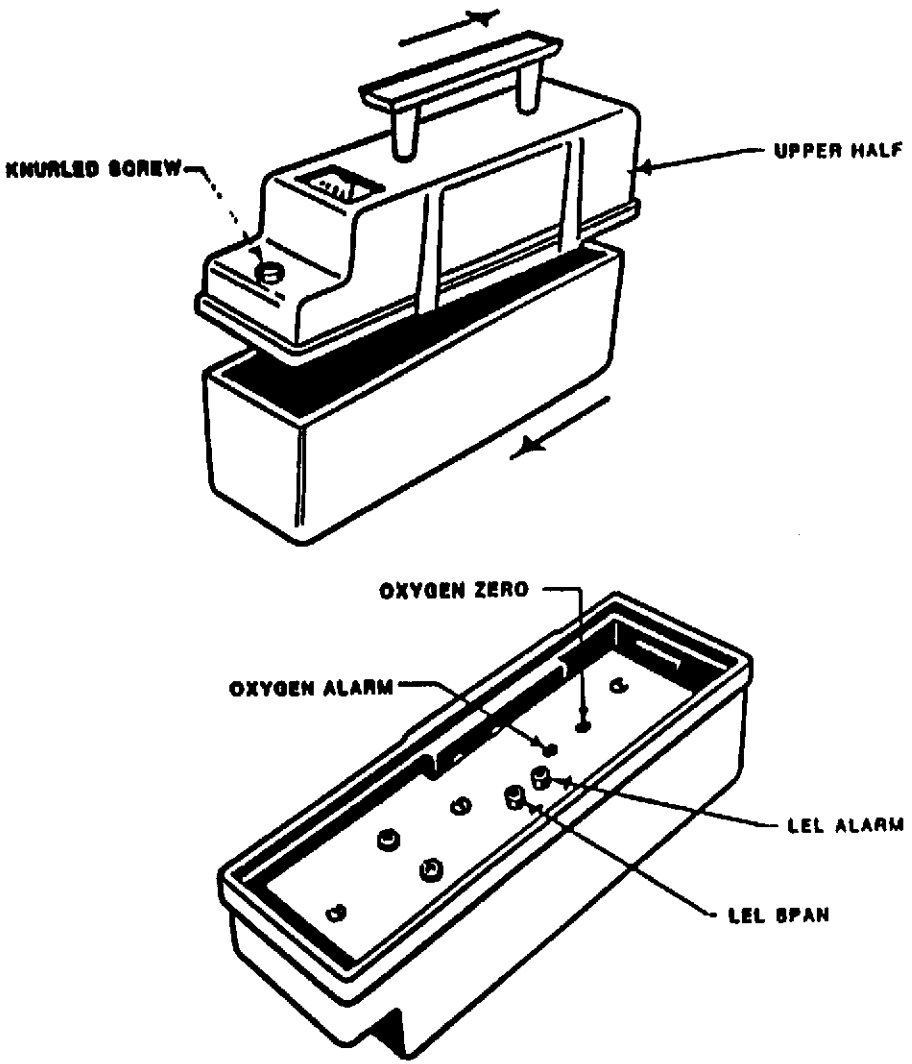
   d) Water in detector

   e) Break in cable or wiring.

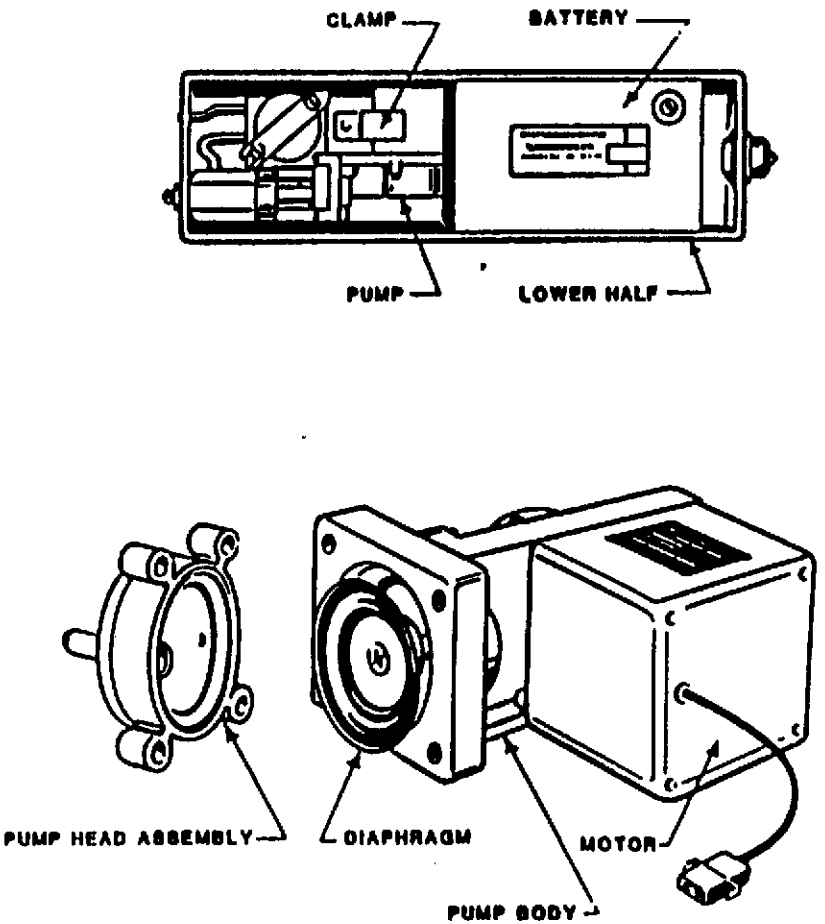
3. If oxygen cell output declines or deteriorates, as is likely toward the end of cell life, this will produce a reduced reading, and low oxygen alarm.

4. If oxygen detector is unplugged, or if one of the wires connecting it internally is broken, reading will go to zero, and low oxygen alarm will sound.

5. On most later models, the steady audible tone sounds when the oxygen reading exceeds 25%. This characteristic is provided to warn against the increased fire hazard due to excess oxygen. It also serves as a warning in case of oxygen cell failure in the high-output mode, which can occur occasionally. It further precludes accidental or intentional incorrect adjustment of the oxygen calibrate



ADJUSTMENT LOCATIONS



PUMP ASSEMBLY FOR MODEL 1214S

E. Buzzer

If buzzer fails, it can be removed by first taking out circuit board (steps D.1 - D.6 above) and unsoldering red and black wires at board. Then remove retaining screws and nuts to free buzzer and its backing plate.

NOTE

Before replacement, first verify that buzzer is actually defective. Connect to a 6-volt battery (red +, black -). A good buzzer will give a steady tone.

F. Circuit Boards

Main circuit board and buzzer can be removed by steps D.1 - D.6, plus E, plus unsoldering wires from detector socket, at board. On sample drawing models, screw terminals are used.

Oxygen circuit board can be removed after main circuit board is taken out, in a similar manner, including removal of the hexagonal plastic spacers which serve as standoffs for the main board.

Preferably, circuit boards or entire upper half of instrument should be returned to factory for repair. If local repair is to be attempted, refer to circuit diagram in this manual.

G. Pump (Model 1214S only)

Pump used is a diaphragm type, driven by a brushless DC motor. It should have long life, several years in normal operation, but it may lose efficiency if dirt is drawn in and collects under the valves. Verify proper pump operation periodically by taking a sample and observing time for gas response to occur. This should be within 5 seconds for a 6' long hose and probe.

If pump needs servicing, it can be removed by taking out the clamp retaining screw in bottom. Pump can be returned for repair on an exchange basis or it can be disassembled and cleaned. Replacement pump head assemblies (Stock No. 30-0340), diaphragms (Stock No. 30-0341) and pump valves (Stock No. 30-0342) are also available.

IV. CALIBRATION AND ADJUSTMENT

A. Combustibles Circuit Calibration

The following steps should be carried out with range switch in LEL (out) position. To check and adjust calibration on a known gas sample:

1. Turn instrument on and allow it to warm up and stabilize preferably for 5 minutes. Be sure batteries are charged sufficiently to read above the check mark.

2. Open instrument case by loosening captive knurled screw located in front of meter. (On diffusion models, this can be done more conveniently when detectors are unplugged. After loosening screw, replace detectors.) Lift upper half of case slightly, move 1/4" to rear to disengage rear latch bar; then separate the two halves. Locate LEL SPAN potentiometer on underside of main circuit board.

3. Expose detector to a known calibrating gas sample. If the sample exists within a large container at atmospheric pressure, the sensor or probe (of 1214S) may be immersed in the container. If sample is under pressure, e.g., the GasTech Calibration Kit, the mixture should be allowed to flow over and surround sensor.

4. Watch meter carefully. If reading does not correspond to desired value, adjust it by turning LEL SPAN potentiometer. Counterclockwise rotation will increase reading.

5. Recheck zero, adjust if necessary, and repeat above steps until correct reading is obtained.

6. If reading cannot be set high enough, replace detector.

B. Combustibles Alarm Threshold

The reading at which the combustibles alarm is actuated can be set by use of the ALARM threshold potentiometer. To set:

1. Turn LEL ZERO control to bring meter needle to desired alarm setting.

2. Turn ALARM threshold potentiometer to the point where alarm just operates. Clockwise rotation will lower alarm setting. Verify setting by turning LEL ZERO knob to bring meter needle into and out of alarm zone.

3. To complete combustibles circuit settings, turn LEL ZERO control to bring meter needle to the zero position on the scale.

C. Oxygen Zero Adjustment

The following steps should be carried out with range switch in OXY (in) position, to check and adjust zero on a known oxygen-free sample.

1. While instrument is still open, identify ZERO potentiometer, which is located on oxygen (upper) circuit board and which can be reached through the rearmost of the two clearance holes in main circuit board.

2. Expose oxygen detector to a known oxygen-free sample, such as nitrogen, argon or helium.

3. Watch meter carefully. If reading does not go exactly to zero, adjust it by turning ZERO potentiometer. Counterclockwise rotation will decrease reading.

4. If zero adjustment cannot be made, replace detector.

5. After zero adjustment has been completed, return detector to normal atmospheric air. Readjust OXY CAL control as necessary to bring meter reading to 21%.

6. If reading cannot be set high enough, replace detector.

D. Oxygen Alarm Threshold

The reading at which the alarm is actuated can be set by use of the ALARM threshold potentiometer. To set:

1. Turn OXY CAL knob to bring meter needle to desired alarm setting.

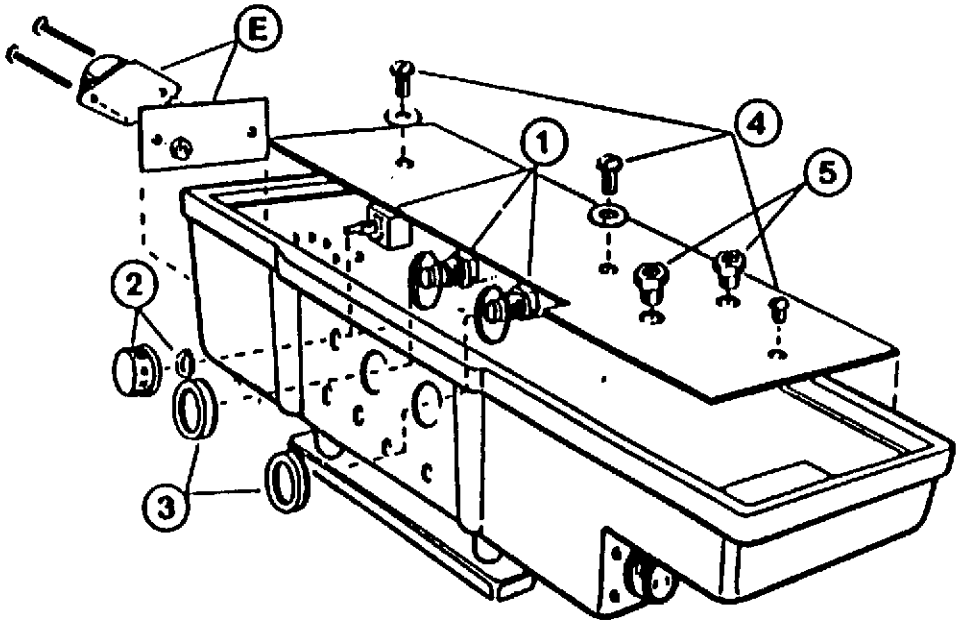
2. Locate oxygen alarm threshold potentiometer, on oxygen circuit board, which can be reached through the foremost of the two clearance holes in the main circuit board.

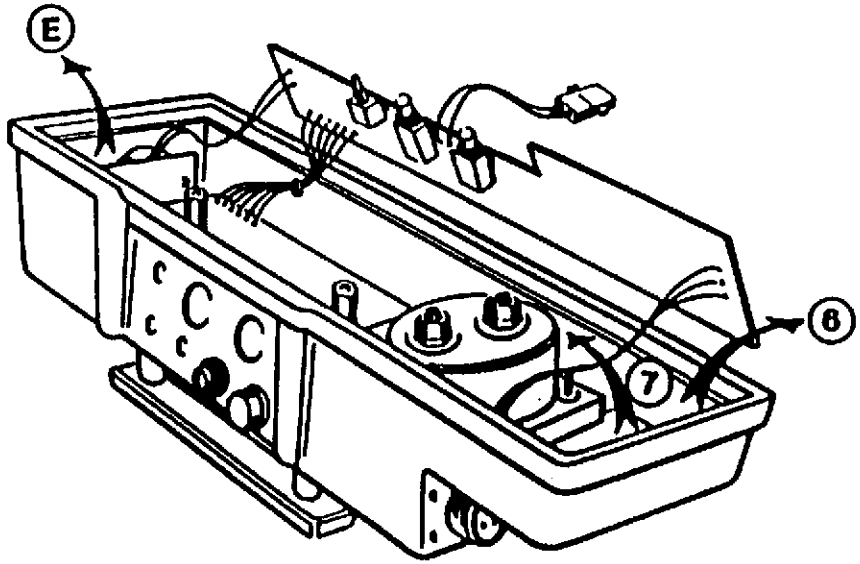
3. Turn ALARM threshold potentiometer to the point where alarm just operates. Clockwise rotation will raise alarm setting. Verify setting by turning OXY CAL control to bring meter needle into and out of alarm zone.

4. To complete the oxygen circuit settings, turn the OXY CAL control, as necessary, to bring meter needle to the 21% position on the scale.

E. Oxygen High Alarm (25%)

This alarm point is factory set and generally need not be changed. It can be readjusted to some other level, by trial, but this can only be done when the main board is loosened and pulled aside (see Section V.D. steps 1-6). The high alarm potentiometer is the one closer to the rear, without an access hole.





METER, BUZZER AND CIRCUIT BOARD REMOVAL/REPLACEMENT

(SEE PAGES 15 AND 16)

2. Oxygen Detector

a) Oxygen Sensor assembly may require repair if:

1) Meter cannot be set to desired level on air within range of OXY CAL Adjust.

2) Meter cannot be set to zero on inert gas within range of ZERO potentiometer.

b) If oxygen sensor assembly requires repair, it should be sent to factory for reactivation, on an exchange basis. Alternatively, a complete new sensor can be ordered. To replace oxygen sensor:

1) Open instrument case. Locate oxygen cell.

2) Swing retainer clamp clockwise and remove it to release cell.

3) Tilt cell upward and pull it out of case. Unplug cell wire at socket.

4) Reinstall newly reactivated cell in same position. Before installing, remove protective seal from face of cell, and shake out any drops of water that remain. Verify that cell is sealed against its O-ring seal when installed. Return old cell to factory for reactivation.

D. Meter

If meter is damaged, it can be removed for repairs or replacement, as follows:

1. With upper half of instrument removed from lower half and inverted, loosen lock nuts inside case from POWER and BATTERY CHECK switch bushings and LEL ZERO control bushing.

2. Remove LEL ZERO control knob and retaining nut.

3. Remove external face nuts from switch bushings.

4. Remove three screws holding circuit board into case.

5. Remove two nuts from meter studs.

6. Tilt and pull circuit board out of case as far as connecting wires permit.

7. Tilt and lift out meter.

8. Reinstall meter in reverse order.

V. MAINTENANCE

A. Batteries

1. Check battery voltage periodically by pressing BATTERY CHECK switch. Recharge before voltage reaches minimum.

When connecting charger, always follow these steps:

a) Confirm that the plug is inserted in the correct way, with the THIS SIDE UP label upwards. The socket is polarized, with the pins offset below the centerline, but can sometimes be forced on the wrong way, particularly if it has become worn with use.

b) Verify that a charge is actually entering battery. To do this, turn instrument on and check meter reading while BATTERY CHECK button is pressed. Observe reading while charger is plugged and unplugged at wall socket. If reading increases when charger is connected, and decreases when unplugged, battery is receiving a charge. If no change is observed, then probably charger or power circuit is at fault. If charger is defective, return it for repair or replacement.

After verifying that instrument is accepting a charge, turn instrument switch off. Do not attempt to charge while instrument is turned on.

2. If sufficient voltage cannot be obtained after charging, open instrument and:

a) Check voltage output with a voltmeter, between red and black wires (unplug connector to gain access to pins). Voltage should be about 8.5 volts.

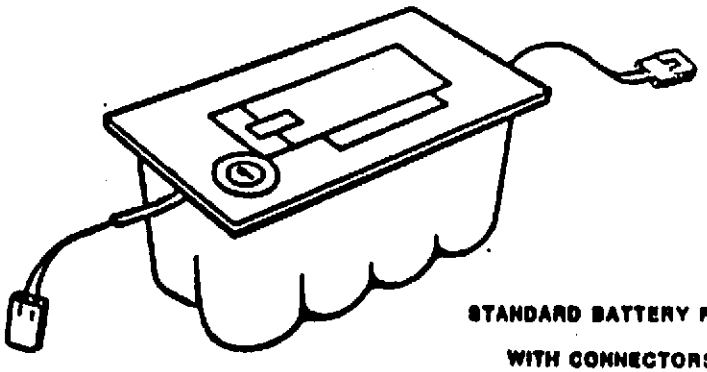
If voltage is acceptable, but volt check reading is too low, meter or switch could be at fault. If voltage is too low, battery is at fault.

b) If no output voltage can be obtained, check fuse by unscrewing recessed cap, marked "FUSE", and removing fuse. It can be checked visually or with an ohmmeter. If burned out, replace with a new one, but be sure to attempt to identify the cause of the overload or short circuit. Fuse must be type 3AG 1A.

c) If battery voltage is too low, and cannot be brought up by overnight charging, it probably needs replacement. To remove, take out the two screws holding it to bottom of case, and disconnect black and orange wires at charging end. If soldered at charger socket, they must be unsoldered at the tips of the socket pins.

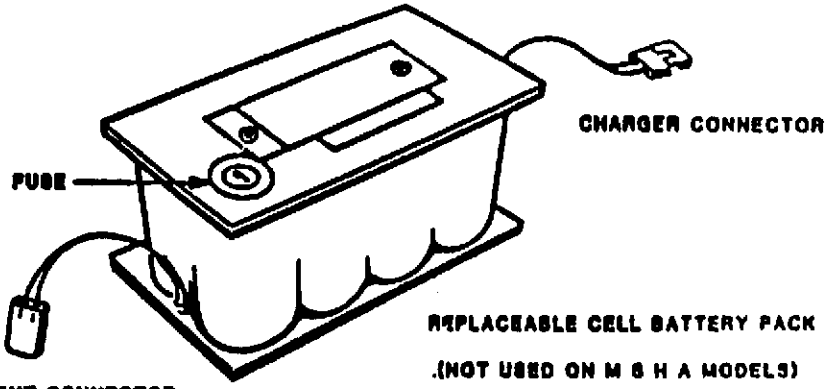
Most instruments are equipped with plug connectors at the charging end. If so equipped, then just unplug the white plastic connector.

New batteries will be received complete with a plug connector, and a mating socket which can be installed on the charger socket is available if needed. Order



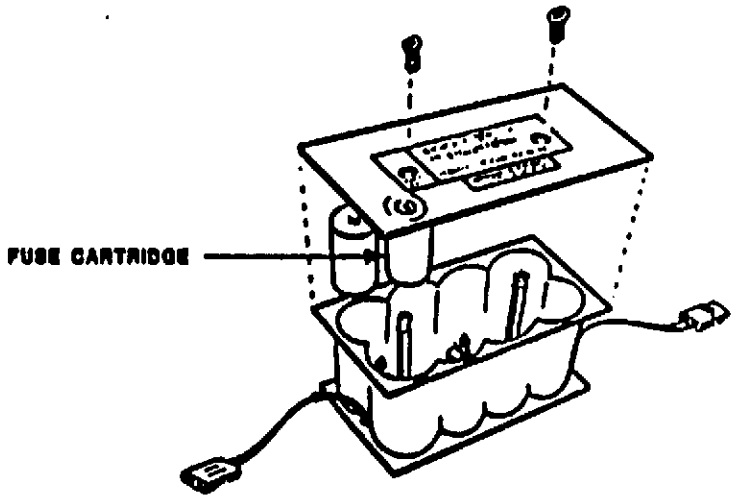
STANDARD BATTERY PACK

WITH CONNECTORS

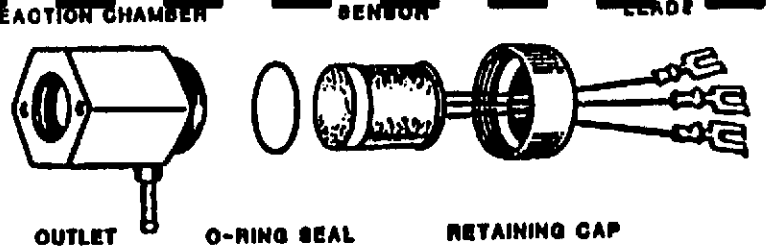


REPLACEABLE CELL BATTERY PACK

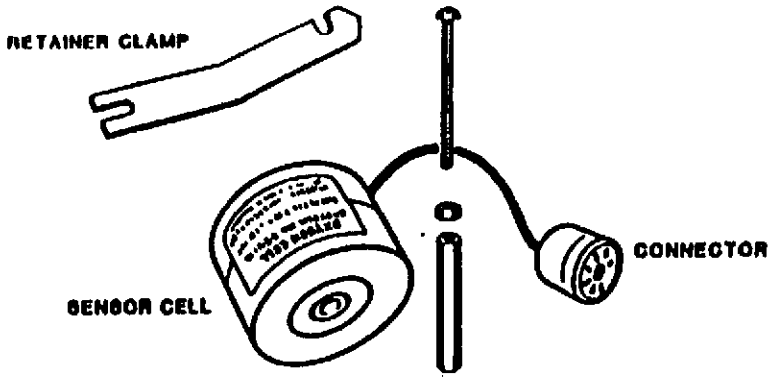
.(NOT USED ON M S H A MODELS)

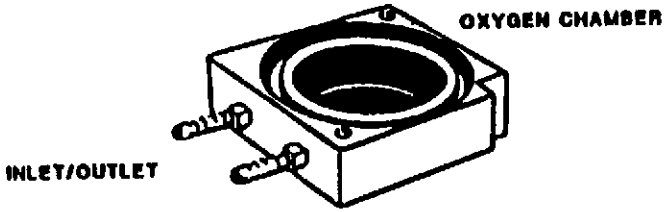


BATTERY PACKS



COMBUSTIBLES DETECTOR





OXYGEN DETECTOR

SAMPLE-DRAWING DETECTORS

3) Oxygen cell will remain connected to plug-in base by two wires. Unsolder these wires, noticing color code.

4) Connect new 49-0611 cell in same position, first removing terminal lugs from wires, and reassemble. Remove protective seal from cell face before assembly.

5) Return old cell to factory for reactivation on an exchange basis. (Order Stock No. 49-0611E.)

d) Oxygen cell is an electrochemical device similar to a battery, which gradually depletes itself, regardless of usage of the cell. It requires periodic reactivation, consisting of replacement of the electrolyte and the membrane, plus cleaning and inspection of the electrodes. This is most economically done at the factory.

New or reactivated cells are guaranteed usable for 1 year, and any cells returned for reactivation within that time period will be inspected and tested for operability. If found to have failed prematurely, they will be reactivated at a pro-rated charge. Cells are internally date-coded.

C. Sample Drawing Type Detectors

1. Combustibles Detector

a) Sensor assembly may require replacement if:

1) Meter cannot be set to zero within range of ZERO potentiometer.

2) Meter cannot be set to desired level within range of SPAN adjust.

b) To replace sensor:

1) Open instrument case.

2) Unscrew the red, green and white wires at terminals on main circuit board, noting color coding.

3) Unscrew knurled retaining cap at reaction chamber.

4) Pull out original sensor and install new one, being sure that O-ring is in place, under flange of detector.

5) Connect wires to proper terminals (R, G, W), turn power on, and adjust ZERO.

3. If the replaceable cell battery pack has been installed and is found defective, open the pack and check the voltage of each individual cell with a voltmeter. Remove two screws on the top of the pack with a 1/8" Allen wrench. The lid is spring loaded and may be held down by hand to ease the screw removal. Carefully remove the lid and the individual cells.

a) The cells supplied are the Stock No. 49-1501 rechargeable D-size nickel-cadmium type, 3.5-4.0 AH, and when charged, measure about 1.35 volts. Discard and replace faulty cells.

b) Examine the battery cavity and carefully clean out all foreign substances. Reinsert the cells into the pack in accordance with the diagram on the lid. (Negative end to springs, button end to rivets). Leave the proper space open for the fuse cartridge.

c) Place the lid onto the cells, press down firmly and insert screws. The convoluted case will assure cell alignment. Tighten the screws snugly, do not overtorque. It may be necessary to spring sides of instrument case apart slightly to clear battery lid.

d) Join all loose connectors, reassemble instrument and charge battery as required.

e) If normal operation from disposable batteries is desired, use the Stock No. 45-8052 battery pack instead of the 49-8051 pack. The spring-loaded top is held down by two knurled thumb screws. When replacing, tighten both screws at the same time to assure even compression of the springs and proper battery contact. Duracell* type disposable batteries are recommended for a proper fit.

This battery pack has no charger connections, so there is no danger of inadvertent charging of disposable cells. It can be used with rechargeable cells, but they must be charged separately.

* Duracell is a trade name of Duracell Inc., Bethel, CT 06801

B. Diffusion Type Detectors

1. Combustibles Detector

a) Sensor assembly may require replacement if:

1) Meter cannot be set to zero within range of ZERO potentiometer.

2) Meter cannot be set to desired calibration level within range of LEL SPAN potentiometer.

b) A complete replacement plug-in detector can be ordered from the factory. An exchange allowance is made on returned detectors.

c) Sensor portion of detector (Stock No. 60-0301) can be replaced as follows:

1) Loosen set screw which retains threaded shell on plug-in base. Unscrew shell from base.

2) Unsolder and remove sensor assembly by heating each of the three pins and pulling sensor from base.

3) Remove residual solder from each connector pin.

4) Solder new sensor in same position, with the common pin connected to pin B. Common pin is identified by a different color of glass insulation than is used on the other two pins.

CAUTION: Tin each detector pin prior to installing the detectors, to assure a good solder joint.

2. Oxygen Detector

a) Oxygen sensor assembly may require repair if:

1) Meter cannot be set to desired level on air within range of OXY CAL control.

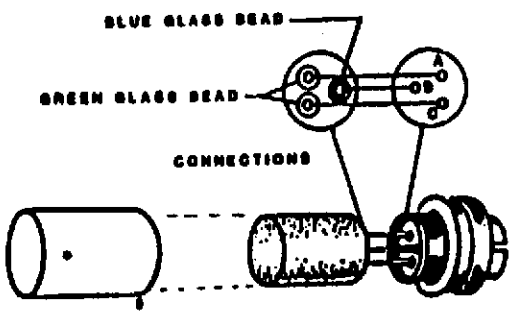
2) Meter cannot be set to zero on inert gas within range of ZERO potentiometer.

b) If oxygen sensor assembly requires repair, it should be sent to factory for reactivation, on an exchange basis (Stock No. 65-1000E). Alternatively, a complete new detector head can be ordered, Stock No. 65-1000.

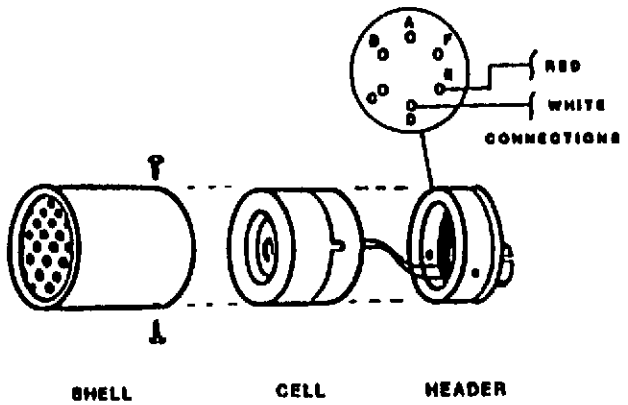
c) If preferred, the plug-in detector can be field-rebuilt, using the Stock No. 65-0611 replacement cell. To rebuild:

1) Remove two fillister-head screws near plug-in base.

2) Pull off detector shell.



COMBUSTIBLES DETECTOR



OXYGEN DETECTOR

DIFFUSION DETECTOR HEADS

TIP CALIBRATION AND MAINTENANCE INSTRUCTIONS

OPERATING MANUAL

TIP *

PHOTOVAC
incorporated

Unit 2 134 Doncaster Avenue
Thornhill, Ontario Canada L3T 1L3

Phone: (416) 881-8225 Telex: 06-964834

I N D E X

BASIC INSTRUMENT DESCRIPTION

TIP* is an analytical instrument which has been designed to sense certain important impurities in air and other gases. The name TIP* stands for "Total Ionizables Present"; this implies that the instrument senses any chemical in the air (or other gas matrix) which is "ionizable". Obviously, virtually any chemical can be ionized, and this includes the normal air gases such as oxygen, nitrogen, etc. In the case of TIP*, the term "ionizable" actually means photoionizable; we must begin by defining this.

TIP* contains a miniature lamp which emits very short wave length ultraviolet (UV) radiation. The energy of this radiation is enough to bring about "photoionization" if it strikes the molecules of certain chemicals. Whether or not photoionization takes place depends upon a factor called the "Ionization Potential" (IP) of the molecule in question. Ionization Potential is normally measured in energy units known as Electron Volts (eV).

Most of the light permanent gases (such as the air gases, hydrogen, helium, etc.) have ionization potentials at 12 eV or more. On the other hand, a huge number of organic chemicals which enter the air as gases or vapors, have ionization potentials below 10.5 eV. Included amongst this latter group are the vast majority of those compounds which we describe as "Pollutants".

The ultraviolet lamp used in TIP* has an energy of about 10.6 eV.

Let us now assume that we have an air sample which is "polluted" with a great number of gases and vapors (perhaps it could have been taken from the vicinity of a gas station at a busy time of day). If this air sample is exposed to radiation from the UV lamp in TIP*, the air gases (and water vapor) will not be photoionized but the pollutants will and a whole range of ions of all shapes and sizes will be formed. We have thus used a carefully selected lamp energy to "pick out" the pollutants and ignore the clean air; this is the essence of the principle used in TIP*.

The TIP* uses a small pump which continuously draws air into a tiny ionization chamber which is also flooded with UV light. Inside this chamber are two electrodes; an electric voltage is applied across these electrodes and one of them is connected to a very sensitive current measuring device (electrometer). When ions are formed, and these will have both positive and negative charges, the negative ions will travel to the positive electrode and the positive ions to the negative electrode. This will result in the flow of electric current which is amplified by the electrometer and can then be used in a number of ways to express the "Total Ionizables Present".

It is important to realize that TIP* does not distinguish between different pollutants; the signal produced represents a composite of all different ionizable pollutants. Where the "pollutant burden" in a given sample of air becomes high, TIP* will register this fact. The correct implication to be drawn is that there is a potentially serious situation which requires further investigation using more specific detection equipment (such as Photovac's 10S gas chromatograph).

In many cases, a factory will have only one chemical in use in a particular area and this will be by far the major pollutant in the air. Here, TIP* can be calibrated for this specific compound and can register a precise reading of the level in a very direct and useful manner.

A further instance where TIP* can give specific quantification would be in the case of an accidental spill of a certain chemical where, again, this chemical would predominate.

More attention will be paid to practical problems of this type in a later section.

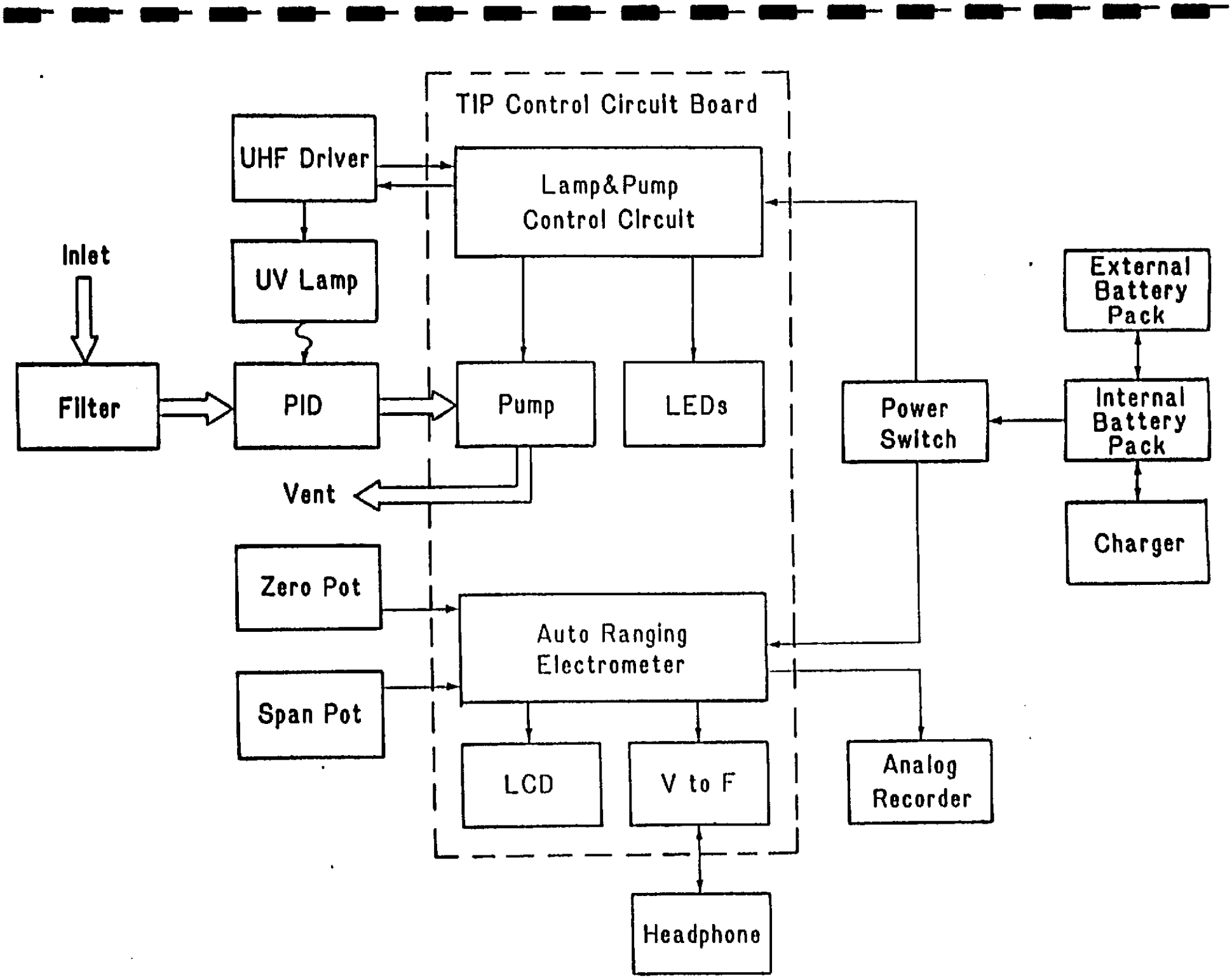
The photoionization detector (PID) used in TIP* is exclusive to Photovac. The technology used involves what is known as an RF excited electrodeless discharge lamp coupled with a very sensitive electrometer. Such technology provides striking sensitivity, the potential for miniaturization (because no high voltage power supply is needed) and a very simple lamp design which is inherently far less expensive (price US$150) than its high voltage counterparts. Again, the simplicity of our lamp increases its expected operational life and allows us to provide a 1-year warranty.

Careful miniaturization has allowed us to package TIP* in a single flashlight-sized casing, weighing just over three pounds. This includes the photoionization detector, the sample pump, all necessary electronics with an autoranging liquid crystal display (LCD) and sufficient rechargeable battery power for about four hours of continuous operation. TIP* will also operate from an external 12 V DC battery pack, rated at 400 ma. Packaging materials are polycarbonate and aluminum and the unit has been designed with the expectation that it must operate under adverse conditions.

A single electrical connector is located at the base of the handle and this is used for battery recharging and for connection of external 12 V DC power. Two outputs are available at this same connector: an analog signal from the electrometer and an audio signal for connection to an ear phone which is pulsed at a rate proportional to the concentration being measured.

TIP* has just three controls: an "On-Off" switch, a "Zero" control knob and a "Span" (actually, Gain) control knob. Zero and Span controls are lockable and are provided with numerical position indication.

All the electronics with the exception of the UHF driver for the ultraviolet lamp are contained on a single printed circuit board. The TIP*'s Functional Block Diagram shows how the various parts interconnect.


TIP Control Circuit Board
UHF Driver
Lamp&Pump
Control Circuit
Inlet
UV Lamp
External
Battery
Pack
Filter
PID
Pump
LEDs
Power
Switch
Internal
Battery
Pack
Vent
Charger
Zero Pot
Auto Ranging
Electrometer
Span Pot
LCD
V to F
Analog
Recorder
Headphone

INSTRUCTIONS FOR USING TIP*

1. Carefully unpack your TIP* and examine for any physical damage which could have occurred in transit. Inform Photovac at once, in such an event.

1. Although TIP* units leave our factory with fully-charged batteries, you should normally expect some loss of charge during storage and overnight re-charge of approximately 16 hours, prior to use, is a good idea.

2. Unpack and check the charging unit. Make sure that the voltage corresponds to that of your local area. Connect the military-style plug to the receptacle located at the base of TIP*'s handle. Make sure the Power Switch on TIP* is off. Plug the charging unit into the mains. Do not overcharge batteries as it will shorten their life. About 16 hours is sufficient charging time.

3. Having charged the batteries, remove the connector by unscrewing the locking nut, which is partially hidden within the base of the TIP*'s handle, and replace the cover.

4. Turn the power switch to "ON" by pulling the handle toward the operator first. Pump will come on momentarily and a minute later you will hear a continuous low humming sound coming from the pump inside the unit. This indicates that the ultraviolet lamp has ignited. Allow another minute for the ion cell to come into equilibrium.

5. Set the "SPAN" knob to maximum position (fully clockwise). Use the "ZERO" knob to set the liquid crystal display to zero. For best results, this should be done while allowing "zero impurity" air to be pumped into TIP*; outdoor air will usually serve as a zero air source for less demanding applications (see Calibration Section, P. 9). Lock the "Zero" knob by turning the black locking ring counterclockwise.

6. The sensitivity of the unit is controlled by the setting of the "Span" knob. The sensitivity increases as the knob is turned clockwise. The idea of the span control is to permit calibration for a given chemical compound. Calibration will be described in a later section but basically, a calibration sample at, say, 10 ppm is allowed to flow into the TIP* and the span control is then used to set the liquid crystal display to 10 (or, if sensitivity to this particular chemical is low, to some other reference value). If the application is non-specific identification under conditions of high sensitivity, it makes sense to have the span control set to maximum. Lock the span control by turning the black ring counterclockwise.

TIP* is now ready for use and will run for about 4 hours before its batteries require re-charging. When not in use, just turn off the power switch by pulling handle towards the operator first. When continuing, turn this back on, allowing at least two minutes for warm up period before taking measurements.

As you move through an area in which TIP* gives a positive reading, you will see rapid fluctuations in the displayed concentration. TIP* has a very fast response and it is sensitive to minor concentration changes which always occur in any large volume of mixed gas. Steady readings will be observed when clean air is permitted to flow or when a homogeneous calibrant is being used.

You may choose to use TIP*'s audio output. This is very valuable as a "second sense" in long tedious jobs where your eyes may become tired watching the LCD or where a leak has to be sought in a very inaccessible spot. Simply connect the optional headphone to the rear receptacle at the base of TIP*'s handle, a "popping" sound will be heard which gets faster as the concentration increases.

Another useful feature is the analog output, this enables TIP* to be connected to an external readout device, such as a chart recorder or a level detector. Connect the optional analog output plug to the rear receptacle at the base of TIP*'s handle and set your recording device to 2 V Full Scale.

The standard 1/8" Swagelok™ fitting at the front-end of the filter is useful for connection to a variety of gas sources and also for extension of the "reach" of TIP* into inaccessible spots. We recommend the use of 1/8 inch Teflon™ tubing for this and the length of this can be up to 20 feet (7 meters). Air sampling within a bore-hole is a good example of such an application.

It is a good practice to make a note of the "Zero" and "Span" settings used at the start of a particular job. The numbered graduations around each knob are designed for this purpose. Because different chemicals have different response factors in TIP*, a separate calibration is needed for each. If you are moving back and forth measuring two different chemicals in one operational period, you can note the "Span" setting required for each and simply re-set the knob as required, without need for re-calibration. It is not advisable to use the above methods for low value of SPAN (less than one), as error in re-setting and consequently a significant error in concentration readings may occur. It is normal for a new TIP* unit to exhibit some slight zero drift and, in any event, it is a sound practice to check Zero periodically. Likewise, Span should also be adjusted from time to time. The frequency with which you perform both of these functions will depend upon the nature of the work and how exacting are its requirements. If you are leak testing or doing a quick "walk-through" premises, it is not necessary to carry out either frequent or exact calibrations.

When TIP* encounters a sample of very high concentration (high 100s to 1000s ppm), the recovery to zero level will be a little sluggish because the large amount of ionizable material must be fully purged from the interior. This will be particularly evident when a Teflon™ extension tube is used.

TIP* is fitted with a 15 μ cartridge-style filter which is designed to capture particles that might otherwise be drawn into the detector. Extended periods of operation in a very dusty environment require frequent inspection of the filter for clogging and/or absorption of particles carrying volatile material. When filter is clogged the sensitivity of the system will decrease since the sample flow-through is decreased. On the other hand, when absorption of the volatile material occurs, a high background reading will be observed and consequently the need for an extreme zero resetting would be required. In either case, filter should be replaced. Replacement of the filter element is described in the Maintenance Section of this manual.

When very high sensitivity is required with commensurate high accuracy, it is advisable to allow TIP* to warm up in the environment in which it is to be used for at least fifteen to twenty minutes. We are talking here of taking readings in the low hundreds to high tens parts-per-billion. Be aware also that slight microphonic noise can occur at these sensitivities; TIP* should be cradled very firmly and not subjected to any vibration or shock while readings are being taken.

BASIC PRECAUTIONS

In the preceding section we described battery charging procedure. Once more we must emphasize the need for regular charging of the nickel cadmium batteries to ensure optimal performance and life. Avoid overcharging (for example, over a weekend) and also avoid leaving the batteries discharged for lengthy periods. The manufacturer advises regular "exercising" of these batteries; full charge, followed by 95% discharge (as indicated by "LO BAT"). The instrument cannot be operated while charging or while it is connected to the charger.

It is vitally important to bear in mind that, under certain circumstances, water can be sucked into the detector. Provided that the water is relatively clean, this need not be a total disaster and generally all that is required is factory service, involving disassembly and cleaning as soon as it is possible after the occurrence. Delay will almost surely result in corrosion of internal parts.

The casing of TIP* has been designed to be as leak-tight as possible. To seal many adjacent parts o-rings are used. However, the instrument is certainly not designed for partial immersion in water, nor for operation in direct contact with rain.

Generally speaking, the ambient operating range of TIP* lies between 0 degrees C (32 degrees F) and 43 degrees C (110 degrees F). Some users have been successful outside this range, but it is not recommended. When the instrument is taken from a low temperature area into a region of much higher temperature and humidity, condensation will occur. In particular, a film of condensation will inevitably be deposited upon the window of the UV lamp. This will result in temporary loss of response. The fastest remedy for this difficulty is simply to allow the instrument to recover while running the pump. The remedy consistent with best instrument care is to allow the TIP* to reach ambient temperature before switching "ON", this minimizes possible internal corrosion.

Despite what has been said in the preceding paragraph, TIP* is a very robust instrument. It is possible to take a sample of breath (100% humidity) into the instrument, without fear of damage, and the response to this is interesting because ionizables such as pentane (perhaps, sometimes, ethanol!) are easily measured in a breath sample. Because of the unique design incorporated into TIP*, the water vapor "quenching" (momentary negative signal) effect is minimal and recovery fast. This has not always been the case with photoionization detectors.

You will notice that the liquid crystal display on TIP* is illuminated while the pump is running. "LO BAT" indication on the display will appear when the battery requires re-charging.

CALIBRATION

We should probably start by saying that the function of calibration is one of the most misunderstood operations that the instrument user is called upon to perform.

Everybody would love to have an eternally calibrated instrument, which only needs to be pointed at the problem in order to yield data of unswerving reliability under every imaginable condition!

Sadly, this era has yet to dawn for field instruments of this type (and for most others, for that matter). Nevertheless, many improvements have been made to instrument design in order to simplify calibration to the stage where it is palatable. We have addressed this problem and offer some simple (but not simplistic) practical solutions.

With TIP*, two basic calibration operations must be performed. These are adjustment of Zero and the adjustment of Span.

The zero adjustment is the easiest. Under conditions where super accuracy and sensitivity are not required, it may be sufficient to acquire zero by taking TIP* outside and using outdoor air. In other cases an office area may prove to be clean enough for the purpose (but don't count on it!). When rigorously done, a source of "Zero Air" or even "Ultra Zero Air" is necessary. These are high purity grades of compressed air, available in bottled form from most major suppliers. The bottle is fitted with a regulator and the air supply can be directly connected to TIP*'s input fitting; a very low rate of flow should be used and the pressure applied must never exceed 1 psi (5 kPa.).

Having adjusted zero (and this should be done with the "SPAN" control at maximum), we will now turn to the procedure for span calibration. How this is done depends so very much upon the task being undertaken. If we are simply doing leak detection of a photoionizable gas or vapor, calibration is seldom necessary; the best strategy is merely to turn span to maximum for best sensing of leakage - actual numerical values are of secondary importance here.

If we are making a "ball-park" assessment of a situation where there is a high ionizable loading in the air, consisting of a mixture of many components, readings obtained will be a composite of these. With photoionization, as the Table of Response Factors shows, readings for a given concentration will vary strongly from compound to compound. This means that the reading on TIP* will be dependent upon both concentration and the nature of the mixture involved. TIP*, in this case, works as a scoping tool; the user can move around the contaminated area seeking "hot spots". When these are located, further investigation may be carried out using an instrument such as Photovac's 10S Portable Gas Chromatograph in order to identify the compounds present.

Once the "meaning" (perhaps in health terms) of a certain high reading in a certain situation has been assessed, TIP* can be used with more confidence as a definitive tool. If readings are taken over a lengthy time period, it may be valuable to calibrate TIP* against one of the components known to be present in the homologous mixture. This serves as a reasonably accurate "base line" for reference.

Now we come to actual methods of calibration. The basic requirement here is to have a supply of the compound, for which calibration is required, diluted in clean air to a level close to that at which measurement has to be made. If we are working in the 0.1 to 10 ppm range with benzene, say, it is appropriate to carry out calibration at mid-range or at around 1 ppm. Similarly, if work is being done on air samples where concentrations of 200 to 1000 ppm are to be measured, a calibration at about 600 ppm would be very appropriate.

Choice of calibration point is important because instrument response is not perfectly linear and, for example, an instrument calibrated at 1 ppm and used to measure around 1000 ppm would be an unsuitable choice and significant error would be anticipated.

It is important to realize also that, ideally, the matrix gas used for the calibration standard should be the same as the one being analyzed. Thus, if vinyl chloride monomer is to be measured in nitrogen atmosphere, the standard should also be prepared in nitrogen atmosphere. There will be a small, but significant error if this is not done; and while such an error can certainly be compensated for, it is sensible to eliminate it if this is practical.

Many specialty gas suppliers provide excellent quality analyzed gaseous standards. Unfortunately, there are exceptions to this and they result from the fact that certain chemical compounds do not have good "keeping" properties at low concentration. Hydrogen sulfide is an excellent example. On the other hand, unsaturated chlorinated compounds, like vinyl chloride and trichloroethylene, "keep" almost indefinitely at low concentration. Benzene can be stored in this way, but choice of containment materials is vital; rubbers are definitely unsuitable.

Whether or not to use a commercially supplied standard is a decision which should be made jointly with a trusted supplier. Photovac will be happy to advise if problems occur.

Probably one of the very best (and certainly the cheapest) ways of acquiring a standard is to make your own. Procedures vary, but we have found that certain plastic sample bags made from proprietary materials, such as Tedlar™, are suitable for containing home made standards for periods, certainly of hours.

TABLE 1

Compound	Relative Response
Acetone	0.452
Benzene	1.000
n-Butyl Acrylate	0.280
Diethylamine	0.509
Ethylene	0.043
Ethylene Oxide	0.130
Furfural	0.240
n-Hexane	0.085
n-Heptane	0.147
Iso-butylene	0.589
Iso-propyl Alcohol	0.046
Methyl Ethyl Ketone	0.099
Propylene	0.454
Propylene Oxide	0.060
Toluene	0.814
1,1,1-Trichloroethane	0.010
1,1,2-Trichloroethylene	0.734
m-Xylene	0.900

The sample bag should have known internal volume (when inflated to the point where the material just begins tc stretch) and should have appropriate fittings for gas filling and connection to the TIP*. The bag is first filled with Zero air (TIP* can be used to check that this air is clear of contamination). A simple calculation can then be done to find out how much of the chemical, as gas or as vapor or liquid, must be added to provide the required concentration.

If we are dealing with a gas, the calculation is the simplest imaginable. If the volume of the bag is 25 L, we simply add 25 µL to yield a 1 ppm mixture. For higher or lower concentrations, we adjust accordingly.

If, however, we have to prepare a standard from liquid or solid sample, the procedure is slightly more complex (but only slightly!). The best way that we have found involves using headspace (this means taking a sample of vapor from above the liquid in a bottle). Vapor pressure of a given liquid varies with temperature. Let us imagine that we are workding with benzene at room temperature 20 degrees C (68 degrees F). Vapor pressure tables tell us that benzene exerts a vapor pressure of 74 mm Hg at this temperature. If benzene was a gas, we would just add 25 µL to our 25 L bag to make a 1 ppm mix, but benzene is a liquid at this temperature, contributing only partially to the total atmospheric pressure above the liquid, and we need to take a larger volume from the headspace than this. Actually, we must take 25 x 760/74 = 257 µL and this will give 1 ppm in the bag (760 mm Hg is, near enough, atmospheric pressure). We could write a formula:

$$v = V \times 760/p$$

Where v = Volume of headspace required (µL)
V = Volume of bag (L)
p = Vapor pressure of sample material in mm Hg at ambient temperature.

One vital point not to be overlooked is the type of syringe used for this purpose which usually employs a steel plunger having a minute Teflon™ tip and graduated glass barrel. The needle is either epoxy bonded to the end of the barrel or removable type having a knurled screw-on sleeve and a Teflon™ sealing bush between itself and the glass. This type of syringe gives excellent service and a commercially available type is Hamilton 1750 RN (500 µL capacity with a replaceable needle).

We must be very careful, however, as this syringe ages. The Teflon™ plunger tip gradually wears and leaks can develop between this and the glass wall; also, the screw-on needle seal can work loose and needs to be checked periodically. Leakage in syringes can be the major cause of problems associated with reproducibility and replication of standards and actual results.

If we don't have the vapour pressure for a particular liquid, we could always use the actual liquid itself to make the standard in the bag.

This is more difficult because the amount to be taken turns out to be quite small and there is a possibility of interaction between the liquid before it evaporates and the wall of the bag. The formula in this case is:

$$m = 4.1 \times 10^{-8} \times M \times V \times C$$

in which m is the mass in grams of liquid which must be taken to give a concentration of C parts-per-million in a volume of V liters where the molecular mass of the liquid is M a.m.u.

Example: We have to make a 1 ppm standard of benzene in a Tedlar™ bag containing 100 liters of clean air. How much benzene must be added?

$$m = 4.1 \times 10^{-8} \times 78 \times 100 \times 1 = 320 \times 10^{-6} \text{ grams}$$

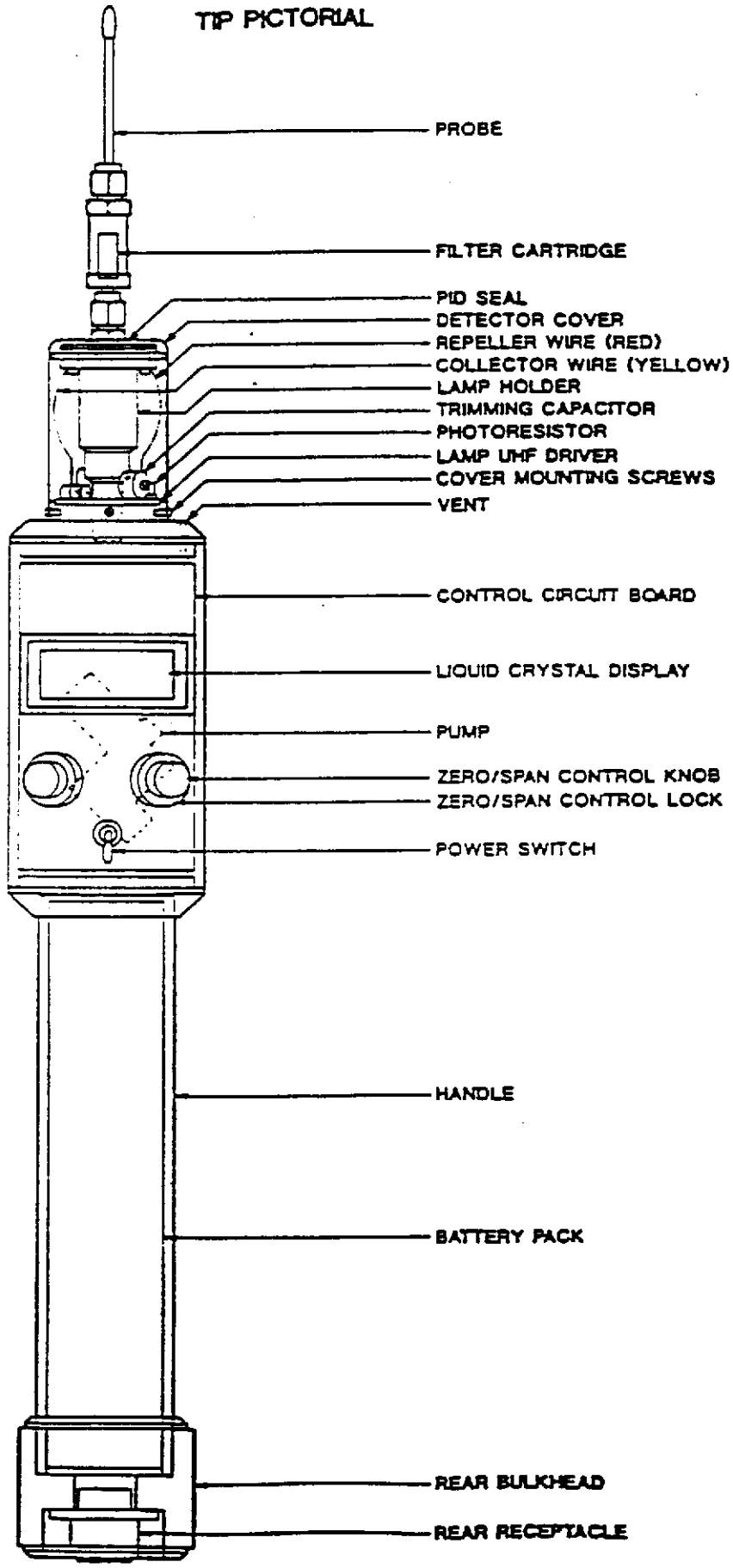
From Tables, the density of benzene is 0.88 g/mL

Therefore the volume of benzene which must be taken is:

$$320 \times 10^{-6}/.88 = 360 \times 10^{-6} \text{ mL or } 0.36 \text{ uL}$$

A 1.00 uL graduated syringe can therefore be used to deliver the correct amount of liquid benzene into the Tedlar™ bag.

TIP PICTORIAL



MAINTENANCE

Routine maintenance for TIP* is absolutely minimal; all that is required is to ensure the batteries remain close to full charge (during periods of non-use) and that the inlet filter is kept clear of dust particles. The filter used is of the 15 μ stainless steel cartridge housed in a stainless steel cylinder permanently attached to the front of the instrument.

Occasionally, loss of TIP* sensitivity may require servicing of the detector and this is almost always limited to simply cleaning or changing the lamp/ion cell assembly.

Periodically, it will be necessary to install new, rechargeable batteries, which can be expected to last for 1 year of heavy use.

The plastic parts of TIP* can be cleaned with a damp cloth and mild detergent, if necessary. DO NOT use any organic solvents as the finish may be damaged.

Filter Replacement

TIP*'s response can be tested with and without the filter and if the response varies by more than 10% the filter should be replaced. In order to replace the filter cartridge, simply hold the filter housing firmly at the base with a 9/16" wrench and unscrew the 1/8" Swagelok™ connection, for the sample inlet at the top of the housing, with another 9/16" wrench. Discard the old filter and replace with the new one. Screw the sample inlet connection firmly into its place. Never use instrument without the filter as the detector can be damaged.

Detector Maintenance

Further maintenance operations, which can be performed by the user, involve the cleaning of the ion chamber and the UV lamp window or replacement of the lamp itself.

If the instrument has been used for extended periods in dusty environments or if there is a significant loss of sensitivity, and is not due to an obstructed filter, the UV lamp and ion chamber will require examination.

In order to access the lamp and ion chamber, refer to the TIP* pictorial diagram. Make certain that the unit is switched off before dismounting and proceed as follows:

1. Remove any inlet probe which may have been installed.

2. Remove the four cover mounting screws holding the detector cover in place.

3. Lift the detector cover straight off the front of TIP* with a twisting motion to overcome friction against the o-ring seal. The ion chamber/lamp assembly will now be exposed.

4. Unplug the yellow collector wire from the little printed circuit board of the UHF driver.

5. Unplug the red wire and unscrew the PID from the lamp holder by grasping gently but firmly the body of the lamp holder and, by counterclockwise rotation, unscrew the electrometer. The lamp will pop up on a spring and may be lifted out for cleaning or replacement.

   When cleaning the lamp window, be careful not to get methanol in contact with the control housing as the finish may be damaged.

   The interior of the ion chamber contains a very delicate wire mesh and must not be touched with any solid object. The lamp window may be cleaned with a cotton swab dipped in methanol and the interior of the ion chamber may be blown free of dust using a gentle compressed air jet. The lamp (or its replacement) is simply put back into the lamp holder and the electrometer is screwed back into place, being very careful to avoid "cross threading". The two wires are replaced as before; and it is vital to ensure that the electrometer o-ring seal is replaced in its seat before putting the cover back onto the detector.

   If sensitivity is not recovered by cleaning of the lamp, or the lamp will not start (as evidenced by the pump not starting and the LEDs not lighting), it is likely that a new lamp is required. Installation follows the course of the instructions just given.

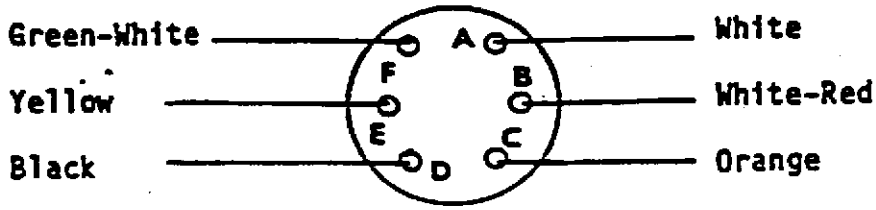
Installing a New Battery

The TIP*'s new batteries can be installed by either replacing the battery pack itself or by replacing the handle unit with the battery pack factory installed.

To replace the battery pack only, proceed as follows:

1. Locate and remove two black socket-head screws from the black bulkhead at the top of the handle.
2. Grasp the handle and the control housing and rock the handle back and forth to release it. The o-ring seal between the two parts is quite tight.
3. Pull off the brown 8-pin connector from the control circuit board. Two black sealing washers will either be loose inside the control housing or else be stuck to the inside of the handle bulkhead or the struts to which it mounts. Remove them.
4. Remove four black socket-head screws holding the military-style receptacle to the base of the TIP*.
5. Unscrew the rear bulkhead from the handle.
6. Push the battery pack from the handle.
7. Unsolder the connecting wires from the receptacle.
8. Push the battery pack from the handle, making sure that the connecting wires come through freely and are not pinched between the receptacle and the bulkhead.
9. Solder the wires from the new battery pack into place as is shown in Figure below.
10. Screw the receptacle with the dust cover into place.
11. Mate the brown plug properly to the receptacle of the control circuit board.
12. Put two socket-head screws through the mounting holes in the handle bulkhead, and slip two new seals over the screws.
13. Position the handle against the control housing and start the two screws into their mounting struts. Be sure no wires are pinched between the struts and the bulkhead.
14. Push the two parts together, then tighten the screws snugly.

To replace the handle with the battery pack as a unit, proceed as outlined above but omit steps 4 to 10 inclusive.



sample instructions

Trichloroethylene 2/a — 6728541

OPERATING INSTRUCTIONS 224—2541 e · 1st Edition · February 1978

1 General and Application

Determination of trichloroethylene ($CHCl : CCl_2$) in air. The Tubes are to be used in conjunction with the DRÄGER Gas Detector Pump. For use, see Section 4 of these Operating Instructions and Instructions for Use 2541 e.

2 Description

See illustration
Opening time (duration of one pump stroke until the limit mark is completely reached): 15 to 30 seconds.

3 Range of Measurement (20° C, 1013 mbar)
With n = 5 strokes, 2 to 50 ppm trichloroethylene
With n = 3 strokes, 20 to 200 ppm trichloroethylene

1 ppm trichloroethylene ≙ 5.48 mg/m³
1 mg/m³ ≙ 0.18 ppm trichloroethylene } 20° C, 1013 mbar

4 Test and Evaluation of the Result

4.1 Before each series of measurements, check the pump for leaks using an unopened DRÄGER Tube.
4.2 Break off the tips of the DRÄGER Tube.
4.3 Insert the DRÄGER Tube tightly in the pump head (arrow points towards the pump).
4.4 Now suck the air sample through the DRÄGER Tube with n = 5 strokes. Trichloroethylene turns the indicating layer orange. The total length of the discoloration is a measure of the concentration. Read-off the concentration in ppm on the 5-stroke scale. If the value is above 50 ppm, the test is completed. If it is below 50 ppm, continue the test with a further 2 strokes (a total of 7). Now read-off the trichloroethylene concentration in ppm on the 5 stroke scale.

5 Remarks

DRÄGER Trichloroethylene Tubes can be used only once, even if the air sample did not contain any trichloroethylene. In the case of a positive indication, the discoloration keeps for several days, if the Tubes are sealed with rubber caps.

6 Influence of Ambient Conditions on the Result of Measurement

6.1 Temperature
The DRÄGER Tubes can be used in a temperature range of from 10° C to 40° C.
6.2 Humidity
Between 5 and 15 mg H_2O per litre. Humidity has no influence on the indication.
6.3 Atmospheric Pressure
For pressure correction, multiply the Tube reading by the following conversion factor.

$$\text{Conversion factor} = \frac{1013}{\text{actual atmospheric pressure (in mbar)}}$$

7 Specificity (Cross-Sensitivity)

The trichloroethylene indication is based on a change of the trichloroethylene in the oxidation layer (chromate); the chlorine liberated is measured in the indicating layer (reagent: o-tolidine)

8 Shelf Life

See expiration date and storage temperature on the side of the box.

9 Important Properties of Trichloroethylene

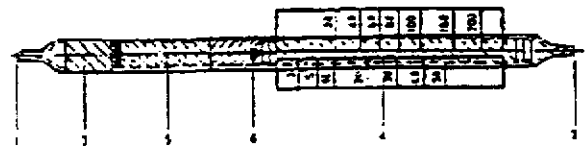
Threshold limit value (USA 1977): 100 ppm (535 mg/m³)
Lower explosive limit: 7.9 vol.% (at 20° C)
Ignition temperature: 410° C
Vapour pressure: 80 mbar (at 20° C)
Saturation concentration in air: 422 mg/litre (at 20° C)
Molecular mass: 131.39
Density (liquid): 1.47 g/cm³ (at 20 °C)
Melting point: —84° C
Boiling point: 87.2° C

10 Information

At the request of the tube user, we will supply the following information:
a) The methods used for calibration of the detector tubes
b) The effects (including reactions) on the operation and accuracy of the gas detector tube unit caused by specific environmental conditions described by the user, if the effects are known to us.

11 Filter Respiratory Protection

Should filter protection be necessary and acceptable, filters with the code letter A should be used.



1 and 2 fused tips
3 sealing surface
4 indicating layer (light grey) with calibrated scales, numerical values = ppm trichloroethylene
5 oxidation layer (yellow)
6 arrow (must point towards pump during measurement)

Trichlorethylene 2/a

5 strokes: 2– 50ppm 3 strokes: 20– 200 ppm

DETECTOR TUBE HANDBOOK

Compiled by Kurt Leichnitz

1	DRÄGER Tube Trichlorethylene 2/a	(67 28541)
2	Standard range of measurement (20°C, 1013 mbar)	2 to 50 ppm trichloroethylene 20 to 200 ppm trichloroethylene
3	Number of strokes of the DRÄGER gas detector pump	n = 5 n = 3
4	Relative standard deviation	15 to 10%

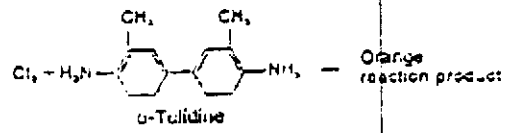
5 Description

Scale tube • yellow conversion layer, reagent: chromate • pale grey indicating layer, reagent: o-tolidine • colour change to orange.

6 Reaction principle

(In the conversion layer)
$CCl_2 : CHCl$ (Trichloroethylene) + Chromate → Cl_2 (Chlorine)

(In the indicating layer)



o-Tolidine

7 Cross-sensitivity

Free halogens, hydrogen halides and readily cleaved halogenated hydrocarbons also give an indication.

1	Gases and vapours to be measured	Trichloroethylene
2	Chemical formula	$CCl_2 = CHCl$
3	DRÄGER Tube(s) to be used	Trichloroethylene
4	Threshold limit value (1978 position)	100 ppm (535 mg/m³)
5	Threshold of smell (app.)	20 ppm
6	1 ppm = ... (20°C, 1013 mbar)	5.48 mg/m³
7	1 mg/m³ = ...(20°C, 1013 mbar)	0.18 ppm
8	Molecular weight	131.39
9	Vapour pressure (at 20°C)	80 mbar (57 mm Hg)
10	Volatility (at 20°C)	422 mg/l
11	Lower ignition limit	7.9 vol.%
12	Upper ignition limit	—
13	Flash point	—
14	Group and hazard class (VbF)	—
15	Ignition temperature	410°C
16	Evaporation factor (ether = 1)	3.8
17	Boiling point (at 1013 mbar)	87.2°C
18	Specific gravity (liquid, 20°C)	1.47 g/cm³
19	Respirator filter, code letter and colour	A, brown

Sample instructions

Trichlorethylene 2/a — 67 28 541

OPERATING INSTRUCTIONS [illegible] — 1st Edition — February 1978

1 General and Application

Determination of trichloroethylene ($CHCl : CCl_2$) in air. The Tubes are to be used in conjunction with the DRÄGER Gas Detector Pump. For use, see Section 4 of these Operating Instructions and Instructions for [illegible].

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See illustration.
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4.3 Insert the DRÄGER Tube tightly in the pump head (arrow points towards the pump).
4.4 First suck the air sample through the DRÄGER Tube with n = 1 stroke. Trichloroethylene forms the indicating layer stains. The total length of the discoloration is a measure of the concentration. Read-off the concentration in ppm on the 5-stroke scale. If the value is above 50 ppm, the test is completed. If it is below 50 ppm, continue the test with a further 2 strokes (a total of 3). Now read-off the trichloroethylene concentration in ppm on the 3 stroke scale.

5 Remarks

DRÄGER Trichloroethylene Tubes can be used many times, even if the air sample did not contain any trichloroethylene. In the case of a positive indication, the discoloration keeps for several days, if the Tubes are sealed with rubber caps.

6 Influence of Ambient Conditions on the Result of Measurement

6.1 Temperature
The DRÄGER Tubes can be used in a temperature range of from 10° C to 40° C.
6.2 Humidity
Between 5 and 15 mg H_2O per litre. Humidity has no influence on the indication.
6.3 Atmospheric Pressure
For pressure correction, multiply the Tube reading by the following conversion factor:

$$\text{Conversion factor} = \frac{1013}{\text{actual atmospheric pressure (in mbar)}}$$

7 Specificity (Cross-sensitivity)

The trichloroethylene indication is based on a change of the trichloroethylene in the oxidation layer (chromate); the chlorine liberated is measured in the indicating layer (reagent: o-tolidine).

8 Shelf Life

See expiration date and storage temperature on the side of the box.

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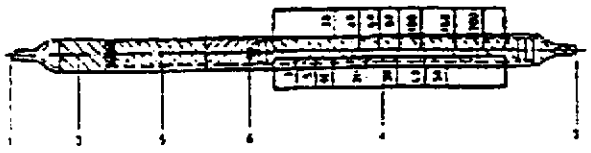
Ignition temperature: 410° C
Vapour pressure: 80 mbar (at 20° C)
Saturation concentration in air: 422 mg/litre (at 20° C)
Molecular mass: 131.39
Density (liquid): 1.47 g/cm³ (at 20 °C)
Melting point: —86° C
Boiling point: 87.2° C

10 Information

At the request of the tube user, we will supply the following information:
a) The methods used for calibration of the detector tube.
b) The effects (including reactions) on the operation and accuracy of the gas detector tube unit caused by specific environmental conditions described by the user, if the effects are known to us.

11 Filter Respiratory Protection

Should filter protection be necessary and acceptable, filters with the code letter A should be used.



1 and 2 fused tips
3 sealing surface
4 indicating layer (light grey) with calibrated scale, measured values in ppm trichloroethylene
5 oxidation layer (yellow)
6 arrow (must point towards pump during measurement)

Trichlorethylene 2/a

5 strokes: 2– 50 ppm 3 strokes: 20– 200 ppm

DETECTOR TUBE HANDBOOK

Compiled by Kurt Leichnitz

1	DRÄGER Tube	Trichlorethylene 2/a (67 28541)
2	Standard range of measurement (20°C, 1013 mbar)	2 to 50 ppm trichloroethylene 20 to 200 ppm trichloroethylene
3	Number of strokes of the DRÄGER gas detector pump	n = 5 n = 3
4	Relative standard deviation	15 to 10%

5 Description

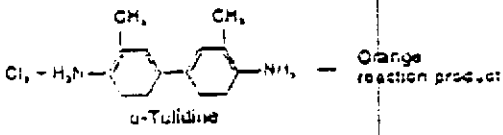
Scale tube • yellow conversion layer, reagent: chromate • pale grey indicating layer, reagent: o-tolidine • colour change to orange.

6 Reaction principle

(In the conversion layer)

$CCl_2 : CHCl$ — Chromate — Cl_2
Trichlorethylene — Chlorine

(In the indicating layer)



o-Tolidine

7 Cross-sensitivity

Free halogens, hydrogen halides and readily cleaved halogenated hydrocarbons also give an indication.

1	Gases and vapours to be measured	Trichloro-ethylene
2	Chemical formula	$CCl_2 = CHCl$
3	DRÄGER Tube(s) to be used	Trichloro-ethylene
4	Threshold limit value (1978 position)	100 ppm (535 mg/m³)
5	Threshold of smell (approx.)	20 ppm
6	1 ppm = ... (20°C, 1013 mbar)	5.48 mg/m³
7	1 mg/m³ = ...(20°C, 1013 mbar)	0.18 ppm
8	Molecular weight	131.39
9	Vapour pressure (at 20°C)	80 mbar (57 mm Hg)
10	Volatility (at 20°C)	422 mg/l
11	Lower ignition limit	7.9 vol.%
12	Upper ignition limit	—
13	Flash point	—
14	Group and hazard class (VbF)	—
15	Ignition temperature	410°C
16	Evaporation factor (ether = 1)	3.8
17	Boiling point (at 1013 mbar)	87.2°C
18	Specific gravity (liquid, 20°C)	1.47 g/cm³
19	Respirator filter, code letter and colour	A, brown

Sample instructions

o-Xylol 10/a

GEBRAUCHSANLEITUNG 234-33161 2. Ausgabe · März 1985

1 Allgemeines und Anwendungsbereich

Bestimmung von o-Xylol C_6H_4 $(CH_3)_2$ (1,2-Dimethylbenzol) in Luft.
Die Rohrchen sind zusammen mit der DRÄGER-Gasspürpumpe, Modell 31, zu verwenden. Zur Handhabung vgl. Abschnitt 4 dieser Gebrauchsanleitung und Gebrauchsanleitung 4341.

Wichtig:
Es ist nicht zulässig, diese Rohrchen mit Pumpen anderer Hersteller zu kombinieren, da es dann zu erheblichen Anzeigefehlern kommen kann. Eine solche Kombination verstieße gegen bestehende Richtlinien.

2 Beschreibung

Vgl. Abbildung.
Öffnungszeit (Dauer eines Pumpenhubes bis zur vollen Spannung der Sperrkette): 6 bis 12 Sekunden.

o-Xylol 10/a

OPERATING INSTRUCTIONS 234-33161e · 2nd Edition · March 1

1 General and application

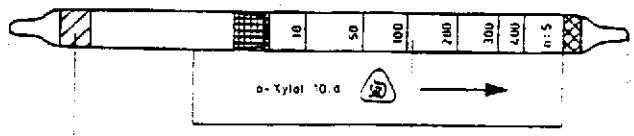
Determination of o-xylene C_6H_4 $(CH_3)_2$ (1,2-dimethylbenzene) in air.
The Tubes are to be used in conjunction with the DRAGER Gas Detector Pump, Model 31. For see Section 4 of these Operating Instructions and Instructions for Use 4341 e.

Important:
It is not permissible to combine the tubes with pumps made by other manufacturers, since this cause considerable errors in indication. Such a combination would offend against re regulations.

2 Description

See illustration.
Opening time (duration of one pump stroke until the limit chain is completely taut): 6 to 12 sec

1 und 2 zugeschmolzene Spitzen
3 Schreibfläche
4 Anzeigeschicht (weiß) mit Strichskala Zahlenwerte = ppm (mL/m³) o-Xylol gültig für n = 5 Hübe
5 Pfeil (soll bei der Prüfung zur Pumpe weisen)



1 and 2 fused tips
3 writing surface
4 indicating layer (white) with calibration scale, numerical values = ppm (mL/m³) o-xylene, valid for 5 pump strokes
5 arrow (must point towards pump during testing)

Bei Rückfragen an das Drägerwerk bitte die außen auf der Packung aufgestempelte Chargennummer angeben

3 Meßbereich (20°C, 1013 mbar entsprechend 20°C, 760 Torr)

Bei n = 5 Hüben	10 bis 400 ppm (mL/m³) o-Xylol
1 ppm (mL/m³) o-Xylol	≙ 4,44 mg/m³ } 20°C, 1013 mbar
1 mg/m³ o-Xylol	≙ 0,23 ppm }

4 Prüfung und Beurteilung des Ergebnisses

4.1 Pumpe vor jeder Meßreihe mit ungeöffnetem Rohrchen auf Dichtheit prüfen.
4.2 Spitzen des DRÄGER-Rohrchens abbrechen.
4.3 DRÄGER-Röhrchen dicht in den Pumpenkopf einsetzen. Pfeil weist zur Pumpe.
4.4 Zu untersuchende Luft mit n = 5 Hüben durch das Rohrchen saugen. o-Xylol verfärbt die weiße Anzeigeschicht rotbraun. Die gesamte Länge der Verfärbung ist das Maß für die o-Xylol-Konzentration.
Zahlenwerte = ppm (mL/m³) o-Xylol.

5 Bemerkungen

Auch nach negativem Ergebnis kann das DRÄGER-Rohrchen nicht wieder verwendet werden. Die Verfärbung ist einige Tage haltbar, wenn Rohrchen mit Gummikappen verschlossen werden.

6 Einfluß der Umgebungsbedingungen auf das Meßergebnis

6.1 Temperatur
Die DRÄGER-Rohrchen können in einem Temperaturbereich von 0 bis 40°C verwendet werden.
6.2 Feuchtigkeit
Im Bereich von 3 bis 15 mg H_2O pro Liter hat die Feuchtigkeit keinen Einfluß auf die Anzeige.
6.3 Luftdruck
Zur Korrektur des Druckeinflusses ist die Anzeige mit folgendem Faktor zu multiplizieren:

$$\text{Korrekturfaktor} = \frac{1013}{\text{tatsächlicher Luftdruck (in mbar)}}$$

7 Spezifität (Querempfindlichkeit)

Die o-Xylol-Anzeige beruht auf der Farbreaktion mit Formaldehyd-Schwefelsäure.
m-Xylol und p-Xylol werden mit etwa gleicher Empfindlichkeit wie das o-Xylol angezeigt.
Außer o-Xylol werden auch andere organische Verbindungen angezeigt; einige Beispiele für die Anzeigeempfindlichkeit:
100 ppm Monostyrol ergibt eine rotbraune Anzeige von ca. 40
100 ppm Toluol ergibt eine dunkelbraune Anzeige von ca. 200
200 ppm Ethylbenzol ergibt eine braune Anzeige von ca. 350
1000 ppm Butadien ergibt eine braune Anzeige von ca. 100
Keine Störung der Anzeige durch z.B. 200 ppm Methanol, 500 ppm n-Octan, 400 ppm Ethylacetat.

8 Vorgesehene Verbrauchszeit

Verbrauchszeit und Lagertemperatur (vgl. die Angaben auf der Banderole).

9 Wichtige Eigenschaften des o-Xylols

MAK-Wert (Bundesrepublik Deutschland (1984): 100 ppm (435 mg/m³)

Formel:	C_6H_4 $(CH_3)_2$
Untere Zündgrenze:	1,0 Vol.-%
Obere Zündgrenze:	7,6 Vol.-%
Zündtemperatur:	465°C
Dampfdruck:	6,7 mbar (20°C)
Flüchtigkeit:	29 mg/L (20°C)
Flammpunkt:	30°C
Molekularmasse:	106,17
Dichte:	0,88 g/cm³
Schmelzpunkt:	− 25°C
Siedepunkt:	144°C

10 Hinweis

Auf Wunsch des Benutzers liefern wir die folgende Information:
a) Die für die Kalibrierung der Prüfröhrchen verwendete Methode.
b) Den Einfluß von Testbedingungen (einschließlich Reaktionsablauf) auf die Umsetzung und auf die Zuverlässigkeit der Anzeige, sofern uns diese Effekte bekannt sind.

11 Filteratemschutz

Falls Filteratemschutz erforderlich und zulässig, dann Filter mit dem Kennbuchstaben A verwenden.

3 Range of measurement (20°C, 1013 mbar, corresponding to 20°C, 760 mm Hg)

With n = 5 strokes	10 to 400 ppm (mL/m³) o-xylene
1 ppm (mL/m³) o-xylene	≙ 4.44 mg/m³ } 20°C, 1013 mbar
1 mg o-xylene/m³	≙ 0.23 ppm }

4 Test and evaluation of the result

4.1 Before each series of measurements, check the pump for leaks using an unopened DRÄ Tube.
4.2 Break off the tips of the DRAGER Tube.
4.3 Insert the DRAGER Tube tightly in the pump head. Arrow points towards the pump.
4.4 Suck the air sample through the DRAGER Tube with 5 pump strokes. o-xylene turns the indicating layer reddish brown. The total length of the discoloration is a measure of the o-xylene concentration.
Numerical values = ppm (mL/m³) o-xylene.

5 Remarks

The DRAGER Tube cannot be used again even after a negative test result. The discoloration for a few days if the Tube is sealed with rubber caps.

6 Influence of ambient conditions on the result of measurement

6.1 Temperature
The DRAGER Tubes can be used within a temperature range of from 0 to 40°C.
6.2 Humidity
Between 3 and 15 mg H_2O per litre, humidity has no influence on the indication.
6.3 Atmospheric pressure
For pressure correction, multiply the Tube reading by the following conversion factor:

$$\text{Conversion factor} = \frac{1013}{\text{actual atmospheric pressure (in mbar)}}$$

7 Specificity (cross-sensitivity)

The o-xylene indication is based on the colour reaction with formaldehyde and sulphuric acid. m-xylene and p-xylene are indicated with about the same sensitivity as o-xylene.
In addition to o-xylene, other organic compounds are indicated. Some examples of the sensitivity indication are:
100 ppm monostyrene give a reddish brown indication of app. 40
100 ppm toluene give a dark brown indication of app. 200
200 ppm ethyl benzene give a brown indication of app. 350
1,000 ppm butadiene give a brown indication of app. 100.
No interference with the indication by, for example:
200 ppm methanol, 500 ppm n-octane, 400 ppm ethyl acetate.

8 Shelf life

For expiry date and storage temperature, see data on package strip.

9 Important properties of o-xylene

Threshold limit value (USA 1984):	100 ppm (435 mg/m³)
Chemical formula:	C_6H_4 $(CH_3)_2$
Lower ignition limit:	1.0 vol.%
Upper ignition limit:	7.6 vol.%
Ignition temperature:	465°C
Vapour pressure:	6.7 mbar (20°C)
Volatility:	29 mg/L (20°C)
Flash point:	30°C
Molecular weight:	106.17
Density:	0.88 g/cm³
Melting point:	−25°C
Boiling point:	144°C

10 Information

At the request of the Tube user, we will supply the following information:
a) The methods used for calibration of the detector tubes.
b) The effects (including reactions) on the operation and accuracy of the gas detector tube caused by specific environmental conditions described by the user, if these effects are known to us.

11 Filter respiratory protection

Should filter protection be necessary and acceptable, use filters with the code letter A.

In all inquiries please state the batch number stamped on the outside of the box.