HAGEMAN-SCHANK, INC.

2723 Crow Canyon Rd., Suite 210
San Ramon, CA 94583
(415) 837-2926

89 NOV 20 AM 8:23

November 16, 1989

PROPOSAL
FOR
SUBSURFACE INVESTIGATION

BUERHER, INC.
1061 EASTSHORE HIGHWAY, BERKELEY, CA

I. INTRODUCTION

The proposed scope of work involves the installation of three groundwater monitoring wells as the result of subsurface contamination found at the time two (2) underground storage tanks were removed from this site.

The site location is 1061 Eastshore Highway, Berkeley, CA, and has been occupied by the current owners for a number of years. In addition to maintaining a warehouse and providing parts for material handling equipment (such as forklifts), mechanical repair shops are present on-site. In conjunction with the equipment repairing, the site has historically operated three underground storage tanks.

On February 18, 1988, a 300 gallon underground waste oil tank and a 1,000 gallon underground gasoline tank were removed. The tank removals were conducted by Willis Brothers Excavating, Pacheco, CA, and Ivan Vegvary, P.E., Lafayette, CA. It is assumed that the tank removal and/or closure was done under permit from the Alameda County Environmental Health Department. A copy of the sampling report for the previous tank removals is included as Attachment A. More detailed information regarding the tank removals will be collected and will be included in the report that is to be submitted to the Alameda County Health Department following the collection of the information proposed and approved in this workplan.

II. SITE DESCRIPTION

Vicinity Description and Hydrogeologic Setting

The location of the site is shown on the vicinity map (Figure 1). The soils beneath the site consist of Quaternary Alluvium overlying Franciscan sandstone and siltstone bedrock (Geologic Map of California, San Francisco Sheet, State of California Division of Mines and Geology, 1980). Bedrock is likely to occur at a depth of twenty or more feet beneath the site. During the borings for the well installations, varying amounts of clay, sand, gravel, and non-native fill can be expected to be encountered.

Based upon the surface topography, as well as the various hydrologic features shown on the vicinity map, the general regional shallow groundwater can be expected to flow from the Berkeley Hills and San Pablo Ridge (area of groundwater recharge) and move westward toward Cordonices Creek and San Francisco Bay (area of discharge). Although the placement of the proposed monitoring wells are based upon this assumption of groundwater flow direction, water level data from the three wells will determine the exact flow direction of the shallow groundwater beneath the site.

Site Description

A map of the site is shown in Figure 2. This map shows the layout of the facility, along with the location of the previous tank excavations and removals. To date, one single-wall fiberglass underground tank remains in service at the facility, and is currently used to store gasoline. The location of the tank is shown on the site map.

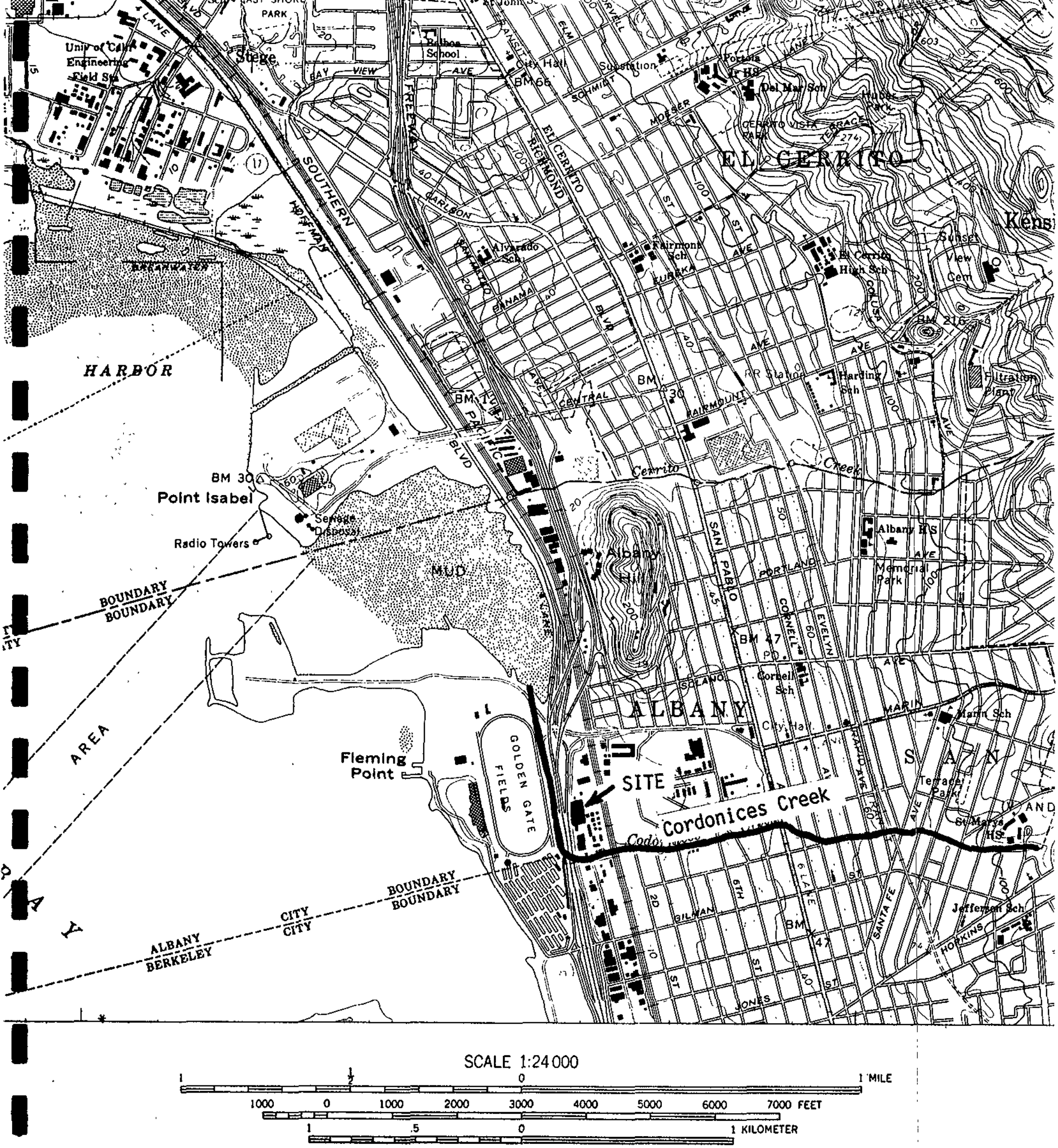


FIGURE 1.
Vicinity Map.

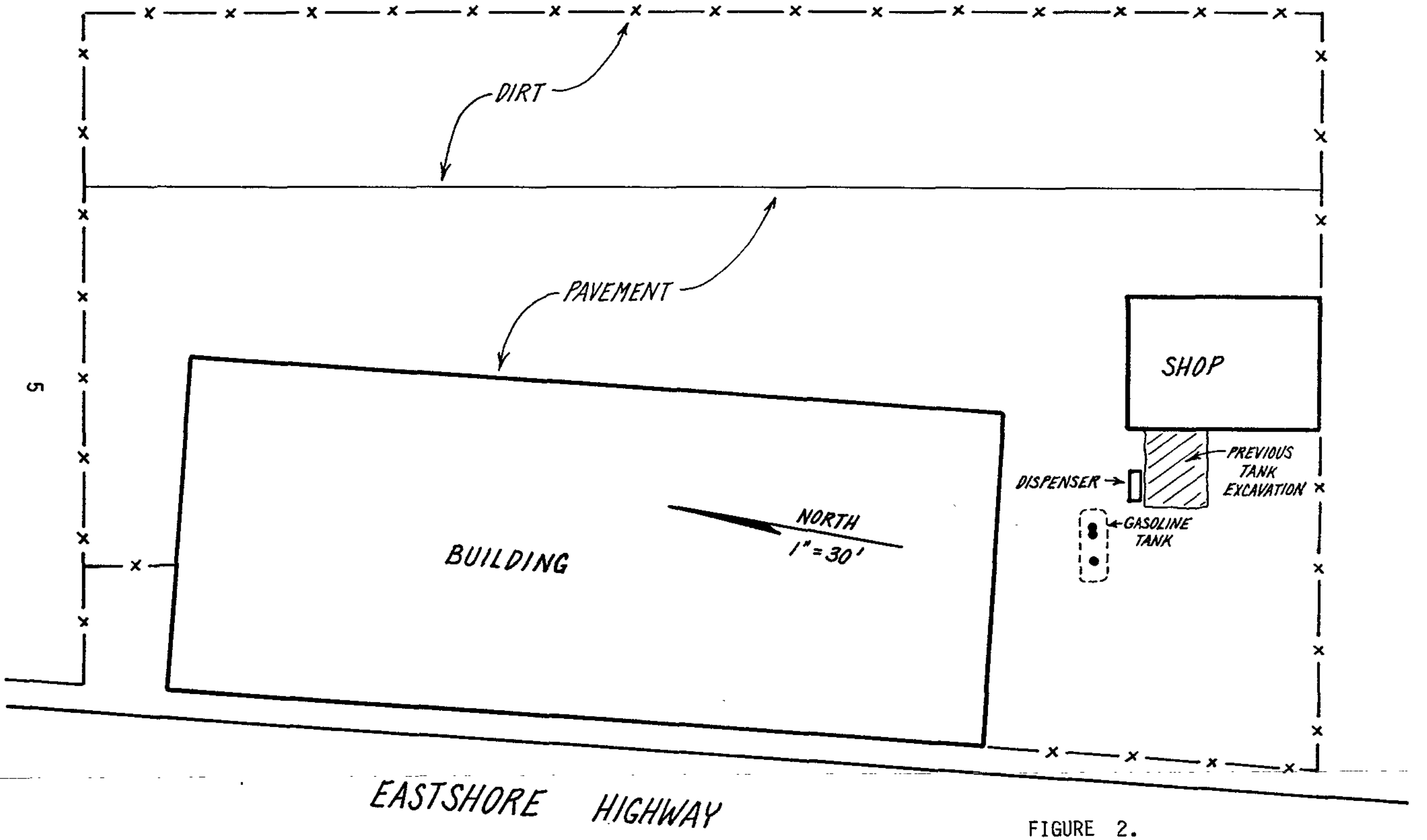


FIGURE 2.

SITE MAP

III. EXTENT OF SOIL CONTAMINATION ON SITE

Since the previous tank removals were conducted by others, little is known as to the magnitude, if any, of soil contamination that was encountered during the excavation. From inspection of the sampling results included in Attachment A, it would appear that high groundwater was encountered during the tank removals (pit water samples were collected in lieu of soil sampling).

The results of the analyses performed on water samples collected from the excavation indicated the presence of Oil and Grease in the pit water at levels up to 17 mg/L, Total Petroleum Hydrocarbons as Gasoline up to 2 mg/L, and Benzene up to 0.180 mg/L.

In addition to petroleum hydrocarbons, the following halogenated organics were detected in the parts-per-billion range:

trans-1,2-Dichloroethylene (6.5 ppb)
Dichloromethane (10 ppb)
1,1,2,2,-Tetrachlorothane (3.4 ppb)
1,1,1,-Trichloroethane (28 ppb)
1,1-Dichloroethane (18 ppb)

The plan for determining groundwater contamination, as discussed in Section IV of this proposal, provides for the analysis of all soil and groundwater samples for volatile organics according to EPA method 624/8240. An attempt will be made to determine the concentrations and extent of these halogenated organic compounds, as well as any other non-petroleum volatile hydrocarbons that may be present in the soil and shallow groundwater beneath the site.

IV. PLAN FOR DETERMINING GROUNDWATER CONTAMINATION

Placement of Monitoring Wells

The purpose of the proposed groundwater investigation is to install and sample three on-site monitoring wells in order to 1) determine the direction of shallow groundwater flow beneath the site, and 2) define the extent of any petroleum constituents that may be present in the shallow groundwater beneath the site.

The proposed locations of the wells are shown in Figure 3. The locations have been selected based upon 1) known locations of soil contamination during previous tank removals, 2) the expected shallow groundwater flow direction, and 3) what is believed to be good spacing between data points in order to achieve reasonable plume definitions of any contaminants that may be present in the shallow groundwater beneath the site.

Monitoring Well Installations

Well installation will begin as soon as possible, following approval by the appropriate regulatory agencies. Each well will be installed with a truck-mounted drill rig using 8-inch hollow-stem augers. During the drilling, soil samples for chemical analyses will be collected at 5-foot intervals until the shallow water table is encountered at a depth of approximately 5 to 10 feet below the ground surface. Each soil sample ~~will be collected by driving~~ a split-barrel sampler fitted with clean brass liners. All samples wll be immediately placed on ice, then transported under chain-of-custody to the laboratory by the end of the work day.

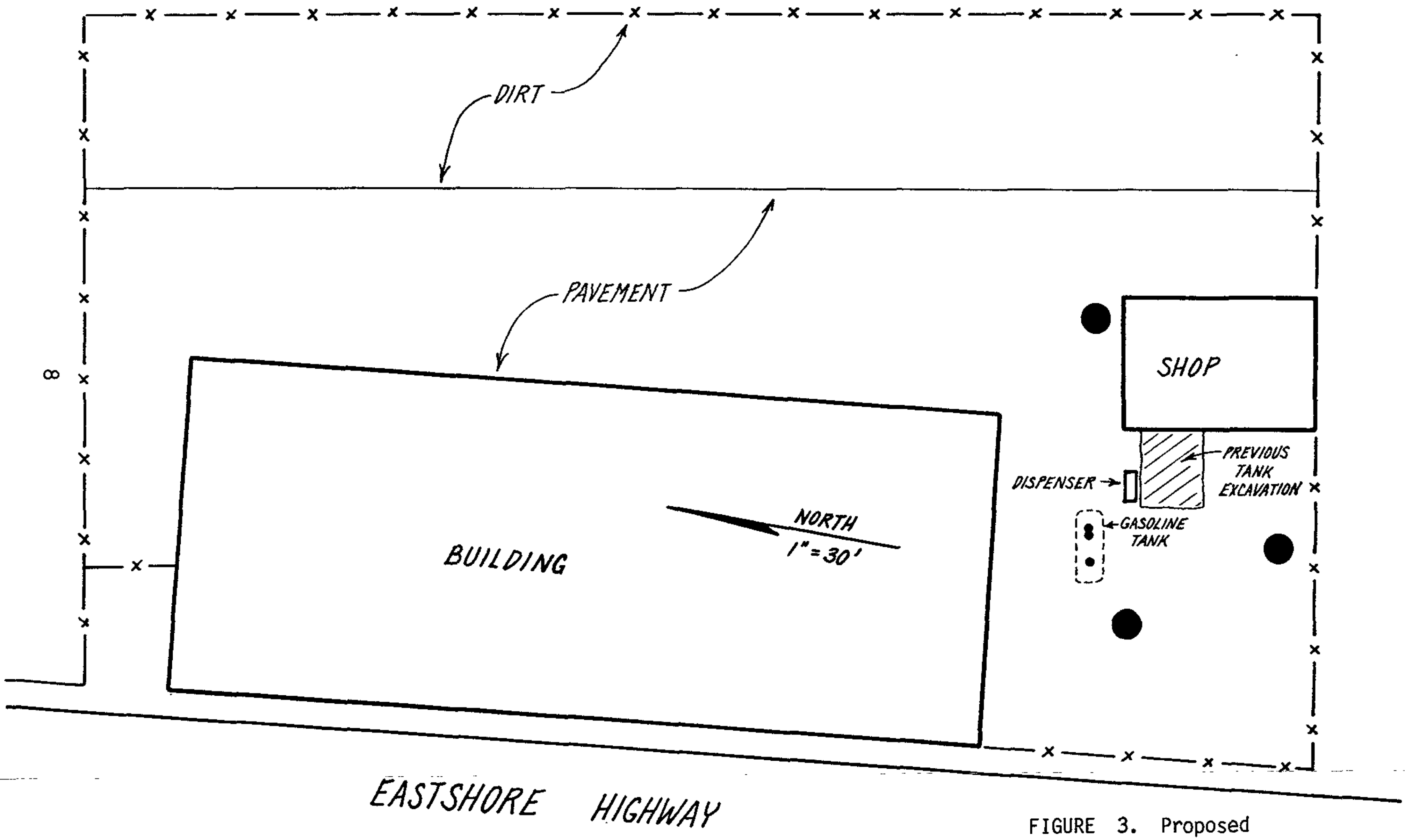


FIGURE 3. Proposed Locations of Monitoring Wells.

The well borings will extend to approximately 10 feet below the shallow water table or until a competent clay layer is encountered (a thickness greater than 5 feet). Each well will be cased to approximately five feet above the shallow water table with 2-inch PVC slotted screen pipe (0.02" slots). The annular space of each well will be packed to one foot above the slotted section with #3 Monterey Sand. At least one foot of wetted bentonite pellets will be placed upon the sand pack, followed by a neat cement/bentonite seal up to the ground surface. Each well will be fitted with a locking steel traffic lid. The borings will be logged in the field by Gary Aguiar, registered civil engineer #34262 (a statement of qualifications is included as Attachment B). A typical well construction diagram is shown in Figure 4.

Prior to the installation of each well, all drilling equipmenmt, including augers, drill stem, and split barrel samplers, will be steam-cleaned on-site.

All drill cuttings will be drummed and stored on-site until the results of laboratory anaylses are obtained. Depending upon these results, the cuttings will be disposed of as either a non-hazardous waste, or else as a hazardous waste under proper manifest to an appropriate TSD facility.

In order to determine groundwater flow direction, the top-of-casing elevation at each monitoring well will be surveyed to within 0.01 foot of an established on-site benchmark.

Groundwater Sampling Plan

Within three days of installation, each well will be developed by removing water with a teflon bailer until the water is relatively clear, or until the aparent turbidity of the water being removed has stabilized.

Prior to sampling, each well will be purged by bailing at least 5 casing

TYPICAL MONITORING WELL CONSTRUCTION

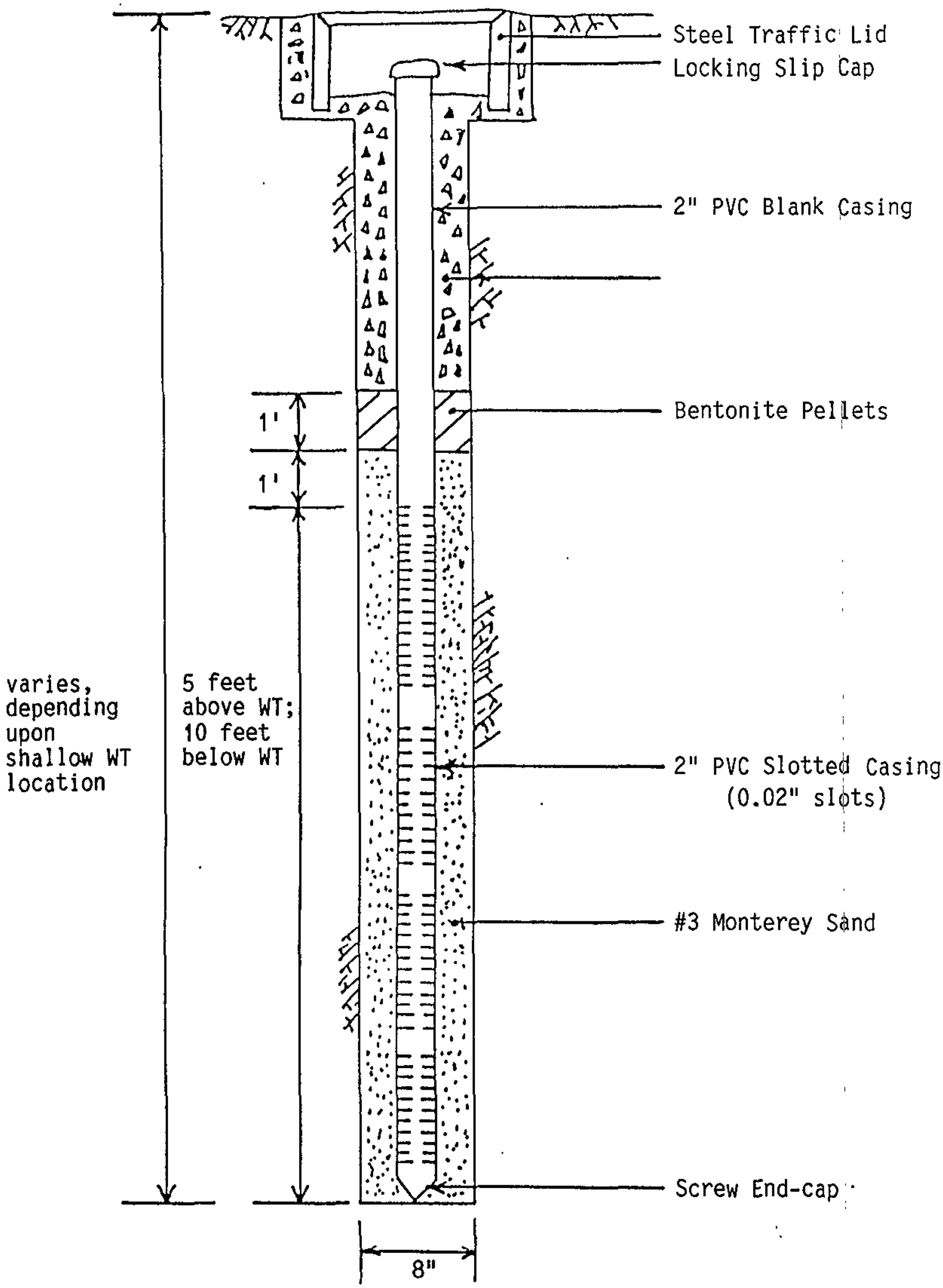


FIGURE 4.

Typical Monitoring Well Construction.

volumes of water. After a well has been adequately purged, a groundwater sample will be bailed and placed in the appropriate containers, as required by the particular laboratory method protocols. All samples will then be immediately placed on ice, then transported under chain-of-custody to the laboratory by the end of each work day.

At the time each monitoring well is sampled, the following information will be recorded in the field: 1) depth-to-water prior to purging, using an electrical well sounding tape, 2) identification of any floating product, sheen, or odor prior to purging, using a clear teflon bailer, 3) sample pH, 4) sample temperature, and 5) specific conductance of the sample.

All analyses will be conducted by a California State DOHS certified laboratory in accordance with EPA recommended procedures. All soil and groundwater samples will be analyzed for 1) total petroleum hydrocarbons as gasoline, 2) BTX, 3) oil & grease, and 4) volatile organics scan (EPA 624/8240).

All water removed from the well during development and purging will be drummed and stored on-site until the results of laboratory anaylses are obtained. Depending upon these results, the water will be sewered as a non-hazardous liquid waste, or else it will be transported as a hazardous liquid waste under proper manifest to an appropriate TSD facility for treatment and disposal.

V. SITE SAFETY PLAN

A set of health and safety operating procedures for field investigations of underground spills of motor oil and petroleum distillate fuel is provided in Attachment C. In order to maintain a safe working environment for field personnel, a copy of these operating procedures will be kept on-site during the field operations, and will be followed in accordance with the magnitude of petroleum contamination encountered.

REGISTERED PROFESSIONAL ENGINEER
GARY H. AGUIAR
No. C-34262
CIVIL
STATE OF CALIFORNIA

Gary Aguiar RCE 34262

Bruce Hageman

ATTACHMENT A

Previous Tank Removal Report

IVAN VEGVARY, P.E., L.S.

Municipal Engineering • Environmental Cleanup

40 Terra Teresa
Lafayette, California 94549
(415) 947-1051

March 24, 1988

re: Tank removal, Buerher, Inc., Material Handling Equipment
1061 Eastshore Highway, Berkeley, CA 94710
(Our job number 88006)

Willis Brothers Excavating
321 1st Avenue, South
Pacheco, CA 94553

Dear Mr. Willis,

Attached are the following reports relative to the contamination monitoring of the above mentioned tank removals.

1. Plot plan of sampling locations

2. Summary table of analytical results

3. Laboratory raw data

4. Chain of Custody Record

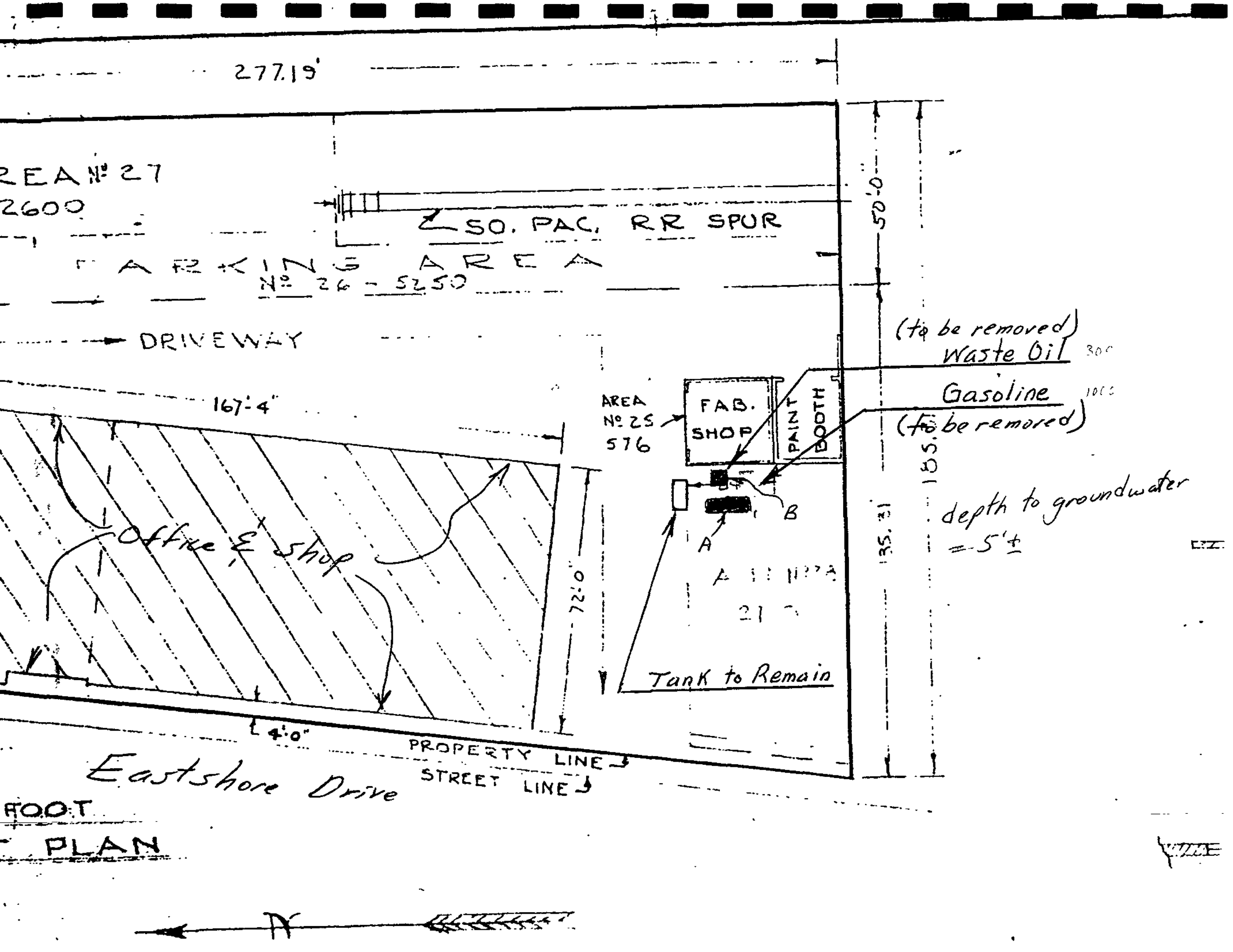
5. My billing for the above services.

If we can be of further service, or if you have any questions, please don't hesitate to call me.

Respectfully submitted,

Ivan Vegvary

Civil Engineer
R.C.E. 18546



277.19'
REA № 27
2600
SO. PAC. RR SPUR
PARKING AREA
№ 26 - 5250
DRIVEWAY
167'-4"
AREA
№ 25
576
FAB. SHOP
PAINT BOOTH
(to be removed)
Waste Oil
Gasoline
(to be removed)
A
B
depth to groundwater
= 5'±
Office & shop
72'-0"
Tank to Remain
50'-0"
185.31
4'-0"
PROPERTY LINE
STREET LINE
Eastshore Drive
FOOT
PLAN

IVAN VEGVARY, P.E., L.S.

Municipal Engineering • Environmental Cleanup

40 Terra Teresa
Lafayette, California 94549
(415) 947-1051

SUMMARY OF LABORATORY REPORT

<u>BEUHRER MATERIAL HANDLING</u>

OUR TEST NUMBER	TEST ON PLAT	TOTAL PETROLEUM HYDROCARBONS GASOLINE	KEROSINE	DIESEL	OIL & GREASE
A	A	(2,000 ug/l EPA 8015, Modified)			
		EPA Method	8020, Modified		
		Benzene	180 ug/l		
		Toluene	23 ug/l		
		xylenes	279 ug/l		
B	B				17,000ug/kg

Pollution conditions indicated by tests (2 parts per million and 17 parts per million) are acceptable and the host materials can stay in place.

EPA Method 8020 detected the following, all in ug/l:

Benzene 100
Toluene 9.9
Xylenes 240

EPA Method 8010 detected the following, all in ug/l:

1,1-Dichloroethane 18
Dichloromethane 10
1,1,2,2-Tetrachloroethane 3.4
Dichloromethane 10
trans-1,2-Dichloroethylene 6.5
1,1,1-Trichloroethane 28

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8 • Ha, ard, California 94545 *(415) 783-6960*

TAL

DATE: 3/14/88

LOG NO.: 5686

DATE SAMPLED: 2/18/88

DATE RECEIVED: 2/18/88

CUSTOMER: Ivan Vegvary

PROJECT: No. 88006, 1061 Eastshore-Albany

Method and Constituent	Units	Sample Type: Water B, 1' Under Tank Concentration	Detection Limit
Standard Method 503E, Hydrocarbons:			
Oil and Grease	ug/l	17,000	1,000
EPA Method 8020:			
Benzene	ug/l	100	3
Chlorobenzene	ug/l	< 5	5
1,2-Dichlorobenzene	ug/l	< 9	9
1,3-Dichlorobenzene	ug/l	< 7	7
1,4-Dichlorobenzene	ug/l	< 7	7
Ethyl benzene	ug/l	< 6	6
Toluene	ug/l	9.9	5
Xylenes	ug/l	240	9

DATE: 3 ‥4/88
LOG NO.: 5‥6
DATE SAMPLED: 2/18/88
DATE RECEIVED: 2/18/88
PAGE: Four

Sample Type: Water

Method and Constituent	Units	A, 1' Under Tank Concentration	Detection Limit
Modified EPA Method 8015:			
Volatile Hydrocarbons	ug/l	2,000	20
Modified EPA Method 8020:			
Benzene	ug/l	180	7
Toluene	ug/l	23	10
Xylenes	ug/l	270	20

Hugh R. McLean
Hugh R. McLean
Supervisory Chemist

HRM:mln

Sample Type: Water

Method and Constituent	Units	B, 1' Under Tank Concentration	B, 1' Under Tank Detection Limit
EPA Method 8010 (Continued):			
1,1-Dichloroethylene	ug/l	< 0.5	0.5
trans-1,2-Dichloroethylene	ug/l	6.5	0.5
Dichloromethane	ug/l	10	0.5
1,2-Dichloropropane	ug/l	< 0.5	0.5
1,3-Dichloropropylene	ug/l	< 0.5	0.5
1,1,2,2-Tetrachloroethane	ug/l	3.4	0.5
1,1,1,2-Tetrachloroethane	ug/l	< 0.5	0.5
Tetrachloroethylene	ug/l	< 0.5	0.5
1,1,1-Trichloroethane	ug/l	28	0.5
1,1,2-Trichloroethane	ug/l	< 0.5	0.5
Trichloroethylene	ug/l	< 0.5	0.5
Trichlorofluoromethane	ug/l	< 0.5	0.5
Trichloropropane	ug/l	< 0.5	0.5
Vinyl chloride	ug/l	< 0.5	0.5

DATE:	3/14/88
LOG NO.:	5
DATE SAMPLED:	2/18/88
DATE RECEIVED:	2/18/88
PAGE:	Two

Sample Type: Water

Method and Constituent	Units	B, 1' Under Tank Concentration	B, 1' Under Tank Detection Limit
EPA Method 8010:			
Benzyl chloride	ug/l	< 0.5	0.5
Bis (2-chloroethoxy) methane	ug/l	< 0.5	0.5
Bis (2-chloroisopropyl) ether	ug/l	< 0.5	0.5
Bromobenzene	ug/l	< 0.5	0.5
Bromodichloromethane	ug/l	< 0.5	0.5
Bromoform	ug/l	< 0.5	0.5
Bromomethane	ug/l	< 0.5	0.5
Carbon tetrachloride	ug/l	< 0.5	0.5
Chloracetaldehyde	ug/l	< 0.5	0.5
Chloral	ug/l	< 0.5	0.5
Chlorobenzene	ug/l	< 0.5	0.5
Chloroethane	ug/l	< 0.5	0.5
Chloroform	ug/l	< 0.5	0.5
1-Chlorohexane	ug/l	< 0.5	0.5
2-Chloroethyl vinyl ether	ug/l	< 0.5	0.5
Chloromethane	ug/l	< 0.5	0.5
Chloromethyl methyl ether	ug/l	< 0.5	0.5
Chlorotoluene	ug/l	< 0.5	0.5
Dibromochloromethane	ug/l	< 0.5	0.5
Dibromomethane	ug/l	< 0.5	0.5
1,2-Dichlorobenzene	ug/l	< 0.5	0.5
1,3-Dichlorobenzene	ug/l	< 0.5	0.5
1,4-Dichlorobenzene	ug/l	< 0.5	0.5
Dichlorodifluoromethane	ug/l	< 0.5	0.5
1,1-Dichloroethane	ug/l	18	0.5
1,2-Dichloroethane	ug/l	< 0.5	0.5

Trace Analysis Laboratory, Inc.
3423 Investment Boulevard, #8, • Ha···ard, California 94545 *(415) 783-6960*

TAL

DATE March 14, 1988

INVOICE

5888

REQUESTOR

SOLD TO Ivan Vegvary
40 Terra Teresa
Lafayette, CA 94549

OUR LOG NO.		YOUR P.O.NO.	PROJECT	CODE
5686			No. 88006, 1061 Eastshore-Albany	T/W

QUANTITY	SAMPLE TYPE	DESCRIPTION	TURNAROUND TIME	UNIT PRICE	AMOUNT
1	Water	TVH/BTX analysis	10 day	85.00	$ 85.00
1	Water	8010, 8020, O & G 503E analysis	10 day	270.00	270.00
		TOTAL			$355.00
		TERMS NET 30 DAYS			

CHAIN OF CUSTODY RECORD

PROJ. NO.

SITE NAME & ADDRESS
1001 Eastshore - Albany

SAMPLERS: *(Signature)*

ID NO.	DATE	TIME	SOIL	WATER	SAMPLING LOCATION	TYPE(1) OF CONTAINER	Total Petroleum HC	Aromatic HC (BTX)	VOC - EPA 8240	Oil & Grease	Tetraethyl Lead		REMARKS
A	[illegible]	[illegible]		X	1' Under Tank	[illegible]	X	X					
B	"	"		X	" " "	"			X	X			

ANALYSES REQUESTED (2)

(1) Brass tubes (soil), or VOA vial water, per RWQCB Guidelines.

(2) Per RWQCB Guidelines

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
[signature]	7/18/88 4:55				
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks	
		[signature]	7/18/88 5:00 pm		

ATTACHMENT B

Statement of Qualifications

STATEMENT OF QUALIFICATIONS

Gary Aguiar:

- B.S., Chemical Engineering, University of California, Berkeley, 1977
  M.S., Sanitary Engineering, University of California, Berkeley, 1981

- Registered Civil Engineer, California, C.E. 34262
  Registered Civil Engineer, Oregon, C.E. 13353
  Registered Civil Engineer, Alaska, C.E. 7769

- Over the past ten years, has participated in all aspects of hydrogeological investigations, groundwater pollution investigations, water resource studies, and hazardous waste management.

- His extensive teaching experience includes the following:

  1/82 - present — UNIVERSITY OF CALIFORNIA EXTENSION, Berkeley, Ca.
  Instructor: Develop and teach courses on the principles of groundwater hydrology, groundwater pollution, and hazardous waste management.

Advisory Committe member: Member of advisory committee for U.C. Berkeley Hazardous Materials Management Certificate Program.

CALIFORNIA STATE UNIVERSITY
9/83 - 12/83 CONSORTIUM, Hayward, Ca.
Assistant Professor: Developed and taught a course on the engineering aspects of environmental planning.

RESOURCE SEMINARS,
1/81 - 9/83 Berkeley, Ca.
Lecturer: Lectured on the principles of groundwater hydrology at seminars given in various U.S. cities.

o Other Qualifications:

Water Treatment Plant Operator Grade III Certificate, California State Department of Health.

Basic Qualified Earth Shorer Certificate, American Society of Safety Engineers.

Radiation Safety / Nuclear Soils Gauge Operator Certificate, Campbell Pacific Nuclear Corp.

o Professional Affiliations:

Member, American Chemical Society
Member, American Water Works Association
Member, National Water Well Association

Gary Aguiar began a private consulting practice in 1984. The first project was the installation of three deep monitoring wells within the drinking water aquifer beneath McKesson Chemical Company's Union City chemical packaging facility. This project involved casing a highly contaminated upper zone prior to drilling through the Newark aquitard. After supervising the drilling operations, properly disposing of the drilling spoils, and sampling the wells, a detailed report was prepared that presented an analysis of the data, as well as an assessment of the impact that shallow groundwater contamination has had upon the quality of the drinking water in the area.

To date, Gary Aguiar has provided services for a total of fifteen clients. Typical work has included:

- Assessment of local hydrogeology around solvent recycling sites located in Denver, Co. and Azusa, Ca., prior to purchase by a national chemical recycler.

- Consultation to a local geologic firm concerning the design of a dewatering and contaminant removal system in tight clays at an electronics factory site located in Santa Clara County.

- Design of a pump test to determine aquifer characteristics prior to design of an extraction system for the removal of gasoline from an underground tank site in Morgan Hill, Ca.

- Hydrogeologic analysis and design of a recovery system for the remediation of gasoline contamination that threatened a drinking water supply in Woodside, Ca.

- Data analysis and professional representation in negotiations with the Regional Water Quality Control Board for a commercial property owner in Santa Clara County. Solvent contamination had been discovered beneath the site.

o In association with a local hydrogeologic consulting firm, a site assessment of a laser manufacturing plant in Palo Alto, Ca. is currently in progress. This project involved assessing the local hydrogeology, sampling surface and groudwaters, formulating a risk assessment in terms of contaminants that may enter the groundwater due to factory processes, and removing hazardous wastes that have been left from past operations.

o Consultation to a local geologic firm concerning the results of soil and groundwater sampling at a large oil refinery in Hanford, Ca. This project has involved assessing the local hydrogeology, relating the presence of subsurface contaminants to specific above-ground refinery processes, and recommending specific chemical analyses to be performed. An assessment of the impact of subsurface contamination was made in terms of the potential for deep migration. In addition, an assessment of the legal impact was made in terms of applicable hazardous waste laws (Title 22 and 40CFR).

o Analysis of hydrogeologic/groundwater quality data for a chemical facility in Freeport, Grand Bahama Island. This project currently involves an assessment of potential contaminant migration, as well as remedial action plan development. The assessment is complicated by karst geology, a strong tidal influence and the occurence of groundwater in a freshwater lens.

o Project management of a soil and groundwater study in and around the chrome plating shop at Mare Island Naval Base, Vallejo, CA. This project has included the installation of a number of monitoring wells, collection of soil samples, and determining the in[illegible] nearby tidal action. The study is complicated [illegible] a significant tidal influence, the [illegible] confined gravel lenses, and the h[illegible] areas.

- Analysis of hydrogeologic/groundwater quality data for production facilities in Clarecastle, Ireland, and in Cuernavaca, Mexico. The work is part of an in-house program of environmental auditing and regulatory compliance being conducted by a large pharmaceuticals company at all of their facilities.

By providing education for the professional community, Gary Aguiar has maintained close contact with the University of California. Through this contact, experts in particular fields can be easily networked, while maintaining low operating overhead costs. In addition, the latest technologies in sampling and contamination remediation are continually evaluated and made available to the client.

DEPARTMENT OF CONSUMER AFFAIRS

BOARD OF REGISTRATION FOR
PROFESSIONAL ENGINEERS
AND LAND SURVEYORS

CIVIL ENGINEER
LICENSE NO. C 034262
AGUIAR GARY HENRY
280 HOWLAND ST #308
REDWOOD CITY CA 94063

Expiration Date

REFERENCE #
N 097297

09/30/91

ATTACHMENT C

Site Safety Plan

HEALTH AND SAFETY PROCEDURES
FOR
FIELD INVESTIGATION OF UNDERGROUND SPILLS OF MOTOR OIL AND PETROLEUM DISTILLATE FUEL

1.0 PURPOSE

This operating procedure established minimum procedures for protecting personnel against the hazardous properties of motor oil and petroleum distillate fuels during the performance of field investigations of known and suspected underground releases of such materials. The procedure was developed to enable health and safety personnel and project managers to quickly prepare and issue site safety plans for investigations of such releases.

2.0 APPLICABILITY

This procedure is applicable to field investigations of underground releases of the substances listed below and involving one or more of the activities listed below.

Substances

- Motor oil (used and unused)
- Leaded and unleaded gasoline
- No. 1 Fuel oil (kerosene, JP-1)
- No. 1-D Fuel oil (light diesel)
- No. 2 Fuel oil (home heating oil)
- No. 2-D Fuel oil (medium diesel)
- No. 4 Fuel oil (residual fuel oil)
- No. 5 Fuel oil (residual fuel oil)
- No. 6 Fuel oil (Bunker C fuel oil)
- JP-3, 4 & 5 (jet fuels)
- Gasahol

Activities

Collection of samples of subsurface soil with aid of truck-mounted drill rig, hand-held power auger or hand auger.

Construction, completion and testing of groundwater monitoring wells.

Collection of groundwater samples from new and existing wells.

Observing removal of underground fuel pipes and storage tanks.

This procedure must not be used for confined space entry (including trench entry) or for installing or operating pilot and full-scale fuel recovery systems.

No safety plans needed for non-intrusive geophysical surveys, reconnaissance surveys and collection of surface soil, surface water and biota.

3.0 RESPONSIBILITY AND AUTHORITY

Personnel responsible for project safety are the Business Unit Health and Safety Officer (HSO), the Project Manager (PM) and the Site Safety Officer (SSO).

The HSO is responsible for reviewing and approving site safety plans and any addenda and for advising both PM and SSO on health and safety matters. The HSO has the authority to audit compliance with the provisions of site safety plans. suspend work or modify work practices for safety reasons, and to dismiss from the site any individual whose conduct on site endangers the health and safety of others.

The PM is responsible for having site safety plans prepared and distributing them to all field personnel and to an authorized representative of each firm contracted to assist with on-site work. The PM is also responsible for ensuring that the provisions of safety plans and their addenda are carried out.

The SSO is responsible for assisting the PM with on site implementation of site safety plans. Responsibilities include:

1. Maintaining safety equipment supplies.

2. Performing or supervising air quality measurements.

3. Directing decontamination operations and emergency response operations.

4. Setting up work zone markers and signs if such zones are specified in the site safety plan.

5. Reporting all accidents, incidents and infractions of safety rules and requirements.

6. Directing other personnel to wear protective equipment when use conditions described in Section 5.0 are met.

The SSO may suspend work anytime he/she determines that the provisions of the site safety plan are inadequate to ensure worker safety and inform the PM and HSO of individuals who on-site behavior jeopardizes their health and safety or the health and safety of others.

4.0 HAZARD EVALUATION

Motor oil and petroleum distillate fuels are mixtures of aliphatic and aromatic hydrocarbons. The predominant classes of compounds in motor oil, gasoline, kerosene and jet fuels are the paraffins (e.g., benzene, toluene). Gasoline contains about 80 percent paraffins, 6 percent naphthenes, and 14 percent aromatic. Kerosene and jet fuels contain 42-48 percent paraffins, 36-38 percent naphthenes, and 16-20 percent aromatic. Diesel fuels and heating oils contain less than 10 percent paraffins, 14-23 percent naphthenes, and 68-78 percent non-volatile aromatic. These heavier fuels contain almost no volatile aromatic compounds. Chemicals are usually added to automotive and aviation fuels to improve their burning properties. Examples are tetraethyl-lead and ethylene dibromide. Most additives are proprietary materials.

Flammability

Crude oil and petroleum distillate fuels possess two intrinsic hazardous properties, namely, flammability and toxicity. The flammable property of the oil and fuels presents a far greater hazard to field personnel than toxicity because it is difficult to protect against and can result in catastrophic consequences. Being flammable, the vapors of volatile components of crude oil and the fuels can be explosive when confined.

The lower flammable or explosive limits (LFL or LEL) of the fuels listed in SEction 508.2 range from 0.6 percent for JP-5 to 1.4 percent for gasolines. LFL and LEL are synonyms. Flash points range from -36°F for gasoline to greater than 150°F for No. 6 fuel oil. JP-5 has a flash point of 140°F. Although it has a lower LEL than gasoline, it can be considered less hazardous because its vapors must be heated to a higher temperature to ignite.

Crude oil and petroleum distillate fuels will not burn in the liquid form; only the vapors will burn and only if the vapor concentration is between the upper and lower flammable limits, sufficient oxygen is present, and an ignition source is present. If these conditions occur in a confined area an explosion may result.

The probability of fire and explosion can be minimized by eliminating any one of the three factors needed to produce combustion. Two of the factors -- ignition source and vapor concentration -- can be controlled in many cases. Ignition can be controlled by prohibiting open fires and smoking on site, installing spark arrestors on drill rig engines, and turning the engines off when LELs are approached. Vapor concentrations can be reduced by using fans. In fuel tanks, vapor concentrations in the head space can be reduced by introducing dry ice (solid carbon dioxide) into the tank; the carbon dioxide gas will displace the combustible vapors.

Toxicity

Crude oil and petroleum distillate fuels exhibit relatively low acute inhalation and dermal toxicity. Concentrations of 160 to 270 ppm gasoline vapor have been reported to cause eye, nose and throat irritation after several hours of exposure. Levels of 500 to 900 ppm can cause irritation and dizziness in one hour, and 2000 ppm produces mile anesthesia in 30 minutes. Headaches have been reported with exposure to 25 ppm or more of gasoline vapors measured with a photoionization meter. Most fuels, particularly gasoline, kerosene and jet fuels are capable of causing skin irritation after several hours contact with the skin.

Petroleum fuels exhibit moderate oral toxicity. The lethal dose of gasoline in children has been reported to be as low as 10-15 grams (2-3 teaspoons). In adults, ingestion of 20-50 grams of gasoline may produce severe symptoms of poisoning. If liquid fuel aspirated (passed in to the lungs) gasoline and other petroleum distillate fuels may cause secondary pneumonia.

Some of the additives to gasoline, such as ethylene dichloride, ethylene dibromide, and tetraethyl and tetramethyl lead,are highly toxic; however, they are present in such low concentrations that their contribution to the overall toxicity of gasoline and other fuels is negligible in most instances.

OSHA has not developed permissible workplace exposure limits for crude oil and petroleum distillate fuels. It recommends using permissible exposure limits for individual components, such as benzene. ACGIH has established a permissible exposure limit of 300 ppm for gasoline. The limit took into consideration the average concentration of benzene in gasoline (one percent) as well as its common additives. Exposure limits established by other countries range from 250 to 500 ppm. Chemical data sheets, prepared for the U.S. Coast Guard's Chemical Hazard Information System (CHRIS), list 200 ppm as the permissible exposure limit for kerosene and jet fuels. This limit was not developed by NIOSH/OSHA or ACGIH.

5.0 HEALTH AND SAFETY DIRECTIVES

5.1 Site-Specific Safety Briefing

Before field work beings, all field personnel, including subcontractor employees, must be briefed on their work assignments and safety procedures contained in this document.

5.2 Personal Protective Equipment

The following equipment should be available on-site to each member of the field team:

- NIOSH-approved full or half-face respirator with organic vapor cartridges (color coded black)
- Saranex or polyethylene-coated Tyvek coveralls
- Splash-proof safety goggles
- Nitrile or neoprene gloves
- Neoprene or butyl boots, calf-length with steel toe and shank
- Hardhat

Equipment Usage

Chemical-resistant safety boots must be worn during the performance of work where surface soil is obviously contaminated with oil or fuel, when product quantities of oil or fuel are likely to be encountered, and within 10 feet of operating heavy equipment.

Respirators must be worn whenever total airborne hydrocarbons levels in the breathing zone of field personnel reach or exceed a 15-minute average of 25 ppm. If total airborne hydrocarbons in the breathing zone exceeds 100 ppm, work must be suspended, personnel directed to move a safe distance from the source, and the HSO or designee consulted.

Chemical resistant gloves must be worn whenever soil or water known or suspected of containing petroleum hydrocarbons is collected or otherwise handled.

Chemical resistant coveralls must be worn whenever product quantities of fuel are actually encountered and when oil or fuel-saturated soil is handled.

Safety goggles must be worn when working within 10 feet of any operating heavy equipment (e.g., drill rig, backhoe). Splash-proof goggles or face shields must be worn whenever product quantities of oil or fuel are encountered.

Hardhats must be worn when working within 10 feet of an operating drill rig, backhoe or other heavy equipment.

Operators of some facilities, such as refineries, often require all personnel working within facility boundaries to wear certain specified safety equipment. Such requirements shall be strictly observed

5.3 Vapor Monitoring

Required Equipment

--- Organic vapor meter with flame or photoionization detector
--- Combustible gas meter

Monitoring Requirements and Guidelines

Vapor monitoring shall be performed as often as necessary and whenever necessary to protect field personnel from hazardous vapors. Monitoring must be performed by individuals trained in the use and care of the monitoring equipment.

During drilling operations, vapor emissions from boreholes must be measured whenever the auger is removed from the boring and whenever flights are added or removed from hollow-stem augers. This requirement does not apply to borings less than five feet deep and borings of any depth made to install monitoring wells in uncontaminated soils. Measurements should be made initially with an organic vapor meter, followed with a combustible gas meter if vapor levels exceed the highest concentration measurable with the organic vapor meter.

Initially measurements shall be made about 12 inches from the bore hole, both upwind and downwind positions. If the total hydrocarbon concentrations exceed the respirator use action level (See Section 508.5.2), measurements must be made in the breathing zone of the individual(s) working closest to the borehole. Decisions regarding respiratory protection should be made using vapor concentrations in the breathing zone.

Organic vapor meters capable of being operated continuously without attention may be operated in that fashion if desired. However, the instrument must be equipped with an alarm set to sound when vapor concentrations reach 25 ppm and must be protected against physical damage and soilage.

If total organic vapor concentrations within 12 inches of the borehole exceed the capacity of the organic vapor meter, a combustible gas meter (CGM) must be used to determine if explosive conditions exist. Operations must be suspended, the drill rig motor shut down, and corrective action taken if combustible gas concentrations reach 40 percent of LEL within a 12-inch radius of the borehole or 10 percent of LEL at a distance greater than 24 inches from the borehole. This procedure must also be followed whenever the organic vapor meter goes offscale at its highest range and no CGM is available. If corrective action cannot be taken, field personnel and all other individuals in the vicinity of the borehole must be directed to move to a safe are and the local fire department and facility management must be alerted.

Organic vapor meters with flame ionization detectors (FID) are much more sensitive to paraffins, with the major component of gasoline, kerosene, and jet fuels, then are meters with 10.0 or 10.2 eV photoionization detectors. As the data in Table 1 show, an FID instrument, such as the Century Systems OVA (Foxboro Analytical), will detect 70-90 percent of actual paraffin concentrations, whereas PID instruments, such as the HNU Model PI-101, AID Model 580, and Photovac TIP with 10.0 to 10.2 eV lamp will detect only 17-25 percent of actual paraffin concentrations when calibrated with benzene and only 24-35 percent when calibrated with isobutylene. Both types of meters are equally sensitive to most aromatic, including benzene, toluene, xylene and ethylbenzene. For these compounds, meter readings equal or exceed 100 percent of actual concentrations. PIDs with 11.7 eV lamps are extremely sensitive to paraffins and aromatic. When calibrated to isobutylene, an 11.7 eV PID will register about twice actual paraffin concentrations and 100 percent or more of actual concentrations of benzene, toluene, and xylene.

An FID meter, recently calibrated with methane and in good working condition, can be expected to provide readings close enough to actual petroleum hydrocarbon concentrations to make corrections unnecessary. Value obtained with a PID must be corrected when measuring for paraffins. For 10.0 and 10.2 eV PIDs, the meter reading should be multiplied by 5 if the instrument is calibrated with benzene. If the instrument is calibrated with isobutylene, the meter readings should be multiplied by 3. If the instrument is equipped with an 11.7 eV probe and is calibrated with isobutylene, the meter reading should be divided by 2.

5.4 Area Control

Access to hazardous and potential hazardous areas of spill sites must be controlled to reduce the probability of occurrence of physical injury and chemical exposure of field personnel, visitors and the public. A hazardous or potentially hazardous area includes any area where

1. Field personnel are required to wear respirators.

2. Borings are being drilled with powered augers.

3. Excavating operations with heavy equipment are being performed.

The boundaries of hazardous and potentially hazardous areas must be identified by cordons, barricades, or emergency traffic cones or posts, depending on conditions. If such areas are left unattended, signs warning of the danger and forbidding entry must be placed around the perimeter if the areas are accessible to the public. Trenches and other large holes must be guarded with wooded or metal barricades spaced no further than 20 feet apart and connected with yellow or yellow and black nylon tape not less and 3/4-inches wide. The barricades must be placed no less than two feet from the edge of the excavation or hole.

Entry to hazardous areas shall be limited to individuals who must work in those areas. Unofficial visitors must not be permitted to enter hazardous areas while work in those areas is in progress. Official visitors should be discouraged from entering hazardous areas, but may be allowed to enter only if they agree to abide by the provisions of this document, follow orders issued by the site safety officer and are informed of the potential dangers that could be encountered in the areas.

5.5 Decontamination

Field decontamination of personnel and equipment is not required except when contamination is obvious (visually or by odor). Recommended decontamination procedures follow:

Personnel

Gasoline, kerosene, jet fuel, heating oil, gasahol and diesel oil should be removed from skin using a mild detergent and water. Hot water is more effective than cold. Liquid dishwashing detergent is more effective than hand soap. Motor oil and the heavier fuel oils (No. 4-6) can be removed with dishwashing detergent and hot ware also; however, if weathered to an asphaltic condition, mechanic's waterless hand cleaner is recommended for initial cleaning followed by detergent and water.

Equipment

Gloves, respirators, hardhats, boots and goggles should be cleaned as described under personnel; however, if boots do not become clean after washing with detergent and water, wash them with a strong solution of trisodium phosphate and hot water and, if this fails, clean them with diesel oil followed by detergent and water to remove diesel oil.

Sampling equipment, augers, vehicle undercarriages and tires should be steam cleaned. The steam cleaner is a convenient source of hot water for personnel and protective equipment cleaning.

5.6 Smoking

Smoking and open flames are strictly prohibited at sites under investigation.

TABLE 1
RELATIVE SENSITIVITIES OF FID AND PID INSTRUMENTS TO SELECTED COMPONENTS OF OILS AND PETROLEUM DISTILLATE FUELS

Component	Sensitivity in Percent of Standard		
	FID	PID	
		10.2 eV[a]	11.7 eV[b]
Paraffins			
Pentane	65	--	141
Hexane	70	22 (31)	189
Heptane	75	17 (24)	221
Octane	80	25 (35)	--
Nonane	90		--
Decane	75	--	--
Napthenes			
Cyclopentane	--	--	--
Methylcyclopentane	80	--	--
Cyclohexane	85	34 (40)	--
Methylcyclohexane	100	--	--
Aromatic			
Benzene	150	100 (143)	122
Toluene	110	100 (143)	100
Ethylbenzene	100	--	--
p-Xylene	116	114 (60)	--
Cumene	100	--	--
n-Propylbenzene	--	--	--
Napthaeine	--	--	--

[a] Values are relative to benzene standard. Values in parentheses are relative to isobutylene standard and were calculated.

[b] Values are relative to isobutylene standard.