HAGEMAN-AGUIAR, INC.
Underground Contamination Investigations, Groundwater Consultants, Environmental Engineering

PROPOSED WORKPLAN
FOR
SUBSURFACE INVESTIGATION

VINCENT ROOFING COMPANY
2181 Dunn Road
Hayward, CA

May 15, 1995

3732 Mt. Diablo Blvd. Suite 372 Lafayette, California 94549 (510) 284-1661 FAX (510) 284-1664

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I. INTRODUCTION

The site location is Vincent Roofing Company located at 2181 Dunn Road in Hayward, California. In conjunction with the roofing contractor operation, a 6,000-gallon underground Gasoline tank has historically been present at the site. In August, 1994, the underground storage tank was removed. At the present time, an above-ground Con-Vault fuel storage tank operates at the site. The location of the site is shown in Figure 1.

Background Information

A map of the site showing the layout of the facility, along with the location of the previous underground tank excavation is shown in Figure 2. At the time of the removal, Gasoline was found to be present in the native soil beneath the tank at concentrations of up to 260 mg/Kg (ppm). In addition, trace amounts of Ethylbenzene, Xylenes and Lead were discovered to be present in the native soil at this same location.

Shallow groundwater was found to be present in the tank pit during the excavation. No detectable concentrations of TPH as Gasoline, Benzene, Toluene, Ethylbenzene or Xylenes were present in the "grab" groundwater sample collected at the time of the tank excavation.

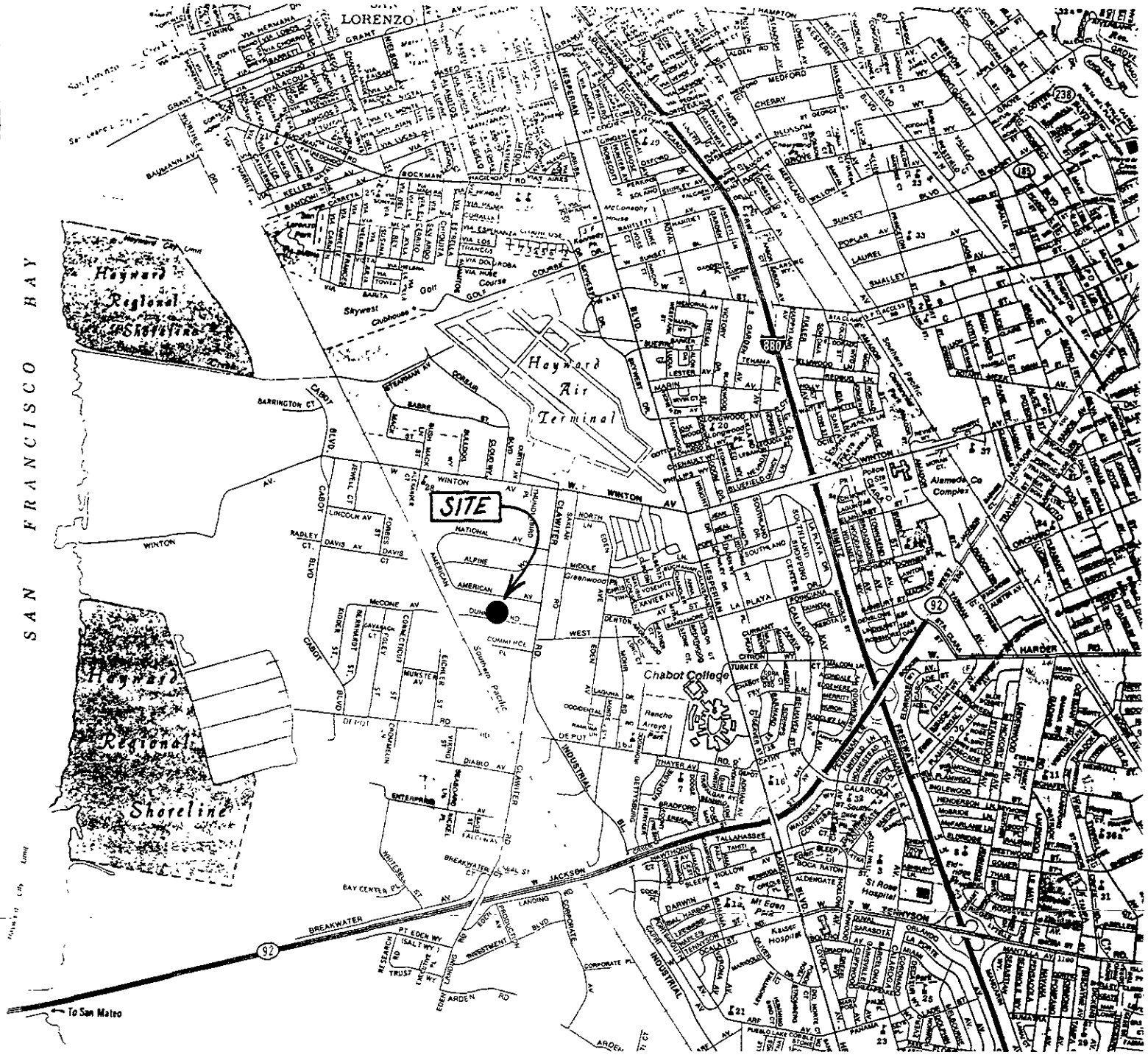


FIGURE 1.

Site Location Map.

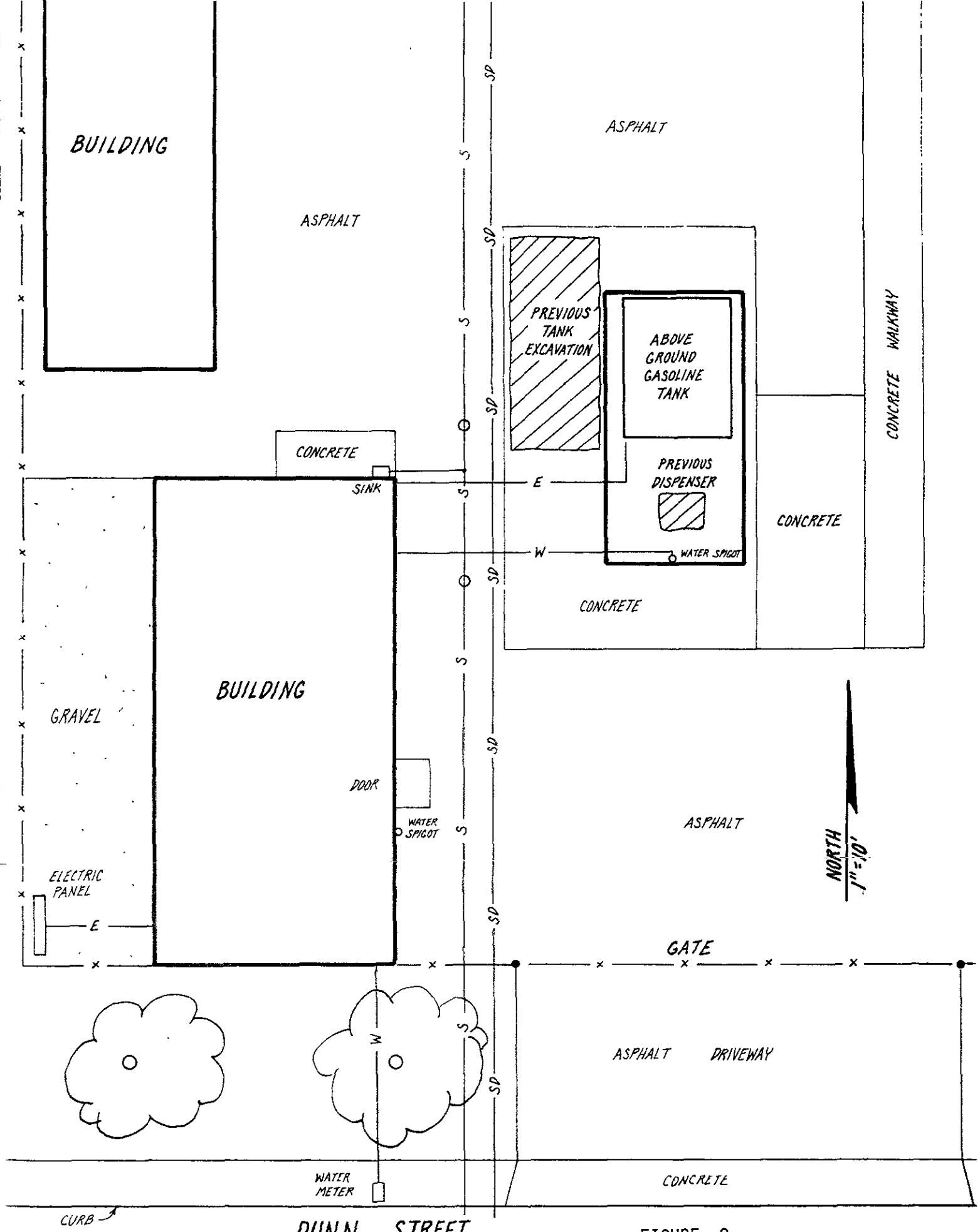


FIGURE 2.
Site Map.

Purpose of Investigation

The purpose of the proposed subsurface investigation is to collect "grab" shallow groundwater samples from several "hydropunch" locations in the immediate vicinity of the previous underground storage tank and previous dispenser location. The data collected from this subsurface investigation is expected to result in a somewhat complete horizontal definition of any on-site residual shallow groundwater contamination that may be present.

The proposed workplan has been prepared in response to a request by the Alameda County Department of Environmental Health for further investigation at the site. Letters from Alameda County to Vincent Roofing are included in Attachment A.

II. SITE DESCRIPTION

Regional Hydrogeology

A regional topographic map is presented as Figure 3. The site is located on a low-lying bay plain, relatively close to San Francisco Bay. The soils in the vicinity of the site consist of Quaternary Alluvium overlying much deeper bedrock that likely to consist of Franciscan sandstone and siltstone (Geologic Map of California, San Francisco Sheet, State of California, Division of Mines and Geology, 1980). Due to its close proximity to San Francisco Bay, this area may have previously been marshland that was artificially filled.

Based upon the surface topography, as well as the various hydrologic features shown on the vicinity map, the regional shallow groundwater can be expected to flow from the hills of eastern Hayward (area of recharge) and move westward toward San Francisco Bay (area of discharge). The locations of the Hayward shoreline Canal and Mt Eden Creek may cause the apparent regional groundwater flow direction to be deflected somewhat south of a truly western direction.

In terms of location of the site with respect to various surface water bodies, 1) a surface storm drain is located approximately 900 feet south of the site, 2) the City of Hayward sewage oxidation ponds are located approximately 1 mile west of the site, 3) the Hayward Shoreline Canal is located approximately 1.2 miles to the southwest of the site, and 4) salt evaporators are located approximately 2 miles to the south of the site. The established shoreline of San Francisco Bay is located approximately 2 miles to the west of the site.

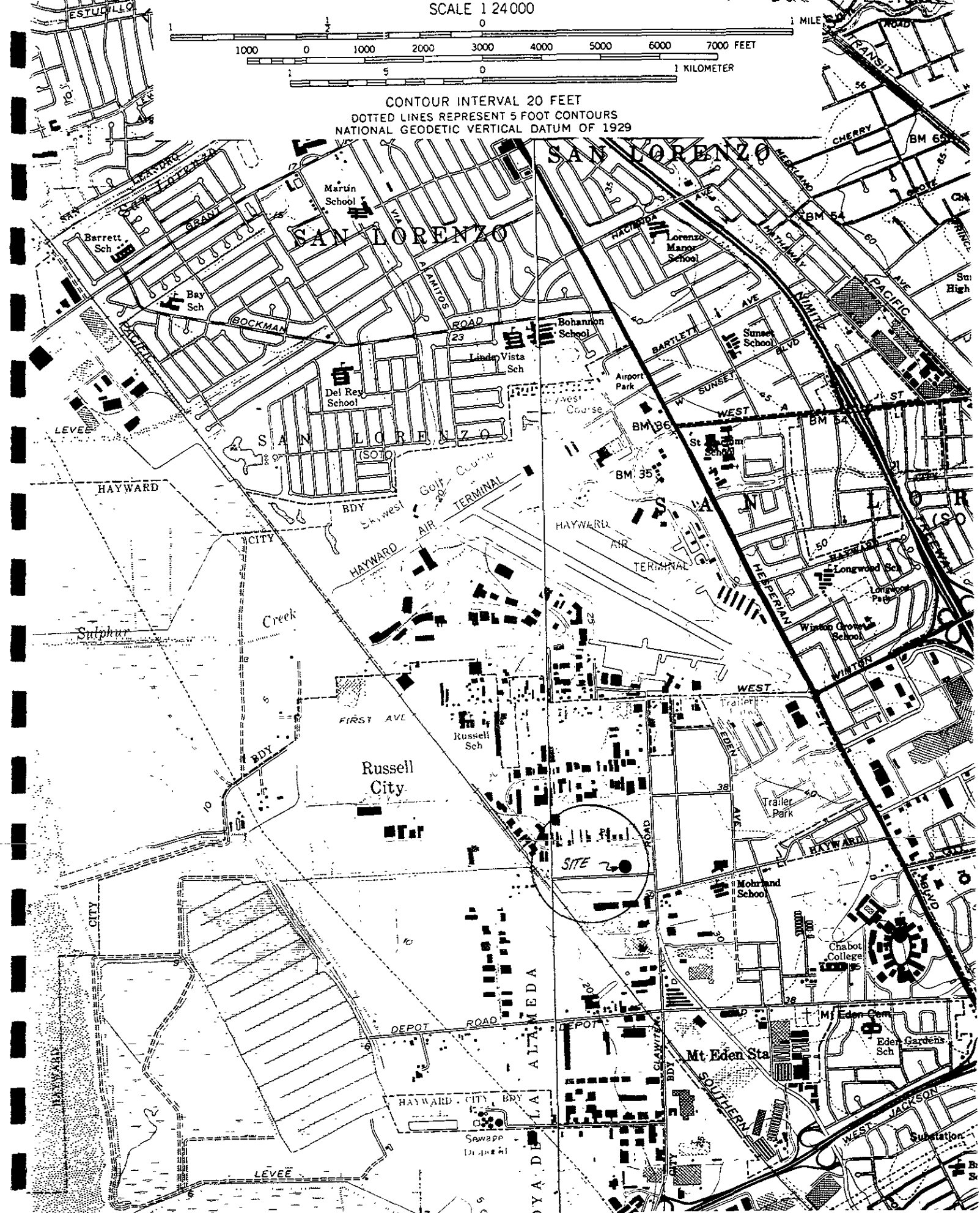


FIGURE 3. Topographic Map.

On-Site Hydrogeology

The shallow groundwater beneath the site is expected occur within lean clay that is interbedded with fine- to medium-grained saturated sand layers. The static shallow water table is expected to be at approximately 12 to 14 feet below the ground surface.

The shallow groundwater in the vicinity of the subject site can be expected to flow in the **southwesterly** direction. This assumed shallow groundwater flow direction appears to be consistent with data collected from other sites in the vicinity of the subject site, and appears to be consistent with the presence of **Hayward Shoreline Canal** to the southwest.

↳ How close are sites? Survey to a common bench mark to determine gradient.

Site Description

A map of the site is shown in Figure 2. This map shows the layout of the facility, along with the locations of the previous tank excavation. At the present time, approximately one-half of the site is paved with asphalt or concrete. Imported gravel covers the remainder of the site. The former tank excavation location is capped with concrete pavement and an above-ground fuel storage tank with spill containment wall.

III. PROPOSED SCOPE OF WORK

The purpose of the proposed groundwater investigation is to collect "grab" groundwater samples at a number of "hydropunch" locations in order to define the lateral extent of any dissolved petroleum constituents that may be present in the shallow groundwater beneath the site.

Groundwater Sampling Locations

The proposed groundwater sampling locations are shown in Figure 4. The locations have been selected based upon 1) the presumed shallow groundwater flow direction, 2) estimated locations of the previous underground tank and associated product dispenser, 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.

Groundwater Sampling Plan

At each "hydropunch" location, a 6-foot long decontaminated 3/4-inch I.D. perforated galvanized steel probe pipe with 5-foot long connecting sections will be pneumatically driven about 5 feet into the aquifer or saturated zone.

Each probe will be purged by removed several casing volumes of water using a stainless steel bailer. After the water level has attained 80% or more of the original static water level in a particular probe, a groundwater sample will be

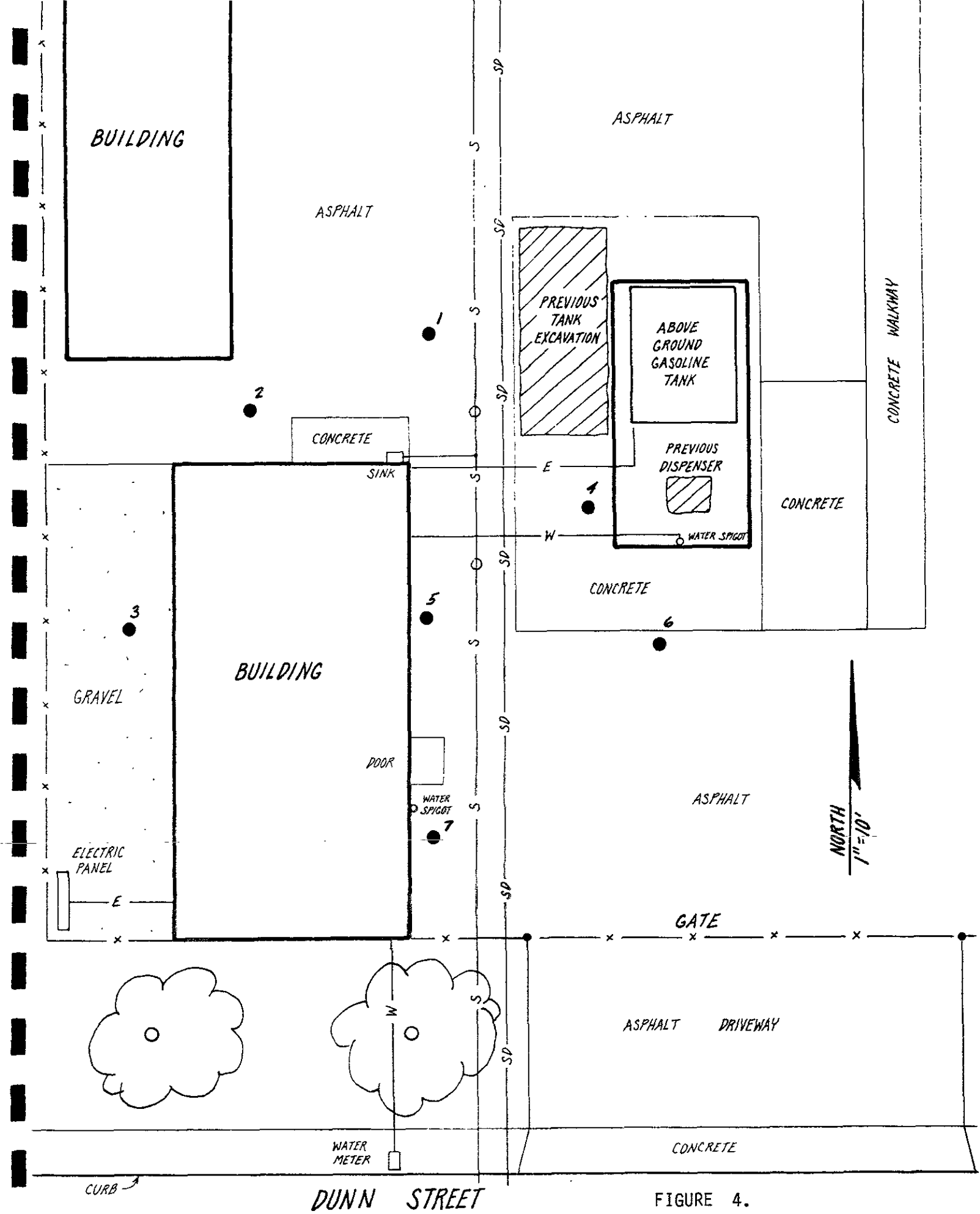


FIGURE 4.
Proposed "Hydropunch" Locations.

collected using a decontaminated stainless steel bailer. The water sample will be placed inside 40 mL VOA vials free of any headspace. The sample will immediately be placed on ice and delivered under chain-of-custody to the laboratory at the conclusion of the field work.

Following the groundwater sample collection, the temporary probe will be removed, and the entire length of the hole will be sealed with neat cement grout.

Hole Sealing

Following the completion of the groundwater sampling operation, each "hydro-punch" hole will be filled with neat cement grout.

Equipment Decontamination

Prior to the installation of each temporary probe, all equipment will have been previously steam-cleaned off-site at the Environmental Control Associates equipment yard in Watsonville, California.

IV. LABORATORY ANALYSIS

All analyses will be conducted by a California State DOHS certified laboratory in accordance with EPA recommended procedures.

Groundwater samples will be analyzed for:

1) total petroleum hydrocarbons as Gasoline (EPA method 8015).

2) Benzene, Toluene, Ethylbenzene, and Total Xylenes (EPA method 602).

V. REPORT

A report will be written that will provide a description of all field work and all laboratory results. The report will include, but not be limited to, the following:

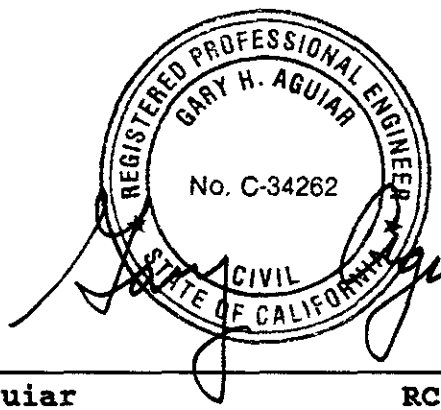
1) a map showing "hydropunch" locations.
2) depths to groundwater.
3) results of laboratory analyses.
4) report of presence of free product.
5) contaminant plume definitions.
6) contaminant source identification.

VI. SITE SAFETY PLAN

A site-specific set of health and safety operating procedures for field investigations of underground spills of motor oil and petroleum distillate fuel is provided in Attachment B. 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.

PROPOSED WORKPLAN FOR SUBSURFACE INVESTIGATION
VINCENT ROOFING COMPANY, Inc.
2181 Dunn Road, Hayward, CA

May 15, 1995



EXP. 9-30-95

Gary Aguiar **RCE 34262**

ATTACHMENT A

BACKGROUND DATA

ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

RAFAT A. SHAHID, ASST. AGENCY DIRECTOR
DEPARTMENT OF ENVIRONMENTAL HEALTH
State Water Resources Control Board
Division of Clean Water Programs
UST Local Oversight Program

ALAMEDA COUNTY-ENV. HEALTH DEPT.
ENVIRONMENTAL PROTECTION DIV.
1131 HARBOR BAY PKWY., #250
ALAMEDA CA 94502-6577
(510)567-6700

StId 3031

March 7, 1995

Clyde E. Vincent
Vincent Roofing company
2181 Dunn Road
Hayward, CA 94545

Subject: Required investigations at Vincent Roofing Co. located at 2181 Dunn Rd., Hayward, CA

Dear Mr. Vincent:

On October 28, 1994, the Alameda County Department of Environmental Health, sent you a letter requiring that you submit a Preliminary Site Assessment work plan to determine the vertical and lateral extent of soil and ground water contamination from past releases from the former underground storage tank (UST) at the subject site. A copy of that letter is enclosed for your review.

Analytical results of a sidewall soil sample collected from the former tank pit identified 260 parts per million (ppm) Total Petroleum Hydrocarbons as gasoline TPHg) and trace amounts of ethylbenzene, xylenes, and lead. Guidelines established by the California Regional Water Quality Control Board require that ground water investigations be conducted when there is evidence to indicate that a release from an UST will impact or may have impacted the ground water. Per our conversation this morning, a preliminary soil and ground water survey in the location where the contamination was found would be advisable before considering well installation and/or placement.

You requested a list of consultants that perform site assessments. Attached are two lists of consultants that have worked within Alameda County. As stated on the lists, this is not an endorsement nor is it a complete list of consultants qualified to perform the environmental investigations required at the site. You are encouraged to look in the phone book under Environmental Consultants, Hazardous Materials and Waste Consultants, Tanks Abandoned, Well Drilling, Geologist, Geotechnical Engineers, etc.; obtain recommendations from those who have had similar work performed; and if necessary, obtain multiple bids.

This is a formal request for a work plan pursuant to **Section 2722 (c)(d) of Title 23 California Code of Regulations.** Please submit the workplan to this office on or before April 10, 1995. Any extensions of the stated deadlines, or modifications of the required tasks, must be confirmed in writing by either this agency or RWQCB.

If you have questions or comments, please call me at (510)567-6755.

Sincerely,

Amy Leech
Hazardous Materials Specialist

ATTACHMENTS

cc: Gordon Coleman - Files(ALL)

DEPARTMENT OF ENVIRONMENTAL HEALTH
Hazardous Material Division
1131 Harbor Way, Rm. 250
Oakland CA 94621
(510) 271-4320

October 28, 1994

Mr. Clyde E. Vincent
Vincent Roofing Company
2181 Dunn Road
Hayward, CA 94545

STID 3031

Re: Required investigations at Vincent Roofing Co., located at 2181 Dunn Road, Hayward, California

Dear Mr. Vincent,

This office has reviewed Kaprealin Engineering, Inc.'s (KEI) report, dated September 6, 1994, documenting the tank removal work conducted out at the above site. Based on the sample analysis results, 260 parts per million (ppm) Total Petroleum Hydrocarbons (TPHg) and traces of ethylbenzene, xylenes, and lead were identified in a sidewall sample collected from the former tank pit.

Guidelines established by the California Regional Water Quality Control Board (RWQCB) require that ground water investigations be conducted when there is evidence to indicate that a release from an UST will impact or may have impacted the ground water.

Although the "grab" ground water sample collected from the tank pit did not identify any contaminants, the Regional Water Quality Control Board's (RWQCB) guidelines state that ground water shall be monitored for a minimum of four quarters to assure that contaminants from the soil are not leaching into and impacting the ground water. This would require that a permanent monitoring well be installed adjacent to the tank pit at the site.

You are required to conduct a **Preliminary Site Assessment (PSA)**, in accordance with RWQCB's Staff Recommendations for the Initial Evaluation and Investigation of Underground Tanks. The PSA must be consistent with requirements set forth in Article 11 of Title 23, California Code of Regulations. The major elements of such an investigation are summarized in the attached **Appendix A**. The major elements of the guidelines include, but are not limited to, the following:

- One permanent ground water monitoring well must be installed within 10 feet of the observed soil contamination, oriented in the confirmed downgradient direction relative to groundwater flow.

- Subsequent to the installation of the monitoring wells, ground water samples are to be collected and analyzed quarterly.

This Department will oversee the assessment and remediation of your site. Our oversight will include the review of and comment on work proposals and technical guidance on appropriate investigative approaches and monitoring schedules. The issuance of well drilling permits, however, will be through the Alameda County Flood Control and Water Conservation District, Zone 7, in Pleasanton. The RWQCB may choose to take over as lead agency if it is determined, following the completion of the initial assessment, that there has been a substantial impact to ground water.

The PSA proposal is due within 60 days of the date of this letter. Once the proposal is approved, field work should commence within 60 days. A report must be submitted within 45 days after the completion of this phase of work at the site. Subsequent reports are to be submitted quarterly until this site qualifies for final RWQCB "sign-off".

The referenced initial and quarterly reports must describe the status of the investigation and must include, among others, the following elements:

- Details and results of all work performed during the designated period of time: records of field observations and data, boring and well construction logs, water level data, chain-of-custody forms, laboratory results for all samples collected and analyzed, tabulations of free product thicknesses and dissolved fractions, etc.
- Status of ground water contamination characterization.
- Interpretations of results: free and dissolved product plume definition maps for each target component, geologic cross sections, etc.
- Recommendations or plans for additional investigative work or remediation.

Please be advised that this is a formal request for a work plan pursuant to Section 2722 (c)(d) of Title 23 California Code of

Regulations. Any extensions of the stated deadlines, or modifications of the required tasks, must be confirmed in writing by either this agency or RWQCB.

If you have any questions or comments, please contact me at (510) 567-6763.

Sincerely,

Juliet Shin
Senior Hazardous Materials Specialist

ATTACHMENT

cc: Edgar Howell

ATTACHMENT B

SITE HEALTH & SAFETY PLAN

SITE HAZARD INFORMATION

FC 1006 (05-11-90)

PLEASE PROVIDE THE FOLLOWING INFORMATION FOR THE SITE

Owners Name: Ed Vincent - Vincent Roofing Company, Inc.

Site Address: 2181 Dunn Road
Hayward, California 94545

Directions to Site: HWY 880 south to Winton Avenue, West on Winton to Clawiter, South on Clawiter approximately 0.5 miles to Dunn Road, West on Dunn Road to 2181 address on north side of street.

Consultant On Site: Hageman-Aguiar, Inc. Phone Number: (510) 284-1661

Site Safety Officer: Gary Aguiar Phone Number: ( )

Type of Facility: Roofing Contractor's Facility & Offices

Site Activities: ☐ Drilling ☐ Construction ☐ Tank Excavation ☐ Soil Excavation ☐ Work in Traffic Area

☒ Groundwater Extraction ☐ Vapor Extraction ☐ In Situ Remediation ☐ Above Ground Remediation

☐ Other: Shallow Groundwater Sampling through "Hydro-Punch" steel tubes inserted into shallow groundwater.

Hazardous Substance

Name (CAS#)	Expected Concentration ☐ Soil ☒ Water ☐ Air	Health Affects
Gasoline, BTEX	up to 1,000 ug/L (ppb)	dizziness, eye irritation

Physical Hazards

☒ Noise
☐ Traffic
☐ Underground Hazards
☐ Overhead Hazards
☐ Excavations/Trenches
☐ Other

Potential Explosion and Fire Hazards (Flammable Range = 1% to 10% Gas Vapor):

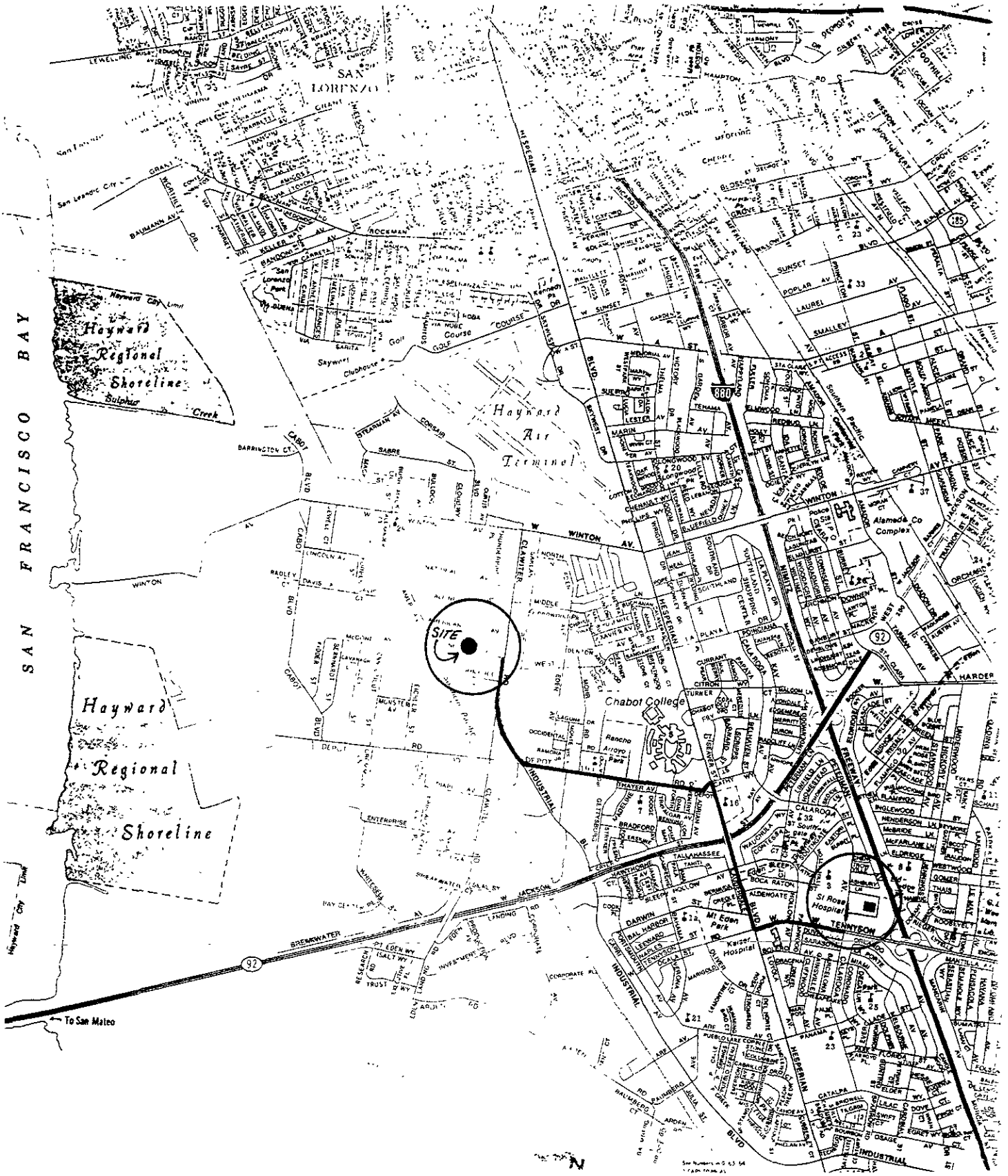
Level Of Protection Equipment

☐ A ☐ B ☒ C ☒ D ☐ See Personal Protective Equipment

Personal Protective Equipment

R = Required A = As Needed

R	Hard Hat	R	Safety Eyewear (Type)
R	Safety Boots	A	Respirator (Type) half-face negative pressure
	Orange Vest		Filter (Type) carbon (organic vapor)
R	Hearing Protection	R	Gloves (Type) rubber/nitrile
R	Tyvek Coveralls		Other
	5 Minute Escape Respirator		



Saint Rose Hospital
27200 Calaroga Avenue
Hayward, California
(510) 782-6200

SITE HAZARD INFORMATION

FC 1006 (05-11-90)

Monitoring Equipment on Site

☐	Organic Vapor Analyzer	☒	PID with lamp of _____ eV
☐	Oxygen Meter	☐	Draeger Tube _____
☒	Combustible Gas Meter	☐	Passive Dosimeter
☐	H_2S Meter	☐	Air Sampling Pump
☐	W.B.G.T.	☐	Filter Media _____

Site Control Measures FID & PID meters on-site. Public access restricted by existing perimeter fence.

Decontamination Procedures Equipment steam-cleaned on-site. Rinseate stored in DOT 17H drums. Gloves, Tyvek suits to be disposed of with drill cuttings. Personnel to wash with soap and water prior to eating or leaving site.

Hospital/Clinic Saint Rose Hospital Phone (510) 783-1123 (emergency)

Hospital Address 27200 Calaroga Avenue (Cross-street at West Tennyson)

Paramedic 911 or 732-2626 Fire Dept. 911 Police Dept. 911

732-2626 293-7000

Emergency/Contingency Plans & Procedures _____

Site Hazard Information Provided By: Gary Aguiar (Print) Phone Number: (510) 284-1661

Gary Aguiar (Signature) Date: 5/15/95

HAGEMAN-AGUIAR, INC.

Underground Contamination Investigations, Groundwater Consultants, Environmental Engineering

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

August 1994

3732 Mt. Diablo Blvd. Suite 372 Lafayette, California 94549 (510) 284-1661 FAX (510) 284-1664

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1. 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. 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:

2.1 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

2.2 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).

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

3. 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 distributed 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 whose on-site behavior jeopardizes their health and safety of the health and safety of others.

4. 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 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.

4.1 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 grater 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 2.1) range from 0.6 percent for JP-5 to 1.4 percent for gasoline. 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.

4.2 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, node 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 mild anesthesia in 30 minutes. Headaches have been reported with exposure to 25 ppm or more of gasoline vapors measured with a photoionization meter. Must fuels, particularly gasoline,

kerosene and jet fuels are capable of causing skin irritation after several hours of 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 (passes into the lungs), gasoline and other petroleum distillate fuels may cause secondary pneumonia.

Some of the additives to gasoline, such as ethylene dichloride, ethylene dibromide, 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. The American Conference of Government Industrial Hygienists (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. HEALTH AND SAFETY DIRECTIVES

5.1 Site-Specific Safety Briefing

Before field work begins, 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
- Hardhats

5.2.1 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 hydrocarbon 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 for 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

5.3.1 Required Equipment

--- Organic vapor meter the flame or photoionization detector

--- Combustible gas meter

5.3.2 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 solid. 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, 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 meter 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 spoilage.

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 shot down, and corrective action taken if combustible gas concentrations reach 40 percent of LEL within a 12-inch radius of the borehole of 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 off-scale 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 area and the local fire department and facility management must be alerted.

Organic vapor meter 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 measured 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 than 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 are in progress. Official visitors should be discouraged from entering hazardous areas, but may be allowed to enter only if the 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:

5.5.1 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 efficient 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 water also; however, if weathered to an asphaltic condition, mechanic's waterless hand cleaner is recommended for initial cleaning followed by detergent and water.

5.5.2 Equipment

Gloves, respirators, hardhats, boots and goggles should be cleaned as described under personnel. If boots do not become clean after washing with detergent and water, wash them with a strong solution of trisodium phosphate and hot water.

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

	Sensitivity in Percent of Standard		
	FID	PID	
Component		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.