REVISED
CORRECTIVE ACTION PLAN

R. T. NAHAS PROPERTY/
TIEN UNOCAL 76 SERVICE STATION
20405 Redwood Road
Castro Valley, California

June 14, 1996

Prepared by:

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Project No. NHS101/16018.2001

PHILIP
ENVIRONMENTAL

Environmental Services Group
Pacific Region

June 14, 1996
NHS101/16018.2001

Mr. Scott Seery
Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: **REVISED CORRECTIVE ACTION PLAN**
R.T. Nahas Property/Tien Unocal 76 Service Station
20405 Redwood Road
Castro Valley, California

Dear Mr. Seery:

Philip Environmental Services Corporation (Philip) is pleased to present this Revised Corrective Action Plan (CAP) for the R. T. Nahas Property (Nahas) located in Castro Valley, California. This Work Plan was prepared in accordance with Alameda County Health Care Services (ACHCS) correspondence dated April 13, 1995 and verbal guidance received during telephone conversations on January 22, 1996 and February 1, 1996, and revised based on verbal comments received during our February 28, 1996 meeting.

The site is an active gasoline service station with two 10,000-gallon gasoline underground storage tanks and one 300-gallon used oil underground storage tank. Previous investigation activities have detected petroleum hydrocarbons in the soil and groundwater beneath the site. Groundwater impact has included the presence of phase separated hydrocarbons (PSH) at the groundwater interface in soil borings located up to 40 feet west and south of the gasoline underground storage tanks. The source of the petroleum hydrocarbons is unknown and may be related to site activities, either through overspill or leaking tank/piping assembly.

The underground storage tanks were installed in the early 1960s and are believed to be constructed of single-walled steel. California regulations require installation of secondary containment or tank replacement for single-walled steel tanks by December 22, 1998 (23 CCR 2662 et seq.). In addition, the station operator and property owner plan to cease operation of the site as a service station, which would require closure of the underground storage tanks. Based on tank upgrade and closure requirements, the extent of PSH encountered, and the presence of petroleum hydrocarbons above Tier 1 risk based screening levels (RBSLs) and Tier 2 site specific target levels (SSTLs), the most cost effective means of remediating the site is source removal through removal of the tanks and associated piping, excavation of significantly impacted soil, and limited PSH skimming/groundwater extraction.

The purpose of this CAP is to present the Tier 1 and Tier 2 ASTM health risk assessment results, and to describe the procedures proposed for source removal. The remediation scope of work includes: (1) removing the underground storage tanks and associated piping, (2) excavating impacted soil near the gasoline UST area and the southern property boundary, (3) skimming PSH from the groundwater, if present, (4) handling the impacted soil through onsite aeration, or offsite transportation for disposal at a landfill or treatment at a thermal desorption facility, (5) transporting PSH to a recycling facility and discharging groundwater to the local publicly owned treatment works, and (6) collecting and analyzing confirmation soil and groundwater samples from the excavation to evaluate the effectiveness of remedial activities. Upon completion of source removal activities, the excavation areas will be backfilled. Following remediation activities, a groundwater monitoring well will be installed at the southern property boundary and sampled.

BACKGROUND

Documents

Philip reviewed the following documents to prepare this Work Plan:

Regional Water Quality Control Board - San Francisco Bay Region. 1996. Supplemental Instructions to State Water Board December 8, 1995 , Interim Guidance on Required Cleanup at Low Risk Fuel Sites, dated January 5, 1996.

BSK & Associates. 1995. Feasibility Study, Soil and Groundwater Remediation, Tien's Unocal Station, 20405 Redwood Road, Castro Valley, California, dated December 11, 1995.

State Water Resources Control Board. 1995. Lawrence Livermore National Laboratory (LLNL) Report on Leaking Underground Storage Tank (UST) Cleanup, dated December 8, 1995.

BSK & Associates. 1995. Groundwater Monitoring Report, October 1995, Unocal 76 Service Station, 20405 and 20629 Redwood Road, Castro Valley, California, dated October 30, 1995.

Lawrence Livermore National Laboratory. 1995. Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks, dated October 16, 1995.

American Society for Testing and Materials. 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, E-1739-95, approved September 10, 1995.

Regional Water Quality Control Board - San Francisco Bay Region. 1995. Water Quality Control Plan (Basin Plan), adopted June 21, 1995.

BSK & Associates. 1993. Perchloroethene Release Assessment, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated December 9, 1993.

BSK & Associates. 1992. Sixth Quarterly Groundwater Monitoring Report, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated January 30, 1992.

BSK & Associates. 1991. Fifth Quarterly Groundwater Monitoring Report, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated November 12, 1991.

BSK & Associates. 1991. Third Quarterly Groundwater Monitoring Report, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated May 8, 1991.

BSK & Associates. 1991. Report, Soil Borings for Soil Assessment, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated April 21, 1991.

BSK & Associates. 1990. Quarterly Monitoring Report and Work Plan for Supplemental Contamination Assessment, Unocal 76 Service Station, 2045 Redwood Road, Castro Valley, California, dated August 30, 1990.

Regional Water Quality Control Board - San Francisco Bay Region. 1990. Tri-Regional Board Staff Recommendations for Preliminary Evaluation and Investigation of Underground Tank Sites, dated August 10, 1990.

BSK & Associates. 1990. Monitoring Facility Installations - Alternative No. 6 Underground Petroleum Tanks, Unocal 76 Service Station, 20405 Redwood Road, Castro Valley, California, dated February 5, 1990.

Site Description and History

The site is an active Unocal 76 service station operated by Mr. Frank Tien and located at 20405 Redwood Road, Castro Valley, California (see Figure 1). The Unocal service station has two 10,000-gallon underground storage tanks and two pump islands with unleaded and super unleaded gasoline. A 300-gallon underground used oil tank is behind (west of) the service station building. The underground storage tanks were installed in the early 1960s and are believed to constructed of single-walled steel. The pump islands are on a concrete slab. The land surface slopes gently to the south, and a small stream drainage is located approximately 750 feet east of the site.

The site is located east of a car wash and north of a shopping center in a mixed residential and commercial area (see Figure 2). A driveway between the service station and the shopping center allows access from Redwood Road to the car wash and shopping center. The driveway is underlain by a storm drain system and an utility corridor (see Figure 2). The property consisting of the service station, driveway and car wash are owned by R.T. Nahas Company.

Previous Work

Investigation activities were conducted by BSK & Associates (BSK) of Pleasanton, California. In December 1989, BSK installed three groundwater monitoring wells (MW-2, MW-3 and MW-4) at the site (see Figure 2). In Spring 1991, BSK conducted a supplemental investigation which focused on defining the extent of impacted soil and included a summary of a 1989 well survey (BSK, April 1991).

In May 1992, additional investigation activities including installation of three offsite groundwater monitoring wells (MW-5, MW-6 and MW-7) and two soil borings (SB-14 and SB-15). Sampling of the of the six groundwater monitoring wells has been conducted since 1992.

In late 1995, BSK prepared a feasibility study which reviewed soil remediation methods including soil-vapor extraction, in-situ bioventing, excavation and disposal and excavation and onsite treatment, and groundwater remediation methods including extraction and treatment, air sparging, and no action. During the feasibility study, an aquifer test was performed on well MW-101, which was installed south of the underground gasoline tanks in September 1995.

Subsurface Conditions

Hydrogeology

Based on the previous investigation data, the site is underlain by four to five feet of organic-rich silty clay fill followed by three to five feet of greenish-gray sandy/clay. In the western portion of the study area, the greenish clay is underlain by seven to eleven feet of yellow-brown sandy clay, grading to a clayey sand with depth, and continuing to the final depth explored.

In the area of wells MW-5 through MW-7, subsurface conditions comprised 10 to 20 feet of dark gray to yellow gray silty clay, the upper ten feet of which may be fill. The silty clay is underlain by 4 to 5 feet of orange-brown clayey silt to silty sand. At fifteen to twenty feet in depth, a silty to sandy grayish clay is encountered. At approximately 25 feet, clayey sand to sand was encountered.

silt/silty sand

Previous investigation and monitoring results indicate that groundwater beneath the site is semi-confined. During drilling activities, groundwater was typically first-encountered at approximately 14 to 20 feet below ground surface (BGS), and subsequently stabilizes at approximately 10 to 12 feet BGS (see Table 1). **Aquifer test results for well MW-101 indicate a transmissivity of 858 gallons per day per foot**, a hydraulic conductivity of 7.6 feet per day (2.7 x 10^{-3} centimeters per second), and a storativity of 0.019.

The groundwater flow direction is to the southwest with a hydraulic gradient of 0.007 feet/foot in October 1995. Based on BSK's review of a 1989 well survey, five active water wells were located within 1/2-mile upgradient of the site.

Hydrocarbon Extent

Petroleum hydrocarbon impacted soil and groundwater have been encountered south and west of the gasoline underground storage tanks. Petroleum and chlorinated hydrocarbons have not been encountered in soil or groundwater in the vicinity of the used oil underground storage tank.

Based on field screening and analytical results, petroleum hydrocarbon impacted soil was detected at depths ranging from just below the asphalt pavement to 17 feet BGS, with the highest concentrations observed between 10 feet BGS and first encountered groundwater (see Table 2). BSK noted that contamination was not always accompanied by soil staining and volatilization was rapid upon exposure to air.

During drilling activities, PSH was noted at soil borings MW-1, MW-1A, SB-2, SB-3, SB-11, and SB-13 (see Figure 2). Elevated concentrations of petroleum hydrocarbons has been encountered in groundwater samples collected from wells MW-2, MW-3, and MW-101 and grab groundwater samples from soil borings SP-1 and SP-2 (see Table 3).

Chlorinated hydrocarbon impacted groundwater has been encountered in well MW-7 and soil boring SP-1 (see Table 3). The chlorinated hydrocarbons include perchloroethene (i.e., PCE or tetrachloroethylene) and associated breakdown products, and are believed to be related to a dry cleaning operation located in the shopping center (see Figure 2).

HEALTH RISK ASSESSMENT

Tier 1 Evaluation

A preliminary health risk assessment based on Tier 1 American Society for Testing and Materials (ASTM) guidance was conducted at the site in accordance with a January 22, 1996 verbal request from the ACHCS. The transport mechanisms reviewed included (1) soil volatilization to outdoor air, (2) vapor intrusion from soil to building, (3) surficial soil ingestion/dermal/inhalation, (4) soil leachate to protect water quality, (5) groundwater volatilization to outdoor air, (6) groundwater ingestion, and (7) vapor intrusion from groundwater to building. The preliminary health risk assessment was based on target levels of less than 1×10^{-6} for carcinogens and chronic hazard quotient of less than 1.0 for noncarcinogens. The concentrations of benzene, toluene, ethylbenzene, and total xylenes were compared to the Tier 1 Risk-Based Screening Level Look-Up Table (the Look-Up Table). The benzene values presented on the Look-Up Table were multiplied by 0.29 as requested in supplemental information of the Regional Water Quality Control Board - San Francisco Bay Region, dated January 5, 1996 (see Table 4).

Evaluation of the soil and groundwater analytical results and the Tier 1 RBSLs indicates that (1) 12 of the 25 soil sampling locations contained benzene concentrations exceeding the RBSL for one or more transport mechanism/exposure pathway, (2) 1 of the 25 soil sampling locations contained a toluene concentration exceeding the RBSL for exposure via vapor intrusion into a building, and (3) 5 of the 9 groundwater sampling locations contained benzene concentrations exceeding the RBSL for one or more transport mechanism/exposure pathway (see Table 5). At the concentrations previously encountered, ethylbenzene and xylenes did not represent a significant risk to human health via the transport mechanisms/exposure pathways evaluated.

Tier 2 Evaluation

A preliminary health risk assessment based on Tier 2 ASTM guidance was conducted at the site in accordance with a February 28, 1996 verbal request from the ACHCS. Exposure pathways were evaluated for the subsurface soil impact, dissolved groundwater impact, and phase separated hydrocarbon impact encountered resulting from leaking underground storage tanks or piping at the site. **Potential transport mechanism for these sources include (1) volatilization and atmospheric dispersion, (2) volatilization and enclosed-space accumulation, leaching and groundwater transport,** and mobile PSH migration (see Figure 3). Surface soil ingestion or dermal contact was not further evaluated due to exposure restrictions caused by the general absence of shallow impact, and the asphalt/building cover over the site. Exposure via groundwater ingestion was not further evaluated due to the absence of known plans to use of the groundwater in the vicinity of the site as a drinking water source. There are no known surface water bodies with recreational use/sensitive habitats downgradient of the site that may result in exposure. Although the site is covered with asphalt or concrete, inhalation is the exposure pathway which is most likely to be completed at the site.

The Tier 1 risk assessment results indicate that benzene and to a lesser extent toluene are the constituents of concern at the site. **The Tier 2 health risk assessment was based on commercial/industrial inhalation exposures with target levels of less than 1 x 10^{-6} for carcinogens and chronic hazard quotient of less than 1.0 for noncarcinogens. Benzene values multiplied by 0.29 as requested in supplemental information of the Regional Water Quality Control Board - San Francisco Bay Region, dated January 5, 1996.**

The Tier 2 risk assessment was conducted using the Tier 2 RBCA Tool Kit computer spreadsheet program prepared by Groundwater Services, Inc. of Houston, Texas. Inhalation transport mechanisms evaluated in the analysis included volatilization and atmospheric dispersion, and volatilization and enclosed space accumulation of BTEX constituents from impacted subsurface soil and groundwater. Soil and groundwater analytical results and aquifer test data were used to modify the modeled areal extent of the impacted soil modeled, and the groundwater flow characteristics (see Table 6). BTEX constituent concentrations detected at soil boring SP-1 were used to evaluate health risk associated with the capillary fringe adjacent to the property boundary (see Tables 2 and 3).

In addition, the computer spreadsheet program allowed for efficient analysis of varying parameters including (1) excess cancer risk target levels, (2) organic carbon content (i.e., 0.001, 0.01 and 0.1), and (3) depth to groundwater/vadose zone thickness (i.e., 11 feet BGS based on static water levels, 16 feet BGS based on first-encountered groundwater noted on the 1991 boring logs, 21 feet BGS based on first-encountered groundwater noted on the 1993 boring logs). The input data was used to calculate site specific target levels (SSTLs) for benzene and toluene in surface soil, subsurface soil, and groundwater.

The results indicate that surface soil and groundwater SSTLs are not significantly influenced by the depth or thickness of impact, or organic carbon content (see Table 7). Subsurface soil SSTLs exhibited more influence by these parameters. Based on the SSTLs calculated for the capillary fringe scenario, (1) 8 of the 25 sampling locations exceeded the benzene SSTLs using a 1 x 10^{-6} excess cancer risk target level, (2) 3 of the 25 sampling locations exceeded the benzene SSTLs using a 1 x 10^{-4} excess cancer risk target level, and (3) none of the samples exceeded the toluene SSTLs using 1.0 chronic hazard quotient for noncarcinogens (see Figure 4). **The benzene SSTLs for subsurface soil was 0.29 mg/kg and 5.2 mg/kg for excess cancer risk target levels of 1 x 10^{-6} and 1 x 10^{-4}, respectively. The benzene SSTLs for groundwater ranged from approximately 30 to over 500 μg/L for excess cancer risk target levels of 1 x 10^{-6} and 1 x 10^{-4},** respectively. The distribution of the sampling locations exceeding the benzene SSTLs center on the underground storage tank complex, the vent pipe line, and the southern property boundary.

no ?
should be

REMEDIATION SCOPE OF WORK

The RWQCB presented a framework for evaluating low risk groundwater cases for closure in correspondence dated January 5, 1996. A fundamental part of low risk groundwater cases is that "the leak has been stopped and on-going sources, including free product, have been removed or remediated" (RWQCB, 1996). An additional consideration is that the site presents no significant risk to human health or the environment. As described above, the previous investigation activities indicate that PSH and benzene locally exceeding Tier 2 SSTLs are present in the soil and groundwater adjacent to the gasoline underground storage tanks and the southern property boundary. **Based on the RWQCB guidance, source removal is required at the site.**

not so certain

agreed

The single-walled steel underground storage tanks at the site require installation of secondary containment or replacement by December 22, 1998 (23 CCR 2662 et seq.). The station operator and property owner plan to cease operation of the site as a service station, which will require closure of the underground storage tanks. Based on tank upgrade and closure requirements, and the source removal requirements, the most cost effective means of remediating the site is through removal of the tanks and associated piping, excavation of significantly impacted soil, and limited PSH skimming/groundwater extraction.

The following is a summary of the tasks to be performed during site remediation.

Task One: Project Preparation

Necessary permits and approval will be obtained from the ACHCS, Alameda County Flood Control District 7 (ACFCD), Alameda County Public Works (ACPW), Castro Valley Fire Department (CVFD), Bay Area Air Quality Management District (BAAQMD), and Castro Valley Sanitary District (CVSD). In addition, materials and equipment will be acquired and subcontractors will be obtained to perform the excavation activities and to analyze soil and groundwater samples. This task includes the preparation of a health and safety plan.

Task Two: Well Abandonment

The wells located near the proposed excavation will be abandoned in order to prevent vertical migration of petroleum hydrocarbons. Wells MW-2, MW-3, MW-4 and MW-101 which have total depths of approximately 25 to 30 feet each, will be overdrilled using 10-inch diameter augers and sealed to the surface with bentonite-cement grout (see Appendix A). Well abandonment permits will be obtained from ACFCD prior to excavation of the impacted soil.

Task Three: Station Demolition

Prior to station demolition, permits will be obtained from ACPW. All work with be performed in accordance with ACPW guidelines. Completion of demolition activities prior to remediation activities will allow access to areas requiring remediation (e.g., soil boring SB-13) and create additional space for stockpiling materials and debris.

Task Four: Underground Storage Tank and Piping Removal

Prior to tank removal, permits will be obtained from ACHCS. All work with be performed in accordance with ACHCS, ACPW, CVFD and BAAQMD guidelines. In brief, the piping will be flushed out into the tanks and all product will be removed from the underground storage tanks. Each hydrocarbon storage tank will be (1) inerted with dry ice, (2) exposed using a backhoe/excavator, (3) removed from the excavation, (4) inspected, and (5) loaded for transport as hazardous waste. In addition, each excavation will be inspected for indications of a petroleum hydrocarbon release. Activities in the gasoline tank area will include removal of the pump islands, dispensers, product and vent piping, and two 10,000-gallon underground storage tanks (see Figure 2). Activities in the used oil tank area will include removal of the 300-gallon tank. The work will be performed by a California-licensed contractor with appropriate hazardous waste classification.

Task Five: Soil and Groundwater Sampling and Analysis

Following removal of the tanks, soil samples will be collected from the sidewalls and bottom of each excavation, and at 20 foot intervals along each piping run in accordance with the *Tri-Regional Board Staff Recommendation for Preliminary Investigation and Evaluation of Underground Storage Tanks Sites* (RWQCB, 1990). Soil samples will be collected by driving a four-inch long brass liner using a hand-held impact sampler into soils (see Appendix C). Each soil sample will be sealed inside brass liners with Teflon™ and polypropylene end caps, wrapped with tape, and stored on ice pending transport to the California certified hazardous materials testing laboratory.

Based on the previous work at the site, groundwater is expected to enter the gasoline tank excavation and is not expected to enter the used oil tank excavation. If PSH is observed, remediation activities will be conducted as described below. If PSH is not observed, one purge volume of water will be extracted and samples of groundwater entering each excavation will be collected and submitted for analysis (see Appendix D).

Soil and groundwater samples will be analyzed by a California certified hazardous materials laboratory. Soil and groundwater samples from the gasoline tank excavation and piping run will be analyzed for total petroleum hydrocarbons as gasoline (TPHg) using modified United States Environmental Protection Agency (EPA) Method 8015 and benzene, toluene, ethylbenzene, and total xylenes (BTEX) using EPA Method 8020/602. One soil sample from the used oil tank excavation will be analyzed for TPHg, total petroleum hydrocarbons as diesel (TPHd) and total petroleum hydrocarbons as motor oil (TPHo) using modified EPA Method 8015, and BTEX using EPA Method 8020, and chlorinated hydrocarbons using EPA Method 8010, semivolatile organic compounds (SVOCs) using EPA Method 8270, and total cadmium, chromium, lead, nickel, and zinc.

Soil and groundwater sampling will be performed under the direction of a California - registered geologist. Sample collection and chemical analyses will be conducted under strict chain-of-custody procedures and will follow the guidelines established by the ACHCS and the EPA.

Task Six: Remedial Activities

Remediation activities will be based on field observations and soil and groundwater sample analytical results and will continue, where practicable, until PSH no longer enters the excavation and significantly impacted soil has been removed. Based on the health risk assessment presented above, benzene is the main constituent of concern. Remediation activities are planned to remediate benzene concentrations in soil and groundwater to below 5.0 mg/kg and 500 µg/L, respectively, in order to meet a target excess cancer risk level of 1 x 10^{-4}. Based on the site investigation data, soil borings SB-2, SB-13 and SP-1 contained benzene concentrations in soil or groundwater exceeding SSTLs for excess cancer risk level of 1 x 10^{-4}. Remediation activities will include excavation of significantly impacted soil and skimming of PSH, if encountered. Areas containing benzene concentrations below SSTLs for excess cancer risk level of 1 x 10^{-4} will not be remediated.

Planned excavation activities will include expansion of the gasoline underground storage tank pit to encompass soil borings SB-2 and SB-13, and exploratory test pit excavation at soil boring SP-1 (see Figure 4). An anticipated 1,500 to 2,000 cubic yards of soil will be excavated from the gasoline underground storage tank area and the soil boring SP-1 area. NO

During excavation activities, the presence of petroleum hydrocarbons in the soil will be monitored using a photoionization detector (PID). Excavation activities will cease and confirmation samples will be collected once PID readings of soil headspace samples are less than 50 parts per million by volume above background. Previous experience indicates that PID readings are typically an order of magnitude higher than laboratory data for petroleum hydrocarbons. Soil left in-place based on PID readings should contain approximately 5.0 mg/kg of total volatile organic compounds and therefore less than 5.0 mg/kg of benzene.

Impacted soil and groundwater may be present beneath of the utility corridor which is located between the gasoline underground storage tank complex and soil boring SP-1. Redirection or removal of the utilities will be evaluated based on field observations during tank removal and exploratory test pit sampling at soil boring SP-1.

If present, PSH entering the excavation will be skimmed off and temporarily stored onsite in an aboveground tank. Groundwater extracted during PSH skimming will be treated using one or two aqueous phase carbon vessel(s), if necessary, and discharged to the sanitary sewer or storm drain, pending permit acquisition.

Due to the chlorinated hydrocarbon source area associated with the dry cleaner, drawdown of groundwater in the tank excavation will be limited to reduce northward migration of chlorinated hydrocarbons.

Task Seven: Confirmation Soil and Groundwater Sampling and Analysis

Following removal of the significantly impacted soil, samples will be collected at 20-foot intervals along the excavation sidewalls. Soil samples will be collected by driving a 4-inch long brass liner using a hand-held impact sampler into soils collected in a backhoe bucket and analyzed for BTEX using EPA Method 8020. In order to meet the benzene SSTLs for excess cancer 1 x 10^{-4} risk, additional soil will be excavated in areas containing benzene concentrations over 5.0 mg/kg. Selected samples from the soil boring SP-1 area may be analyzed for chlorinated hydrocarbons using EPA Method 8010/601 for disposal/recycling purposes.

Following removal of PSH and immediately prior to backfilling the excavation, a groundwater sample will be collected and analyzed as described above. Residual petroleum hydrocarbon concentrations are expected and will biodegrade over time.

In order to further characterize the site, samples may be collected and analyzed for supplemental risk assessment purposes (e.g., total dissolved solids, total organic carbon, and moisture content).

Task Eight: Backfilling

Upon completion of excavation activities, the excavation will be backfilled, compacted, and resurfaced. Excavated soil determined to be clean (soil containing less than 1.0 mg/kg of BTEX constituents based on analysis of **one sample per 50 cubic yards** of soil) and free of debris and imported fill will be used as backfill material. The backfill material will be compacted in 8 to 12-inch lifts to at least 90% dry Proctor density. Compaction testing may be performed to confirm proper backfill compaction if required. In addition, the utility corridor will be replaced if removed during remedial activities.

The driveway areas will be resurfaced with approximately 12 inches of base material overlain by 4 to 6 inches of asphalt.

Task Nine: Disposal/Recycling

Concrete, asphalt and other debris resulting from station demolition, tank removal and remediation activities will be stockpiled and transported offsite for disposal or recycling. The tanks and piping will be transported as hazardous waste to a metal recycling facility as required by ACHCS.

Up to approximately 2,000 cubic yards of soil generated during excavation will be temporarily stockpiled at the service station and car wash properties. The stockpiles will be bermed and the soil will be placed on and covered with plastic sheeting in accordance with BAAQMD guidelines. The soil will be segregated into "clean" and "impacted" based on observations, photoionization detector measurements, and confirmed by analytical results. Based on the analytical results, the soil stockpiles will be used as backfill, aerated onsite, or transported offsite for treatment and/or disposal, in accordance with EPA guidelines. If necessary for disposal purposes, composite soil samples of the stockpiles will be collected and analyzed.

Fluids generated during tank removal, PSH skimming, and excavation backfilling will be stored in a temporary aboveground tank and/or be transported offsite in vacuum trucks. Pending approval of a permit, fluids in the aboveground tank will be treated using one or two aqueous phase carbon vessels and subsequently discharged to the sanitary sewer or storm drain. Additional samples of the water entering the sanitary sewer or storm drain will be collected and analyzed in accordance with permit requirements. Fluids transported offsite will be recycled at an appropriate facility.

Task Ten: Well Installation

near SP-1

Following excavation activities, one groundwater monitoring well will be installed between the former tank location and the southern property boundary as requested during our February 1996 meeting. The well will be installed using eight-inch diameter hollow-stem augers. The well will be constructed using 2-inch diameter polyvinyl chloride casing. The well will be screened with fifteen feet of 0.010-inch slot and packed with No. 2/12 sand from the bottom the boring to two feet above the top of screen. The sandpack was overlain by a minimum of one foot of bentonite and bentonite-cement grout to the surface. The surface completion will consist of concrete and a traffic-rated well cover.

Following well installation activities, the well will be developed by surging, swabbing and pumping and/or bailing to remove fine-grained sediments from the well casing and sandpack, and align the grains of the water-bearing zone around the screened interval for more efficient groundwater flow. During development, an estimated ten casing volumes of water will be purged from the well. Following development, groundwater samples will be collected from the well and analyzed by a California certified hazardous materials testing laboratory for BTEX constituents using EPA Method 8020/602. Disposal/recycling of soil cuttings and purge water produced during well installation and development will be coordinated with remedial activities described above.

Task Eleven: Tank Closure, Remedial Activities and Well Installation Report

A report will be prepared documenting the tank removal, remediation activities, analytical results, and disposal/recycling procedures. The report will be reviewed, signed, and stamped by a California-registered geologist.

SITE CLOSURE

As described in the LLNL report, the concentrations of residual dissolved petroleum hydrocarbons in groundwater decrease over time once source removal activities are completed. Based on the previous investigation activities, the anticipated results of the source removal, and the biodegradability of petroleum hydrocarbons, the site will qualify as a low-risk groundwater case per RWQCB correspondence dated January 5, 1996.

No additional remedial action is anticipated following completion of this scope of work. If warranted, additional risk assessment based on monitoring data will be conducted for residual petroleum hydrocarbon concentrations.

If you have any questions, please don't hesitate to call us at (510) 420-7910.

Sincerely yours,
PHILIP ENVIRONMENTAL SERVICES CORPORATION

Khaled Rahman, R.G., C.H.G. No. 0261
Project Manager

David C. Tight, R.G., C.H.G.
Operations Manager

KBR
KHALED B. RAHMAN
No. 0261
exp. 7/31/97

Attachments:

Figure 1	-	Site Location Map
Figure 2	-	Site Vicinity Map
Figure 3	-	Exposure Scenario Evaluation Flowchart
Figure 4	-	Health Risk Results and Proposed Remediation Activities
Table 1	-	Groundwater Elevation Data
Table 2	-	Soil Analytical Results
Table 3	-	Groundwater Analytical Results
Table 4	-	Risk Based Screening Level Summary
Table 5	-	Areas Exceeding Risk Based Screening Levels
Table 6	-	Tier 1 and Tier 2 Health Risk Assessment Assumption Comparison
Table 7	-	Site Specific Target Levels
Appendix A	-	Monitoring Well Abandonment Procedures
Appendix B	-	Soil Sampling and Decontamination Procedures
Appendix C	-	Groundwater Sampling and Analysis Procedures

cc: R.T. Nahas, R.T. Nahas Company
Christine Noma, Wendel, Rosen, Black, & Dean
Frank Tien, Tien Unocal

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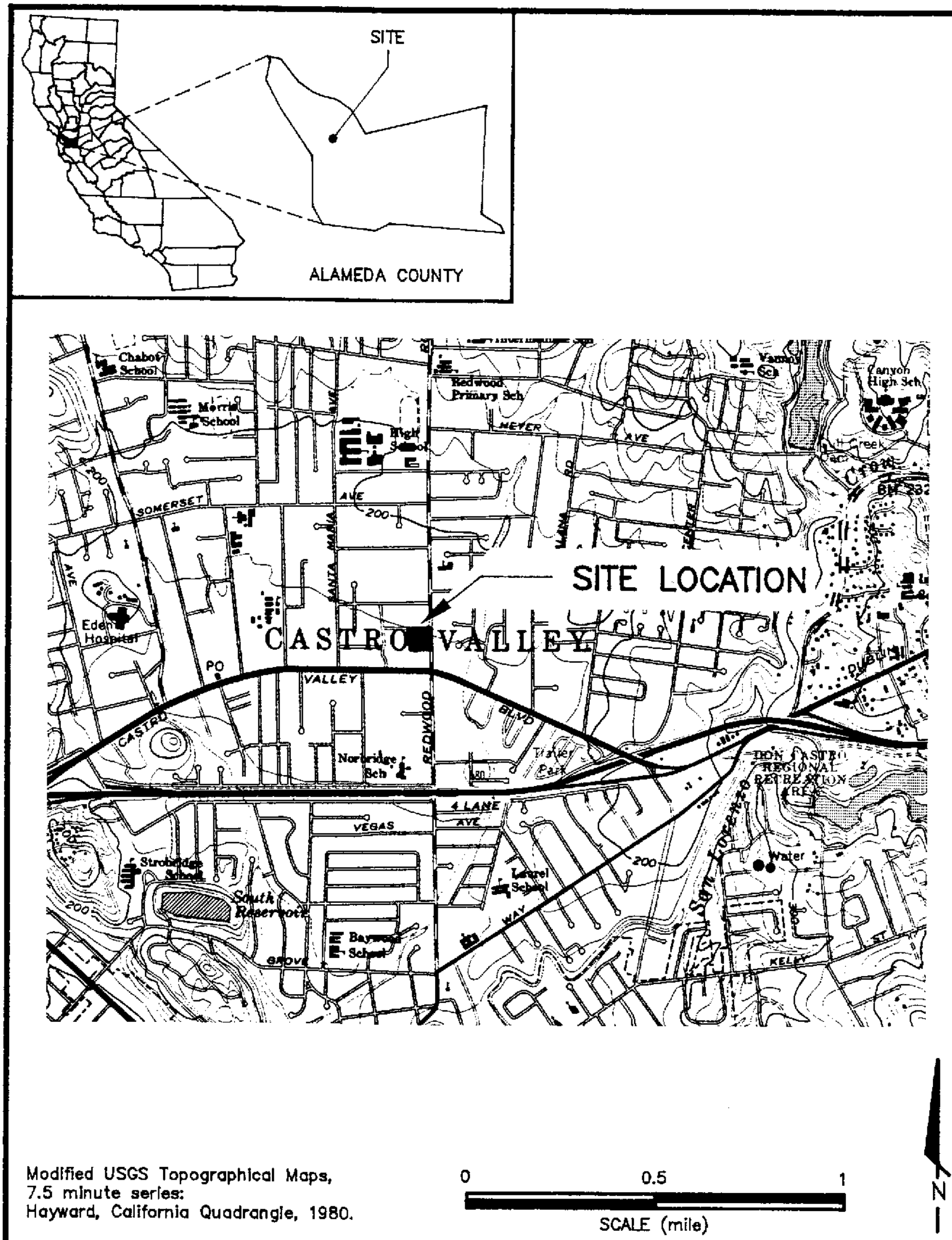
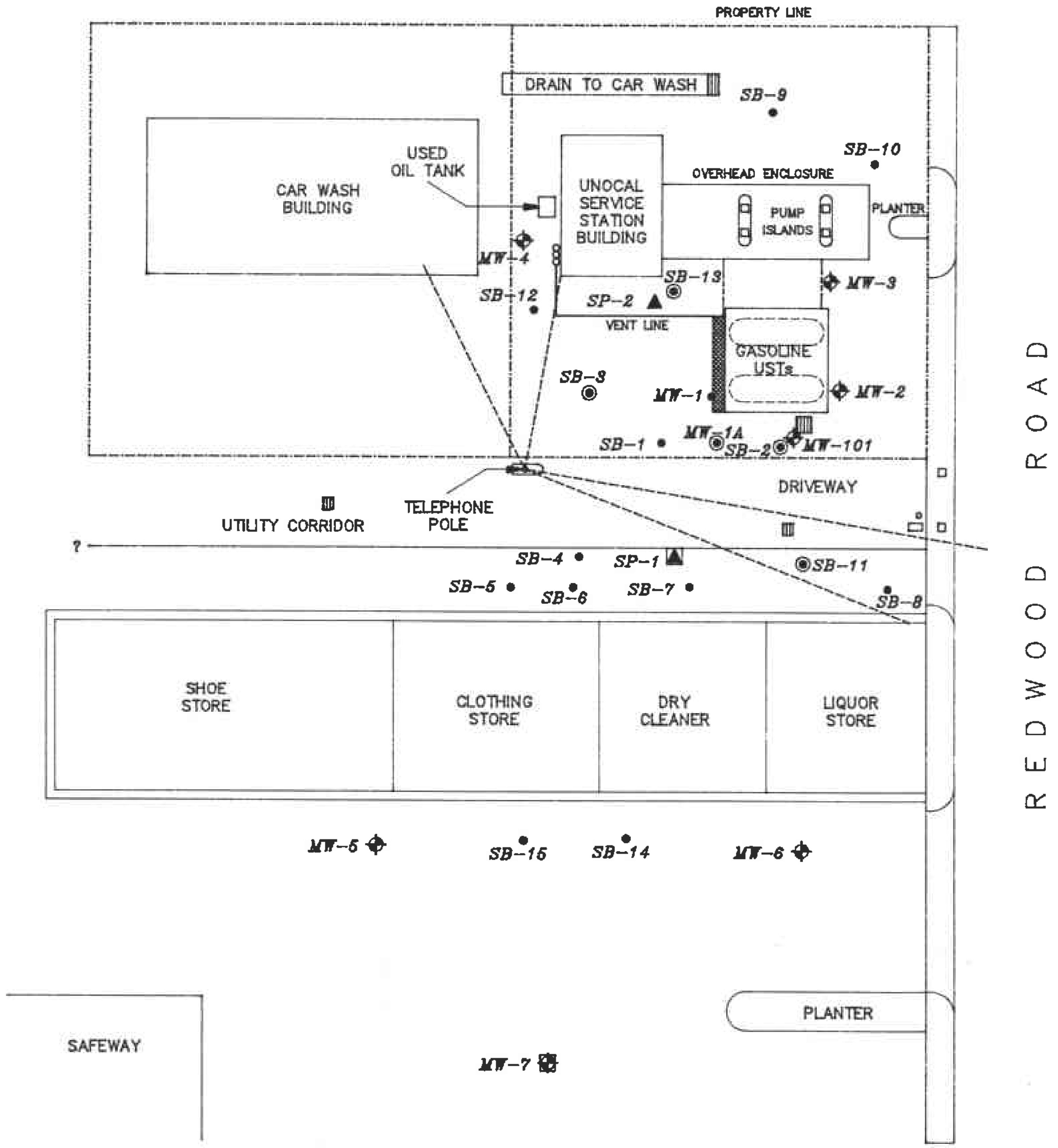


Modified USGS Topographical Maps,
7.5 minute series:
Hayward, California Quadrangle, 1980.

PHILIP ENVIRONMENTAL	SITE LOCATION MAP R.T. Nahas Property 20405 Redwood Road Castro Valley, California	Figure 1
		Project No. 15461
		Drawn By SBW Date 12/11/95
	Reviewed By : Date : 2/12/96	Drawing No. AAMB0101



0 20 40
SCALE (feet)

N

EXPLANATION

MW-4 ⌖	GROUNDWATER MONITORING WELL
SP-2 ▲	SOIL PROBE LOCATION
SB-9 •	SOIL BORING LOCATION
SB-13 ◉	SOIL BORING LOCATION WITH REPORTED PHASE-SEPARATED HYDROCARBONS
SB-13 ▲	SOIL PROBE LOCATION WITH REPORTED CHLORINATED HYDROCARBONS
- - - - - -	OVERHEAD LINE
——— - ———	PRODUCT LINE
—— - - ——	PROPERTY LINE
▥	STORM DRAIN
▨	FORMER TRENCH EXCAVATION
⬭	UNDERGROUND STORAGE TANK

BASED ON A DRAFTING BY BSK ASSOCIATES.

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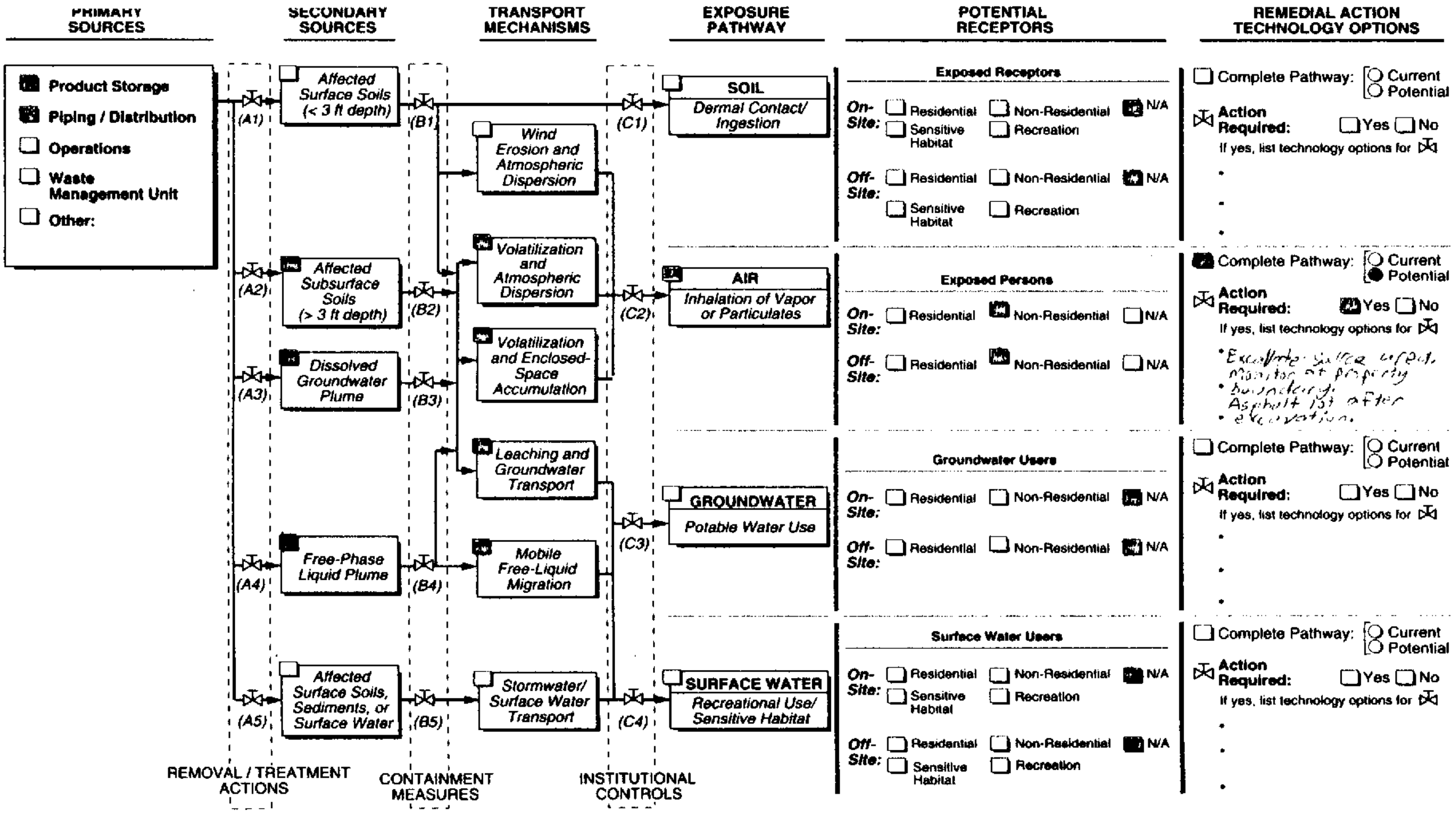
Figure 2
Project No. 15461
Drawn By SBW
Date 1/30/96
Drawing No. BAMB0102

SITE VICINITY MAP
R.T. Nahas Property
20405 Redwood Road
Castro Valley, California

Reviewed By : K. Bal
Date : 2/12/96



Exposed Receptors

On-Site: ☐ Residential ☐ Non-Residential ☒ N/A ☐ Sensitive Habitat ☐ Recreation

Off-Site: ☐ Residential ☐ Non-Residential ☒ N/A ☐ Sensitive Habitat ☐ Recreation

☐ Complete Pathway: ○ Current ○ Potential

Action Required: ☐ Yes ☐ No

If yes, list technology options for

Exposed Persons

On-Site: ☐ Residential ☒ Non-Residential ☐ N/A

Off-Site: ☐ Residential ☒ Non-Residential ☐ N/A

☒ Complete Pathway: ○ Current ● Potential

Action Required: ☒ Yes ☐ No

If yes, list technology options for

- Excavate surface [illegible]. Monitor at property
- boundary. Asphalt lot after
- excavation.

Groundwater Users

On-Site: ☐ Residential ☐ Non-Residential ☒ N/A

Off-Site: ☐ Residential ☐ Non-Residential ☒ N/A

☐ Complete Pathway: ○ Current ○ Potential

Action Required: ☐ Yes ☐ No

If yes, list technology options for

Surface Water Users

On-Site: ☐ Residential ☐ Non-Residential ☒ N/A ☐ Sensitive Habitat ☐ Recreation

Off-Site: ☐ Residential ☐ Non-Residential ☒ N/A ☐ Sensitive Habitat ☐ Recreation

☐ Complete Pathway: ○ Current ○ Potential

Action Required: ☐ Yes ☐ No

If yes, list technology options for

MODIFIED FROM A GROUNDWATER SERVICES INC. WORKSHEET.

PHILIP ENVIRONMENTAL

EXPOSURE SCENARIO EVALUATION FLOWCHART
R.T. Nahas Property
20405 Redwood Road
Castro Valley, California

Figure 3

Project No. 15461

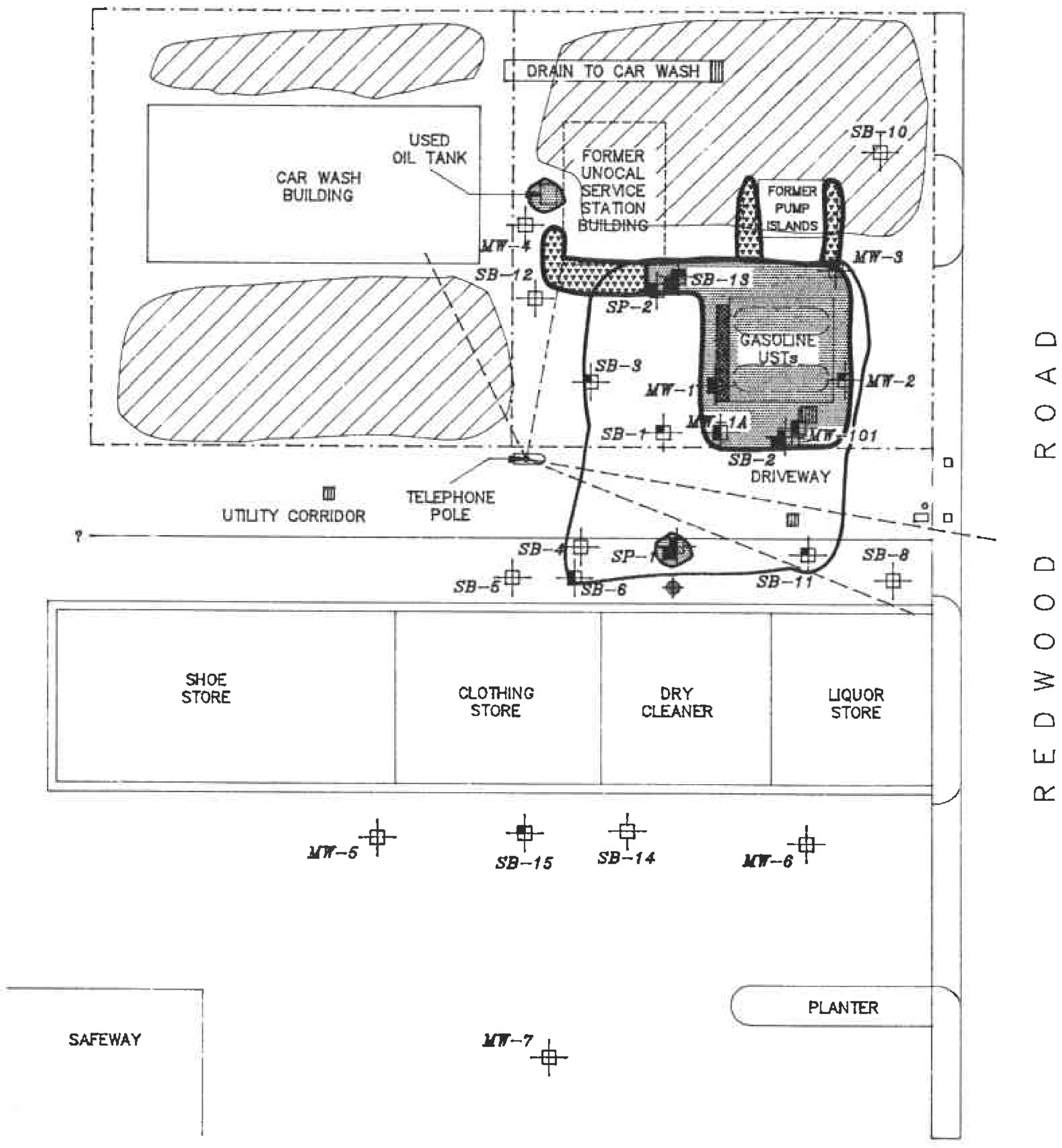
Drawn By SBW

Date 6/13/96

Reviewed By : VBR

Date : 6/14/96

Drawing No. AAMB0105



EXPLANATION

◆	PROPOSED POST-REMEDIATION GROUNDWATER MONITORING WELL LOCATION
⊞	BENZENE CONCENTRATIONS OVER TIER 1 LEVELS OF 0.0032 mg/kg IN SOIL OR 2.9 ug/L IN GROUNDWATER
⊞	TOLUENE CONCENTRATIONS OVER TIER 1 LEVELS OF 54.5 mg/kg IN SOIL OR 20,400 ug/L IN GROUNDWATER
⊞	BENZENE CONCENTRATIONS OVER TIER 2 LEVELS (1 x 10^{-6}) OF 0.29 mg/kg IN SOIL OR 29 ug/L IN GROUNDWATER
⊞	TOLUENE CONCENTRATIONS OVER TIER 2 LEVELS OF 1,200 mg/kg IN SOIL OR 120,000 ug/L IN GROUNDWATER
⊞	BENZENE CONCENTRATIONS OVER TIER 2 LEVELS (1 x 10^{-4}) OF 5.2 mg/kg IN SOIL OR 560 ug/L IN GROUNDWATER
– – – –	OVERHEAD LINE
———	PRODUCT LINE
–·–·–	PROPERTY LINE
▥	STORM DRAIN
▩	FORMER TRENCH EXCAVATION
⬭	UNDERGROUND STORAGE TANK
⬭	POTENTIAL MAXIMUM EXCAVATION EXTENT
▨	PROPOSED SOIL STOCKPILE
▩	ANTICIPATED EXCAVATION TO FOUR FEET BELOW GROUND SURFACE
▩	ANTICIPATED EXCAVATION TO SIXTEEN FOOT BELOW GROUND SURFACE

RISK TARGET LEVELS BASED ON 1 x 10^{-6} OR 1 x 10^{-4} EXCESS CANCER RISK, OR 1.0 NON-CARCINOGENIC CHRONIC HAZARD QUOTIENT.

BASED ON A DRAFTING BY BSK ASSOCIATES.

PHILIP
ENVIRONMENTAL

Figure 4
Project No. 15461
Drawn By SBW
Date 6/14/96
Drawing No. BAMB0104

HEALTH RISK RESULTS AND PROPOSED REMEDIATION ACTIVITIES
R.T. Nahas Property
20405 Redwood Road
Castro Valley, California

Reviewed By : LDR
Date : 6/14/96

Table 1
GROUNDWATER ELEVATION DATA

R.T. Nahas Property

Castro Valley, California

Well	Date Measured	Total Depth (ft-BTOC)	TOC Elevation (ft-MSL)	Depth to Water (ft-BTOC)	Water Elevation (ft-MSL)
MW-2	12/14/89	30	188.60	10.98	177.62
	8/7/90	30	188.60	11.31	177.29
	4/2/91	30	188.60	9.90	178.70
	10/17/91	-	188.60	11.75	176.85
	1/8/92	-	188.60	9.86	178.74
	10/12/95	28.85	183.47	10.66	172.81
MW-3	12/14/89	30	189.02	11.23	177.79
	8/7/90	30	189.02	11.27	177.75
	4/2/91	30	189.02	10.15	178.87
	10/17/91	-	189.02	11.97	177.05
	1/8/92	-	189.02	10.05	178.97
	10/12/95	29.05	184.03	10.97	173.06
MW-4	12/14/89	25	189.70	12.10	177.60
	8/7/90	25	189.70	12.19	177.51
	4/2/91	25	189.70	10.75	178.95
	10/17/91	-	189.70	13.00	176.70
	1/8/92	-	189.70	11.03	178.67
	10/12/95	24.55	184.61	11.70	172.91
MW-5	4/27/94	-	183.62	11.72	171.90
	10/12/95	34.50	183.92	12.12	171.80
MW-6	4/27/91	-	183.70	11.90	171.80
	10/12/95	26.78	183.60	12.32	171.28
MW-7	4/27/91	-	182.52	10.97	171.55
	10/12/95	28.00	182.42	11.34	171.08

NM: Not Measured
TOC: Top of casing
ft-BTOC: Feet below top of casing
ft-MSL: Feet above mean sea level

Table 2
SOIL ANALYTICAL RESULTS
BSK & Associates Investigation Activities

R.T. Nahas Property
Castro Valley, California

Sample No.	Date	Sample Depth (ft-BGS)	TVH (mg/kg)	TPH (mg/kg)	TOG (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)	VOCs (mg/kg)	Total Lead (mg/kg)
	EPA Analytical Method:		8015m	8015m	413.1	8020	8020	8020	8020	8010	DHS-LUFT
MW-1	12/5/89	5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/5/89	10	**89**	-	-	**1.8**	**7.8**	**3.8**	**20**	-	-
	12/5/89	15	ND(<10)	-	-	**0.09**	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/5/89	19	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
MW-1A	12/7/89	5	ND(<10)	ND(<10)	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	ND(<2.0)
	12/7/89	10	**110**	**50***	-	**2.2**	**11**	**5.4**	**25**	-	ND(<2.0)
	12/7/89	13	**11**	ND(<10)	-	**0.64**	**0.71**	**0.64**	**3.5**	-	ND(<2.0)
	12/7/89	16.5	-	ND(<10)	-	-	-	-	-	-	ND(<2.0)
MW-2	12/4/89	5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/4/89	10	ND(<10)	-	-	**0.05**	ND(<0.02)	ND(<0.02)	**0.03**	-	-
	12/4/89	15	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/4/89	20	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
MW-3	12/5/89	5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/5/89	10	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
	12/5/89	15	**92**	-	-	ND(<0.02)	ND(<0.02)	**0.97**	**4.0**	-	-
	12/5/89	19	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
MW-4	12/7/89	5	-	ND(<10)	ND(<100)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<varies)	-
	12/5/89	8.5	-	ND(<10)	ND(<100)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<varies)	-
	12/5/89	13	-	ND(<10)	ND(<100)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<varies)	-
SB-1	3/13/91	14.5	ND(<10)	-	-	**0.05**	**0.03**	ND(<0.02)	**0.06**	-	-
SB-2	3/13/91	10.5	**440**	-	-	**4.5**	**18**	**11**	**55**	-	-
	3/13/91	13	**810**	**340***	-	**5.3**	**4.2**	**13**	**76**	-	ND(<2.0)
SB-3	3/13/91	13.5	**15**	ND(<10)	-	**0.09**	**0.18**	**0.19**	**1.1**	-	ND(<2.0)
	3/13/91	17	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
SB-4	3/13/91	14	ND(<10)	ND(<10)	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	**0.10**	-	-
SB-5	3/13/91	14.5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
SB-6	3/14/91	15	**310**	-	-	**0.80**	**15**	**6.2**	**36**	-	-

Table 2
SOIL ANALYTICAL RESULTS (continued)
BSK & Associates Investigation Activities

R.T. Nahas Property
Castro Valley, California

Sample No.	Date	Sample Depth (ft-BGS)	TVH (mg/kg)	TPH (mg/kg)	TOG (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)	VOCs (mg/kg)	Total Lead (mg/kg)
EPA Analytical Method:			8015m	8015m	413.1	8020	8020	8020	8020	8010	DHS-LUFT
SB-7	3/14/91	11	**Not sampled**								
SB-8	3/14/91	20.5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
SB-10	3/14/91	16	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
SB-11	3/28/91	10.5	**31**	-	-	**0.09**	**0.03**	**0.49**	**1.8**	-	-
SB-12	3/28/91	15.5	ND(<10)	-	-	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.02)	-	-
SB-13	3/28/91	10.5	**1,100**	-	-	**5.5**	**67**	**27**	**140**	-	-
	3/28/91	14	**530**	-	-	**7.8**	**48**	**14**	**73**	-	-
SB-14	3/30/92	21	ND(<1)	ND(<1)	-	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.005)	-	-
SB-15	3/30/92	20.5	ND(<1)	**3.0**	-	**0.007**	**0.008**	ND(<0.005)	ND(<0.005)	-	-
MW-5	3/31/92	21	ND(<1)	ND(<1)	-	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.005)	-	-
MW-6	4/1/92	16	ND(<1)	ND(<1)	-	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.005)	-	-
MW-7	4/2/92	15.5	ND(<1)	ND(<1)	-	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.005)	-	-
SP-1	11/18/93	16	ND(<1)	-	-	**0.18**	ND(<0.005)	**0.075**	**0.055**	ND(<varies)	-
SP-2	11/18/93	14	**9**	-	-	**0.14**	**0.52**	**0.19**	**1.0**	ND(<varies)	-
MW-101	9/26/95	10	**120**	-	-	ND(<0.005)	**0.95**	**2.1**	**11**	-	-
		15	**63**	-	-	ND(<0.005)	**1.5**	**0.87**	**9.8**	-	-

Soil analytical results presented in milligrams per kilogram.

*	Laboratory reports that TPH quantified represents interference with TVH
EPA	Environmental Protection Agency
ft-BGS	Feet below ground surface
mg/kg	Milligrams per kilogram
ND	Concentration below detection limit presented in parentheses
TOG	Total Oil and Grease
TVH	Total Volatile Hydrocarbons
TPH	Total Petroleum Hydrocarbons

Table 3
GROUNDWATER ANALYTICAL RESULTS
BSK & Associates Investigation Activities

R.T. Nahas Property
Castro Valley, California

Sample No.	Date	TVH (ug/l)	TPHd (ug/l)	TOG (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethyl-benzene (ug/l)	Total Xylenes (ug/l)	VOCs (ug/l)
EPA Analytical Method:		8015m	8015m	413.1	602	602	602	602	601
MW-2	12/14/89	72	-	-	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	-
	8/7/90	180	-	-	21	3.9	7.2	28	-
	1/91	430	-	-	50	33	22	110	-
	4/2/91	4,800	-	-	640	520	170	790	-
	7/91	220	-	-	14	1.0	8.0	17	-
	10/17/91	170	-	-	2.9	ND(<0.3)	2.5	6.0	-
	1/8/92	5,200	-	-	480	870	160	860	-
	4/20/92	300	-	-	70	0.30	15	7.0	-
	7/92	84	-	-	10	ND	0.60	2.3	-
	10/92	ND	-	-	2.3	ND	2.3	3.0	-
	1/93	170	-	-	11	5.1	1.4	6.3	-
	3/93	720	-	-	110	32	67	28	-
	7/93	220	-	-	17	1.1	6.0	12	-
	10/93	98	-	-	4	ND	2.3	3.1	-
	1/94	130	-	-	13	3.4	4.9	9.2	-
	4/94	270	-	-	23	1.1	8.2	17	-
	7/94	180	-	-	14	0.70	5.8	12	-
	10/94	97	-	-	2.8	ND	2.9	1.8	-
	1/95	440	-	-	48	5.8	15.0	27	-
	4/95	480	-	-	72	2.8	47.0	22	-
	10/12/95	450	-	-	7.4	ND(<0.3)	5.1	5.5	-
MW-3	12/14/89	ND(<50)	-	-	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	-
	8/7/90	290	-	-	55	3.8	20	59	-
	1/91	110			29	3.3	9.7	34	-
	4/2/91	3,600	-	-	450	270	150	760	-
	7/91	220	-	-	14	14	8.0	33	-
	10/17/91	ND(<50)	ND	ND	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
	1/8/92	60			4.0	10	2.0	8.0	-
	4/20/92	ND(<50)	-	-	1.0	0.40	ND(<0.3)	0.90	-
	7/92	ND	-	-	1.3	0.40	ND	1.3	-
	10/92	ND	-	-	2.1	ND	ND	0.30	-
	1/93	ND	-	-	1.2	1.0	0.60	4.1	-
	3/93	330	-	-	32	0.90	64	13	-
	7/93	330	-	-	24	11	14	82	-
	10/93	ND	-	-	5.0	ND	0.60	1.2	-
	1/94	69	-	-	5.5	2.1	2.6	14	-
	4/94	62	-	-	17	1.0	4.9	24	-
	7/94	52	-	-	7.2	0.40	1.6	4.6	-
	10/94	ND	-	-	0.90	ND	ND	ND	-
	1/95	250	-	-	24	ND	14	45	-
	4/95	450	-	-	26	0.6	40	19	-
	10/12/95	340	-	-	9.0	3.9	8.5	34	-

Table 3
GROUNDWATER ANALYTICAL RESULTS (continued)
BSK & Associates Investigation Activities

R.T. Nahas Property
Castro Valley, California

Sample No.	Date	TVH (ug/l)	TPHd (ug/l)	TOG (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethyl-benzene (ug/l)	Total Xylenes (ug/l)	VOCs (ug/l)
EPA Analytical Method:		8015m	8015m	413.1	602	602	602	602	601
MW-4	12/14/89	ND(<50)	ND(<100)	ND(<5,000)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<varies)
	8/7/90	ND(<50)	ND(<100)	ND(<1,000)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	-
	4/2/91		ND(<100)	ND(<1,000)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	-
	10/17/91	ND(<50)	ND(<100)	ND(<1,000)	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
	4/20/92	ND(<50)	ND(<50)	ND(<1,000)	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
	10/92	ND	120	ND	ND	ND	ND	ND	-
	1/93	ND	ND	ND	ND	ND	ND	ND	-
	3/93	ND	ND	ND	ND	ND	ND	ND	-
	7/93	ND	ND	1,000	ND	ND	ND	ND	-
	10/93	ND	ND	ND	0.40	ND	ND	0.40	-
	4/94	ND	ND	ND	ND	ND	ND	0.40	-
	7/94	ND	86	ND	ND	0.60	ND	ND	-
	10/94	ND	ND	ND	ND	36	ND	1.3	-
	1/95	ND	ND	2,000	ND	ND	ND	ND	-
	4/95	ND	ND	ND	ND	ND	ND	ND	-
	10/12/95	ND(<50)	ND(<50)	-	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
MW-5	4/13/92	ND(<50)	-	-	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
	7/92	ND	-	-	ND	ND	ND	ND	-
	10/92	ND	-	-	ND	0.40	ND	ND	-
	1/93	ND	-	-	ND	ND	ND	ND	-
	3/93	ND	-	-	ND	ND	ND	ND	-
	7/93	ND	-	-	ND	ND	ND	ND	-
	10/93	ND	-	-	ND	ND	ND	ND	-
	4/94	ND	-	-	ND	0.40	ND	1.0	-
	10/94	87	-	-	ND	71	0.40	1.7	-
	4/95	ND	-	-	ND	ND	ND	ND	-
	10/12/95	ND(<50)	-	-	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
MW-6	4/13/92	ND(<50)	-	-	ND(<0.3)	0.30	ND(<0.3)	ND(<0.3)	-
	7/92	ND	-	-	ND	ND	ND	ND	-
	10/92	ND	-	-	ND	ND	ND	ND	-
	1/93	ND	-	-	ND	ND	ND	ND	-
	3/93	ND	-	-	ND	ND	ND	ND	-
	7/93	ND	-	-	ND	ND	ND	ND	-
	10/93	ND	-	-	ND	ND	ND	ND	-
	4/94	ND	-	-	ND	0.30	ND	0.40	-
	10/94	ND	-	-	0.40	140	0.50	2.3	-
	4/95	ND	-	-	ND	ND	ND	ND	-
	10/12/95	ND(<50)	-	-	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-
MW-7	4/13/92	1,300*	-	-	0.40	0.30	0.30	0.90	-
	7/92	830*	-	-	ND	ND	ND	ND	-
	10/92	3,900*	-	-	ND	ND	ND	ND	-
	1/93	1,900*	-	-	ND	ND	ND	ND	-
	3/93	830*	-	-	ND	ND	ND	ND	-
	7/93	680*	-	-	ND	ND	ND	ND	-
	10/93	360*	-	-	ND	ND	ND	0.70	-
	1/94	330*	-	-	ND	ND	ND	ND	-
	4/94	360*	-	-	ND	ND	ND	ND	-
	4/95	-	-	-	ND	ND	ND	ND	-
	10/12/95	-	-	-	ND(<0.3)	ND(<0.3)	ND(<0.3)	ND(<0.3)	-

Table 3
GROUNDWATER ANALYTICAL RESULTS (continued)
BSK & Associates Investigation Activities

R.T. Nahas Property
Castro Valley, California

Sample No.	Date	TVH (ug/l)	TPHd (ug/l)	TOG (ug/l)	Benzene (ug/l)	Toluene (ug/l)	Ethylbenzene (ug/l)	Total Xylenes (ug/l)	VOCs (ug/l)
EPA Analytical Method:		8015m	8015m	413.1	602	602	602	602	601
SP-1	11/18/93	**49,000**	-	-	**3,900**	**13,000**	**2,800**	**15,000**	**
SP-2	11/18/93	**1,400**	-	-	**54**	**240**	**87**	**390**	ND(<varies)
MW-101	9/27/95	**9,400**	-	-	**170**	**94**	**150**	**710**	-

Water analyses presented in micrograms per liter or milligrams per liter as noted.

*	Gas chromatograph noted as not typical of gasoline. Laboratory indicates value reflects discrete peaks.
**	Sample contained 12 ug/l of 1,2 dichloroethane, 28 ug/l of cis-1,2-dichloroethene, 15 ug/l of trans-1,2-dichloroethene, 22 ug/l of tetrachloroethene, and 20 ug/l of trichloroethene.
EPA	Environmental Protection Agency
ND	Concentration below detection limit presented in parentheses
TVH	Total Volatile Hydrocarbons
TPHd	Total Petroleum Hydrocarbons as Diesel
TOG	Total Oil and Grease
ug/l	microgram per liter
VOCs	volatile organic compounds

Table 4
RISK BASED SCREENING LEVEL SUMMARY
Tier 1 Health Risk Assessment

R.T. Nahas Property
Castro Valley, California

Media	Exposure Pathway	Receptor Scenario	Target Level*	Benzene	Toluene	Ethyl-benzene	Total Xylenes
CARCINOGENS	BENZENE						
SOIL	Volatilization to Outdoor Air (mg/kg)	Commercial/Industrial	1.00E-06	0.13	-	-	-
	Vapor intrusion from Soil to Building (mg/kg)	Commercial/Industrial	1.00E-06	0.0032 49	-	-	-
NA	Surficial Soil ingestion/dermal/inhalation (mg/kg)	Commercial/Industrial	1.00E-06	2.9			
NA	Leachate to protect Groundwater ingestion Target Level (mg/kg)	Commercial/Industrial	1.00E-06	0.017	-	-	-
GROUNDWATER	Volatilization to Outdoor Air (ug/l)	Commercial/Industrial	1.00E-06	~~7,800~~ 5340 ~~5,840~~	-	-	-
NA	Groundwater Ingestion (ug/l)	Commercial/Industrial	1.00E-06	2.9	-	-	-
	Vapor intrusion from groundwater to Buildings (ug/l)	Commercial/Industrial	1.00E-06	21.4	-	-	-
NONCARCINOGENS							
SOIL	Volatilization to Outdoor Air (mg/kg)	Commercial/Industrial	1	-	res	res	res
	Vapor intrusion from Soil to Building (mg/kg)	Commercial/Industrial	1	-	54.5	1,100	res
	Surficial Soil ingestion/dermal/inhalation (mg/kg)	Commercial/Industrial	1	-	18,700	11,500	208,000
	Leachate to protect Groundwater ingestion Target Level (mg/kg)	Commercial/Industrial	1	-	361	1,610	res
GROUNDWATER	Volatilization to Outdoor Air (ug/l)	Commercial/Industrial	1	-	>S	>S	>S
	Groundwater Ingestion (ug/l)	Commercial/Industrial	1	-	20,400	10,200	>S
	Vapor intrusion from groundwater to Buildings (ug/l)	Commercial/Industrial	1	-	85,000	>S	>S

*	Target level set to one in one million excess cancer risk for carcinogens, and a hazard quotient of over 1 for noncarcinogens.
ASTM RBSLs	American Society of Testing and Materials Risk based screening levels presented on Tier 1 Lookup Table (ASTM, E-1739-95). Benzene levels modified by multiplying by 0.29 as requested in Regional Water Quality Control Board - San Francisco Bay Region Supplemental Information dated January 5, 1996.
mg/kg	milligram per kilogram
ug/l	microgram per liter
res	selected risk level is not exceeded for pure compound at any concentration
>S	selected risk level is not exceeded for all possible dissolved concentrations

Table 5
AREAS EXCEEDING RISK BASED SCREENING LEVELS
Tier 1 Health Risk Assessment

R.T. Nahas Property
Castro Valley, California

Sample Location	PSH Noted	Soil Volatilization to Outdoor Air	Soil Vapor Intrusion From Soil to Building	Surficial Soil Ingestion/ Dermal/ Inhalation	Soil Leachate to Protect Water Quality	Groundwater Volatilization to Outdoor Air	Groundwater Ingestion	Groundwater Vapor Intrusion From Groundwater to Building
MW-1	-	B	B	-	B	NS	NS	NS
MW-1A	Yes	B	B	-	B	NS	NS	NS
MW-2	-	-	B	-	B	-	B	-
MW-3	-	-	-	-	-	-	B	-
MW-4	-	-	-	-	-	-	-	-
SB-1	-	-	B	-	B	NS	NS	NS
SB-2	Yes	B	B	B	B	NS	NS	NS
SB-3	Yes	-	B	-	B	NS	NS	NS
SB-4	-	-	-	-	-	NS	NS	NS
SB-5	-	-	-	-	-	NS	NS	NS
SB-6	-	B	B	-	B	NS	NS	NS
SB-7	-	NS	NS	NS	NS	NS	NS	NS
SB-8	-	-	-	-	-	NS	NS	NS
SB-9	-	NS	NS	NS	NS	NS	NS	NS
SB-10	-	-	-	-	-	NS	NS	NS
SB-11	Yes	-	B	-	B	NS	NS	NS
SB-12	-	-	-	-	-	NS	NS	NS
SB-13	Yes	B	B,T	B	B	NS	NS	NS
SB-14	-	-	-	-	-	NS	NS	NS
SB-15	-	-	B	-	-	NS	NS	NS
MW-5	-	-	-	-	-	-	-	-
MW-6	-	-	-	-	-	-	-	-
MW-7	-	-	-	-	-	-	-	-
SP-1	-	B	B	-	B	-	B	B
SP-2	-	B	B	-	B	-	B	B
MW-101	-	-	-	-	-	-	B	B

B,T, E, X	Detected constituent concentration exceeds RBSLs and requires remediation or further evaluation (B - benzene, T - toluene, E - ethylbenzene, X - xylenes)
-	Detected concentrations do not exceed RBSLs and remediation is not required
NS	Not sampled
PSH	Phase separated hydrocarbons
RBSLs	Risk based screening levels

NHS101\CAP\2001RA02.XLS

Table 6
TIER 1 AND TIER 2 HEALTH RISK ASSESSMENT ASSUMPTION COMPARISON

R.T. Nahas Property
Castro Valley, California

Parameters	Definition (Units)	Tier 1 RBSL Look-Up Table Values	Tier 2 SSTL RBCA Tool Kit Values	Comments
Surface				
A	Contaminated soil area (cm^2)	-	**2.8E+06**	Modified based on site investigation data
W	Length of affected soil parallel to wind (cm)	1.5E+03	**2.3E+03**	Modified based on site investigation data
W.gw	Length of affected soil parallel to groundwater (cm	-	**2.3E+03**	Modified based on site investigation data
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	2.0E+02	
Lss	Definition of surficial soils (cm)	1.0E+02	1.0E+02	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	**2.2E-10**	Tool Kit default
Groundwater				
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02	2.0E+02	
I	Groundwater infiltration rate (cm/yr)	3.0E+01	3.0E+01	
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03	**6.0E+02**	Modified based on site investigation data
Ugw.tr	Groundwater Transport velocity (cm/yr)	-	**2.0E+03**	Modified based on site investigation data
Ks	Saturated Hydraulic Conductivity(cm/s)	-	**2.7E-03**	Modified based on site investigation data
grad	Groundwater Gradient (cm/cm)	-	**7.0E-03**	Modified based on site investigation data
phi.eff	Effective Porosity in Water-Bearing Unit	3.8E-01	**3.0E-01**	Modified based on site investigation data
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-02	**1.0E-03** to **1.0E-01**	Range of values based on site investigation data
Soil				
hc	Capillary zone thickness (cm)	5.0E+00	~11' – 21' 5.0E+00	~12"
hv	Vadose zone thickness (cm)	3.0E+02	**3.4E+02** to **6.4E+02**	Range of values based on site investigation data
rho	Soil density (g/cm^3)	1.7E+00	1.7E+00	
foc	Fraction of organic carbon in vadose zone	1.0E-02	**1.0E-03** to **1.0E-01**	Range of values based on site investigation data
phi	Soil porosity in vadose zone	3.8E-01	**3.0E-01**	Modified based on site investigation data
Lgw	Depth to groundwater (cm)	3.0E+02	**3.4E+02** to **6.5E+02**	Range of values based on site investigation data
Ls	Depth to top of affected soil (cm)	1.0E+02	1.0E+02 to **6.4E+02**	Range of values based on site investigation data
Lsubs	Thickness of affected subsurface soils (cm)	-	**1.5E+01** to **5.6E+02**	Range of values based on site investigation data
pH	Soil/groundwater pH	-	6.5E+00	
phi.w	Volumetric water content - Capiillary	3.4E-01	**2.7E-01**	Modified based on site investigation data
phi.a	Volumetric air content - Capillary	3.8E-02	**3.0E-02**	Modified based on site investigation data
phi.w	Volumetric water content - Vadose	1.2E-01	**9.4E-02**	Modified based on site investigation data
phi.a	Volumetric air content - Vadose	2.6E-01	**2.1E-01**	Modified based on site investigation data
phi.w	Volumetric water content - Foundation	1.2E-01	**9.4E-02**	Modified based on site investigation data
phi.a	Volumetric air content - Foundation	2.6E-01	**2.1E-01**	Modified based on site investigation data

Table 6 (Continued)
TIER 1 AND TIER 2 HEALTH RISK ASSESSMENT ASSUMPTION COMPARISON

R.T. Nahas Property
Castro Valley, California

Parameters	Definition (Units)	Tier 1 RBSL Look-Up Table Values	Tier 2 SSTL RBCA Tool Kit Values	Comments
Building				
Lb	Building volume/area ratio (cm)	3.0E+02	3.0E+02	which receptor? - station building or strip mall
ER	Building air exchange rate (s^-1)	2.3E-04	2.3E-04	
Lcrk	Foundation crack thickness (cm)	1.5E+01	1.5E+01	
eta	Foundation crack fraction	1.0E-02	1.0E-02	

Tier 1 RBSL Look-Up Table Values from Table X2.6 of ASTM E 1739-95

Tier 2 SSTL RBCA Tool Kit Values reflect data input for computer model prepared by Groundwater Services, Inc. of Houston, Texas

Emboldened Tier 1 and Tier 2 values differ.

ASTM	American Society for Testing and Materials
cm	centimeter
g	gram
L	Liter
mg	milligram
RBCA	Risk Based Corrective Action
RBSL	Risk Based Screening Level
s	second
SSTL	Site Specific Target Level
yr	year

Table 7
SITE SPECIFIC TARGET LEVELS
Tier 2 Health Risk Assessment

R.T. Nahas Property
Castro Valley, California

Varying Parameters	Definition (Units)	CAPILLARY FRINGE								
		DTW = 11' Impacted Soil 0.5' Thick			DTW = 16' Impacted Soil 0.5' Thick			DTW = 21' Impacted Soil 0.5' Thick		
Groundwater										
foc.sat	Fraction organic carbon in water-bearing unit	0.001	0.01	0.10	0.001	0.01	0.10	0.001	0.01	0.10
Soil										
foc	Fraction of organic carbon in vadose zone	0.001	0.01	0.10	0.001	0.01	0.10	0.001	0.01	0.10
hv	Vadose zone thickness (cm)	335	335	335	488	488	488	640	640	640
Lgw	Depth to groundwater (cm)	340	340	340	493	493	493	645	645	645
Ls	Depth to top of affected soil (cm)	335	335	335	488	488	488	640	640	640
Lsubs	Thickness of affected subsurface soils (cm)	15	15	15	15	15	15	15	15	15
Excess Cancer Risk > 1.0E-06										
SSTL - Benzene	Surface Soil (mg/kg)	13	13	13	13	13	13	13	13	13
SSTL - Benzene	Subsurface Soil (mg/kg)	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
SSTL - Benzene	Groundwater (ug/L)	29	29	29	32	32	32	32	32	32
Excess Cancer Risk > 1.0E-04										
SSTL - Benzene	Surface Soil (mg/kg)	res	res	1305	res	res	1,305	res	res	1,305
SSTL - Benzene	Subsurface Soil (mg/kg)	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
SSTL - Benzene	Groundwater (ug/L)	522	522	522	551	551	551	551	551	551
Noncarcinogenic Chronic Hazard Quotient > 1										
SSTL - Toluene	Surface Soil (mg/kg)	res	res	res	res	res	res	res	res	res
SSTL - Toluene	Subsurface Soil (mg/kg)	res	res	1,200	res	res	1,200	res	res	1,200
SSTL - Toluene	Groundwater (ug/L)	120,000	120,000	120,000	120,000	120,000	120,000	130,000	130,000	130,000

?

Pathway?
- vapor from soil
- vapor from GW
receptor?

Values determined using the Tier 2 RBCA Tool Kit prepared by Groundwater Services, Inc. of Houston, Texas.

Benzene levels modified by multiplying model results by 0.29 as requested in Regional Water Quality Control Board - San Francisco Bay Region Supplemental Information dated January 5, 1996.

cm	Centimeter
DTW	Depth to Water (below ground surface)
g	Gram
kg	Kilogram
L	Liter
mg	Milligram
res	Target risk levels are not exceeded for pure compound present at any concentration.
s	Second
SSTL	Site Specific Target Level
ug	Microgram
yr	year

APPENDIX A

Monitoring Well Abandonment Procedures

APPENDIX A

Monitoring Well Abandonment Procedures

Groundwater monitoring wells are decommissioned (abandoned) by either (1) pressure grouting or (2) over-drilling and grouting. The method used is dependent on the construction of the well and local regulatory guidelines.

Wells decommissioned by pressure grouting are sealed by pumping bentonite-cement grout into the casing of the well. The pressure-grout method fills the entire casing length and forces grout through the screened interval of the casing, which seals the void space of the sand pack. Pressure grouting effectively seals the well without producing soil cuttings. If required, the well box and the upper five feet of the well may be removed.

Wells are decommissioned by over-drilling with hollow-stem augers that are larger than those used during well installation. During over-drilling, the well casing and annular materials (i.e., sand pack and surface seal) are removed and the boring is sealed with bentonite-cement grout. Soils and debris are generally stockpiled or stored in drums for subsequent removal.

APPENDIX B

Soil Sampling
and
Decontamination Procedures

APPENDIX B

Soil Sampling
and
Decontamination
Procedures

EXPLORATORY TRENCHING

Before the exploratory trenches are initiated, permits are obtained, if necessary, from the appropriate agencies, and an underground utility-locating service is hired to clear the proposed investigation area for subsurface utilities. In addition, Underground Service Alert (USA) is contacted to schedule visits to the site by public and private utility companies. Each company locates it's utilities with the aid of maps, and the locating service verifies and marks these locations. All utility clearances are coordinated with the client or client representative before site activities begin.

SOIL SAMPLING

In general, soil samples are collected by driving a four-inch long brass liner into the soil with a hand-held impact sampler. Each soil sample is sealed inside the brass liners with aluminum foil (shiny side towards the sample) or Teflon™ tape, polypropylene end caps, and wrapped with duct tape. The soil samples are labeled, and stored in an iced cooler for shipment to a California Department of Health Services (DHS)-approved laboratory. At the time of sampling, each sample is logged on a Chain-of-Custody record which accompanies the sample to the laboratory. Soil samples selected for analysis have the request for analysis noted on the Chain-of-Custody. The remaining soil samples are sent to the laboratory on a hold-for-analysis basis.

In general, soil samples are selected for chemical analysis using a photoionization detector (PID). The PID determines the relative concentration of total volatile organic compounds. The soil samples are selected for analysis where (1) the PID reading first detects a reading above the background level, (2) at the point above this interval where the PID reading is negligible, (3) at the first point below the contaminated interval where the PID reading is negligible, and (4) at the water table. If volatile organics are not detected with the PID, the sample collected five feet above the water table is submitted for analysis

The soil samples are labeled, and transported to a California Department of Health Services (DHS)-approved laboratory. At the time of sampling, each sample is logged on a Chain-of-Custody record which accompanies the sample to the laboratory. Soil samples selected for analysis have the request for analysis noted on the Chain-of-Custody. The remaining soil samples are sent to the laboratory on a hold for analysis basis.

DECONTAMINATION AND QUALITY ASSURANCE PROCEDURES

All equipment is properly decontaminated to prevent cross-contamination between sampling locations. The two methods of decontamination used at the site are steam cleaning and detergent washing followed by tap water and deionized water rinses. During field work, all equipment that is placed in the borings or wells, or that comes in contact with groundwater are decontaminated as follows:

Equipment	Decontamination Procedures
Hand-Held Impact Sampler	Detergent washed, and tap water and deionized water rinsed between each sampling point
Water Level Sensor	Detergent washed, tap water and distilled water rinsed between each use
Oil/Water Interface Probe	Detergent washed, tap water and distilled water rinsed between each use
Bailers	Steam cleaned between each use
Teflon™ Sampling Bailer	Detergent washed, then steam cleaned and rinsed with distilled water prior to sampling each well

Quality Assurance Sampling

In general, one trip blank accompanies the cooler of soil samples. The trip blank is analyzed for the same volatile components as the soil samples, usually total petroleum hydrocarbons as gasoline, and benzene, toluene, ethylbenzene, and total xylenes.

Where required rinsate samples of the sampling equipment are collected at the beginning of each day to determine if the sampling equipment is adequately decontaminated. After decontamination, rinsate samples are collected from the equipment used for sampling (split-spoon sampler or Teflon™ bailer) by: (1) rinsing deionized water through the split-spoon sampler and across the brass liners which the soils contacted, or through the inside of the Teflon bailer, and (2) filling the appropriate sample vial for analysis. The rinsate samples are labeled, placed in coolers, noted on the sample log and chain-of-custody forms, and handled according to EPA procedures. The samples are sent to the analytical laboratory and analyzed for the same parameters as the soil or groundwater samples collected after the rinsate samples are collected.

APPENDIX C

Groundwater
Sampling and Analysis
Procedures

APPENDIX C

Groundwater Sampling and Analysis Procedures

INTRODUCTION

The sampling and analysis procedures for water-quality monitoring programs are contained in this Appendix. These procedures ensure that consistent and reproducible sampling methods are used, proper analytical methods are applied, analytical results are accurate, precise, and complete, and the overall objectives of the monitoring program are achieved.

SAMPLE COLLECTION

Sample collection procedures include: equipment cleaning, water-level and total well-depth measurements, and well purging and sampling.

Equipment Cleaning

Pre-cleaned sample bottles, caps, and septa are provided by a Department of Health Services-approved laboratory. All sampling containers are used once and discarded after analyses are completed.

Before starting the sampling event and between each event, all equipment to be placed in the well or come in contact with groundwater is disassembled and cleaned thoroughly with detergent water, steam cleaned with tap water, and rinsed with deionized water. Any parts that may absorb contaminants, such as plastic pump valves or bladders, are cleaned as described above or replaced. The water-level sounder and oil/water interface probe are washed with detergent and rinsed with distilled water before use in the each well. The rinse water is stored in 55-gallon drums onsite and is disposed of by the client.

Water-Level, Phase Separated Hydrocarbon, and Total Well-Depth Measurements

Before purging and sampling, the depth to water, phase separated hydrocarbon (PSH) thickness, and the total well depth is measured using an electric sounder, a bottom-filling clear Lucite™ bailer, and/or an oil/water interface probe. The electric sounder, manufactured by Slope-Indicator, Inc., is a transistorized instrument that uses a reel-mounted, two conductor, coaxial cable that connects the control panel to the sensor. Cable markings are stamped at 1-foot intervals. An engineer's rule is used to measure the depths to the nearest 0.01 foot. The water level is measured by lowering the sensor into the monitoring well. A low current circuit is completed when the sensor contacts the water, which serves as an electrolyte. The current is amplified and fed across an indicator light and audible buzzer, signaling contact with water. A sensitivity control compensates for very saline or conductive water. After the water level is determined, a bailer is lowered to a point just below the liquid level, retrieved, and inspected for PSH.

If PSH is encountered, its thickness is measured with an oil/water interface probe. This instrument's dual-sensing probe utilizes an optical liquid sensor and electrical conductivity probe. The instrument emits a solid tone when immersed in oil, and an oscillating tone when immersed in water. If PSH greater than 1/32-inch in thickness is detected, a sample is not collected from that well.

All liquid measurements are recorded to the nearest 0.01 foot in the field logbook. The groundwater elevation at each monitoring well is calculated by subtracting the measured depth to water from the surveyed well-casing elevation. Total well depth is measured by lowering the sensor to the bottom of the well. Total well depth, used to calculate purge volumes and to determine whether the well screen is partially obstructed by silt, is recorded to the nearest 0.1 foot in the field logbook.

Well Purging

Before sampling, standing water in the casing is purged from the monitoring well using a pump or bailer. Samples are collected after three to four well casing volumes are purged,

PHILIP
ENVIRONMENTAL

LETTER OF TRANSMITTAL

To: Alameda County Health Care Services
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Date: June 25, 1996

Project: R.T. Nahas Property/
Tien Unocal 76 Service Station
20405 Redwood Road
Castro Valley, California

ATTN: Mr. Scott Seery

1) **For Review and Comment ( )**
2) **For Approval ( )**
3) **As Requested ( )**
4) **For Your Use (x)**

We are enclosing (x) / Sending under separate cover ( ):

No. of Copies	Description
2	Revised Corrective Action Plan

Comments:

By: Khaled Rahman

and the pH, specific conductance, and temperature have stabilized, or five well volumes have been evacuated. Some low yield monitoring wells are expected to be evacuated to dryness after the removal of less than three casing volumes. Such low yield monitoring wells are allowed to recover for a minimum of two hours. If the well has recovered to 80% of its original water level after two hours, a sample is collected. Otherwise, the well is allowed to recover up to 24 hours prior to sampling. If insufficient water recharges after 24 hours, the monitoring well is recorded as dry for the sampling event.

All field measurements are recorded in a waterproof field logbook. Water sample field data sheets are prepared to record the field data. These data sheets are reviewed by the sampling coordinator when the sampling event is completed.

The pH, specific conductance, and temperature meter are calibrated each day before beginning field activities. The calibration is checked once each day to verify meter performance. All field meter calibrations are recorded in the field logbook.

Groundwater generated from well-purging operations is contained for temporary storage in 55-gallon drums. All drums are labeled and stored onsite in a location designated by the client or client representative. The sampler records the following information on the drum label for each drum generated:

- Drum content (groundwater)
- Source (well designation)
- Date generated
- Client contact
- Project number
- Name of sampler

The groundwater is stored onsite for a maximum of 90 days. Burlington notifies the client that the water is ready for removal.

Well Sampling

A Teflon bailer is used for well sampling. Glass bottles of at least 40 milliliters volume and fitted with Teflon-lined septa are used in sampling for volatile organics. These bottles are filled completely to prevent air from remaining in the bottle. A positive meniscus forms when the bottles are completely full. A convex Teflon septum is placed over the meniscus to eliminate air. After capping, the bottles are inverted and tapped to verify that they do not contain air bubbles. The sample containers for other parameters are filled, and capped. If required, duplicate sample analyses are performed on five percent of the groundwater samples collected.

SAMPLE HANDLING AND DOCUMENTATION

Sample Handling

All sample containers are labeled immediately following sample collection. Samples are kept cool with ice until received by the laboratory. Ice is replaced each day to maintain refrigeration. At the time of sampling, each sample is logged on a Chain-of-Custody record which accompanies the sample to the Department of Health Services-approved laboratory.

Sample Documentation

The following procedures are used during sampling and analysis to provide Chain-Of-Custody control:

- Field logbooks to document sampling activities in the field
- Labels to identify individual samples
- Chain-of-custody record sheets for documenting possession and transfer of samples

Field Logbook

In the field, the sampler records the following information on the Water Sample Field Data Sheet for each sample collected:

- Project number
- Client name
- Location
- Name of sampler
- Date and time
- Pertinent well data (e.g., casing diameter, depth to water, total well depth)
- Calculated and actual purge volumes
- Purging equipment used
- Sampling equipment used
- Appearance of each sample (e.g., color, turbidity, sediment)
- Results of field analyses (i.e., temperature, pH, specific conductance)
- General comments

The field logbooks are signed by the sampler.

Labels

Sample labels contain the following information:

- Project number
- Sample number (i.e., well designation)
- Sampler's initials

- Date and time of collection
- Type of preservative used (if any)

Sampling and Analysis Chain-of-Custody Record

The Sampling and Analysis Chain-of-Custody record, initiated at the time of sampling, contains, but is not limited to, the well designation, sample type, analytical request, date of sampling, and the name of the sampler. The record sheet is signed, and dated by the sampler when transferring the samples. The number of custodians in the chain of possession is kept to a minimum.