The
Ratcliff
Architects

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11 May 1992

Mr. Brian Oliva
Alameda County Department of Environmental Health
80 Swan Way, Room 200
Oakland, CA 94621

Project: Site Investigations Report: Subsoils Toxicity Assessment
Emeryville Branch Postal Station Site
TRA Project No. 91023

Dear Mr. Oliva:

As Architects for the new Emeryville Branch Post Office, we have been requested by Postal Service management to transmit the enclosed report for your review and records.

The report contains a toxicity assessment and risk analysis for the building site at 62nd and Overland Avenues, Emeryville, recently completed for USPS by Harding Lawson Associates.

Based on the report's conclusions that potential "risk levels are within ranges considered acceptable by both EPA and the State of California," we have been informed by USPS that mitigation measures beyond those already included in site development plans will not be necessary, and to proceed to complete design and construction documents and construction of the new facility at the earliest possible date in order to meet the original completion deadline.

Inquiries relating to this transmittal should be directed to Mr. David Derus, USPS Project Manager, at 1-415-742-4250.

Sincerely,

James E. Vann, AIA
Project Architect

JEV:cb

Enclosure

cc: David Derus, USPS
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A Report Prepared for

United States Postal Service
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850 Cherry Street
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SITE INVESTIGATION REPORT
PROPOSED FACILITY
6121 HOLLIS STREET
EMERYVILLE, CALIFORNIA

HLA Job No. 05525,134.02

by

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TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

This Site Investigation Report has been prepared by Harding Lawson Associates (HLA) for the United States Postal Service (USPS) to present the results of additional site characterization activities at the proposed USPS facility, 6121 Hollis Street, Emeryville, California (Plate 1). The purpose of this investigation was to assess the concentrations of polychlorinated biphenyls (PCBs) and total petroleum hydrocarbons (TPH) in subsurface soil and groundwater prior to construction of the proposed facility.

The preliminary results were presented to the Alameda County Department of Environmental Health (ACDEH) and the California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB), in a meeting on March 18, 1992.

2.0 BACKGROUND INFORMATION

2.1 Site Description

The USPS property in Emeryville is situated east of Interstate 80/580, approximately 1 mile north of the Bay Bridge (Plate 1). The site is currently a vacant lot approximately 255 feet wide by 290 feet long. The northern property line is contiguous with 62nd Street. A Southern Pacific Railroad spur is adjacent to the western site boundary. PCB contamination detected in the soil and groundwater immediately south of the site on property owned by Westinghouse has been enclosed by a slurry wall and capped.

2.2 Site History

Several soil samples collected in the vicinity of the southern site boundary were analyzed for PCBs by the California Department of Health Services (DHS) in February 1981. These samples contained elevated PCB concentrations. This finding prompted ITT Grinnell Corporation, the former owner of the property, to retain CH2M Hill to conduct additional soil sampling and analysis. CH2M Hill's June 1981 report confirmed that PCBs were present in the shallow soil along the southwestern property boundary adjacent to a railroad spur. The sampling locations were not well documented in the DHS or CH2M Hill reports; therefore, the analytical results could not be used to characterize the site.

In 1985, the RWQCB issued Cleanup and Abatement Order No. 85-006 for the Westinghouse property, asserting that Westinghouse did not take adequate action to prevent the movement of PCBs from its property. Following negotiations with state and federal regulatory agencies, a continuous 35-foot-deep slurry wall was constructed around the PCB-contaminated soil. Outside the wall, soil from certain areas along the northern and eastern boundaries of the site having significant (greater than 50 parts per million [ppm]) PCB concentrations was excavated and moved to within the slurry wall. The soil was later covered with a cap to reduce erosion and surface water infiltration.

In August 1990, HLA drilled 17 shallow soil borings at the USPS site using a hand auger. Eleven soil borings were drilled to a depth of 3.5 feet, and five borings were drilled to a depth of 2 feet or less, because rocky soil or concrete prohibited further hand auguring. One boring was abandoned after drilling through asphalt into concrete.

Of the 41 soil samples analyzed for PCBs, only one sample, collected from a depth of 1.2 to 2.0 feet, contained PCBs at a concentration at or above 5,000 micrograms per kilogram (μg/kg) (5 ppm). This sample contained 52,000 μg/kg (52 ppm) PCB. It was requested that the laboratory confirm the concentration reported; a second soil sample from the same sample tube was analyzed, indicating 17,000 μg/kg (17 ppm) PCBs. Although the results were inconsistent, the two analyses indicate that PCBs are present.

Petroleum hydrocarbon odors were detected in three of the borings, and soil samples from these borings were analyzed for TPH. TPH as diesel was detected at a maximum concentration of 430 milligrams per kilogram (mg/kg). TPH as gasoline (51 mg/kg) and as kerosene (260 mg/kg) also were detected. The results are presented in HLA's Shallow Soils Investigation Report dated September 20, 1990 (*HLA, 1990*).

3.0 SCOPE OF WORK

The following scope of work was prepared in 1991 to further characterize the lateral and vertical distribution of PCB and TPH at the site, prior to and during construction activities and to estimate volumes of soil for disposal, if necessary.

The site characterization activities included:

- Review of environmental investigations for the adjacent Westinghouse property
- Drilling eight shallow exploratory borings to collect soil samples
- Drilling two exploratory borings to collect soil and groundwater samples
- Installation, development, and sampling of one groundwater monitoring well.

3.1 Data Review

HLA searched the public files at the RWQCB for information and reports describing environmental investigations at the adjacent Westinghouse property. Unfortunately, the files were incomplete; sufficient information to assess surrounding groundwater conditions was unavailable.

3.2 Drilling and Soil Sampling

Exploratory borings were drilled in 11 locations to evaluate subsurface lithology and collect soil samples for chemical analysis. One of the borings (MW-1) was drilled and a groundwater monitoring well installed in the borehole to collect groundwater samples for chemical analysis. Borehole locations were selected on the basis of previous sampling results and proposed utility trenching areas (*HLA, 1991*). The boring locations are shown on Plate 2. All borings were continuously cored to facilitate lithologic description, and the soil was classified using the Unified Soil Classification System and the Munsell Soil Color Index Chart. Logs were prepared for each boring and are presented in Appendix A.

All borings were drilled to 8 feet below ground surface with the exception of borings B-9 and B-10, which were drilled to the first occurrence of groundwater. Boring MW-1 was drilled to 18.5 feet and completed as a groundwater monitoring well.

Soil samples were collected using a California modified split spoon sampler lined with stainless steel sample tubes. One sample from each sampling interval was screened in the field for the presence of organic vapors using an organic vapor analyzer (OVA). OVA readings and visual observations such as staining and odor were recorded on the boring logs. All samples were handled and analyzed as described in Section 4.0.

For each borehole, all drilling and sampling equipment was cleaned using a high pressure, hot water wash. All decontamination was performed onsite, and the wash water was contained and placed in 55-gallon drums that were labeled and stored onsite.

Upon completion of drilling and sampling activities, the borings, excluding MW-1, were backfilled to the ground surface with neat cement. Borehole cuttings were placed in drums, labeled, and stored onsite. The soil cuttings and wash water will be properly disposed of during site construction activities.

3.2.2 Borehole Groundwater Samples

Grab groundwater samples were collected from borings B-9 and B-10 (Plate 2). Prior to sampling, a stainless steel bailer was used to evacuate water in the boreholes. Initial groundwater samples were collected with a clean stainless steel bailer.

Grab groundwater samples were analyzed for PCB, TPH, and benzene, toluene, ethyl-benzene, and xylenes (BTEX) using the analytical methods described in Section 4.0. All samples were labeled and handled as described in Section 4.0.

3.3 Monitoring Well Installation

Monitoring Well MW-1 was installed near the western property boundary, as shown on Plate 2. The well boring was drilled a minimum of 10 feet into the first water-bearing zone using a truck-mounted hollow-stem auger drill rig equipped with 6-inch-outside-diameter augers. The well was constructed using 2-inch-diameter, flush-threaded Schedule 40 PVC well casing, factory slotted well screen (0.020-inch slot size), and an end cap. The well screen extends approximately 8.0 feet into the first water-bearing zone and approximately 2.0 feet above first-encountered groundwater to account for seasonal and tidal fluctuations in groundwater levels.

Commercially prepared, sized, and washed sand (Lonestar #3) was placed as a filter pack around the well screen, from the bottom of the borehole to 1 foot above the screen. The sand was poured slowly down the annulus between the borehole and the well casing to prevent bridging and damage to the well screen or casing. The sand level was monitored during placement with a weighted measuring tape.

A bentonite seal was placed above the filter pack to minimize the intrusion of grout into the filter pack and to seal off the targeted monitoring zone from surface water infiltration. A 2-foot-thick seal was installed and hydrated with fresh water. After the bentonite hydrated for 30 minutes, the annular space above the seal was filled with a neat cement grout. The well was completed below grade with locking watertight well caps in Christy boxes with traffic rated covers. Well construction details are presented in the Log of Monitoring Well MW-1 in Appendix A.

3.4 Monitoring Well Development

The monitoring well was developed after completion by carefully surging the water in the well and evacuating the sediment and water by bailing and pumping intermittently.

Physical parameters (temperature, pH, and electrical conductance), purging volumes, and observed turbidity were monitored and recorded on groundwater sample forms during well development. These forms are presented in Appendix B. Development continued until the water was visibly free of sediment, when possible, and aquifer parameters had stabilized.

All water generated during well development was placed in 55-gallon drums that were labeled and stored onsite.

3.5 Groundwater Sampling

Prior to sampling Monitoring Well MW-1 on January 31, 1992, the water level was measured to calculate the purge volume and then purged with a PVC bailer. Physical parameters were monitored and recorded on the groundwater sampling form (Appendix B), and purging continued until aquifer parameters had stabilized.

Groundwater samples were collected in clean stainless steel bailers and decanted into laboratory-provided containers. Each sample container was preserved, as appropriate, handled, and analyzed as described in Section 4.0.

For Quality Assurance/Quality Control (QA/QC), one duplicate groundwater sample was collected and one field blank was poured during the sampling round. All QA/QC samples were handled and analyzed as described in Section 4.0.

4.0 CHEMICAL ANALYSIS PROGRAM

4.1 Sample Documentation and Handling

The following information was entered on a field investigation daily report form during drilling and on the groundwater sampling form during water sampling (see Appendix B) at the time of sample collection:

- Sampler's name
- Time and date of sample collection
- Sample location
- Sample number
- Volume of each sample container
- Type of analysis
- Preservatives
- Unusual conditions (e.g., color, odor, solids)
- Field conditions (e.g., weather, air temperature)
- Sampling technique and equipment used
- Indicator parameter measurements (pH, temperature, specific conductivity).

Each sample was labeled, sealed, and stored on ice promptly after collection. Sample identification records were prepared to maintain sample identification, document chain of custody, and control sample disposition. Forms were completed in waterproof black ink. The following sample identification documents were used (examples of these forms are presented in Appendix B).

- Sample labels
- Chain of custody forms.

Preprinted sample labels were used for identification of samples. Each label contained the following information.

- o Name of collector
- o Date and time of collection
- o Place of collection
- o Job number
- o Sample number
- o Filtered or nonfiltered.

A completed chain of custody form accompanied each sample to the analytical laboratory to document sample possession from the time of collection. The individuals relinquishing and receiving the samples signed, dated, and noted times of transfer on the chain of custody form. The chain of custody forms contain the following information.

- o Sample or station number or sample I.D.
- o Signature of collector, sampler, or recorder
- o Date and time of collection
- o Place of collection
- o Sample type
- o Signatures of persons involved in the chain of possession
- o Inclusive dates of possession
- o Analyses requested.

The laboratory portion of the form was completed by laboratory personnel upon receipt of the samples and contains the following information.

- o Name of person receiving the sample
- o Laboratory sample number

- Date of sample receipt
- Analyses requested.

4.2 Analytical Procedures

All samples were analyzed by Quantec Laboratory, a California state-certified analytical laboratory in Pleasant Hill, California. EPA Test Method 8080 was used for PCB analysis; EPA Method 8015 (modified) was used for TPH as gasoline and diesel; and EPA Method 8020 was used for BTEX.

Analytical QA/QC for the laboratory was based on the laboratory's specific QA/QC procedures and EPA's method manuals. The method detection limit for each chemical analysis was reported by the laboratory and appears on the analytical reports.

5.0 RESULTS

5.1 Exploratory Boring Sampling

5.2 Soil Samples

Analytical results of soil samples for PCBs, TPH as diesel, kerosene, and gasoline, and BTEX are presented in Tables 1, 2, and 3, respectively. Of the 22 samples analyzed, PCBs were detected (21 mg/kg) only in the sample collected from Boring B-9 at a depth of 6.5 feet bgs. TPH as diesel was detected in three borings, with a maximum concentration of 700 mg/kg in Boring MW-1 at 7 feet bgs. TPH as kerosene was detected in three borings at concentrations ranging from 2 to 86 mg/kg. Benzene and toluene were detected in only one sample, at 6.5 feet bgs from Boring B-9.

5.3 Groundwater Samples

Analytical results of groundwater samples collected from boreholes B-9 and B-10 and Monitoring Well MW-1 and analyzed for PCBs, TPH, and BTEX are presented in Tables 1, 2, and 3, respectively. PCBs were detected in the two groundwater grab samples collected from Borings B-9 and B-10 and the groundwater sample collected from Monitoring Well MW-1. TPH as diesel was detected in the three groundwater samples collected, and TPH as kerosene was detected only in the grab sample from Boring B-9. Benzene and toluene were detected in groundwater collected from Borings B-9 and B-10 but were not detected in Monitoring Well MW-1.

6.0 RISK ASSESSMENT FOR POST OFFICE/EMERYVILLE

This section presents a human health based risk assessment for the property located at 6121 Hollis Street in Emeryville, California, hereafter referred to as the "site," or "property." This risk assessment was requested by ACDEH to estimate the health hazards to individuals who could be exposed to chemicals in soil and groundwater at the site. The USPS owns the property and will develop it as the Emeryville Branch Postal Station. Because chemicals were detected at the site, particularly in soil, and the possibility exists that workers involved with excavation or related activities during construction could come into contact with chemicals in the soil, this risk assessment was prepared to assess potential health risks.

This risk assessment evaluates potential health risks for two future adult worker populations: those workers involved with construction activities and USPS employees who will occupy the planned building. Risks to construction workers were quantitatively assessed assuming that workers are involved with digging trenches for underground utility lines (water and electrical, storm sewer). Risks to USPS employees, were assessed in a qualitative fashion, using the quantitative results from the excavation worker scenario for comparison.

This section is divided into the following subsection topics.

Section 6.1	Site Characterization, Description, and Future Land Use
Section 6.2	Selection of Chemicals of Concern (COCs)
Section 6.3	Toxicity Assessment
Section 6.4	Exposure Assessment
Section 6.5	Risk Characterization
Section 6.6	Uncertainties
Section 6.7	Post-Development Risks

Section 6.8 Summary and Conclusions

This organization is consistent with general guidelines defining the nature and order of the components of a risk assessment, as recommended by both federal and California EPA (*EPA, 1989; DHS, 1986c*). Sections 6.1 through 6.9 contain a summary of the results and findings of the risk assessment; details about procedures and methods used to quantify risks are in Appendix D.

6.1 Site Characterization, Description, and Future Land Use

Site characterization details, history of the site, and the presence of chemicals detected within site boundaries are presented in Section 2.0.

As previously stated, the site is to be developed as a working United States Postal Service facility. This facility is expected to cover approximatley 95 percent of the native site soil. The cover or cap will consist of the concrete building foundation and asphalt pavement for parking and other related uses. Only small strips of land primarily at the front entrance (along 62nd Street) of the facility will be left uncapped to allow planting of decorative landscaping as required by the City of Emeryville Zoning Ordinance, Section 9-4.54. No chemicals were detected in this area during site characterization. Additionally, 2 feet of native top soil will be excavated and removed from the planting area and replaced with imported top soil to form the planting bed.

6.1.1 Chemicals in Groundwater

Results of groundwater sampling are presented in Section 5.0. The groundwater sample collected from Monitoring Well MW-1 was found to contain PCB (Aroclor 1260) at a concentration of 0.39 mg/l (390 μg/l), which exceeds the federal drinking water standard of 0.5 μg/l (*Marshack, 1990*), and TPH as diesel at a concentration of 22 mg/l.

The shallow groundwater beneath the site is not used as a drinking water source and is discussed in more detail in Section 7.4.3.

Chemicals detected in groundwater were not evaluated in this risk assessment (see Section 7.4.3.)

6.1.2 Chemicals in Soil

Results of soil sampling are presented in Section 5.0. The six chemicals detected were Aroclor 1260, TPH as diesel, gasoline, and kerosene, and benzene and toluene. The nature and extent of these detected chemicals are discussed in more detail in the following section.

6.2 Selection of Chemicals of Concern

Six different chemicals have been detected in site soil and groundwater. The selection of analytes as chemicals to be carried through the risk assessment process (referred to as chemicals of concern [COCs]) is an important step to allow for focusing on those chemicals expected to comprise the majority of potential risks from chemical exposure. The COC selection process is described in more detail by the EPA in their risk assessment guidance document (*EPA, 1989*).

This selection process is limited to the three classes of chemicals detected in site soil: PCB, TPH, and BTEX. PCB Aroclor 1260, TPH as diesel, gasoline, and kerosene, and two BTEX compounds, benzene and toluene, were found above the level of detection.

COC selection criteria include frequency of detection (FOD) and concentration levels. For VOCs detected in site soil, FOD was less than 5 percent, and detected concentrations were only slightly above detection limits (Table 3). EPA has suggested a cut-off threshold of 5 percent FOD for inclusion of a chemical as a COC (*EPA, 1989*);

therefore, any chemical detected with an FOD of less than 5 percent may be eliminated from further consideration in the risk assessment if detected at low concentrations. Based on these criteria, both benzene and toluene were eliminated from further evaluation in this risk assessment.

Three forms of TPH were also detected in site soils: TPH as diesel, gasoline, and kerosene. None of these three forms were included in the risk assessment. The rationale for this is presented below.

TPH as diesel, gasoline, and kerosene are all mixtures of both volatile organic compounds (VOCs) and semi-volatile organic compounds (SOCs). Typical VOCs in these TPH mixtures include benzene and hexane (*ORNL, 1989*), while SOCs generally include a number of polynuclear aromatic hydrocarbons (PNAs). A number of these VOC and SOC chemicals are either known or suspected of being human carcinogens. Other VOC/SOC chemicals typically found in TPH mixtures, while not carcinogenic, are systemic toxicants. Finally, some of these compounds display both carcinogenic and systemic activity. For these reasons, TPH has been of concern at certain sites with very high concentrations of TPH or after large spills.

However, the profile of TPH mixtures presented above is only applicable for fresh product. TPH mixtures gradually change composition with time, a process known as "weathering." These weathered TPH mixtures bear little resemblance to fresh product. Most significantly, VOC levels will tend to drop dramatically for weathered samples of TPH, because these compounds are volatile and therefore likely to be lost as vapor emissions over time. SOCs, including PNAs, are not as volatile as VOCs but are subject to various degradation processes, most important of which is probably degradation by soil microbes (*Kostecki and Calabrese, 1991*). Therefore, after time, most TPH mixtures consist of high molecular weight, persistent tarry substances that are not likely to pose a health hazard to potentially exposed individuals.

An analytical laboratory characterizes these TPH mixtures as diesel, gasoline, and kerosene by comparing the gas chromatogram (GC) obtained for the sample with a library of chromatograms typically associated with a particular TPH mixture. These chromatograms show separate peaks for each detected VOC or SOC; the characteristic chromatograms used for mixture identification are referred to as "fingerprints." However, this GC technique is extremely sensitive, so that very low concentrations of chemicals in soil can be detected. So it is possible to characterize a sample as "TPH as gasoline" by its GC fingerprint when very low levels of the components of TPH in gasoline are present in the soil.

adequate reasoning

The site characterization results demonstrate that the TPH detected in site soil is weathered. Therefore, the material characterized in site soil as TPH as diesel, gasoline, and kerosene consists of relatively nontoxic tarry substances and is not addressed further in the risk assessment.

The only chemical detected in soil, selected as a COC, and quantified in this risk assessment is the PCB Aroclor 1260.

6.3 Toxicity Assessment

To provide summary human health toxicity information for Aroclor 1260, EPA terminology with respect to toxicity data must be understood. In developing risk assessment methods, EPA and the Department of Toxic Substances Control (DTSC) recognized that fundamental differences exist between carcinogenic and noncarcinogenic chemicals. Therefore, the variables that are used to estimate potential health impacts are different for carcinogenic and noncarcinogenic chemicals. Because of these differences, human health risk characterization is conducted separately for carcinogenic effects and noncarcinogenic effects of chemicals. For carcinogens, it is assumed that any level of exposure could possibly cause cancer (i.e., there is no "threshold" dose for carcinogenic effects). For chemicals exhibiting noncarcinogenic effects, it is believed that organisms have protective mechanisms that must be overcome before the toxic endpoint is produced (i.e., there is a threshold dose for these toxic effects; *EPA, 1986*). Exposures below the threshold dose are not expected to cause adverse effects, while exposures above the threshold dose may result in toxic effects.

Key toxicity variables used in quantitative risk assessment are slope factors (SFs) for carcinogens and reference doses (RfDs) for noncarcinogens. The carcinogenic SF [expressed in units of $(mg/kg/day)^{-1}$] is developed to represent the "potency" of a chemical as a carcinogen and is usually determined by the upper 95 percent confidence limit of the slope of the linearized multistage (LMS) model. This model expresses excess cancer risk (response) as a function of the dose of the chemical. The LMS model is based on high-to-low dose extrapolation (e.g., test animals exposed to high concentrations of chemicals are often used to predict effects that may occur in humans exposed to low doses of chemicals) and assumes no threshold for the initiation of carcinogenic effects.

The EPA assigns weight-of-evidence classifications to potential carcinogens as a measure of the evidence of the chemical's ability to cause cancer in humans. Group A (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between human exposure to the agent and cancer. Group B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from human studies but for which there is sufficient evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals, and Group D chemicals (not classified as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available. Group E chemicals (evidence of noncarcinogenicity in humans) are agents for which there is no evidence of carcinogenicity in adequate human or animal studies.

The RfD (expressed in units of mg/kg/day) is an estimated daily intake (dose) of a noncarcinogenic chemical that is not expected to result in adverse health effects, even over a lifetime of exposure (*Vettorrazzi, 1976; EPA, 1980, 1989; Dourson and Stara, 1983)*. The RfD is generally based on the relationship between the dose of a noncarcinogen and the toxic effects that can occur in experimental animals or humans and assumes that a threshold dose exists prior to the initiation of toxic effects (*Dourson and Stara, 1983*). To derive an RfD from experimental data, the threshold of observed effects in a test organism is divided by uncertainty factors used in extrapolation (and possibly modifying factors) to establish an RfD that is protective of the most sensitive members of the human population.

The Integrated Risk Information System (IRIS) on-line data base records EPA-determined RfDs and SFs. This database, which is regularly updated, is the source for the most up-to-date toxicity values.

Aroclor 1260 Toxicity Values

Neither an oral nor inhalation RfD for any of the PCBs, including Aroclor 1260, is currently available (*IRIS, 1992*). The oral SF is 7.7 $(mg/kg/day)^{-1}$. This value is based on the findings of several studies in which rats or mice were orally exposed to PCBs. A statistically significant increase in the incidence of hepatocellular carcinoma was observed in three strains of rats and two strains of mice. Studies in humans occupationally exposed to PCBs have demonstrated inadequate yet suggestive evidence of an excess risk of liver cancer by ingestion, inhalation, or dermal contact (*IRIS, 1992*). EPA has therefore designated PCBs, including Aroclor 1260, as B2 chemicals, or possible human carcinogens via oral exposure. No inhalation SF has been determined (*IRIS, 1992*).

6.4 Human Health Exposure Assessment

Significant pathways of exposure to Aroclor 1260 in the soil could occur and pose human health concerns. Presented below are important mechanisms of exposure as they apply to the site, the identification of exposed populations, applicable exposure pathways, and the exposure factors (rate of incidental soil ingestion, area of exposed skin for chemical contact, and so on) selected for each pathway.

6.4.1 Mechanisms of Exposure

Because PCBs in general are both relatively non-volatile chemicals, as supported by vapor pressure measurements (7.7×10^{-5} mm Hg from *EPA, 1986b*), and tend to sorb strongly to organic matter in soil, as evidenced by the relatively high organic carbon partition coefficient (K_{oc}) value of 5.3×10^{5} (*EPA, 1986b*), the major human exposure pathway for Aroclor 1260 involves direct contact with soil particles containing the chemical. Volatilization of PCB from subsurface soils and subsequent inhalation of chemical vapors is not expected to constitute an important mechanism of exposure.

6.4.2 Exposed Populations

This risk assessment evaluates risks under a reasonable maximum exposure (RME) scenario only. This is a simplifying but conservative approach, because the exposure an individual may receive under more likely conditions (i.e., average exposure scenario) is by definition lower than the estimated RME exposure.

During development of the site, workers are expected to lay utility lines in trenches dug in native soil. These individuals, hereafter referred to as "trench workers," will likely receive the greatest exposure to site contaminants, because of direct worker contact with site soil before it is capped by the building and asphalt. Therefore, any risks quantified for these trench workers should overestimate the risk of all other individuals potentially exposed to site soil. For example, an individual observing the construction activity from the perimeter of the site will be subject to risks no greater than, and likely significantly lower, than the trench worker. Therefore, throughout the remainder of the quantitative risk assessment, only trench workers will be evaluated.

6.4.3 Exposure Pathways

Three exposure pathways were evaluated in this risk assessment.

- Trench workers incidentally ingesting contaminated soil via hand-to-mouth behavior
- Trench workers dermally contacting contaminated soils via adherence of soil to exposed skin
- Trench workers inhaling dusts agitated during construction activities and containing chemicals adsorbed to dust particles.

These three exposure pathways are consistent with the mechanisms of exposure discussed in Section 6.4.1. Although chemicals were detected in groundwater beneath the site, exposure pathways involving contaminated groundwater were not evaluated for two main reasons. First, the naturally occurring levels of total dissolved solids (TDS) in the groundwater are probably high enough to render the groundwater supply unfit as a drinking water supply. Therefore, there will be no human contact with groundwater. Second, the site is located in a highly commercial/industrial area that has regional groundwater contamination problems. The regional contamination also makes the groundwater nonpotable.

For the three evaluated pathways, exposure factors (also referred to as intake assumptions) were selected and are presented in Tables 4, 5, and 6. The rationale for selecting these intake assumptions, based on EPA guidance (*EPA, 1989*), are discussed in more detail in Appendix D.

6.5 Risk Characterization

Both carcinogenic and systemic, noncarcinogenic effects expected to result from exposure to site contaminants via the three exposure pathways discussed in Section 6.4.3 were quantified according to standard methods (*EPA, 1989*). These risk characterization methods are discussed in more detail in Appendix D. Tables 7, 8, and 9 present the quantitative risk results obtained from this risk assessment. Both dermal and ingestion risks are presented. It was not possible to quantify risks from inhalation of dust particles because the appropriate criterion (inhalation SF) has not been developed for Aroclor 1260. Nevertheless, Table 6 presents the dose, expressed as a chronic daily intake (CDI), that a trench worker is expected to receive as a result of exposure to contaminated dusts generated by construction activities at the site. No noncarcinogenic hazard indices could be calculated because no RfD has been developed for PCB.

As shown in Table 9, potential risks due to dermal contact with and ingestion of soil are 4.3×10^{-6} and 9.7×10^{-7}, respectively. Potential multipathway RME exposures result in a calculated risk to trench workers of 5×10^{-6}, less than the 1×10^{-5} level considered acceptable by the State of California (*HWA, 1988*). Therefore, no unacceptable risks to workers are expected to result from contact with site soil containing Aroclor 1260.

6.6 Uncertainties

The risk assessment process contains inherent uncertainty. In many cases, a range of values may be available for certain intake assumptions, and the areas in a site selected to be sampled may not completely define the contamination. It is impossible to reduce uncertainties to "zero" in any risk assessment, but it is still desirable to confidently present risk assessment results that are likely to protect potentially exposed individuals. A common practice in risk assessment is to select values for intake assumptions and other risk assessment components that will produce conservative estimates of risk. Thus, any uncertainties implicit in the risk assessment process that tend to contribute to calculated risks will likely overestimate actual risks; final risk estimates are therefore expected to be sufficiently protective of human life. This conservative approach was taken in this risk assessment. Specific uncertainties in this risk assessment are discussed in more detail in Appendix D.

6.7 Post-Development Risks

This risk assessment quantitatively evaluates the potential chemical hazards unprotected trench workers may be subject to as a result of contact with contaminated site soil during construction. As discussed in Section 6.2.1, the site will be developed as a USPS Post Office, where nearly all but narrow strips of soil along primarily the front entrance to the facility will be paved. Because the unpaved area contained no detectable levels of chemicals, the two significant exposure pathways evaluated in this risk assessment (ingestion of and dermal contact with soil) will not be present following construction, because no contact with site soil will be possible. For these reasons, the risks to future USPS employees and customers using the proposed USPS facility will be lower than the risks quantified for the trench worker. Though the duration of exposure to the site will be potentially longer for future USPS employees than for trench workers, exposure pathways will be removed when the soil is covered and the site developed.

6.8 Summary and Conclusions

The risk assessment quantitatively evaluated health risks to construction workers involved in digging utility trenches in soil at the USPS site. The soil contains detectable concentrations of PCB Aroclor 1260 and TPH as diesel, kerosene, and gasoline.

Although various TPH mixtures were detected in site soil, these were not quantitatively evaluated in the risk assessment, as there is presently no regulatory agency guidance on how to conduct quantitative risk assessments on TPH mixtures where the exact composition of the mixture is unknown. Additionally, although benzene and toluene was detected in one soil sample, the frequency of detection for these compounds was less than 5 percent and they were not included in the quantitative risk assessment for soil (Section 6.2). On basis of guidance from the RWQCB and the ACDEH, only PCBs in soil were recognized as being present at concentrations requiring a risk assessment.

In site groundwater, Aroclor 1260 and TPH as diesel were both detected, but neither was included in the quantitative risk assessment. Aroclor 1260 was not included because groundwater is not used as a drinking water supply or for irrigation purposes. TPH as diesel was not included for reasons already discussed for soil contaminants.

The potential health risks to trench workers were evaluated by assessing exposure through incidental soil ingestion, dermal (skin) contact with soil, and inhalation of dust particles containing PCBs. On the basis of intake assumptions shown on Tables 4 through 6, the potential excess cancer risks to these workers are 9.7×10^{-7} for incidental soil ingestion (Table 7) and 4.3×10^{-6} for dermal contact with soil (Table 8). No excess

5.3×10^{-6}

cancer risk could be quantified because no toxicity criteria have been developed for inhalation exposures to PCBs. Similarly, no noncarcinogenic hazard index could be calculated. Total multipathway excess cancer risk to those workers is estimated to be 5×10^{-6} (Table 9).

This excess risk level is within EPA's "acceptable" risk range of 1×10^{-4} to 1×10^{-6} and less than the California EPA risk level of 1×10^{-5}. Therefore, exposures to these individuals are expected to be within acceptable limits.

It should be emphasized that the results presented in this report are based on conservative exposure assumptions. For example, intake assumptions used for the calculation of both the dermal and ingestion exposures were based on EPA recommendations that result in an overestimation of actual exposures. Also, rather than using the arithmetic mean PCB concentration found in site soil to estimate exposure, the 95 percent upper confidence limit of the mean concentration was used. Therefore, the actual risks to trench workers are likely to be lower than the levels presented in this report.

It should also be noted that the risk assessment process has inherent limitations based on assumptions utilized and the scientific basis and rationale for each assumption. The risk assessment was based on simplified assumptions that may or may not characterize absolute risk from exposure to PCB in soil. The risk assessment assumes that the future use of this property will result in exposures to future receptors no greater than those outlined herein. If conditions exist that were not fully characterized in the site investigation, or if potential land use or receptor populations change in the future, the potential health risks associated with the site may differ from those detailed in this report.

The calculated risks to individuals involved in trench digging, where extended direct contact is expected with site soil containing PCB, are within the range considered acceptable by both EPA and the State of California. Results of this risk assessment suggest that risks to future occupants of the proposed postal service building (postal service employees) are minimal. Because future postal service workers will receive no direct dermal or incidental ingestion exposure to PCB in site soil because the site will be almost totally covered by asphalt or concrete, and because this direct exposure results in an acceptable calculated risk for construction workers, it can be inferred that future postal service employees will receive less exposure to PCB than those estimated for the construction workers. Therefore, risks to future onsite postal service employees must be lower than the calculated risks for construction workers.

7.0 REFERENCES

California Department of Health Services (DHS), Toxic Substances Control Division, 1986c. *California Site Mitigation Decision Tree Manual.* May.

Dourson, M. L., and J. F. Stara, 1983. Regulatory History and Environmental Support of Uncertainty (Safety) Factors. *Regulatory Toxicology and Pharmacology.* 3:224-238.

Harding Lawson Associates (HLA), 1990. *Shallow Soils Investigation Report, 6121 Hollis Street, Emeryville, California.* September 20.

________, 1991. *Work Plan, 6121 Hollis Street, Emeryville, California.* January 30.

Health and Welfare Agency (HWA), 1988. California Code of Regulations, Division 2, Chapter 3. State of California Drinking Water and Toxic Enforcement Action of 1986, Article 8, Section 12711 et seq.

Kostecki, P. T. and E. J. Calabrese, 1991. *Hydrocarbon Contaminated Soils and Groundwater, Volume 1.* Lewis Publishers, Chelsea, Michigan.

Marshack, J. B., 1990. *A Compilation of Water Quality Goals.* California Regional Water Quality Control Board, Central Valley Region. October.

Oak Ridge National Laboratory (ORNL), 1989. *The Installation Restoration Program Toxicology Guide, Volume 4.* Published under USDOE Interagency Agreement No. 1891-A076-A1. July.

U.S. Environmental Protection Agency (EPA), 1980. *Ambient Water Criteria Documents Availability.* Federal Register 15: 79318-79379.

U.S. Environmental Protection Agency (EPA), 1986a. Guidelines for Carcinogenic Risk Assessment. *Federal Register* 51: 33992-32003. September 24.

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, 1986b. *Superfund Public Health Evaluation Manual.* EPA/540/1-86/060. October.

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, 1989. *Risk Assessment Guidance for Superfund, Vol. 1, Human Health Evaluation Manual (Part A) (interim final).* EPA/540/1-89/02. Washington, D.C., U.S. Government Printing Office. December.

Vettororazzi, G., 1976. Safety Factors and Their Application in the Toxicological Evaluation. In: *The Evaluation of Toxicological Data for the Protection of Public Health.* Oxford, England: Pergamon Press. pp. 207-223.

Table 1
Analytical Results of Borehole Soil Samples
Polychlorinated Biphenyls
United States Postal Service
Proposed Emeryville Facility

Boring Number	Sample ID Number	Sample Depth	Sample Date	Units	Aroclor 1260	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254
B-1	92053007	3.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053009	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-2	92053011	6.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053012	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-3	92053014	6.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053015	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-4	92053017	6.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053018	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-5	92053020	6.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053021	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-6	92053023	6.5	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053024	9	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-7	92053110	6.5	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053111	9	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-8	92053113	6.5	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053114	9	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
B-9	92053102	6.5	31-Jan-92	(mg/kg)	21	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053103	9	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053104	water	31-Jan-92	(mg/l)	86	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)
B-10	92053106	9	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053107	9	31-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053108	water	31-Jan-92	(mg/l)	0.002	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)
MW-1	92053001	4	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053002	7	30-Jan-92	(mg/kg)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)
	92053115	product	31-Jan-92	(mg/kg)	NA	NA	NA	NA	NA	NA	NA
	92053116	water	31-Jan-92	(mg/l)	0.390	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)
Field Blank	92053118	water	31-Jan-92	(mg/l)	0.0096	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)	ND(<0.0005)

mg/kg = milligrams per kilogram
mg/l = milligrams per liter
ND = not detected at the stated detection limit.
NA = not analyzed
Note: Sample depth represents feet below ground surface.

Table 2
Analytical Results of Borehole Soil Samples
Total Petroleum Hydrocarbons
United States Postal Service
Proposed Emeryville Facility

Boring Number	Sample ID Number	Sample Depth	Sample Date	Units	TPH as Diesel	TPH as Kerosene	TPH as Gasoline
B-1	92053007	3.5	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053009*	9.0	30-Jan-92	(mg/kg)	ND(<1)	20	0.055***
B-2	92053011*	6.5	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053012	9.0	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-3	92053014	6.5	30-Jan-92	(mg/kg)	130	ND(<1)	0.180***
	92053015	9.0	30-Jan-92	(mg/kg)	29	ND(<1)	0.055***
B-4	92053017*	6.5	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053018	9.0	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-5	92053020*	6.5	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<1)
	92053021	9.0	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-6	92053023*	6.5	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053024	9.0	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-7	92053110	6.5	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053111	9.0	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-8	92053113	6.5	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
	92053114	9.0	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.2)
B-9	92053102*	6.5	31-Jan-92	(mg/kg)	160	86	ND(<10)**
	92053103	9.0	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.6)**
	92053104	water	31-Jan-92	(mg/l)	940	870	ND(<11)**
B-10	92053106*	6.0	31-Jan-92	(mg/kg)	ND(<1)	2	ND(<0.5)**
	92053107	9.0	31-Jan-92	(mg/kg)	ND(<1)	ND(<1)	ND(<0.3)**
	92053108*	water	31-Jan-92	(mg/l)	0.4	ND(<0.05)	ND(<0.8)**
MW-1	92053001	4.0	30-Jan-92	(mg/kg)	ND(<1)	ND(<1)	0.0004***
	92053002*	7.0	30-Jan-92	(mg/kg)	700	ND(<1)	0.510***
	92053115*	product	31-Jan-92	(mg/kg)	1100	trace	NA
	92053116*	water	31-Jan-92	(mg/l)	22	trace	ND(<8)**
Trip Blank	92053117	water	31-Jan-92	(mg/l)	ND(<0.05)	ND(<0.05)	ND(<0.05)
Field Blank	92053118	water	31-Jan-92	(mg/l)	ND(<0.05)	ND(<0.05)	ND(<0.05)

mg/kg = milligrams per kilogram
mg/l = milligrams per liter
ND = not detected at the stated detection limit.
NA = not analyzed
* = oil detected
** = Detection limit raised due to the presence of non-gasoline compounds.
*** = Hydrocarbon pattern does not resemble gasoline.
Note: Sample depth represents feet below ground surface.

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Table 3
Analytical Results of Borehole Soil Samples
Benzene, Toluene, Ethylbenzene, and Xylenes
United States Postal Service
Proposed Emeryville Facility

Boring Number	Sample ID Number	Sample Depth	Sample Date	Units	Benzene	Toluene	Ethylbenzene	Xylenes
B-1	92053007	3.5	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053009**	9.0	30-Jan-92	(mg/kg)	ND(<0.02)	ND(<0.05)	ND(<0.02)	ND(<0.06)
B-2	92053011	6.5	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053012	9.0	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-3	92053014**	6.5	30-Jan-92	(mg/kg)	ND(<0.02)	ND(<0.1)	ND(<0.03)	ND(<0.4)
	92053015**	9.0	30-Jan-92	(mg/kg)	ND(<0.02)	ND(<0.02)	ND(<0.02)	ND(<0.06)
B-4	92053017	6.5	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053018	9.0	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-5	92053020	6.5	30-Jan-92	(mg/kg)	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.02)
	92053021	9.0	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-6	92053023	6.5	30-Jan-92	(mg/kg)	ND(<0.005)	ND(<0.005)	ND(<0.005)	ND(<0.02)
	92053024	9.0	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-7	92053110	6.5	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053111	9.0	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-8	92053113	6.5	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053114	9.0	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
B-9	92053102*	6.5	31-Jan-92	(mg/kg)	0.02	0.006	ND(<0.005)**	ND(<0.02)**
	92053103	9.0	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053104	water	31-Jan-92	(mg/l)	0.01	0.001	ND(<0.0003)	ND(<0.001)
B-10	92053106	6.0	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053107	9.0	31-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053108	water	31-Jan-92	(mg/l)	0.0009	0.0008	ND(<0.0003)	ND(<0.001)
MW-1	92053001	4.0	30-Jan-92	(mg/kg)	ND(<0.001)	ND(<0.001)	ND(<0.001)	ND(<0.003)
	92053002**	7.0	30-Jan-92	(mg/kg)	ND(<0.02)	ND(<0.1)	ND(<0.1)	ND(<0.3)
	92053115	product	31-Jan-92	(mg/kg)	NA	NA	NA	NA
	92053116	water	31-Jan-92	(mg/l)	ND(<0.0003)	ND(<0.0003)	ND(<0.0003)	ND(<0.002)**
Trip Blank	92053117	water	31-Jan-92	(mg/l)	ND(<0.0003)	ND(<0.0003)	ND(<0.0003)	ND(<0.001)
Field Blank	92053118	water	31-Jan-92	(mg/l)	ND(<0.0003)	ND(<0.0003)	ND(<0.0003)	ND(<0.001)

mg/kg = milligrams per kilogram
mg/l = milligrams per liter
ND = not detected at the stated detection limit.
NA = not analyzed
* = oil detected
** = Detection limit raised due to the presence of non-gasoline compounds.
Note: Sample depth represents feet below ground surface.

Table 4. Intake Assumptions for Ingestion of Soil by Trench Workers – USPS Emeryville

Scenario	Location	Receptor Population	Age /a/ (years)	EF Exposure Frequency (days/ years)	ED Exposure Duration (years/ lifetime)	IR Ingestion Rate (mg/day)	CF Conversion Factor (kg/mg)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME (days)	ATc Carcinogenic AVERAGING TIME (years)	ATN /b/ Noncarcinogenic AVERAGING TIME (days)	ATN /b/ Noncarcinogenic AVERAGING TIME (years)
REASONABLE MAXIMUM SCENARIO	Onsite	Current Adult Worker	18 - 43	30	1	480.00	1.00E-06	70	365	70	365	ED

Equation /c/

$$\text{Intake Dose} = \frac{CS \times OAF \times EF \times ED \times IR \times CF}{BW \times AT}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
/c/ CS - Chemical concentration in soil (mg/kg);
OAF - Oral absorption factor; assumed to be 100% (1.0).

Table 5. Intake Assumptions for Dermal Contact with Soil by Trench Workers – USPS Emeryville

Scenario	Location	Receptor Population	Age /a/ (years)	EF Exposure Frequency (days/ years)	ED Exposure Duration (years/ lifetime)	CF Conversion Factor (kg/mg)	SA Skin Surface Area (cm^2)	AF Adherence Factor (mg/cm^2)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME (days)	ATc Carcinogenic AVERAGING TIME (years)	ATN /b/ Noncarcinogenic AVERAGING TIME (days)	ATN /b/ Noncarcinogenic AVERAGING TIME (years)
REASONABLE MAXIMUM SCENARIO	Onsite	Current Adult Worker	18 - 43	30	1	1.00E-06	5300.00	1.00	70	365	70	365	ED

Equation /c/

$$\text{Intake Dose} = \frac{CS \times DAF \times EF \times ED \times CF \times SA \times AF}{BW \times AT}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
/c/ CS - Chemical concentration in soil (mg/kg);
DAF - Dermal absorption factor.

Table 6. Intake Assumptions for Inhalation of Dust by Trench Workers – USPS Emeryville

Scenario	Location	Receptor Population	Age /a/ (years)	ET Exposure Time (hours/ day)	EF Exposure Frequency (days/ years)	ED Exposure Duration (years/ lifetime)	IR Inhalation Rate (m^3/hour)	BW Body Weight (kg)	ATc Carcinogenic AVERAGING TIME (days)	ATc Carcinogenic AVERAGING TIME (years)	ATN /b/ Noncarcinogenic AVERAGING TIME (days)	ATN /b/ Noncarcinogenic AVERAGING TIME (years)
REASONABLE MAXIMUM SCENARIO	Onsite	Current Adult Worker	18 - 43	8.00	30	1	3.00	70	365	70	365	ED

Equation /c/

$$\text{Intake Dose} = \frac{CA \times PAF \times ET \times EF \times ED \times IR}{BW \times AT}$$

/a/ The age groups assigned are based on assumed exposure duration (ED).
/b/ ATn (years) is equivalent to ED value in all cases.
/c/ CA - Chemical concentration in air (mg/m^3);
PAF - Pulmonary absorption factor; assumed to be 100% (1.0).

Notes:
CA = CS x RP
where: CS = concentration in soil (expressed as unitless fraction);
RP = suspended respirable particulates (mg/m^3).

Table 7. Estimation of Carcinogenic Health Risks and Noncarcinogenic Adverse Health Effects Associated with Exposures to Soil via Ingestion by Trench Workers – USPS Emeryville /a/

				REASONABLE MAXIMUM SCENARIO				
Chemical	Location	Receptor	Age (years)	Conc. (mg/kg)	CDIn /b/ (mg/kg/day)	HQ /c/	CDIc /b/ (mg/kg/day)	Risk /d/
PCB-1260	Onsite	Adult Worker	18 - 43	1.57E+01	8.85E-06	--	1.26E-07	9.73E-07
Sum Total	Onsite	Adult Worker	18 - 43	N/A	N/A	--	N/A	9.73E-07

/a/ See text for explanation.
/b/ Dose calculated based on intake assumptions for soil ingestion pathway and RME concentration in soil.
/c/ HQ = Hazard Quotient (Dose/RfD); used to evaluate noncarcinogenic effects.
/d/ Risk = Carcinogenic Slope Factor x Dose; used to evaluate carcinogenic effects.
Notes:
Dashes (--) = Not calculable because U.S. EPA-established toxicity values not determined.

Table 8. Estimation of Carcinogenic Health Risks and Noncarcinogenic Adverse Health Effects Associated with Exposures to Soil via Dermal Contact by Trench Workers – USPS Emeryville /a/

				REASONABLE MAXIMUM SCENARIO				
Chemical	Location	Receptor	Age (years)	Conc. (mg/kg)	CDIn /b/ (mg/kg/day)	HQ /c/	CDIc /b/ (mg/kg/day)	Risk /d/
PCB-1260	Onsite	Adult Worker	18 - 43	1.57E+01	3.91E-05	--	5.58E-07	4.30E-06
Sum Total	Onsite	Adult Worker	18 - 43	N/A	N/A	--	N/A	4.30E-06

/a/ See text for explanation.
/b/ Dose calculated based on intake assumptions for soil ingestion pathway and RME concentration in soil.
/c/ HQ = Hazard Quotient (Dose/RfD); used to evaluate noncarcinogenic effects.
/d/ Risk = Carcinogenic Slope Factor x Dose; used to evaluate carcinogenic effects.
Notes:
Dashes (--) = Not calculable because U.S. EPA-established toxicity values not determined.

Table 9. Summary of Risks from Multipathway Exposure of Trench Workers - USPS, Emeryville

RECEPTOR	EXPOSURE SCENARIO	POTENTIAL UPPERBOUND EXCESS CANCER RISK	HAZARD INDEX
		RME	RME
ONSITE TRENCH WORKERS	Ingestion of Soil	9.73E-07	--
	Dermal Contact with Soil	4.30E-06	--
	Inhalation of Dust Emissions	--	--
	Sum Total	5E-06	--

-- = not calculable because U.S. EPA-established toxicity values not determined.

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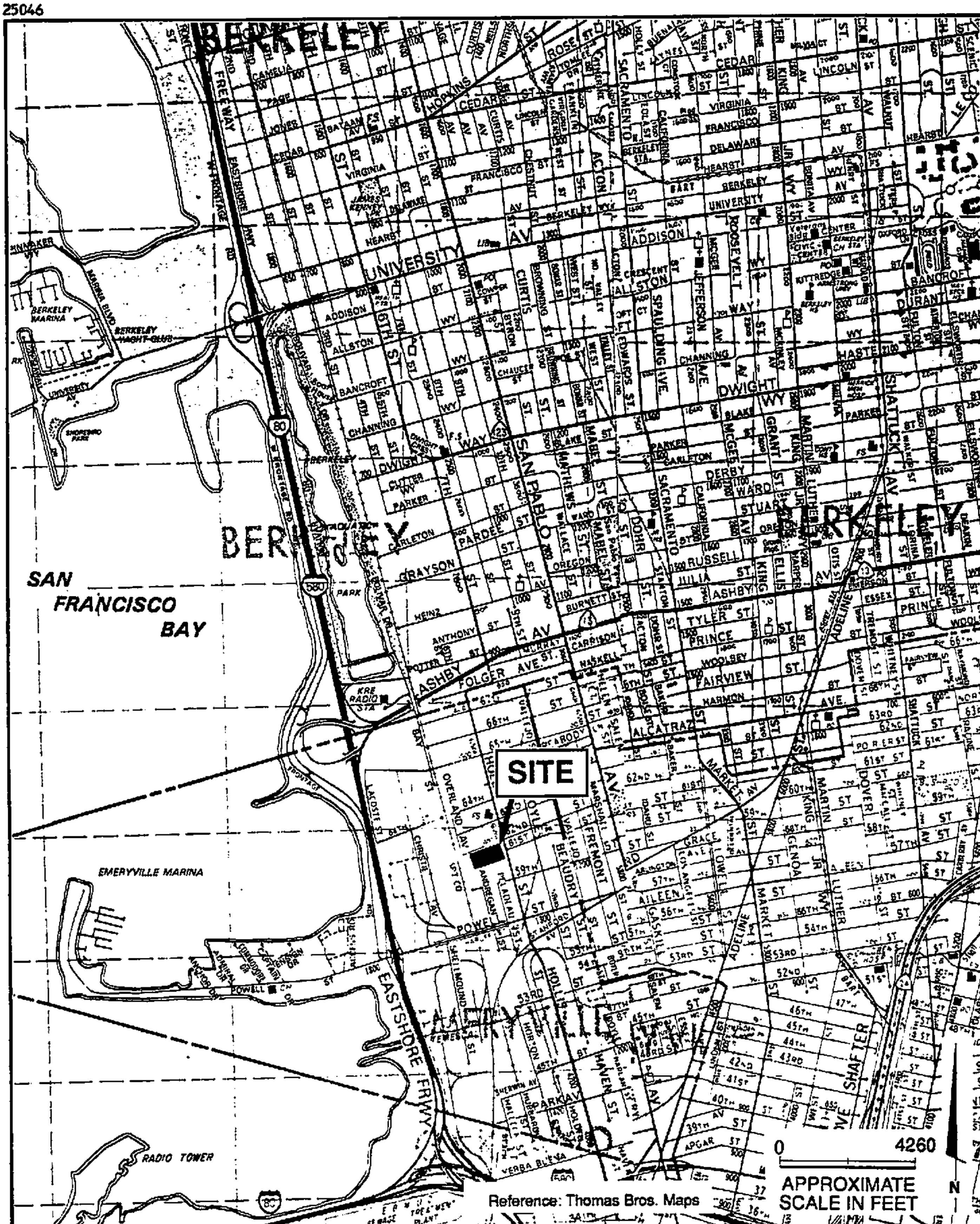

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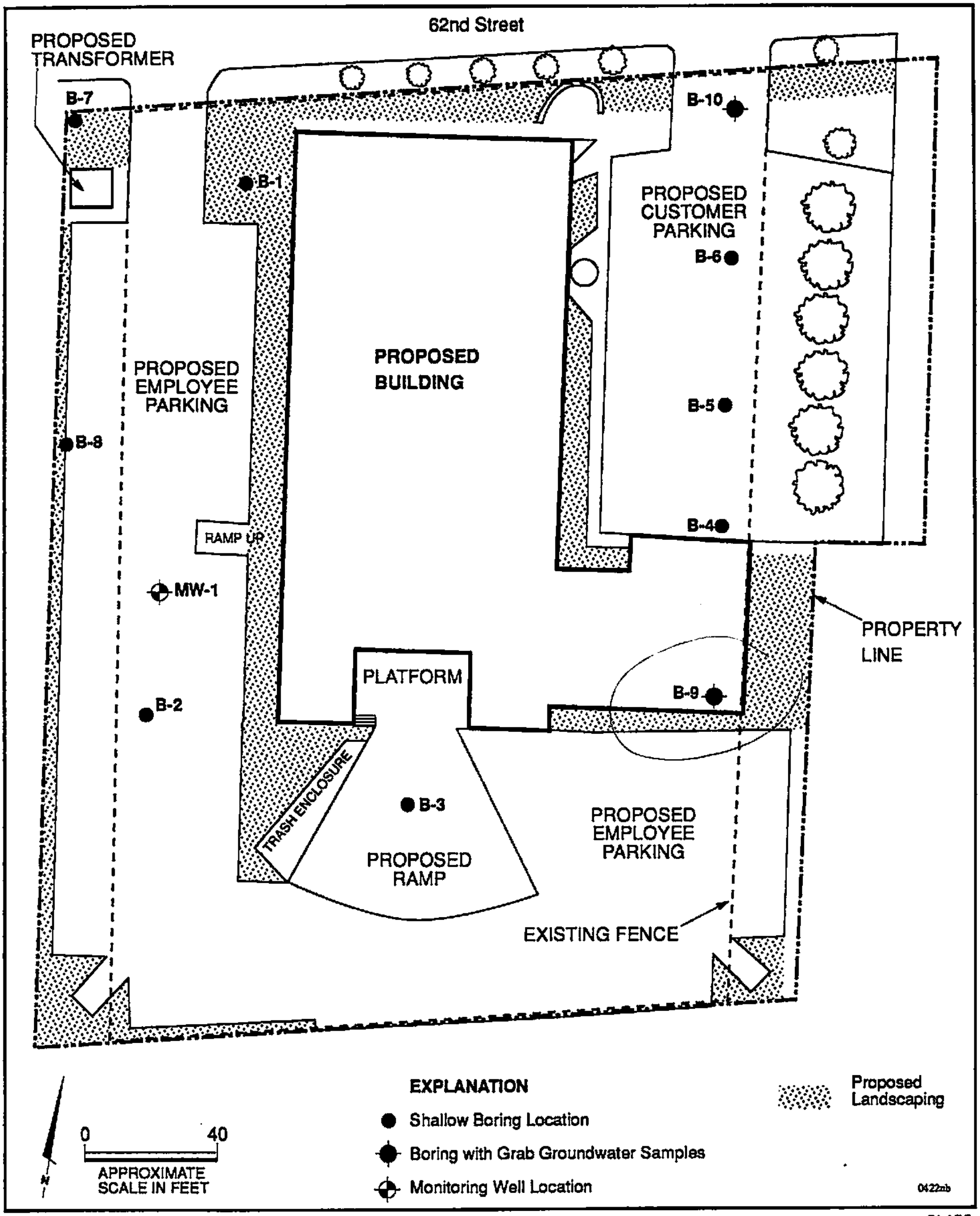
Vicinity Map
Proposed USPS Facility
Emeryville, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJB	5525,134.02	MHW	1/92	

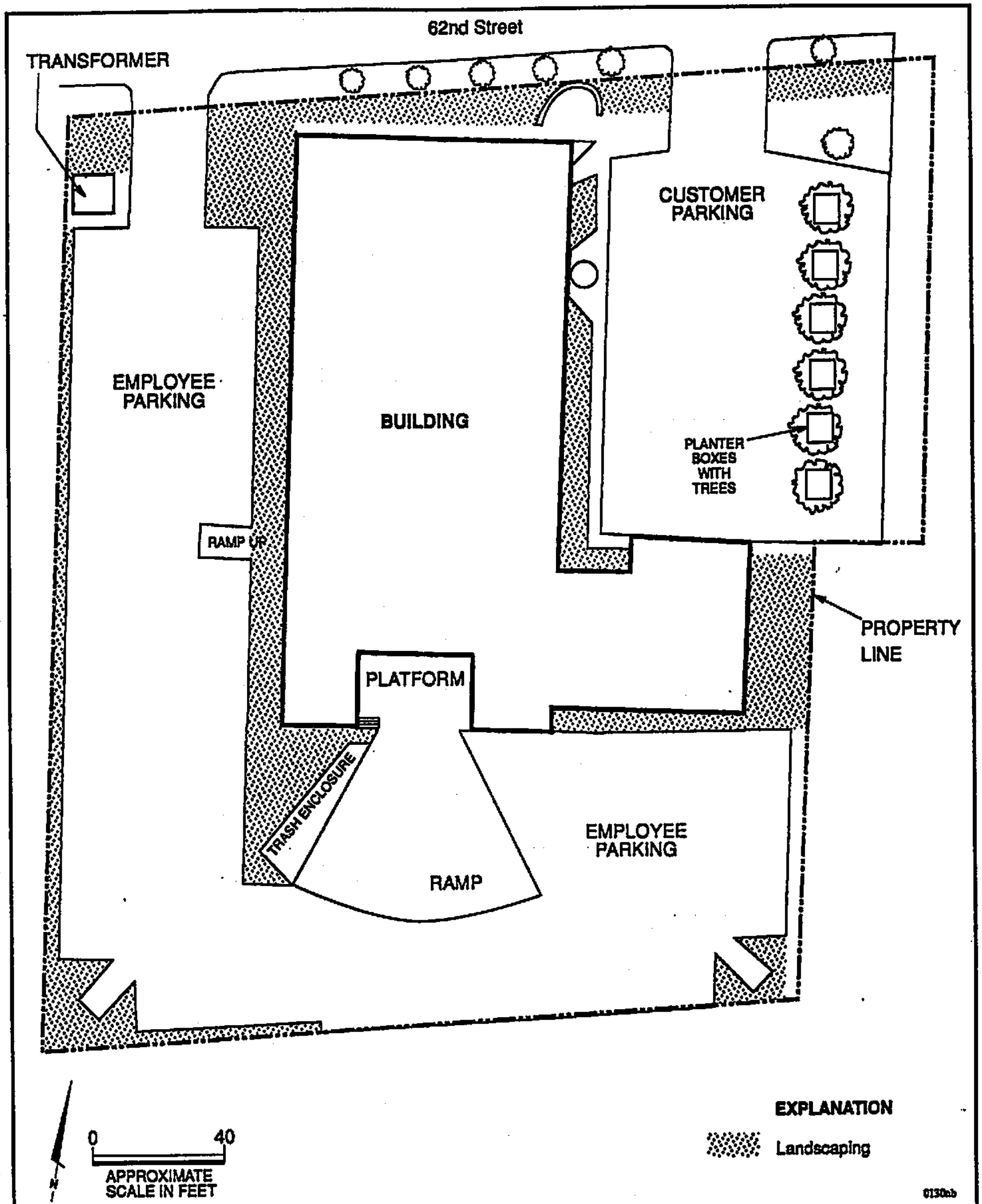


Harding Lawson Associates
Engineering and Environmental Services

Boring Location Map
Proposed USPS Facility
Emeryville, California

PLATE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	[signature]	1/92	4/92

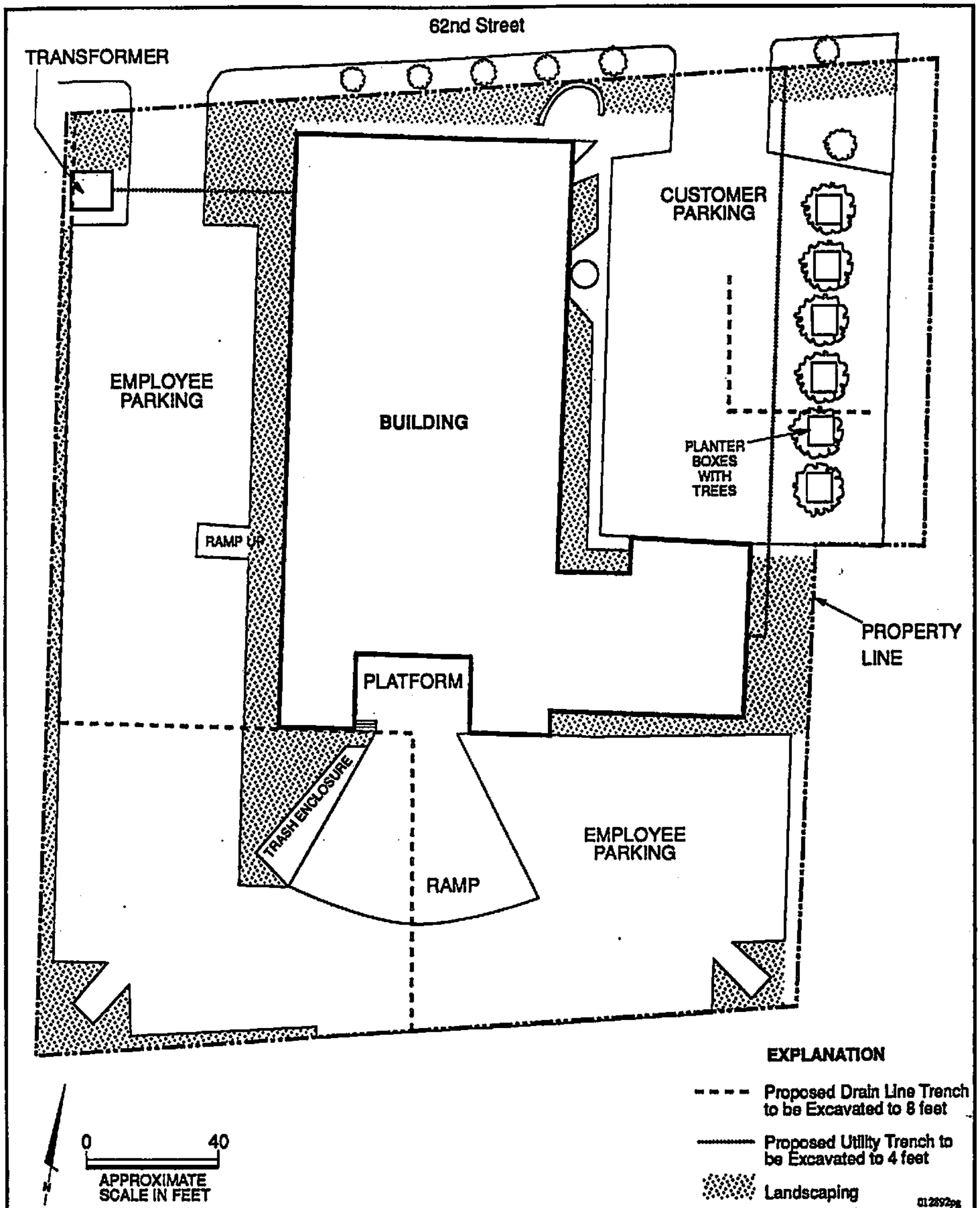


Harding Lawson Associates
Engineering and Environmental Services

Proposed Building Plan
Proposed USPS Facility
Emeryville, California

PLATE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MHW	1/92	



Harding Lawson Associates
Engineering and Environmental Services

Proposed Trench Location Map
Proposed USPS Facility
Emeryville, California

PLATE **4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MKW	1/92	

Appendix A

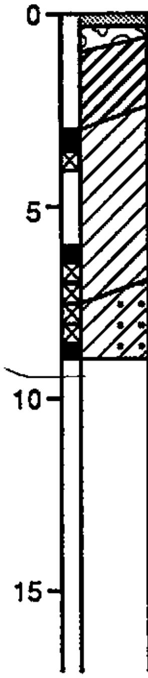
EXPLORATORY BORING LOGS

Log of Boring B-1

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)
	3007	4	
	3008	2	
	3009	100	



6" ASPHALT
6" BASEROCK-GRAVEL TO 2"
BLACK CLAY WITH GRAVEL (fill)

GRAY SANDY CLAY (CL) 5G 4/1 soft, moist, ~20% very fine sand, slight hydrocarbon odor, brown staining

MULTI-COLORED SANDY CLAY WITH GRAVEL (CL-SC) 5GY 5/1 medium stiff, moist, hydrocarbon odor, ~30% very fine sand, ~15% angular gravel to 1/2"

no groundwater encountered

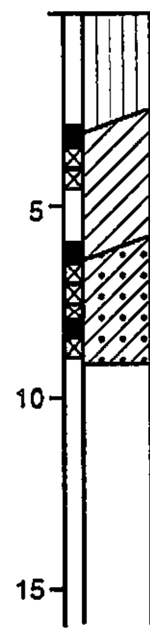
Bottom of boring at 9.0 feet

Log of Boring B-2

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)
	3010	<5	
	3011	<5	
	3012	<5	



DARK BROWN GRAVELLY SILT (ML) 7.5YR 3/2 soft moist ~10% gravel to 1 1/2"

YELLOWISH BROWN SANDY CLAY (CL) 10YR 5/8 medium stiff moist ~20% very fine sand ~10% gravel to 3/8" trace black organics, no odor

GRAY GRAVELLY CLAYEY SAND (SC) 5G 4/1 medium dense wet fine sand, ~25%-30% clay, ~15% gravel to 1/2", no odor

no groundwater encountered

Bottom of boring at 9.0 feet

0422nb

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Engineering and Environmental Services

Logs of Borings B-1 and B-2
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A1**

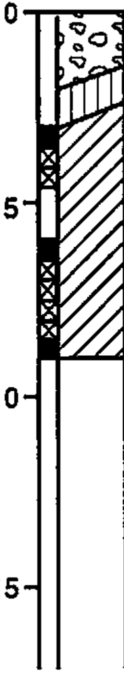
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MKW	2/92	4/92

Log of Boring B-3

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)
	3013	30	
	3014	100	
	3015	>1000	



GRAY GRAVEL UP TO 1" WITH BLACK SILT (fill)

BLACK SILTY CLAY (ML) 10YR 2/1
soft moist trace gravel

GRAY GRAVELLY SANDY CLAY (CL) 5G 4/1
medium stiff moist 20% very fine sand 10% gravel to 1/2" hydrocarbon odor

increasing gravel to 20% to 1", becoming wet with strong hydrocarbon odor at 7 ft

strong hydrocarbon odor

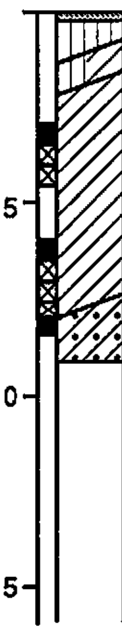
Bottom of boring at 9.0 feet

Log of Boring B-4

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)
	3016	<5	
	3017	20	
	3018	10	



3" ASPHALT

DARK BROWN GRAVELLY SILT (ML) 10YR 3/3
soft moist 10% angular gravel to 1" (fill)

YELLOWISH BROWN SANDY CLAY (CL)
10YR / 6/8 soft moist ~25% very fine- to medium-fine sand

becoming wet with ~15% gravel to 1/2"

YELLOWISH BROWN CLAYEY SAND WITH GRAVEL (SC) 10YR 5/8 medium dense, wet, ~20% clay, ~20% fine gravel to 1/2"

Bottom of boring at 9.0 feet

0422nb

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings B-3 and B-4
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A2**

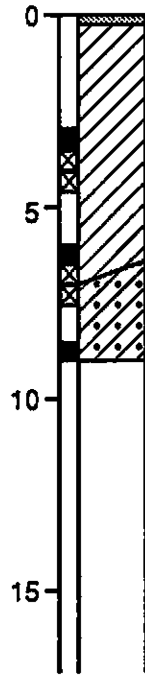
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MKW	2/92	4/92

Log of Boring B-5

Equipment: 6" Hollow Stem Auger

Elevation: NA Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)
	3019	0
	3020	0
	3021	0



3" ASPHALT

YELLOWISH BROWN SILTY SANDY CLAY (CL)
10YR 6/8 soft moist ~20% silt very fine- to fine sand trace gravel to 3/8"

becoming medium stiff, decreasing silt at 3 ft

increase in grain size of sand

YELLOWISH BROWN CLAYEY SAND (SC)
10YR 6/8 medium dense wet, very fine- to medium sand 30-40% clay

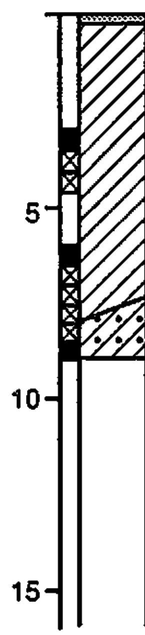
Bottom of boring at 9.0 feet

Log of Boring B-6

Equipment: 6" Hollow Stem Auger

Elevation: NA Date: 1/30/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)
	3022	0
	3023	0
	3024	0



3" ASPHALT, no baserock

YELLOWISH BROWN GRAVELLY SILTY SANDY CLAY (CL) 10YR 6/8 ~25% very fine- to coarse sand, ~15% silt, ~5% gravel to 1/4"

increasing stiffness and sand and gravel content at 3 ft

increasing moisture at 6.5 ft

YELLOWISH BROWN GRAVELLY CLAYEY SAND (SC)
10YR 6/8 medium dense wet very fine- to coarse sand, ~30% clay, ~10% fine gravel to 3/8"

Bottom of boring at 9.0 feet

0422nb

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings B-5 and B-6
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A3**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MKW	2/92	4/92

Log of Boring B-7

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/31/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)	Description
			0	GRAY GRAVEL (GP) loose, predominately 3/4" to 1 1/2" angular aggregate - railroad base (fill)
	3109	<5		BLACK CLAY (CH) 10YR 2/1 soft moist highly plastic
			5	OLIVE SANDY CLAY (CL) stiff moist 15-20% very fine- course sand, trace fine gravel some orange and black oxide staining
	3110	<5		
				increasing sand content to 30%; ~ 5% gravel to 1/4" at 8 ft
	3111	<5		Bottom of boring at 9.0 feet
			10	
			15	

Log of Boring B-8

Equipment: 6" Hollow Stem Auger

Elevation: NA   Date: 1/31/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)	Description
			0	GRAY GRAVEL (GP) loose, dry, aggregate up to 2", - railroad base (fill)
				BLACK CLAY (CH) 10YR 2/1 soft moist highly plastic
	3112	<5		LIGHT OLIVE BROWN SANDY CLAY (CL) 2.5Y 5/4 medium stiff moist 10-15% very fine- to fine sand trace fine gravel some orange-black oxide staining
			5	
	3113	<5		increasing grain size with depth
	3114	<5		Bottom of boring at 9.0 feet
			10	
			15	

0422nb

Harding Lawson Associates
Engineering and
Environmental Services

Logs of Borings B-7 and B-8
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A4**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
PGc	5525,134.02	[signature]	2/92	4/92

Laboratory Tests | Sample # 9205 | OVA Reading (ppm) | Depth (ft.) | Sample

Log of Boring B-9

Equipment 6" Hollow Stem Auger

Elevation NA Date 1/31/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)	Description
			0	3" ASPHALT
				BLACK SILTY SANDY CLAY (ML-CL) 10YR 2/1 soft, moist
				YELLOWISH BROWN SANDY CLAY (CL) 10YR 5/8 soft, moist, 20% very fine to coarse sand, 5% gravel to 1/4"
	3101	200		GRAY GRAVELLY SANDY CLAY (CL) 5B6 4/1 soft moist-wet 20-30% very fine- to coarse sand ~10% gravel to 1/2" strong hydrocarbon odor and staining
			5	
	3102	>1000		gravel increasing to 30% at 6.0 ft
	3103	>1000		heavy staining saturated at 8.5 ft
			10	drill to 12 ft and collect water sample
				Bottom of boring at 12.0 feet
			15	

Log of Boring B-10

Equipment 6" Hollow Stem Auger

Elevation NA Date 1/31/92

Laboratory Tests	Sample # 9205	OVA Reading (ppm)	Depth (ft.)	Description
			0	3" ASPHALT
				BLACK GRAVELLY SILTY CLAY (CL) 10YR 2/1 soft, moist
	3105	<5		REDDISH BROWN SANDY GRAVELLY CLAY (CL) 75YR 5/8 medium stiff, moist, 70% very fine to coarse sand, 20-30% angular gravel to 3/4"
			5	
	3106	<5		increasing gravel to ~40% at 6 ft
	3107	<5		saturated at 9.0 ft
			10	drill to 12 ft - collect water sample
				Bottom of boring at 12.0 feet
			15	

0422nb

Harding Lawson Associates
Engineering and Environmental Services

Logs of Borings B-9 and B-10
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A5**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	MLW	2/92	4/92

TOP OF PVC CASING
Elevation NA

Equipment 6" Hollow Stem Auger

Elevation NA Date 1-30-92

GROUND SURFACE

Well construction	Sample # 9205	OVA Reading (ppm)	Depth (ft.)	Description
TOP OF CASING at 2.0 ft above ground surface		10	0	6" ASPHALT, no base rock GRAY SANDY CLAY (CL) 5G 4/1 soft moist, ~10-15% very fine- to medium sand hydrocarbon odor
8" DIA. BOREHOLE 0-18.5 ft				
2" DIA. SCHED. 40 PVC BLANK CASING -2.0 to 8.0 ft	3001	50		
BENTONITE-CEMENT SEAL 0 to 5.0 ft			5	~15% gravel to 3/4", increasing sand, strong hydrocarbon odor at 6.5 ft
BENTONITE PELLET SEAL 5.0 to 7.0 ft	3002	200		
LONESTAR #3 SANDPACK 7.0 to 18.5 ft	3003	NA		GRAY CLAYEY SAND WITH GRAVEL (SC) 5G 4/1 loose, saturated, ~15% gravel, ~10% clay, strong hydrocarbon odor, sheen on sampler
2" DIA. SLOTTED SCREEN (0.020" slot size) 8.0 to 18.5 ft			∇10	GRAY GRAVEL WITH SAND (GP) 5BG 4/1 loose, saturated, ~30% sand, trace fines, hydrocarbon odor
	3004	300		YELLOWISH BROWN CLAYEY SAND (SC) 10YR 5/8 medium stiff, moist, ~20-30% clay, fine sand
	3005	18	15	
				increasing clay to ~50% at 17 ft
BOTTOM WELL CAP, HOLE CLEANED OUT to 18.5 ft	3006	9		Bottom of boring at 18.5 ft
			20	
			25	
			30	
			35	
			40	

0422nb

Harding Lawson Associates
Engineering and Environmental Services

Log of Monitoring Well MW-1
United States Postal Service
Proposed Emeryville Facility
Emeryville, California

PLATE **A6**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
NJBc	5525,134.02	[signature]	2/92	4/92

FIELD LOG OF BORING

SHEET ____ OF ____

LOCATION OF BORING:	PROJECT:	BORING NO.
		TOTAL DEPTH:
	JOB NO.:	LOGGED BY:
	PROJ. MGR.:	EDITED BY:
	DRILLING CONTRACTOR:	
	DRILL RIG TYPE:	
	DRILLERS NAME:	
	SAMPLING METHODS:	
	HAMMER WT.:	DROP:
	STARTED, TIME:	DATE:
	COMPLETED, TIME:	DATE:

BORING DEPTH (ft.)			
CASING DEPTH (ft.)			
WATER DEPTH (ft.)			
TIME:			
DATE:			

BACKFILLED, TIME: DATE: BY:

SURFACE ELEV.: DATUM:

CONDITIONS:

SAMPLE DEPTH	SAMPLER TYPE	BLOWS/6-IN.	INCHES DRIVEN	INCHES RECOVERED	SAMPLE CONDITION	DRILLING RATE (min/ft.)				DEPTH IN FEET	GRAPHIC LOG
										1	
										2	
										3	
										4	
										5	
										6	
										7	
										8	
										9	
										10	

FIELD LOG OF BORING (CONTINUED)

SHEET ____ OF ____

DEPTH	TYPE	BLOWS	DRIVEN	REC'V'D	COND.	D.RATE				DEPTH	GRAPHIC LOG	PROJECT:	NO.	BORING NO.
										1				
										2				
										3				
										4				
										5				
										6				
										7				
										8				
										9				
										0				
										1				
										2				
										3				
										4				
										5				
										6				
										7				
										8				
										9				
										0				

PFS

Harding Lawson Associates
Engineers and Geoscientists

GROUND-WATER SAMPLING FORM

Well No. ______
Well Type: ☐ Monitor ☐ Extraction ☐ Other ______
Well Material: ☐ PVC ☐ St. Steel ☐ Other ______
Date ______ Time ______
Sampled by ______ (Initials)

Job Name ______
Job Number ______
Recorded by ______ (Signature)

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches):
☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other ______
Total Depth of Casing (TD in feet BTOC): ______
Water Level Depth (WL in feet BTOC): ______
Number of Well Volumes to be purged (# Vols)
☐ 3 ☐ 4 ☐ 5 ☐ 10 ☐ Other ______

PURGE METHOD

☐ Bailer - Type: ______
☐ Submersible ☐ Centrifugal ☐ Bladder; Pump No.: ______
☐ Other - Type: ______

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Other ______
Depth in feet (BTOC): ______ Screen Interval in feet (BTOC):
from ______ to ______

PURGE VOLUME CALCULATION

$\left(\underset{\text{TD (feet)}}{\_\_\_\_} - \underset{\text{WL (feet)}}{\_\_\_\_} \right) \times \underset{\text{D (inches)}}{\_\_\_\_}^{2} \times \underset{\text{\# Vols}}{\_\_\_\_} \times 0.0408 = \underset{\text{Calculated Purge Volume}}{\_\_\_\_}$ gallons

PURGE TIME

______ Start ______ Stop ______ Elapsed

PURGE RATE

Initial ______ gpm Final ______ gpm

ACTUAL PURGE VOLUME

______ gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T ☐ °C ☐ °F	Other ______

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T ☐ °C ☐ °F	Other ______
Meter Nos.				

Observations During Purging (Well Condition, Turbidity, Color, Odor): ______
Discharge Water Disposal: ☐ Sanitary Sewer ☐ Storm Sewer ☐ Other ______

WELL SAMPLING

SAMPLING METHOD

☐ Same As Above
☐ Bailer - Type: ______
☐ Grab - Type: ______
☐ Submersible ☐ Centrifugal ☐ Bladder; Pump No.: ______
☐ Other - Type: ______

SAMPLE DISTRIBUTION

Sample Series: ______

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments

QUALITY CONTROL SAMPLES

Duplicate Samples

Original Sample No.	Duplicate Sample No.

Blank Samples

Type	Sample No.

Other Samples

Type	Sample No.

Sheet ______ of ______

Project: ______ Job No.: ______

Subject: FIELD INVESTIGATION DAILY REPORT Date: ______

Equipment Rental: ______ Company: ______ To: ______

Equipment Hours: ______ F.E. Time from: ______ to: ______ By: ______

(outside service and expense record must be attached for any outside costs)

Attachments:

Initial

Harding Lawson Associates

Harding Lawson Associates
10324 Placer Lane
Sacramento, California 95827
916/364-0793
Telecopy: 916/364-5633

CHAIN OF CUSTODY FORM

Lab: ______________________

Samplers: ______________________

Job Number: ______________________

Name/Location: ______________________

Project Manager: ______________________

Recorder: ______________________
(Signature Required)

SOURCE CODE	MATRIX				#CONTAINERS & PRESERV.			SAMPLE NUMBER OR LAB NUMBER			DATE				STATION DESCRIPTION/ NOTES	ANALYSIS REQUESTED					
	Water	Sediment	Soil	Oil	Unpres.	H_2SO_4	HNO_3	Yr	Wk	Seq	Yr	Mo	Dy	Time		EPA 601/8010	EPA 602/8020	EPA 624/8240	EPA 625/8270	ICP METALS	EPA 8015M/TPH

LAB NUMBER			DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
Yr	Wk	Seq				

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
RELINQUISHED BY: *(Signature)*	RECEIVED BY: *(Signature)*	DATE/TIME
DISPATCHED BY: *(Signature)* DATE/TIME	RECEIVED FOR LAB BY: *(Signature)*	DATE/TIME
METHOD OF SHIPMENT		

Laboratory Copy White   Project Office Copy Yellow   Field or Office Copy Pink

6533

Harding Lawson Associates

Job Name

Job Number

Collector (Signature) Date

Time Place

Sample No.

Well/Boring No

Depth

Appendix C

LABORATORY ANALYTICAL REPORTS

QuanteQ Laboratories
An Ecologics Company

HARDING LAWSON ASSOC
FEB 2 0 1992

FORMERLY MED-TOX

Certificate of Analysis

DOHS CERTIFICATION NO. E772

AIHA ACCREDITATION NO. 332

HARDING LAWSON ASSOCIATES
7655 REDWOOD BLVD.
NOVATO, CA 94948

ATTN: MELISSA WANN

CLIENT PROJ. ID: 5525,134.02

REPORT DATE: 02/19/92

DATE SAMPLED: 01/30/92

DATE RECEIVED: 01/30/92

QUANTEQ JOB NO: 9201234

ANALYSIS OF: SOIL SAMPLES

See attached for results

Andrew Bradeen, Manager
Organic Laboratory

Results FAXed 02/10-11/92

Quanteq Laboratories
An Ecologics Company

HARDING LAWSON ASSOCIATES

DATE RECEIVED: 01/30/92 REPORT DATE: 02/19/92

CLIENT PROJ. ID: 5525,134.02 QUANTEQ JOB NO: 9201234

Sample Identification Client Id.	Lab No.	Extractable Hydrocarbons as Diesel (mg/L)	Extractable Hydrocarbons as Kerosene (mg/L)
92053001	01A	ND	ND
92053002	02A	700 *	ND
92053007	07A	ND	ND
92053009	09A	ND *	20
92053011	11A	ND *	ND
92053012	12A	ND	ND
92053014	14A	130	ND
92053015	15A	29	ND
92053017	17A	ND *	ND
92053018	18A	ND	ND
92053020	20A	ND *	ND
92053021	21A	ND	ND
92053023	23A	ND *	ND
92053024	24A	ND	ND
Detection limit:		1	1

Method: 3550 GCFID

Instrument: C

Date Extracted: 01/31,02/05/92
Date Analyzed: 02/03-06/92

ND = Not Detected

* Oil detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053001
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-01A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/05/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3
PURGEABLE HYDROCARBONS AS:			
Gasoline		0.4* mg/kg	0.2 mg/kg

ND = Not Detected

* Hydrocarbon pattern does not resemble that of gasoline.

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053002
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-02A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/05-07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	20
Toluene	108-88-3	ND	100
Ethylbenzene	100-41-4	ND	100
Xylenes, Total	1330-20-7	ND	300
PURGEABLE HYDROCARBONS AS:			
Gasoline		510* mg/kg	0.2 mg/kg

ND = Not Detected

* Hydrocarbon pattern does not resemble that of gasoline; detection limits raised because of interferences.

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053007
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-07A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/05/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3

PURGEABLE HYDROCARBONS AS:

Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053009
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-09A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/05-07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	20
Toluene	108-88-3	ND	50
Ethylbenzene	100-41-4	ND	20
Xylenes, Total	1330-20-7	ND	60
PURGEABLE HYDROCARBONS AS:			
Gasoline		55* mg/kg	0.2 mg/kg

ND = Not Detected

* Hydrocarbon pattern does not resemble that of gasoline; detection limits raised because of interferences.

Quanteq Laboratories
An Ecologics Company

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053011
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-11A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053012
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-12A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053014
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-14A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/07-10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	20
Toluene	108-88-3	ND	100
Ethylbenzene	100-41-4	ND	30
Xylenes, Total	1330-20-7	ND	400
PURGEABLE HYDROCARBONS AS:			
Gasoline		180* mg/kg	0.2 mg/kg

ND = Not Detected

* Hydrocarbon pattern does not resemble that of gasoline; detection limits raised because of interferences.

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053015
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-15A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	20
Toluene	108-88-3	ND	20
Ethylbenzene	100-41-4	ND	20
Xylenes, Total	1330-20-7	ND	60
PURGEABLE HYDROCARBONS AS:			
Gasoline		55* mg/kg	0.2 mg/kg

ND = Not Detected

* Hydrocarbon pattern does not resemble that of gasoline; detection limits raised because of interferences.

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053017
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-17A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053018
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-18A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/07/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3

PURGEABLE HYDROCARBONS AS:

Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053020
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-20A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	5
Toluene	108-88-3	ND	5
Ethylbenzene	100-41-4	ND	5
Xylenes, Total	1330-20-7	ND	20
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	1 mg/kg

ND = Not Detected

Note: Due to an apparent 'matrix effect', it was necessary to dilute this sample to achieve adequate internal standard recovery. Reported detection limits have been adjusted accordingly.

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053021
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-21A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3

PURGEABLE HYDROCARBONS AS:

Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053023
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-23A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	5
Toluene	108-88-3	ND	5
Ethylbenzene	100-41-4	ND	5
Xylenes, Total	1330-20-7	ND	20
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	1 mg/kg

ND = Not Detected

Note: Due to an apparent 'matrix effect', it was necessary to dilute this sample to achieve adequate internal standard recovery. Reported detection limits have been adjusted accordingly.

Quanteq Laboratories

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HARDING LAWSON ASSOCIATES

CLIENT ID: 92053024
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-24A
QUANTEQ JOB NO: 9201234
DATE ANALYZED: 02/10/92
INSTRUMENT: H

BTEX AND HYDROCARBONS (SOIL MATRIX)

METHOD: EPA 8020, 5030 GCFID

	CAS #	CONCENTRATION (ug/kg)	DETECTION LIMIT (ug/kg)
Benzene	71-43-2	ND	1
Toluene	108-88-3	ND	1
Ethylbenzene	100-41-4	ND	1
Xylenes, Total	1330-20-7	ND	3
PURGEABLE HYDROCARBONS AS:			
Gasoline		ND mg/kg	0.2 mg/kg

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053001
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-01A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053002
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-02A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR		CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor	1016	12674-11-2	ND	0.05
Aroclor	1221	11104-28-2	ND	0.05
Aroclor	1232	11141-16-5	ND	0.05
Aroclor	1242	53469-21-9	ND	0.05
Aroclor	1248	12672-29-6	ND	0.05
Aroclor	1254	11097-69-1	ND	0.05
Aroclor	1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053007
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-07A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053009
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-09A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053011
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-11A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053012
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-12A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053014
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-14A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053015
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-15A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053017
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-17A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053018
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-18A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053020
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-20A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053021
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-21A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053023
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-23A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

HARDING LAWSON ASSOCIATES

CLIENT ID: 92053024
CLIENT PROJ. ID: 5525,134.02
DATE SAMPLED: 01/30/92
DATE RECEIVED: 01/30/92
REPORT DATE: 02/19/92

QUANTEQ LAB NO: 9201234-24A
QUANTEQ JOB NO: 9201234
DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
INSTRUMENT: B

EPA METHOD 8080
POLYCHLORINATED BIPHENYLS
(SOIL MATRIX)

AROCLOR	CAS #	CONCENTRATION (mg/kg)	DETECTION LIMIT (mg/kg)
Aroclor 1016	12674-11-2	ND	0.05
Aroclor 1221	11104-28-2	ND	0.05
Aroclor 1232	11141-16-5	ND	0.05
Aroclor 1242	53469-21-9	ND	0.05
Aroclor 1248	12672-29-6	ND	0.05
Aroclor 1254	11097-69-1	ND	0.05
Aroclor 1260	11096-82-5	ND	0.05

ND = Not Detected

Quanteq Laboratories
An Ecologics Company

QUALITY CONTROL DATA

DATE EXTRACTED: 01/31/92
DATE ANALYZED: 02/03/92
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234
INSTRUMENT: C
SAMPLE SPIKED: 9201220-22A

MATRIX SPIKE RECOVERY SUMMARY
TPH EXTRACTABLE SOILS
METHOD 3550 GCFID
(SOIL MATRIX; EXTRACTION METHOD)

ANALYTE	Spike Conc. (mg/kg)	Sample Result (mg/kg)	MS Result (mg/kg)	MSD Result (mg/kg)	Average Percent Recovery	RPD
Diesel	43.9	ND	28.2	25.1	60.7	11.6

CURRENT QC LIMITS (Revised 08/15/91)

Analyte	Percent Recovery	RPD
Diesel	(60.3-116.2)	19.7

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

QUALITY CONTROL DATA

DATE EXTRACTED: 02/05/92
DATE ANALYZED: 02/06/92
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234
INSTRUMENT: C
SAMPLE SPIKED: 9201234-21A

MATRIX SPIKE RECOVERY SUMMARY
TPH EXTRACTABLE SOILS
METHOD 3550 GCFID
(SOIL MATRIX; EXTRACTION METHOD)

ANALYTE	Spike Conc. (mg/kg)	Sample Result (mg/kg)	MS Result (mg/kg)	MSD Result (mg/kg)	Average Percent Recovery	RPD
Diesel	40.6	ND	32.6	36.6	85.2	11.6

CURRENT QC LIMITS (Revised 08/15/91)

Analyte	Percent Recovery	RPD
Diesel	(60.3-116.2)	19.7

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

QUALITY CONTROL DATA

DATE ANALYZED: 02/05/92
SAMPLE SPIKED: 9201234-07A
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234

INSTRUMENT: H

MATRIX SPIKE RECOVERY SUMMARY
METHOD 5030 w/GCFID/8020
(SOIL MATRIX)

ANALYTE	Spike Conc. (ug/kg)	Sample Result (ug/kg)	MS Result (ug/kg)	MSD Result (ug/kg)	Average Percent Recovery	RPD
Benzene	26.4	ND	27.1	26.8	102.1	1.1
Toluene	110	ND	107	108	97.7	0.9
Hydrocarbons as Gasoline	1040	ND	1000	1010	96.6	1.0

CURRENT QC LIMITS (Revised 08/15/91)

Analyte	Percent Recovery	RPD
Benzene	(80.8-125.2)	9.6
Toluene	(82.7-119.1)	10.2
Gasoline	(54.0-120.1)	14.8

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

QUALITY CONTROL DATA

DATE ANALYZED: 02/10/92
SAMPLE SPIKED: 9201246-07A
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234

INSTRUMENT: H

MATRIX SPIKE RECOVERY SUMMARY
METHOD 5030 w/GCFID/8020
(SOIL MATRIX)

ANALYTE	Spike Conc. (ug/kg)	Sample Result (ug/kg)	MS Result (ug/kg)	MSD Result (ug/kg)	Average Percent Recovery	RPD
Benzene	26.4	ND	25.5	25.7	97.0	0.8
Toluene	115	ND	110	110	95.7	0.0
Hydrocarbons as Gasoline	1040	ND	1170	1150	111.5	1.7

CURRENT QC LIMITS (Revised 08/15/91)

Analyte	Percent Recovery	RPD
Benzene	(80.8-125.2)	9.6
Toluene	(82.7-119.1)	10.2
Gasoline	(54.0-120.1)	14.8

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

QUALITY CONTROL DATA

DATE EXTRACTED: 02/03/92

QUANTEQ JOB NO: 9201234

CLIENT PROJ. ID: 5525,134.02

INSTRUMENT: B

SURROGATE STANDARD RECOVERY SUMMARY

METHOD 8080
(SOIL MATRIX)

SAMPLE IDENTIFICATION			SURROGATE RECOVERY (PERCENT)
Date Analyzed	Client Id.	Lab No.	2,4,5,6-Tetrachloro-meta-xylene
02/04/92	92053001	01A	91
02/04/92	92053002	02A	74
02/04/92	92053007	07A	74
02/04/92	92053009	09A	88
02/04/92	92053011	11A	90
02/04/92	92053012	12A	81
02/04/92	92053014	14A	71
02/04/92	92053015	15A	78
02/04/92	92053017	17A	107
02/04/92	92053018	18A	98
02/04/92	92053020	20A	111
02/04/92	92053021	21A	89
02/04/92	92053023	23A	101
02/04/92	92053024	24A	102

CURRENT QC LIMITS

ANALYTE	PERCENT RECOVERY
2,4,5,6-Tetrachloro-meta-xylene	(59-115)

QUALITY CONTROL DATA

DATE EXTRACTED: 02/03/92
DATE ANALYZED: 02/04/92
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234
SAMPLE SPIKED: 9201234-18A
INSTRUMENT: B

MATRIX SPIKE RECOVERY SUMMARY

METHOD 8080 (PCBs)
(SOIL MATRIX)

COMPOUND	Spike Amount (mg/kg)	Sample Result (mg/kg)	MS Result (mg/kg)	MSD Result (mg/kg)	Average Percent Recovery	RPD
A1260	143	ND	144	167	109.0	14.8

CURRENT QC LIMITS

Analyte	Percent Recovery	RPD
A1260	(34-134)	25

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

Quanteq Laboratories
An Ecologics Company

QUALITY CONTROL DATA

DATE EXTRACTED: 02/04/92
DATE ANALYZED: 02/04/92
CLIENT PROJ. ID: 5525,134.02

QUANTEQ JOB NO: 9201234
SAMPLE SPIKED: 9201234-13A
INSTRUMENT: B

MATRIX SPIKE RECOVERY SUMMARY

METHOD 8080 (PCBs)
(SOIL MATRIX)

COMPOUND	Spike Amount (mg/kg)	Sample Result (mg/kg)	MS Result (mg/kg)	MSD Result (mg/kg)	Average Percent Recovery	RPD
A1260	143	ND	183	177	126.0	3.3

CURRENT QC LIMITS

Analyte	Percent Recovery	RPD
A1260	(34-134)	25

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RPD = Relative Percent Difference
ND = Not Detected

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R-5,5-D

CHAIN OF CUSTODY FORM

920/234

Lab: Med Tox

Job Number: 5525,134.02

Name/Location: USPS - Emeryville

Project Manager: Melissa Wann

Samplers: Rick Erdman

Recorder: Rick Erdman (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/ NOTES	~~EPA 601/8010~~ 8080	EPA 602/8020	EPA 624/8240	EPA 625/8270	ICP METALS	EPA ~~8015M~~/TPH-gas/BTEX	TPH-diesel, kerosene
48			X		1			92	05	3001	92	01	30	0932	01A	X					X	X
										3002				0939	02A	X					X	X
										3003				0945	* 03A							
										3004				0955	* 04A							
										3005				1003	* 05A							
										3006				1008	* 06A							
										3007				1237	07A	*					*	*
										3008				1246	* 08A							
										3009				1253	09A	*					*	*

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						* please hold until further notification

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
Rick Erdman	Kim Flores	1/30/92 4:24
Kim Flores 1/30/92 5:45		

DISPATCHED BY: (Signature)	DATE/TIME	RECEIVED FOR LAB BY: (Signature)	DATE/TIME
		Gina Gillespie	1/30/92 1745

METHOD OF SHIPMENT: lab courier

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Accounting: 415/898-1052

CHAIN OF CUSTODY FORM

Lab: Med-Tox

Job Number: 5525.134.02

Name/Location: USPS - Emeryville

Project Manager: Melissa Wann

Samplers: Rick Erdman

Recorder: Rick Erdman (Signature Required)

SOURCE CODE	MATRIX: Water	#CONTAINERS & PRESERV.: Unpres.	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/NOTES	~~EPA 601/8010~~ 8080	EPA 602/8020	EPA 624/8240	EPA 625/8270	ICP METALS	~~EPA 8015M/TPH~~ TPH - gas, BTEX	TPH - diesel, Kerosene
48	X	1	92	05	3010	92	01	30	1312	* 10A							
48	X	1	92	05	3011	92	01	30	1320	11A	X					X	X
48	X	1	92	05	3012	92	01	30	1325	12A	X					X	X
48	X	1	92	05	3013	92	01	30	1341	* 13A							
48	X	1	92	05	3014	92	01	30	1349	* 14A	X					X	X
48	X	1	92	05	3015	92	01	30	1355	15A	X					X	X
48	X	1	92	05	3016	92	01	30	1418	* 16A							
48	X	1	92	05	3017	92	01	30	1425	17A	X					X	X
48	X	1	92	05	3018	92	01	30	1430	18A	X					X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						* please hold

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
Rick Erdman	Kim Flores	1/30/92 4:24
Kim Flores 1/30/92 5:45		

DISPATCHED BY: (Signature) DATE/TIME

RECEIVED FOR LAB BY: (Signature) Gina Gillespie DATE/TIME 1/30/92/1745

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Accounting: 415/898-1052

CHAIN OF CUSTODY FORM

9201254

Lab: Med-Tox

Job Number: 5535.134.02

Name/Location: USPS - Emeryville

Project Manager: Melissa Wann

Samplers: Rick Erdman

Recorder: Rick Erdman (Signature Required)

SOURCE CODE	MATRIX: Water	Sediment	Soil	Oil	#CONTAINERS & PRESERV.: Unpres.	H_2SO_4	HNO_3	SAMPLE NUMBER OR LAB NUMBER: Yr	Wk	Seq	DATE: Yr	Mo	Dy	Time	STATION DESCRIPTION/NOTES	EPA 601/8010 8080	EPA 602/8020	EPA 624/8240	EPA 625/8270	ICP METALS	EPA 8015M/TPH - gas w/BTEX	TPH - diesel, Kerosene
48			X		1			92	05	3019	92	01	30	1449	* 19A	X					X	X
										3020				1456	20A	X					X	X
										3021				1501	21A	X					X	X
										3022				1523	* 22A							
										3023				1534	23A	X					X	X
										3024				1539	24A	X					X	X

LAB NUMBER: Yr	Wk	Seq	DEPTH IN FEET	COL MTD CD	QA CODE	MISCELLANEOUS
						* please hold

CHAIN OF CUSTODY RECORD

RELINQUISHED BY: (Signature)	RECEIVED BY: (Signature)	DATE/TIME
Rick Erdman	Kim Flores	1/30/92 4:24
Kim Flores 1/30/92 5:45		

DISPATCHED BY: (Signature)	DATE/TIME	RECEIVED FOR LAB BY: (Signature)	DATE/TIME
		Gina Gillespie	1/30/92 1745

METHOD OF SHIPMENT lab courier

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Appendix D

QUANTITATIVE RISK ASSESSMENT FOR TRENCH WORKERS

APPENDIX D
QUANTITATIVE RISK ASSESSMENT OF CONSTRUCTION WORKERS EXPOSED TO PCB 1260

The following information presented is intended to support the assumptions and conclusions of the risk assessment discussed in Section 6.0.

D.1 Exposure Pathways

In the following section, exposure assessment (dose) calculations for each exposure pathway at the site are presented, including incidental ingestion of soil, dermal contact with soil, and inhalation of fugitive dusts. For all routes of exposure, the exposure frequency (EF) was assumed to be 30 days, or 6 days per week for 5 weeks.

D.1.1 Incidental Ingestion of Soil

Incidental ingestion of soil can occur if an individual eats, drinks, smokes, or is involved in labor-intensive activities in exposed soils. For example, workers involved in construction activities may be exposed via this pathway.

The soil ingestion rate for construction workers was assumed to be 480 milligrams per day (mg/day) for the RME scenario (*EPA, 1991a*). This value, which is regarded as highly conservative by EPA (*1991a*) is based on a study by Hawley (*1985*), who determined the rate of soil ingestion under maximum exposure conditions (8 hours of yard work by an adult). According to EPA (*1991a*), this value is appropriate for use in outdoor construction scenarios for a limited exposure frequency. A conservative gastrointestinal absorption factor of 100 percent (1.0) was assumed (*IRIS, 1991*); that is, all of an ingested chemical was assumed to be absorbed through the gastrointestinal tract.

Using the assumptions described above and the following equation, a chronic daily intake (CDI) for incidental ingestion exposure can be calculated as follows:

$$CDI = \frac{C_{soil} \times ED \times EF \times IR_s \times AF_o}{BW \times DY \times YL \times CF} \qquad \text{(Equation D-1)}$$

where:

CDI = chronic daily intake (mg/kg/day)

C_{soil} = concentration of chemicals in soil (mg/kg)

ED = duration of exposure (years)

EF = exposure frequency (days/year)

IR_s = soil ingestion rate (mg/day)

AF_o = oral absorption factor (unitless)

BW = body weight (kg)

DY = days in a year (i.e., 365 days/year)

YL = period over which exposure is being estimated (years); equal to ED (years) for noncarcinogens and 70 years for carcinogens

CF = conversion factor (10^6 mg/kg).

D.1.2 Dermal Contact with Soil

Dermal exposure to chemicals in soil can potentially occur to workers engaged in construction activities in exposed soils. This route of exposure was evaluated as discussed below.

The extent of exposure from dermal contact with soil was estimated using the duration of exposure, surface area of exposed skin, and the quantity of soil coming in direct contact with the skin. For the RME scenario, it was assumed that an individual wears a short sleeve shirt, shorts, and shoes (*EPA, 1991b*). The exposed surface area of

AdF = adherence factor (mg/cm^2)

SA = surface area of exposed skin (cm^2/day)

AF_d = dermal absorption factor (unitless)

BW = body weight (kg)

DY = days in a year (i.e., 365 days/year)

YL = period over which exposure is being estimated (years); equal to ED (years) for noncarcinogens and 70 years for carcinogens, and

CF = conversion factor (10^6 mg/kg).

D.1.3 Inhalation of Fugitive Dusts

Chemicals in soil may be released into the air adsorbed to dust particles generated by winds, as well as by human activities that disturb surface soils. These chemical-laden dust particles may potentially be inhaled by onsite receptors.

For the RME scenario, an onsite worker inhalation rate was estimated from an EPA study of activity patterns by activity level (*EPA, 1985*). The pattern of activity for an RME outdoor exposure was estimated to include 50 percent moderate activity and 50 percent heavy activity. Based on these percentages and the literature information for the activity levels of adults (*EPA, 1990a*), the inhalation rate for the RME scenario was estimated to be 3.0 m^3/hour. Assuming an 8-hour workday, this is equivalent to 24 m^3/day. According to EPA (*1990a*), trench digging is a "moderate"-level activity. Therefore, the RME value of 3.0 m^3/hour is conservative, since it includes 50 percent heavy activity.

The value for total suspended particulates in air was adapted from Hawley's (1985) estimate of 0.07 mg/m^3. This value is based on a compilation of measurements of dustfall in indoor and outdoor air in suburban, urban, and industrial areas

(*Hawley, 1985*). Because Hawley's data do not include measurements of suspended particulate matter in ambient air at construction sites where heavy soil disturbance is occurring, the value of 0.07 mg/m^3 was thought to be too low for the USPS site. An RME value was calculated as follows:

$$RP_r = \frac{RP_a \times IR_r}{IR_a} \qquad \text{(Equation D-3)}$$

where:

RP_r = suspended respirable particulate, RME scenario (mg/m^3)

RP_a = suspended respirable particulate, average scenario (0.07 mg/m^3; *Hawley, 1985*)

IR_r = soil ingestion rate, RME scenario (480 mg/day; *EPA, 1991a*)

IR_a = Soil ingestion rate, average scenario (50 mg/day; *EPA, 1991a*)

The average value of 0.07 mg/m^3 was adjusted to 0.67 mg/m^3 to represent the RME suspended respirable particulate value for this assessment.

It was conservatively assumed that 100 percent of inhaled chemical-laden particulates would be absorbed in the lungs (inhalation absorption factor of 1.0).

Using the assumptions described above and the following equation, chronic daily intakes (CDIs) for inhalation of fugitive dusts can be calculated as follows:

$$CDI = \frac{C_{soil} \times ED \times EF \times IR_i \times RP \times AF_i}{BW \times DY \times YL \times CF} \qquad \text{(Equation D-4)}$$

where:

CDI = chronic daily intake (mg/kg/day)

C_{soil} = concentration of chemicals in soil (mg/kg)

ED = exposure duration (years)

EF = exposure frequency (days/year)

carcinogenesis. On the basis of this theory, EPA has developed chemical-specific, route-specific SFs for chemicals that are known or suspected carcinogens.

The SF is based on a multiple-exposure, linear non-threshold extrapolation model. Specifically, this model is predicated on the assumption that any level of exposure to a carcinogen will result in some degree of carcinogenic risk, however minute. EPA states that this method of estimating risks is appropriate when evaluating cancer risks less than 10^{-2}, i.e., one excess cancer over a lifetime per 100 exposed individuals (*EPA, 1989a).*

Excess lifetime cancer risks were estimated by multiplying the CDI of Aroclor 1260 by its route-specific SF. This calculation was performed only for the oral route because no inhalation risk factor is available (*IRIS, 1992*). The product of this calculation (predicted excess cancer risk) was compared to EPA's "acceptable" risk range of 10^{-4} to 10^{-6} (*EPA, 1989a, 1990b*) and California's "acceptable" risk level of 1×10^{-5} (*HWA, 1988*). This range represents the probability of one excess cancer case per 10,000 (10^{-4}) exposed individuals to one excess cancer case per 1,000,000 (10^{-6}) exposed individuals over a lifetime.

D.2.2 Noncarcinogenic Effects

EPA's policy regarding noncarcinogenic chemicals differs from its policy for carcinogens (*EPA, 1989a, b*). With respect to noncarcinogens, for systemic toxicity effects to occur, physiological homeostatic, compensating, and adaptive mechanisms existing in humans must first be rendered inactive prior to any manifestation of a particular toxic response. EPA's theory for noncarcinogens is that the toxic response has a "threshold" concentration above which toxic effects may occur. EPA has established

RfDs for noncarcinogenic COCs which represent the dose of the specific chemical not expected to result in adverse health effects, even over a lifetime of exposure.

The likelihood of manifesting noncarcinogenic effects is not expressed as a probability as is the likelihood for carcinogenic risk. EPA recommends evaluation of noncarcinogenic potential using a calculation of hazard quotients (HQ) and hazard indices (HIs). The HQ is a pathway-specific (e.g., dermal, inhalation) ratio of the calculated CDI for each chemical compared to the agency-established, chemical-specific RfD (CDI/RfD). The HI is the sum of all the HQs for an individual pathway and from all pathways of exposure, and is used to assess a total noncarcinogenic risk. If either the HI or an HQ exceeds a value of 1.0, there "may be a concern for potential noncarcinogenic effects" (*EPA, 1989a*). Any HQ or HI less than 1.0 indicates that there is a low probability of adverse health effects occurring for the evaluated exposure scenarios.

The risk characterization results for potential carcinogenic risks evaluated in this risk assessment are presented in the following sections. No HI or HQ could be calculated because EPA has not determined oral or inhalation RfDs for Aroclor 1260 or other PCB (*IRIS, 1992*).

D.2.3 Incidental Ingestion of Soil

Potential carcinogenic risks from exposure to Aroclor 1260 in soil via incidental ingestion of soil are presented in Table 2-A. The potential upperbound excess lifetime cancer risk for the RME scenario was found to be 9.7×10^{-7}. This is well below EPA's "acceptable" risk range of 10^{-4} to 10^{-6}, indicating a low probability of carcinogenic health effects from ingestion exposure to Aroclor 1260 at the USPS site.

D.2.4 Dermal Contact with Soil

Potential carcinogenic risks from exposure to the Aroclor 1260 in soil via dermal contact are presented in Table 8. The potential upperbound excess lifetime cancer risk was found to be 4.3 x 10^{-6} for RME scenario, to the lower end of EPA's "acceptable" risk range of 10^{-4} to 10^{-6} and below DTSC's level of 10^{-5}, indicating a low probability of carcinogenic health effects from dermal exposure to Aroclor 1260 at the USPS site.

D.2.5 Inhalation of Fugitive Dusts

Intake assumptions for this pathway are presented in Section D.1.3 and Table 6. However, because no inhalation RfD is available, no carcinogenic risk could be calculated.

D.2.6 Multipathway Exposure

Exposure via any one of the pathways discussed above does not preclude exposure via another pathway. Adult workers could be exposed to the Aroclor 1260 in soil through dermal contact, incidental ingestion, and inhalation of fugitive dust. The total risk to the individual would depend on the number of pathways contributing to the exposure, and the risk contributed by each pathway. Since chemicals entering the body by different exposure routes may have different sites of action and different toxic effects, a high degree of uncertainty is involved in summing the impacts across pathways.

For the purposes of this risk assessment and as directed by EPA (*1989a*), exposures across the different pathways (with the exception of inhalation exposure) were summed together and are presented in Table 9. For the adult worker scenario, the potential upperbound excess lifetime cancer risks were found to be 5 x 10^{-6}, which is to the lower end of EPA's "acceptable" risk range of 10^{-4} to 10^{-6} and below DTSC's level of 10^{-5}. Therefore, it is unlikely that exposure to Aroclor 1260 across multiple routes at the USPS site will result in significant cancer risks to any individuals.

D.3 Uncertainties

EPA guidelines for risk assessment are intended to promote technical quality and consistency in the risk assessment process (*EPA, 1989a,b*). In addition to providing technical information and policy guidance, the guidelines also stress that risk assessments should include a discussion of the strengths and weaknesses of each assessment by describing uncertainties, assumptions, and limitations, as well as the scientific basis and rationale for each assessment (*EPA, 1989a*).

Uncertainty is inherent in many aspects of the risk assessment process. In addition to the use of many conservative assumptions and approximations, the identification and analysis of environmental conditions is difficult and inexact. There are four broad areas where uncertainties may be found in the risk assessment process:

1) Collection of site-specific data
2) Exposure to receptor populations
3) Chemical toxicity
4) Risk characterization.

For each of these areas, a number of factors may increase or decrease the confidence in the accuracy of a risk assessment. Some of these factors, as they may apply to the risk assessment, are discussed below.

D.3.1 Collection of Site-Specific Data

Factors that may introduce uncertainty into analyses of site environmental data are as follows:

- Sample collection methods
- Rationale for placement of sampling stations
- Accurate characterization of area geology and hydrology
- Representativeness and completeness of data
- Adequacy of data to describe site conditions
- Characterization of exposed or potentially exposed populations
- Analytical methods, detection limits, and quality control/quality assurance procedures.

It was assumed in this evaluation that the sampling activities fully characterized the nature and distribution of chemicals at the USPS facility, and that the concentrations used in the exposure and risk assessments are representative of the chemicals found at the facility. The sampling strategy was designed to fully characterize the nature and extent of the contamination. As such, sampling locations were selected near and downgradient of known or suspected sources. The use of these data may result in an overestimate of potential risks since the sampled areas were more likely to contain chemicals than not.

Through the use of conservative assumptions, the actual risks from exposure to Aroclor 1260 originating at the USPS facility are not likely to exceed risks from the RME case and are likely to be much lower than the risks predicted from this evaluation.

D.3.2 Exposure to Receptor Populations

In the exposure evaluation, the primary routes of potential exposure were evaluated, as well as the potential magnitude, duration, and/or frequency of contact. A major source of uncertainty in estimating exposures is the assumption that all individuals within a particular receptor group will receive the same dose. Biological variability in absorption, ingestion rates, breathing rates, frequency and duration will exist, even in a narrowly defined age group or identified sensitive population group.

The evaluated exposure pathways are considered to be the primary pathways of exposure. Minor or secondary pathways often cannot be estimated from available data and were eliminated from consideration in exposure calculations. It is expected that those pathways evaluated in this risk assessment consider the majority of the potential health risks from site chemicals.

D.3.3 Chemical Toxicity

Most of the toxicity information used in risk calculations was obtained from animal studies at high doses. Although epidemiological (human) studies for specific human populations are available as a source of toxicity information for Aroclor 1260, EPA classifies the human data as inadequate (*IRIS, 1991*). Animal data served as the principal basis of the oral slope factor used to assess risk for Aroclor 1260. Extrapolation from animals exposed to high doses of the chemical to humans potentially exposed to much lower doses may be a major source of uncertainty.

In addition, the actual mechanism of toxic action in laboratory animals of some chemicals may not be the same as in humans. Slope factors are calculated assuming that humans are equally sensitive to the carcinogenic effects of chemicals as laboratory animals. This represents a large source of uncertainty.

Factors influencing toxicity and, consequently, the evaluation of risk based on animal data are listed below:

- Choice of species, strain, age, and sex of animals
- Number of animals in the study
- Individual variation within animal species

- Similarity in the routes of exposure between the tested species and route of interest in humans
- Purity of test compound
- Decay of test compound
- Selection of dose levels and use of control groups
- Distribution of animals among dose levels
- Similarity between test animals and humans in terms of metabolism and pharmacokinetics
- Proper histopathological examination of animals
- Proper animal husbandry and dietary considerations
- Experimental surroundings
- Selection of proper endpoint in animal studies
- Latency periods
- Synergism or antagonism between chemicals
- Species to species extrapolation of dose levels
- High to low dose extrapolations and choice of model to describe dose-response curve for carcinogenic chemicals (i.e., all chemicals are assumed to be carcinogenic in the same way)
- Statistical evaluation of confidence intervals and methods used to analyze data.

D.3.4 Risk Characterization

Integrating site-specific data into the risk characterization step also includes uncertainties. However, very conservative assumptions have been employed to minimize the impact of these uncertainties.

Calculations of chemical intakes can provide considerable uncertainty in a risk assessment. Intake assumptions include, for example, inhalation rates, dermal contact rates, ingestion rates, skin surface areas, and absorption factors. The assumptions used to calculate intakes are conservative based upon the best available scientific literature and/or assumed values. Intake assumptions are often debated in the scientific community. The range of uncertainty in the values quoted by various researchers can make a substantial difference in the results of a risk assessment. The intake assumptions used in this evaluation were obtained both from peer-reviewed scientific literature and from EPA guidance documents. Uncertainties in the assessments may exist from the use of these assumptions and may result in an overestimate of risk.

In summary, every effort has been made to reduce the uncertainties inherent in this risk assessment. To reduce uncertainties, directly measured concentrations (e.g., soil concentrations) were used to evaluate risk, rather than modeled concentrations. Conservative assumptions regarding the toxicity of the compounds have also been used in the assessment. As indicated in the previous sections, it is expected that any uncertainties in this risk assessment would therefore tend to err on the conservative side. Through the use of conservative assumptions, the actual risks from exposure to Aroclor 1260 originating at the USPS site are not likely to exceed risks from the RME case and are likely to be much lower than the risks predicted from this evaluation.

D.4 LITERATURE CITED

Hawley, J.K., 1985. Assessment of Health Risk from Exposure to Contaminated Soil. *Risk Analysis* 5:289-302.

Health and Welfare Agency, 1988. *California Code of Regulations, Division 2, Chapter 3*, State of California Drinking Water and Toxic Enforcement Action of 1986, Article 8, Section 12711 et. seq.

Integrated Risk Information System (IRIS), 1991. Online database. U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency (EPA), 1985. *Development of Statistical Distribution on Ranges of Standard Factors Used in Exposure Assessments.* EPA 600/18-85-010.

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, 1986. *Superfund Public Health Evaluation Manual.* Washington, D.C. EPA/540/1-86/060. October.

U.S. Environmental Protection Agency (EPA), Office of Emergency and Remedial Response, 1989a. *Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual. Interim Final.* Washington, D.C. EPA/540/1-89/002. December.

U.S. Environmental Protection Agency (EPA), Region IX, 1989b. *Risk Assessment Guidance for Superfund Human Health Risk Assessment. Interim Final. U.S. EPA Region IX Recommendations.* December 15.

U.S. Environmental Protection Agency (EPA), Office of Health and Environmental Assessment, 1990a. *Exposure Factors Handbook.* EPA 600/8-89/043. Washington, D.C. March.

U.S. Environmental Protection Agency (EPA), 1990b. Corrective Action for Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule. *Federal Register* 55:30798:30884. July 27.

U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response, 1991a. *Human Health Evaluation Manual, Supplemental Guidance, "Standard Default Exposure Factors" (Memorandum)* OSWER Directive 9285.6-03. Washington, D.C. March 25.

U.S. Environmental Protection Agency (EPA), Office of Health and Environmental Assessment, 1991bRW. *Interim Guidance for Dermal Exposure Assessment.* Review Draft. OHEA - E-367. March.