GEOMATRIX

RO#62

LOP 376

SOIL AND GROUNDWATER SAMPLING REPORT AND HEALTH RISK ASSESSMENT

Rix Property
6460 Hollis Street
Emeryville, California

Prepared for:

HFH Limited
1355 Ocean Avenue
Emeryville, California

July 1998
Project No. 4710.01

Geomatrix Consultants

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1 July 1998
Project 4710.01

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Alameda County Health Agency
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

Dr. Ravi Arulanantham
Regional Water Quality Control Board
San Francisco Bay Region
2101 Webster Street
Oakland, California 94612

Subject: Soil and Groundwater Sampling Report and Health Risk Assessment
Rix Property
Emeryville, California

Dear Ms. Hugo and Dr. Arulanantham:

Geomatrix Consultants, Inc., is pleased to submit this report on behalf of HFH, Limited. This report presents the results of soil and groundwater sampling and a human health risk assessment conducted at the subject site. Please contact either of the undersigned if you have any questions or require additional information.

Sincerely,

GEOMATRIX CONSULTANTS, INC.

Jennifer L. Patterson
Project Engineer

Tom Graf, P.E.
Principal Engineer

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cc: Andy Getz; HFH, Limited
Erik Housh; MRE Commercial Real Estate

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1.0 INTRODUCTION

This report summarizes the results of soil and groundwater sampling activities and a human health risk assessment conducted by Geomatrix Consultants, Inc. (Geomatrix), at the Rix Property located at 6460 Hollis Street in Emeryville, California (Figure 1). Work was conducted on behalf of HFH, Ltd., of Emeryville, California, in regards to their potential purchase of the property. The purpose of the work conducted at the site was to provide additional assessment of chemicals in soil and groundwater beneath the site and to address the items outlined by the Alameda County Health Care Services Agency (ACHCSA) in their 25 March 1998 letter to Mr. Frank DeWolf (property owner) that must be addressed prior to receiving site closure. This report outlines site background information, field activities, and results of the work conducted, and addresses each point outlined by the ACHCSA.

2.0 SITE BACKGROUND

The site is currently vacant and consists of one large building and a yard area. Geomatrix reviewed historical Sanborn Fire Insurance maps (Sanborn maps) of the site and reports prepared by others to obtain site background information. A description of on-site investigations and regional information are presented in this section.

The site was undeveloped on the 1911 Sanborn map. Sterling Paint Company operated on the premises from at least 1950. In 1967 and 1969, an industrial adhesives facility is shown on the Sanborn map. Sometime after 1969, Rix Industries began using the site for manufacturing of large air compressors. Rix Industries vacated the property in 1996.

Ten underground storage tanks (USTs) were located on the property. Five of these USTs were located beneath the building and five were located in the yard area east of the building. Reportedly, these USTs historically contained chlorinated solvents, methyl ethyl ketone, alcohols, and ethyl silicate. Groundwater beneath the site is located at a depth of approximately 4 feet below ground surface (bgs) and flows towards the west to southwest.

2.1 PREVIOUS ON-SITE INVESTIGATIONS

In 1992, Hageman-Aguiar, Inc. (HA), of Lafayette, California, sampled the UST contents, advanced soil borings, and installed and sampled three monitoring wells on behalf of Mr. DeWolf. Analytical results of UST contents indicated diesel fuel, sec-butanol, mineral spirits, methyl isobutyl ketone (MIBK), and tetrachloroethene (PCE). Eight soil borings were advanced in the vicinity of the five USTs located beneath the building and soil samples were collected at depths of 2 or 4 feet below ground surface (bgs) depending on the compaction of the soil. Soil samples contained petroleum hydrocarbons (up to 400 milligrams per kilogram [mg/kg]) and volatile organic compounds (VOCs; up to 1.5 mg/kg). Monitoring wells MW-1 and MW-2 were installed inside the building and well MW-3 was installed in the yard area between the USTs and the building (Figure 2). Soil samples were collected from depths of 3 to 7.5 feet bgs during monitoring well installation. These samples contained petroleum hydrocarbons (up to 3,000 mg/kg), ketones (up to 41 mg/kg), and other VOCs (up to 31 mg/kg). These wells were sampled periodically until August 1996. Groundwater samples contained petroleum hydrocarbons (up to 21,000 micrograms per liter [µg/l]), alcohols (up to 17,000 µg/l), ketones (up to 97,000 µg/l) and other VOCs (up to 2200 µg/l). Concentrations of detected constituents have exhibited a decreasing trend over time. Soil sample analytical results from the borings and monitoring wells are included in Appendix A. Historical analytical results for the monitoring wells are included in Appendix B.

In July 1994, the five USTs located beneath the building were closed in-place by HA. The USTs were triple-rinsed and filled with cement sand slurry. In December 1994, the five remaining USTs in the yard area and approximately 160 tons of overexcavated soil were removed from the site. Ten soil samples were collected from the sidewalls of the UST excavation at depths of 4 feet bgs (the approximate groundwater level). Soil samples contained petroleum hydrocarbons (up to 4.2 mg/kg), alcohols (up to 860 mg/kg), ketones (up to 31 mg/kg), and other VOCs (up to 0.021 mg/kg).

In February 1998, two soil borings were advanced by International Geologic (IG), of Oakland, California, on behalf of a potential buyer to collect grab groundwater samples. Groundwater samples were also collected from the monitoring wells. The borings were located approximately downgradient of the former UST locations along the western property boundary. Analytical results showed concentrations of petroleum hydrocarbons (up to 62,000 µg/l), and VOCs (up to 86 µg/l) in the grab groundwater samples. Groundwater samples collected from the monitoring wells contained petroleum hydrocarbons (up to 9,300 µg/l), and VOCs (up to 173 µg/l). These results are included in Appendix B.

2.2 REGIONAL INFORMATION

Based on information provided by the ACHCSA, environmental investigations have been conducted at several properties in the vicinity of the site. A monitoring well was installed upgradient of the site at 1372 Ocean Avenue by IG in association with a UST removal. The well is located adjacent to the eastern and upgradient boundary of the site. The analytical results from sampling conducted in March 1998 indicated concentrations of several VOCs at concentrations up to 82 µg/l and petroleum hydrocarbons at concentrations up to 120 µg/l.

Environmental investigations have also been conducted at the Ryerson Steel Facility and Lowenberg Property located across Hollis Street and downgradient of the site. VOCs

were detected in groundwater samples at these properties at concentrations up to 170 µg/l in 1995.

Geomatrix conducted a regional well survey through the Alameda County Public Works Association (ACPWA) and identified one property with an irrigation well approximately 1/3-mile downgradient of the site. The total depth of this well is 470 feet. Other items identified during the well survey appear to be related to shallow groundwater investigations at other industrial properties in the area.

3.0 FIELD ACTIVITIES

In April 1998, Geomatrix performed shallow soil sampling, grab groundwater sampling, and well installation and groundwater monitoring activities. Field activities are discussed below. Prior to beginning field activities, appropriate permits were acquired (Appendix C) and Underground Service Alert (USA) was notified to clear locations for underground utilities. All activities were conducted in accordance with Geomatrix protocols (Appendix D) and samples were sent to American Environmental Network of Pleasant Hill, California, for analysis. Laboratory analyses for the samples collected were chosen based on results of previous site investigations and a review of previous site activities.

3.1 SHALLOW SOIL SAMPLING

Geomatrix collected shallow one soil sample per boring from depths of 0.5 to 2 feet bgs at ten locations (S-1 to S-10) on site. Soil samples were collected using a hand auger; locations are shown on Figure 2. Samples S-1 and S-2, S-7 and S-8, and S-9 and S-10 were composited for analyses for CAM 17 metals by U.S. Environmental Protection Agency (U.S. EPA) Methods 6000/7000 series. Sample S-6 was analyzed discretely for CAM 17 metals . Samples S-3, S-4, and S-5 were analyzed discretely for VOCs according to U.S. EPA Method 8260 and for CAM 17 metals.

3.2 GRAB GROUNDWATER SAMPLING

Four soil borings (GGW-1 through GGW-4) were advanced by Gregg Drilling, Inc., of Martinez, California, for the collection of grab groundwater and soil samples. Sampling locations are shown on Figure 2. Soil borings were advanced to depths of 6 to 12 feet bgs; lithologic logs are included in Appendix E. Soil samples were collected from depths of 1 to 2 feet bgs and analyzed discretely for CAM 17 metals. Grab groundwater samples were analyzed for VOCs according to U.S. EPA Method 8260 and CAM 17 metals. In addition, samples from borings GGW-2 and GGW-3 were analyzed for TPHd and TPHg.

3.3 MONITORING WELL INSTALLATION AND DEVELOPMENT

One monitoring well (MW-4) was installed by Gregg Drilling, Inc., adjacent to the site, downgradient of the former UST locations. The well was constructed of 2-inch-diameter polyvinyl chloride (PVC) well casing to 3 feet bgs and 10 feet of 2-inch-diameter factory-slotted PVC well screen from 3 to 13 feet bgs. The filter pack is Monterey 2/12 sand and the well is sealed with 6 inches of bentonite and 1.5 feet of cement. Well construction details are included in Appendix E.

Approximately 24-hours after installation, the well was developed by Gregg Drilling using a method of surging and then purging the well. The existing monitoring wells (MW-1 through MW-3) were also redeveloped at this time to remove any sediment that may have built up.

3.4 GROUNDWATER MONITORING

Three days after the wells were developed, Geomatrix collected groundwater samples according to Geomatrix protocols. Groundwater samples were analyzed for VOCs according to U.S. EPA Method 8260. In addition, samples from MW-2 and MW-4 were analyzed for CAM 17 metals, and an additional groundwater sample from MW-4 was

sent to Friedman & Bruya, of Seattle, Washington, for hydrocarbon fingerprinting. The groundwater samples collected for VOC and CAM 17 analyses were analyzed by the laboratory after the holding time had expired. Analytical results for MW-1 through MW-3 were similar to those from the February 1998 sampling event, so the wells were not resampled. Since no basis for comparison was available for MW-4, a second sample was collected for analysis for VOCs, which was conducted within the holding time.

4.0 ANALYTICAL RESULTS

This section presents the analytical results of soil and groundwater sampling conducted at the site by Geomatrix. Analytical results are summarized in Tables 1 through 4 and on Figures 3 through 5. Laboratory analytical data sheets are included in Appendix F.

4.1 SHALLOW SOIL SAMPLES

Thirteen metals were detected in shallow composite and discrete soil samples collected from borings S-1 through S-10 and GGW-1 through GGW-4. Analytical results for metals in soil samples are presented in Table 1 and on Figure 3. Metals concentrations are compared to concentrations considered to be indicative of regional background to assist in evaluating the data. The regional background data used for comparison were collected by the Lawrence Berkeley National Laboratory (LBNL) for the purpose of establishing background concentrations of selected metals in the vicinity of the laboratory (LBNL, 1995). A chemical was considered to be present above representative background concentrations if the maximum concentration of the site data was above the 95 percent upper tolerance limit (95% UTL) of the LBNL data. Barium, cadmium, chromium, copper, lead, mercury, and zinc were detected in one or more samples at concentrations greater than background levels. Elevated metals concentrations were detected in samples collected from both the yard area and beneath the building slab.

Based on the elevated lead concentrations in some soil samples, a waste extraction test (WET) for lead was performed on two of the composite samples (S-7,8 and S-9,10) to determine disposal options available for future construction. Lead was detected at concentrations of 15 mg/l in the samples S-7,8 and at 8.7 mg/l in sample S-9,10. The soluble threshold limit concentration (STLC) for lead is 5 mg/l. Based on these concentrations, excavated near-surface soil at the site will likely require disposal as a California hazardous waste. However, lead was not detected at concentrations above laboratory reporting limits in groundwater samples collected at the site (see Sections 4.2 and 4.3).

VOCs were detected in the three soil samples analyzed (S-3, S-4, and S-5) at concentrations ranging from 0.03 to 6.5 mg/kg. Analytical results for VOCs in soil are presented in Table 2 and on Figure 4. These samples were collected from beneath the building slab.

4.2 GRAB GROUNDWATER SAMPLES

The analytical results for the grab groundwater samples analyzed for metals and TPH are presented in Table 3. Arsenic, barium, cobalt, molybdenum, nickel, vanadium, and zinc were detected in one or more of the four grab groundwater samples analyzed at concentrations ranging from 6 to 520 µg/l. Of the two samples analyzed for TPHg and TPHd, only TPHg was detected in the sample and duplicate sample collected from boring GGW-3, at concentrations of 220 and 240 µg/l.

Analytical results for the four samples analyzed for VOCs are presented in Table 4 and on Figure 5. Vinyl chloride and 1,1-dichloroethane (1,1-DCA) were detected in the sample collected from GGW-2, located in Hollis Street, downgradient of the site, at concentrations of 120 and 11 µg/l, respectively. The sample and duplicate sample collected from GGW-3, located within the yard area, contained several VOCs at concentrations ranging from 5 to 120 µg/l. The samples collected from GGW-1 and

GGW-4 did not contain VOCs above laboratory reporting limits; however, the reporting limits were elevated due to matrix interferences. A sheen was noted in this well during sampling activities.

4.3 MONITORING WELL SAMPLES

Groundwater samples collected from wells MW-2 and MW-4 were analyzed for metals. Analytical results for metals in groundwater are presented in Table 3. Arsenic, barium, and nickel were detected in both samples and molybdenum was detected in the sample collected from MW-2.

Samples collected from all four monitoring wells were analyzed for VOCs. Analytical results are included in Table 4 and on Figure 5. Several VOCs were detected in the groundwater samples at concentrations ranging from 5 to 250 µg/l. Results were generally consistent with past monitoring events in the existing wells. Two samples were analyzed from the new downgradient well, MW-4. Three constituents were detected in one of the samples; sec-butylbenzene at a concentration of 15 µg/l, isopropylbenzene at a concentration of 16 µg/l, and n-propylbenzene at a concentration of 5 µg/l. The second sample did not contain any constituents above laboratory reporting limits.

The hydrocarbon fingerprinting analysis performed on the groundwater sample from MW-4 indicated the presence of diesel fuel that had undergone evaporative and biological degradation.

5.0 HEALTH RISK ASSESSMENT

This section presents an assessment of the potential risks to human health and the environment associated with the presence of chemicals detected in soil and groundwater at the site assuming continued commercial use of the property. The results of the human health risk assessment (HHRA) are discussed below. An ecological risk assessment was

not considered necessary for the following reasons. First, current and planned future use of this site is for commercial purposes, and the majority of the site is or will be covered by buildings, pavement, and landscaping. Second, the site is located within a commercial/industrial area approximately ½-half mile from the nearest surface water body, the San Francisco Bay. Therefore, no further assessment of potential risks to non-human receptors is warranted.

The HHRA is organized into sections that parallel the risk assessment process outlined by the National Academy of Science (1983) and U.S. EPA (1989), including data evaluation, exposure assessment, toxicity assessment, and risk characterization. The primary guidance used in this HHRA are California Environmental Protection Agency's (Cal-EPA's) "Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities" (1992), U.S. EPA's "Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Parts A and B" (1989; 1991a), and U.S. EPA's "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors" (1991b). Cal-EPA's "Preliminary Endangerment Assessment (PEA) Guidance Manual" (1994a) was used, as appropriate, in the development of chemical-specific parameters and exposure pathway assumptions.

5.1 DATA EVALUATION

Data evaluation is the process of analyzing site characteristics and analytical data to identify chemicals of potential concern (COPCs) to be evaluated in the HHRA. As described previously, several VOCs have been detected in soil and groundwater beneath the site. For purposes of this HHRA, all of the detected organic chemicals were identified as COPCs. Several naturally occurring metals also were detected in soil and groundwater. As discussed further in Section 5.2, potential exposure to chemicals in groundwater is limited to inhalation of vapors; therefore, metals detected in groundwater are not considered further in the HHRA. For metals detected in soil, the analytical data for each chemical, including chemical name, total number of samples analyzed, total number of detections, range of detected concentrations, and range of detection limits are

summarized in Table 5. Metals in soil were identified as COPCs according to the following criteria:

- Primary Criterion

  If the maximum detected concentration is greater than the U.S. EPA Region 9 preliminary remediation goal (PRG) for residential soil, then that chemical was further evaluated using the Secondary Criterion described below. If the maximum detected concentration is less than the appropriate PRG, then that chemical was not considered further in the HHRA.

- Secondary Criterion

  If the maximum detected concentration is greater than the concentration in soil considered indicative of regional background, then that chemical was identified as a COPC. If the maximum detected concentration is less than the background concentration, then that chemical was not considered further in the HHRA.

The representative background data used as part of the secondary criterion were collected by LBNL for the purpose of establishing background concentrations of selected metals in the vicinity of the laboratory (LBNL, 1995). The LBNL data set is discussed in more detail in Section 4.1. A chemical was considered to be present in soil at concentrations within background if the maximum detected concentration was below the 95% UTL of the LBNL data. The metals in soil identified as COPCs are presented in Table 5. As stated previously, three of the six samples analyzed for metals were each composites of two discrete samples. Even if the results from these samples were doubled (i.e., assuming that the total concentration detected was in one of the discrete samples), the same metals would be identified as COPCs in soil.

5.2 EXPOSURE ASSESSMENT

Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposure. The principal elements of exposure assessment consist of:

- evaluation of the influence of fate and transport processes for the COPCs,
- identification of potential exposure scenarios (i.e., receptors) and exposure pathways,
- calculation of representative chemical concentrations, and
- estimation of potential chemical uptake.

A site conceptual model was created based on the soil and groundwater conditions, current and planned future land use, and physical and chemical characteristics of the chemicals potentially present at the site. As described in the U.S. EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (1988a), the purpose of a site conceptual model is to describe what is currently known about chemical sources, likely migration pathways, exposure routes, and possible exposure scenarios so that the data necessary to complete a risk assessment are identified. Figure 6 presents the site conceptual model for this site. Each of the components of the site conceptual model is discussed in the following sections.

The exposure assessment reflects reasonable maximum exposure (RME) conditions for each receptor. The U.S. EPA defines the RME scenario as "The highest exposure that is reasonably expected to occur at the site (U.S. EPA, 1989). In addition, the U.S. EPA states that "the intent of the RME is to estimate a conservative exposure case (i.e., well above average) that is still within the range of possible exposures" (U.S. EPA, 1989).

5.2.1 Environmental Fate and Transport of Chemicals of Potential Concern

The environmental fate of the COPCs is controlled by the cumulative interaction of transport and transformation processes. Once released into the environment, a chemical may partition among various environmental media (soil, water, air). The transport processes that define the movement of chemicals between media are highly dependent on the physicochemical properties of both the chemicals and the environmental media.

The COPCs can be divided into two categories: VOCs and metals. The following paragraphs provide a brief overview of the fate and transport characteristics of each of

these general categories. Several physical constants, including molecular weight, Henry's Law constant, and organic carbon partitioning coefficient are presented for the organic COPCs in Table 6. These physical constants were used to identify whether or not a chemical may be considered volatile. It was assumed that a COPC is volatile if its Henry's Law constant is greater than 10^{-5} atmospheres-cubic meters per mole (atm-m^3/mole) and its molecular weight is less than 200 grams per mole (U.S. EPA, 1991a).

Volatile Organic Chemicals

VOCs have relatively high vapor pressures, and relatively high solubilities in water and organic solvents. Chemicals that are volatile and water soluble tend to have low soil adsorption and bioaccumulative potentials. Based on these characteristics, these chemicals are relatively mobile in soil and may volatilize into the air or leach to groundwater.

Metals

Lead was the only metal identified as a COPC. Lead occurs naturally in soil, is non-volatile, and adheres tightly to soil particles. In general, the mobility of lead in the environment depends on the pH of the surrounding medium. Under acidic conditions, lead may become soluble and be mobilized through soil by infiltrating water or can be dissolved directly into groundwater if present in the saturated zone. Otherwise, lead is relatively immobile in soil and generally exhibits low water solubility. Lead is not subject to biodegradation and will persist in the environment (NRC, 1994; Freeze and Cherry, 1979).

Environmental media (e.g., soil, air, groundwater) that may significantly contribute to an individual's exposure to a chemical can be determined based on this general understanding of the environmental transport mechanisms of the COPCs. As shown in Figure 6, COPCs at the site may be present in surface and subsurface soil, air, or groundwater.

5.2.2 Identification of Potential Receptors and Exposure Pathways

Based on the current and planned future use of the site for commercial purposes, potential receptors are limited to current and future on-site workers. As shown in Figure 6, current and future on-site workers may come into contact with chemicals in surface soil or air. Potential exposure to future construction workers who may intrude into subsurface soil or shallow groundwater will be addressed as part of a site-specific Health and Safety Plan at the time of construction.

Exposure pathways are the means through which an individual may contact a chemical in the environment. Exposure pathways are governed by environmental conditions (e.g., depth to groundwater or prevailing wind direction); by the potential for the chemical to move from one medium (water or air) to another; and by the general lifestyles and/or work activities of potentially exposed populations (e.g., construction work or office work). Although several potential pathways may exist, only a few may be complete. For a pathway to be complete, each of the following elements must exist:

- a source and mechanism for chemical release,
- an environmental transport medium (e.g., air, water),
- a point of potential contact with the medium, and
- an exposure route at the contact point (e.g., inhalation, dermal contact).

Current and future on-site workers may be exposed to COPCs in surface soil outside the existing building via incidental ingestion and dermal contact. In the event that the existing building is replaced, future on-site workers are not expected to come into contact with soil because, after construction, it is expected that the newly constructed building or buildings, asphalt or concrete pavement, and landscaping will cover the site. Current and future on-site workers may also be exposed to COPCs present in indoor air as vapors (originating from soil or groundwater).

Shallow groundwater beneath and in the vicinity of the site is not currently used as a drinking water source. A regional well survey identified only one irrigation well

approximately 1/3-mile downgradient of the site. The total depth of this well is 470 feet. Other wells identified during the survey appear to be related to shallow groundwater investigations at other industrial properties in the area. Given the generally poor quality of the shallow groundwater due to historical industrial practices in the City of Emeryville and the possible impacts from sewers and storm drains, it is very unlikely that shallow groundwater will be used as a municipal source of water in the foreseeable future. Therefore, potential exposure to chemicals in groundwater associated with domestic use was not evaluated in this HHRA.

5.2.3 Exposure Point Concentrations

Estimates of exposure point concentrations are necessary for evaluating chemical uptake in exposed individuals. For purposes of evaluating an RME scenario, the U.S. EPA recommends that the exposure point concentration be equal to the 95-percent upper confidence limit (95% UCL) of the arithmetic mean of a given set of chemical concentration data to account for the uncertainty in estimating the true average concentration at a site (U.S. EPA, 1992a). In this case, the COPCs in soil and groundwater were detected relatively infrequently and at relatively low concentrations. Therefore, to be conservative, the maximum detected concentrations were used (see Table 7).

The concentrations of volatile COPCs in air were estimated based on the representative concentrations in soil and groundwater. As shown in Appendix G, the emission rates of the COPCs in air above these media were estimated using the VOC emissions model (Cal-EPA, 1994a). The resulting emission rates were used in conjunction with a box model to estimate indoor air concentrations for current and future on-site workers. Several physical constants required for these models are summarized in Table 6. In some cases, physical constants were not readily available and had to be calculated; these calculations are shown in Appendix H.

5.2.4 Exposure Equations and Input Parameters

This section presents the exposure equations and input parameters used to calculate the annual average daily dose (AADD) and lifetime average daily dose (LADD) for each of the identified routes of exposure. The AADD and LADD both provide quantitative estimates of an individual's daily exposure to a chemical. The difference between the two estimates is the time over which the exposure is averaged. Noncarcinogenic health effects are assumed to occur only after a threshold dose is reached (see Section 5.3.1); therefore, the AADD represents the average daily dose during the period of exposure. Conversely, carcinogenic health risks are not considered to be threshold phenomena (see Section 5.3.2). Therefore, the LADD represents the average daily dose over a lifetime.

As discussed in Section 5.3.3, potential noncarcinogenic health risks associated with exposure to lead are evaluated using Cal-EPA's Lead Spread Model rather than calculating an AADD. Therefore, the only exposure pathway for which an AADD or LADD was calculated is inhalation of vapors. The components of this equation are presented below:

Inhalation of Vapors

$$\text{Dose}_{IV} = \frac{\text{Cin} \times \text{IRa} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

Dose_{IV}	=	Dose received through inhalation of vapors originating from soil or groundwater (mg/kg-day)
Cin	=	Chemical concentration in indoor air (mg/m^3)
IRa	=	Inhalation rate (m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Values used for each input parameter, including the source and rationale, are summarized in Table 8. In all cases, the input parameters are equal to conservative default assumptions prescribed by Cal-EPA (e.g., 1992) or U.S. EPA (e.g., 1991b).

5.3 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is two-fold (U.S. EPA, 1989):

- to evaluate available information regarding the potential for a chemical to cause adverse health effects in exposed individuals (hazard identification), and
- to estimate the relationship between the extent of exposure and the increased likelihood (e.g., probability or chance) and/or severity of adverse effects (dose-response assessment).

Hazard identification entails determining if a chemical can cause an increase in a particular adverse effect (e.g., cancer) and the likelihood that the adverse effect will occur in humans. The result of the hazard identification is a toxicity profile that summarizes the available toxicological information and its relevance to human exposure under conditions present at the site. Dose-response assessment entails quantifying the relationship between the dose of a contaminant and the incidence of adverse effects in the exposed population. The result of the dose-response assessment is toxicity criteria that are used in the risk characterization to estimate the likelihood of adverse effects occurring in humans at different exposure levels. The toxicity criteria used to evaluate noncarcinogenic and carcinogenic health risks are commonly referred to as reference doses (RfDs) and slope factors (SFs), respectively. The basis for these criteria is described briefly in the following sections.

5.3.1 Toxicity Criteria for Noncarcinogenic Health Risks

Observable noncancer biological effects of chemical substances occur only after a threshold dose is reached. For the purposes of establishing health criteria, this threshold dose is usually estimated from the no-observed adverse effect level (NOAEL) or the lowest-observed adverse effect level (LOAEL) determined in chronic animal exposure

studies. The NOAEL is defined as the highest dose at which no adverse effects occur, whereas the LOAEL is defined as the lowest dose at which adverse effects begin to occur. Cal-EPA, U.S. EPA, and other regulatory agencies use NOAELs and LOAELs derived from animal studies to establish RfDs to evaluate human intake of noncarcinogenic compounds. RfDs, which are expressed in terms of mg/kg-day, are criteria intended to represent the dose of a chemical that is not expected to cause adverse health effects over a lifetime of daily exposure, even in sensitive individuals, with a substantial margin of safety. The associated noncarcinogenic toxicity criteria used in the HHRA are presented in Table 9.

5.3.2 Toxicity Criteria for Carcinogenic Health Risks

Regulatory guidance assumes that chemicals that are carcinogenic should be treated as if they do not have thresholds (U.S. EPA, 1989). This approach assumes that the dose-response curve for carcinogens only allows for zero risk at zero dose (i.e., for all doses, some risk is assumed to be present). To estimate theoretically plausible responses at these low doses, various mathematical models are used. The accuracy of the projected risk depends on how well the model predicts the true relationship between dose and risk at dose levels where the relationship cannot be actually measured. The accuracy of these models is currently unknown, but they are believed not to underestimate the true risk.

Health risks for exposure to carcinogens are defined in terms of probabilities that quantify the likelihood of a carcinogenic response in an individual receiving a given dose of a particular compound. The SF, which is expressed in units of $(mg/kg\text{-}day)^{-1}$, is defined as the 95% UCL of the probability of a carcinogenic response per unit daily intake of a chemical over 70 years. By using the 95% UCL, the estimate of carcinogenic response will be conservative and will purposefully overestimate the actual risk posed by the chemical. The associated carcinogenic toxicity criteria used in the HHRA are presented in Table 10.

5.3.3 Toxicity Criteria for Lead

Noncarcinogenic toxicity criteria have not been established for lead. Instead, the potential for noncarcinogenic health effects associated with exposure to lead in soil were evaluated using the Cal-EPA Lead Spread Model (Cal-EPA, 1992). This mathematical model estimates blood-lead levels resulting from contact with lead in various environmental media (e.g., soil, air, food). The blood-lead level is of interest, because, unlike other chemicals, sufficient toxicology data exist to correlate the body burden of lead measured by blood-lead level with a specific adverse effect (e.g., a blood-lead level of "x" is associated with a particular adverse health effect).

5.4 RISK CHARACTERIZATION

Risk characterization represents the final step in the risk assessment process, in which the results of the exposure and toxicity assessments are integrated into quantitative or qualitative estimates of potential health risks. Noncarcinogenic and carcinogenic health risks are characterized separately, as described below.

5.4.1 Noncarcinogenic Health Risks

Potential noncarcinogenic adverse health effects were evaluated by comparing the AADD to the appropriate RfD. This comparison is expressed in terms of a "hazard quotient" and was calculated as follows:

$$\text{Hazard Quotient} = \frac{\text{AADD}}{\text{RfD}}$$

A hazard quotient less than or equal to 1 indicates that the predicted exposure should not pose a significant noncarcinogenic health risk (U.S. EPA, 1989). In cases where individual chemicals potentially act on the same organs or result in the same health endpoint (e.g., respiratory irritants), additive effects can be addressed by calculating a hazard index as follows:

$$\text{Hazard Index} = \sum_{a}^{n} \text{Hazard Quotient}_a + \text{Hazard Quotient}_b + \ldots + \text{Hazard Quotient}_n$$

A hazard index of less than or equal to 1 is indicative of acceptable levels of exposure for chemicals having an additive effect. In this HHRA, a screening-level hazard index was calculated by summing the hazard quotients for all chemicals, regardless of toxic endpoint. This approach likely overestimates the potential for noncarcinogenic health effects due to simultaneous exposure to multiple chemicals; however, it can be used as a screening tool to rapidly eliminate those exposure scenarios that do not pose a noncarcinogenic health risk.

The potential noncarcinogenic health risks associated with exposure to the COPCs by current or future on-site workers are summarized in Table 11; the calculation spreadsheets are presented in Appendix I. The total hazard index is 0.009. This value is considerably less than 1, indicating that exposure to chemicals at the site should not pose a noncarcinogenic health risk to current or future on-site commercial workers under the conditions evaluated.

5.4.2 Carcinogenic Health Risks

Carcinogenic health risks are defined in terms of the probability of an individual developing cancer as the result of exposure to a given chemical at a given concentration and are dependent on the LADD and the appropriate SF. In this assessment, theoretical lifetime excess cancer risks were estimated as follows:

$$\text{Theoretical Lifetime Excess Cancer Risk} = \text{LADD} \times \text{SF}$$

As with hazard indices, the estimated cancer risks for each chemical and exposure route were summed to estimate the total excess cancer risk for the exposed individual. The U.S. EPA considers estimates of lifetime excess cancer risk associated with exposure to chemicals of less than one-in-one-million ($1x10^{-6}$) to be *de minimis*. Risks within the range of one-in-one-million to one hundred-in-one-million ($1x10^{-4}$) may be acceptable

depending on other factors (e.g., site-specific considerations) (U.S. EPA, 1990a and 1990b). In addition, the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) considers lifetime excess cancer risks less than ten-in-one-million ($1x10^{-5}$) as being insignificant for purposes of the Act (i.e., no warning to the potentially exposed population is required) (22 California Code of Regulations [CCR] 12721(d)(3)).

The potential carcinogenic health risks associated with exposure to COPCs by current or future on-site workers are summarized in Table 12; the calculation spreadsheets are provided in Appendix I. The total theoretical lifetime excess cancer risk is $4x10^{-8}$. This value is below the generally accepted risk range of 10^{-4} to 10^{-6}, indicating that exposure to chemicals at the site should not pose an unacceptable carcinogenic health risk to current or future on-site commercial workers under the conditions evaluated.

5.4.3 Lead Health Risks

As discussed in section 5.3.3, the Cal-EPA's Lead Spread Model was used to evaluate potential health risks associated with the presence of lead in soil. The Centers for Disease Control (CDC) have established a blood-lead level of concern at 10 micrograms per deciliter (Tg/dl) of whole blood for children. The Cal-EPA has adopted the 10 Tg/dl significance level established by the CDC for both children and adults (Cal-EPA, 1992); however, this standard may be overly conservative for evaluating potential risks to adults. A more appropriate value may be 30 Tg/dl, as recommended in the California Code of Regulations (CCR) Title 8 §1532, Lead in Construction Standard.

The output from the Lead Spread Model is presented in Appendix J. The estimated blood lead level at the 99th percentile is 4.9 Tg/dl for the current or future on-site worker. This value is well below the level of concern adopted by the Cal-EPA, indicating that exposure to lead in soil should not pose an unacceptable risk to current or future on-site workers.

5.4.4 Uncertainty Analysis

Uncertainty is inherent in many aspects of the risk assessment process, and generally arises from a lack of knowledge of (1) site conditions, (2) toxicity and dose-response of

the COPCs, and (3) the extent to which an individual will be exposed to those chemicals. The assumptions that introduce the greatest amount of uncertainty and their effect on the noncarcinogenic and carcinogenic risk estimates are discussed below. In general, assumptions were selected in a manner that purposefully biases the process toward health conservatism.

Exposure Point Concentrations

The maximum detected concentrations in soil and groundwater were used as the exposure point concentrations in this HHRA. This assumption should overestimate the concentrations to which an individual would be exposed over an extended period of time.

Exposure Assumptions and Parameters

Default Cal-EPA and U.S. EPA exposure assumptions and parameters were used throughout this HHRA. These values are established with the intent of being conservative to account for the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site. For example, this HHRA assumes that a future on-site commercial worker will work at the site for 25 years; however, in 1992 the Bureau of Labor Statistics reported that the average number of years an individual works in one job is 4.5 years (Bureau of Labor Statistics, 1992). These upper-bound estimates of exposure most likely overestimate the potential health risks associated with exposure to the COPCs in soil and groundwater.

Toxicity Criteria

One of the largest sources of uncertainty in any risk assessment is associated with the toxicity criteria used to estimate noncarcinogenic and carcinogenic health risks. The noncarcinogenic toxicity criteria (i.e., oral and inhalation RfDs) incorporate multiple uncertainty factors to account for limitations in the quality of available data (e.g., animal data in lieu of human data). The carcinogenic toxicity criteria (i.e., oral and inhalation SFs) are based on a mathematical extrapolation from high to low doses. Both of these methods are conservative to ensure that the noncarcinogenic and carcinogenic health risks are far more likely to be overestimated than underestimated.

These and other assumptions contribute to the overall uncertainty in the results of the HHRA. However, given that the largest sources of uncertainty generally result in overestimates of exposure or risk, it is believed that the noncarcinogenic and carcinogenic risks presented in this HHRA represent conservative estimates of the risks, if any, posed by the site.

5.5 CONCLUSIONS OF THE RISK ASSESSMENT

The HHRA presents an evaluation of the potential human health risks associated with the presence of chemicals soil and groundwater at the site assuming continued commercial use of the property. The HHRA was completed in accordance with multiple risk assessment guidance documents provided by Cal-EPA and U.S. EPA. Potential noncarcinogenic and carcinogenic health risks were estimated for current and future on-site workers assuming conservative estimates of human exposure. Potential exposure to future on-site construction workers will be addressed as part of a site-specific Health and Safety Plan at the time of construction.

As shown in Tables 11 and 12, the estimated hazard indices and theoretical excess cancer risks for current and future on-site workers are at or below the levels generally considered acceptable by regulatory agencies (i.e., a hazard index of 1 for noncarcinogens and a cancer risk of $1x10^{-4}$ to $1x10^{-6}$ for carcinogens) under the conditions evaluated. In addition, the estimated blood-lead levels are well below a level of regulatory concern. Therefore, the presence of chemicals at the site should not pose an unacceptable noncarcinogenic or carcinogenic risk to current or future on-site workers assuming continued commercial use of the site.

6.0 CONCLUSIONS

This section will address the guidelines for evaluating sites for closure as a low risk groundwater case as identified by the ACHCSA in their 25 March 1998 letter.

1) The leak has been stopped and on-going sources have been removed or remediated.

The five USTs located under the building at the site were closed in-place in July 1994. The five USTs located in the yard and 161.54 tons of soil were removed in December 1994. Confirmation soil sampling from around the USTs and groundwater concentrations detected in samples collected from monitoring wells within and downgradient of the former and existing UST locations do not indicate that residual chemicals in site soil are a significant ongoing source to groundwater.

2) The site has been adequately characterized.

ACHCSA stated in their 25 March 1998 letter that "additional downgradient sampling will be required, [and] groundwater monitoring must be performed continuously to show that the plume is stable and/or shrinking." Geomatrix installed an additional monitoring well (MW-4), downgradient of the USTs and previous sampling points. As presented above, diesel and only low concentrations of isopropylbenzene and n-propylbenzene were detected in the samples collected from MW-4. Sample results from the existing monitoring wells (MW-1, MW-2, and MW-3) were consistent with the previous sampling round conducted in February 1998. Geomatrix conducted additional site sampling to assess the potential impact of previous site operations on soil and groundwater. This additional sampling is considered adequate to characterize risks posed by the site to human health and the environment. In addition, we recommend that groundwater monitoring be conducted on a semiannual basis to confirm the stability of the plume identified in the area of the underground storage tanks.

3) The dissolved hydrocarbon plume is not migrating.

A thin film of weathered diesel was encountered in MW-4, downgradient of the UST installation. Weathered diesel is not considered to be significantly soluble

and would therefore not contribute to a migrating dissolved plume. Groundwater monitoring at the site does not indicate plume migration.

4) No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.

One irrigation well is located approximately 1/3-mile downgradient of the site. However, this well is 470 feet deep. The shallow groundwater beneath Emeryville is currently not used as a drinking water source and likely will not be used in the foreseeable future based on historical practices in the area and possible effects from the sewer and storm drains. Based on results of shallow soil and groundwater sampling, it is unlikely that constituents detected at the site would affect the deeper aquifer, which is located approximately 42 feet bgs (EKI, 1995).

5) The site presents no significant risk to human health

The results of the HHRA indicate that chemicals in soil and groundwater do not present an unacceptable noncarcinogenic or carcinogenic health risk to current or future on-site workers under the conditions evaluated. Potential health risks associated with exposure to soil or groundwater by a future on-site construction worker will be addressed as part of a site-specific health and safety plan.

6) The site presents no significant risk to the environment.

No ecological risk assessment was considered warranted because the current planned future use of the site is for commercial purposes and the site is located within a commercial/industrial area approximately ½-mile from the nearest surface water body.

7.0 RECOMMENDATIONS

Based on the information presented herein, Geomatrix recommends that groundwater monitoring wells MW-3 and MW-4 continue to be sampled on a semiannual basis to

confirm stability of the existing plume. These wells are located upgradient of the USTs beneath the building (MW-3) and downgradient of all the former USTs, respectively (MW-4). We recommend that monitoring wells MW-1 and MW-2 be destroyed to allow commercial use of the building. It is our opinion that the two remaining wells will be sufficient to determine the stability of the plume beneath the site.

We also recommend that a risk management plan be developed and implemented during proposed future construction at the site. This plan will include:

- Proper handling and storage of excavated soil;
- Sampling of soil stockpiles for disposal purposes;
- Aeration of soil removed from beneath the current building slab;
- Removal of the USTs that have been closed in-place beneath the building and surrounding soil if the building is demolished;
- Development of a site-specific health and safety plan for on-site construction workers.
- groundwater management plan

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TABLES

GEOMATRIX

TABLE 1

SOIL SAMPLE ANALYTICAL RESULTS - METALS[1]

Rix Property
Emeryville, California

Concentrations are in milligrams per kilogram (mg/kg)

Sample ID	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Vanadium	Zinc
S-1,2	<20	300	<0.5	<0.5	33	8	33	84	0.07	<2	28	30	150
S-3	<20	190	<0.5	<0.5	32	7	12	7	<0.06	<2	19	35	23
S-4	<20	160	<0.5	0.6	120	8	40	60	0.51	3	37	42	140
S-5	<20	140	0.6	<0.5	68	13	20	45	0.09	<2	79	40	77
S-6	<20	1800	<0.5	1.5	37	10	53	240	0.32	<2	26	36	630
S-7,8	<11	560	<0.5	1.8	38	10	41	430	0.24	<2	41	27	720
S-9,10	<10	870	<0.5	2	71	16	120	410	0.46	<2	43	40	490
GGW1-1.0	<10	180	<0.5	<0.5	31	8	12	6	<0.06	<2	21	31	22
GGW2-2.0	10	150	<0.5	<0.5	47	6	10	7	<0.06	<2	25	36	31
GGW3-1.5	12	1600	<0.5	3	88	11	32	390	0.32	<2	29	40	900
GGW4-1.5	<10	260	0.5	0.6	41	18	24	84	0.07	<2	39	43	120
LBNL Background[2]	19.1	323.6	1.0	2.7	99.6	22.2	69.4	16.1	0.4	7.4	119.8	74.3	106.1

Note:

1. Samples were collected on 22 April 1998 by Geomatrix Consultants, Inc. and analyzed for metals according to EPA Method 6000/7000 Series by American Environmental Network of Pleasant Hill, California. Samples were collected within the top 2 feet of soil.
2. Lawrence Berkeley National Laboratory, 1995, Protocol for Determining Background Concentrations of Metals in Soil at Lawrence Berkeley National Laboratory, August.

GEOMATRIX

TABLE 2

SOIL SAMPLE ANALYTICAL RESULTS
VOLATILE ORGANIC COMPOUNDS[1]

Rix Property
Emeryville, California

Concentrations are in milligrams per kilogram (mg/kg)

Sample ID	n-Butylbenzene	sec-Butylbenzene	Ethylbenzene	Isopropylbenzene	p-Isopropyltoluene	n-Propylbenzene	Napthalene	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Xylenes, Total
S-03	<0.03	0.03	0.03	<0.03	0.03	0.04	0.16	0.24	0.053	0.18
S-05	6.5	6	<3	4	<3	5.9	5.1	<3	<3	<5
S-04	<0.3	<0.3	<0.3	<0.3	0.3	0.3	<0.3	1.9	1.4	1.1

Note:

1. Soil samples were collected on 22 April 1998 by Geomatrix Consultants, Inc. and analyzed for volatile organic compounds (VOCs) according to EPA Method 8260 by American Environmental Network of Pleasant Hill, California. Only constituents detected are shown. Samples were collected from beneath the slab inside the building within the top 2 feet of soil.

GEOMATRIX

TABLE 3

GROUNDWATER ANALYTICAL RESULTS
METALS AND TOTAL PETROLEUM HYDROCARBONS[1]

Rix Property
Emeryville, California

Concentrations reported in micrograms per liter (µg/l)

Sample ID	Dated Sampled	Arsenic	Barium	Cobalt	Molyb-denum	Nickel	Vanadium	Zinc	TPHd	TPHg
MW-2[2]	4/27/98	7	19000	<5	<10	10	<5	<10	NA	NA
MW-4[2]	4/27/98	18	150	<5	20	10	<5	<10	NA	NA
GGW-1	4/22/98	34	230	5	30	10	<5	110	NA	NA
GGW-2	4/22/98	<5	150	6	50	30	<5	10	<50	<50
GGW-3[3]	4/22/98	<5/<5	520/410	6/6	<10/<10	<10/<10	<5/<5	100/80	NA/<50	220/240
GGW-4	4/22/98	8	40	<5	<10	<10	32	10	NA	NA

Notes:

1. Samples were collected by Geomatrix Consultants, Inc., and analyzed for CAM 17 metals according to EPA Methods 6000/7000 series and total petroleum hydrocarbons quantified as gasoline (TPHg) and as diesel (TPHd) according to EPA Method 8015 by American Environmental Network of Pleasant Hill, California. Only analytes detected are shown. TPHd samples were analyzed following silica gel cleanup procedures according to EPA Method 3630M.
2. Samples were analyzed outside of holding time.
3. A duplicate sample was collected. Both results are shown.

GEOMATRIX

TABLE 4

GROUNDWATER ANALYTICAL RESULTS[1]
VOLATILE ORGANIC COMPOUNDS
Rix Property
Emeryville, California

Concentrations reported in micrograms per liter (µg/l)

Sample ID	Dated Sampled	sec-Butyl-benzene	1,1-DCA	cis-1,2-DCE	trans-1,2-DCE	Ethyl-benzene	Iso-propyl-benzene	Naph-thalene	PCE	n-Propyl-benzene	Toluene	TCE	1,2,4-TMB	1,3,5-TMB	VC	Total Xylenes
MW-1[2]	4/27/98	8	18	5	10	<5	8	<5	<5	9	<5	13	<5	<5	<10	10
MW-2[2]	4/27/98	<5	12	61	18	7	<5	5	120	<5	<5	130	<5	<5	12	26
MW-3[2,3]	4/27/98	<30/<30	<30/<30	140/140	<30/<30	<30/<30	<30/<30	<30/<30	40/30	<30/<30	250/220	190/190	<30/<30	<30/<30	100/110	75/<50
MW-4[2,4]	4/27/98/ 5/15/98	15/<5	<5/<5	<5/<5	<5/<5	<5/<5	16/<5	<5/<5	<5/<5	5/<5	<5/<5	<5/<5	<5/<5	<5/<5	<10/<10	<10/<10
GGW1	4/22/98	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<100	<100
GGW2	4/22/98	<5	120	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	11	<10
GGW3[3]	4/22/98	<5/<5	6/5	<5/<5	<5/<5	<5/<5	<5/<5	<5/<5	<5/<5	<5/<5	<5/<5	<5/<5	120/110	11/10	<10/<10	13/10
GGW4	4/22/98	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<1000	<1000

Notes:

1. Samples were collected by Geomatrix Consultants, Inc., and analyzed for volatile organic compounds (VOCs) according to EPA Method 8260 by American Environmental Network of Pleasant Hill, California. Only constituents detected are shown.
   1,1-DCA = 1,1-dichloroethane; cis-1,2-DCE = cis-1,2-dichloroethene,
   trans-1,2-DCE = trans-1,2-dichloroethene; PCE = tetrachloroethene; TCE = trichloroethylene; 1,2,4-TMB = 1,2,4-trimethylbenzene;
   1,3,5-TMB = 1,3,5-trimethylbenzene; VC = vinyl chloride.
2. Samples were analyzed after the holding time had expired.
3. A duplicate sample was collected. Both results are shown.

GEOMATRIX

TABLE 5

IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN IN SOIL (METALS)

Rix Property
Emeryville, California

Chemical	No. of Samples	No. of Detctions	Percent (%) Detected	Range of Detections	Range of Detection Limits	Residential PRG	LBNL Background Data[1]			Selected as COPC?
							Minimum	Maximum	95% UTL	
Arsenic	11	2	18	10 - 12	10 - 20	0.38	0.25	63	19.1	NO[3]
Barium	11	11	100	140 - 1800	--	5200	--	--	--	NO
Beryllium	11	2	18	0.5 - 0.6	0.5	150	--	--	--	NO
Cadmium	11	6	55	0.6 - 3	0.5	9[2]	--	--	--	NO
Chromium	11	11	100	31 - 120	--	210	--	--	--	NO
Cobalt	11	11	100	6 - 18	--	3300	--	--	--	NO
Copper	11	11	100	10 - 120	--	2800	--	--	--	NO
Lead	11	11	100	6 - 430	--	130[2]	0.5	31	16.1	YES
Mercury	11	8	73	0.07 - 0.51	0.06	22	--	--	--	NO
Molybdenum	11	1	9	3	2	370	--	--	--	NO
Nickel	11	11	100	19 - 79	--	150[2]	--	--	--	NO
Vanadium	11	11	100	27 - 43	--	520	--	--	--	NO
Zinc	11	11	100	22 - 900	--	22000	--	--	--	NO

Notes:
COPC = Chemicals of Potential Concern
UTL = Upper Tolerance Limit
PRG = U.S. EPA Region 9, Preliminary Remedation Goal (U.S. EPA, 1998)

1. Lawrence Berkeley National Laboratory (LBNL), 1995, Protocol for Determining Background Concentrations of metals in soil at Lawrence Berkeley National Laboratory.
2. California-modified PRG.
3. The maximum detection limit is slightly higher than the background value; however, given that the maximum detected value is 12 mg/kg and the detection limit for other samples is less than the background value, arsenic was not identified as a COPC.

GEOMATRIX

TABLE 6

PHYSICAL CONSTANTS FOR ORGANIC CHEMICALS OF POTENTIAL CONCERN
Rix Property
Emeryville, California

Chemical	Molecular Weight (g/mol)	Reference	Henry's Law Constant at 25oC (atm-m3/mol)	Reference	Solubility (S) at 25oC (mg/L)	Reference	Diffusivity in Air (Di) (cm2/sec)	Reference
n-Butylbenzene	134.22	Montgomery, 1996	1.25E-03	Montgomery, 1996	5.00E+01	Montgomery, 1996	0.064	Calculated
sec-Butylbenzene	134.22	Montgomery, 1996	1.14E-02	Montgomery, 1996	1.71E+02	Montgomery, 1996	0.064	Calculated
1,1-Dichloroethane	98.96	Montgomery, 1996	5.62E-03	U.S. EPA, 1996	5.06E+03	U.S. EPA, 1996	0.0742	U.S. EPA, 1996
cis-1,2-Dichloroethene	96.94	trans-1,2-Dichloroethene	4.08E-03	U.S. EPA, 1996	3.50E+03	U.S. EPA, 1996	0.0736	U.S. EPA, 1996
trans-1,2-Dichloroethene	96.94	Montgomery, 1996	9.38E-03	U.S. EPA, 1996	6.30E+03	U.S. EPA, 1996	0.0707	U.S. EPA, 1996
Ethylbenzene	106.17	Montgomery, 1996	7.88E-03	U.S. EPA, 1996	1.69E+02	U.S. EPA, 1996	0.075	U.S. EPA, 1996
Isopropylbenzene	120.19	Montgomery, 1996	5.58E-03	Montgomery, 1996	7.30E+01	Howard, 1997	0.068	Calculated
p-Isopropyltoluene	134.22	Montgomery, 1996	1.10E-02	Howard, 1997	2.34E+01	Howard, 1997	0.064	Calculated
Naphthalene	128.18	Montgomery, 1996	4.83E-04	U.S. EPA, 1996	3.10E+01	U.S. EPA, 1996	0.059	U.S. EPA, 1996
n-Propylbenzene	120.19	Montgomery, 1996	1.08E-02	Montgomery, 1996 (average of three values)	8.34E+01	Montgomery, 1996 (average of three values)	0 068	Calculated
Tetrachloroethene	165.83	Montgomery, 1996	1.84E-02	U.S. EPA, 1996	2.00E+02	U.S. EPA, 1996	0.072	U.S. EPA, 1996
Toluene	92.14	Montgomery, 1996	6.64E-03	U.S. EPA, 1996	5.26E+02	U.S. EPA, 1996	0.087	U.S. EPA, 1996
Trichloroethene	131.39	Montgomery, 1996	1.03E-02	U.S. EPA, 1996	1.10E+03	U.S. EPA, 1996	0.079	U.S. EPA, 1996
1,2,4-Trimethylbenzene	12.19	Montgomery, 1996	5.70E-03	Montgomery, 1996	5.70E+01	Montgomery, 1991	0.068	U.S. EPA, 1996
1,3,5-Trimethylbenzene	120.19	Montgomery, 1996	6.73E-03	Montgomery, 1996	9.77E+01	Montgomery, 1996	0.068	Calculated
Vinyl Chloride	62.5	Montgomery, 1996	2.70E-02	U.S. EPA, 1996	2.76E+03	U.S. EPA, 1996	0 106	U.S. EPA, 1996
Xylenes	106.17	Montgomery, 1996	6 73E-03	U.S. EPA, 1996 (average of the three isomers)	1.75E+02	U.S. EPA, 1996 (average of the three isomers)	0.087	U.S. EPA, 1996 (average of the three isomers)

Notes:
Diffusivity in air coefficients were calculated using equations presented in U.S. EPA's Superfund Exposure Assessment Manual (1988b)

References:

Howard,P.H., 1997, Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume V, Lewis Publishers, Boca Raton, New York

Montgomery, J.H., 1991, Groundwater Chemical Desk Reference, Lewis Publishers, Chelsea, Michigan

Montgomery, J.H., 1996, Groundwater Chemical Desk Reference, Second Edition, Lewis Publishers, Chelsea, Michigan

U.S. EPA, 1996, Soil Screening Guidance, Technical Background Document, EPA/540/R-95-/128.

GEOMATRIX

TABLE 7

REPRESENTATIVE CONCENTRATIONS FOR CHEMICALS OF POTENTIAL CONCERN

Rix Property
Emeryville, California

Chemical	Maximum Soil Concentration (mg/kg)	Maximum Groundwater Concentration (mg/l)
n-Butylbenzene	6.5	ND
sec-Butylbenzene	6	0.015
1,1-Dichloroethane	ND	0.12
cis-1,2-Dichloroethene	ND	0.14
trans-1,2-Dichloroethene	ND	0.018
Ethylbenzene	0.03	0.007
Isopropylbenzene	4	0.016
p-Isopropyltoluene	0.3	ND
Lead	430	NA
Naphthalene	5.1	0.005
n-Propylbenzene	5.9	0.009
Tetrachloroethene	ND	0.12
Toluene	ND	0.25
Trichloroethene	ND	0.19
1,2,4-Trimethylbenzene	1.9	0.12
1,3,5-Trimethylbenzene	1.4	0.011
Vinyl Chloride	ND	0.11
Xylenes	1.1	0.075

Notes:
NA = not applicable
ND = not detected

GEOMATRIX

TABLE 8

EXPOSURE PARAMETERS

Rix Property
Emeryville, California

Exposure Parameters	Units	Value	Rationale
Exposure Frequency (EF)	days/year	250	Cal-EPA, 1992; U.S. EPA, 1991
Exposure Duration (ED)	years	25	Cal-EPA, 1992; U.S. EPA, 1991
Body Weight	kg	70	Cal-EPA, 1992; U.S. EPA, 1991
Averaging Time	days	25,550 (carcinogens) 9,125 (noncarciongens)	Cal-EPA, 1992; U.S. EPA, 1991
Inhalation Rate (IRa)	m^3/day	20	Cal-EPA, 1992; U.S. EPA, 1991

References:

California Environmental Protection Agency (Cal-EPA), 1992, Supplemental Guidence for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities.

U.S. EPA, 1991b, Human Health Evaluation Manual, Supplemental Guidence: "Standard Default Exposure Factors:" Office of Emergency and Remedial Responce, Washington, D.C.

GEOMATRIX

TABLE 9

NONCARCINOGENIC TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN

Rix Property
Emeryville, California

Chemical	RfDo (mg/kg-day)	Reference	RfDi (mg/kg-day)	Reference	Target Organ	Critical Effect	Reference
n-Butylbenzene	0.01	U.S. EPA, 1998	0.01	Route Extrapolation	--	--	--
sec-Butylbenzene	0.01	U.S. EPA, 1998	0.01	Route Extrapolation	--	--	--
1,1-Dichloroethane	NE	NE	0.14	U.S. EPA, 1997	Kidney	Damage	U.S. EPA, 1997
cis-1,2-Dichloroethene	0.01	U.S. EPA, 1997	0.01	Route Extrapolation	Blood	Decereased Hematocrit and Hemoglobin	U.S. EPA, 1997
trans-1,2-Dichloroethene	0.02	IRIS, 1998	0.02	Route Extrapolation	Liver	Increase in Serum Alkaline Phosphatase Levels	IRIS, 1998
Ethylbenzene	NE	NE	0.29	IRIS, 1998	Liver and Kidney	Toxicity	IRIS, 1998
Isopropylbenzene	NE	NE	0.0026	U.S. EPA, 1997	Kidney/ Central Nervous System/ Nose	Increased Weight/ Involvment/ Irritation	U.S. EPA, 1997
p-Isopropyltoluene	NE	NE	NA	NA	--	--	--
Naphthalene	NE	NE	0.00086	U.S. EPA, 1998	--	--	--
n-Propylbenzene	0.01	U.S. EPA, 1998	0.01	Route Extrapolation	--	--	--
Tetrachloroethene	0.01	IRIS, 1998	0.01	Route Extrapolation	Liver/ Total Body	Increased Weight/ Decereased Weight	IRIS, 1998
Toluene	NE	NE	0.11	IRIS, 1998	Liver and Kidney	Weight Changes	IRIS, 1998
Trichloroethene	0.006	U.S. EPA, 1998	0.006	Route Extrapolation	--	--	--
1,2,4-Trimethylbenzene	NE	NE	0.0017	U.S. EPA, 1998	--	--	--
1,3,5-Trimethylbenzene	NE	NE	0.0017	U.S. EPA, 1998	--	--	--
Vinyl Chloride	NE	NE	NA	NA	NA	NA	NA
Xylenes	NE	NE	0.2	U.S. EPA, 1998	Central Nervious System/ Whole Body	Hyperactivity /Decreased Weight	U.S. EPA, 1997

Notes:
NA = not available
NE = not evaluated

References:

Integrated Risk Information System (IRIS), 1998, on-line search, June.
U.S. EPA, 1997, Health Effects Summary Tables, FY-1997 Annual, Office of Solid Waste and Energy Response.
U.S. EPA, 1998, U.S. EPA Region 9 Preliminary Remediation Goals (PRGs)

GEOMATRIX

TABLE 10

CARCINOGENIC TOXICITY CRITERIA FOR CHEMICALS OF POTENTIAL CONCERN

Rix Property
Emeryville, California

Chemical	SFi $(mg/kg\text{-}day)^{-1}$	Reference	Target Organ	Critical Effect	Reference
Tetrachloroethene	0.021	U.S. EPA, 1998	Liver	Hepatocellular adenomas/carcinomas	Cal-EPA, 1994b
Trichloroethene	0.01	U.S. EPA, 1998	Liver/Lung	Hepatocellular adenomas/carcinomas/lymphoma; adenocarcinomas	Cal-EPA, 1994b
Vinyl Chloride	0.27	Cal-EPA, 1994	Liver/Mammary Gland/ Lung	Angiosarcomas/hepatocellular carcinomas; adenocarcimonas; carcinomas	Cal-EPA, 1994b

Reference:
Cal-EPA, 1994b, California Cancer Potency Factors: Office of Environmental Health Hazard Assessment, Sacramento, California.

GEOMATRIX

TABLE 11

HAZARD QUOTIENT SUMMARY TABLE

Rix Property
Emeryville, California

Chemical	Inhalation of Vapors from Soil	Inhalation of Vapors from Groundwater	Total Hazard Index
n-Butylbenzene	3E-04	NA	3E-04
sec-Butylbenzene	2E-03	3E-06	2E-03
1,1-Dichloroethane	NA	2E-07	2E-07
cis-1,2-Dichloroethene	NA	3E-06	3E-06
trans-1,2-Dichloroethene	NA	4E-07	4E-07
Ethylbenzene	4E-07	3E-08	4E-07
Isopropylbenzene	2E-03	4E-07	2E-03
p-Isopropyltoluene	NA	NA	NA
Naphthalene	5E-05	3E-06	5E-05
n-Propylbenzene	2E-03	2E-06	2E-03
Tetrachloroethene	NA	1E-06	1E-06
Toluene	NA	2E-06	2E-06
Trichloroethene	NA	3E-05	3E-05
1,2,4-Trimethylbenzene	1E-03	2E-04	1E-03
1,3,5-Trimethylbenzene	2E-03	8E-06	2E-03
Vinyl Chloride	NA	NA	NA
Xylenes	2E-05	4E-07	2E-05
Total	9E-03	3E-04	9E-03

Notes:
NA = not applicable

GEOMATRIX

TABLE 12

CANCER RISK SUMMARY TABLE

Rix Property
Emeryville, California

Chemical	Inhalation of Vapors from Groundwater
n-Butylbenzene	NA
sec-Butylbenzene	NA
1,1-Dichloroethane	NA
cis-1,2-Dichloroethene	NA
trans-1,2-Dichloroethene	NA
Ethylbenzene	NA
Isopropylbenzene	NA
p-Isopropyltoluene	NA
Naphthalene	NA
n-Propylbenzene	NA
Tetrachloroethene	5E-09
Toluene	NA
Trichloroethene	3E-09
1,2,4-Trimethylbenzene	NA
1,3,5-Trimethylbenzene	NA
Vinyl Chloride	3E-08
Xylenes	NA
Total	4E-08

Notes:
NA = not applicable

FIGURES

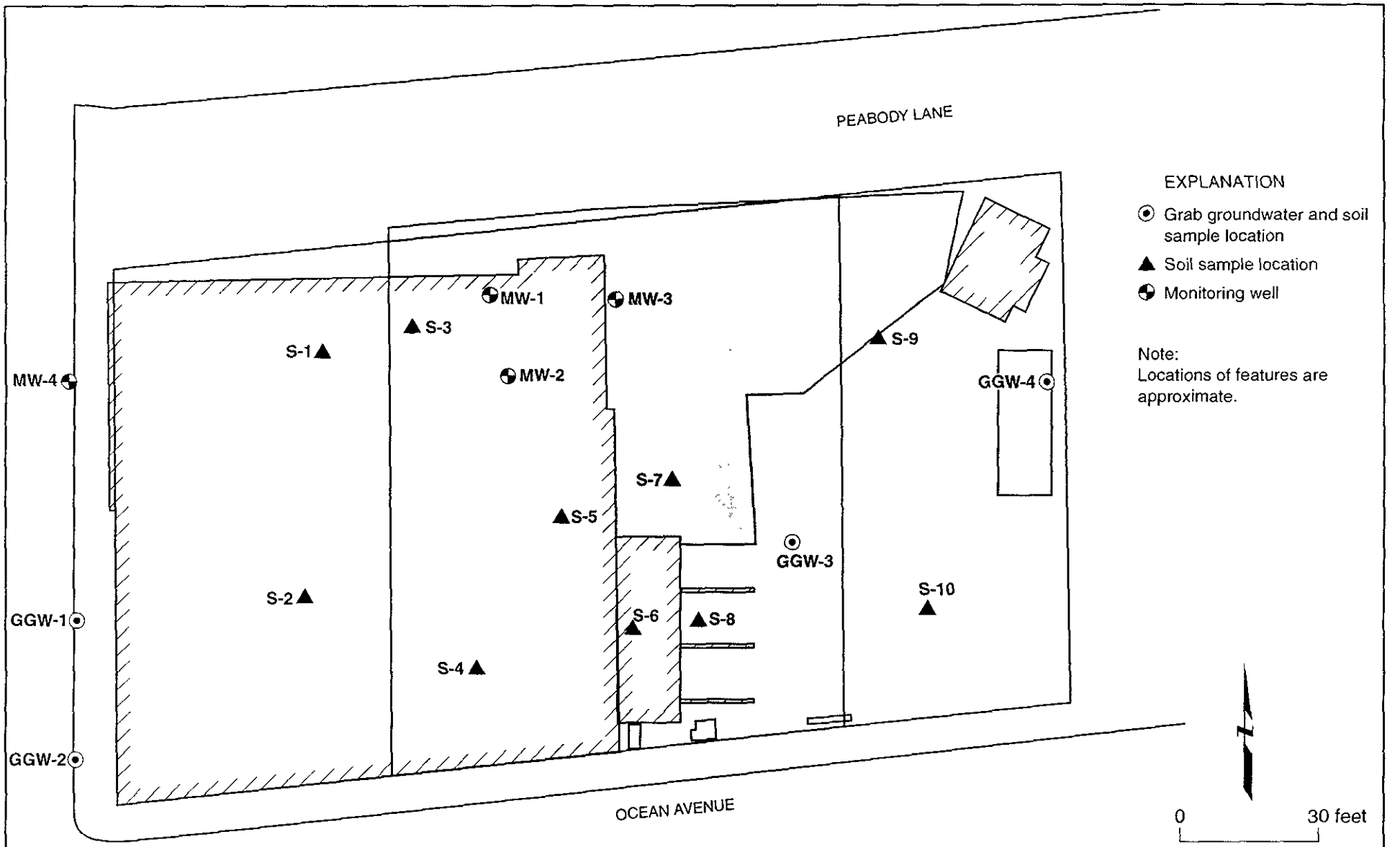
GEOMATRIX

SITE LOCATION MAP
RIX Property
6460 Hollis Street
Emeryville, California

Figure
1

Project No.
4710.01

s:\4710.01\SoilGrdwtr 0698\fig 01.ai



GEOMATRIX

SITE PLAN
RIX Property
6460 Hollis Street
Emeryville, California

Figure
2

Project No.
4710.01

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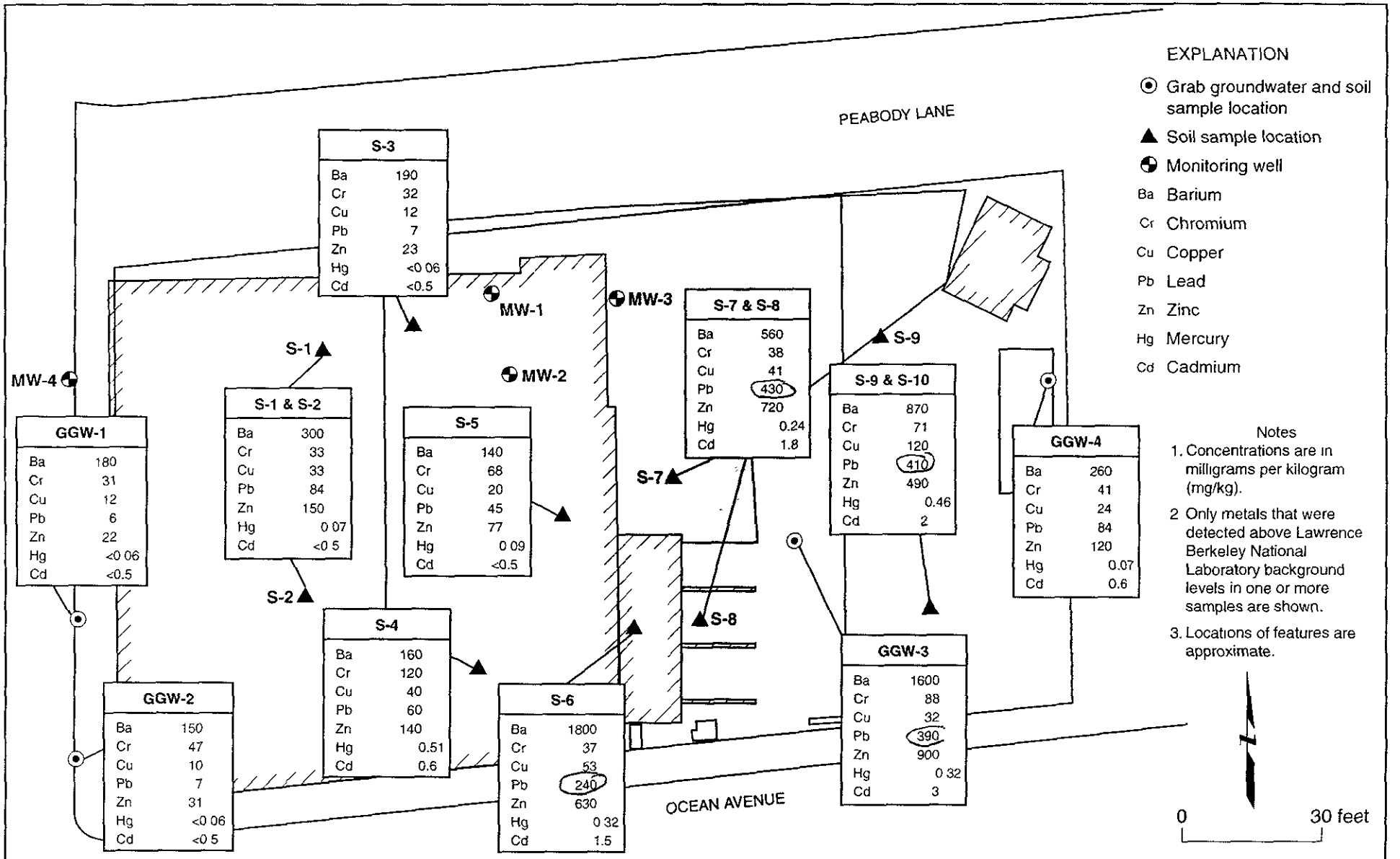


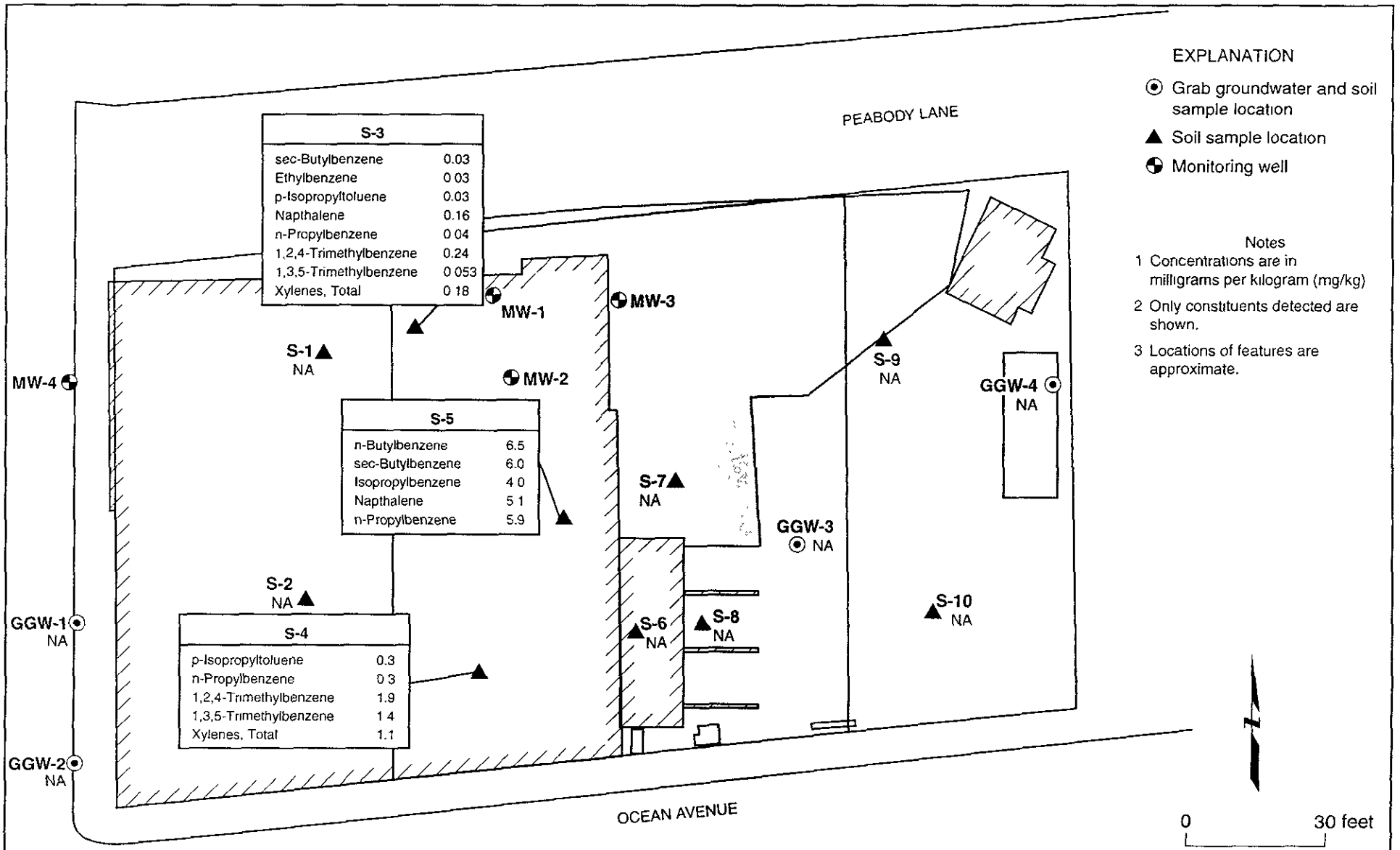
GEOMATRIX

METALS CONCENTRATIONS IN SOIL SAMPLES
RIX Property
6460 Hollis Street
Emeryville, California

Figure
3

Project No.
4710.01

s \4710 01\SoilGrdwtr_0698\fig_03.ai



GEOMATRIX

VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN SOIL SAMPLES
RIX Property
6460 Hollis Street
Emeryville, California

Figure 4

Project No. 4710.01

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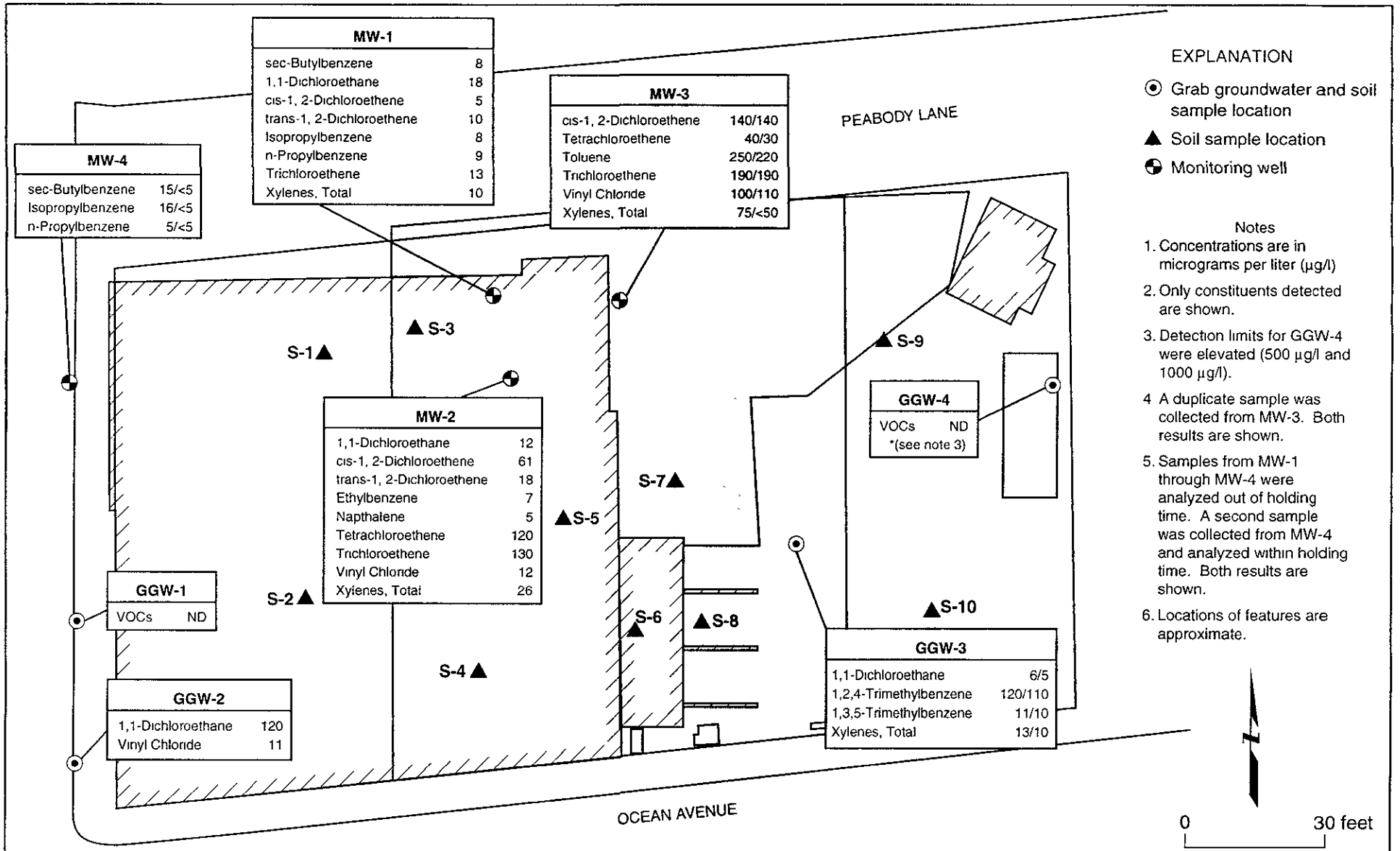


EXPLANATION

- Grab groundwater and soil sample location
- Soil sample location
- Monitoring well

Notes

1. Concentrations are in micrograms per liter (µg/l)
2. Only constituents detected are shown.
3. Detection limits for GGW-4 were elevated (500 µg/l and 1000 µg/l).
4. A duplicate sample was collected from MW-3. Both results are shown.
5. Samples from MW-1 through MW-4 were analyzed out of holding time. A second sample was collected from MW-4 and analyzed within holding time. Both results are shown.
6. Locations of features are approximate.

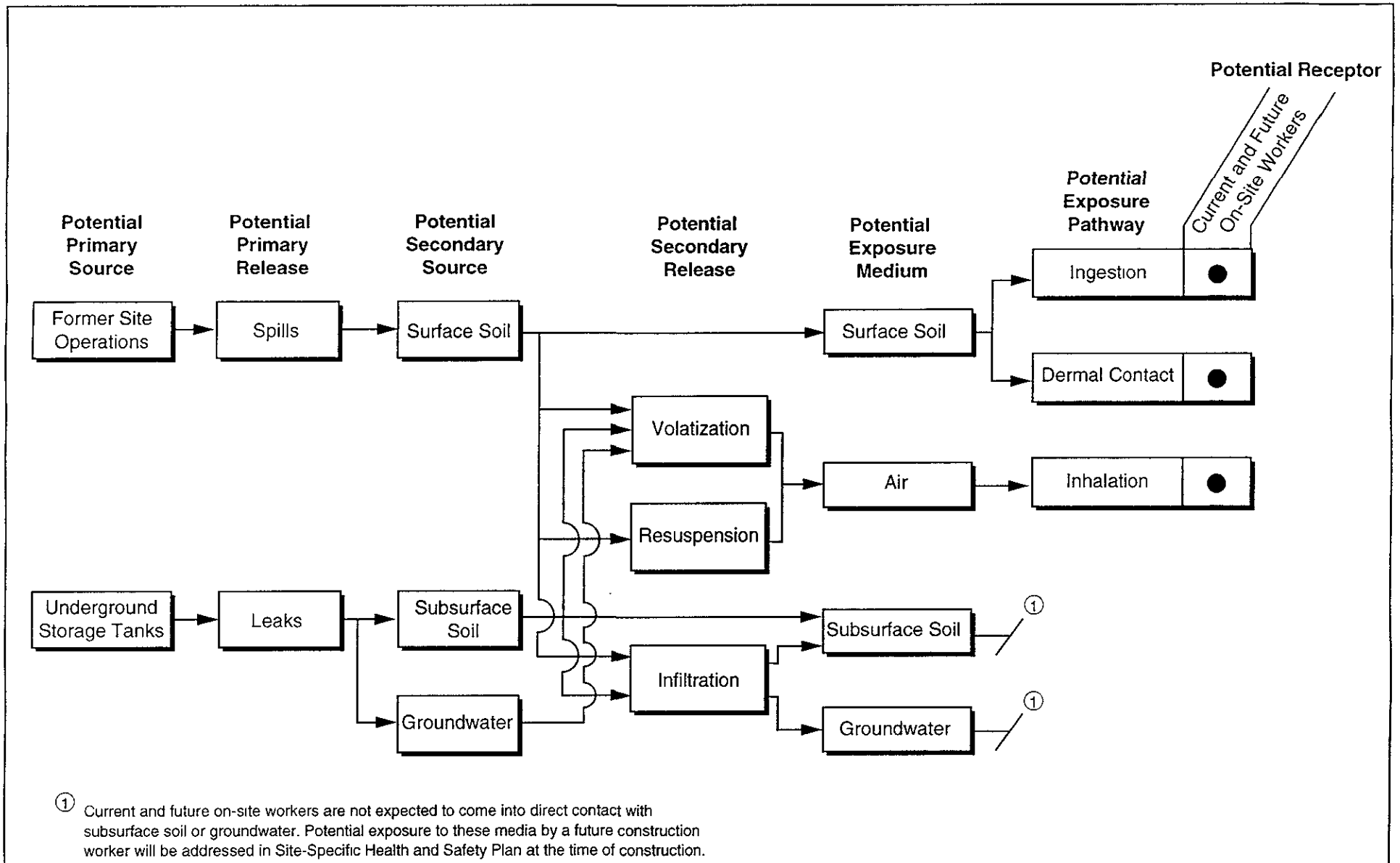
GEOMATRIX

VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER SAMPLES
RIX Property
6460 Hollis Street
Emeryville, California

Figure 5

Project No. 4710.01

s \4710 01\SoilGrdwtr 0698\fig_05 ai



(1) Current and future on-site workers are not expected to come into direct contact with subsurface soil or groundwater. Potential exposure to these media by a future construction worker will be addressed in Site-Specific Health and Safety Plan at the time of construction.

GEOMATRIX

SITE CONCEPTUAL MODEL
Rix Property
Emeryville, California

Project No.
4710.01

Figure
6

s \4710 01\SoilGrdwtr_0698\fig_R_01 ai

GEOMATRIX

APPENDIX A

PREVIOUS SOIL SAMPLE ANALYTICAL RESULTS

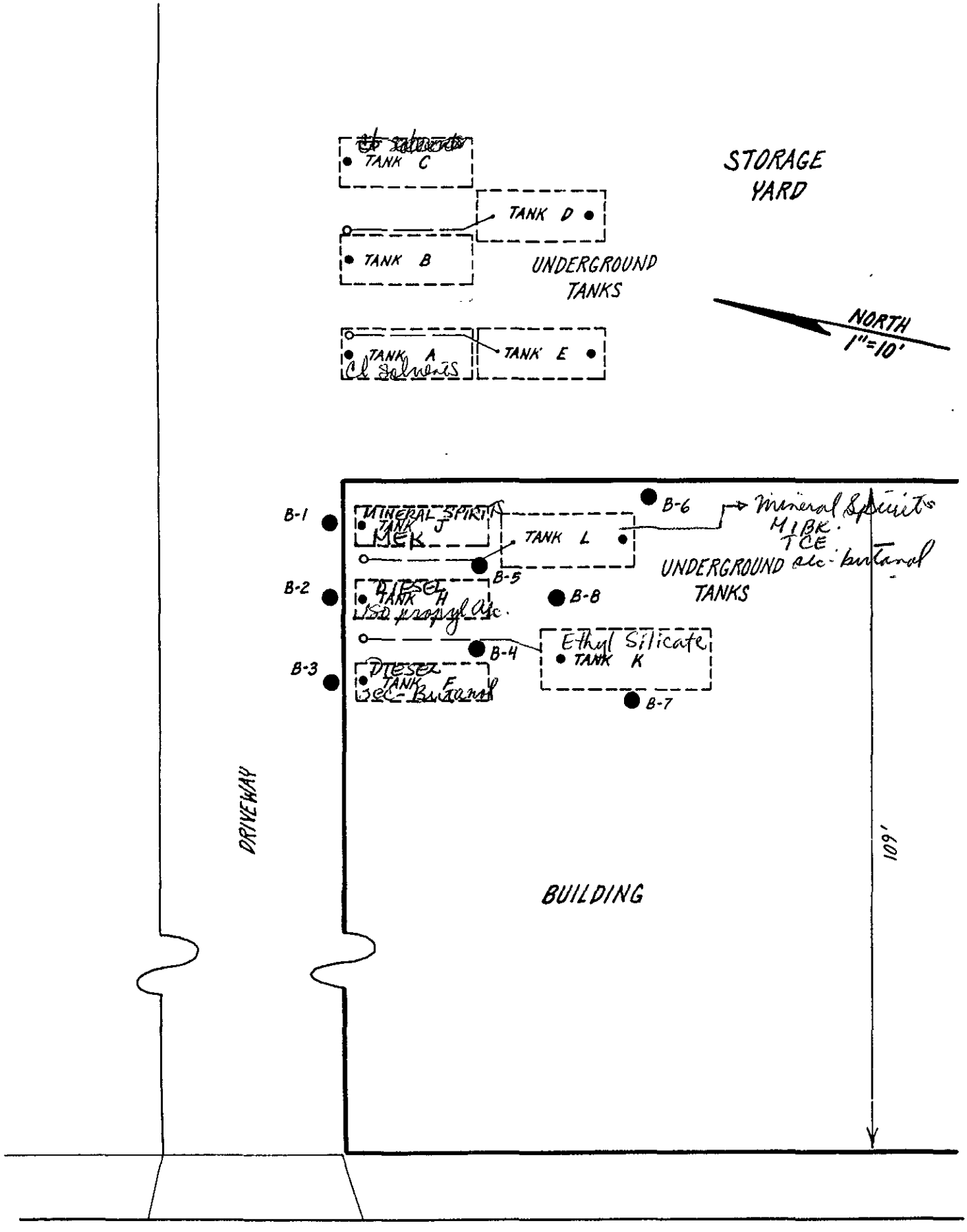


FIGURE 4. Locations of Hand Soil Borings.

TABLE 3. Hand Boring Soil Sampling Results.

Chemical		B-1	B-2	B-3	B-4	B-5	B-6
Gasoline	(mg/kg)	2.2	12	42	34	8.8	15
Diesel	(mg/kg)	3.4	1.5	52	30	32	41
Kerosene	(mg/kg)	ND	ND	ND	ND	ND	ND
Mineral Spirits	(mg/kg)	ND	1.8	ND	26	19	20
Methyl Ethyl Ketone (MEK)	(mg/kg)	ND	ND	ND	ND	ND	ND
Methyl Isobutyl Ketone (MIBK)	(mg/kg)	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	(ug/kg)	ND	ND	ND	ND	52	ND
Tetrachloroethene	(ug/kg)	360	340	230	160	1,500	230
Trichloroethene (TCE)	(ug/kg)	ND	ND	ND	ND	97	ND
Benzene	(mg/kg)	ND	ND	ND	ND	0.0073	ND
Toluene	(mg/kg)	0.0080	0.013	0.056	0.021	0.24	0.023
Ethyl Benzene	(mg/kg)	0.0058	ND	0.15	0.064	0.039	0.043
Total Xylenes	(mg/kg)	0.0057	0.0092	0.54	0.82	0.91	0.12
Ethyl Silicate	(ug/kg)	ND	ND	ND	ND	ND	ND
Oil & Grease	(mg/kg)	76	160	100	310	310	400

ND = not detected

TABLE 3 (cont.). Hand Boring Soil Sampling Results.

Chemical		B-7	B-8
Gasoline	(mg/kg)	29	3.2
Diesel	(mg/kg)	60	5.6
Kerosene	(mg/kg)	ND	ND
Mineral Spirits	(mg/kg)	ND	13
Methyl Ethyl Ketone (MEK)	(mg/kg)	ND	ND
Methyl Isobutyl Ketone (MIBK)	(mg/kg)	ND	ND
cis-1,2-Dichloroethene	(ug/kg)	ND	5.2
Tetrachloroethene	(ug/kg)	210	330
Trichloroethene (TCE)	(ug/kg)	ND	6.5
Benzene	(mg/kg)	ND	ND
Toluene	(mg/kg)	0.020	0.078
Ethyl Benzene	(mg/kg)	0.078	0.0051
Total Xylenes	(mg/kg)	0.090	0.049
Ethyl Silicate	(ug/kg)	ND	ND
Oil & Grease	(mg/kg)	260	160

ND = not detected

TABLE 4. Well Installation Soil Sampling Results.

Chemical		MW-1 @ 3'	MW-1 @ 5'	MW-2 @ 3'	MW-2 @ 5'	MW-3 @ 5'	MW-3 @ 7.5'
Gasoline	(mg/kg)	ND	300	140	1,800	55	85
Diesel	(mg/kg)	ND	540	500	3,000	24	6.9
Kerosene	(mg/kg)	ND	430	400	2,400	19	5.5
Mineral Spirits	(mg/kg)	ND	380	350	2,100	17	4.8
Methyl Ethyl Ketone (MEK)	(mg/kg)	ND	ND	ND	ND	41	ND
Methyl Isobutyl Ketone (MIBK)	(mg/kg)	ND	ND	ND	ND	4.9	ND
cis-1,2-Dichloroethene	(ug/kg)	ND	ND	ND	ND	720	ND
Tetrachloroethene	(ug/kg)	ND	ND	ND	ND	31,000	4,500
Trichloroethene (TCE)	(ug/kg)	ND	ND	ND	ND	420	ND
Benzene	(mg/kg)	ND	ND	ND	ND	ND	0.096
Toluene	(mg/kg)	ND	0.12	ND	0.80	19	1.7
Ethyl Benzene	(mg/kg)	ND	ND	0.11	ND	0.78	0.96
Total Xylenes	(mg/kg)	ND	2.6	0.79	2.6	5.8	8.0
Ethyl Silicate	(ug/kg)	ND	ND	ND	ND	ND	ND
Oil & Grease	(mg/kg)	ND	ND	ND	ND	ND	ND

ND = not detected

GEOMATRIX

APPENDIX B

PREVIOUS GROUNDWATER ANALYTICAL DATA

TABLE 1
CUMULATIVE RESULTS FOR WELL MW-1
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR HYDROCARBON COMPOUNDS by EPA 5030/8015 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
TPHg	680	<50	440	630	620	960	1,500	1,200	940[abc]
TPHd	6,100	590	1,000	1,400	1,600	2,600	760	420	9,300[dec]
Kerosene	6,100	960	<50	<50	<50	<50	<50	<50	8,700
Stoddard Solvent	6,400	<50	190	310	58	450	190	110	580[abc]
Oil & Grease	14	NA	NA	NA	NA	NA	NA	NA	<250
Benzene	3.8	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Toluene	<0.5	<0.5	0.8	0.5	<0.5	1.7	0.6	1.0	1.1[f]
Ethylbenzene	38	<0.5	2.6	1.2	2.3	1.4	4.6	3.9	2.5[g]
Total Xylenes	3.4	<0.5	6.2	3.6	9.6	7.9	14	16	9.8[h]
MTBE	NA	NA	NA	NA	NA	NA	NA	NA	<5

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< : Less than the detection limit for the analysis method.
a. Strongly aged gasoline or diesel range compounds are significant.
b No recognizable pattern.
c Lighter than water immiscible sheen is present.
d Unmodified or weakly modified diesel is significant.
e Gasoline range compounds are significant.
f 1.1 ppb by EPA 8260.
g 2.6 ppb by EPA 8260
h 8.2 by EPA 8260
NA Not analyzed

TABLE 2
CUMULATIVE RESULTS FOR WELL MW-1
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 601 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	<0.5	<0.5	1.8	1.5	1.9	<0.5	<0.5	<0.5
1,1-Dichloroethane	36	33	32	12	<0.5	<0.5	<0.5	14[b]
1,1-Dichloroethene	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,1 Trichloroethane	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5
Cis/Trans 1,2-Dichloroethene	<0.5	<0.5	8.5	2.7	5.1	<0.5	<0.5	3.4[d]
Tetrachloroethene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.8[a]
Trichloroethene	<0.5	<0.5	15	4.6	<0.5	<0.5	<0.5	0.97[a]
Trichloroflouromethane	<0.5	NR	9.8	4.9	<0.5	<0.5	<0.5	2.3[e]
Vinyl Chloride	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.3[c]

Results in micrograms per kilograms (ug/l) = parts per billion (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< Less than the detection limit for the analysis method.
a < 1.0 ppb by EPA 8260.
b 11 ppb by EPA 8260.
c 1.0 ppb by EPA 8260
d 1.8 ppb by EPA 8260.
e Not confirmed by EPA 8260; one other probable freon is present.
NR Not reported.

TABLE 3
CUMULATIVE RESULTS FOR WELL MW-1
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Acetone	< 50	210	2,700	610	76	220	180	210	< 15
Isopropanol	< 500	9,100	17,000	6,400	< 500	< 500	< 500	< 500	< 200
Methyl Ethyl Ketone	< 500	230	1,500	1,300	97,000	700	1,100	1,400	< 1.0
Methyl Isobutyl Ketone	< 500	180	420	600	< 500	< 500	< 500	< 500	< 1.0
Sec-Butanol	< 500	710	< 500	< 500	< 500	< 500	< 500	< 500	< 5
n-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	2.0
sec-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	6.3
Isopropylbenzene	NR	NR	NR	NR	NR	NR	NR	NR	8.7
p-Isopropyl toluene	NR	NR	NR	NR	NR	NR	NR	NR	1.2
n-Propyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	8.1

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< Less than the detection limit for the analysis method.
NR Not reported.

TABLE 4
CUMULATIVE RESULTS FOR WELL MW-2
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR HYDROCARBON COMPOUNDS by EPA 5030/8015 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
TPHg	1,400	4,800	810	1,000	780	1,200	1,100	890	760[abc]
TPHd	17,000	320	620	810	960	350	620	610	2,300[dee]
Kerosene	17,000	490	<50	<50	<50	<50	<50	<50	2,200
Stoddard Solvent	20,000	<50	160	350	<50	<50	81	76	390[abc]
Oil & Grease	19	NA	NA	NA	NA	NA	NA	NA	280
Benzene	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5
Toluene	1.2	1.2	1.2	0.9	<0.5	0.6	<0.5	<0.5	0.73
Ethylbenzene	69	5.6	4.3	3.2	3.0	3.2	2.3	1.1	12[f]
Total Xylenes	530	18	11	6.4	13	9.7	12	9.2	50[g]
MTBE	NA	NA	NA	NA	NA	NA	NA	NA	<5

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< Less than the detection limit for the analysis method.
a Heavier gasoline range compounds are significant (aged gasoline?).
b No recognizable pattern.
c Lighter than water immiscible sheen is present.
d Gasoline range compounds are significant.
e Diesel range compounds are significant; no recognizable pattern.
f 11 ppb by EPA 8260.
g 47 ppb by EPA 8260
NA Not analyzed.

TABLE 5
CUMULATIVE RESULTS FOR WELL MW-2
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 601 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4
Chloroform	<0.5	<0.5	2.7	4.9	4.4	1.8	1.6	<4
1,1-Dichloroethane	22	17	9.6	8	<0.5	<0.5	<0.5	7.7
1,1-Dichloroethene	<0.5	<0.5	2	<0.5	<0.5	<0.5	<0.5	<4
1,2-Dichloroethane	<0.5	<0.5	3.2	<0.5	<0.5	<0.5	<0.5	<4
1,1,1 Trichloroethane	<0.5	<0.5	4.8	<0.5	<0.5	<0.5	<0.5	<4
Cis/Trans 1,2-Dichloroethene	99	45	11	6.9	14	0.9	6.1	173[a]
Tetrachloroethene	52	34	49	20	14	<0.5	<0.5	110[b]
Trichloroethene	21	20	41	33	11	36	13	170[b]
Trichloroflouromethane	<0.5	NR	3.6	2.7	<0.5	<0.5	<0.5	<4
Vinyl Chloride	46	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.8

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
<: Less than the detection limit for the analysis method.
a: 141 ppb by EPA 8260.
b 130 ppb by EPA 8260.
NR Not reported.

TABLE 6
CUMULATIVE RESULTS FOR WELL MW-2
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Acetone	< 50	< 50	1,100	2,500	< 50	62	79	88	< 25
Isopropanol	< 500	9,100	17,000	6,400	< 500	< 500	< 500	< 500	< 2,000
Methyl Ethyl Ketone	< 500	< 500	18,000	22,000	59,000	6,100	5,200	4,900	< 10
Methyl Isobutyl Ketone	< 500	500	360	< 500	< 500	< 500	< 500	< 500	< 10
Sec-Butanol	< 500	90	< 500	< 500	< 500	< 500	< 500	< 500	< 50
n-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 10
sec-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 10
Isopropylbenzene	NR	NR	NR	NR	NR	NR	NR	NR	< 10
p-Isopropyl toluene	NR	NR	NR	NR	NR	NR	NR	NR	< 10
n-Propyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 10

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< : Less than the detection limit for the analysis method.
NR: Not reported.

TABLE 7
CUMULATIVE RESULTS FOR WELL MW-3
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR HYDROCARBON COMPOUNDS by EPA 5030/8015 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
TPHg	9,300	4,300	920	410	1,100	1,100	640	580	260[a,b,c]
TPHd	20,000	310	<50	900	1,200	200	420	390	710[d,c]
Kerosene	20,000	470	<50	<50	<50	<50	<50	<50	630
Stoddard Solvent	21,000	<50	<50	370	<50	<50	<50	<50	76[a,b,c]
Oil & Grease	28	NA	NA	NA	NA	NA	NA	NA	<250
Benzene	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5
Toluene	1,600	10	3.7	1.7	0.8	<0.5	<0.5	<0.5	57[c]
Ethylbenzene	<0.5	2.6	3.2	0.5	11	3.2	0.7	0.6	3.6[f]
Total Xylenes	700	10	16	2.5	2.6	9.6	2.1	1.8	18[g]
MTBE	NA	NA	NA	NA	NA	NA	NA	NA	<5

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
<: Less than the detection limit for the analysis method.
a: Heavier gasoline range compounds are significant (aged gasoline?).
b: One to a few isolated peaks present.
c: Lighter than water immiscible sheen is present.
d: Unmodified or weakly modified diesel is significant.
e: 41 ppb by EPA 8260.
f: 2.7 ppb by EPA 8260.
g: 16 by EPA 8260
NA: Not analyzed

TABLE 8
CUMULATIVE RESULTS FOR WELL MW-3
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 601 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	32	<0.5	<3
Chloroform	<0.5	<0.5	4.3	3.8	17	5.2	76	<3
1,1-Dichloroethane	30	47	52	16	<0.5	<0.5	<0.5	33[b]
1,1-Dichloroethene	<0.5	29	48	26	<0.5	<0.5	<0.5	12[c]
1,2-Dichloroethane	<0.5	<0.5	8.5	<0.5	<0.5	<0.5	<0.5	<3[e]
1,1,1 Trichloroethane	81	12	28	<0.5	<0.5	<0.5	<0.5	8.3[d]
1,1,2 Trichloroethane	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3[e]
Cis/Trans 1,2-Dichloroethene	630	327	6.6	4.9	<0.5	3.7	0.7	105.7[f]
Tetrachloroethene	2,200	110	54	34	<0.5	<0.5	<0.5	11[g]
Trichloroethene	300	290	140	63	53	41	180	140[h]
Trichloroflouromethane	<0.5	NR	30	17	<0.5	<0.5	<0.5	11[i]
Vinyl Chloride	<0.5	67	<0.5	<0.5	<0.5	<0.5	<0.5	140[j]

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
<: Less than the detection limit for the analysis method.
a: < 1.0 ppb by EPA 8260.
b: 29 ppb by EPA 8260.
c: 8.2 ppb by EPA 8260.
d: 6.2 ppb by EPA 8260
e: 1.6 ppb by EPA 8260.
f: 74 ppb by EPA 8260
g: 7.5 ppb by EPA 8260.
h: 100 ppb by EPA 8260.
i: Not confirmed by EPA 8260; one other probable freon is present.
j: 110 ppb by EPA 8260
NR: Not reported

TABLE 9
CUMULATIVE RESULTS FOR WELL MW-3
LABORATORY ANALYSES OF GROUNDWATER SAMPLES
FOR VOCs by EPA 8260
6460 Hollis Street
Emeryville, California

Compound Detected	7/92	8/94	11/94	2/95	6/95	10/95	4/96	8/96	2/98
Acetone	< 50	< 50	810	1,300	160	340	410	420	< 15
Isopropanol	< 500	9,400	6,700	5,800	< 500	< 500	< 500	< 500	< 200
Methyl Ethyl Ketone	< 500	370	40,000	19,000	32,000	6,600	5,900	5,100	< 1.0
Methyl Isobutyl Ketone	< 500	250	22,000	4,500	< 500	< 500	< 500	< 500	< 1.0
Sec-Butanol	< 500	710	< 500	< 500	< 500	< 500	< 500	< 500	< 5
n-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 1
sec-Butyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 1
Isopropylbenzene	NR	NR	NR	NR	NR	NR	NR	NR	< 1
p-Isopropyl toluene	NR	NR	NR	NR	NR	NR	NR	NR	< 1
n-Propyl benzene	NR	NR	NR	NR	NR	NR	NR	NR	< 1

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< : Less than the detection limit for the analysis method.
NR: Not reported

TABLE 10
RESULTS FOR HYDROPUNCH LOCATIONS HP-1 and HP-2
LABORATORY ANALYSES OF GROUNDWATER SAMPLES COLLECTED FEBRUARY 21, 1998
FOR HYDROCARBON COMPOUNDS by EPA 5030/8015 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	HP-1	HP-2
TPHg	80[a]	1,500[cde]
TPHd	240[h]	62,000[fge]
Kerosene	200	61,000
Stoddard Solvent	< 50	860[cde]
Oil & Grease	< 250	7,500
Benzene	< 0.5	0.73
Toluene	1.6[h]	7.3[k]
Ethylbenzene	< 0.5	2.8
Total Xylenes	1.1[l]	17[l]
MTBE	8.6[j]	< 5

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
<: Less than the detection limit for the analysis method.
a: Unmodified or weakly modified gasoline is significant.
h: Diesel range compounds are significant: no recognizable pattern.
c: Strongly aged gasoline or diesel range compound are significant.
d: No recognizable pattern.
e: Lighter than water immiscible sheen is present.
f: Unmodified or weakly modified diesel is significant.
g: Gasoline range compounds are significant.
h: < 1.0 ppb by EPA 8260.
i: 1.5 ppb by EPA 8260
j: 6.4 ppb by EPA 8260.
k: 5.9 ppb by EPA 8260.
l: 1.5 ppb by EPA 8260

TABLE 11
CUMULATIVE RESULTS FOR HYDROPUNCH LOCATIONS HP-1 AND HP-2
LABORATORY ANALYSES OF GROUNDWATER SAMPLES COLLECTED FEBRUARY 21, 1998
FOR VOCs by EPA 601 and 8260
6460 Hollis Street
Emeryville, California

Compound Detected	HP-1	HP-2
Bromoform	<0.5	<2
Chloroform	0.67	<2
1,1-Dichloroethane	0.82	86[a]
1,1-Dichloroethene	<0.5	18[b]
1,2-Dichloroethane	<0.5	<2
1,1,1-Trichloroethane	<0.5	50[c]
1,1,2 Trichloroethane	<0.5	<2
Cis/Trans 1,2-Dichloroethene	<0.5	67.5[d]
Tetrachloroethene	<0.5	7.0[e]
Trichloroethene	<0.5	8.2[f]
Dichlorodiflouromethane	<0.5	<2[g]
Trichloroflouromethane	<0.5	54[h]
Vinyl Chloride	0.94	24[i]

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
<: Less than the detection limit for the analysis method.
a: 82 ppb by EPA 8260
b: 15 ppb by EPA 8260.
c: 35 ppb by EPA 8260
d: 49.3 ppb by EPA 8260.
e: 5.5 ppb by EPA 8260
f: 5.8 ppb by EPA 8260.
g: 42 by EPA 8260.
h: Not confirmed by EPA 8260; one other probable freon is present.
i: 19 ppb by EPA 8260

TABLE 12
CUMULATIVE RESULTS FOR HYDROPUNCH LOCATIONS HP-1 AND HP-2
ANALYSES OF GROUNDWATER SAMPLES COLLECTED FEBRUARY 21, 1998
FOR VOCs by EPA 8260
6460 Hollis Street
Emeryville, California

Compound Detected	HP-1	HP-2
Acetone	< 15	< 30
Isopropanol	< 200	< 200
Methyl Ethyl Ketone	1.1	< 2
Methyl Isobutyl Ketone	< 1	< 2
Sec-Butanol	< 5	< 5
n-Butyl benzene	< 1	5.3
sec Butyl benzene	< 1	11
Isopropylbenzene	1.0	15
p-Isopropyl toluene	< 1	< 2
n-Propyl benzene	< 1	13

Results in micrograms per kilograms (ug/l) = parts per million (ppb).
Data from 7/92 through 8/96 obtained from Hageman/Aguiar (see references section.)
< : Less than the detection limit for the analysis method.
NR: Not reported

GEOMATRIX

APPENDIX C

PERMITS

ALAMEDA COUNTY PUBLIC WORKS AGENCY

WATER RESOURCES SECTION
951 TURNER COURT, SUITE 300, HAYWARD, CA 94545-2651
PHONE (510) 670-5575 ANDREAS GODFREY FAX (510) 670-5262
(510) 670-5248 ALVIN KAN

DRILLING PERMIT APPLICATION

FOR APPLICANT TO COMPLETE

LOCATION OF PROJECT 6460 Hollis St
Emeryville, CA

California Coordinates Source _____ ft. Accuracy ± ____ ft.
CCN _____ ft. CCE _____ ft.
APN _____

CLIENT
Name HFH, Ltd.
Address 1255 Powell Ave Phone 510-652-9191
City Emeryville, CA Zip 94608

APPLICANT
Name Geomatrix Consultants, Inc.
Jennifer Patterson Fax (415) 434-1365
Address 100 Pine St, 10th Floor Phone (415) 434-9400
City San Francisco Zip 94111

TYPE OF PROJECT

Well Construction		Geotechnical Investigation	
Cathodic Protection	☐	General	☐
Water Supply	☐	Contamination	☐
Monitoring	☒	Well Destruction	☐

PROPOSED WATER SUPPLY WELL USE

New Domestic	☐	Replacement Domestic	☐
Municipal	☐	Irrigation	☐
Industrial	☐	Other _____	☐

DRILLING METHOD:

Mud Rotary	☐	Air Rotary	☐	Auger	☒
Cable	☐	Other	☐		

DRILLER'S LICENSE NO. 485165

WELL PROJECTS
Drill Hole Diameter 6 in. Maximum
Casing Diameter 2 in. Depth 15 ft.
Surface Seal Depth 1.5 ft. Number 1

GEOTECHNICAL PROJECTS
Number of Borings 11 Maximum
Hole Diameter 2 in. Depth 10 ft.

ESTIMATED STARTING DATE 4/21/98
ESTIMATED COMPLETION DATE 4/24/98

I hereby agree to comply with all requirements of this permit and Alameda County Ordinance No. 73-68.

APPLICANT'S SIGNATURE [signature] DATE 4/15/98

FOR OFFICE USE

PERMIT NUMBER 98WR163
WELL NUMBER _____
APN _____

PERMIT CONDITIONS

Circled Permit Requirements Apply

(A.) GENERAL
1. A permit application should be submitted so as to arrive at the ACPWA office five days prior to proposed starting date.
(2.) Submit to ACPWA within 60 days after completion of permitted work the original Department of Water Resources Water Well Drillers Report or equivalent for well projects, or drilling logs and location sketch for geotechnical projects.
(3.) Permit is void if project not begun within 90 days of approval date.

B. WATER SUPPLY WELLS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth is 50 feet for municipal and industrial wells or 20 feet for domestic and irrigation wells unless a lesser depth is specially approved.

(C.) GROUNDWATER MONITORING WELLS INCLUDING PIEZOMETERS
1. Minimum surface seal thickness is two inches of cement grout placed by tremie.
2. Minimum seal depth for monitoring wells is the maximum depth practicable or 20 feet.

D. GEOTECHNICAL
Backfill bore hole with compacted cuttings or heavy bentonite and upper two feet with compacted material. In areas of known or suspected contamination, tremied cement grout shall be used in place of compacted cuttings

E. CATHODIC
Fill hole above anode zone with concrete placed by trem

F. WELL DESTRUCTION
See attached.

G. SPECIAL CONDITIONS

APPROVED [signature] DATE 4/16/98

PERMIT NO. 4-4-98

(FORM REVISED JUNE 1996)

ENCROACHMENT PERMIT
CITY OF EMERYVILLE - PUBLIC WORKS DEPARTMENT
2200 POWELL ST., 12TH FLR.
EMERYVILLE, CA 94608
(510) 596 4330

DATE April 15, 1998

PROPERTY OWNER H.F.H., Ltd. PHONE NO. 652-4191

CONTACT PERSON Andrew Gretz

ADDRESS 1355 Ocean Avenue, Emeryville

CONTRACTOR Gretz Construction Co. LICENSE NO. 382305 CLASS B

CONTACT PERSON Andrew Gretz PHONE NO. 652-4191

ADDRESS 2915 Deakin St., Berkeley, CA 94705

LOCATION OF WORK (INCLUDE ADDRESS AND STREET NAME AND CROSS STREETS)

PLANNED DATE OF COMMENCEMENT April 21, 1998 PLANNED DATE OF COMPLETION Well installation complete April 24,

DESCRIPTION OF WORK (INCLUDE AVERAGE DEPTH OF EXCAVATION, MAXIMUM DEPTH, AVERAGE WIDTH, LENGTH, AND ESTIMATED COST OF WORK)

Install ground water monitoring well in ~~sidewalk~~ Street on ~~west~~ east side of Hollis Street, ~~roughly aligning~~ 120 ft. north of centerline of Ocean Ave. and two with ~~northerly~~ edge of Ocean Avenue right of ~~way~~ one-time water samples nearby. As it projects west. ~~Steel plate cover flush with sidewalk.~~

CURRENT BUSINESS LICENSE ON FILE X YES? _____ NO?

CONTRACTOR SIGNATURE Andrew Gretz

DO NOT WRITE BELOW THIS LINE

☐ 24 HOUR NOTICE PRIOR TO START OF WORK ☐ PLAN TO BE SUBMITTED

REMARKS

NOTE: PROOF OF ADEQUATE INSURANCE MUST BE PRESENTED PRIOR TO START OF WORK OR THIS PERMIT IS VOID.

SEE ATTACHED ENCROACHMENT PERMIT GENERAL PROVISIONS.

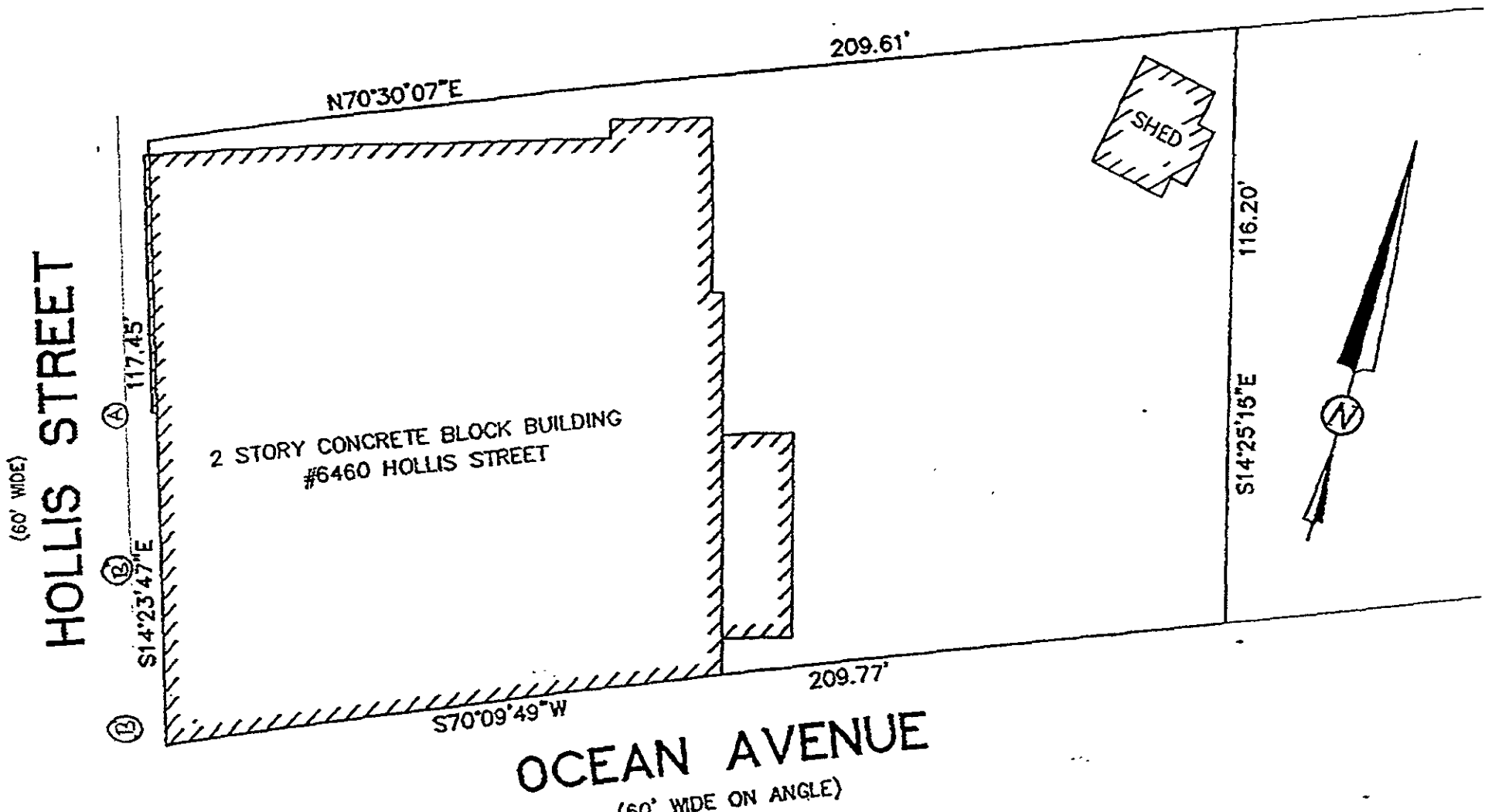
FOR INSPECTION UPON COMPLETION OF WORK, PLEASE CALL JUAN ARREGUIN AT (510) 596-4333. FOR REFUNDABLE DEPOSIT UPON ENGINEER SIGN-OFF, PLEASE CALL KATHLEEN WALLS AT (510) 596-4336. PLEASE REFER TO THE PERMIT NUMBER LISTED ABOVE.

INSPECTION COMPLETED ON _____ BY _____

REFUNDABLE DEPOSIT RETURNED ON _____ BY _____

Maurice Kaufman
(SIGNATURE)

Sr Civil Engineer
(TITLE)



Ⓐ monitoring well

Ⓑ one-time shallow groundwater sample

PRELIMINARY SURVEY PLAT

#6460 HOLLIS STREET

APRIL 16, 1998

SCALE 1" = 30'

CITY OF EMERYVILLE DEPARTMENT OF PUBLIC WORKS
ENCROACHMENT PERMIT GENERAL PROVISIONS

1. **Authority:** Each Encroachment Permit is issued in accordance with Title 7, Chapters 2 and 3 of the Emeryville Municipal Code.

2. **Revocation:** Encroachment Permits are revocable on twenty-four (24) hours' notice.

3. **Responsible Party:** No party other than the named permittee or their agent is authorized to work under any permit.

4. **Acceptance of Provisions:** It is understood and agreed by the permittee that the doing of any work under this permit shall constitute an acceptance of the provisions of this permit and all attachments.

5. **Notice Prior to Starting Work:** Before starting work under the Encroachment Permit, the permittee shall notify the designated City representative two (2) working days prior to initial start of work. When work has been interrupted for more than five (5) working days, an additional 24-hour notification is required before restarting work unless a pre-arranged agreement has been made with the City's representative. Unless otherwise specified, all work shall be performed on weekdays and during normal working hours of the City's representative.

6. **Standards of Construction:** All work performed within the City right of way shall conform to recognized standards of construction and the current City's Standard Specifications, Standard Plans and Manual on High ad Low Risk Facilities Within Highway Rights-of-Way and any Special Provisions relating thereto.

7. **Inspection and Approval by City:** All work shall be subject to monitoring inspection, and approval by the City. The permittee shall request a final inspection and acceptance of the work within three (3) working days from the completion of the work.

8. **Permit on the Work Site:** The Encroachment Permit or a copy thereof shall be kept at the site of the work and must be shown to any representative of the City or any law enforcement officer on demand. WORK MAY BE SUSPENDED IF PERMIT IS NOT AT JOB SITE AS PROVIDED.

9. **Conflicting Permits:** If a prior encroachment conflicts with the proposed work, the new permittee must arrange for any necessary removal or relocation with the prior permittee. Any such removal or relocation will be at no expense to the City.

10. **Permits From Other Agencies:** The permittee shall, whenever required by law, secure the written authorization for any work that must be approved or permitted by any federal, state or local agency having jurisdiction. Failure to comply with the law, as noted above, will invalidate the City's permit.

11. **Provisions for Pedestrians:** Where facilities exist, a minimum sidewalk and bikepath width of four feet (4) shall be maintained at all times for safe passage through the work area. At no time shall pedestrians be diverted onto a portion of the street used for vehicular traffic. At locations where adjacent alternate walkways cannot be provided, appropriate signs and barricades shall be installed at the limits of construction and in advance of the closure at the nearest crosswalk or intersection to divert pedestrians across the street.

12. **Protection of Traffic:** Adequate provisions shall be made for the protection for the traveling pubic. Warning signs, lights and safety devices and other measures required for the public safety, shall conform to the requirements of the Manual of traffic Controls issued by Caltrans. Traffic control for day or nighttime lane closures shall be in conformance with Caltrans Standard Plans for Traffic Control Systems.

13. **Minimum Interference with Traffic:** All work shall be planned and carried out so that there will be the least possible inconvenience to the traveling public. The permittee is authorized to place properly attired flagger(s) to stop and warn conventional traffic. Traffic shall not be unreasonably delayed. Flagging procedures shall be in conformance with the Instructions to Flaggers pamphlet and/or Manual of Traffic Controls for

construction and Maintenance Work Zones issued by Caltrans.

14. **Care of Drainage:** If the work contemplated in any Encroachment Permit shall interfere with the established drainage, ample provision shall be made by the permittee to provide for it as may be directed by the City.

15. **Water Control:** The Contractor shall use Best Management Practices established by the Alameda County Urban Runoff Clean Water Program to prevent construction water, debris, or groundwater from entering storm drains.

16. **Restoration:** In every case, the permittee shall be responsible for restoring to the specifications set forth in Emeryville Municipal Code section 7-2.08 any portion of the City facility which as been excavated or otherwise disturbed by permittee. In addition, all brush, timber, scraps, material, etc., shall be entirely removed and the right-of-way shall be left in as presentable a condition as existed before work started. The permittee shall maintain the surface over facilities placed under any permit. If the facility is not restored as herein provided for, or if the City elects to make repairs, permittee agrees by acceptance of this permit to bear the cost thereof. Permittee understands that under Emeryville Municipal Code section 7-2.12, it is liable for any subsidence in the facilities disturbed by permittee that occurs within one (1) year from the date of completion.

17. **Work Area Maintenance:** Permittee is solely responsible for maintaining any area it uses in a safe, orderly, and clean condition so as to prevent any injury to damage to property or person.

18. **Cost of Work:** Unless otherwise stated on the permit or other separate written agreement, all costs incurred for work within the City right-of-way pursuant to this Encroachment permit shall be borne by the permittee, and permittee hereby waives all claims for indemnification or contribution from the City for such work.

19. **Inspection Billing:** When the permittee is to be billed for inspections, such costs will be at the current hourly rate established by the City for Permits.

20. **Submit Plan:** For installation of all underground facilities, and all surface work or other activity of consequence, the permittee shall furnish 1 (one) set of plans showing location and construction or other activity with its application. Thirty (30) days after completion and acceptance of the work, one (1) set of as-built plans shall be submitted to the City.

21. **Deposit:** This permit shall not be effective for any purpose unless, and until the permittee submits to the City a deposit of one thousand dollars ($1,000).

22. **Release and Indemnification:** Permittee agrees that the City of Emeryville and its officers, employees, agents and volunteers shall not be liable in any manner for injury to or death of any person or for damage to property from any cause. The permittee shall be responsible for any liability, cost, expense, or claim associated with injuries to or death of any person or damage to property related directly or indirectly to any act or failure to act arising under this permit, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity, or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit.

The permittee shall indemnify and save harmless the City of Emeryville and its officers, employees, agents and volunteer from all claims, suits, actions, expenses, including but not limited to attorney's and expert's fees and costs, resulting from the performance of work or other activity under the permit, or arising out of the failure on the permittee's part to perform his obligations under this permit in respect to maintenance or any other obligations, or resulting from defects or obstructions, or from any cause whatsoever during the progress of the work, or other activity or at any subsequent time work or other activity is being performed under the obligations provided by and contemplated by the permit, except as otherwise provided by statute. The duty of the permittee to indemnify and save harmless includes the duties to defend. The permittee waives any and all rights to any type of expressed or implied indemnity against the City, its officers or employees. It is the intent of the parties that the permittee will indemnify and hold harmless the City, its officers, employees, agents and volunteers from any and all

claims, suits or actions as set forth above regardless of the existence or degree of fault or negligence, whether active or passive, primary or secondary, on the part of the City, the permittee, persons employed by the permittee, or persons acting in behalf of the permittee.

23. **No Precedent Established:** this permit is issued with the understanding that any particular action is not to be considered as establishing any precedent (1) on the question of the expediency of permitting any certain kind of encroachment to be erected within right-of-way of the City of Emeryville or (2) as to any utility of the acceptability of any such permits as to any other or future situation.

24. **Compliance with laws:** Permittee is solely responsible for compliance with all applicable federal, state and local laws and regulations, including but not limited to all environmental laws and regulations.

25. **Future Moving of Installations:** If the Encroachment Permit was issued at the request of the Permittee, it is understood that whenever City construction construction or maintenance work on the City right-of-way requires the installation to be removed, adjusted or relocated, the permittee, at his sole expense, upon request of the City shall comply with said request.

26. **Attorneys fees:** In the event that either party institutes any action, suit, or other dispute resolution proceeding based on this Permit against the other party, the prevailing party is entitled to receive from the losing party all costs or expenses of the proceeding, including but not limited to reasonable attorney fees and court costs.

APPENDIX D

GEOMATRIX PROTOCOLS

PROTOCOL
DRILLING AND DESTRUCTION OF SOIL BORINGS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during drilling and destruction of soil borings. The soil borings will provide information about geologic conditions, soil engineering properties, and/or soil quality. If the soil boring is utilized for well installation, the well will be installed in accordance with the protocol INSTALLATION OF WELLS.

The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

If required, permits for drilling of soil borings will be acquired from the appropriate agency(s) before drilling is initiated, and an underground utility check will be conducted before drilling begins. An underground utility check will, at a minimum, consist of contacting a local utility alert service, if available.

2.0 DRILLING

A DAILY FIELD RECORD will be completed for each day of fieldwork, and the original will be kept in the project files.

The soil borings will be drilled using rotary, hollow stem auger, direct-push, or other appropriate method. In all rotary borings, compressed air will be filtered to remove oils before being circulated into the borehole. In mud rotary borings, appropriate drilling fluid additives, such as bentonite, will be used to maintain an open hole and to carry cuttings to the

surface. However, organic drilling fluid additives will only be used with prior project manager approval. The drilling mud will be circulated into a settling tank or basin located near the boring. The viscosity of the drilling fluid will be assessed periodically by the driller and will be controlled throughout the drilling operation to achieve the required results (hole stability, sample return, and mud cake thickness along borehole wall). Only potable water will be used as makeup water for drilling fluid. Exploratory borings drilled using the hollow stem auger method generally do not require the use of drilling fluid. If required, potable water from a municipal supply will be used to maintain boring stability.

The planned depth of each soil boring will be determined by the project manager before drilling. The Geomatrix field geologist/engineer will specify to the drill rig operator the depth of soil sample collection, method of sample retrieval, and other matters pertaining to the satisfactory completion of the borings. Geomatrix staff will observe the volume of drill cuttings returned to assess whether significant cavitation has occurred. Drill cuttings, unused soil samples, and drilling fluids generated during drilling of soil borings will be stored properly for future disposal by the client, unless other arrangements have been made.

The drill rods, augers, hoses, bits, and other components that fluids and cuttings contact will be steam-cleaned before drilling each boring, as well as at the beginning of each project and at the completion of field activities. Drive samplers will be cleaned with Alconox and water or steam-cleaned before each sampling event. Only potable water from a municipal supply will be used for decontamination of drilling equipment. Decontamination rinsate will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

3.0 SAMPLING AND LOGGING

3.1 OBTAINING SAMPLES

Borings will be continuously cored or sampled at depth intervals specified by the project manager, based on the intended use of the boring. Continuous sampling is recommended; however, samples and/or cuttings will be obtained for logging purposes at least every 5 feet for all borings. Drive samples will be used to log hollow stem auger borings if continuous cores are not collected. The samples and/or drill cuttings will be collected and described. A lithologic log of these samples will be made. Samples for chemical analysis will be collected in accordance with the protocol SOIL SAMPLING FOR CHEMICAL ANALYSIS.

3.1.1 Discrete Sampling

For discrete sampling of mud rotary or auger borings, sampling will be accomplished by driving or pushing a split-barrel sampler or Shelby tube. The field geologist/engineer will record information on the BORING LOG pertaining to the sampling, such as rate of penetration, hydraulic ram pressure or drive-hammer blow count, coring smoothness, and sample recovery. In general, the split-barrel sampler will be opened for observation and logging of the retrieved core.

At selected depth intervals, the split-barrel sampler may be fitted with brass or stainless steel liners for collection of soil samples for possible subsequent chemical or physical testing. Samples may be retained for future review and/or preserved for chemical or physical testing, as specified by the project manager. The samples will be stored and labeled to show project number, boring number, and cored interval denoted either by depth or a sequential numbering system. Procedures for preservation and transport of soil samples retained for chemical analysis are presented in the protocol SOIL SAMPLING FOR CHEMICAL ANALYSIS.

3.1.2 Collecting Drill Cuttings

The field geologist/engineer may observe drill cuttings from the drilling fluid return for lithologic information to supplement discrete sampling. Sampling and logging cuttings will be performed as follows:

1. The height of the drilling table above ground surface, lengths of the drill bit, sub and drill collars, and length of drill rods should be taken into account in calculating the depth of penetration.

2. In mud rotary drilling, a small-diameter, fine mesh hand screen will be used to obtain a sample of the cuttings from the borings by holding the screen directly in the flow of the drill fluid return line. In air rotary drilling, cuttings will be collected after discharge from the cyclone.

3. In rotary drilling, a composite sample may be obtained from the return line by leaving the screen in place during the time it takes the driller to advance the boring to a preselected depth.

4. In rotary drilling, the travel time for cuttings to reach the surface may be estimated each time the driller adds a new length of drill rod by timing the first arrival of cuttings after circulation is resumed. This travel time can be used along with the depth of penetration to estimate the start and finish of each 5-foot sampling interval.

3.2 LOGGING OF EXPLORATORY BORINGS

The observations of the field geologist/engineer will be recorded on a BORING LOG OR WELL LOG at the time of drilling. The drill rig operator and the field geologist/engineer will discuss significant changes in material penetrated, drilling conditions, hydraulic pressure, drilling action, and drilling fluid circulation rate. The field geologist/engineer will be present during drilling of soil borings and will observe and record such changes by time and depth.

Drill cuttings and core samples will be observed in the field. A lithologic description will be recorded on the BORING LOG using the Unified Soil Classification System (USCS) as described in the American Society of Testing and Materials (ASTM) Standard D 2488-90. This description will include the USCS soil type, grain sizes and estimated percentages of

each, moisture content, color according to the Munsell color charts (Kollmorgen Instruments Corp.), plasticity for fine-grained materials, consistency, and other pertinent information, such as degree of induration, calcareous content, presence of fossils and other distinctive materials.

The original field logs will be retained by the Geomatrix office for review by the responsible professional and for storage in the project files.

4.0 GEOPHYSICAL LOGS

Following completion of drilling, downhole geophysical logs may be performed after the drilling fluid has been circulated to decrease the amount of suspended sediment in the return fluid. Geophysical methods and equipment will be selected to provide stratigraphic or hydrogeologic data appropriate for the project. Geophysical logging will be done as quickly and promply after drilling as feasible, while the boring sidewall is still in stable condition, to reduce the possibility of bridging. Instruments on the logging unit will be adjusted to try to give the maximum definition of strata boundaries. All downhole geophysical equipment will be cleaned before and after use in each borehole.

5.0 FIELD SCREENING

Soil samples collected from the borings may be screened using a portable meter such as a photoionization detector (PID), a flame ionization detector (FID), a lower explosion limit (LEL) meter or other organic vapor meter. The meter may be used to assess the presence of volatile organic compounds (VOCs) or other gases in soil samples. Additional field screening techniques for chemical characterization of soils may include x-ray fluorescence (XRF) and thin-layer chromatography (TLC). Procedures for field screening are described in the protocol SOIL SAMPLING FOR CHEMICAL ANALYSIS.

6.0 DESTROYING SOIL BORINGS

Soil borings that are not completed as monitoring wells will be destroyed by filling the holes with a neat cement grout, cement/sand grout, or cement/bentonite grout. A high-solids bentonite grout may be used if appropriate. Geomatrix field staff will calculate the borehole volume and compare it to the volume of grout used to evaluate whether bridging has occurred. These calculations and the actual volume emplaced will be noted on the BORING LOG. The grout will be placed in continuous lifts from the bottom of the boring to a depth of 20 feet above the water table. The grout will be emplaced by pumping it through the hollow stem augers, drill pipe, tremie pipe, or flexible hose initially lowered to the bottom of the borings and raised incrementally as placement proceeds. If hollow stem augers are used, the augers should be raised incrementally as grout emplacement proceeds. Augers will not be raised in increments greater than 20 feet or greater than allowed by borehole stability. Borings that are terminated above the water table and not greater than 20 feet deep may be destroyed by continuous lifts originating at the ground surface. The grout will be pumped or poured until a return of fresh grout is visible at the surface. Additional grout may need to be added to the soil boring if significant settlement has occurred after the grout has set.

Attachments: Daily Field Record
Boring Log
Well Log

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

GEOMATRIX

Page ______ of ______

Project and Task Number: ______________________________ Date: ______________________________

Time	Description of Work Performed

PROJECT:	Log of Boring No.	
BORING LOCATION:	ELEVATION AND DATUM:	
DRILLING CONTRACTOR:	DATE STARTED:	DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:	MEASURING POINT:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST	COMPL.
SAMPLING METHOD:	LOGGED BY:	
HAMMER WEIGHT: / DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION: NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react w/HCl. geo. inter.	REMARKS
					Surface Elevation:	

B-1 (12/95)

Project No.	Geomatrix Consultants	Figure

PROJECT:

Log of Boring No.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION: NAME (USCS Symbol) color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl, geo. inter.	REMARKS

B-2 (12/95)

Project No.	Geomatrix Consultants	Figure

PROJECT:	Log of Well No.		
BORING LOCATION:	ELEVATION AND DATUM:		
DRILLING CONTRACTOR:	DATE STARTED:		DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST	COMPL.	CASING:
SAMPLING METHOD:	LOGGED BY:		
HAMMER WEIGHT: DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react w/HCl. geo inter. Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-1 (12/95)

Project No.	Geomatrix Consultants	Figure

W-1 (Blank)

PROJECT:

Log of Well No.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION *NAME (USCS Symbol): color, moist, % by weight , plast., consistency, structure, cementation, react. w/HCl geo. inter.*	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-2 (12/95)

Project No.	Geomatrix Consultants	Figure

PROTOCOL
SOIL SAMPLING FOR CHEMICAL ANALYSIS

1.0 INTRODUCTION

This protocol describes the procedures to be followed for collecting soil samples for chemical analysis and conducting soil field screening in conjunction with drilling soil borings and excavating soil. The laboratory must be certified by the appropriate regulating agency for the analyses to be performed.

If required, permits will be acquired from the appropriate agency, and an underground utility check will be performed before drilling or excavating begins. An underground utility check will, at a minimum, consist of contacting a local utility alert service, if available.

The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 SAMPLE COLLECTION

Soil samples may be collected during drilling or excavating activities. The procedures for sample collection are discussed below.

2.1 SAMPLE COLLECTION DURING DRILLING

The drilling of soil borings will be conducted in accordance with the protocol DRILLING AND DESTRUCTION OF SOIL BORINGS. The soil sampler either will be washed with laboratory grade detergent-water solution to remove soil present and rinsed with potable water, or it may be steam-cleaned prior to and between sampling. Soil samples will be collected in clean brass or stainless steel liners that have been washed with detergent-water solution and

rinsed with potable water or steam-cleaned. The liners will generally be placed in a 2-inch- or 2.5-inch-diameter split-spoon sampler and then driven or pushed into the soil at the selected sampling depth. The sample will be parted at the joints between the liners using a clean, sharp stainless steel knife or spatula. Alternatively, a subsample for chemical analyses may also be collected by driving a smaller-diameter liner into the center of the larger core sample, taking care to reduce the potential for sample disturbance and air space within the liner. If the soil sample is collected using a hand auger, a subsample should be collected from the core of the auger, again taking care to reduce the potential for sample disturbance and air space within the liner. If the sample is to be analyzed for non-volatiles only, a loose sample may be placed in a glass jar. Samples to be analyzed for metals may be homogenized before analysis either in the field or by the laboratory to provide results more representative of average concentrations in the sampling interval.

2.2 SAMPLE COLLECTION DURING EXCAVATION

Excavated soil will be sampled as required under the appropriate agency guidelines, if applicable, or as necessary to provide the data desired. The lateral and vertical dimensions of the excavation, as well as the sample location and depth, will be mapped, and the volume estimated. If possible, samples will be collected from the backhoe or excavator bucket without entering the excavation. Samples may be collected directly from the walls or floor of the excavation, provided Occupational Safety and Health Administration (OSHA) regulations are followed before entering an excavation.

Soil stockpiles also may be sampled after completion of excavation. If they are sampled, the stockpile location, dimensions, and sample locations will be mapped, and the stockpile volume will be estimated. If compositing of soil samples containing volatile compounds is required, it should be performed by the laboratory.

The soil from excavations or stockpiles should be sampled by scraping away 3 to 6 inches of surface soil or hand augering to a known depth. A clean glass jar, brass tube, or stainless

steel tube will be forced into the soil to completely fill the container, or a clean hammer sampler may be used in conjunction with brass or stainless steel liners.

3.0 SAMPLE HANDLING AND PRESERVATION

Soil samples will be handled using the following procedures:

1. Clean gloves appropriate for the chemicals of concern will be worn by the sampler before touching the sample containers, and care will be taken to avoid contact with the sample.

2. The sample will be quickly observed for color, appearance, and composition. The ends of the liners will be immediately covered with Teflon® sheeting and/or aluminum foil, capped with plastic end caps, and sealed with tape. Glass jars will be immediately sealed with a lid.

3. The sample container will be labeled before or immediately after sampling with a self-adhesive label having the following information written in waterproof ink:

    - Geomatrix
    - Project number
    - Sample ID number
    - Date and time sample was collected
    - Initials of sample collector

4. The sample will be placed in a chest, that contains ice or blue ice if required, for transport to the laboratory. Table 1 lists common analyses performed and the appropriate storage and handling requirements.

4.0 DOCUMENTATION

4.1 FIELD DATA SHEETS

A DAILY FIELD RECORD will be completed for each day of fieldwork. Locations and unique identification of soil samples collected from soil borings will be recorded on the BORING LOG or WELL LOG. Locations and unique identification of soil samples collected from excavations or stockpiles will be recorded on a DAILY FIELD RECORD, site map, and/or other appropriate form. Samples may also be recorded on a SAMPLE CONTROL

LOG SHEET or in the DAILY FIELD RECORD as a means of identifying and tracking the samples. Following review by the project manager, the original field records will be kept in the project file.

4.2 CHAIN-OF-CUSTODY PROCEDURES

After samples have been collected and labeled, they will be maintained under chain-of-custody procedures. These procedures document the transfer of custody of samples from the field to the laboratory. Each sample sent to the laboratory for analysis will be recorded on a CHAIN-OF-CUSTODY RECORD, which will include instructions to the laboratory on the analytical services required.

Information contained on the triplicate CHAIN-OF-CUSTODY RECORD will include:

- Project number
- Signature of sampler
- Date and time sampled
- Sample I.D.
- Number of sample containers
- Sample matrix (soil, water, or other)
- Analyses required
- Remarks, including preservatives, special conditions, or specific quality control measures
- Turnaround time and person to receive laboratory report
- Method of shipment to the laboratory
- Release signature of sampler and signatures of all people assuming custody
- Condition of samples when received by laboratory (to be completed by the laboratory)

Blank spaces on the CHAIN-OF-CUSTODY RECORD will be crossed out between the last sample listed and the signatures at the bottom of the sheet.

The field sampler will sign the CHAIN-OF-CUSTODY RECORD and will record the time and date at the time of transfer to the laboratory or an intermediate person. A set of signatures is required for each relinquished/received transfer, including transfer within Geomatrix. The

original imprint of the CHAIN-OF-CUSTODY RECORD will accompany the sample containers; a duplicate copy will be kept in the Geomatrix project file.

If the samples are to be shipped to the laboratory, the original CHAIN-OF-CUSTODY relinquishing the samples will be sealed inside a plastic bag within the ice chest, and the chest will be sealed with custody tape which has been signed and dated by the last person listed on the chain-of-custody. U.S. Department of Transportation shipping requirements will be followed and the sample shipping receipt will be retained in the project files as part of the permanent chain-of-custody document. The shipping company (e.g., Federal Express, UPS, DHL) will not sign the chain-of-custody forms as a receivor; instead the laboratory will sign as a receivor when the samples are received.

5.0 SOIL FIELD SCREENING

Soil will occasionally be screened using a field instrument or method. Readings should be recorded on the BORING LOG, WELL LOG, DAILY FIELD RECORD, or another form prepared for this purpose. Two screening methods are described below.

5.1 ORGANIC VAPOR METERS

A portable photoionization detector (PID), flame ionization detector (FID), lower explosive limit meter (LEL), or other type of organic vapor meter (OVM) may be used to screen soil. The purpose of the field screening is to assess the presence of volatile organic compounds (VOCs) in the soil. The meter measures total VOCs in the air in parts per million (ppm) by volume in reference to a selected standard. The meter will be calibrated each day prior to the soil sampling. The meter cannot specifically identify each volatile compound, but can be adjusted to be sensitive to selected volatile organics. Before choosing a meter, the response factor of the meter to the chemicals of concern at the site should be considered. Soil should be screened as soon as possible after being exposed to the atmosphere. The general procedure for screening is as follows:

1. Using a clean tool, dig a hole to expose fresh soil in a backhoe bucket or stockpile, or separate the brass liners from a driven sample.

2. Insert the probe of the OVM into the hole, taking care not to clog the probe with soil. Alternatively, headspace readings may be taken by placing soil in a covered (e.g., aluminum foil or Teflon® sheet) clear glass jar or plastic resealable bag, and after several minutes have elapsed, introducing the probe into the headspace area. No soil sample used for headspace screening will be submitted to the laboratory for chemical analysis.

3. Record the results in ppm for PIDs and FIDs, and in percent of the lower explosive limit for LELs.

4. Ensure that the instrument returns to a zero measurement before the next reading. If necessary, move to an area without measurable organic vapors to zero-out the instrument.

6.0 EQUIPMENT CLEANING

The sampler, brass or stainless steel liners, spatula, and tools used in assembly and disassembly of the soil sampler will be cleaned before and after each use. All soil will be removed from the tools and parts, and the tools will be steam-cleaned or washed in laboratory-grade detergent water with a brush, followed by rinsing in potable water. Decontamination rinsate will be collected and stored properly for future disposal by the client unless other arrangements have been made.

Attachments:
Table: Water and Soil Analytical Methods and Sample Handling
Figures: Daily Field Record
Boring Log
Well Log
Chain-of-Custody Record
Sample Control Log Sheet

TABLE 1

WATER AND SOIL ANALYTICAL METHODS AND SAMPLE HANDLING

Parameter	Method	Water Containers[1]	Preservation[1]	Maximum Holding Time[1]
Total Petroleum Hydrocarbons: • as diesel • as gasoline	 GCFID (3550)[2] GCFID (5030)[2]	 2 - 1 liter amber glass 2 - 40 ml VOA glass	 cool on ice HCL to pH 2 in water samples: cool on ice	 14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Benzene, Toluene, Xylene, and Ethylbenzene	EPA 8020	2 - 40 ml VOA glass	HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days)
Oil and Grease	5520 E & F (soil)[3] 5520 C & F (water)[3]	2 - 1 liter amber glass	H_2SO_4 to pH <2 in water samples: cool on ice	28 days
Volatile Organics	EPA 8010 EPA 8240[5]	2 - 40 ml VOA glass 2 - 40 ml VOA glass	cool on ice[4] HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Semi-volatile Organics	EPA 8270	2 - 1 liter amber glass	cool on ice	7 days for extraction, water 14 days for extraction, soil 40 days for analysis
Polynuclear Aromatic Hydrocarbons	EPA 8310	2 - 40 ml VOA glass	cool on ice	7 days, water 14 days, soil
Metals (dissolved)	EPA 7000 series for specific metal	1 - 500 ml plastic	Water Samples: field filtration (0.45 micron filter) and field acidify to pH 2 with HNO_3 except: Cr^{+6} - cool on ice	6 months, except: Hg - 28 days Cr^{+6} - 24 hours, water; 24 hours after prep, soil

Notes:

1 All soil samples should be collected in full, clean brass liners, capped with aluminum foil or Teflon and plastic caps, and sealed with tape. If soil samples are to be analyzed for metals, they may be placed in laboratory-prepared clean glass jars. Soil should be cooled as indicated under "preservation" and maximum holding times apply to both soil and water unless otherwise noted.

2 For analysis in California, use California DHS recommended procedure as presented in LUFT manual using gas chromatography with a flame ionization detector. In other states, local requirements should be followed.

3 Method to be used in California Regional Water Quality Control Board North Coast and Central Valley Regions. In other areas, local requirements should be followed.

4 If EPA Methods 8010 and 8020 are to be run in sequence, HCL may be added. Check with the project manager before adding acid.

5 Chloroethylvinylether may be detected at concentrations below 50 parts per billion due to degradation of HCL.

References:

U.S. EPA, 1986, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods - SW-846, Third Edition, July, and final amendments.

California State Water Resources Control Board, 1989, Leaking Underground Fuel Tank (LUFT) Field Manual, Tables 3-3 and 3-4, October.

California Regional Water Quality Control Boards, North Coast, San Francisco Bay, and Central Valley Regions, 1990, Regional Board Staff Recommendations for Initial Evaluation and Investigation of Underground Tanks, 10 August.

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

GEOMATRIX

Page _____ of _____

Project and Task Number: ______________________________ Date: ______________________________

Time	Description of Work Performed

Forms(PF) 005 (Revised 12/95)

PROJECT:	Log of Boring No.	
BORING LOCATION:	ELEVATION AND DATUM:	
DRILLING CONTRACTOR:	DATE STARTED:	DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:	MEASURING POINT:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST	COMPL.
SAMPLING METHOD:	LOGGED BY:	
HAMMER WEIGHT: DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION: NAME (USCS Symbol)· color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl, geo. inter.	REMARKS
					Surface Elevation:	

B-1 (12/95)

Project No.	Geomatrix Consultants	Figure

PROJECT:

Log of Boring No.

DEPTH (feet)	SAMPLES			OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl. geo. inter.	REMARKS
	Sample No	Sample	Blows/ Foot			

B-2 (12/95)

Project No.	Geomatrix Consultants	Figure

B-2 (Blank)

PROJECT:	Log of Well No.	
BORING LOCATION:	ELEVATION AND DATUM:	
DRILLING CONTRACTOR:	DATE STARTED:	DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:	SCREEN INTERVAL:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST COMPL.	CASING:
SAMPLING METHOD:	LOGGED BY:	
HAMMER WEIGHT: DROP:	RESPONSIBLE PROFESSIONAL:	REG. NO.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol)· color, moist, % by weight , plast., consistency, structure, cementation, react. w/HCl geo inter Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-1 (12/95)

Project No.	Geomatrix Consultants	Figure

W-1 (Blank)

PROJECT:

Log of Well No.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react w/HCl geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-2 (12/95)

Project No.	Geomatrix Consultants	Figure

W-2 (Blank)

CHAIN-OF-CUSTODY RECORD

Nº

Date:

Page of

Project No.:

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel												Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers

ANALYSES

REMARKS

Additional Comments

Turnaround time:

Results to:

Total No. of containers:

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Method of Shipment:
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	Laboratory Comments and Log No.:
Company:		Company:		Company:		
Received by (signature):	Date:	Received by (signature):	Date:	Received by (signature):	Date:	
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	
Company:		Company:		Company:		

GEOMATRIX

Forms(PF).012b (Revised 12/95)

SAMPLE CONTROL LOG

GEOMATRIX

Project Name: _____ Laboratory: _____

Project and Task No.: _____ Page _____ of _____

Sampling Date	Sampling Time	Sample Number (ID)	C.O.C. Number	Analyses Requested	Turnaround Time, Sample Location, Handling Notes, Chain-of-Custody Remarks, et. (Duplicate, blank info, etc.)	Date Sent to Lab	Date Results Due

Forms(PF).006 (Revised 12/95)

PROTOCOL
INSTALLATION AND DESTRUCTION OF WELLS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during the installation or destruction of monitoring, groundwater extraction, and vapor extraction wells. Drilling and logging of soil borings for the well installation will be in conformance with the protocol DRILLING OF SOIL BORINGS. The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 WELL INSTALLATION

A DAILY FIELD RECORD will be completed for each day of fieldwork, and the original will be kept in the project files. If required, permits will be acquired from the appropriate agency(s), and an underground utility check will be performed before drilling begins. An underground utility check will, at a minimum, consist of contacting a local utility alert service, if available.

After well installation, well completion report(s) will be completed and filed with the State Department of Water Resources or the appropriate agency.

Each groundwater monitoring well will be designed to enable measurement of the potentiometric surface and to permit water sampling of a specific water-bearing zone. Each vapor monitoring well will be designed to enable measurement of pressure conditions and permit sampling of a specific zone. The field geologist/engineer, in consultation with the project geologist or engineer, who will be licensed in the state in which the work is performed if required, will specify the screened interval using the lithologic log and geophysical log (if

performed) and will select the well materials and techniques for well completion to be compatible with the subsurface conditions and the intended use of the well. Construction of all wells will be in conformance with the following provisions. A TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM is attached.

2.1 WELL SCREEN AND CASING

The well casing will generally consist of threaded stainless steel or schedule 40 (minimum) polyvinyl chloride (PVC) casing. The inside diameter of the casing will be large enough to permit easy passage of an appropriate water-level probe and equipment for purging wells and water sample collection.

The well screen will generally consist of machine-slotted PVC or wire-wrapped stainless steel screen. The slot sizes will be compatible with the selected filter material. The screened sections will provide flow between the target zone and the well, allowing efficiency in well development and collection of representative samples.

2.2 FILTER MATERIAL

Filter material will be well-graded, clean sand (generally less than 2 percent by weight passing a No. 200 sieve and less than 5 percent by weight of calcareous material). The filter material will be either a standard sand gradation designed for a range of anticipated soil types or a sand gradation specifically designed to fit the soils collected from anticipated well completion zone.

2.3 SETTING SCREENS AND RISER CASING

Upon completion of drilling and/or geophysical logging, the boring will be sounded to verify the total depth, and the well casing will be assembled and lowered into the boring. Well casing materials will be measured to the nearest 0.1 foot and steam-cleaned before being lowered into the borehole. The well assembly will be designed so that the well screen is opposite the target zone. The bottom of the well will be fitted with a secure bottom-end cap. No PVC cement or other solvents will be used to fasten the well casing joints, well screen joints, or end caps. When installing wells in an open borehole, stainless steel centralizers will

be used immediately above and below the well screen and approximately every 30 to 50 feet along the length of the casing. Centralizers need not be placed on well assemblies installed within augers or drill casings because the auger or drill casing will adequately center the well casing and screen in the borehole.

For borings drilled by the mud rotary method, potable water may be added to the drill mud and circulated in the borehole after completion of the boring. Circulation will continue until the suspended sediment in the return fluid has been decreased. If borehole conditions are relatively stable, the mud will be thinned before the casing assembly is lowered to the specified depth. This is preferred because it reduces the potential for clogging the well screen with thick mud. Conversely, if borehole conditions are relatively unstable, the mud will be thinned after the casing is placed at the specified depth but prior to installation of annular fill materials. After installation of the well assembly, a slurry of filter sand and potable water will then be tremied into the annular space.

For borings drilled using the hollow stem auger method, the filter sand will be placed after the well assembly has been lowered to the specific depth through the augers. The augers will be incrementally raised as the filter sand is placed by free fall through the augers. The depth to the top of the filter pack will be measured after each increment to detect possible bridging. If bridging occurs, it will be broken by washing the filter materials into proper place with potable water or by repeatedly raising and lowering the augers slightly. The amount of water, if any, added to the borehole should be noted on the BORING LOG or DAILY FIELD RECORD.

For monitoring wells, the filter sand will be placed in a calculated quantity sufficient to fill the annular space to a level of about 1 to 2 feet above the top of the well screen. For extraction wells, the level of filter sand above the well screen will be based on site conditions. The depth to the top of the filter pack will be verified by measuring, using a tremie pipe or a weighted tape. Groundwater extraction wells or monitoring wells may be surged before placement of the transition seal to promote filter material settlement, as specified by the project manager.

Once the depth to the top of the filter material has been verified, bentonite or fine sand may be placed in the annular space as a transition seal between the filter material and the grout. A sufficient quantity of bentonite or fine sand will be poured to fill the annular space to a level of about 2 feet above the top of the filter pack. If bentonite is to be placed below standing water, a high-solids bentonite grout will be pumped through a tremie pipe, or pellets may be poured through the annulus. If bentonite is to be placed above standing water, a high-solids bentonite grout should be used or pellets may be placed in 6-inch lifts. Unless prohibited by well conditions, each lift should be hydrated using approximately 1 gallon of potable water per lift of pellets. The completed bentonite transition seal will be allowed to hydrate for at least 30 minutes prior to placing the grout. If a layer of fine sand is placed as the transition seal, the fine sand will be mixed with potable water and placed as a slurry through the tremie pipe or poured dry through the annulus. The depth to the top of the transition seal will be verified by measuring, using the tremie pipe or a weighted tape.

A neat cement grout, cement/sand grout, cement/bentonite grout, or high-solids bentonite grout will be placed from the top of the transition seal to the ground surface. The grout seal will be placed by pumping through a tremie pipe lowered to within 5 feet of the top of the transition seal in mud rotary borings. The grout seal will be placed in hollow stem auger borings by free fall through the augers as they are incrementally raised or by pumping through flexible hose or tremie pipe lowered to near the bottom of the zone to be grouted. The grout must be tremied if there is standing water in the augers above the transition seal. Grout/additive/water mixtures will be determined on a site-specific basis. Typical specifications of grout mixtures include: (a) neat cement/bentonite grout, consisting of a mixture of one sack (94 pounds) of Portland Type I/II cement, approximately 2 to 5 percent by weight (of cement) powdered bentonite, and approximately 6 to 8 gallons of water; (b) neat cement grout, consisting of one sack of Portland cement and approximately 5 to 6 gallons of water; and (c) cement/sand grout, consisting of no more than two parts sand to one part cement and approximately 7 gallons of water. Only potable water will be used to prepare the grout. No work will be done on the monitoring well until after the grout has set approximately 24 hours.

2.4 SURFACE COMPLETION

Upon completion of the well, a suitable slip-on cap, threaded end cap, or waterproof cap will be fitted on the top of the riser casing to reduce the potential for entry of surface runoff or foreign matter. Either a steel protective well cover (e.g., stovepipe) or a vault which may have a traffic-rated cover will be completed at the ground surface. All wells will be locked for security and will be designed to limit surface water infiltration.

2.5 DEVELOPMENT OF GROUNDWATER MONITORING OR EXTRACTION WELLS

When the well installation is complete and the grout has cured a minimum of 24 hours, the well will be developed by surging, bailing, and/or pumping, or other appropriate method as specified by the project manager. The objectives of well development are to remove sediment that may have accumulated during well installation, to consolidate the filter pack around the well screen, and to enhance the hydraulic connection between the target zone and the well. In most instances, a bailer will be used to remove sediment and turbid water from the bottom of the well. A surge block may then be used within the entire screened interval to flush the filter pack of fine sediment. Surging will be conducted slowly to reduce disruption to the filter pack and screen. The well will be bailed again to remove sediment drawn in by the surging process until suspended sediment is reduced.

Following bailing and surging, the well may be further developed using air-lift or pumping methods. A bailer may be used for low-yield wells. If possible, the well will be developed at a higher pumping rate than the anticipated rate of future purging. During development, the turbidity of the water will be monitored, and the pH, specific conductance, and temperature of the return water will be measured. Drawdown and recovery will be measured during and at the end of the development process, respectively, using an electric sounder. Well development will proceed until, in the judgment of the Geomatrix field personnel, the return water is of sufficient clarity. If the screened interval is too long to be developed adequately in one stage, multiple stages will be employed, in which the end of the pump intake will be raised or lowered to various depths, as required.

2.6 DOCUMENTATION

A well construction diagram for each well will be completed in the field on the WELL LOG by the field geologist/engineer and submitted to the reviewing geologist or engineer upon completion of each well. Well installation and construction data will be summarized on the DAILY FIELD RECORD or on a specialized form produced for this purpose. Well development notes and field measurements of water quality parameters will be summarized on a WELL SAMPLING AND/OR DEVELOPMENT RECORD. Following review by the project manager, the original records will be kept in the project file.

3.0 CLEANING OF DRILLING EQUIPMENT

Cleaning of the drill rig and associated drilling equipment will follow the procedures discussed in Section 2.0 of the protocol DRILLING AND DESTRUCTION OF SOIL BORINGS.

All well casing materials will be cleaned before they are installed. Well development equipment will be cleaned before use. The following cleaning procedure has been found to be effective and will be used or adapted as appropriate for general conditions of materials or equipment to be cleaned.

1. Steam-rinse with potable water or rinse in deionized or organic-free water.
2. Cover with clean plastic to protect materials and equipment from contact with chemical products, dust, or other contaminants.

Alternatively, well casing materials that have been steam-cleaned and sealed in individual airtight plastic bags by the factory can be used.

Decontamination rinsate will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

4.0 WELL DESTRUCTION

Destruction of wells will be completed in accordance with applicable state and local requirements. If required, permits for destruction will be obtained from the appropriate regulatory agency. As part of destruction design and implementation, care will be taken to seal groundwater pathways between multiple aquifers and to limit surface water infiltration through the destroyed borehole.

If practical, the well casing will be removed from the borehole. If the well casing cannot be removed, the casing should be cut and/or pressure-grouted in accordance with regulating agency requirements. For shallow wells and if the well has been completed in the uppermost aquifer, the casing may be pulled from the borehole before auger entry. Alternatively, and if the well has been completed below the uppermost aquifer, the annular fill may be drilled out with hollow stem augers and the casing removed from the borehole through the augers. If the well casing is PVC or other similar material and cannot be removed as described above, it may be removed by drilling out the casing and annular fill using a tricone or drag bit and a rotary drilling method. The borehole will be redrilled to the same or a slightly larger diameter than the original borehole. The redrilled borehole will be plumb and adequately centered, and all of the well casing will be removed.

The borehole will be filled with a neat cement, cement/sand, cement/bentonite grout, or a high-solids bentonite grout. Before its initial set, the grout will be placed in one continuous pour from the bottom of the boring to the ground surface. The grout will be emplaced by pumping through a tremie pipe or flexible hose which is initially lowered to the bottom of the borehole. The augers should be raised incrementally as emplacement proceeds, but not exceed increments of 20 feet or increments greater than allowed by borehole stability. Boreholes that are terminated above the water table and are not greater than 20 feet deep may be grouted by a continuous pour originating at the ground surface. If the aquifer is confined and the head pressure is great, the grout may need to be placed under pressure.

The volume of sealing material used will be calculated and compared to the casing or borehole volume to ensure that bridging has not occurred during well destruction. If the well is in an urban area and if the casing remains in the borehole, a hole will be excavated around the well to a depth of 5 feet, and the casing will be removed to the bottom of the excavation. The sealing material will be allowed to spill over into the excavation to form a cap. The remainder of the excavation will be backfilled with either native material, grout, or concrete.

Attachments: Daily Field Record
Typical Monitoring Well Construction Diagram
Well Log
Well Sampling and/or Development Record

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

DAILY FIELD RECORD (continued)

GEOMATRIX

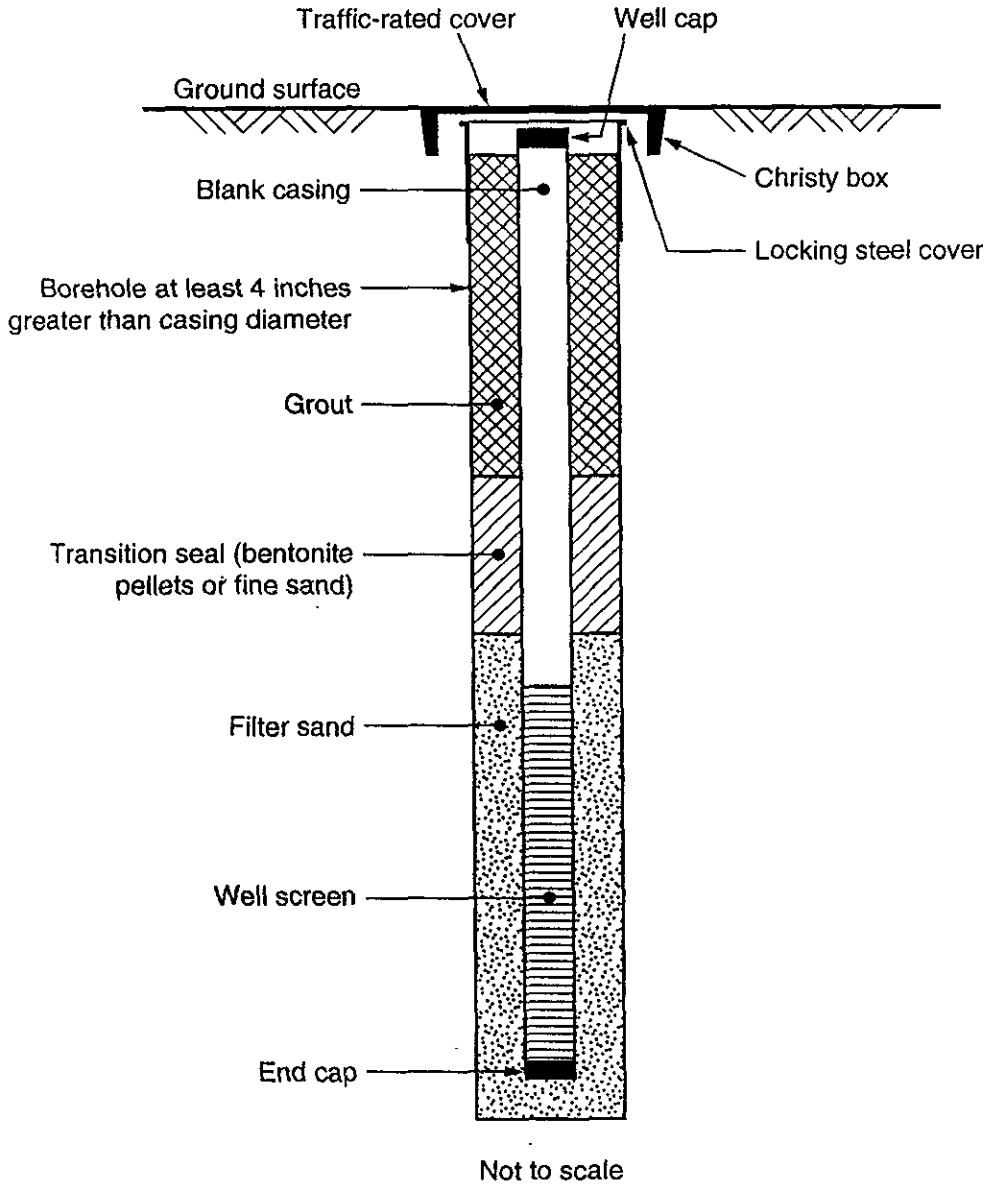
Page _____ of _____

Project and Task Number: ______________________ Date: ______________________

Time	*Description of Work Performed*

Forms(PF) 005 (Revised 12/95)

TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM



PROJECT:	Log of Well No.		
BORING LOCATION:	ELEVATION AND DATUM:		
DRILLING CONTRACTOR:	DATE STARTED:		DATE FINISHED:
DRILLING METHOD:	TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:	DEPTH TO WATER: FIRST	COMPL.	CASING:
SAMPLING METHOD:	LOGGED BY:		
HAMMER WEIGHT: DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

DEPTH (feet)	SAMPLES: Sample No	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react w/HCl geo inter Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-1 (12/95)

Project No.	Geomatrix Consultants	Figure

PROJECT:

Log of Well No.

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION NAME (USCS Symbol): color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

W-2 (12/95)

Project No.	Geomatrix Consultants	Figure

W-2 (Blank)

GEOMATRIX

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: _____ Initial Depth to Water: _____

Sample ID: _____ Duplicate ID: _____ Depth to Water after Sampling: _____

Sample Depth: _____ Total Depth of Well: _____

Project and Task No.: _____ Well Diameter: _____

Project Name: _____ 1 Casing/Borehole Volume = _____ (Circle one)

Date: _____ 4 Casing/Borehole Volumes = _____ (Circle one)

Sampled By: _____ Total Casing/Borehole Volumes Removed: _____

Method of Purging: _____

Method of Sampling: _____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE - CALIBRATION			
KCL Solution (µS/cm = µmhos/cm)			
Temperature °C			
Instrument Reading			

Model or Unit No.:

Notes: _____

PROTOCOL

SAMPLING OF GROUNDWATER MONITORING WELLS AND WATER SUPPLY WELLS

1.0 INTRODUCTION

This protocol describes the procedures to be followed during sampling of groundwater monitoring wells and water supply wells for laboratory chemical analysis. The laboratory must be certified by the appropriate regulating agency for the analyses to be performed.

The procedures presented herein are intended to be of general use and may be supplemented by a work plan and/or health and safety plan. As the work progresses and if warranted, appropriate revisions may be made by the project manager. Detailed procedures in this protocol may be superseded by applicable regulatory requirements.

2.0 SAMPLING

2.1 SAMPLE COLLECTION

A. Monitoring Wells

Methods for purging and sampling monitoring wells with dedicated and non-dedicated equipment are described in this Section. When practical, the purging and sampling technique adopted for a given site will remain consistent from one sampling event to the next.

A.1 Purging Monitoring Wells

A submersible pump, diaphragm pump, positive displacement pump, which may contain a bladder, or a bailer will be used for evacuating (purging) the monitoring well casing. If the well is to be sampled using equipment that must be separately introduced into the well, the purge intake will be located near the top of the water column for removal of at least one casing volume to remove stagnant water above the screened interval in the well

casing; the pump may then be moved to the midscreen interval to complete the purging progress, if required. If a bailer is used to purge the monitoring well, it will be gently lowered into the well to reduce the potential for aeration of water. Purging will progress at a rate intended to minimize differential drawdown between the interior of the well screen and the filter material to limit cascading water along the inside of the well casing. Procedures for purging slowly recharging wells are discussed in Section A.3.

A minimum of four well casing volumes or one saturated borehole volume, whichever is greater, will be removed to purge the well prior to collection of groundwater samples if the well will be purged with non-dedicated equipment. If a low-flow capacity pump is dedicated in the well, the micropurge method described in Section A.4 may be used to reduce the purge volume. If the well goes dry before four casing volumes are removed, the procedure discussed in Section A.3 will be followed. The saturated borehole volume is the volume of water in the well casing plus the volume of water in the filter pack. For a well with a dedicated pump and packer, a casing volume is defined as the volume of water in the well casing below the inflated packer.

Periodic observations of turbidity and measurements of temperature, pH, and specific electrical conductance (SEC) will be made with field equipment during purging to evaluate whether the water samples are representative of the target zone. Samples will be collected when: (1) a minimum of four sets of parameter readings have been taken; and (2) the temperature, pH, and SEC reach relatively constant values, and the turbidity has stabilized.

A.2 Sampling Monitoring Wells

The sampler will wear clean gloves appropriate for the chemicals of concern while collecting the sample. Samples will be collected directly in laboratory-prepared bottles from the sampling device.

Each sampling episode or day should generally begin with the well having the least suspected concentrations of target compounds. Successive wells should generally be sampled in sequence of increasing suspected concentration.

A Teflon® bailer, new disposable bailer, stainless steel positive displacement Teflon® bladder pump with Teflon® tubing, or a clean electric submersible pump with low-flow sampling capacity will be used to collect the water samples for laboratory chemical analysis.

If a bailer is being used to collect the sample, it will be gently lowered into the well below the point where the purge device was located. Samples will collected in the following order: (1) volatile organic compounds; (2) semi-volatile organic compounds; (3) metals; (4) other analytes.

If a bladder pump or electric submersible pump is being used to sample the well for volatile compounds, the flow rate will be adjusted to either 1) approximately 100 milliliters per minute; 2) a rate specifically selected for the well based on groundwater flow rates and well hydraulic conditions; or 3) as low as possible. This rate will be maintained until the discharge line has been purged and the sample collected.

A.3 Purging and Sampling Wells With Slow Recharge

Wells that recharge very slowly may be purged dry once, allowed to recharge, and then sampled as soon as sufficient water is available. In this case, at least two sets of parameter readings of field water quality should be taken, one initially and one after recharge.

A.4 Purging and Sampling Wells Using "Micropurge" Sampling Method

Based on current research, a low-flow-rate, reduced purge method may be used to purge and sample a well with a dedicated pump (Barcelona et al., 1994; Kearl et al., 1994). This method may be used if acceptable to applicable agencies. This method assumes the water within the screened interval is not stagnant, and a small change to the natural flow rate in the screened interval will result in samples with particulates and colloidal material representative of groundwater. The pump should be preset in the screen interval at least 24 hours before the sampling event. A minimum of two pump plus riser pipe volumes should be purged at a flow rate of approximately 100 milliliters per minute or as low as possible based on groundwater flow and well hydraulic conditions. Purging should progress until water quality parameters (pH, SEC, temperature) have reached relatively constant values. Dissolved oxygen readings are recommended, if practical.

B. Water Supply Wells

Water supply wells will be sampled by purging the wells for a period of time adequate to purge the pump riser pipe. Alternatively, if the volume of the riser pipe is unknown, the pressure tank will be drained until the pump cycles on, or the well may be purged until three successive field measurements performed 5 to 10

minutes apart have stabilized. If the well is currently pumping, the sample can be taken without purging the well. Water samples will then be collected from the discharge point nearest the well head. Samples will be collected directly into laboratory-prepared bottles.

C. Extraction Wells

Extraction wells will be sampled while extraction is occurring. Samples will be collected from an in-line sampling port after purging the sampling line. Samples will be collected directly into laboratory-prepared bottles.

A WELL SAMPLING AND/OR DEVELOPMENT RECORD will be used to record the following information:

- Sample I.D.
- Duplicate I.D., if applicable
- Date and time sampled
- Name of sample collector
- Well designation (State well numbering system for water supply wells, and unique sequential number for other wells)
- Owner's name, or other common designation for water supply wells
- Well diameter
- Depth to water on day sampled
- Casing volume on day sampled
- Method of purging (bailing, pumping, etc.)
- Amount of water purged
- Extraordinary circumstances (if any)
- Results of instrument calibration/standardization and field measurements (temperature, pH, specific electrical conductance) and observed relative turbidity
- Depth from which sample was obtained
- Number and type of sample container(s)
- Purging pump intake depth
- Times and volumes corresponding to water quality measurement
- Purge rate

2.2 SAMPLE CONTAINERS AND PRESERVATION

Appropriate pre-cleaned sample containers and preservatives for the analyses to be performed will be obtained from the subcontracted analytical laboratory. Frequently requested analyses and sample handling requirements are listed in Table 1.

2.3 SAMPLE LABELING

Sample containers will be labeled before or immediately after sampling with self-adhesive tags having the following information written in waterproof ink:

- Geomatrix
- Project number
- Sample I.D. number
- Date and time sample was collected
- Initials of sample collector

2.4 QUALITY CONTROL SAMPLES

In order to evaluate the precision and accuracy of analytical data, quality control samples, such as duplicates and blanks, will be periodically prepared. These samples will be collected or prepared and analyzed by the laboratory, as specified in the project Quality Assurance Project Plan (QAPP) or by the project manager.

2.5 HANDLING, STORAGE, AND TRANSPORTATION

Efforts will be made to handle, store, and transport supplies and samples safely. Exposure to dust, direct sunlight, high temperature, adverse weather conditions, and possible contamination will be avoided. Immediately following collection, samples will be placed in a clean chest that contains ice or blue ice (if cooling is required), and will be transported to the subcontracted laboratory as soon as practical, or in accordance with the project QAPP.

3.0 FIELD MEASUREMENTS

Field measurements of temperature, pH, and SEC will be performed on aliquots of groundwater that will not be submitted for laboratory analysis. Field water quality measurements and instrument calibration details will be recorded on the WELL SAMPLING AND/OR DEVELOPMENT RECORD.

3.1 TEMPERATURE MEASUREMENTS

Temperature measurements will be made with a mercury-filled thermometer or an electronic thermistor, and all measurements will be recorded in degrees Celsius.

3.2 pH MEASUREMENT

The pH measurement will be made as soon as possible after collection of the sample, generally within a few minutes. The pH will be measured by immersing the pH probe into an aliquot of groundwater.

The pH meter will be calibrated at the beginning of and once during each sampling day and whenever appropriate, in accordance with the equipment manufacturer's specifications, as outlined in the instruction manual for the specific pH meter used. Two buffers (either pH-4 and pH-7, or pH-7 and pH-10, whichever most closely bracket the anticipated range of groundwater conditions) will be used for instrument calibration.

3.3 SPECIFIC ELECTRICAL CONDUCTANCE MEASUREMENT

SEC will be measured by immersing the conductivity probe into an aliquot of groundwater. The probes used should automatically compensate for the temperature of the sample. Measurements will be reported in units of micro-Siemens (μS) per square centimeter (equivalent to micromhos or μmhos) at 25 degrees Celsius.

The SEC meter will be calibrated at the beginning and once during each sampling day in

accordance with the equipment manufacturer's specifications, as outlined in the instruction manual for the SEC meter used. The SEC meter will be calibrated with the available standardized potassium chloride (KCl) solution that is closest to the SEC expected in groundwater below the site.

4.0 DOCUMENTATION

4.1 FIELD DATA SHEETS

A DAILY FIELD RECORD will be completed for each day of fieldwork. A WELL SAMPLING AND/OR DEVELOPMENT RECORD will be used for each well to record the information collected during water quality sampling. Samples may also be recorded on a SAMPLE CONTROL LOG SHEET or in the DAILY FIELD RECORD as a means of identifying and tracking the samples. Following review by the project manager, the original records will be kept in the project file.

4.2 CHAIN-OF-CUSTODY PROCEDURES

After samples have been collected and labeled, they will be maintained under chain-of-custody procedures. These procedures document the transfer of custody of samples from the field to the laboratory. Each sample sent to the laboratory for analysis will be recorded on a CHAIN-OF-CUSTODY RECORD, which will include instructions to the laboratory for analytical services.

Information contained on the triplicate CHAIN-OF-CUSTODY RECORD will include:

- Project number
- Signature of sampler(s)
- Date and time sampled
- Sample I.D.
- Number of sample containers
- Sample matrix (water)
- Analyses required

- Remarks, including preservatives, special conditions, or specific quality control measures
- Turnaround time and person to receive laboratory report
- Method of shipment to the laboratory
- Release signature of sampler(s), and signatures of all people assuming custody.
- Condition of samples when received by laboratory

Blank spaces on the CHAIN-OF-CUSTODY RECORD will be crossed out between the last sample listed and the signatures at the bottom of the sheet.

The field sampler will sign the CHAIN-OF-CUSTODY RECORD and will record the time and date at the time of transfer to the laboratory or to an intermediate person. A set of signatures is required for each relinquished/reserved transfer, including transfer within Geomatrix. The original imprint of the chain-of-custody record will accompany the sample containers. A duplicate copy will be placed in the project file.

If the samples are to be shipped to the laboratory, the original CHAIN-OF-CUSTODY will be sealed inside a plastic bag within the ice chest, and the chest will be sealed with custody tape which has been signed and dated by the last person listed on the chain-of-custody. U.S. Department of Transportation shipping requirements will be followed and the sample shipping receipt will be retained in the project files as part of the permanent chain-of-custody document. The shipping company (e.g., Federal Express, UPS, DHL) will not sign the chain-of-custody forms as a receivor; instead the laboratory will sign as a receivor when the samples are received.

5.0 EQUIPMENT CLEANING

Bailers, sampling pumps, purge pumps, and other non-dedicated purging or sampling apparatus will be cleaned before and after sampling each well. Factory new and sealed disposable bailers may be used for sampling, but may not be reused. Thermometers, pH

electrodes, and SEC probes that will be used repeatedly will be cleaned before and after sampling each well and at any time during sampling if the object comes in contact with foreign matter.

Purged waters and solutions resulting from cleaning of purging or sampling equipment will be collected and stored properly for future disposal by the client, unless other arrangements have been made.

Cleaning of reusable equipment that is not dedicated to a particular well will consist of the following:

- Bailers - the inside and outside of bailers will be cleaned in a solution of laboratory-grade detergent and potable water, followed by a rinse with deionized (DI) water. They may also be steam-cleaned, followed by a DI water rinse. If samples are to be collected for metals analysis, the Teflon® bailer may be rinsed with a pH2 nitric acid solution followed by a double DI rinse.

- Purge Pumps - All downhole, reusable portions of purge pumps will be steam-cleaned on the outside. If the pump does not have a backflow check valve, the inside of the pump and tubing also should be steam-cleaned. For a purge pump with a backflow check valve, the interior of the pump and tubing may be cleaned by pumping a laboratory-grade detergent and potable water solution through the system followed by a potable water rinse, or by steam-cleaning.

- Water Quality Meters - All meters will be cleaned by rinsing the probe portions in DI water, and allowing to air dry.

- Bailer Tripod - The tripod cable will be steam-cleaned or rinsed with DI water.

Sample bottles and bottle caps will be cleaned by the subcontracted laboratory using standard EPA-approved protocols. Sample bottles and bottle caps will be protected from contact with solvents, dust, or other contamination. Sample bottles will not be reused.

6.0 REFERENCES

Barcelona, M.J., et al., 1994, Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground-Water Sampling: *Groundwater*, January-February.

Kearl, P.M., et al., 1994, Field Comparison of Micropurging vs. Traditional Ground Water Sampling: *Ground Water Monitoring Review*, Fall.

Attachments: Water and Soil Analytical Methods and Sample Handling
Well Sampling and/or Development Record
Daily Field Record
Chain-of-Custody Record
Sample Control Log Sheet

TABLE 1

WATER AND SOIL ANALYTICAL METHODS AND SAMPLE HANDLING

Parameter	Method	Water Containers[1]	Preservation[1]	Maximum Holding Time[1]
Total Petroleum Hydrocarbons: • as diesel • as gasoline	 GCFID (3550)[2] GCFID (5030)[2]	 2 - 1 liter amber glass 2 - 40 ml VOA glass	 cool on ice HCL to pH 2 in water samples: cool on ice	 14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Benzene, Toluene, Xylene, and Ethylbenzene	EPA 8020	2 - 40 ml VOA glass	HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days)
Oil and Grease	5520 E & F (soil)[3] 5520 C & F (water)[3]	2 - 1 liter amber glass	H_2SO_4 to pH <2 in water samples: cool on ice	28 days
Volatile Organics	EPA 8010 EPA 8240[5]	2 - 40 ml VOA glass 2 - 40 ml VOA glass	cool on ice[4] HCL to pH 2 in water samples: cool on ice	14 days (unacidified water, 7 days) 14 days (unacidified water, 7 days)
Semi-volatile Organics	EPA 8270	2 - 1 liter amber glass	cool on ice	7 days for extraction, water 14 days for extraction, soil 40 days for analysis
Polynuclear Aromatic Hydrocarbons	EPA 8310	2 - 40 ml VOA glass	cool on ice	7 days, water 14 days, soil
Metals (dissolved)	EPA 7000 series for specific metal	1 - 500 ml plastic	Water Samples: field filtration (0.45 micron filter) and field acidify to pH 2 with HNO_3 except: Cr^{+6} - cool on ice	6 months, except: Hg - 28 days Cr^{+6} - 24 hours, water; 24 hours after prep, soil

Notes:

1. All soil samples should be collected in full, clean brass liners, capped with aluminum foil or Teflon and plastic caps, and sealed with tape. If soil samples are to be analyzed for metals, they may be placed in laboratory-prepared clean glass jars. Soil should be cooled as indicated under "preservation" and maximum holding times apply to both soil and water unless otherwise noted.
2. For analysis in California, use California DHS recommended procedure as presented in LUFT manual using gas chromatography with a flame ionization detector. In other states, local requirements should be followed.
3. Method to be used in California Regional Water Quality Control Board North Coast and Central Valley Regions. In other areas, local requirements should be followed.
4. If EPA Methods 8010 and 8020 are to be run in sequence, HCL may be added. Check with the project manager before adding acid.
5. Chloroethylvinylether may be detected at concentrations below 50 parts per billion due to degradation of HCL.

References:

U.S. EPA, 1986, Test Methods for Evaluating Solid Waste - Physical/Chemical Methods - SW-846, Third Edition, July, and final amendments.

California State Water Resources Control Board, 1989, Leaking Underground Fuel Tank (LUFT) Field Manual, Tables 3-3 and 3-4, October.

California Regional Water Quality Control Boards, North Coast, San Francisco Bay, and Central Valley Regions, 1990, Regional Board Staff Recommendations for Initial Evaluation and Investigation of Underground Tanks, 10 August.

GEOMATRIX

WELL SAMPLING AND/OR DEVELOPMENT RECORD

Well ID: _____

Sample ID: _____ Duplicate ID: _____

Sample Depth: _____

Project and Task No.: _____

Project Name: _____

Date: _____

Sampled By: _____

Method of Purging: _____

Method of Sampling: _____

Initial Depth to Water: _____

Depth to Water after Sampling: _____

Total Depth of Well: _____

Well Diameter: _____

1 Casing/Borehole Volume = _____
(Circle one)

4 Casing/Borehole Volumes = _____
(Circle one)

Total Casing/Borehole
Volumes Removed: _____

Time	Intake Depth	Rate (gpm)	Cum. Vol. (gal.)	Temp. (°C)	pH (units)	Specific Electrical Conductance (µS/cm)	Remarks (color, turbidity, and sediment)

pH CALIBRATION (choose two)				
Buffer Solution	pH 4.0	pH 7.0	pH 10.0	
Temperature °C				
Instrument Reading				

Model or Unit No.:

SPECIFIC ELECTRICAL CONDUCTANCE – CALIBRATION			
KCL Solution (µS/cm = µmhos/cm)			
Temperature °C			
Instrument Reading			

Model or Unit No.:

Notes: _____

DAILY FIELD RECORD

GEOMATRIX

Project and Task Number:	Date:
Project Name:	Field Activity:
Location:	Weather:
Time of OVM Calibration:	

PERSONNEL: Name	Company	Time In	Time Out

PERSONAL SAFETY CHECKLIST

	Steel-toed Boots		Hard Hat		Tyvek Coveralls
	Rubber Gloves		Safety Goggles		1/2-Face Respirator

DRUM I.D.	DESCRIPTION OF CONTENTS AND QUANTITY	LOCATION

TIME	DESCRIPTION OF WORK PERFORMED

GEOMATRIX

DAILY FIELD RECORD (continued)

Page _____ of _____

Project and Task Number: ______________________ Date: ______________________

Time	Description of Work Performed

CHAIN-OF-CUSTODY RECORD

Nº

Date:

Page of

Project No.:

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel											Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers

ANALYSES

REMARKS

Additional Comments

Turnaround time:

Results to:

Total No. of containers:

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Method of Shipment:		
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	Laboratory Comments and Log No.:		
Company:		Company:		Company:				
Received by (signature):	Date:	Received by (signature):	Date:	Received by (signature):	Date:			
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:			
Company:		Company:		Company:				

GEOMATRIX

Forms(PF).012b (Revised 12/95)

SAMPLE CONTROL LOG

GEOMATRIX

Project Name: _____

Project and Task No.: _____

Laboratory: _____

Page _____ of _____

Sampling Date	Sampling Time	Sample Number (ID)	C.O.C. Number	Analyses Requested	Turnaround Time, Sample Location, Handling Notes, Chain-of-Custody Remarks, et. (Duplicate, blank info, etc.)	Date Sent to Lab	Date Results Due

Forms(PF).006 (Revised 12/95)

GEOMATRIX

APPENDIX E

LITHOLOGIC LOGS AND WELL CONSTRUCTION DETAILS

PROJECT: RIX PROPERTY
6460 Hollis Street
Emeryville, California

Log of Boring No. GGW1

BORING LOCATION: Hollis Street (Approximately 80 feet north of Ocean Ave.)

ELEVATION AND DATUM: Not surveyed

DRILLING CONTRACTOR: Gregg Drilling, Inc.

DATE STARTED: 4/22/98 | DATE FINISHED: 4/22/98

DRILLING METHOD: Direct push

TOTAL DEPTH: 12.0 feet bgs | MEASURING POINT: Ground surface

DRILLING EQUIPMENT: Geoprobe 5400

DEPTH TO WATER: FIRST 10.0 feet bgs | COMPL. ---

SAMPLING METHOD: Macro-core system 1 3/4-inch

LOGGED BY: Preston Gaines

HAMMER WEIGHT: --- | DROP: ---

RESPONSIBLE PROFESSIONAL: C. Crocker | REG. NO. RG 6114

DEPTH (feet)	SAMPLES: Sample No	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION (NAME (USCS Symbol), color, moist, % by weight, plast, consistency, structure, cementation, react w/HCl geo. inter)	REMARKS
					Surface Elevation:	
0					4 inches asphalt	
1	GGW1-10				SILTY SAND (SM) Dark brown (7.5YR 3/2), dry, 55% fine to medium sand, 25% low plasticity fines, 20% coarse subangular gravel	
2					LEAN CLAY (CL) Black (Gley 1 2.5/N), moist, 90% fines, 10% fine sand, medium to high plasticity, firm	
3					Soft	
4					Color change to dark greenish gray (2Gley 10G 4/1), hard	
5						
6					SANDY LEAN CLAY with GRAVEL (CL) Dark greenish gray (2Gley 10G 4/1), wet, 50% medium plasticity fines, 30% coarse sand, 20% fine subangular gravel, soft	
7					CLAYEY SAND (SC) Dark greenish gray (2Gley 10G 4/1), wet, 55% coarse sand, 35% medium plasticity fines, 10% fine gravel	
8						
9					FAT CLAY (CH) Yellowish brown (10YR 5/4), wet, 90% fines, 10% fine sand, medium plasticity, soft	
10					Color change to dark gray (Gley1 4/N), firm	
11						
12					Bottom of boring at 12.0 feet bgs.	
13						
14						
15						

B-1 (12/95)

Project No. 4710.01 | Geomatrix Consultants | Figure ---

s:\4710.01\logs\ GGW 01.ai

PROJECT. RIX PROPERTY
6460 Hollis Street
Emeryville, California

Log of Boring No. GGW2

BORING LOCATION: Corner of Hollis Street and Ocean Avenue

ELEVATION AND DATUM: Not surveyed

DRILLING CONTRACTOR. Gregg Drilling, Inc.

DATE STARTED: 4/22/98 | DATE FINISHED: 4/22/98

DRILLING METHOD. Direct push

TOTAL DEPTH: 12.0 feet bgs | MEASURING POINT: Asphalt road surface

DRILLING EQUIPMENT: Geoprobe 5400

DEPTH TO WATER: FIRST 9.5 feet bgs | COMPL. ---

SAMPLING METHOD: Macro-core system 1 3/4-inch

LOGGED BY: Preston Gaines

HAMMER WEIGHT: --- | DROP: ---

RESPONSIBLE PROFESSIONAL: C. Crocker | REG. NO. RG 6114

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/ Foot	OVM Reading (ppm)	DESCRIPTION (NAME (USCS Symbol) color, moist, % by weight, plast, consistency, structure, cementation, react. w/HCl geo inter.)	REMARKS
					Surface Elevation:	
					4 inches asphalt pavement	
1					SILTY SAND with GRAVEL (SM) Dark brown (7.5YR 3/2), dry, 55% fine to medium sand, 25% low plasticity fines, 20% fine subangular to subrounded gravel	
2	GGW2-20				LEAN CLAY (CL) Very dark gray (7.5YR 3/1), moist, 95% fines, 5% fine sand, medium plasticity	
3					Clayey sand (SC)	
4					Color change to dark greenish gray (2Gley 10G 4/1), firm	
5					SANDY LEAN CLAY with GRAVEL (CL) Brown (7.5YR 4/2), moist, 50% fines, 35% fine to medium sand, 15% fine subrounded gravel, medium plasticity, firm	
6					Color change to dark greenish gray (10GY 4/1)	
7					Hard	
8					FAT CLAY (CH) Yellowish brown (10YR 5/4), moist, 100% fines, high plasticity, firm	
9					Trace fine gravel	
10					CLAYEY SAND (SC) Brown (7.5YR 4/2), wet, 60% fine sand, 40% medium plasticity fines	
11					FAT CLAY (CH) Very dark gray (Gley1 3/N), wet, 100% fines, high plasticity, firm	
12					Bottom of boring at 12.0 feet bgs.	
13						
14						
15						

B-1 (12/95)

Project No. 4710 01 | Geomatrix Consultants | Figure ---

s \4710 01\logs\ GGW 02 a

PROJECT: RIX PROPERTY
6460 Hollis Street
Emeryville, California

Log of Boring No. GGW3

BORING LOCATION: Behind building - low depression area	ELEVATION AND DATUM: Not surveyed	
DRILLING CONTRACTOR: Gregg Drilling, Inc.	DATE STARTED: 4/22/98	DATE FINISHED: 4/22/98
DRILLING METHOD: Hand auger (only)	TOTAL DEPTH: 5.0 feet bgs	MEASURING POINT: Ground surface
DRILLING EQUIPMENT: Hand auger (only)	DEPTH TO WATER: FIRST 2.9 feet bgs	COMPL. ~2.5 feet bgs
SAMPLING METHOD: Drive sampler (soil)	LOGGED BY: Preston Gaines	
HAMMER WEIGHT: --- DROP: ---	RESPONSIBLE PROFESSIONAL: C. Crocker	REG. NO. RG 6114

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION (NAME (USCS Symbol) color, moist, % by weight, plast., consistency, structure, cementation, react w/HCl, geo inter.)	REMARKS
					Surface Elevation:	
1					SILTY GRAVEL with SAND (GM) Dark brown (7.5YR 3/2), dry, 50% fine to coarse gravel, 30% low plasticity fines, 20% medium to coarse sand	
2	GGW3-1 5				LEAN CLAY with SAND (CL) Dark reddish gray (2.5YR 3/1), moist, 85% fines, 15% fine to medium sand, medium plasticity, soft	
3					Wet	
4					SILTY SAND with GRAVEL (SM) Very dark gray (7.5YR 3/1), wet, 50% medium to coarse sand, 30% low plasticity fines, 20% fine to coarse gravel	
5					SILT with SAND (ML) Black (7.5YR 2.5/1), wet, 85% fines, 15% fine to medium sand, low plasticity, very soft	
6					Bottom of boring at 5.0 feet bgs.	
7						
8						
9						
10						
11						
12						
13						
14						
15						

B-1 (12/95)

PROJECT: RIX PROPERTY
6460 Hollis Street
Emeryville, California

Log of Boring No. GGW4

BORING LOCATION: Concrete slab area behind building	ELEVATION AND DATUM: Not surveyed	
DRILLING CONTRACTOR: Gregg Drilling, Inc.	DATE STARTED: 4/22/98	DATE FINISHED: 4/22/98
DRILLING METHOD: Hand auger	TOTAL DEPTH: 6.0 feet bgs	MEASURING POINT: Top of slab
DRILLING EQUIPMENT: Hand auger	DEPTH TO WATER: FIRST 4.0 feet bgs	COMPL. 3.0 feet bgs
SAMPLING METHOD: Drive sampler and large 2-in. diam. disposable bailer	LOGGED BY: Preston Gaines	
HAMMER WEIGHT: --- DROP: ---	RESPONSIBLE PROFESSIONAL: C. Crocker	REG. NO. RG 6114

DEPTH (feet)	SAMPLES: Sample No.	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION (NAME (USCS Symbol) color, moist, % by weight, plast., consistency, structure, cementation, react. w/HCl geo inter)	REMARKS
					Surface Elevation:	
					8-inch concrete slab	
1					SANDY LEAN CLAY with GRAVEL (CL) Dark brown (7.5YR 5/4), moist, 50% fines, 30% fine to medium sand, 20% fine to coarse gravel, medium plasticity	
2	GGW4 1 5				LEAN CLAY with GRAVEL (CL) Yellowish brown (10YR 5/4) with very dark gray (7.5YR 3/1) mottling, moist, 75% fines, 15% fine gravel, 10% fine sand, trace wood fragments, medium plasticity	
3						
4					Fine to medium sand to 15%, increasing fine to coarse gravel to 5%, wet	
5					Color change to bluish gray (Gley2 6/1)	
6					Color change to black (1Gley 2.5/N)	
7					Bottom of boring at 6.0 feet bgs.	
8						
9						
10						
11						
12						
13						
14						
15						

Project No. 4710 01	Geomatrix Consultants	Figure ---

PROJECT: RIX PROPERTY
6460 Hollis Street
Emeryville, California

Log of Well No. MW-4

BORING LOCATION: Hollis Street (north end of building)

ELEVATION AND DATUM: Ground surface of Hollis Street

DRILLING CONTRACTOR: Gregg Drilling, Inc.

DATE STARTED: 4/22/98 | DATE FINISHED: 4/22/98

DRILLING METHOD: 8 1/4-inch hollow stem auger

TOTAL DEPTH: 13.0 feet | SCREEN INTERVAL: 3.0-13.0 feet

DRILLING EQUIPMENT: Simco limited access rig (2400)

DEPTH TO WATER: FIRST 11.0 feet | COMPL. --- | CASING: 2-inch ?????

SAMPLING METHOD: Direct push, Geoprobe 54

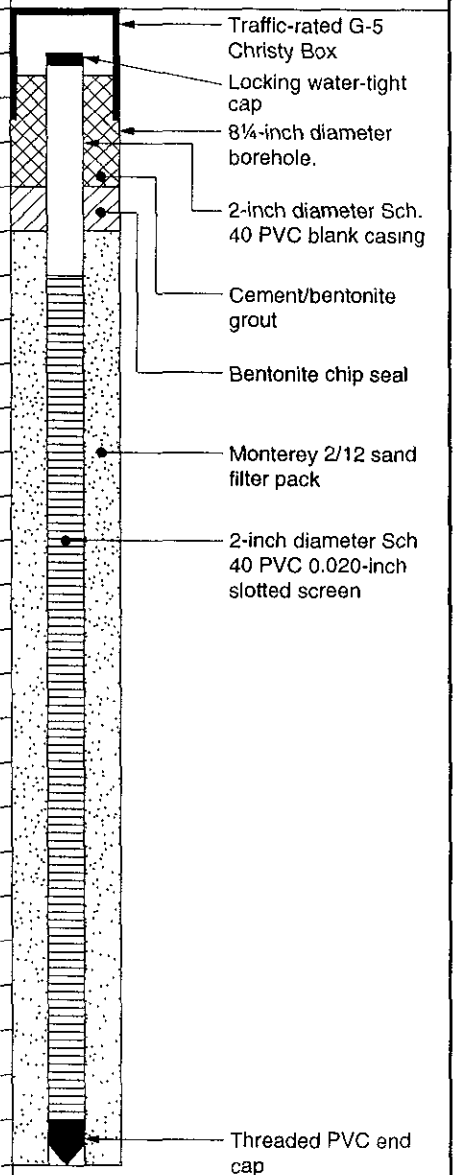
LOGGED BY: C. Crocker

HAMMER WEIGHT: --- | DROP: ---

RESPONSIBLE PROFESSIONAL: C. Crocker | REG. NO. RG 6114

DEPTH (feet)	SAMPLES: Sample No	SAMPLES: Sample	SAMPLES: Blows/Foot	OVM Reading (ppm)	DESCRIPTION (NAME (USCS Symbol), color, moist, % by weight., plast., consistency, structure, cementation, react. w/HCl, geo inter.)
					Surface Elevation.
					Asphalt
1					WELL-GRADED SAND with SILT (SW-SM) Strong brown (7.5YR 5/6), moist, 90% fine to coarse sand, 10% low plasticity fines, loose
2					Large cobble
3					LEAN CLAY with SAND (CL) Greenish gray (Gley 5/5GY), moist, 80% fines, 20% fine to medium sand, trace gravel, medium plasticity, firm
4					Increased clay content, medium plasticity
5					
6					Zone with up to 30% fine to coarse sand
7					LEAN CLAY (CL) Greenish gray (Gley 5/5GY), moist, 90-95% fines, 5-10% fine to medium sand, medium plasticity, firm
8					
9					
10					Zone with up to 50% angular gravel
11					SANDY LEAN CLAY (CL) Greenish gray (Gley 5/5GY), wet, 65-70% fines, 30-35% fine to coarse sand, trace gravel, low plasticity, soft
12					Zone of clayey sand
13					LEAN CLAY (CL) Mottled greenish gray (Gley 5/5GY) and light olive brown (2.5Y 5/3), 95% fines, 5% fine to coarse sand, trace white angular gravel, medium plasticity, hard
14					
15					Bottom of boring at 13 feet bgs.

WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS



W-1 (12/95)

Project No. 4710.01 | Geomatrix Consultants | Figure ---

s:\4710 01\logs\ MW 04 a

GEOMATRIX

APPENDIX F

LABORATORY ANALYTICAL DATA SHEETS

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

GEOMATRIX CONSULTANTS
100 PINE ST., SUITE 1000
SAN FRANCISCO, CA 94111

ATTN: JENNIFER PATTERSON
CLIENT PROJ. ID: 4710

C.O.C. NUMBER: 4217

REPORT DATE: 06/02/98

DATE(S) SAMPLED: 04/22/98

DATE RECEIVED: 04/22/98

AEN WORK ORDER: 9804229

PROJECT SUMMARY:

On April 22, 1998, this laboratory received 10 soil sample(s).

Client requested 6 sample(s) be composited into 3 and analyzed with 4 discreet sample(s) for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Reviewed by:

William Sorbola

GEOMATRIX CONSULTANTS

SAMPLE ID: S-03
AEN LAB NO: 9804229-05
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
EPA 8260A - Soil	EPA 8260A				
Benzene	71-43-2	ND	30	ug/Kg	05/03/98
Bromobenzene	108-86-1	ND	30	ug/Kg	05/03/98
Bromochloromethane	74-97-5	ND	30	ug/Kg	05/03/98
Bromodichloromethane	75-27-4	ND	50	ug/Kg	05/03/98
Bromoform	75-25-2	ND	30	ug/Kg	05/03/98
Bromomethane	74-83-9	ND	50	ug/Kg	05/03/98
n-Butylbenzene	104-51-8	ND	30	ug/Kg	05/03/98
sec-Butylbenzene	135-98-8	30 *	30	ug/Kg	05/03/98
tert-Butylbenzene	98-06-6	ND	30	ug/Kg	05/03/98
Carbon Tetrachloride	56-23-5	ND	30	ug/Kg	05/03/98
Chlorobenzene	108-90-7	ND	30	ug/Kg	05/03/98
Chloroethane	75-00-3	ND	50	ug/Kg	05/03/98
Chloroform	67-66-3	ND	30	ug/Kg	05/03/98
Chloromethane	74-87-3	ND	50	ug/Kg	05/03/98
2-Chlorotoluene	95-49-8	ND	30	ug/Kg	05/03/98
4-Chlorotoluene	106-43-4	ND	30	ug/Kg	05/03/98
Dibromochloromethane	124-48-1	ND	30	ug/Kg	05/03/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	100	ug/Kg	05/03/98
1,2-Dibromoethane	106-93-4	ND	30	ug/Kg	05/03/98
Dibromomethane	74-95-3	ND	30	ug/Kg	05/03/98
1,2-Dichlorobenzene	95-50-1	ND	30	ug/Kg	05/03/98
1,3-Dichlorobenzene	541-73-1	ND	30	ug/Kg	05/03/98
1,4-Dichlorobenzene	106-46-7	ND	30	ug/Kg	05/03/98
Dichlorodifluoromethane	75-71-8	ND	50	ug/Kg	05/03/98
1,1-Dichloroethane	75-34-3	ND	30	ug/Kg	05/03/98
1,2-Dichloroethane	107-06-2	ND	30	ug/Kg	05/03/98
1,1-Dichloroethene	75-35-4	ND	30	ug/Kg	05/03/98
cis-1,2-Dichloroethene	156-59-2	ND	30	ug/Kg	05/03/98
trans-1,2-Dichloroethene	156-60-5	ND	30	ug/Kg	05/03/98
1,2-Dichloropropane	78-87-5	ND	30	ug/Kg	05/03/98
1,3-Dichloropropane	142-28-9	ND	30	ug/Kg	05/03/98
2,2-Dichloropropane	594-20-7	ND	30	ug/Kg	05/03/98
1,1-Dichloropropene	563-58-6	ND	30	ug/Kg	05/03/98
Ethylbenzene	100-41-4	30 *	30	ug/Kg	05/03/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-03
AEN LAB NO: 9804229-05
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Hexachlorobutadiene	87-68-3	ND	30	ug/Kg	05/03/98
Isopropylbenzene	98-82-8	ND	30	ug/Kg	05/03/98
p-Isopropyltoluene	99-87-6	30 *	30	ug/Kg	05/03/98
Methylene Chloride	75-09-2	ND	50	ug/Kg	05/03/98
Naphthalene	91-20-3	160 *	30	ug/Kg	05/03/98
n-Propylbenzene	103-65-1	40 *	30	ug/Kg	05/03/98
Styrene	100-42-5	ND	30	ug/Kg	05/03/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	30	ug/Kg	05/03/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	30	ug/Kg	05/03/98
Tetrachloroethene	127-18-4	ND	30	ug/Kg	05/03/98
Toluene	108-88-3	ND	30	ug/Kg	05/03/98
1,2,3-Trichlorobenzene	87-61-6	ND	30	ug/Kg	05/03/98
1,2,4-Trichlorobenzene	120-82-1	ND	30	ug/Kg	05/03/98
1,1,1-Trichloroethane	71-55-6	ND	30	ug/Kg	05/03/98
1,1,2-Trichloroethane	79-00-5	ND	30	ug/Kg	05/03/98
Trichloroethene	79-01-6	ND	30	ug/Kg	05/03/98
Trichlorofluoromethane	75-69-4	ND	30	ug/Kg	05/03/98
1,2,3-Trichloropropane	96-18-4	ND	30	ug/Kg	05/03/98
1,2,4-Trimethylbenzene	95-63-6	240 *	30	ug/Kg	05/03/98
1,3,5-Trimethylbenzene	108-67-8	53 *	30	ug/Kg	05/03/98
Vinyl Chloride	75-01-4	ND	50	ug/Kg	05/03/98
Xylenes, Total	1330-20-7	180 *	50	ug/Kg	05/03/98
Acetone	67-64-1	ND	500	ug/Kg	05/03/98
2-Butanone	78-93-3	ND	500	ug/Kg	05/03/98
Carbon Disulfide	75-15-0	ND	50	ug/Kg	05/03/98
cis-1,3-Dichloropropene	10061-01-5	ND	30	ug/Kg	05/03/98
trans-1,3-Dichloropropene	10061-02-6	ND	30	ug/Kg	05/03/98
2-Hexanone	591-78-6	ND	300	ug/Kg	05/03/98
4-Methyl-2-pentanone	108-10-1	ND	300	ug/Kg	05/03/98
Vinyl Acetate	108-05-4	ND	300	ug/Kg	05/03/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	50	ug/Kg	05/03/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	190 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	7 *	1	mg/kg	05/01/98
Chromium	EPA 6010	32 *	2	mg/kg	05/01/98
Copper	EPA 6010	12 *	2	mg/kg	05/01/98
Mercury	EPA 7471	ND	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	19 *	2	mg/kg	05/01/98
Lead	EPA 6010	7 *	4	mg/kg	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-03
AEN LAB NO: 9804229-05
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	35 *	2	mg/kg	05/01/98
Zinc	EPA 6010	23 *	5	mg/kg	05/01/98

Reporting limits elevated for EPA 8260 due to high levels of target compounds. Sample run at dilution.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-05
AEN LAB NO: 9804229-06
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
EPA 8260A - Soil	EPA 8260A				
Benzene	71-43-2	ND	3000	ug/Kg	05/03/98
Bromobenzene	108-86-1	ND	3000	ug/Kg	05/03/98
Bromochloromethane	74-97-5	ND	3000	ug/Kg	05/03/98
Bromodichloromethane	75-27-4	ND	5000	ug/Kg	05/03/98
Bromoform	75-25-2	ND	3000	ug/Kg	05/03/98
Bromomethane	74-83-9	ND	5000	ug/Kg	05/03/98
n-Butylbenzene	104-51-8	6,500 *	3000	ug/Kg	05/03/98
sec-Butylbenzene	135-98-8	6,000 *	3000	ug/Kg	05/03/98
tert-Butylbenzene	98-06-6	ND	3000	ug/Kg	05/03/98
Carbon Tetrachloride	56-23-5	ND	3000	ug/Kg	05/03/98
Chlorobenzene	108-90-7	ND	3000	ug/Kg	05/03/98
Chloroethane	75-00-3	ND	5000	ug/Kg	05/03/98
Chloroform	67-66-3	ND	3000	ug/Kg	05/03/98
Chloromethane	74-87-3	ND	5000	ug/Kg	05/03/98
2-Chlorotoluene	95-49-8	ND	3000	ug/Kg	05/03/98
4-Chlorotoluene	106-43-4	ND	3000	ug/Kg	05/03/98
Dibromochloromethane	124-48-1	ND	3000	ug/Kg	05/03/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	10000	ug/Kg	05/03/98
1,2-Dibromoethane	106-93-4	ND	3000	ug/Kg	05/03/98
Dibromomethane	74-95-3	ND	3000	ug/Kg	05/03/98
1,2-Dichlorobenzene	95-50-1	ND	3000	ug/Kg	05/03/98
1,3-Dichlorobenzene	541-73-1	ND	3000	ug/Kg	05/03/98
1,4-Dichlorobenzene	106-46-7	ND	3000	ug/Kg	05/03/98
Dichlorodifluoromethane	75-71-8	ND	5000	ug/Kg	05/03/98
1,1-Dichloroethane	75-34-3	ND	3000	ug/Kg	05/03/98
1,2-Dichloroethane	107-06-2	ND	3000	ug/Kg	05/03/98
1,1-Dichloroethene	75-35-4	ND	3000	ug/Kg	05/03/98
cis-1,2-Dichloroethene	156-59-2	ND	3000	ug/Kg	05/03/98
trans-1,2-Dichloroethene	156-60-5	ND	3000	ug/Kg	05/03/98
1,2-Dichloropropane	78-87-5	ND	3000	ug/Kg	05/03/98
1,3-Dichloropropane	142-28-9	ND	3000	ug/Kg	05/03/98
2,2-Dichloropropane	594-20-7	ND	3000	ug/Kg	05/03/98
1,1-Dichloropropene	563-58-6	ND	3000	ug/Kg	05/03/98
Ethylbenzene	100-41-4	ND	3000	ug/Kg	05/03/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-05
AEN LAB NO: 9804229-06
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Hexachlorobutadiene	87-68-3	ND	3000	ug/Kg	05/03/98
Isopropylbenzene	98-82-8	4,000 *	3000	ug/Kg	05/03/98
p-Isopropyltoluene	99-87-6	ND	3000	ug/Kg	05/03/98
Methylene Chloride	75-09-2	ND	5000	ug/Kg	05/03/98
Naphthalene	91-20-3	5,100 *	3000	ug/Kg	05/03/98
n-Propylbenzene	103-65-1	5,900 *	3000	ug/Kg	05/03/98
Styrene	100-42-5	ND	3000	ug/Kg	05/03/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	3000	ug/Kg	05/03/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	3000	ug/Kg	05/03/98
Tetrachloroethene	127-18-4	ND	3000	ug/Kg	05/03/98
Toluene	108-88-3	ND	3000	ug/Kg	05/03/98
1,2,3-Trichlorobenzene	87-61-6	ND	3000	ug/Kg	05/03/98
1,2,4-Trichlorobenzene	120-82-1	ND	3000	ug/Kg	05/03/98
1,1,1-Trichloroethane	71-55-6	ND	3000	ug/Kg	05/03/98
1,1,2-Trichloroethane	79-00-5	ND	3000	ug/Kg	05/03/98
Trichloroethene	79-01-6	ND	3000	ug/Kg	05/03/98
Trichlorofluoromethane	75-69-4	ND	3000	ug/Kg	05/03/98
1,2,3-Trichloropropane	96-18-4	ND	3000	ug/Kg	05/03/98
1,2,4-Trimethylbenzene	95-63-6	ND	3000	ug/Kg	05/03/98
1,3,5-Trimethylbenzene	108-67-8	ND	3000	ug/Kg	05/03/98
Vinyl Chloride	75-01-4	ND	5000	ug/Kg	05/03/98
Xylenes, Total	1330-20-7	ND	5000	ug/Kg	05/03/98
Acetone	67-64-1	ND	50000	ug/Kg	05/03/98
2-Butanone	78-93-3	ND	50000	ug/Kg	05/03/98
Carbon Disulfide	75-15-0	ND	5000	ug/Kg	05/03/98
cis-1,3-Dichloropropene	10061-01-5	ND	3000	ug/Kg	05/03/98
trans-1,3-Dichloropropene	10061-02-6	ND	3000	ug/Kg	05/03/98
2-Hexanone	591-78-6	ND	30000	ug/Kg	05/03/98
4-Methyl-2-pentanone	108-10-1	ND	30000	ug/Kg	05/03/98
Vinyl Acetate	108-05-4	ND	30000	ug/Kg	05/03/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	5000	ug/Kg	05/03/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	140 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	0.6 *	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	13 *	1	mg/kg	05/01/98
Chromium	EPA 6010	68 *	2	mg/kg	05/01/98
Copper	EPA 6010	20 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.09 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	79 *	2	mg/kg	05/01/98
Lead	EPA 6010	45 *	4	mg/kg	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-05
AEN LAB NO: 9804229-06
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	40 *	2	mg/kg	05/01/98
Zinc	EPA 6010	77 *	5	mg/kg	05/01/98

Reporting limits elevated for EPA 8260 due to high levels of non-target compounds. Sample run at dilution.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-04
AEN LAB NO: 9804229-07
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
EPA 8260A - Soil	EPA 8260A				
Benzene	71-43-2	ND	300	ug/Kg	05/03/98
Bromobenzene	108-86-1	ND	300	ug/Kg	05/03/98
Bromochloromethane	74-97-5	ND	300	ug/Kg	05/03/98
Bromodichloromethane	75-27-4	ND	500	ug/Kg	05/03/98
Bromoform	75-25-2	ND	300	ug/Kg	05/03/98
Bromomethane	74-83-9	ND	500	ug/Kg	05/03/98
n-Butylbenzene	104-51-8	ND	300	ug/Kg	05/03/98
sec-Butylbenzene	135-98-8	ND	300	ug/Kg	05/03/98
tert-Butylbenzene	98-06-6	ND	300	ug/Kg	05/03/98
Carbon Tetrachloride	56-23-5	ND	300	ug/Kg	05/03/98
Chlorobenzene	108-90-7	ND	300	ug/Kg	05/03/98
Chloroethane	75-00-3	ND	500	ug/Kg	05/03/98
Chloroform	67-66-3	ND	300	ug/Kg	05/03/98
Chloromethane	74-87-3	ND	500	ug/Kg	05/03/98
2-Chlorotoluene	95-49-8	ND	300	ug/Kg	05/03/98
4-Chlorotoluene	106-43-4	ND	300	ug/Kg	05/03/98
Dibromochloromethane	124-48-1	ND	300	ug/Kg	05/03/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	1000	ug/Kg	05/03/98
1,2-Dibromoethane	106-93-4	ND	300	ug/Kg	05/03/98
Dibromomethane	74-95-3	ND	300	ug/Kg	05/03/98
1,2-Dichlorobenzene	95-50-1	ND	300	ug/Kg	05/03/98
1,3-Dichlorobenzene	541-73-1	ND	300	ug/Kg	05/03/98
1,4-Dichlorobenzene	106-46-7	ND	300	ug/Kg	05/03/98
Dichlorodifluoromethane	75-71-8	ND	500	ug/Kg	05/03/98
1,1-Dichloroethane	75-34-3	ND	300	ug/Kg	05/03/98
1,2-Dichloroethane	107-06-2	ND	300	ug/Kg	05/03/98
1,1-Dichloroethene	75-35-4	ND	300	ug/Kg	05/03/98
cis-1,2-Dichloroethene	156-59-2	ND	300	ug/Kg	05/03/98
trans-1,2-Dichloroethene	156-60-5	ND	300	ug/Kg	05/03/98
1,2-Dichloropropane	78-87-5	ND	300	ug/Kg	05/03/98
1,3-Dichloropropane	142-28-9	ND	300	ug/Kg	05/03/98
2,2-Dichloropropane	594-20-7	ND	300	ug/Kg	05/03/98
1,1-Dichloropropene	563-58-6	ND	300	ug/Kg	05/03/98
Ethylbenzene	100-41-4	ND	300	ug/Kg	05/03/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-04
AEN LAB NO: 9804229-07
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Hexachlorobutadiene	87-68-3	ND	300	ug/Kg	05/03/98
Isopropylbenzene	98-82-8	ND	300	ug/Kg	05/03/98
p-Isopropyltoluene	99-87-6	300 *	300	ug/Kg	05/03/98
Methylene Chloride	75-09-2	ND	500	ug/Kg	05/03/98
Naphthalene	91-20-3	ND	300	ug/Kg	05/03/98
n-Propylbenzene	103-65-1	300 *	300	ug/Kg	05/03/98
Styrene	100-42-5	ND	300	ug/Kg	05/03/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	300	ug/Kg	05/03/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	300	ug/Kg	05/03/98
Tetrachloroethene	127-18-4	ND	300	ug/Kg	05/03/98
Toluene	108-88-3	ND	300	ug/Kg	05/03/98
1,2,3-Trichlorobenzene	87-61-6	ND	300	ug/Kg	05/03/98
1,2,4-Trichlorobenzene	120-82-1	ND	300	ug/Kg	05/03/98
1,1,1-Trichloroethane	71-55-6	ND	300	ug/Kg	05/03/98
1,1,2-Trichloroethane	79-00-5	ND	300	ug/Kg	05/03/98
Trichloroethene	79-01-6	ND	300	ug/Kg	05/03/98
Trichlorofluoromethane	75-69-4	ND	300	ug/Kg	05/03/98
1,2,3-Trichloropropane	96-18-4	ND	300	ug/Kg	05/03/98
1,2,4-Trimethylbenzene	95-63-6	1,900 *	300	ug/Kg	05/03/98
1,3,5-Trimethylbenzene	108-67-8	1,400 *	300	ug/Kg	05/03/98
Vinyl Chloride	75-01-4	ND	500	ug/Kg	05/03/98
Xylenes, Total	1330-20-7	1,100 *	500	ug/Kg	05/03/98
Acetone	67-64-1	ND	5000	ug/Kg	05/03/98
2-Butanone	78-93-3	ND	5000	ug/Kg	05/03/98
Carbon Disulfide	75-15-0	ND	500	ug/Kg	05/03/98
cis-1,3-Dichloropropene	10061-01-5	ND	300	ug/Kg	05/03/98
trans-1,3-Dichloropropene	10061-02-6	ND	300	ug/Kg	05/03/98
2-Hexanone	591-78-6	ND	3000	ug/Kg	05/03/98
4-Methyl-2-pentanone	108-10-1	ND	3000	ug/Kg	05/03/98
Vinyl Acetate	108-05-4	ND	3000	ug/Kg	05/03/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	500	ug/Kg	05/03/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	160 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	0.6 *	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	8 *	1	mg/kg	05/01/98
Chromium	EPA 6010	120 *	2	mg/kg	05/01/98
Copper	EPA 6010	40 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.51 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	3 *	2	mg/kg	05/01/98
Nickel	EPA 6010	37 *	2	mg/kg	05/01/98
Lead	EPA 6010	60 *	4	mg/kg	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: S-04
AEN LAB NO: 9804229-07
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	42 *	2	mg/kg	05/01/98
Zinc	EPA 6010	140 *	5	mg/kg	05/01/98

Reporting limits elevated for EPA 8260 due to high levels of target compounds. Sample run at dilution.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-06
AEN LAB NO: 9804229-08
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	1,800 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	1.5 *	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	10 *	1	mg/kg	05/01/98
Chromium	EPA 6010	37 *	2	mg/kg	05/01/98
Copper	EPA 6010	53 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.32 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	26 *	2	mg/kg	05/01/98
Lead	EPA 6010	240 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	36 *	2	mg/kg	05/01/98
Zinc	EPA 6010	630 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-07,08 (COMP)
AEN LAB NO: 9804229-11
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#CA Waste Extraction	CA Title 22	-		Extrn Date	05/15/98
Lead in WET Extract	EPA 7420	15 *	0.1	mg/L	05/18/98
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	11 *	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	560 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	1.8 *	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	10 *	1	mg/kg	05/01/98
Chromium	EPA 6010	38 *	2	mg/kg	05/01/98
Copper	EPA 6010	41 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.24 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	41 *	2	mg/kg	05/01/98
Lead	EPA 6010	430 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	27 *	2	mg/kg	05/01/98
Zinc	EPA 6010	720 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-01,02 (COMP)
AEN LAB NO: 9804229-12
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT		REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, for Furnace	EPA 3050	-			Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-			Prep Date	04/30/98
Arsenic	EPA 6010	ND		10	mg/kg	05/08/98
Selenium	EPA 6010	ND		20	mg/kg	05/08/98
CCR 17 Metals						
Silver	EPA 6010	ND		0.5	mg/kg	05/01/98
Barium	EPA 6010	300	*	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND		0.5	mg/kg	05/01/98
Cadmium	EPA 6010	ND		0.5	mg/kg	05/01/98
Cobalt	EPA 6010	8	*	1	mg/kg	05/01/98
Chromium	EPA 6010	33	*	2	mg/kg	05/01/98
Copper	EPA 6010	33	*	2	mg/kg	05/01/98
Mercury	EPA 7471	0.07	*	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND		2	mg/kg	05/01/98
Nickel	EPA 6010	28	*	2	mg/kg	05/01/98
Lead	EPA 6010	84	*	4	mg/kg	05/01/98
Antimony	EPA 6010	ND		5	mg/kg	06/08/98
Thallium	EPA 6010	ND		50	mg/kg	05/01/98
Vanadium	EPA 6010	30	*	2	mg/kg	05/01/98
Zinc	EPA 6010	150	*	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: S-09,10 (COMP)
AEN LAB NO: 9804229-13
AEN WORK ORDER: 9804229
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#CA Waste Extraction	CA Title 22	-		Extrn Date	05/15/98
Lead in WET Extract	EPA 7420	8.7 *	0.1	mg/L	05/18/98
#Digestion, for Furnace	EPA 3050	-		Prep Date	04/30/98
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	870 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	2.0 *	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	16 *	1	mg/kg	05/01/98
Chromium	EPA 6010	71 *	2	mg/kg	05/01/98
Copper	EPA 6010	120 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.46 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	43 *	2	mg/kg	05/01/98
Lead	EPA 6010	410 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	40 *	2	mg/kg	05/01/98
Zinc	EPA 6010	490 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9804229
CLIENT PROJECT ID: 4710

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates. Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

'. Indicates result outside of established laboratory QC limits.

ANALYSIS: Lead

MATRIX: WET Extract

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: WET_PBW | INSTR RUN: AA_V12\980518101500/1/
INSTRUMENT: Video 12 aa spectrometer | PREPARED: | BATCH ID: WET051598
UNITS: mg/L | ANALYZED: 05/18/98 | DILUTION:
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Lead in Water by EPA 7420	ND		0.1						

OTHER QC SAMPLES

SAMPLE TYPE: Spike-Post-digestion | LAB ID: PD04229-13B | INSTR RUN: AA_V12\980518101500/4/2
INSTRUMENT: Video 12 aa spectrometer | PREPARED: | BATCH ID: WET051598
UNITS: mg/L | ANALYZED: 05/18/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Lead in Water by EPA 7420	17.3	8.70		8.00	108				

SAMPLE TYPE: Spike-Post-digestion-Dup | LAB ID: PR04229-13B | INSTR RUN: AA_V12\980518101500/5/3
INSTRUMENT: Video 12 aa spectrometer | PREPARED: | BATCH ID: WET051598
UNITS: mg/L | ANALYZED: 05/18/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Lead in Water by EPA 7420	17.3	17.0						1.75	

SAMPLE TYPE: Spike-Post-digestion | LAB ID: PS04229-13B | INSTR RUN: AA_V12\980518101500/3/2
INSTRUMENT: Video 12 aa spectrometer | PREPARED: | BATCH ID: WET051598
UNITS: mg/L | ANALYZED: 05/18/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Lead in Water by EPA 7420	17.0	8.70		8.00	104				

ANALYSIS: Mercury

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: HGS_BLNK | INSTR RUN: HG\980503123000/1/
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	ND		0.06						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGS_LCD | INSTR RUN: HG\980503123000/3/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	ND	0.06	0.400	95.8	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGS_LCS | INSTR RUN: HG\980503123000/2/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	ND	0.06	0.400	95.8	75	125		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: HGS_LCR | INSTR RUN: HG\980503123000/4/2
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	0.383	0.06					0	25

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: SAND_PBS | INSTR RUN: ICP\980430115500/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	ND		0.5						
Ba	Barium	ND		5						
Be	Beryllium	ND		0.5						
Cd	Cadmium	ND		0.5						
Co	Cobalt	ND		1						
Cr	Chromium	ND		2						
Cu	Copper	ND		2						
Mo	Molybdenum	ND		2						
Ni	Nickel	ND		2						
Pb	Lead	ND		4						
Tl	Thallium	ND		50						
V	Vanadium	ND		2						
Zn	Zinc	ND		5						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFS_PBS_Z | INSTR RUN: ICP\980508123100/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	ND		0.5						
As	Arsenic	ND		10						
Ba	Barium	ND		5						
Be	Beryllium	ND		0.5						
Cd	Cadmium	ND		0.5						
Co	Cobalt	ND		1						
Cr	Chromium	ND		2						
Cu	Copper	ND		2						
Mo	Molybdenum	ND		2						
Ni	Nickel	ND		2						
Pb	Lead	ND		4						
Se	Selenium	ND		20						
Tl	Thallium	ND		50						
V	Vanadium	ND		2						
Zn	Zinc	ND		5						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFS_PBS_Z | INSTR RUN: ICP\980508123100/15/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 06/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: SAND_LCD | INSTR RUN: ICP\980430115500/3/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.76	ND	0.5	10.0	97.6	75	125		
Ba	Barium	209	ND	5	200	105	75	125		
Be	Beryllium	9.41	ND	0.5	10.0	94.1	75	125		
Cd	Cadmium	9.72	ND	0.5	10.0	97.2	75	125		
Co	Cobalt	103	ND	1	100	103	75	125		
Cr	Chromium	103	ND	2	100	103	75	125		

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: SAND_LCD | INSTR RUN: ICP\980430115500/3/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Cu	Copper	99.5	ND	2	100	99.5	75	125		
Mo	Molybdenum	94.9	ND	2	100	94.9	75	125		
Ni	Nickel	102	ND	2	100	102	75	125		
Pb	Lead	101	ND	4	100	101	75	125		
Tl	Thallium	398	ND	50	400	99.5	75	125		
V	Vanadium	102	ND	2	100	102	75	125		
Zn	Zinc	98.9	ND	5	100	98.9	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: SAND_LCS | INSTR RUN: ICP\980430115500/2/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.89	ND	0.5	10.0	98.9	75	125		
Ba	Barium	210	ND	5	200	105	75	125		
Be	Beryllium	9.37	ND	0.5	10.0	93.7	75	125		
Cd	Cadmium	9.89	ND	0.5	10.0	98.9	75	125		
Co	Cobalt	103	ND	1	100	103	75	125		
Cr	Chromium	104	ND	2	100	104	75	125		
Cu	Copper	99.7	ND	2	100	99.7	75	125		
Mo	Molybdenum	90.5	ND	2	100	90.5	75	125		
Ni	Nickel	102	ND	2	100	102	75	125		
Pb	Lead	103	ND	4	100	103	75	125		
Tl	Thallium	401	ND	50	400	100	75	125		
V	Vanadium	103	ND	2	100	103	75	125		
Zn	Zinc	98.5	ND	5	100	98.5	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFS_LCD_Z | INSTR RUN: ICP\980508123100/4/2
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.56	ND	0.5	5.00	91.2	75	125		
As	Arsenic	7.51	ND	10	10.0	75.1	75	125		
Ba	Barium	101	ND	5	100	101	75	125		
Be	Beryllium	4.65	ND	0.5	5.00	93.0	75	125		
Cd	Cadmium	5.10	ND	0.5	5.50	92.7	75	125		
Co	Cobalt	49.3	ND	1	50.0	98.6	75	125		
Cr	Chromium	49.0	ND	2	50.0	98.0	75	125		
Cu	Copper	48.0	ND	2	50.0	96.0	75	125		
Mo	Molybdenum	45.9	ND	2	50.0	91.8	75	125		
Ni	Nickel	48.3	ND	2	50.0	96.6	75	125		
Pb	Lead	53.9	ND	4	55.0	98.0	75	125		
Se	Selenium	17.7	ND	20	20.0	88.5	75	125		
Tl	Thallium	194	ND	50	210	92.4	75	125		
V	Vanadium	49.8	ND	2	50.0	99.6	75	125		
Zn	Zinc	46.6	ND	5	50.0	93.2	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFS_LCD_Z | INSTR RUN: ICP\980508123100/18/16
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 06/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	45.8	ND	5	50.0	91.6	75	125		

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFS_LCS_Z | INSTR RUN: ICP\980508123100/3/2
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.42	ND	0.5	5.00	88.4	75	125		
As	Arsenic	7.55	ND	10	10.0	75.5	75	125		
Ba	Barium	98.7	ND	5	100	98.7	75	125		
Be	Beryllium	4.49	ND	0.5	5.00	89.8	75	125		
Cd	Cadmium	5.06	ND	0.5	5.50	92.0	75	125		
Co	Cobalt	47.7	ND	1	50.0	95.4	75	125		
Cr	Chromium	47.7	ND	2	50.0	95.4	75	125		
Cu	Copper	46.3	ND	2	50.0	92.6	75	125		
Mo	Molybdenum	43.6	ND	2	50.0	87.2	75	125		
Ni	Nickel	46.8	ND	2	50.0	93.6	75	125		
Pb	Lead	52.7	ND	4	55.0	95.8	75	125		
Se	Selenium	16.4	ND	20	20.0	82.0	75	125		
Tl	Thallium	187	ND	50	210	89.0	75	125		
V	Vanadium	48.2	ND	2	50.0	96.4	75	125		
Zn	Zinc	44.6	ND	5	50.0	89.2	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFS_LCS_Z | INSTR RUN: ICP\980508123100/17/16
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 06/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	44.1	ND	5	50.0	88.2	75	125		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: SAND_LCR | INSTR RUN: ICP\980430115500/4/2
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.76	9.89	0.5					1.32	25
Ba	Barium	209	210	5					0.477	25
Be	Beryllium	9.41	9.37	0.5					0.426	25
Cd	Cadmium	9.72	9.89	0.5					1.73	25
Co	Cobalt	103	103	1					0	25
Cr	Chromium	103	104	2					0.966	25
Cu	Copper	99.5	99.7	2					0.201	25
Mo	Molybdenum	94.9	90.5	2					4.75	25
Ni	Nickel	102	102	2					0	25
Pb	Lead	101	103	4					1.96	25
Tl	Thallium	398	401	50					0.751	25
V	Vanadium	102	103	2					0.976	25
Zn	Zinc	98.9	98.5	5					0.405	25

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: IFS_LCR_Z | INSTR RUN: ICP\980508123100/5/3
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.56	4.42	0.5					3.12	25
As	Arsenic	7.51	7.55	10					0.531	25
Ba	Barium	101	98.7	5					2.30	25
Be	Beryllium	4.65	4.49	0.5					3.50	25
Cd	Cadmium	5.10	5.06	0.5					0.787	25
Co	Cobalt	49.3	47.7	1					3.30	25

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: IFS_LCR_Z | INSTR RUN: ICP\980508123100/5/3
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Cr	Chromium	49.0	47.7	2					2.69	25
Cu	Copper	48.0	46.3	2					3.61	25
Mo	Molybdenum	45.9	43.6	2					5.14	25
Ni	Nickel	48.3	46.8	2					3.15	25
Pb	Lead	53.9	52.7	4					2.25	25
Se	Selenium	17.7	16.4	20					7.62	25
Tl	Thallium	194	187	50					3.67	25
V	Vanadium	49.8	48.2	2					3.27	25
Zn	Zinc	46.6	44.6	5					4.39	25

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: IFS_LCR_Z | INSTR RUN: ICP\980508123100/19/17
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 06/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	45.8	44.1	5					3.78	25

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix | LAB ID: MD04229-05A | INSTR RUN: ICP\980430115500/7/5
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	8.51	ND	0.5	10.0	85.1	70	130		
Ba	Barium	388	193	5	200	97.5	70	130		
Be	Beryllium	9.21	ND	0.5	10.0	92.1	70	130		
Cd	Cadmium	8.72	ND	0.5	10.0	87.2	70	130		
Co	Cobalt	95.6	6.52	1	100	89.1	70	130		
Cr	Chromium	119	31.9	2	100	87.1	70	130		
Cu	Copper	102	12.2	2	100	89.8	70	130		
Mo	Molybdenum	84.4	ND	2	100	84.4	60	140		
Ni	Nickel	107	18.8	2	100	88.2	70	130		
Pb	Lead	92.2	6.98	4	100	85.2	70	130		
Tl	Thallium	310	ND	50	400	77.5	70	130		
V	Vanadium	123	34.9	2	100	88.1	70	130		
Zn	Zinc	109	22.9	5	100	86.1	70	130		

SAMPLE TYPE: Spike-Sample/Matrix | LAB ID: MS04229-05A | INSTR RUN: ICP\980430115500/6/5
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.34	ND	0.5	10.0	93.4	70	130		
Ba	Barium	390	193	5	200	98.5	70	130		
Be	Beryllium	9.96	ND	0.5	10.0	99.6	70	130		
Cd	Cadmium	9.74	ND	0.5	10.0	97.4	70	130		
Co	Cobalt	106	6.52	1	100	99.5	70	130		
Cr	Chromium	129	31.9	2	100	97.1	70	130		
Cu	Copper	107	12.2	2	100	94.8	70	130		
Mo	Molybdenum	92.7	ND	2	100	92.7	60	140		
Ni	Nickel	118	18.8	2	100	99.2	70	130		
Pb	Lead	103	6.98	4	100	96.0	70	130		
Tl	Thallium	346	ND	50	400	86.5	70	130		
V	Vanadium	132	34.9	2	100	97.1	70	130		

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: MS04229-05A
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980430115500/6/5
BATCH ID: IFS043098-Q
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Zn	Zinc	115	22.9	5	100	92.1	70	130		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: MR04229-05A
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980430115500/8/6
BATCH ID: IFS043098-Q
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	8.51	9.34	0.5					9.30	25
Ba	Barium	388	390	5					0.514	25
Be	Beryllium	9.21	9.96	0.5					7.82	25
Cd	Cadmium	8.72	9.74	0.5					11.1	25
Co	Cobalt	95.6	106	1					10.3	25
Cr	Chromium	119	129	2					8.06	25
Cu	Copper	102	107	2					4.78	25
Mo	Molybdenum	84.4	92.7	2					9.37	25
Ni	Nickel	107	118	2					9.78	25
Pb	Lead	92.2	103	4					11.1	25
Tl	Thallium	310	346	50					11.0	25
V	Vanadium	123	132	2					7.06	25
Zn	Zinc	109	115	5					5.36	25

ANALYSIS: Volatile GC/MS

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/kg
METHOD:

LAB ID: BLNK_0501
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: GCMS12\980501020000/1/
BATCH ID: MS12S050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	128			100	128	60	140		
Toluene-d8	(surr)	112			100	112	65	135		
p-BFB	(surr)	93.1			100	93.1	65	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		10						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						
1,1-Dichloropropene		ND		5						
Ethylbenzene		ND		5						
Hexachlorobutadiene		ND		5						
Isopropylbenzene		ND		5						
p-Isopropyltoluene		ND		5						
Methylene Chloride		ND		10						
Naphthalene		ND		5						
n-Propylbenzene		ND		5						
Styrene		ND		5						
1,1,1,2-Tetrachloroethane		ND		5						
1,1,2,2-Tetrachloroethane		ND		5						
Tetrachloroethene		ND		5						
1,2,3-Trichlorobenzene		ND		5						
1,2,4-Trichlorobenzene		ND		5						
1,1,1-Trichloroethane		ND		5						
1,1,2-Trichloroethane		ND		5						
Trichlorofluoromethane		ND		5						
1,2,3-Trichloropropane		ND		5						
1,2,4-Trimethylbenzene		ND		5						
1,3,5-Trimethylbenzene		ND		5						
Vinyl Chloride		ND		10						
Xylenes, Total		ND		10						
Trichlorotrifluoroethane		ND		5						
Acetone		ND		100						
Acrylonitrile		ND		10						
2-Butanone		ND		100						

ANALYSIS: Volatile GC/MS

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: BLNK_0501 | INSTR RUN: GCMS12\980501020000/1/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/01/98 | DILUTION: 1.00
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCD_0503 | INSTR RUN: GCMS12\980501020000/7/1
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 50.0
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	102	128		100	102	60	140		
Toluene-d8	(surr)	104	112		100	104	65	135		
p-BFB	(surr)	105	93.1		100	105	65	135		
1,1-Dichloroethene		200	ND		2500	8.00	55	135		
Benzene		2490	ND		2500	99.60	65	135		
Trichloroethene		2740	ND		2500	109.6	65	135		
Toluene		2390	ND		2500	95.60	65	135		
Chlorobenzene		3210	ND		2500	128.4	65	135		

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCS_0501 | INSTR RUN: GCMS12\980501020000/2/1
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/01/98 | DILUTION: 1.00
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	113	128		100	113	60	140		
Toluene-d8	(surr)	104	112		100	104	65	135		
p-BFB	(surr)	99.7	93.1		100	99.7	65	135		
1,1-Dichloroethene		45.8	ND	5	50.0	91.6	65	135		
Benzene		58.9	ND	5	50.0	118	65	135		
Trichloroethene		58.0	ND	5	50.0	116	65	135		
Toluene		62.6	ND	5	50.0	125	65	135		
Chlorobenzene		67.2	ND	5	50.0	134	65	135		

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCS_0503 | INSTR RUN: GCMS12\980501020000/6/ 1
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 50.0
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	114	128		100	114	60	140		
Toluene-d8	(surr)	100	112		100	100	65	135		
p-BFB	(surr)	105	93.1		100	105	65	135		
1,1-Dichloroethene		2400	ND		2500	96.00	55	135		
Benzene		2410	ND		2500	96.40	65	135		
Trichloroethene		2660	ND		2500	106.4	65	135		
Toluene		2660	ND		2500	106.4	65	135		

ANALYSIS: Volatile GC/MS

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCS_0503 | INSTR RUN: GCMS12\980501020000/6/ 1
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 50.0
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Chlorobenzene	3230	ND		2500	129.2	65	135		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Laboratory Control Sample Duplicate | LAB ID: LCR_0503 | INSTR RUN: GCMS12\980501020000/8/6
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 50.0
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	102	114			11.1	60	140		
Toluene-d8	(surr)	104	100			3.92	65	135		
p-BFB	(surr)	105	105			0	65	135		
1,1-Dichloroethene		2000	2400						18.18	40
Benzene		2490	2410						3.265	30
Trichloroethene		2740	2660						2.963	30
Toluene		2390	2660						10.69	30
Chlorobenzene		3210	3230						0.6211	30

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client | LAB ID: 9804229-05A | INSTR RUN: GCMS12\980501020000/4/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 5.00
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	505			500	101	60	140		
Toluene-d8	(surr)	494			500	98.8	65	135		
p-BFB	(surr)	472			500	94.4	65	135		

SAMPLE TYPE: Sample-Client | LAB ID: 9804229-06A | INSTR RUN: GCMS12\980501020000/5/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 500
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	D			50000	0 !	60	140		
Toluene-d8	(surr)	D			50000	0 !	65	135		
p-BFB	(surr)	D			50000	0 !	65	135		

SAMPLE TYPE: Sample-Client | LAB ID: 9804229-07A | INSTR RUN: GCMS12\980501020000/9/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12S050198
UNITS: ug/kg | ANALYZED: 05/03/98 | DILUTION: 50.0
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	103			100	103	60	140		
Toluene-d8	(surr)	127			100	127	65	135		
p-BFB	(surr)	117			100	117	65	135		

---------- End of Quality Control Report ----------

R4SD

9804229

Chain-of-Custody Record

№ 4217

Date: 4/22/98

Page 1 of 1

Project No.: 4710

Samplers (Signatures): [signature]

	Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel	TPH as BTEX	CAM 17 Metals	VOCs 8260	HOLD					Cooled	Soil (S) or water (W)	Acidified	Number of containers
1A	4/22	0925	S-07	>	11A						X							X	S		1
2A	4/22	0950	S-08								X							X	S		1
3A	4/22	1002	S-01	>	12A						X							X	S		1
4A	4/22	1025	S-02								X							X	S		1
5A	4/22	1040	S-03								X	X						X	S		1
6A	4/22	1100	S-05								X	X						X	S		1
7A	4/22	1125	S-04								X	X						X	S		1
8A	4/22	1420	S-06								X							X	S		1
9A	4/22	1445	S-09	>	13A						X		X	H	O	L	D	X	S		1
10A	4/22	1500	S-10								X		X	H	O	L	D	X	S		1

REMARKS — Additional comments:

Do Not run metals until you talk with Jennifer Patterson. Some samples may need to be composited.

~~HOLD~~ S-09, S-10 RD 4/28/98

Turnaround time: STANDARD

Results to: Jennifer Patterson

Total No. of containers:

Relinquished by: Charlie Crocker	Date: 4/22/98	Relinquished by: [signature]	Date: 4-22-98	Relinquished by:	Date:	Method of shipment: Lab Pickup
Signature: [signature]		Signature: Rich Gilmore		Signature:		Laboratory comments and Log No.:
Printed name:		Printed name: RICK GILMORE	18:30	Printed name:		4/23/98 Composite soil S-07 (11A) & S-08, S-09 (13A) & S-10 off hold & Composite - For metals analysis only per J. Patterson (12A)
Company: Geomatrix		Company: AEN		Company:		metals off hold
Received by: /	Time: 1625	Received by:	Time: 4/22 1830	Received by:	Time:	
Signature: Rich Gilmore		Signature: Greg Glaser		Signature:		
Printed name: RICK GILMORE		Printed name: Greg Glaser		Printed name:		
Company: AEN		Company: AEN		Company:		

Geomatrix Consultants
100 Pine St 10th Floor
San Francisco, CA 94111
(415) 434-9400

CHANGE ORDER REQUEST

FAX 5-13

AMERICAN ENVIRONMENTAL NETWORK (AEN)
3440 VINCENT ROAD
PLEASANT HILL, CA 94523
PHONE 925 ~~(510)~~ 930-9090
FAX 925 ~~(510)~~ 930-0256

DATE/TIME 5-13-98 COMPANY Geomatrix

AEN REP. Robin Bjaco CONTACT Tom Graf

AEN PROJ NO. 9804229 PROJECT 4710 (PROJ. #) 4217 (COC #)

ADDITIONAL ANALYSIS ✓ CHANGED ANALYSIS ____ OTHER ____

Standard TAT

STLC Pb

11A S-07, 08 Comp

13A S-09, 10 Comp

ACCEPTED - *The above specifications of this Change Order are satisfactory and are hereby accepted*

DATE OF ACCEPTANCE _____ *SIGNATURE* _____

PLEASE AUTHORIZE BY SIGNING REQUEST AND RETURN BY FAX

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

GEOMATRIX CONSULTANTS
100 PINE ST., SUITE 1000
SAN FRANCISCO, CA 94111

ATTN: JEN PATTERSON
CLIENT PROJ. ID: 4710

C.O.C. NUMBER: 11029

REPORT DATE: 06/02/98

DATE(S) SAMPLED: 04/22/98

DATE RECEIVED: 04/22/98

AEN WORK ORDER: 9804232

PROJECT SUMMARY:

On April 22, 1998, this laboratory received 10 (4 soil and 6 water) sample(s).

Client requested 9 sample(s) be analyzed for chemical parameters; one sample was placed on hold. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Reviewed by:

William Luksch

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW1
AEN LAB NO: 9804232-01
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	04/28/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	50	ug/L	05/06/98
Bromobenzene	108-86-1	ND	50	ug/L	05/06/98
Bromochloromethane	74-97-5	ND	50	ug/L	05/06/98
Bromodichloromethane	75-27-4	ND	50	ug/L	05/06/98
Bromoform	75-25-2	ND	50	ug/L	05/06/98
Bromomethane	74-83-9	ND	100	ug/L	05/06/98
n-Butylbenzene	104-51-8	ND	50	ug/L	05/06/98
sec-Butylbenzene	135-98-8	ND	50	ug/L	05/06/98
tert-Butylbenzene	98-06-6	ND	50	ug/L	05/06/98
Carbon Tetrachloride	56-23-5	ND	50	ug/L	05/06/98
Chlorobenzene	108-90-7	ND	50	ug/L	05/06/98
Chloroethane	75-00-3	ND	100	ug/L	05/06/98
Chloroform	67-66-3	ND	50	ug/L	05/06/98
Chloromethane	74-87-3	ND	100	ug/L	05/06/98
2-Chlorotoluene	95-49-8	ND	50	ug/L	05/06/98
4-Chlorotoluene	106-43-4	ND	50	ug/L	05/06/98
Dibromochloromethane	124-48-1	ND	50	ug/L	05/06/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	50	ug/L	05/06/98
1,2-Dibromoethane	106-93-4	ND	50	ug/L	05/06/98
Dibromomethane	74-95-3	ND	50	ug/L	05/06/98
1,2-Dichlorobenzene	95-50-1	ND	50	ug/L	05/06/98
1,3-Dichlorobenzene	541-73-1	ND	50	ug/L	05/06/98
1,4-Dichlorobenzene	106-46-7	ND	50	ug/L	05/06/98
Dichlorodifluoromethane	75-71-8	ND	100	ug/L	05/06/98
1,1-Dichloroethane	75-34-3	ND	50	ug/L	05/06/98
1,2-Dichloroethane	107-06-2	ND	50	ug/L	05/06/98
1,1-Dichloroethene	75-35-4	ND	50	ug/L	05/06/98
cis-1,2-Dichloroethene	156-59-2	ND	50	ug/L	05/06/98
trans-1,2-Dichloroethene	156-60-5	ND	50	ug/L	05/06/98
1,2-Dichloropropane	78-87-5	ND	50	ug/L	05/06/98
1,3-Dichloropropane	142-28-9	ND	50	ug/L	05/06/98
2,2-Dichloropropane	594-20-7	ND	50	ug/L	05/06/98
1,1-Dichloropropene	563-58-6	ND	50	ug/L	05/06/98
Ethylbenzene	100-41-4	ND	50	ug/L	05/06/98
Hexachlorobutadiene	87-68-3	ND	50	ug/L	05/06/98
Isopropylbenzene	98-82-8	ND	50	ug/L	05/06/98
p-Isopropyltoluene	99-87-6	ND	50	ug/L	05/06/98
Methylene Chloride	75-09-2	ND	200	ug/L	05/06/98
Naphthalene	91-20-3	ND	50	ug/L	05/06/98
n-Propylbenzene	103-65-1	ND	50	ug/L	05/06/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW1
AEN LAB NO: 9804232-01
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Styrene	100-42-5	ND	50	ug/L	05/06/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	50	ug/L	05/06/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	50	ug/L	05/06/98
Tetrachloroethene	127-18-4	ND	50	ug/L	05/06/98
Toluene	108-88-3	ND	50	ug/L	05/06/98
1,2,3-Trichlorobenzene	87-61-6	ND	50	ug/L	05/06/98
1,2,4-Trichlorobenzene	120-82-1	ND	50	ug/L	05/06/98
1,1,1-Trichloroethane	71-55-6	ND	50	ug/L	05/06/98
1,1,2-Trichloroethane	79-00-5	ND	50	ug/L	05/06/98
Trichloroethene	79-01-6	ND	50	ug/L	05/06/98
Trichlorofluoromethane	75-69-4	ND	50	ug/L	05/06/98
1,2,3-Trichloropropane	96-18-4	ND	50	ug/L	05/06/98
1,2,4-Trimethylbenzene	95-63-6	ND	50	ug/L	05/06/98
1,3,5-Trimethylbenzene	108-67-8	ND	50	ug/L	05/06/98
Vinyl Chloride	75-01-4	ND	100	ug/L	05/06/98
Xylenes, Total	1330-20-7	ND	100	ug/L	05/06/98
Acetone	67-64-1	ND	1000	ug/L	05/06/98
2-Butanone	78-93-3	ND	1000	ug/L	05/06/98
Carbon Disulfide	75-15-0	ND	100	ug/L	05/06/98
cis-1,3-Dichloropropene	10061-01-5	ND	50	ug/L	05/06/98
trans-1,3-Dichloropropene	10061-02-6	ND	50	ug/L	05/06/98
2-Hexanone	591-78-6	ND	500	ug/L	05/06/98
4-Methyl-2-pentanone	108-10-1	ND	500	ug/L	05/06/98
Vinyl Acetate	108-05-4	ND	500	ug/L	05/06/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	100	ug/L	05/06/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/01/98
Arsenic	EPA 6010	0.034 *	0.005	mg/L	05/05/98
Barium	EPA 6010	0.23 *	0.01	mg/L	05/01/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/01/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/01/98
Cobalt	EPA 6010	0.005 *	0.005	mg/L	05/01/98
Chromium	EPA 6010	ND	0.01	mg/L	05/01/98
Copper	EPA 6010	ND	0.01	mg/L	05/01/98
Mercury	EPA 7470	ND	0.0002	mg/L	04/26/98
Molybdenum	EPA 6010	0.03 *	0.01	mg/L	05/01/98
Nickel	EPA 6010	0.01 *	0.01	mg/L	05/01/98
Lead	EPA 6010	ND	0.04	mg/L	05/01/98
Antimony	EPA 6010	ND	0.02	mg/L	05/01/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/01/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/01/98
Zinc	EPA 6010	0.11 *	0.01	mg/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW1
AEN LAB NO: 9804232-01
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW1-1.0
AEN LAB NO: 9804232-02
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	ND	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	180 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	8 *	1	mg/kg	05/01/98
Chromium	EPA 6010	31 *	2	mg/kg	05/01/98
Copper	EPA 6010	12 *	2	mg/kg	05/01/98
Mercury	EPA 7471	ND	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	21 *	2	mg/kg	05/01/98
Lead	EPA 6010	6 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	31 *	2	mg/kg	05/01/98
Zinc	EPA 6010	22 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW2
AEN LAB NO: 9804232-03
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Sample Filtration	GFF 0.7 um	-		Filtr Date	04/24/98
TPH as Gas	5030/GC-FID	ND	0.05	mg/L	04/30/98
#Silica gel Cleanup	EPA 3630M	-		Cleanup	05/01/98
#Extraction for TPH	EPA 3510	-		Extrn Date	05/01/98
TPH as Diesel	GC-FID	ND	0.05	mg/L	05/02/98
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	04/28/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/01/98
Bromobenzene	108-86-1	ND	5	ug/L	05/01/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/01/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/01/98
Bromoform	75-25-2	ND	5	ug/L	05/01/98
Bromomethane	74-83-9	ND	10	ug/L	05/01/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/01/98
sec-Butylbenzene	135-98-8	ND	5	ug/L	05/01/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/01/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/01/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/01/98
Chloroethane	75-00-3	ND	10	ug/L	05/01/98
Chloroform	67-66-3	ND	5	ug/L	05/01/98
Chloromethane	74-87-3	ND	10	ug/L	05/01/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/01/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/01/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/01/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/01/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/01/98
Dibromomethane	74-95-3	ND	5	ug/L	05/01/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/01/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/01/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/01/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/01/98
1,1-Dichloroethane	75-34-3	120 *	5	ug/L	05/01/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/01/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/01/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/01/98
trans-1,2-Dichloroethene	156-60-5	ND	5	ug/L	05/01/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW2
AEN LAB NO: 9804232-03
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/01/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/01/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/01/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/01/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/01/98
Isopropylbenzene	98-82-8	ND	5	ug/L	05/01/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/01/98
Methylene Chloride	75-09-2	ND	20	ug/L	05/01/98
Naphthalene	91-20-3	ND	5	ug/L	05/01/98
n-Propylbenzene	103-65-1	ND	5	ug/L	05/01/98
Styrene	100-42-5	ND	5	ug/L	05/01/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/01/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/01/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/01/98
Toluene	108-88-3	ND	5	ug/L	05/01/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/01/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/01/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/01/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/01/98
Trichloroethene	79-01-6	ND	5	ug/L	05/01/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/01/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/01/98
1,2,4-Trimethylbenzene	95-63-6	ND	5	ug/L	05/01/98
1,3,5-Trimethylbenzene	108-67-8	ND	5	ug/L	05/01/98
Vinyl Chloride	75-01-4	11 *	10	ug/L	05/01/98
Xylenes, Total	1330-20-7	ND	10	ug/L	05/01/98
Acetone	67-64-1	ND	100	ug/L	05/01/98
2-Butanone	78-93-3	ND	100	ug/L	05/01/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/01/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/01/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/01/98
2-Hexanone	591-78-6	ND	50	ug/L	05/01/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/01/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/01/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/01/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/01/98
Arsenic	EPA 6010	ND	0.005	mg/L	05/05/98
Barium	EPA 6010	0.15 *	0.01	mg/L	05/01/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/01/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/01/98
Cobalt	EPA 6010	0.006 *	0.005	mg/L	05/01/98
Chromium	EPA 6010	ND	0.01	mg/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW2
AEN LAB NO: 9804232-03
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Copper	EPA 6010	ND	0.01	mg/L	05/01/98
Mercury	EPA 7470	ND	0.0002	mg/L	04/26/98
Molybdenum	EPA 6010	0.05 *	0.01	mg/L	05/01/98
Nickel	EPA 6010	0.03 *	0.01	mg/L	05/01/98
Lead	EPA 6010	ND	0.04	mg/L	05/01/98
Antimony	EPA 6010	ND	0.02	mg/L	05/01/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/01/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/01/98
Zinc	EPA 6010	0.01 *	0.01	mg/L	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW2-2.0
AEN LAB NO: 9804232-04
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	10 *	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	150 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	6 *	1	mg/kg	05/01/98
Chromium	EPA 6010	47 *	2	mg/kg	05/01/98
Copper	EPA 6010	10 *	2	mg/kg	05/01/98
Mercury	EPA 7471	ND	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	25 *	2	mg/kg	05/01/98
Lead	EPA 6010	7 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	36 *	2	mg/kg	05/01/98
Zinc	EPA 6010	31 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW3
AEN LAB NO: 9804232-05
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Sample Filtration	0.45 um	-		Filtr Date	04/24/98
TPH as Gas	5030/GC-FID	0.22 *	0.05	mg/L	04/30/98
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	04/28/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/01/98
Bromobenzene	108-86-1	ND	5	ug/L	05/01/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/01/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/01/98
Bromoform	75-25-2	ND	5	ug/L	05/01/98
Bromomethane	74-83-9	ND	10	ug/L	05/01/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/01/98
sec-Butylbenzene	135-98-8	ND	5	ug/L	05/01/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/01/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/01/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/01/98
Chloroethane	75-00-3	ND	10	ug/L	05/01/98
Chloroform	67-66-3	ND	5	ug/L	05/01/98
Chloromethane	74-87-3	ND	10	ug/L	05/01/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/01/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/01/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/01/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/01/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/01/98
Dibromomethane	74-95-3	ND	5	ug/L	05/01/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/01/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/01/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/01/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/01/98
1,1-Dichloroethane	75-34-3	6 *	5	ug/L	05/01/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/01/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/01/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/01/98
trans-1,2-Dichloroethene	156-60-5	ND	5	ug/L	05/01/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/01/98
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/01/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/01/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/01/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/01/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/01/98
Isopropylbenzene	98-82-8	ND	5	ug/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW3
AEN LAB NO: 9804232-05
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/01/98
Methylene Chloride	75-09-2	ND	10	ug/L	05/01/98
Naphthalene	91-20-3	ND	5	ug/L	05/01/98
n-Propylbenzene	103-65-1	ND	5	ug/L	05/01/98
Styrene	100-42-5	ND	5	ug/L	05/01/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/01/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/01/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/01/98
Toluene	108-88-3	ND	5	ug/L	05/01/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/01/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/01/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/01/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/01/98
Trichloroethene	79-01-6	ND	5	ug/L	05/01/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/01/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/01/98
1,2,4-Trimethylbenzene	95-63-6	120 *	5	ug/L	05/01/98
1,3,5-Trimethylbenzene	108-67-8	11 *	5	ug/L	05/01/98
Vinyl Chloride	75-01-4	ND	10	ug/L	05/01/98
Xylenes, Total	1330-20-7	13 *	10	ug/L	05/01/98
Acetone	67-64-1	ND	100	ug/L	05/01/98
2-Butanone	78-93-3	ND	100	ug/L	05/01/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/01/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/01/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/01/98
2-Hexanone	591-78-6	ND	50	ug/L	05/01/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/01/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/01/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/01/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/01/98
Arsenic	EPA 6010	ND	0.005	mg/L	05/05/98
Barium	EPA 6010	0.52 *	0.01	mg/L	05/01/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/01/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/01/98
Cobalt	EPA 6010	0.006 *	0.005	mg/L	05/01/98
Chromium	EPA 6010	ND	0.01	mg/L	05/01/98
Copper	EPA 6010	ND	0.01	mg/L	05/01/98
Mercury	EPA 7470	ND	0.0002	mg/L	04/26/98
Molybdenum	EPA 6010	ND	0.01	mg/L	05/01/98
Nickel	EPA 6010	ND	0.01	mg/L	05/01/98
Lead	EPA 6010	ND	0.04	mg/L	05/01/98
Antimony	EPA 6010	ND	0.02	mg/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW3
AEN LAB NO: 9804232-05
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/01/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/01/98
Zinc	EPA 6010	0.10 *	0.01	mg/L	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW3-1.5
AEN LAB NO: 9804232-06
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion for ICP/AA	EPA 3050A	-		Prep Date	04/30/98
Arsenic	EPA 6010	12 *	10	mg/kg	05/08/98
Selenium	EPA 6010	ND	20	mg/kg	05/08/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.5	mg/kg	05/01/98
Barium	EPA 6010	1,600 *	5	mg/kg	05/01/98
Beryllium	EPA 6010	ND	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	3.0 *	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	11 *	1	mg/kg	05/01/98
Chromium	EPA 6010	88 *	2	mg/kg	05/01/98
Copper	EPA 6010	32 *	2	mg/kg	05/01/98
Mercury	EPA 7471	0.32 *	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND	2	mg/kg	05/01/98
Nickel	EPA 6010	29 *	2	mg/kg	05/01/98
Lead	EPA 6010	390 *	4	mg/kg	05/01/98
Antimony	EPA 6010	ND	5	mg/kg	06/08/98
Thallium	EPA 6010	ND	50	mg/kg	05/01/98
Vanadium	EPA 6010	40 *	2	mg/kg	05/01/98
Zinc	EPA 6010	900 *	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW4
AEN LAB NO: 9804232-07
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	04/28/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	500	ug/L	05/06/98
Bromobenzene	108-86-1	ND	500	ug/L	05/06/98
Bromochloromethane	74-97-5	ND	500	ug/L	05/06/98
Bromodichloromethane	75-27-4	ND	500	ug/L	05/06/98
Bromoform	75-25-2	ND	500	ug/L	05/06/98
Bromomethane	74-83-9	ND	1000	ug/L	05/06/98
n-Butylbenzene	104-51-8	ND	500	ug/L	05/06/98
sec-Butylbenzene	135-98-8	ND	500	ug/L	05/06/98
tert-Butylbenzene	98-06-6	ND	500	ug/L	05/06/98
Carbon Tetrachloride	56-23-5	ND	500	ug/L	05/06/98
Chlorobenzene	108-90-7	ND	500	ug/L	05/06/98
Chloroethane	75-00-3	ND	1000	ug/L	05/06/98
Chloroform	67-66-3	ND	500	ug/L	05/06/98
Chloromethane	74-87-3	ND	1000	ug/L	05/06/98
2-Chlorotoluene	95-49-8	ND	500	ug/L	05/06/98
4-Chlorotoluene	106-43-4	ND	500	ug/L	05/06/98
Dibromochloromethane	124-48-1	ND	500	ug/L	05/06/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	500	ug/L	05/06/98
1,2-Dibromoethane	106-93-4	ND	500	ug/L	05/06/98
Dibromomethane	74-95-3	ND	500	ug/L	05/06/98
1,2-Dichlorobenzene	95-50-1	ND	500	ug/L	05/06/98
1,3-Dichlorobenzene	541-73-1	ND	500	ug/L	05/06/98
1,4-Dichlorobenzene	106-46-7	ND	500	ug/L	05/06/98
Dichlorodifluoromethane	75-71-8	ND	1000	ug/L	05/06/98
1,1-Dichloroethane	75-34-3	ND	500	ug/L	05/06/98
1,2-Dichloroethane	107-06-2	ND	500	ug/L	05/06/98
1,1-Dichloroethene	75-35-4	ND	500	ug/L	05/06/98
cis-1,2-Dichloroethene	156-59-2	ND	500	ug/L	05/06/98
trans-1,2-Dichloroethene	156-60-5	ND	500	ug/L	05/06/98
1,2-Dichloropropane	78-87-5	ND	500	ug/L	05/06/98
1,3-Dichloropropane	142-28-9	ND	500	ug/L	05/06/98
2,2-Dichloropropane	594-20-7	ND	500	ug/L	05/06/98
1,1-Dichloropropene	563-58-6	ND	500	ug/L	05/06/98
Ethylbenzene	100-41-4	ND	500	ug/L	05/06/98
Hexachlorobutadiene	87-68-3	ND	500	ug/L	05/06/98
Isopropylbenzene	98-82-8	ND	500	ug/L	05/06/98
p-Isopropyltoluene	99-87-6	ND	500	ug/L	05/06/98
Methylene Chloride	75-09-2	ND	1000	ug/L	05/06/98
Naphthalene	91-20-3	ND	500	ug/L	05/06/98
n-Propylbenzene	103-65-1	ND	500	ug/L	05/06/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW4
AEN LAB NO: 9804232-07
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Styrene	100-42-5	ND	500	ug/L	05/06/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	500	ug/L	05/06/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	500	ug/L	05/06/98
Tetrachloroethene	127-18-4	ND	500	ug/L	05/06/98
Toluene	108-88-3	ND	500	ug/L	05/06/98
1,2,3-Trichlorobenzene	87-61-6	ND	500	ug/L	05/06/98
1,2,4-Trichlorobenzene	120-82-1	ND	500	ug/L	05/06/98
1,1,1-Trichloroethane	71-55-6	ND	500	ug/L	05/06/98
1,1,2-Trichloroethane	79-00-5	ND	500	ug/L	05/06/98
Trichloroethene	79-01-6	ND	500	ug/L	05/06/98
Trichlorofluoromethane	75-69-4	ND	500	ug/L	05/06/98
1,2,3-Trichloropropane	96-18-4	ND	500	ug/L	05/06/98
1,2,4-Trimethylbenzene	95-63-6	ND	500	ug/L	05/06/98
1,3,5-Trimethylbenzene	108-67-8	ND	500	ug/L	05/06/98
Vinyl Chloride	75-01-4	ND	1000	ug/L	05/06/98
Xylenes, Total	1330-20-7	ND	1000	ug/L	05/06/98
Acetone	67-64-1	ND	10000	ug/L	05/06/98
2-Butanone	78-93-3	ND	10000	ug/L	05/06/98
Carbon Disulfide	75-15-0	ND	1000	ug/L	05/06/98
cis-1,3-Dichloropropene	10061-01-5	ND	500	ug/L	05/06/98
trans-1,3-Dichloropropene	10061-02-6	ND	500	ug/L	05/06/98
2-Hexanone	591-78-6	ND	5000	ug/L	05/06/98
4-Methyl-2-pentanone	108-10-1	ND	5000	ug/L	05/06/98
Vinyl Acetate	108-05-4	ND	5000	ug/L	05/06/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	1000	ug/L	05/06/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/01/98
Arsenic	EPA 6010	0.008 *	0.005	mg/L	05/05/98
Barium	EPA 6010	0.04 *	0.01	mg/L	05/01/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/01/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/01/98
Cobalt	EPA 6010	ND	0.005	mg/L	05/01/98
Chromium	EPA 6010	ND	0.01	mg/L	05/01/98
Copper	EPA 6010	ND	0.01	mg/L	05/01/98
Mercury	EPA 7470	ND	0.0002	mg/L	04/26/98
Molybdenum	EPA 6010	ND	0.01	mg/L	05/01/98
Nickel	EPA 6010	ND	0.01	mg/L	05/01/98
Lead	EPA 6010	ND	0.04	mg/L	05/01/98
Antimony	EPA 6010	ND	0.02	mg/L	05/01/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/01/98
Vanadium	EPA 6010	0.032 *	0.005	mg/L	05/01/98
Zinc	EPA 6010	0.01 *	0.01	mg/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW4
AEN LAB NO: 9804232-07
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW4-1.5
AEN LAB NO: 9804232-08
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT		REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion for ICP/AA	EPA 3050A	-			Prep Date	04/30/98
Arsenic	EPA 6010	ND		10	mg/kg	05/08/98
Selenium	EPA 6010	ND		20	mg/kg	05/08/98
CCR 17 Metals						
Silver	EPA 6010	ND		0.5	mg/kg	05/01/98
Barium	EPA 6010	260	*	5	mg/kg	05/01/98
Beryllium	EPA 6010	0.5	*	0.5	mg/kg	05/01/98
Cadmium	EPA 6010	0.6	*	0.5	mg/kg	05/01/98
Cobalt	EPA 6010	18	*	1	mg/kg	05/01/98
Chromium	EPA 6010	41	*	2	mg/kg	05/01/98
Copper	EPA 6010	24	*	2	mg/kg	05/01/98
Mercury	EPA 7471	0.07	*	0.06	mg/kg	05/03/98
Molybdenum	EPA 6010	ND		2	mg/kg	05/01/98
Nickel	EPA 6010	39	*	2	mg/kg	05/01/98
Lead	EPA 6010	84	*	4	mg/kg	05/01/98
Antimony	EPA 6010	ND		5	mg/kg	06/08/98
Thallium	EPA 6010	ND		50	mg/kg	05/01/98
Vanadium	EPA 6010	43	*	2	mg/kg	05/01/98
Zinc	EPA 6010	120	*	5	mg/kg	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW13 duplicate GGW3
AEN LAB NO: 9804232-09
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Sample Filtration	GFF 0.7 um	-		Filtr Date	04/24/98
TPH as Gas	5030/GC-FID	0.24 *	0.05	mg/L	04/30/98
#Silica gel Cleanup	EPA 3630M	-		Cleanup	05/01/98
#Extraction for TPH	EPA 3510	-		Extrn Date	05/01/98
TPH as Diesel	GC-FID	ND	0.05	mg/L	05/02/98
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	04/28/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/02/98
Bromobenzene	108-86-1	ND	5	ug/L	05/02/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/02/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/02/98
Bromoform	75-25-2	ND	5	ug/L	05/02/98
Bromomethane	74-83-9	ND	10	ug/L	05/02/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/02/98
sec-Butylbenzene	135-98-8	ND	5	ug/L	05/02/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/02/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/02/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/02/98
Chloroethane	75-00-3	ND	10	ug/L	05/02/98
Chloroform	67-66-3	ND	5	ug/L	05/02/98
Chloromethane	74-87-3	ND	10	ug/L	05/02/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/02/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/02/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/02/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/02/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/02/98
Dibromomethane	74-95-3	ND	5	ug/L	05/02/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/02/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/02/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/02/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/02/98
1,1-Dichloroethane	75-34-3	5 *	5	ug/L	05/02/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/02/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/02/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/02/98
trans-1,2-Dichloroethene	156-60-5	ND	5	ug/L	05/02/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/02/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW13 duplicate GGW-5
AEN LAB NO: 9804232-09
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/02/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/02/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/02/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/02/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/02/98
Isopropylbenzene	98-82-8	ND	5	ug/L	05/02/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/02/98
Methylene Chloride	75-09-2	ND	20	ug/L	05/02/98
Naphthalene	91-20-3	ND	5	ug/L	05/02/98
n-Propylbenzene	103-65-1	ND	5	ug/L	05/02/98
Styrene	100-42-5	ND	5	ug/L	05/02/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/02/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/02/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/02/98
Toluene	108-88-3	ND	5	ug/L	05/02/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/02/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/02/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/02/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/02/98
Trichloroethene	79-01-6	ND	5	ug/L	05/02/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/02/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/02/98
1,2,4-Trimethylbenzene	95-63-6	110 *	5	ug/L	05/02/98
1,3,5-Trimethylbenzene	108-67-8	10 *	5	ug/L	05/02/98
Vinyl Chloride	75-01-4	ND	10	ug/L	05/02/98
Xylenes, Total	1330-20-7	10 *	10	ug/L	05/02/98
Acetone	67-64-1	ND	100	ug/L	05/02/98
2-Butanone	78-93-3	ND	100	ug/L	05/02/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/02/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/02/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/02/98
2-Hexanone	591-78-6	ND	50	ug/L	05/02/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/02/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/02/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/02/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/01/98
Arsenic	EPA 6010	ND	0.005	mg/L	05/05/98
Barium	EPA 6010	0.41 *	0.01	mg/L	05/01/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/01/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/01/98
Cobalt	EPA 6010	0.006 *	0.005	mg/L	05/01/98
Chromium	EPA 6010	ND	0.01	mg/L	05/01/98

GEOMATRIX CONSULTANTS

SAMPLE ID: GGW13 duplicate GGW3
AEN LAB NO: 9804232-09
AEN WORK ORDER: 9804232
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/22/98
DATE RECEIVED: 04/22/98
REPORT DATE: 06/02/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Copper	EPA 6010	ND	0.01	mg/L	05/01/98
Mercury	EPA 7470	ND	0.0002	mg/L	04/26/98
Molybdenum	EPA 6010	ND	0.01	mg/L	05/01/98
Nickel	EPA 6010	ND	0.01	mg/L	05/01/98
Lead	EPA 6010	ND	0.04	mg/L	05/01/98
Antimony	EPA 6010	ND	0.02	mg/L	05/01/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/01/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/01/98
Zinc	EPA 6010	0.08 *	0.01	mg/L	05/01/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9804232
CLIENT PROJECT ID: 4710

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

!: Indicates result outside of established laboratory QC limits.

ANALYSIS: Arsenic

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:
LAB ID: IFW_PBW_W
PREPARED:
ANALYZED: 05/05/98
INSTR RUN: ICP\980505212400/10/
BATCH ID: IFW050598-W
DILUTION: 0.200

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Arsenic	ND		0.0050						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:
LAB ID: IFW_LCD_W
PREPARED:
ANALYZED: 05/05/98
INSTR RUN: ICP\980505212400/12/10
BATCH ID: IFW050598-W
DILUTION: 0.200

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Arsenic	0.0749	ND	0.0050	0.0800	93.6	80	120		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:
LAB ID: IFW_LCS_W
PREPARED:
ANALYZED: 05/05/98
INSTR RUN: ICP\980505212400/11/10
BATCH ID: IFW050598-W
DILUTION: 0.200

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Arsenic	0.0751	ND	0.0050	0.0800	93.9	80	120		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:
LAB ID: IFW_LCR_W
PREPARED:
ANALYZED: 05/05/98
INSTR RUN: ICP\980505212400/13/11
BATCH ID: IFW050598-W
DILUTION: 0.200

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Arsenic	0.0749	0.0751	0.0050					0.267	15

ANALYSIS: Extractable TPH

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: BLKW-0501-1 | INSTR RUN: GC_C\980501000000/15/
INSTRUMENT: HP 5890 | PREPARED: 05/01/98 | BATCH ID: DSLW050198-1
UNITS: mg/L | ANALYZED: 05/04/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Diesel		ND		0.05						
Motor Oil		ND		0.2						
n-Pentacosane	(surr)	92.3			100	92.3	60	130		

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCDW-0501-1 | INSTR RUN: GC_C\980501000000/17/15
INSTRUMENT: HP 5890 | PREPARED: 05/01/98 | BATCH ID: DSLW050198-1
UNITS: mg/L | ANALYZED: 05/04/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Diesel		1.97	ND	0.05	2.00	98.5	60	130		
n-Pentacosane	(surr)	91.2	92.3		100	91.2	60	130		

SAMPLE TYPE: Laboratory Control Spike | LAB ID: LCSW-0501-1 | INSTR RUN: GC_C\980501000000/16/15
INSTRUMENT: HP 5890 | PREPARED: 05/01/98 | BATCH ID: DSLW050198-1
UNITS: mg/L | ANALYZED: 05/04/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Diesel		1.72	ND	0.05	2.00	86.0	60	130		
n-Pentacosane	(surr)	81.5	92.3		100	81.5	60	130		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Laboratory Control Sample Duplicate | LAB ID: LCRW-0501-1 | INSTR RUN: GC_C\980501000000/18/16
INSTRUMENT: HP 5890 | PREPARED: 05/01/98 | BATCH ID: DSLW050198-1
UNITS: mg/L | ANALYZED: 05/04/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Diesel		1.97	1.72	0.05					13.6	20
Motor Oil		ND	ND	0.2					0	
n-Pentacosane	(surr)	91.2	81.5		100	91.2	60	130		

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client | LAB ID: 9804232-03D | INSTR RUN: GC_C\980501000000/25/
INSTRUMENT: HP 5890 | PREPARED: 05/01/98 | BATCH ID: DSLW050198-1
UNITS: mg/L | ANALYZED: 05/02/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
n-Pentacosane	(surr)	107.8			100	108	60	130		

ANALYSIS: Extractable TPH

MATRIX: Water

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP 5890
UNITS: mg/L
METHOD:

LAB ID: 9804232-090
PREPARED: 05/01/98
ANALYZED: 05/02/98

INSTR RUN: GC_C\980501000000/26/
BATCH ID: DSLW050198-1
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
n-Pentacosane	(surr)	100.9			100	101	60	130		

ANALYSIS: Mercury

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: HGW_BLNK | INSTR RUN: HG\980426133000/1/
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW042698
UNITS: mg/L | ANALYZED: 04/26/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	ND		0.0002						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGW_LCD | INSTR RUN: HG\980426133000/3/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW042698
UNITS: mg/L | ANALYZED: 04/26/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00203	ND	0.0002	0.00200	102	80	120		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGW_LCS | INSTR RUN: HG\980426133000/2/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW042698
UNITS: mg/L | ANALYZED: 04/26/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00200	ND	0.0002	0.00200	100	80	120		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: HGW_LCR | INSTR RUN: HG\980426133000/4/2
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW042698
UNITS: mg/L | ANALYZED: 04/26/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00203	0.00200	0.0002					1.49	20

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: HGS_BLNK | INSTR RUN: HG\980503123000/1/
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	ND		0.06						

ANALYSIS: Mercury

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGS_LCD | INSTR RUN: HG\980503123000/3/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	ND	0.06	0.400	95.8	75	125		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGS_LCS | INSTR RUN: HG\980503123000/2/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	ND	0.06	0.400	95.8	75	125		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: HGS_LCR | INSTR RUN: HG\980503123000/4/2
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGS053598
UNITS: mg/kg | ANALYZED: 05/03/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in soil EPA 7471	0.383	0.383	0.06					0	25

ANALYSIS: Metals Scan by ICP

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFW_PBW_K | INSTR RUN: ICP\980501200300/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW0402898-K
UNITS: mg/L | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag Silver	ND		0.005						
Ba Barium	ND		0.01						
Be Beryllium	ND		0.002						
Cd Cadmium	ND		0.005						
Co Cobalt	ND		0.005						
Cr Chromium	ND		0.01						
Cu Copper	ND		0.01						
Mo Molybdenum	ND		0.01						
Ni Nickel	ND		0.01						
Pb Lead	ND		0.04						
Sb Antimony	ND		0.02						
Tl Thallium	ND		0.05						
V Vanadium	ND		0.005						
Zn Zinc	ND		0.01						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFW_BLNK_W | INSTR RUN: ICP\980505212400/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag Silver	ND		0.005						
Ba Barium	ND		0.01						
Be Beryllium	ND		0.002						
Cd Cadmium	ND		0.005						
Co Cobalt	ND		0.005						
Cr Chromium	ND		0.01						
Cu Copper	ND		0.01						
Mo Molybdenum	ND		0.01						
Ni Nickel	ND		0.01						
Pb Lead	ND		0.04						
Sb Antimony	ND		0.02						
Tl Thallium	ND		0.05						
V Vanadium	ND		0.005						
Zn Zinc	ND		0.01						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCD_K | INSTR RUN: ICP\980501200300/3/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW0402898-K
UNITS: mg/L | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag Silver	0.0256	ND	0.005	0.0250	102	80	120		
Ba Barium	1.04	ND	0.01	1.00	104	80	120		
Be Beryllium	0.0262	ND	0.002	0.0250	105	80	120		
Cd Cadmium	0.0542	ND	0.005	0.0500	108	80	120		
Co Cobalt	0.262	ND	0.005	0.250	105	80	120		
Cr Chromium	0.103	ND	0.01	0.100	103	80	120		
Cu Copper	0.1285	ND	0.01	0.125	103	80	120		
Mo Molybdenum	0.208	ND	0.01	0.200	104	80	120		
Ni Nickel	0.254	ND	0.01	0.250	102	80	120		
Pb Lead	0.531	ND	0.04	0.500	106	80	120		
Sb Antimony	0.497	ND	0.02	0.500	99.4	80	120		
Tl Thallium	0.495	ND	0.05	0.500	99.0	80	120		
V Vanadium	0.259	ND	0.005	0.250	104	80	120		
Zn Zinc	0.261	ND	0.01	0.250	104	80	120		

ANALYSIS: Metals Scan by ICP

MATRIX: Water

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCS_K | INSTR RUN: ICP\980501200300/2/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW0402898-K
UNITS: mg/L | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0257	ND	0.005	0.0250	103	80	120		
Ba	Barium	1.01	ND	0.01	1.00	101	80	120		
Be	Beryllium	0.0258	ND	0.002	0.0250	103	80	120		
Cd	Cadmium	0.0506	ND	0.005	0.0500	101	80	120		
Co	Cobalt	0.253	ND	0.005	0.250	101	80	120		
Cr	Chromium	0.101	ND	0.01	0.100	101	80	120		
Cu	Copper	0.121	ND	0.01	0.125	96.8	80	120		
Mo	Molybdenum	0.198	ND	0.01	0.200	99.0	80	120		
Ni	Nickel	0.246	ND	0.01	0.250	98.4	80	120		
Pb	Lead	0.505	ND	0.04	0.500	101	80	120		
Sb	Antimony	0.473	ND	0.02	0.500	94.6	80	120		
Tl	Thallium	0.481	ND	0.05	0.500	96.2	80	120		
V	Vanadium	0.251	ND	0.005	0.250	100	80	120		
Zn	Zinc	0.255	ND	0.01	0.250	102	80	120		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCD_W | INSTR RUN: ICP\980505212400/3/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.00
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0230	ND	0.005	0.0250	92.0	80	120		
Ba	Barium	0.958	ND	0.01	1.00	95.8	80	120		
Be	Beryllium	0.0230	ND	0.002	0.0250	92.0	80	120		
Cd	Cadmium	0.0480	ND	0.005	0.0500	96.0	80	120		
Co	Cobalt	0.240	ND	0.005	0.250	96.0	80	120		
Cr	Chromium	0.0962	ND	0.01	0.100	96.2	80	120		
Cu	Copper	0.115	ND	0.01	0.125	92.0	80	120		
Mo	Molybdenum	0.186	ND	0.01	0.200	93.0	80	120		
Ni	Nickel	0.232	ND	0.01	0.250	92.8	80	120		
Pb	Lead	0.480	ND	0.04	0.500	96.0	80	120		
Sb	Antimony	0.437	ND	0.02	0.500	87.4	80	120		
Tl	Thallium	0.481	ND	0.05	0.500	96.2	80	120		
V	Vanadium	0.238	ND	0.005	0.250	95.2	80	120		
Zn	Zinc	0.232	ND	0.01	0.250	92.8	80	120		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCS_W | INSTR RUN: ICP\980505212400/2/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.00
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0220	ND	0.005	0.0250	88.0	80	120		
Ba	Barium	0.950	ND	0.01	1.00	95.0	80	120		
Be	Beryllium	0.0224	ND	0.002	0.0250	89.6	80	120		
Cd	Cadmium	0.0472	ND	0.005	0.0500	94.4	80	120		
Co	Cobalt	0.236	ND	0.005	0.250	94.4	80	120		
Cr	Chromium	0.0912	ND	0.01	0.100	91.2	80	120		
Cu	Copper	0.113	ND	0.01	0.125	90.4	80	120		
Mo	Molybdenum	0.182	ND	0.01	0.200	91.0	80	120		
Ni	Nickel	0.229	ND	0.01	0.250	91.6	80	120		
Pb	Lead	0.471	ND	0.04	0.500	94.2	80	120		
Sb	Antimony	0.430	ND	0.02	0.500	86.0	80	120		
Tl	Thallium	0.487	ND	0.05	0.500	97.4	80	120		
V	Vanadium	0.235	ND	0.005	0.250	94.0	80	120		
Zn	Zinc	0.232	ND	0.01	0.250	92.8	80	120		

ANALYSIS: Metals Scan by ICP

MATRIX: Water

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCR_K
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980501200300/4/2
BATCH ID: IFW0402898-K
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0256	0.0257	0.005					0.390	20
Ba	Barium	1.04	1.01	0.01					2.93	20
Be	Beryllium	0.0262	0.0258	0.002					1.54	20
Cd	Cadmium	0.0542	0.0506	0.005					6.87	20
Co	Cobalt	0.262	0.253	0.005					3.50	20
Cr	Chromium	0.103	0.101	0.01					1.96	20
Cu	Copper	0.125	0.121	0.01					3.25	20
Mo	Molybdenum	0.208	0.198	0.01					4.93	20
Ni	Nickel	0.254	0.246	0.01					3.20	20
Pb	Lead	0.531	0.505	0.04					5.02	20
Sb	Antimony	0.497	0.473	0.02					4.95	20
Tl	Thallium	0.495	0.481	0.05					2.87	20
V	Vanadium	0.259	0.251	0.005					3.14	20
Zn	Zinc	0.261	0.255	0.01					2.33	20

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCR_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/4/2
BATCH ID: IFW050598-W
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0230	0.0220	0.005					4.44	20
Ba	Barium	0.958	0.950	0.01					0.839	20
Be	Beryllium	0.0230	0.0224	0.002					2.64	20
Cd	Cadmium	0.0480	0.0472	0.005					1.68	20
Co	Cobalt	0.240	0.236	0.005					1.68	20
Cr	Chromium	0.0962	0.0912	0.01					5.34	20
Cu	Copper	0.115	0.113	0.01					1.75	20
Mo	Molybdenum	0.186	0.182	0.01					2.17	20
Ni	Nickel	0.232	0.229	0.01					1.30	20
Pb	Lead	0.480	0.471	0.04					1.89	20
Sb	Antimony	0.437	0.430	0.02					1.61	20
Tl	Thallium	0.481	0.487	0.05					1.24	20
V	Vanadium	0.238	0.235	0.005					1.27	20
Zn	Zinc	0.232	0.232	0.01					0	20

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: MD04232-01I
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980501200300/7/5
BATCH ID: IFW0402898-K
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0251	ND	0.005	0.0250	100	80	120		
Ba	Barium	1.25	0.228	0.01	1.00	102	80	120		
Be	Beryllium	0.0258	ND	0.002	0.0250	103	80	120		
Cd	Cadmium	0.0514	ND	0.005	0.0500	103	80	120		
Co	Cobalt	0.256	0.00530	0.005	0.250	100	80	120		
Cr	Chromium	0.0998	ND	0.01	0.100	99.8	80	120		
Cu	Copper	0.124	ND	0.01	0.125	99.2	80	120		
Mo	Molybdenum	0.231	0.0285	0.01	0.200	101	80	120		
Ni	Nickel	0.256	0.0107	0.01	0.250	98.1	80	120		
Pb	Lead	0.502	ND	0.04	0.500	100	80	120		
Sb	Antimony	0.481	ND	0.02	0.500	96.2	80	120		
Tl	Thallium	0.526	ND	0.05	0.500	105	80	120		
V	Vanadium	0.255	ND	0.005	0.250	102	80	120		

ANALYSIS: Metals Scan by ICP

MATRIX: Water

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: MS04232-011
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980501200300/6/5
BATCH ID: IFW0402898-K
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0252	ND	0.005	0.0250	101	80	120		
Ba	Barium	1.23	0.228	0.01	1.00	100	80	120		
Be	Beryllium	0.0249	ND	0.002	0.0250	99.6	80	120		
Cd	Cadmium	0.0479	ND	0.005	0.0500	95.8	80	120		
Co	Cobalt	0.250	0.00530	0.005	0.250	97.9	80	120		
Cr	Chromium	0.0981	ND	0.01	0.100	98.1	80	120		
Cu	Copper	0.121	ND	0.01	0.125	96.8	80	120		
Mo	Molybdenum	0.224	0.0285	0.01	0.200	97.8	80	120		
Ni	Nickel	0.250	0.0107	0.01	0.250	95.7	80	120		
Pb	Lead	0.494	ND	0.04	0.500	98.8	80	120		
Sb	Antimony	0.470	ND	0.02	0.500	94.0	80	120		
Tl	Thallium	0.489	ND	0.05	0.500	97.8	80	120		
V	Vanadium	0.248	ND	0.005	0.250	99.2	80	120		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: MR04232-011
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980501200300/8/6
BATCH ID: IFW0402898-K
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0251	0.0252	0.005					0.398	20
Ba	Barium	1.25	1.23	0.01					1.61	20
Be	Beryllium	0.0258	0.0249	0.002					3.55	20
Cd	Cadmium	0.0514	0.0479	0.005					7.05	20
Co	Cobalt	0.256	0.250	0.005					2.37	20
Cr	Chromium	0.0998	0.0981	0.01					1.72	20
Cu	Copper	0.124	0.121	0.01					2.45	20
Mo	Molybdenum	0.231	0.224	0.01					3.08	20
Ni	Nickel	0.256	0.250	0.01					2.37	20
Pb	Lead	0.502	0.494	0.04					1.61	20
Sb	Antimony	0.481	0.470	0.02					2.31	20
Tl	Thallium	0.526	0.489	0.05					7.29	20
V	Vanadium	0.255	0.248	0.005					2.78	20

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: SAND_PBS
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980430115500/1/
BATCH ID: IFS043098-Q
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	ND		0.5						
Ba	Barium	ND		5						
Be	Beryllium	ND		0.5						
Cd	Cadmium	ND		0.5						
Co	Cobalt	ND		1						
Cr	Chromium	ND		2						
Cu	Copper	ND		2						
Mo	Molybdenum	ND		2						
Ni	Nickel	ND		2						
Pb	Lead	ND		4						

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: SAND_PBS | INSTR RUN: ICP\980430115500/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Tl	Thallium	ND		50						
V	Vanadium	ND		2						
Zn	Zinc	ND		5						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFS_PBS_Z | INSTR RUN: ICP\980508123100/1/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 05/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	ND		0.5						
As	Arsenic	ND		10						
Ba	Barium	ND		5						
Be	Beryllium	ND		0.5						
Cd	Cadmium	ND		0.5						
Co	Cobalt	ND		1						
Cr	Chromium	ND		2						
Cu	Copper	ND		2						
Mo	Molybdenum	ND		2						
Ni	Nickel	ND		2						
Pb	Lead	ND		4						
Se	Selenium	ND		20						
Tl	Thallium	ND		50						
V	Vanadium	ND		2						
Zn	Zinc	ND		5						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFS_PBS_Z | INSTR RUN: ICP\980508123100/15/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS050698-Z
UNITS: mg/kg | ANALYZED: 06/08/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: SAND_LCD | INSTR RUN: ICP\980430115500/3/1
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFS043098-Q
UNITS: mg/kg | ANALYZED: 05/01/98 | DILUTION: 1.000000
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.76	ND	0.5	10.0	97.6	75	125		
Ba	Barium	209	ND	5	200	105	75	125		
Be	Beryllium	9.41	ND	0.5	10.0	94.1	75	125		
Cd	Cadmium	9.72	ND	0.5	10.0	97.2	75	125		
Co	Cobalt	103	ND	1	100	103	75	125		
Cr	Chromium	103	ND	2	100	103	75	125		
Cu	Copper	99.5	ND	2	100	99.5	75	125		
Mo	Molybdenum	94.9	ND	2	100	94.9	75	125		
Ni	Nickel	102	ND	2	100	102	75	125		
Pb	Lead	101	ND	4	100	101	75	125		
Tl	Thallium	398	ND	50	400	99.5	75	125		
V	Vanadium	102	ND	2	100	102	75	125		
Zn	Zinc	98.9	ND	5	100	98.9	75	125		

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: SAND_LCS
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: ICP\980430115500/2/1
BATCH ID: IFS043098-Q
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.89	ND	0.5	10.0	98.9	75	125		
Ba	Barium	210	ND	5	200	105	75	125		
Be	Beryllium	9.37	ND	0.5	10.0	93.7	75	125		
Cd	Cadmium	9.89	ND	0.5	10.0	98.9	75	125		
Co	Cobalt	103	ND	1	100	103	75	125		
Cr	Chromium	104	ND	2	100	104	75	125		
Cu	Copper	99.7	ND	2	100	99.7	75	125		
Mo	Molybdenum	90.5	ND	2	100	90.5	75	125		
Ni	Nickel	102	ND	2	100	102	75	125		
Pb	Lead	103	ND	4	100	103	75	125		
Tl	Thallium	401	ND	50	400	100	75	125		
V	Vanadium	103	ND	2	100	103	75	125		
Zn	Zinc	98.5	ND	5	100	98.5	75	125		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: IFS_LCD_Z
PREPARED:
ANALYZED: 05/08/98

INSTR RUN: ICP\980508123100/4/2
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.56	ND	0.5	5.00	91.2	75	125		
As	Arsenic	7.51	ND	10	10.0	75.1	75	125		
Ba	Barium	101	ND	5	100	101	75	125		
Be	Beryllium	4.65	ND	0.5	5.00	93.0	75	125		
Cd	Cadmium	5.10	ND	0.5	5.50	92.7	75	125		
Co	Cobalt	49.3	ND	1	50.0	98.6	75	125		
Cr	Chromium	49.0	ND	2	50.0	98.0	75	125		
Cu	Copper	48.0	ND	2	50.0	96.0	75	125		
Mo	Molybdenum	45.9	ND	2	50.0	91.8	75	125		
Ni	Nickel	48.3	ND	2	50.0	96.6	75	125		
Pb	Lead	53.9	ND	4	55.0	98.0	75	125		
Se	Selenium	17.7	ND	20	20.0	88.5	75	125		
Tl	Thallium	194	ND	50	210	92.4	75	125		
V	Vanadium	49.8	ND	2	50.0	99.6	75	125		
Zn	Zinc	46.6	ND	5	50.0	93.2	75	125		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: IFS_LCD_Z
PREPARED:
ANALYZED: 06/08/98

INSTR RUN: ICP\980508123100/18/16
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	45.8	ND	5	50.0	91.6	75	125		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: IFS_LCS_Z
PREPARED:
ANALYZED: 05/08/98

INSTR RUN: ICP\980508123100/3/2
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.42	ND	0.5	5.00	88.4	75	125		
As	Arsenic	7.55	ND	10	10.0	75.5	75	125		
Ba	Barium	98.7	ND	5	100	98.7	75	125		
Be	Beryllium	4.49	ND	0.5	5.00	89.8	75	125		
Cd	Cadmium	5.06	ND	0.5	5.50	92.0	75	125		
Co	Cobalt	47.7	ND	1	50.0	95.4	75	125		
Cr	Chromium	47.7	ND	2	50.0	95.4	75	125		
Cu	Copper	46.3	ND	2	50.0	92.6	75	125		
Mo	Molybdenum	43.6	ND	2	50.0	87.2	75	125		
Ni	Nickel	46.8	ND	2	50.0	93.6	75	125		

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:
LAB ID: IFS_LCS_Z
PREPARED:
ANALYZED: 05/08/98
INSTR RUN: ICP\980508123100/3/2
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Pb	Lead	52.7	ND	4	55.0	95.8	75	125		
Se	Selenium	16.4	ND	20	20.0	82.0	75	125		
Tl	Thallium	187	ND	50	210	89.0	75	125		
V	Vanadium	48.2	ND	2	50.0	96.4	75	125		
Zn	Zinc	44.6	ND	5	50.0	89.2	75	125		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:
LAB ID: IFS_LCS_Z
PREPARED:
ANALYZED: 06/08/98
INSTR RUN: ICP\980508123100/17/16
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	44.1	ND	5	50.0	88.2	75	125		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:
LAB ID: SAND_LCR
PREPARED:
ANALYZED: 05/01/98
INSTR RUN: ICP\980430115500/4/2
BATCH ID: IFS043098-Q
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	9.76	9.89	0.5					1.32	25
Ba	Barium	209	210	5					0.477	25
Be	Beryllium	9.41	9.37	0.5					0.426	25
Cd	Cadmium	9.72	9.89	0.5					1.73	25
Co	Cobalt	103	103	1					0	25
Cr	Chromium	103	104	2					0.966	25
Cu	Copper	99.5	99.7	2					0.201	25
Mo	Molybdenum	94.9	90.5	2					4.75	25
Ni	Nickel	102	102	2					0	25
Pb	Lead	101	103	4					1.96	25
Tl	Thallium	398	401	50					0.751	25
V	Vanadium	102	103	2					0.976	25
Zn	Zinc	98.9	98.5	5					0.405	25

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:
LAB ID: IFS_LCR_Z
PREPARED:
ANALYZED: 05/08/98
INSTR RUN: ICP\980508123100/5/3
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	4.56	4.42	0.5					3.12	25
As	Arsenic	7.51	7.55	10					0.531	25
Ba	Barium	101	98.7	5					2.30	25
Be	Beryllium	4.65	4.49	0.5					3.50	25
Cd	Cadmium	5.10	5.06	0.5					0.787	25
Co	Cobalt	49.3	47.7	1					3.30	25
Cr	Chromium	49.0	47.7	2					2.69	25
Cu	Copper	48.0	46.3	2					3.61	25
Mo	Molybdenum	45.9	43.6	2					5.14	25
Ni	Nickel	48.3	46.8	2					3.15	25
Pb	Lead	53.9	52.7	4					2.25	25
Se	Selenium	17.7	16.4	20					7.62	25
Tl	Thallium	194	187	50					3.67	25
V	Vanadium	49.8	48.2	2					3.27	25
Zn	Zinc	46.6	44.6	5					4.39	25

ANALYSIS: Metals Scan by ICP

MATRIX: Soil/Bulk

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/kg
METHOD:

LAB ID: IFS_LCR_Z
PREPARED:
ANALYZED: 06/08/98

INSTR RUN: ICP\980508123100/19/17
BATCH ID: IFS050698-Z
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Sb	Antimony	45.8	44.1	5					3.78	25

ANALYSIS: Selenium

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: IFW_PBW_W | INSTR RUN: ICP\980505212400/14/
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 0.200
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Selenium	ND		0.01						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCD_W | INSTR RUN: ICP\980505212400/16/14
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 0.200
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Selenium	0.0906	ND	0.01	0.100	90.6	80	120		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: IFW_LCS_W | INSTR RUN: ICP\980505212400/15/14
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 0.200
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Selenium	0.0866	ND	0.01	0.100	86.6	80	120		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: IFW_LCR_W | INSTR RUN: ICP\980505212400/17/15
INSTRUMENT: TJA Enviro 36 | PREPARED: | BATCH ID: IFW050598-W
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 0.200
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Selenium	0.0906	0.0866	0.01					4.51	15

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0501
PREPARED:
ANALYZED: 05/01/98

INSTR RUN: GCMS12\980501000000/1/
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	88.3			100	88.3	65	140		
Toluene-d8	(surr)	102			100	102	70	135		
p-BFB	(surr)	102			100	102	70	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		5						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						
1,1-Dichloropropene		ND		5						
Ethylbenzene		ND		5						
Hexachlorobutadiene		ND		5						
Isopropylbenzene		ND		5						
p-Isopropyltoluene		ND		5						
Methylene Chloride		ND		10						
Naphthalene		ND		5						
n-Propylbenzene		ND		5						
Styrene		ND		5						
1,1,1,2-Tetrachloroethane		ND		5						
1,1,2,2-Tetrachloroethane		ND		5						
Tetrachloroethene		ND		5						
1,2,3-Trichlorobenzene		ND		5						
1,2,4-Trichlorobenzene		ND		5						
1,1,1-Trichloroethane		ND		5						
1,1,2-Trichloroethane		ND		5						
Trichlorofluoromethane		ND		5						
1,2,3-Trichloropropane		ND		5						
1,2,4-Trimethylbenzene		ND		5						
1,3,5-Trimethylbenzene		ND		5						
Vinyl Chloride		ND		10						
Xylenes, Total		ND		10						
Trichlorotrifluoroethane		ND		5						
Acetone		ND		100						
Acrylonitrile		ND		10						
2-Butanone		ND		100						

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: BLNK_0501 | INSTR RUN: GCMS12\980501000000/1/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12W050198
UNITS: ug/L | ANALYZED: 05/01/98 | DILUTION: 1.00
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: BLNK_0505 | INSTR RUN: GCMS12\980505020000/1/
INSTRUMENT: HP mass spec for Volatiles | PREPARED: | BATCH ID: MS12W050598
UNITS: ug/L | ANALYZED: 05/05/98 | DILUTION: 1.00
METHOD:

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	103			100	103	65	140		
Toluene-d8	(surr)	101			100	101	70	135		
p-BFB	(surr)	99.0			100	99.0	70	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		5						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						
1,1-Dichloropropene		ND		5						
Ethylbenzene		ND		5						
Hexachlorobutadiene		ND		5						
Isopropylbenzene		ND		5						
p-Isopropyltoluene		ND		5						
Methylene Chloride		ND		10						

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0505
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: GCMS12\980505020000/1/
BATCH ID: MS12W050598
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Naphthalene	ND		5						
n-Propylbenzene	ND		5						
Styrene	ND		5						
1,1,1,2-Tetrachloroethane	ND		5						
1,1,2,2-Tetrachloroethane	ND		5						
Tetrachloroethene	ND		5						
1,2,3-Trichlorobenzene	ND		5						
1,2,4-Trichlorobenzene	ND		5						
1,1,1-Trichloroethane	ND		5						
1,1,2-Trichloroethane	ND		5						
Trichlorofluoromethane	ND		5						
1,2,3-Trichloropropane	ND		5						
1,2,4-Trimethylbenzene	ND		5						
1,3,5-Trimethylbenzene	ND		5						
Vinyl Chloride	ND		10						
Xylenes, Total	ND		10						
Trichlorotrifluoroethane	ND		5						
Acetone	ND		100						
Acrylonitrile	ND		10						
2-Butanone	ND		100						
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: LCS_0506
PREPARED:
ANALYZED: 05/06/98

INSTR RUN: GCMS12\980505020000/4/1
BATCH ID: MS12W050598
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	105	103		100	105	65	135		
Toluene-d8	(surr)	102	101		100	102	70	130		
p-BFB	(surr)	97.3	99.0		100	97.3	70	130		
1,1-Dichloroethene		44.7	ND	5	50.0	89.4	70	130		
Benzene		54.2	ND	5	50.0	108	70	130		
Trichloroethene		55.4	ND	5	50.0	111	70	130		
Toluene		53.2	ND	5	50.0	106	70	130		
Chlorobenzene		63.8	ND	5	50.0	128	70	130		

ANALYSIS: Volatile GC/MS

MATRIX: Water

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MS04232-03F
PREPARED:
ANALYZED: 05/02/98
INSTR RUN: GCMS12\980501000000/7/4
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	100	106		100	100	65	135		
Toluene-d8	(surr)	107	105		100	107	70	130		
p-BFB	(surr)	91.3	95.4		100	91.3	70	130		
1,1-Dichloroethene		48.7	ND	5	50.0	97.4	70	130		
Benzene		51.3	ND	5	50.0	103	70	130		
Trichloroethene		56.2	ND	5	50.0	112	70	130		
Toluene		48.9	ND	5	50.0	97.8	70	130		
Chlorobenzene		62.5	ND	5	50.0	125	70	130		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MR04232-03F
PREPARED:
ANALYZED: 05/02/98
INSTR RUN: GCMS12\980501000000/9/7
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	151	100		100	151 !	65	135		
Toluene-d8	(surr)	93.4	107		100	93.4	70	130		
p-BFB	(surr)	104	91.3		100	104	70	130		
1,1-Dichloroethene		45.8	48.7	5	50.0				6.14	20
Benzene		55.3	51.3	5	50.0				7.50	20
Trichloroethene		58.0	56.2	5	50.0				3.15	20
Toluene		55.8	48.9	5	50.0				13.2	20
Chlorobenzene		66.6	62.5	5	50.0				6.35	20

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804232-03F
PREPARED:
ANALYZED: 05/01/98
INSTR RUN: GCMS12\980501000000/4/
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	106			100	106	65	135		
Toluene-d8	(surr)	105			100	105	70	130		
p-BFB	(surr)	95.4			100	95.4	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804232-05F
PREPARED:
ANALYZED: 05/01/98
INSTR RUN: GCMS12\980501000000/5/
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	121			100	121	65	135		
Toluene-d8	(surr)	103			100	103	70	130		
p-BFB	(surr)	102			100	102	70	130		

ANALYSIS: Volatile GC/MS

MATRIX: Water

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804232-09F
PREPARED:
ANALYZED: 05/02/98
INSTR RUN: GCMS12\980501000000/6/
BATCH ID: MS12W050198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	132			100	132	65	135		
Toluene-d8	(surr)	95.5			100	95.5	70	130		
p-BFB	(surr)	96.1			100	96.1	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804232-01B
PREPARED:
ANALYZED: 05/06/98
INSTR RUN: GCMS12\980505020000/5/
BATCH ID: MS12W050598
DILUTION: 10.0

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	1180			1000	118.0	65	135		
Toluene-d8	(surr)	971			1000	97.1	70	130		
p-BFB	(surr)	960			1000	96.0	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804232-07H
PREPARED:
ANALYZED: 05/06/98
INSTR RUN: GCMS12\980505020000/6/
BATCH ID: MS12W050598
DILUTION: 100

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	8570			10000	85.70	65	135		
Toluene-d8	(surr)	9640			10000	96.40	70	130		
p-BFB	(surr)	10100			10000	101.00	70	130		

QUALITY CONTROL DATA

METHOD: EPA 8020, 5030 GCFID

AEN JOB NO: 9804232
AEN LAB NO: E043003
DATE ANALYZED: 04/30/98
INSTRUMENT: E
MATRIX: WATER

Method Blank

	CAS #	Result (ug/L)	Reporting Limit (ug/L)
Benzene	71-43-2	ND	0.5
Toluene	108-88-3	ND	0.5
Ethylbenzene	100-41-4	ND	0.5
Xylenes, Total	1330-20-7	ND	2
HCs as Gasoline		ND mg/L	0.05 mg/L

QUALITY CONTROL DATA

METHOD: EPA 8020, 5030 GCFID

AEN JOB NO: 9804232
INSTRUMENT: E
MATRIX: WATER

Surrogate Standard Recovery Summary

Date Analyzed	Client Id.	Lab Id.	Percent Recovery Fluorobenzene
04/30/98	GGW2	03	95
04/30/98	GGW3	05	95
04/30/98	GGW13	09	95
QC Limits:			70-130

DATE ANALYZED: 04/30/98
SAMPLE SPIKED: LCS
INSTRUMENT: E

Laboratory Control Sample Recovery

Analyte	Spike Added (ug/L)	LCS Result (ug/L)	LCD Result (ug/L)	LCS Percent Recovery	RPD	QC Limits Percent Recovery	QC Limits RPD
Benzene	200	216	221	108	2	70-130	20
Toluene	200	210	213	105	1	70-130	20
Ethylbenzene	200	208	211	104	1	70-130	20
Total Xylenes	600	621	620	104	<1	70-130	20

*** END OF REPORT ***

12553 9804232

CHAIN-OF-CUSTODY RECORD

№ 11029 | Date: 4-22-98 | Page 1 of 1

Project No.: 4710

Samplers (Signatures): Preston Gaines

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	Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel	VOCs by 8260	Metals CAM 17	HOLD	Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers
1-I	4-22	1350	GGW1								X	X		Y	W	Y/N	9
52A		1350	GGW1-1.0									X		Y	S	N	1
A-H		1315	GGW2						X	X	X	*		Y	W	Y/N	8
A		1150	GGW2-2.0									X		Y	S	N	1
A-I		1515	GGW3 ♣						X	X	X	*		Y	W	Y/N	9
iA		0950	GGW3-1.5									X		Y	S	N	1
A-I		1440	GGW4								X	X		Y	W	Y/N	9
iA		0915	GGW4-1.5									X		Y	S	N	1
A-I		1530	GGW13						X	X	X	*		Y	W	Y/N	9
ABC	↓	1525	Blank										X	Y	W	Y	3

ANALYSES

REMARKS

Additional Comments

VOCs by 8260

~~TPH~~ GGW-1 & GGW-4.
Metals by CAM-17 (field filtered - plastic HNO_3)

· TPHg, TPHd by Modified 8015

Diesel: ~~filter~~ & silica gel first clean up

GGW-2, GGW-3, GGW-13
* Do not use plastic bottles for metals - filter sample from extra amber & analyze for dissolved CCR-17. ufuular BZ

Turnaround time: Standard

Results to: Jen Patterson

Total No. of containers: 51

Relinquished by (signature)	Date	Relinquished by (signature)	Date	Relinquished by (signature)	Date
Preston Gaines	4/22/98	Rick Gilmore	4-22-98		
Printed Name: Preston Gaines	Time: 1645	Printed Name: RICK GILMORE	Time: 18:30	Printed Name:	Time:
Company: Geomatrix		Company: AEN		Company:	
Received by (signature)	**Date**	**Received by (signature)**	**Date**	**Received by (signature)**	**Date**
Rick Gilmore	4-22-98	Greg Glaser	4/22		
Printed Name: RICK GILMORE	Time: 16:45	Printed Name: Greg Glaser	Time: 1830	Printed Name:	Time:
Company: AEN		Company: AEN		Company:	

Method of Shipment: pick-up

Laboratory Comments and Log No.:
Jen J. Patterson - Hold GGW3 & GGW13 1L Plastic only - do not use for metals
Filter & preserve duplicate Diesel amber for GGW3 & GGW13 for metals.
R. Bye

Geomatrix Consultants
100 Pine Street, 10th Floor
San Francisco, California 94111
415 434 9400

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

GEOMATRIX CONSULTANTS
100 PINE ST., SUITE 1000
SAN FRANCISCO, CA 94111

ATTN: JENNIFER PATTERSON
CLIENT PROJ. ID: 4710

C.O.C. NUMBER: 11007

REPORT DATE: 05/26/98

DATE(S) SAMPLED: 04/27/98

DATE RECEIVED: 04/28/98

AEN WORK ORDER: 9804273

PROJECT SUMMARY:

On April 28, 1998, this laboratory received 6 water sample(s).

Client requested sample(s) be analyzed for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Reviewed by:

William Luoto

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-4
AEN LAB NO: 9804273-01
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	05/05/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/21/98
Bromobenzene	108-86-1	ND	5	ug/L	05/21/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/21/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/21/98
Bromoform	75-25-2	ND	5	ug/L	05/21/98
Bromomethane	74-83-9	ND	10	ug/L	05/21/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/21/98
sec-Butylbenzene	135-98-8	15 *	5	ug/L	05/21/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/21/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/21/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/21/98
Chloroethane	75-00-3	ND	10	ug/L	05/21/98
Chloroform	67-66-3	ND	5	ug/L	05/21/98
Chloromethane	74-87-3	ND	10	ug/L	05/21/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/21/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/21/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/21/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/21/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/21/98
Dibromomethane	74-95-3	ND	5	ug/L	05/21/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/21/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/21/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/21/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/21/98
1,1-Dichloroethane	75-34-3	ND	5	ug/L	05/21/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/21/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/21/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/21/98
trans-1,2-Dichloroethene	156-60-5	ND	5	ug/L	05/21/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/21/98
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/21/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/21/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/21/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/21/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/21/98
Isopropylbenzene	98-82-8	16 *	5	ug/L	05/21/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/21/98
Methylene Chloride	75-09-2	ND	10	ug/L	05/21/98
Naphthalene	91-20-3	ND	5	ug/L	05/21/98
n-Propylbenzene	103-65-1	5 *	5	ug/L	05/21/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-4
AEN LAB NO: 9804273-01
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Styrene	100-42-5	ND	5	ug/L	05/21/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/21/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/21/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/21/98
Toluene	108-88-3	ND	5	ug/L	05/21/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/21/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/21/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/21/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/21/98
Trichloroethene	79-01-6	ND	5	ug/L	05/21/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/21/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/21/98
1,2,4-Trimethylbenzene	95-63-6	ND	5	ug/L	05/21/98
1,3,5-Trimethylbenzene	108-67-8	ND	5	ug/L	05/21/98
Vinyl Chloride	75-01-4	ND	10	ug/L	05/21/98
Xylenes, Total	1330-20-7	ND	10	ug/L	05/21/98
Acetone	67-64-1	ND	100	ug/L	05/21/98
2-Butanone	78-93-3	ND	100	ug/L	05/21/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/21/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/21/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/21/98
2-Hexanone	591-78-6	ND	50	ug/L	05/21/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/21/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/21/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/21/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/06/98
Arsenic	EPA 6010	0.018 *	0.005	mg/L	05/05/98
Barium	EPA 6010	0.15 *	0.01	mg/L	05/05/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/05/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/05/98
Cobalt	EPA 6010	ND	0.005	mg/L	05/05/98
Chromium	EPA 6010	ND	0.01	mg/L	05/05/98
Copper	EPA 6010	ND	0.01	mg/L	05/05/98
Mercury	EPA 7470	ND	0.0002	mg/L	05/04/98
Molybdenum	EPA 6010	0.02 *	0.01	mg/L	05/05/98
Nickel	EPA 6010	0.01 *	0.01	mg/L	05/05/98
Lead	EPA 6010	ND	0.04	mg/L	05/05/98
Antimony	EPA 6010	ND	0.02	mg/L	05/06/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/05/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/05/98
Zinc	EPA 6010	ND	0.01	mg/L	05/05/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-4
AEN LAB NO: 9804273-01
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-1
AEN LAB NO: 9804273-02
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/21/98
Bromobenzene	108-86-1	ND	5	ug/L	05/21/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/21/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/21/98
Bromoform	75-25-2	ND	5	ug/L	05/21/98
Bromomethane	74-83-9	ND	10	ug/L	05/21/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/21/98
sec-Butylbenzene	135-98-8	8 *	5	ug/L	05/21/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/21/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/21/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/21/98
Chloroethane	75-00-3	ND	10	ug/L	05/21/98
Chloroform	67-66-3	ND	5	ug/L	05/21/98
Chloromethane	74-87-3	ND	10	ug/L	05/21/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/21/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/21/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/21/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/21/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/21/98
Dibromomethane	74-95-3	ND	5	ug/L	05/21/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/21/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/21/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/21/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/21/98
1,1-Dichloroethane	75-34-3	18 *	5	ug/L	05/21/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/21/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/21/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/21/98
trans-1,2-Dichloroethene	156-60-5	10 *	5	ug/L	05/21/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/21/98
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/21/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/21/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/21/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/21/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/21/98
Isopropylbenzene	98-82-8	8 *	5	ug/L	05/21/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/21/98
Methylene Chloride	75-09-2	ND	10	ug/L	05/21/98
Naphthalene	91-20-3	ND	5	ug/L	05/21/98
n-Propylbenzene	103-65-1	9 *	5	ug/L	05/21/98
Styrene	100-42-5	ND	5	ug/L	05/21/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/21/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-1
AEN LAB NO: 9804273-02
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/21/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/21/98
Toluene	108-88-3	ND	5	ug/L	05/21/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/21/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/21/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/21/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/21/98
Trichloroethene	79-01-6	13 *	5	ug/L	05/21/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/21/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/21/98
1,2,4-Trimethylbenzene	95-63-6	ND	5	ug/L	05/21/98
1,3,5-Trimethylbenzene	108-67-8	ND	5	ug/L	05/21/98
Vinyl Chloride	75-01-4	ND	10	ug/L	05/21/98
Xylenes, Total	1330-20-7	10 *	10	ug/L	05/21/98
Acetone	67-64-1	ND	100	ug/L	05/21/98
2-Butanone	78-93-3	ND	100	ug/L	05/21/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/21/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/21/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/21/98
2-Hexanone	591-78-6	ND	50	ug/L	05/21/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/21/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/21/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/21/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-2
AEN LAB NO: 9804273-03
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
#Digestion, Metals by ICP	EPA 3010	-		Prep Date	05/05/98
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/21/98
Bromobenzene	108-86-1	ND	5	ug/L	05/21/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/21/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/21/98
Bromoform	75-25-2	ND	5	ug/L	05/21/98
Bromomethane	74-83-9	ND	10	ug/L	05/21/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/21/98
sec-Butylbenzene	135-98-8	ND	5	ug/L	05/21/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/21/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/21/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/21/98
Chloroethane	75-00-3	ND	10	ug/L	05/21/98
Chloroform	67-66-3	ND	5	ug/L	05/21/98
Chloromethane	74-87-3	ND	10	ug/L	05/21/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/21/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/21/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/21/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/21/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/21/98
Dibromomethane	74-95-3	ND	5	ug/L	05/21/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/21/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/21/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/21/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/21/98
1,1-Dichloroethane	75-34-3	12 *	5	ug/L	05/21/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/21/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/21/98
cis-1,2-Dichloroethene	156-59-2	61 *	5	ug/L	05/21/98
trans-1,2-Dichloroethene	156-60-5	18 *	5	ug/L	05/21/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/21/98
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/21/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/21/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/21/98
Ethylbenzene	100-41-4	7 *	5	ug/L	05/21/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/21/98
Isopropylbenzene	98-82-8	ND	5	ug/L	05/21/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/21/98
Methylene Chloride	75-09-2	ND	10	ug/L	05/21/98
Naphthalene	91-20-3	ND	5	ug/L	05/21/98
n-Propylbenzene	103-65-1	ND	5	ug/L	05/21/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-2
AEN LAB NO: 9804273-03
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
Styrene	100-42-5	ND	5	ug/L	05/21/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/21/98
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/21/98
Tetrachloroethene	127-18-4	120 *	5	ug/L	05/21/98
Toluene	108-88-3	ND	5	ug/L	05/21/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/21/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/21/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/21/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/21/98
Trichloroethene	79-01-6	130 *	5	ug/L	05/21/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/21/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/21/98
1,2,4-Trimethylbenzene	95-63-6	ND	5	ug/L	05/21/98
1,3,5-Trimethylbenzene	108-67-8	ND	5	ug/L	05/21/98
Vinyl Chloride	75-01-4	12 *	10	ug/L	05/21/98
Xylenes, Total	1330-20-7	26 *	10	ug/L	05/21/98
Acetone	67-64-1	ND	100	ug/L	05/21/98
2-Butanone	78-93-3	ND	100	ug/L	05/21/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/21/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/21/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/21/98
2-Hexanone	591-78-6	ND	50	ug/L	05/21/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/21/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/21/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/21/98
CCR 17 Metals					
Silver	EPA 6010	ND	0.005	mg/L	05/06/98
Arsenic	EPA 6010	0.007 *	0.005	mg/L	05/05/98
Barium	EPA 6010	19 *	0.01	mg/L	05/05/98
Beryllium	EPA 6010	ND	0.002	mg/L	05/05/98
Cadmium	EPA 6010	ND	0.005	mg/L	05/05/98
Cobalt	EPA 6010	ND	0.005	mg/L	05/05/98
Chromium	EPA 6010	ND	0.01	mg/L	05/05/98
Copper	EPA 6010	ND	0.01	mg/L	05/05/98
Mercury	EPA 7470	ND	0.0002	mg/L	05/04/98
Molybdenum	EPA 6010	ND	0.01	mg/L	05/05/98
Nickel	EPA 6010	0.01 *	0.01	mg/L	05/05/98
Lead	EPA 6010	ND	0.04	mg/L	05/05/98
Antimony	EPA 6010	ND	0.02	mg/L	05/06/98
Selenium	EPA 6010	ND	0.01	mg/L	05/05/98
Thallium	EPA 6010	ND	0.05	mg/L	05/05/98
Vanadium	EPA 6010	ND	0.005	mg/L	05/05/98
Zinc	EPA 6010	ND	0.01	mg/L	05/05/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-2
AEN LAB NO: 9804273-03
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-3
AEN LAB NO: 9804273-04
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	30	ug/L	05/21/98
Bromobenzene	108-86-1	ND	30	ug/L	05/21/98
Bromochloromethane	74-97-5	ND	30	ug/L	05/21/98
Bromodichloromethane	75-27-4	ND	30	ug/L	05/21/98
Bromoform	75-25-2	ND	30	ug/L	05/21/98
Bromomethane	74-83-9	ND	50	ug/L	05/21/98
n-Butylbenzene	104-51-8	ND	30	ug/L	05/21/98
sec-Butylbenzene	135-98-8	ND	30	ug/L	05/21/98
tert-Butylbenzene	98-06-6	ND	30	ug/L	05/21/98
Carbon Tetrachloride	56-23-5	ND	30	ug/L	05/21/98
Chlorobenzene	108-90-7	ND	30	ug/L	05/21/98
Chloroethane	75-00-3	ND	50	ug/L	05/21/98
Chloroform	67-66-3	ND	30	ug/L	05/21/98
Chloromethane	74-87-3	ND	50	ug/L	05/21/98
2-Chlorotoluene	95-49-8	ND	30	ug/L	05/21/98
4-Chlorotoluene	106-43-4	ND	30	ug/L	05/21/98
Dibromochloromethane	124-48-1	ND	30	ug/L	05/21/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	30	ug/L	05/21/98
1,2-Dibromoethane	106-93-4	ND	30	ug/L	05/21/98
Dibromomethane	74-95-3	ND	30	ug/L	05/21/98
1,2-Dichlorobenzene	95-50-1	ND	30	ug/L	05/21/98
1,3-Dichlorobenzene	541-73-1	ND	30	ug/L	05/21/98
1,4-Dichlorobenzene	106-46-7	ND	30	ug/L	05/21/98
Dichlorodifluoromethane	75-71-8	ND	50	ug/L	05/21/98
1,1-Dichloroethane	75-34-3	ND	30	ug/L	05/21/98
1,2-Dichloroethane	107-06-2	ND	30	ug/L	05/21/98
1,1-Dichloroethene	75-35-4	ND	30	ug/L	05/21/98
cis-1,2-Dichloroethene	156-59-2	140 *	30	ug/L	05/21/98
trans-1,2-Dichloroethene	156-60-5	ND	30	ug/L	05/21/98
1,2-Dichloropropane	78-87-5	ND	30	ug/L	05/21/98
1,3-Dichloropropane	142-28-9	ND	30	ug/L	05/21/98
2,2-Dichloropropane	594-20-7	ND	30	ug/L	05/21/98
1,1-Dichloropropene	563-58-6	ND	30	ug/L	05/21/98
Ethylbenzene	100-41-4	ND	30	ug/L	05/21/98
Hexachlorobutadiene	87-68-3	ND	30	ug/L	05/21/98
Isopropylbenzene	98-82-8	ND	30	ug/L	05/21/98
p-Isopropyltoluene	99-87-6	ND	30	ug/L	05/21/98
Methylene Chloride	75-09-2	ND	50	ug/L	05/21/98
Naphthalene	91-20-3	ND	30	ug/L	05/21/98
n-Propylbenzene	103-65-1	ND	30	ug/L	05/21/98
Styrene	100-42-5	ND	30	ug/L	05/21/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	30	ug/L	05/21/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-3
AEN LAB NO: 9804273-04
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,1,2,2-Tetrachloroethane	79-34-5	ND	30	ug/L	05/21/98
Tetrachloroethene	127-18-4	40 *	30	ug/L	05/21/98
Toluene	108-88-3	250 *	30	ug/L	05/21/98
1,2,3-Trichlorobenzene	87-61-6	ND	30	ug/L	05/21/98
1,2,4-Trichlorobenzene	120-82-1	ND	30	ug/L	05/21/98
1,1,1-Trichloroethane	71-55-6	ND	30	ug/L	05/21/98
1,1,2-Trichloroethane	79-00-5	ND	30	ug/L	05/21/98
Trichloroethene	79-01-6	190 *	30	ug/L	05/21/98
Trichlorofluoromethane	75-69-4	ND	30	ug/L	05/21/98
1,2,3-Trichloropropane	96-18-4	ND	30	ug/L	05/21/98
1,2,4-Trimethylbenzene	95-63-6	ND	30	ug/L	05/21/98
1,3,5-Trimethylbenzene	108-67-8	ND	30	ug/L	05/21/98
Vinyl Chloride	75-01-4	100 *	50	ug/L	05/21/98
Xylenes, Total	1330-20-7	75 *	50	ug/L	05/21/98
Acetone	67-64-1	ND	500	ug/L	05/21/98
2-Butanone	78-93-3	ND	500	ug/L	05/21/98
Carbon Disulfide	75-15-0	ND	50	ug/L	05/21/98
cis-1,3-Dichloropropene	10061-01-5	ND	30	ug/L	05/21/98
trans-1,3-Dichloropropene	10061-02-6	ND	30	ug/L	05/21/98
2-Hexanone	591-78-6	ND	300	ug/L	05/21/98
4-Methyl-2-pentanone	108-10-1	ND	300	ug/L	05/21/98
Vinyl Acetate	108-05-4	ND	300	ug/L	05/21/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	50	ug/L	05/21/98

Reporting limits elevated due to high levels of target compounds. Sample run at dilution.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-5 duplicate MW-3
AEN LAB NO: 9804273-05
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	30	ug/L	05/15/98
Bromobenzene	108-86-1	ND	30	ug/L	05/15/98
Bromochloromethane	74-97-5	ND	30	ug/L	05/15/98
Bromodichloromethane	75-27-4	ND	30	ug/L	05/15/98
Bromoform	75-25-2	ND	30	ug/L	05/15/98
Bromomethane	74-83-9	ND	50	ug/L	05/15/98
n-Butylbenzene	104-51-8	ND	30	ug/L	05/15/98
sec-Butylbenzene	135-98-8	ND	30	ug/L	05/15/98
tert-Butylbenzene	98-06-6	ND	30	ug/L	05/15/98
Carbon Tetrachloride	56-23-5	ND	30	ug/L	05/15/98
Chlorobenzene	108-90-7	ND	30	ug/L	05/15/98
Chloroethane	75-00-3	ND	50	ug/L	05/15/98
Chloroform	67-66-3	ND	30	ug/L	05/15/98
Chloromethane	74-87-3	ND	50	ug/L	05/15/98
2-Chlorotoluene	95-49-8	ND	30	ug/L	05/15/98
4-Chlorotoluene	106-43-4	ND	30	ug/L	05/15/98
Dibromochloromethane	124-48-1	ND	30	ug/L	05/15/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	30	ug/L	05/15/98
1,2-Dibromoethane	106-93-4	ND	30	ug/L	05/15/98
Dibromomethane	74-95-3	ND	30	ug/L	05/15/98
1,2-Dichlorobenzene	95-50-1	ND	30	ug/L	05/15/98
1,3-Dichlorobenzene	541-73-1	ND	30	ug/L	05/15/98
1,4-Dichlorobenzene	106-46-7	ND	30	ug/L	05/15/98
Dichlorodifluoromethane	75-71-8	ND	50	ug/L	05/15/98
1,1-Dichloroethane	75-34-3	ND	30	ug/L	05/15/98
1,2-Dichloroethane	107-06-2	ND	30	ug/L	05/15/98
1,1-Dichloroethene	75-35-4	ND	30	ug/L	05/15/98
cis-1,2-Dichloroethene	156-59-2	140 *	30	ug/L	05/15/98
trans-1,2-Dichloroethene	156-60-5	ND	30	ug/L	05/15/98
1,2-Dichloropropane	78-87-5	ND	30	ug/L	05/15/98
1,3-Dichloropropane	142-28-9	ND	30	ug/L	05/15/98
2,2-Dichloropropane	594-20-7	ND	30	ug/L	05/15/98
1,1-Dichloropropene	563-58-6	ND	30	ug/L	05/15/98
Ethylbenzene	100-41-4	ND	30	ug/L	05/15/98
Hexachlorobutadiene	87-68-3	ND	30	ug/L	05/15/98
Isopropylbenzene	98-82-8	ND	30	ug/L	05/15/98
p-Isopropyltoluene	99-87-6	ND	30	ug/L	05/15/98
Methylene Chloride	75-09-2	ND	50	ug/L	05/15/98
Naphthalene	91-20-3	ND	30	ug/L	05/15/98
n-Propylbenzene	103-65-1	ND	30	ug/L	05/15/98
Styrene	100-42-5	ND	30	ug/L	05/15/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	30	ug/L	05/15/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-5 duplicate MW-3
AEN LAB NO: 9804273-05
AEN WORK ORDER: 9804273
CLIENT PROJ. ID: 4710

DATE SAMPLED: 04/27/98
DATE RECEIVED: 04/28/98
REPORT DATE: 05/26/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,1,2,2-Tetrachloroethane	79-34-5	ND	30	ug/L	05/15/98
Tetrachloroethene	127-18-4	30 *	30	ug/L	05/15/98
Toluene	108-88-3	220 *	30	ug/L	05/15/98
1,2,3-Trichlorobenzene	87-61-6	ND	30	ug/L	05/15/98
1,2,4-Trichlorobenzene	120-82-1	ND	30	ug/L	05/15/98
1,1,1-Trichloroethane	71-55-6	ND	30	ug/L	05/15/98
1,1,2-Trichloroethane	79-00-5	ND	30	ug/L	05/15/98
Trichloroethene	79-01-6	190 *	30	ug/L	05/15/98
Trichlorofluoromethane	75-69-4	ND	30	ug/L	05/15/98
1,2,3-Trichloropropane	96-18-4	ND	30	ug/L	05/15/98
1,2,4-Trimethylbenzene	95-63-6	ND	30	ug/L	05/15/98
1,3,5-Trimethylbenzene	108-67-8	ND	30	ug/L	05/15/98
Vinyl Chloride	75-01-4	110 *	50	ug/L	05/15/98
Xylenes, Total	1330-20-7	ND	50	ug/L	05/15/98
Acetone	67-64-1	ND	500	ug/L	05/15/98
2-Butanone	78-93-3	ND	500	ug/L	05/15/98
Carbon Disulfide	75-15-0	ND	50	ug/L	05/15/98
cis-1,3-Dichloropropene	10061-01-5	ND	30	ug/L	05/15/98
trans-1,3-Dichloropropene	10061-02-6	ND	30	ug/L	05/15/98
2-Hexanone	591-78-6	ND	300	ug/L	05/15/98
4-Methyl-2-pentanone	108-10-1	ND	300	ug/L	05/15/98
Vinyl Acetate	108-05-4	ND	300	ug/L	05/15/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	50	ug/L	05/15/98

Reporting limits elevated due to high levels of target compounds. Sample run at dilution.

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9804273
CLIENT PROJECT ID: 4710

Quality Control and Project Summary

All Samples:

Samples for EPA 8260 were analyzed out of hold time. Results are estimated.

All other laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I. Interference.

!· Indicates result outside of established laboratory QC limits.

ANALYSIS: Mercury

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank | LAB ID: HGW_PBW | INSTR RUN: HG\980505123000/1/
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	ND		0.0002						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGW_LCD | INSTR RUN: HG\980505123000/3/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00216	ND	0.0002	0.00200	108	80	120		

SAMPLE TYPE: Spike-Method/Media blank | LAB ID: HGW_LCS | INSTR RUN: HG\980505123000/2/1
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00210	ND	0.0002	0.00200	105	80	120		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate | LAB ID: HGW_LCR | INSTR RUN: HG\980505123000/4/2
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00216	0.00210	0.0002					2.82	20

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix | LAB ID: MD04273-03I | INSTR RUN: HG\980505123000/8/6
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00190	ND	0.0002	0.00200	95.0	80	120		

SAMPLE TYPE: Spike-Sample/Matrix | LAB ID: MS04273-03I | INSTR RUN: HG\980505123000/7/6
INSTRUMENT: Coleman Hg Analyzer 50D | PREPARED: | BATCH ID: HGW050498
UNITS: mg/L | ANALYZED: 05/05/98 | DILUTION: 1.000000
METHOD:

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00184	ND	0.0002	0.00200	92.0	80	120		

ANALYSIS: Mercury

MATRIX: Water

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: Coleman Hg Analyzer 50D
UNITS: mg/L
METHOD:

LAB ID: MR04273-03I
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: HG\980505123000/9/7
BATCH ID: HGW050498
DILUTION: 1.000000

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mercury in water	0.00190	0.00184	0.0002					3.21	20

ANALYSIS: Metals Scan by ICP

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_BLNK_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/1/
BATCH ID: IFW050598-W
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	ND		0.005						
As	Arsenic	ND		0.04						
Ba	Barium	ND		0.01						
Be	Beryllium	ND		0.002						
Cd	Cadmium	ND		0.005						
Co	Cobalt	ND		0.005						
Cr	Chromium	ND		0.01						
Cu	Copper	ND		0.01						
Mo	Molybdenum	ND		0.01						
Ni	Nickel	ND		0.01						
Pb	Lead	ND		0.04						
Sb	Antimony	ND		0.02						
Se	Selenium	ND		0.07						
Tl	Thallium	ND		0.05						
V	Vanadium	ND		0.005						
Zn	Zinc	ND		0.01						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCD_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/3/1
BATCH ID: IFW050598-W
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0230	ND	0.005	0.0250	92.0	80	120		
As	Arsenic	0.0749	ND	0.04	0.0800	93.6	80	120		
Ba	Barium	0.958	ND	0.01	1.00	95.8	80	120		
Be	Beryllium	0.0230	ND	0.002	0.0250	92.0	80	120		
Cd	Cadmium	0.0480	ND	0.005	0.0500	96.0	80	120		
Co	Cobalt	0.240	ND	0.005	0.250	96.0	80	120		
Cr	Chromium	0.0962	ND	0.01	0.100	96.2	80	120		
Cu	Copper	0.115	ND	0.01	0.125	92.0	80	120		
Mo	Molybdenum	0.186	ND	0.01	0.200	93.0	80	120		
Ni	Nickel	0.232	ND	0.01	0.250	92.8	80	120		
Pb	Lead	0.480	ND	0.04	0.500	96.0	80	120		
Sb	Antimony	0.437	ND	0.02	0.500	87.4	80	120		
Se	Selenium	0.0906	ND	0.07	0.100	90.6	80	120		
Tl	Thallium	0.481	ND	0.05	0.500	96.2	80	120		
V	Vanadium	0.238	ND	0.005	0.250	95.2	80	120		
Zn	Zinc	0.232	ND	0.01	0.250	92.8	80	120		

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCS_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/2/1
BATCH ID: IFW050598-W
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.0220	ND	0.005	0.0250	88.0	80	120		
As	Arsenic	0.0751	ND	0.04	0.0800	93.9	80	120		
Ba	Barium	0.950	ND	0.01	1.00	95.0	80	120		
Be	Beryllium	0.0224	ND	0.002	0.0250	89.6	80	120		
Cd	Cadmium	0.0472	ND	0.005	0.0500	94.4	80	120		
Co	Cobalt	0.236	ND	0.005	0.250	94.4	80	120		
Cr	Chromium	0.0912	ND	0.01	0.100	91.2	80	120		
Cu	Copper	0.113	ND	0.01	0.125	90.4	80	120		

ANALYSIS: Metals Scan by ICP

MATRIX: Water

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Spike-Method/Media blank
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCS_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/2/1
BATCH ID: IFW050598-W
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Mo	Molybdenum	0.182	ND	0.01	0.200	91.0	80	120		
Ni	Nickel	0.229	ND	0.01	0.250	91.6	80	120		
Pb	Lead	0.471	ND	0.04	0.500	94.2	80	120		
Sb	Antimony	0.430	ND	0.02	0.500	86.0	80	120		
Se	Selenium	0.0866	ND	0.07	0.100	86.6	80	120		
Tl	Thallium	0.487	ND	0.05	0.500	97.4	80	120		
V	Vanadium	0.235	ND	0.005	0.250	94.0	80	120		
Zn	Zinc	0.232	ND	0.01	0.250	92.8	80	120		

LABORATORY CONTROL DUPLICATES

SAMPLE TYPE: Method Spike Sample Duplicate
INSTRUMENT: TJA Enviro 36
UNITS: mg/L
METHOD:

LAB ID: IFW_LCR_W
PREPARED:
ANALYZED: 05/05/98

INSTR RUN: ICP\980505212400/4/2
BATCH ID: IFW050598-W
DILUTION: 1.000000

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Ag	Silver	0.230	0.0220	0.005					165 !	20
As	Arsenic	0.0749	0.0751	0.04					0.267	20
Ba	Barium	0.958	0.950	0.01					0.839	20
Be	Beryllium	0.0230	0.0224	0.002					2.64	20
Cd	Cadmium	0.0480	0.0472	0.005					1.68	20
Co	Cobalt	0.240	0.236	0.005					1.68	20
Cr	Chromium	0.0962	0.0912	0.01					5.34	20
Cu	Copper	0.115	0.113	0.01					1.75	20
Mo	Molybdenum	0.186	0.182	0.01					2.17	20
Ni	Nickel	0.232	0.229	0.01					1.30	20
Pb	Lead	0.480	0.471	0.04					1.89	20
Sb	Antimony	0.437	0.430	0.02					1.61	20
Se	Selenium	0.0906	0.0866	0.07					4.51	20
Tl	Thallium	0.481	0.487	0.05					1.24	20
V	Vanadium	0.238	0.235	0.005					1.27	20
Zn	Zinc	0.232	0.232	0.01					0	20

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0515
PREPARED:
ANALYZED: 05/15/98

INSTR RUN: GCMS12\980515020000/1/
BATCH ID: MS12W051598
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	117			100	117	65	140		
Toluene-d8	(surr)	103			100	103	70	135		
p-BFB	(surr)	95.5			100	95.5	70	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		5						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						
1,1-Dichloropropene		ND		5						
Ethylbenzene		ND		5						
Hexachlorobutadiene		ND		5						
Isopropylbenzene		ND		5						
p-Isopropyltoluene		ND		5						
Methylene Chloride		ND		10						
Naphthalene		ND		5						
n-Propylbenzene		ND		5						
Styrene		ND		5						
1,1,1,2-Tetrachloroethane		ND		5						
1,1,2,2-Tetrachloroethane		ND		5						
Tetrachloroethene		ND		5						
1,2,3-Trichlorobenzene		ND		5						
1,2,4-Trichlorobenzene		ND		5						
1,1,1-Trichloroethane		ND		5						
1,1,2-Trichloroethane		ND		5						
Trichlorofluoromethane		ND		5						
1,2,3-Trichloropropane		ND		5						
1,2,4-Trimethylbenzene		ND		5						
1,3,5-Trimethylbenzene		ND		5						
Vinyl Chloride		ND		10						
Xylenes, Total		ND		10						
Trichlorotrifluoroethane		ND		5						

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0515
PREPARED:
ANALYZED: 05/15/98

INSTR RUN: GCMS12\980515020000/1/
BATCH ID: MS12W051598
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Acetone	ND		100						
Acrylonitrile	ND		10						
2-Butanone	ND		100						
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0521
PREPARED:
ANALYZED: 05/21/98

INSTR RUN: GCMS13\980521000000/1/
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	112			100	112	65	140		
Toluene-d8	(surr)	95.3			100	95.3	70	135		
p-BFB	(surr)	97.0			100	97.0	70	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		5						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0521
PREPARED:
ANALYZED: 05/21/98

INSTR RUN: GCMS13\980521000000/1/
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,1-Dichloropropene	ND		5						
Ethylbenzene	ND		5						
Hexachlorobutadiene	ND		5						
Isopropylbenzene	ND		5						
p-Isopropyltoluene	ND		5						
Methylene Chloride	ND		10						
Naphthalene	ND		5						
n-Propylbenzene	ND		5						
Styrene	ND		5						
1,1,1,2-Tetrachloroethane	ND		5						
1,1,2,2-Tetrachloroethane	ND		5						
Tetrachloroethene	ND		5						
1,2,3-Trichlorobenzene	ND		5						
1,2,4-Trichlorobenzene	ND		5						
1,1,1-Trichloroethane	ND		5						
1,1,2-Trichloroethane	ND		5						
Trichlorofluoromethane	ND		5						
1,2,3-Trichloropropane	ND		5						
1,2,4-Trimethylbenzene	ND		5						
1,3,5-Trimethylbenzene	ND		5						
Vinyl Chloride	ND		10						
Xylenes, Total	ND		10						
Trichlorotrifluoroethane	ND		5						
Acetone	ND		100						
Acrylonitrile	ND		10						
2-Butanone	ND		100						
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: LCS_0515
PREPARED:
ANALYZED: 05/15/98

INSTR RUN: GCMS12\980515020000/2/1
BATCH ID: MS12W051598
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	105	117		100	105	65	135		
Toluene-d8	(surr)	105	103		100	105	70	130		
p-BFB	(surr)	105	95.5		100	105	70	130		
1,1-Dichloroethene		52.9	ND	5	50.0	106	70	130		
Benzene		51.8	ND	5	50.0	104	70	130		
Trichloroethene		48.7	ND	5	50.0	97.4	70	130		
Toluene		52.2	ND	5	50.0	104	70	130		
Chlorobenzene		55.3	ND	5	50.0	111	70	130		

ANALYSIS: Volatile GC/MS

MATRIX: Water

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: LCS_0521
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/2/1
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	90.2	112		100	90.2	65	135		
Toluene-d8	(surr)	101	95.3		100	101	70	130		
p-BFB	(surr)	94.2	97.0		100	94.2	70	130		
1,1-Dichloroethene		48.6	ND	5	50.0	97.2	70	130		
Benzene		53.9	ND	5	50.0	108	70	130		
Trichloroethene		53.0	ND	5	50.0	106	70	130		
Toluene		53.3	ND	5	50.0	107	70	130		
Chlorobenzene		57.7	ND	5	50.0	115	70	130		

MATRIX SPIKE SAMPLES

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MD04273-01D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/8/3
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	84.8	78.4		100	84.8	65	135		
Toluene-d8	(surr)	100	110		100	100	70	130		
p-BFB	(surr)	102	98.4		100	102	70	130		
1,1-Dichloroethene		51.2	ND	5	50.0	102	70	130		
Benzene		50.4	ND	5	50.0	101	70	130		
Trichloroethene		48.1	ND	5	50.0	96.2	70	130		
Toluene		51.0	ND	5	50.0	102	70	130		
Chlorobenzene		53.1	ND	5	50.0	106	70	130		

SAMPLE TYPE: Spike-Sample/Matrix
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MS04273-01D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/7/3
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	84.5	78.4		100	84.5	65	135		
Toluene-d8	(surr)	101	110		100	101	70	130		
p-BFB	(surr)	103	98.4		100	103	70	130		
1,1-Dichloroethene		56.3	ND	5	50.0	113	70	130		
Benzene		54.1	ND	5	50.0	108	70	130		
Trichloroethene		51.0	ND	5	50.0	102	70	130		
Toluene		52.9	ND	5	50.0	106	70	130		
Chlorobenzene		57.0	ND	5	50.0	114	70	130		

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MR04273-01D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/9/7
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	84.8	84.5		100	84.8	65	135		
Toluene-d8	(surr)	100	101		100	100	70	130		
p-BFB	(surr)	102	103		100	102	70	130		
1,1-Dichloroethene		51.2	56.3	5	50.0				9.49	20

ANALYSIS: Volatile GC/MS

MATRIX: Water

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: MR04273-01D
PREPARED:
ANALYZED: 05/21/98

INSTR RUN: GCMS13\980521000000/9/7
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Benzene	50.4	54.1	5	50.0				7.08	20
Trichloroethene	48.1	51.0	5	50.0				5.85	20
Toluene	51.0	52.9	5	50.0				3.66	20
Chlorobenzene	53.1	57.0	5	50.0				7.08	20
Bromobenzene	ND	ND	5					0	
Bromochloromethane	ND	ND	5					0	
Bromodichloromethane	ND	ND	5					0	
Bromoform	ND	ND	5					0	
Bromomethane	ND	ND	10					0	
n-Butylbenzene	ND	ND	5					0	
sec-Butylbenzene	ND	ND	5					0	
tert-Butylbenzene	ND	ND	5					0	
Carbon Tetrachloride	ND	ND	5					0	
Chloroethane	ND	ND	10					0	
Chloroform	ND	ND	5					0	
Chloromethane	ND	ND	10					0	
2-Chlorotoluene	ND	ND	5					0	
4-Chlorotoluene	ND	ND	5					0	
Dibromochloromethane	ND	ND	5					0	
1,2-Dibromo-3-chloropropan	ND	ND	5					0	
1,2-Dibromoethane	ND	ND	5					0	
Dibromomethane	ND	ND	5					0	
1,2-Dichlorobenzene	ND	ND	5					0	
1,3-Dichlorobenzene	ND	ND	5					0	
1,4-Dichlorobenzene	ND	ND	5					0	
Dichlorodifluoromethane	ND	ND	10					0	
1,1-Dichloroethane	ND	ND	5					0	
1,2-Dichloroethane	ND	ND	5					0	
cis-1,2-Dichloroethene	ND	ND	5					0	
trans-1,2-Dichloroethene	ND	ND	5					0	
1,2-Dichloropropane	ND	ND	5					0	
1,3-Dichloropropane	ND	ND	5					0	
2,2-Dichloropropane	ND	ND	5					0	
1,1-Dichloropropene	ND	ND	5					0	
Ethylbenzene	ND	ND	5					0	
Hexachlorobutadiene	ND	ND	5					0	
Isopropylbenzene	ND	ND	5					0	
p-Isopropyltoluene	ND	ND	5					0	
Methylene Chloride	ND	ND	10					0	
Naphthalene	ND	ND	5					0	
n-Propylbenzene	ND	ND	5					0	
Styrene	ND	ND	5					0	
1,1,1,2-Tetrachloroethane	ND	ND	5					0	
1,1,2,2-Tetrachloroethane	ND	ND	5					0	
Tetrachloroethene	ND	ND	5					0	
1,2,3-Trichlorobenzene	ND	ND	5					0	
1,2,4-Trichlorobenzene	ND	ND	5					0	
1,1,1-Trichloroethane	ND	ND	5					0	
1,1,2-Trichloroethane	ND	ND	5					0	
Trichlorofluoromethane	ND	ND	5					0	
1,2,3-Trichloropropane	ND	ND	5					0	
1,2,4-Trimethylbenzene	ND	ND	5					0	
1,3,5-Trimethylbenzene	ND	ND	5					0	
Vinyl Chloride	ND	ND	10					0	
Xylenes, Total	ND	ND	10					0	
Trichlorotrifluoroethane	ND	ND	5					0	
Acetone	ND	ND	100					0	
Acrylonitrile	ND	ND	10					0	
2-Butanone	ND	ND	100					0	
Carbon Disulfide	ND	ND	10					0	

ANALYSIS: Volatile GC/MS

MATRIX: Water

MATRIX SPIKE DUPLICATES

SAMPLE TYPE: Spiked Sample Duplicate
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: MR04273-01D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/9/7
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
trans-1,4-Dichloro-2-buten	ND	ND	100					0	
cis-1,3-Dichloropropene	ND	ND	5					0	
trans-1,3-Dichloropropene	ND	ND	5					0	
2-Hexanone	ND	ND	50					0	
Methyl Iodide	ND	ND	200					0	
4-Methyl-2-pentanone	ND	ND	50					0	
Vinyl Acetate	ND	ND	50					0	
2-Chloroethyl Vinyl Ether	ND	ND	10					0	
o-Xylene	ND	ND	10					0	
m,p-Xylene	ND	ND	10					0	
MTBE	ND	ND	5					0	

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804273-05A
PREPARED:
ANALYZED: 05/15/98
INSTR RUN: GCMS12\980515020000/4/
BATCH ID: MS12W051598
DILUTION: 5.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	599			500	120	65	135		
Toluene-d8	(surr)	505			500	101	70	130		
p-BFB	(surr)	526			500	105	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804273-01D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/3/
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	78.4			100	78.4	65	135		
Toluene-d8	(surr)	110			100	110	70	130		
p-BFB	(surr)	98.4			100	98.4	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804273-02D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/4/
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	77.3			100	77.3	65	135		
Toluene-d8	(surr)	104			100	104	70	130		
p-BFB	(surr)	99.0			100	99.0	70	130		

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:
LAB ID: 9804273-03D
PREPARED:
ANALYZED: 05/21/98
INSTR RUN: GCMS13\980521000000/5/
BATCH ID: MS13W052198
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	76.9			100	76.9	65	135		
Toluene-d8	(surr)	101			100	101	70	130		
p-BFB	(surr)	97.6			100	97.6	70	130		

ANALYSIS: Volatile GC/MS

MATRIX: Water

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: 9804273-04C
PREPARED:
ANALYZED: 05/21/98

INSTR RUN: GCMS13\980521000000/6/
BATCH ID: MS13W052198
DILUTION: 5.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	486			500	97.2	65	135		
Toluene-d8	(surr)	489			500	97.8	70	130		
p-BFB	(surr)	524			500	105	70	130		

---------- End of Quality Control Report ----------

9804273

CHAIN-OF-CUSTODY RECORD

No. 11007

Date: 4/27/98

Page 1 of 1

Project No.: 4710

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel	EPA method 8260	CAM 17 metals	Hold-TPHG	Hold-TPHD	8260 hold	Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers	Additional Comments
4/27/98	1030	MW-4								X	X	X	X		X	W	Y	9	1A-1I
	1115	MW-1								X		X	X		X	W	Y	8	2A-2H
	1150	MW-2								X	X	X	X		X	W	Y	9	3A-3I
	1400	MW-3								X		X	X		X	W	Y	8	4A-4H
↓	1430	MW-5								X		X	X		X	W	Y	8	5A-5H
↓	1500	MW-6										X	X	X	X	W	Y	8	6A-6H

ANALYSES

REMARKS

R-3 S-2
R-1 S-A
C-1 S-2

Turnaround time:

Results to: Jennifer Patterson

Total No. of containers: 34

WGC WGC
EZ 50

Relinquished by (signature)	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Method of Shipment:
Printed Name: Will Caldicott	Time:	Printed Name:	Time:	Printed Name:	Time:	Laboratory Comments and Log No.:
Company: GEOMATRIX		Company:		Company:		
Received by (signature): Paul C. Richeda	Date: 4/28	Received by (signature):	Date:	Received by (signature):	Date:	
Printed Name: PAUL C RICHEDA	Time: 1400	Printed Name:	Time:	Printed Name:	Time:	
Company: AEN		Company:		Company:		

Geomatrix Consultants
GEOMATRIX
100 Pine Street, 10th Floor
San Francisco, California 94111
415 434 9400

American Environmental Network

Certificate of Analysis

DOHS Certification: 1172 AIHA Accreditation: 11134

GEOMATRIX CONSULTANTS
100 PINE ST., SUITE 1000
SAN FRANCISCO, CA 94111

ATTN: WILL CALDICOTT
CLIENT PROJ. ID: 4710.01

C.O.C. NUMBER: 10166

REPORT DATE: 05/22/98

DATE(S) SAMPLED: 05/15/98

DATE RECEIVED: 05/15/98

AEN WORK ORDER: 9805174

PROJECT SUMMARY:

On May 15, 1998, this laboratory received 2 water sample(s).

Client requested sample(s) be analyzed for chemical parameters. Results of analysis are summarized on the following page(s). Please see quality control report for a summary of QC data pertaining to this project.

Samples will be stored for 30 days after completion of analysis, then disposed of in accordance with State and Federal regulations. Samples may be archived by prior arrangement.

If you have any questions, please contact Client Services at (510) 930-9090.

Reviewed by:

William Luckhardt

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-4
AEN LAB NO: 9805174-01
AEN WORK ORDER: 9805174
CLIENT PROJ. ID: 4710.01

DATE SAMPLED: 05/15/98
DATE RECEIVED: 05/15/98
REPORT DATE: 05/22/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
EPA 8260A - Water	EPA 8260A				
Benzene	71-43-2	ND	5	ug/L	05/19/98
Bromobenzene	108-86-1	ND	5	ug/L	05/19/98
Bromochloromethane	74-97-5	ND	5	ug/L	05/19/98
Bromodichloromethane	75-27-4	ND	5	ug/L	05/19/98
Bromoform	75-25-2	ND	5	ug/L	05/19/98
Bromomethane	74-83-9	ND	10	ug/L	05/19/98
n-Butylbenzene	104-51-8	ND	5	ug/L	05/19/98
sec-Butylbenzene	135-98-8	ND	5	ug/L	05/19/98
tert-Butylbenzene	98-06-6	ND	5	ug/L	05/19/98
Carbon Tetrachloride	56-23-5	ND	5	ug/L	05/19/98
Chlorobenzene	108-90-7	ND	5	ug/L	05/19/98
Chloroethane	75-00-3	ND	10	ug/L	05/19/98
Chloroform	67-66-3	ND	5	ug/L	05/19/98
Chloromethane	74-87-3	ND	10	ug/L	05/19/98
2-Chlorotoluene	95-49-8	ND	5	ug/L	05/19/98
4-Chlorotoluene	106-43-4	ND	5	ug/L	05/19/98
Dibromochloromethane	124-48-1	ND	5	ug/L	05/19/98
1,2-Dibromo-3-chloropropane	96-12-8	ND	5	ug/L	05/19/98
1,2-Dibromoethane	106-93-4	ND	5	ug/L	05/19/98
Dibromomethane	74-95-3	ND	5	ug/L	05/19/98
1,2-Dichlorobenzene	95-50-1	ND	5	ug/L	05/19/98
1,3-Dichlorobenzene	541-73-1	ND	5	ug/L	05/19/98
1,4-Dichlorobenzene	106-46-7	ND	5	ug/L	05/19/98
Dichlorodifluoromethane	75-71-8	ND	10	ug/L	05/19/98
1,1-Dichloroethane	75-34-3	ND	5	ug/L	05/19/98
1,2-Dichloroethane	107-06-2	ND	5	ug/L	05/19/98
1,1-Dichloroethene	75-35-4	ND	5	ug/L	05/19/98
cis-1,2-Dichloroethene	156-59-2	ND	5	ug/L	05/19/98
trans-1,2-Dichloroethene	156-60-5	ND	5	ug/L	05/19/98
1,2-Dichloropropane	78-87-5	ND	5	ug/L	05/19/98
1,3-Dichloropropane	142-28-9	ND	5	ug/L	05/19/98
2,2-Dichloropropane	594-20-7	ND	5	ug/L	05/19/98
1,1-Dichloropropene	563-58-6	ND	5	ug/L	05/19/98
Ethylbenzene	100-41-4	ND	5	ug/L	05/19/98
Hexachlorobutadiene	87-68-3	ND	5	ug/L	05/19/98
Isopropylbenzene	98-82-8	ND	5	ug/L	05/19/98
p-Isopropyltoluene	99-87-6	ND	5	ug/L	05/19/98
Methylene Chloride	75-09-2	ND	10	ug/L	05/19/98
Naphthalene	91-20-3	ND	5	ug/L	05/19/98
n-Propylbenzene	103-65-1	ND	5	ug/L	05/19/98
Styrene	100-42-5	ND	5	ug/L	05/19/98
1,1,1,2-Tetrachloroethane	630-20-6	ND	5	ug/L	05/19/98

GEOMATRIX CONSULTANTS

SAMPLE ID: MW-4
AEN LAB NO: 9805174-01
AEN WORK ORDER: 9805174
CLIENT PROJ. ID: 4710.01

DATE SAMPLED: 05/15/98
DATE RECEIVED: 05/15/98
REPORT DATE: 05/22/98

ANALYTE	METHOD/ CAS#	RESULT	REPORTING LIMIT	UNITS	DATE ANALYZED
1,1,2,2-Tetrachloroethane	79-34-5	ND	5	ug/L	05/19/98
Tetrachloroethene	127-18-4	ND	5	ug/L	05/19/98
Toluene	108-88-3	ND	5	ug/L	05/19/98
1,2,3-Trichlorobenzene	87-61-6	ND	5	ug/L	05/19/98
1,2,4-Trichlorobenzene	120-82-1	ND	5	ug/L	05/19/98
1,1,1-Trichloroethane	71-55-6	ND	5	ug/L	05/19/98
1,1,2-Trichloroethane	79-00-5	ND	5	ug/L	05/19/98
Trichloroethene	79-01-6	ND	5	ug/L	05/19/98
Trichlorofluoromethane	75-69-4	ND	5	ug/L	05/19/98
1,2,3-Trichloropropane	96-18-4	ND	5	ug/L	05/19/98
1,2,4-Trimethylbenzene	95-63-6	ND	5	ug/L	05/19/98
1,3,5-Trimethylbenzene	108-67-8	ND	5	ug/L	05/19/98
Vinyl Chloride	75-01-4	ND	10	ug/L	05/19/98
Xylenes, Total	1330-20-7	ND	10	ug/L	05/19/98
Acetone	67-64-1	ND	100	ug/L	05/19/98
2-Butanone	78-93-3	ND	100	ug/L	05/19/98
Carbon Disulfide	75-15-0	ND	10	ug/L	05/19/98
cis-1,3-Dichloropropene	10061-01-5	ND	5	ug/L	05/19/98
trans-1,3-Dichloropropene	10061-02-6	ND	5	ug/L	05/19/98
2-Hexanone	591-78-6	ND	50	ug/L	05/19/98
4-Methyl-2-pentanone	108-10-1	ND	50	ug/L	05/19/98
Vinyl Acetate	108-05-4	ND	50	ug/L	05/19/98
2-Chloroethyl Vinyl Ether	110-75-8	ND	10	ug/L	05/19/98

ND = Not detected at or above the reporting limit
* = Value at or above reporting limit

AEN (CALIFORNIA)
QUALITY CONTROL REPORT

AEN JOB NUMBER: 9805174
CLIENT PROJECT ID: 4710.01

Quality Control and Project Summary

All laboratory quality control parameters were found to be within established limits.

Definitions

Laboratory Control Sample (LCS)/Method Spikes(s): Control samples of known composition. LCS and Method Spike data are used to validate batch analytical results.

Matrix Spike(s): Aliquot of a sample (aqueous or solid) with added quantities of specific compounds and subjected to the entire analytical procedure. Matrix spike and matrix spike duplicate QC data are advisory.

Method Blank: An analytical control consisting of all reagents, internal standards, and surrogate standards carried through the entire analytical process. Used to monitor laboratory background and reagent contamination.

Not Detected (ND): Not detected at or above the reporting limit.

Relative Percent Difference (RPD): An indication of method precision based on duplicate analyses.

Reporting Limit (RL): The lowest concentration routinely determined during laboratory operations. The RL is generally 1 to 10 times the Method Detection Limit (MDL). Reporting limits are matrix, method, and analyte dependent and take into account any dilutions performed as part of the analysis.

Surrogates: Organic compounds which are similar to analytes of interest in chemical behaviour, but are not found in environmental samples. Surrogates are added to all blanks, calibration and check standards, samples, and spiked samples. Surrogate recovery is monitored as an indication of acceptable sample preparation and instrument performance.

D: Surrogates diluted out.

I: Interference.

!: Indicates result outside of established laboratory QC limits.

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0519
PREPARED:
ANALYZED: 05/19/98

INSTR RUN: GCMS13\980519000000/1/
BATCH ID: MS13W051998
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	83.8			100	83.8	65	140		
Toluene-d8	(surr)	101			100	101	70	135		
p-BFB	(surr)	98.5			100	98.5	70	135		
1,1-Dichloroethene		ND		5						
Benzene		ND		5						
Trichloroethene		ND		5						
Toluene		ND		5						
Chlorobenzene		ND		5						
Bromobenzene		ND		5						
Bromochloromethane		ND		5						
Bromodichloromethane		ND		5						
Bromoform		ND		5						
Bromomethane		ND		10						
n-Butylbenzene		ND		5						
sec-Butylbenzene		ND		5						
tert-Butylbenzene		ND		5						
Carbon Tetrachloride		ND		5						
Chloroethane		ND		10						
Chloroform		ND		5						
Chloromethane		ND		10						
2-Chlorotoluene		ND		5						
4-Chlorotoluene		ND		5						
Dibromochloromethane		ND		5						
1,2-Dibromo-3-chloropropan		ND		5						
1,2-Dibromoethane		ND		5						
Dibromomethane		ND		5						
1,2-Dichlorobenzene		ND		5						
1,3-Dichlorobenzene		ND		5						
1,4-Dichlorobenzene		ND		5						
Dichlorodifluoromethane		ND		10						
1,1-Dichloroethane		ND		5						
1,2-Dichloroethane		ND		5						
cis-1,2-Dichloroethene		ND		5						
trans-1,2-Dichloroethene		ND		5						
1,2-Dichloropropane		ND		5						
1,3-Dichloropropane		ND		5						
2,2-Dichloropropane		ND		5						
1,1-Dichloropropene		ND		5						
Ethylbenzene		ND		5						
Hexachlorobutadiene		ND		5						
Isopropylbenzene		ND		5						
p-Isopropyltoluene		ND		5						
Methylene Chloride		ND		10						
Naphthalene		ND		5						
n-Propylbenzene		ND		5						
Styrene		ND		5						
1,1,1,2-Tetrachloroethane		ND		5						
1,1,2,2-Tetrachloroethane		ND		5						
Tetrachloroethene		ND		5						
1,2,3-Trichlorobenzene		ND		5						
1,2,4-Trichlorobenzene		ND		5						
1,1,1-Trichloroethane		ND		5						
1,1,2-Trichloroethane		ND		5						
Trichlorofluoromethane		ND		5						
1,2,3-Trichloropropane		ND		5						
1,2,4-Trimethylbenzene		ND		5						
1,3,5-Trimethylbenzene		ND		5						
Vinyl Chloride		ND		10						
Xylenes, Total		ND		10						
Trichlorotrifluoroethane		ND		5						
Acetone		ND		100						
Acrylonitrile		ND		10						
2-Butanone		ND		100						

ANALYSIS: Volatile GC/MS

MATRIX: Water

METHOD BLANK SAMPLES

SAMPLE TYPE: Blank-Method/Media blank
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: BLNK_0519
PREPARED:
ANALYZED: 05/19/98

INSTR RUN: GCMS13\980519000000/1/
BATCH ID: MS13W051998
DILUTION: 1.00

ANALYTE	RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
Carbon Disulfide	ND		10						
trans-1,4-Dichloro-2-buten	ND		100						
cis-1,3-Dichloropropene	ND		5						
trans-1,3-Dichloropropene	ND		5						
2-Hexanone	ND		50						
Methyl Iodide	ND		200						
4-Methyl-2-pentanone	ND		50						
Vinyl Acetate	ND		50						
2-Chloroethyl Vinyl Ether	ND		10						
o-Xylene	ND		10						
m,p-Xylene	ND		10						
MTBE	ND		5						

LABORATORY CONTROL SAMPLES

SAMPLE TYPE: Laboratory Control Spike
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: LCS_0519
PREPARED:
ANALYZED: 05/19/98

INSTR RUN: GCMS13\980519000000/2/1
BATCH ID: MS13W051998
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	84.7	83.8		100	84.7	65	135		
Toluene-d8	(surr)	98.8	101		100	98.8	70	130		
p-BFB	(surr)	98.8	98.5		100	98.8	70	130		
1,1-Dichloroethene		54.5	ND	5	50.0	109	70	130		
Benzene		52.3	ND	5	50.0	105	70	130		
Trichloroethene		51.3	ND	5	50.0	103	70	130		
Toluene		53.9	ND	5	50.0	108	70	130		
Chlorobenzene		56.4	ND	5	50.0	113	70	130		

SAMPLE SURROGATES

SAMPLE TYPE: Sample-Client
INSTRUMENT: HP mass spec for Volatiles
UNITS: ug/L
METHOD:

LAB ID: 9805174-01A
PREPARED:
ANALYZED: 05/19/98

INSTR RUN: GCMS13\980519000000/8/
BATCH ID: MS13W051998
DILUTION: 1.00

ANALYTE		RESULT	REF RESULT	REPORTING LIMIT	SPIKE VALUE	RECOVERY (%)	REC LIMITS (%) LOW	REC LIMITS (%) HIGH	RPD (%)	RPD LIMIT (%)
1,2-DCA-d4	(surr)	76.3			100	76.3	65	135		
Toluene-d8	(surr)	99.8			100	99.8	70	130		
p-BFB	(surr)	89.4			100	89.4	70	130		

---------- End of Quality Control Report ----------

R-3,5-1

9805174

CHAIN-OF-CUSTODY RECORD

Nº 10166

Date: 5/15/98

Page 1 of 1

Project No.: 4710.01

Samplers (Signatures): Will Caldicott

	Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel	8260	Cooled	Soil (S), Water (W), or Vapor (V)	Acidified	Number of containers
A-C	5/15/98	1115	MW-4								X	Y	W	Y	3
A-C	↓	1238	MW-5								X	Y	W	Y	3

ANALYSES

REMARKS

Additional Comments

hold

Turnaround time: ASAP

Results to: Will Caldicott

Total No. of containers: 6

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature):	Date:
Will Caldicott					
Printed Name: Will Caldicott	Time:	Printed Name:	Time:	Printed Name:	Time:
Company: Geomatrix		Company:		Company:	
Received by (signature):	Date:	Received by (signature):	Date:	Received by (signature): Ronald C. Jensen	Date: 5/15/98
Printed Name:	Time:	Printed Name:	Time:	Printed Name: RON JENSEN	Time: 16:15
Company:		Company:		Company: AEN	

Method of Shipment: lab courier

Laboratory Comments and Log No.: COC INSIDE COOLER

GEOMATRIX
Geomatrix Consultants
100 Pine Street, 10th Floor
San Francisco, California 94111
415 434 9400

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Jensen, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
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e-mail: fbi@isomedia.com

May 19, 1998

Will Caldicott, Project Manager
Geomatrix Consultants, Inc.
100 Pine Street, Suite 1000
San Francisco, CA 94111-5112

Dear Mr. Caldicott:

Included are the results from the testing of material submitted on May 15, 1998 from your 4710.01 project. Any samples that may remain are currently scheduled for disposal in 30 days. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you should have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Charlene Jensen

Charlene Jensen
Chemist

Enclosures
GMC0519R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: 05/19/98
Date Received: 05/15/98
Project: 4710.01
Date Extracted: 05/18/98
Date Analyzed: 05/19/98

RESULTS FROM THE ANALYSIS OF THE WATER SAMPLE FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY USING A FLAME IONIZATION DETECTOR (FID) *AND ELECTRON CAPTURE DETECTOR (ECD)*

Sample ID	GC Characterization
MW-4	The GC trace using the flame ionization detector (FID) showed the presence of medium boiling compounds. The patterns displayed by these peaks are indicative of diesel fuel. The medium boiling compounds appeared as a pattern of peaks eluting from *n*-C_9 to *n*-C_{26}. A dominant pattern of *n*-alkanes was not seen. The medium boiling material appears to have undergone evaropative and biological degradation. The large peak seen near 25 minutes on the GC/FID trace is pentacosane, added as a quality assurance check for this GC analysis. There is a second surrogate present that is seen on the GC/ECD trace at about 26 minutes which is dibutyl chlorendate.

CHAIN-OF-CUSTODY RECORD

Nº 9077 | Date: 5/15/98 | Page 1 of 1

Project No: 4710.01

Samplers (Signatures):

Date	Time	Sample Number	EPA Method 8010	EPA Method 8020	EPA Method 8020 (BTEX only)	EPA Method 8240	EPA Method 8270	TPH as gasoline	TPH as diesel	Hydrocarbon fingerprint												Cooled	Soil (S), Water (W) or Vapor (V)	Acidified	Number of containers
5/15/98	1115	MW-4								X			-01									Y	W	N	2

ANALYSES

REMARKS

Additional Comments

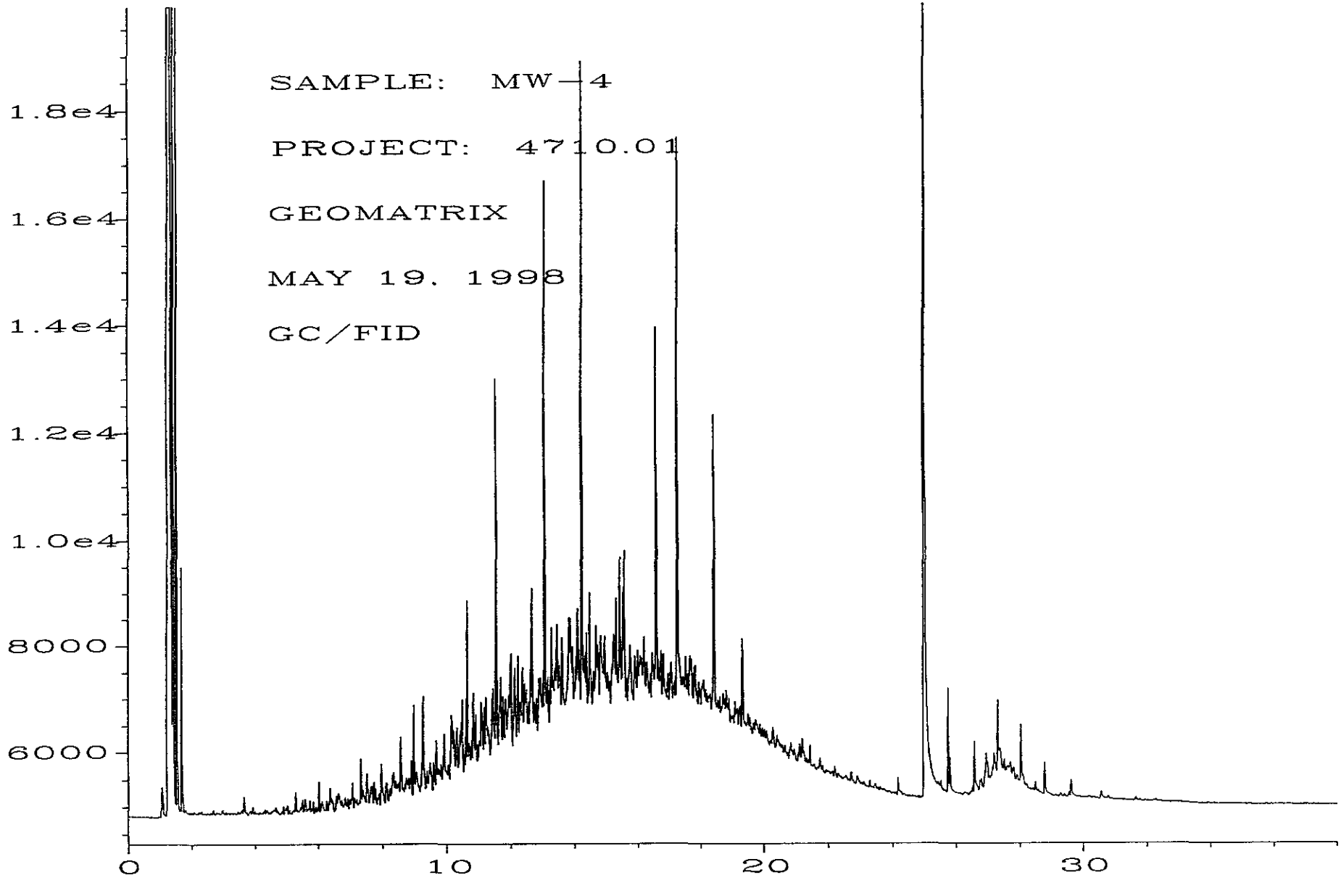
Turnaround time: ASAP

Results to: Will Caldicott

Total No of containers: 2

Relinquished by (signature):	Date:	Relinquished by (signature):	Date:	Relinquished by (signature).	Date:	Method of Shipment: UPS overnight
Printed Name: Will Caldicott	Time:	Printed Name:	Time:	Printed Name:	Time:	Laboratory Comments and Log No:
Company: Geomatrix		Company:		Company:		
Received by (signature):	Date: 5/16	Received by (signature)	Date.	Received by (signature).	Date	
Printed Name: James E Bruss	Time: 10AM	Printed Name:	Time:	Printed Name	Time	
Company: Friedman & Bruss		Company		Company		

GEOMATRIX Geomatrix Consultants
100 Pine Street 10th Floor
San Francisco California 94111
415 434 9400



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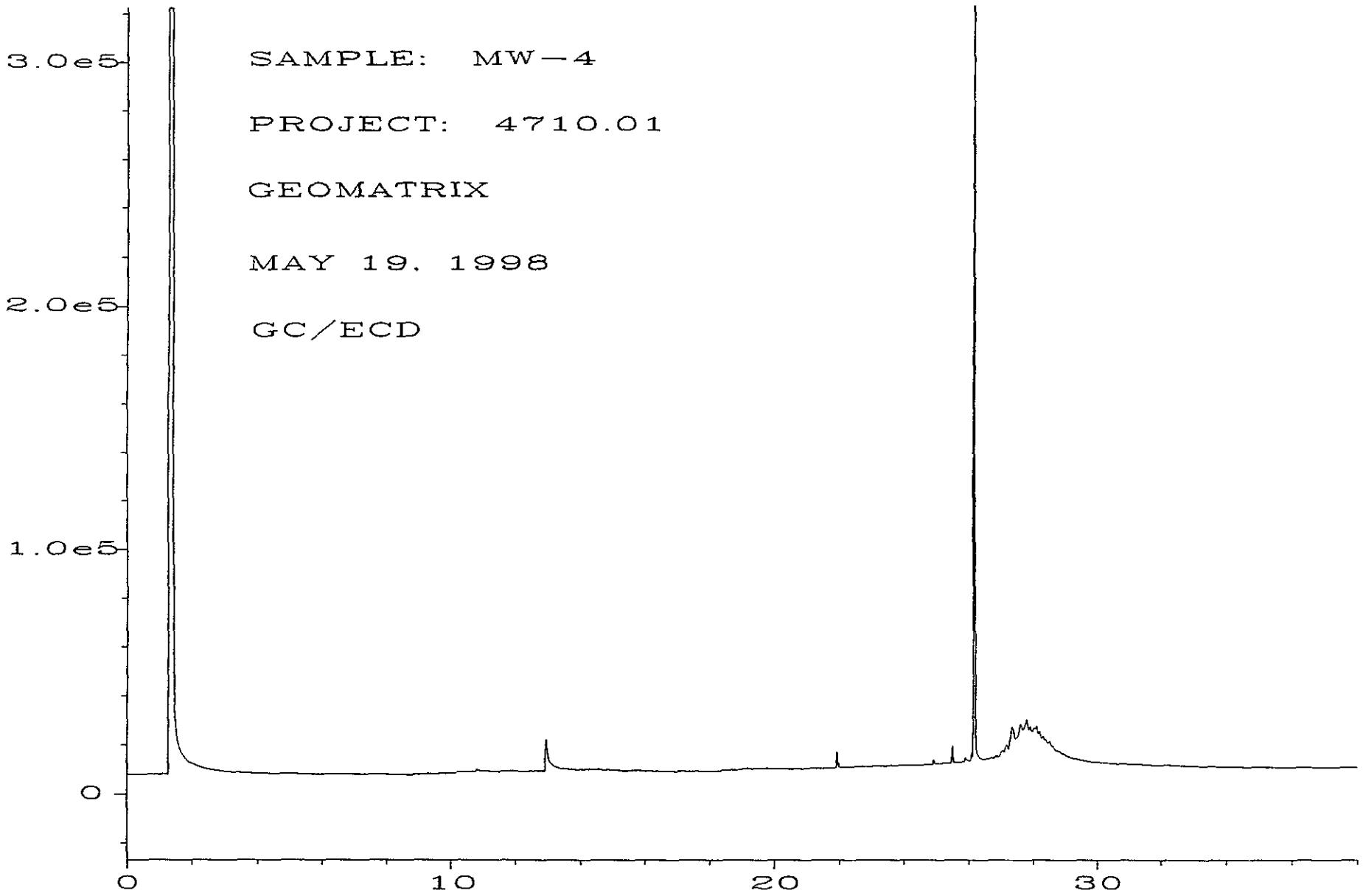

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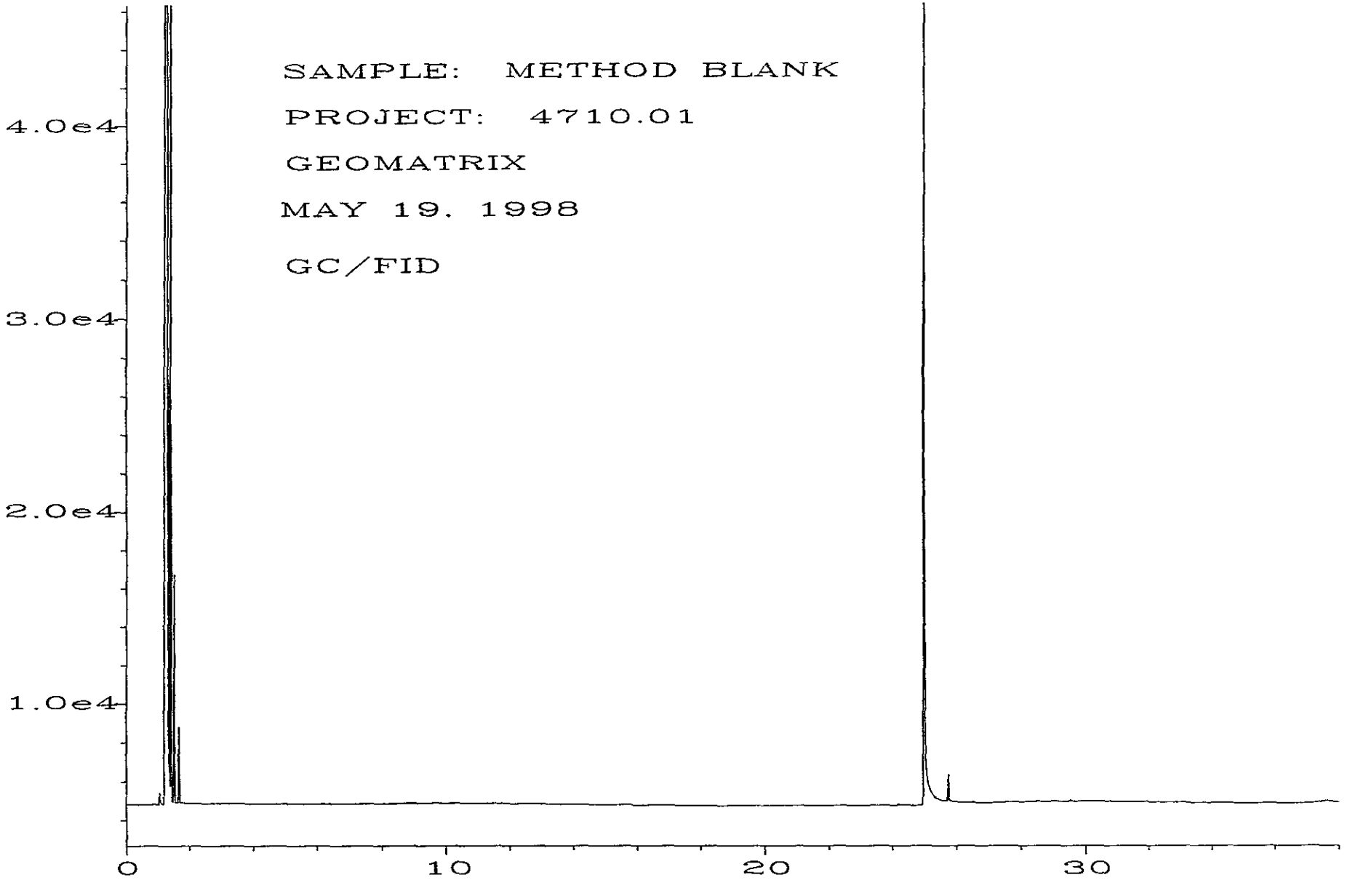

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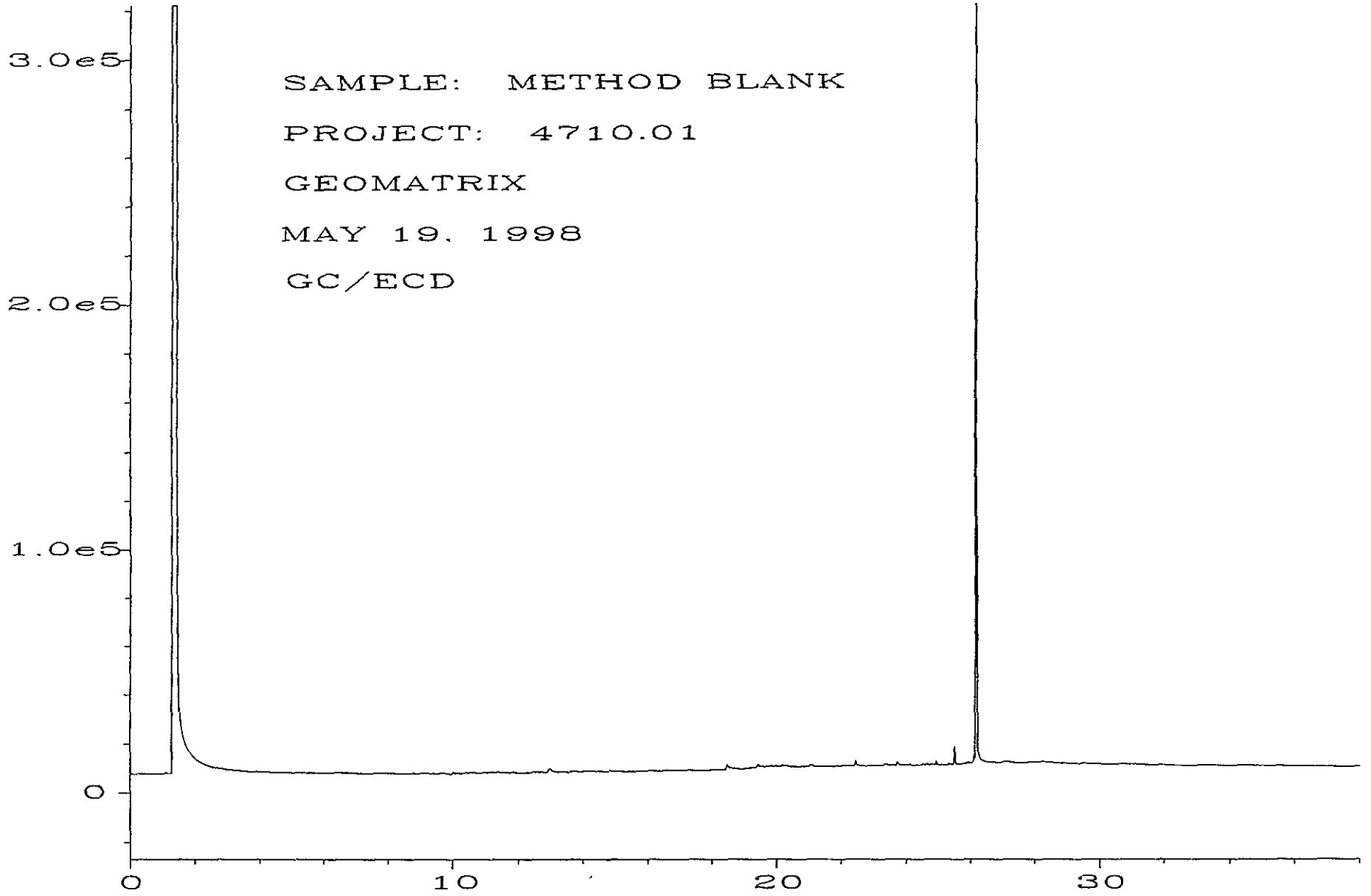

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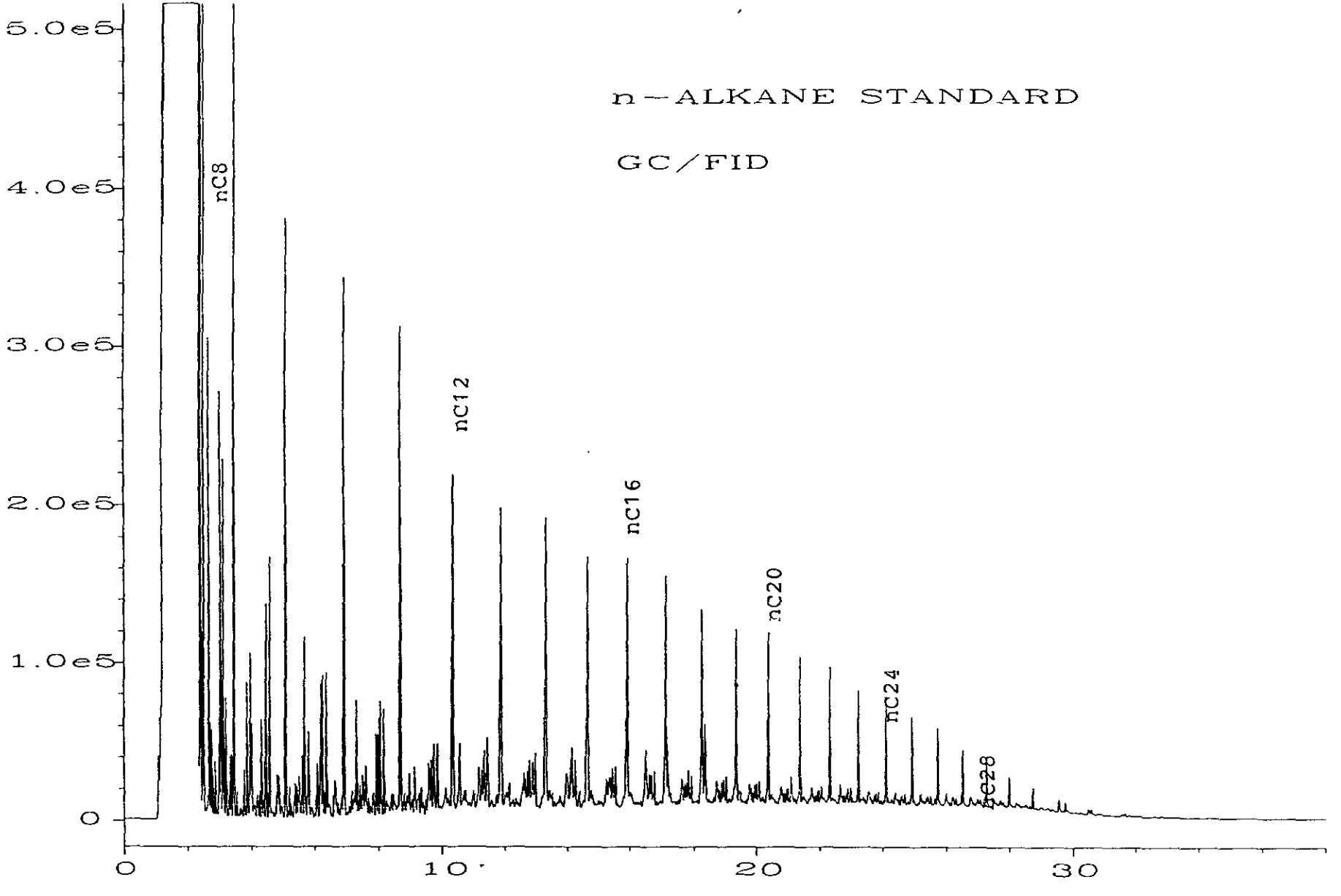

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GEOMATRIX

APPENDIX G

ESTIMATION OF CHEMICAL EMISSIONS AND AMBIENT AND INDOOR AIR CONCENTRATIONS

APPENDIX G

ESTIMATION OF CHEMICAL EMISSIONS AND AMBIENT AND INDOOR AIR CONCENTRATIONS

The vapor emission rates of volatile chemicals of potential concern (COPCs) in soil were estimated using the VOC emissions model provided in the Preliminary Endangerment Assessment (PEA) guidance manual (Cal-EPA, 1994a). In addition, the VOC emissions model was modified to accommodate emissions from groundwater. This model is a simple screening model that assumes that all phases are in equilibrium (vapor, liquid, solid phases) and that the source remains constant over time (i.e., does not account for source depletion). The estimated emission rates calculated for soil and groundwater were used to calculate indoor and ambient air concentrations using a box model. The box model is a simple mass balance equation that is based on the concept of a theoretically enclosed space over the area of interest. These models are described in the following paragraphs.

Soil Vapor Emissions

The VOC emissions model is not considered valid if "free phase" chemicals are present in the soil matrix. The presence of free phase chemicals can be assessed by comparing the concentration of the volatile COPCs in soil to the soil saturation concentration (C_{sat}), which is based on the adsorptive limit of the soil and the theoretical dissolution limit of each chemical in the available soil moisture. When the concentration in soil is greater than or equal to the C_{sat}, free phase material is considered to be present. The C_{sat} can be calculated using the equation presented in the U.S. EPA Soil Screening Guidance (U.S. EPA, 1996) and the default parameters presented in the PEA guidance manual (Cal-EPA, 1994a). The C_{sat} was calculated for each volatile COPC using the following equation; chemical-specific input parameters, including their source and rationale, are provided in Table 6 of the main text.

$$C_{sat} = \frac{S}{\rho b}(Kd \times \rho b + Pw + H' \times Pa)$$

Where:

C_{sat} = Soil saturation concentration for volatile COPCs ($mg_{chemical}/kg_{soil}$)

S = Chemical-specific solubility in water ($mg_{chemical}/L_{water}$; chemical-specific)

ρb = Dry soil bulk density (1.5 kg_{soil}/L_{soil}; Cal-EPA, 1994a)

Kd = Soil-water partition coefficient [cm^3_{water}/g_{soil}; equal to the chemical-specific organic carbon partition coefficient (Koc; L_{water}/kg_{soil} or cm^3_{water}/g_{soil} chemical-specific) multiplied by the fraction of organic carbon in soil (foc; 0.02; Cal-EPA, 1994a)].

Pw = Water-filled soil porosity (0.15 $cm^3_{water}/ cm^3_{soil}$; Cal-EPA, 1994a)

H′ = Dimensionless Henry's Law Constant [cm^3_{water}/cm^3_{air}; equal to the Henry's Law Constant (chemical-specific) multiplied by 41 (conversion factor) Cal-EPA, 1994a]

Pa = Air-filled soil porosity (0.284 cm^3_{air}/ cm^3_{soil}; Cal-EPA, 1994a)

As shown in the attached calculation spreadsheets, the concentrations of COPCs in soil are less than the Csat value. Therefore, use of the VOC emissions model is valid for concentrations in soil at the site.

The VOC emissions model uses chemical-specific physical characteristics (e.g., diffusivity in air) and assumptions regarding soil properties at the site (e.g., air-filled porosity) to predict the emission rate of volatile chemicals at the soil surface. The emission rate for each volatile COPC in soil was calculated using the following equation; chemical-specific parameters are presented in Table R-3 of the main text.

$$Ei = \frac{2 \times A \times Dei \times Pa \times Kas \times Cs \times 0.001\,kg/g}{\sqrt{\pi \times \alpha \times T}}$$

Where:

Ei = Emission rate over area of interest ($mg_{chemical}/sec$)

A = Emission area (12,000,000 cm^2; equivalent to 1200 m^2; site-specific)

Dei = Chemical-specific effective diffusivity [$cm^3/cm\text{-}sec.$; calculated as follows: Di x ($Pa^{3.333}/Pt^2$); where Di is the chemical-specific diffusivity in air (cm^2/sec), Pa is equal to the air-filled porosity, and Pt equals the total soil porosity]

Pa = Air-filled soil porosity (0.284 cm^3_{air}/ cm^3_{soil}; Cal-EPA, 1994a)

Pt = Total porosity (0.434 $cm^3_{water}/ cm^3_{soil}$; Cal-EPA, 1994a)

Kas = Soil/air partition coefficient [g_{soil}/cm^3_{air}; calculated as follows: (H/Kd) x 41; where H is the Henry's Law Constant (chemical specific) and Kd is soil-water partition coefficient (defined above)]

Cs = Bulk soil concentration of COPC ($mg_{chemical}/kg_{soil}$)

π = 3.14

α = cm^3/cm-sec; calculated as follows: $\alpha = \frac{(Dei \times Pa)}{Pa + [\rho \times (1 - Pa)/Kas]}$

ρ = Particle density (2.65 g_{soil}/cm^3_{soil}; Cal-EPA, 1994a)

T = Exposure duration (sec; equal to 1 year for noncarcinogenic health risks and 25 years for carcinogenic health risks)

Groundwater Vapor Emissions

As presented in the PEA guidance manual, the VOC emissions model estimates vapor emission rates from volatile chemicals in soil. For purposes of this evaluation, the VOC emissions model was modified to estimate groundwater vapor emissions by replacing the components of the model that estimate the concentration in soil vapor based on a soil concentration (i.e., measured soil concentration and soil-to-air partitioning coefficient) with components that estimate the concentration in soil vapor based on a groundwater concentration (i.e., measured groundwater concentration and Henry's Law Constant). The emission rate for each volatile COPC in groundwater was calculated using the following equation; the chemical-specific parameters are presented in Table 6 of the main text.

$$Ei = \frac{2 \times A \times Dei \times Pa \times H' \times Cw \times 0.001\, L_{water}/cm^3_{soil}}{\sqrt{\pi \times \alpha \times T}}$$

Where:

Ei = Emission rate over area of interest ($mg_{chemical}$/sec)

A = Emission area (12,000,000 cm^2; equivalent to 1200 m^2; site-specific)

Dei = Chemical-specific effective diffusivity [cm^3/cm-sec.; calculated as follows: Di x ($Pa^{3.333}/Pt^2$); where Di is the chemical-specific diffusivity in air

(cm^2/sec) and Pa is equal to the air-filled porosity and Pt equals the total soil porosity]

Pa = Air-filled soil porosity (0.284 cm^3_{air}/ cm^3_{soil}; Cal-EPA, 1994a)

Pt = Total porosity (0.434 $cm^3_{pore\ space}$/ cm^3_{soil}; Cal-EPA, 1994a)

H′ = Dimensionless Henry's Law Constant [(cm^3_{water}/ cm^3_{air}) equal to the Henry's Law Constant (chemical-specific) multiplied by 41 (conversion factor; Cal-EPA, 1994a).

Cw = Groundwater concentration of COPC ($mg_{chemical}/L_{water}$)

π = 3.14

α = cm^3/cm-sec; calculated as follows: $\alpha = \frac{(Dei \times Pa)}{Pa + [\rho \times (1 - Pa)/Kas]}$

K_{as} = Soil/air partition coefficient [g_{soil}/cm^3_{air}; calculated as follows: (H′/Kd) where Kd is soil-water partition coefficient]

K_d = Soil-water partition coefficient [cm^3_{water}/g_{soil}; equal to the chemical-specific organic carbon partition coefficient (Koc; L_{water}/kg_{soil} or cm^3_{water}/g_{soil} chemical-specific) multiplied by the fraction of organic carbon in soil [foc; 0.02 unitless; Cal-EPA, 1994a])].

ρ = Particle density (2.65 g_{soil}/cm^3_{soil}; Cal-EPA, 1994a)

T = Exposure interval (sec; equal to 1 year for noncarcinogenic health risks and 25 years for carcinogenic health risks)

Indoor Air Concentrations

The box model is typically used to estimate ambient air concentrations assuming vapors enter the box from the subsurface and are removed from the box by the wind. For purposes of this evaluation, the box model was modified to estimate indoor air concentrations by assuming that vapors enter the box via emissions through the cracks in the floor and are removed by ventilation. With these modifications, indoor air concentrations were calculated using the following equation, which was taken from the U.S. EPA's "Air/Superfund National Technical Guidance Study Series Assessing Potential Indoor Air Impacts at Superfund Sites" (1992); the calculations are presented in the attached calculation spreadsheets.

$$Cin = \frac{Ei \times F}{ACH/CF \times V}$$

Where:

Cin	=	Indoor air concentration (mg/m^3)
Ei	=	Emission rate from groundwater (mg/sec; calculated previously)
F	=	Fraction of floor area that is cracked (0.001 unitless; upper end of range for a house [Grimsrud et al., 1983])
ACH	=	Air exchanges per hour (1.5 hr^{-1}, U.S EPA, 1992; upper end of the range reported for a house)
CF	=	Conversion factor (3600 sec/hr)
V	=	Volume of air in building (3600 m^3; site-specific)

GEOMATRIX

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker Reasonable Maximum Exposure (RME) Scenario

Indoor Air Concentrations for Volatile Chemicals in Soil - Noncarcinogenic Health Risks
Step 1 Calculate Soil Saturation Concentration

$C_{sat} = S/Rho * (Kd * Rho + Pw + H' * Pa)$

Where $Kd = Koc * foc$ $H' = H * 41$

Chemical	Organic Carbon Partition Coefficient (Koc) (l/kg)	Fraction of Organic Carbon (foc) (unitless)	Solubility (S) (mg/l)	Soil Bulk Density (Rho) (kg/l)	Water-filled Soil Porosity (Pw) (cm^3/cm^3)	Henry's Law Constant (H) (atm-m^3/mole)	Dimensionless Henry's Law Constant (H') (cm^3/cm^3)	Air-filled Soil Porosity (Pa) (cm^3/cm^3)	Csat (mg/kg)	Max Soil Conc [Cs] (mg/kg)	Is Cs > Csat?
n-Butylbenzene	2 48E+03	0 02	5 00E+01	1 5	0 15	1 25E-03	5 13E-02	0 284	2 5E+03	6 5	n
sec-Butylbenzene	8 91E+02	0 02	1 71E+02	1 5	0 15	1 14E-02	4 67E-01	0 284	3 1E+03	6	n
1 1-Dichloroethane	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
cis-1 2-Dichloroethene	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
trans-1 2-Dichloroethene	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
Ethylbenzene	3 63E+02	0 02	1 69E+02	1 5	0 15	7 88E-03	3 23E-01	0 284	1 3E+03	0 03	n
Isopropylbenzene	2 82E+03	0 02	7 30E+01	1 5	0 15	5 58E-03	2 29E-01	0 284	4 1E+03	4	n
Isopropyltoluene	2 41E+03	0 02	2 34E+01	1 5	0 15	1 10E-02	4 51E-01	0 284	1 1E+03	0 3	n
Naphthalene	2 00E+03	0 02	3 10E+01	1 5	0 15	4 83E-04	1 98E-02	0 284	1 2E+03	5 1	n
n-Propylbenzene	7 41E+02	0 02	8 34E+01	1 5	0 15	1 08E-02	4 43E-01	0 284	1 3E+03	5 9	n
Tetrachloroethene	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
Toluene	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
Trichloroethene	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
1,2,4-Trimethylbenzene	3 72E+03	0 02	5 70E+01	1 5	0 15	5 70E-03	2 34E-01	0 284	4 2E+03	1 9	n
1 3 5-Trimethylbenzene	6 61E+02	0 02	9 77E+01	1 5	0 15	6 73E-03	2 76E-01	0 284	1 3E+03	1 4	n
Vinyl Chloride	NA	0 02	NA	1 5	0 15	NA	NA	0 284	NA	ND	NA
Xylene	3 86E+02	0 02	1 75E+02	1 5	0 15	6 73E-03	2 76E-01	0 284	1 4E+03	1 1	n

GEOMATRIX

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker- Reasonable Maximum Exposure (RME) Scenario

Step 2 Calculate Emission Rate

$Ei = 2 * A * Dei * Pa * Kas * Cs * 0.001/(\pi * \alpha * T)^{0.5}$

Where $Dei = Di * (Pa^{3.333}/Pt^2)$ $\quad Kas = (H/Kd) * 41$ $\quad Kd = Koc * foc$ $\quad \alpha = Dei * Pa/(Pa + (\rho * (1-Pa)/Kas))$

Chemical	Emission Area (A) (cm^2)	Diffusivity in Air (Di) (cm^2/sec)	Air-filled Soil Porosity (Pa) (cm^3/cm^3)	Total Soil Porosity (Pt) (cm^3/cm^3)	Effective Diffusivity (Dei) (cm^3/cm-sec)	Henry's Law Constant (H) (atm-m^3/mole)	Organic Carbon Partition Coefficient (Koc) (l/kg)	Fraction of Organic Carbon (foc) (unitless)	Soil/Air Partition Coefficient (Kas) (g/cm^3)	Max Soil Conc (Cs) (mg/kg)	Particle Density (ρ) (g/cm^3)	alpha (α) (cm^3/cm-sec)	Exposure Duration (T) (sec)	Emission Rate (Ei) (mg/sec)
n-Butylbenzene	1.2E+07	0.064	0.284	0.434	5.12E-03	1.25E-03	2.48E+03	0.02	1.03E-03	6.5	2.65	7.90E-07	3.15E+07	2.65E-02
sec-Butylbenzene	1.2E+07	0.064	0.284	0.434	5.12E-03	1.14E-02	8.91E+02	0.02	2.62E-02	6	2.65	2.00E-05	3.15E+07	1.23E-01
1,1-Dichloroethane	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
cis-1,2-Dichloroethene	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
trans-1,2-Dichloroethene	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
Ethylbenzene	1.2E+07	0.075	0.284	0.434	6.00E-03	7.88E-03	3.63E+02	0.02	4.45E-02	0.03	2.65	3.97E-05	3.15E+07	8.71E-04
Isopropylbenzene	1.2E+07	0.068	0.284	0.434	5.44E-03	5.58E-03	2.82E+03	0.02	4.06E-03	4	2.65	3.30E-06	3.15E+07	3.33E-02
Isopropyltoluene	1.2E+07	0.068	0.284	0.434	5.44E-03	1.10E-02	2.41E+03	0.02	9.36E-03	0.3	2.65	7.61E-06	3.15E+07	3.79E-03
Naphthalene	1.2E+07	0.059	0.284	0.434	4.72E-03	4.83E-04	2.00E+03	0.02	4.95E-04	5.1	2.65	3.50E-07	3.15E+07	1.38E-02
n-Propylbenzene	1.2E+07	0.068	0.284	0.434	5.44E-03	1.08E-02	7.41E+02	0.02	2.99E-02	5.9	2.65	2.42E-05	3.15E+07	1.33E-01
Tetrachloroethene	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
Toluene	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
Trichloroethene	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
1,2,4-Trimethylbenzene	1.2E+07	0.068	0.284	0.434	5.44E-03	5.70E-03	3.72E+03	0.02	3.15E-03	1.9	2.65	2.56E-06	3.15E+07	1.39E-02
1,3,5-Trimethylbenzene	1.2E+07	0.068	0.284	0.434	5.44E-03	6.73E-03	6.61E+02	0.02	2.09E-02	1.4	2.65	1.69E-05	3.15E+07	2.64E-02
Vinyl Chloride	NA	NA	0.284	0.434	NA	NA	NA	0.02	NA	NA	2.65	NA	3.15E+07	NA
Xylene	1.2E+07	0.087	0.284	0.434	6.96E-03	6.73E-03	3.86E+02	0.02	3.57E-02	1.1	2.65	3.70E-05	3.15E+07	3.08E-02

Step 3 Calculate Indoor Air Concentrations

$Cm = (Ei * F)/((ACH/CF) * V)$

Chemical	Emission Rate (Ei) (mg/sec)	Fretn of Flr that is Crkd (F)	Air Exchange Rate (ACH) $(hr)^{-1}$	Volume of Air in Bldg (V) (m^3)	Conversion Factor (sec/hr)	Indoor Air Conc (Cm) (mg/m^3)
n-Butylbenzene	2.65E-02	0.001	1.5	3600	3600	1.76E-05
sec-Butylbenzene	1.23E-01	0.001	1.5	3600	3600	8.22E-05
1,1-Dichloroethane	NA	0.001	1.5	3600	3600	NA
cis-1,2-Dichloroethene	NA	0.001	1.5	3600	3600	NA
trans-1,2-Dichloroethene	NA	0.001	1.5	3600	3600	NA
Ethylbenzene	8.71E-04	0.001	1.5	3600	3600	5.80E-07
Isopropylbenzene	3.33E-02	0.001	1.5	3600	3600	2.22E-05
Isopropyltoluene	3.79E-03	0.001	1.5	3600	3600	2.53E-06
Naphthalene	1.38E-02	0.001	1.5	3600	3600	9.20E-06
n-Propylbenzene	1.33E-01	0.001	1.5	3600	3600	8.90E-05
Tetrachloroethene	NA	0.001	1.5	3600	3600	NA
Toluene	NA	0.001	1.5	3600	3600	NA
Trichloroethene	NA	0.001	1.5	3600	3600	NA
1,2,4-Trimethylbenzene	1.39E-02	0.001	1.5	3600	3600	9.28E-06
1,3,5-Trimethylbenzene	2.64E-02	0.001	1.5	3600	3600	1.76E-05
Vinyl Chloride	NA	0.001	1.5	3600	3600	NA
Xylene	3.08E-02	0.001	1.5	3600	3600	2.05E-05

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Human Health Risk Assessment
Rite Property
Emeryville, California

Current and Future On-Site Commercial Worker: Reasonable Maximum Exposure (RME) Scenario

Indoor Air Concentrations for Chemicals in Groundwater-Noncarcinogenic and Carcinogenic Health Risks

Step 1 Estimate Flux from Groundwater Noncarcinogenic Health Risks

Emission Rate = (2 *A* Dei * Pa * Cw *H' * CF)/(π * is * T)^0 5
Where
α = (Dei * Pa)/(Pa + (ρ*(1-Pa)/Kas))
Dei = Di * ($Pa^{3.333}$/Pt^2)
Kas = (H/Kd)*41
H' = H * 41
Kd = Koc*foc

Chemical	Max GW Conc (Cw) (mg/l)	Emissions Area (A) (cm^2)	Diffusivity in Air (Di) (cm^2/sec)	Air-Filled Soil Porosity (Pa) (cm^3/cm^3)	Total Porosity (Pt) (cm^3/cm^3)	Effective Diffusivity (Dei) (cm^3/cm-sec)	Henry's Law Constant (H) (atm-m^3/mole)	Dimensionless Henry's Law Constant (H') (cm^3/cm^3)	Organic Carbon Partition Coefficient (Koc) (ml/g)	Fraction of Organic Carbon (foc) (Unitless)	Soil-Water Partition Coefficient (Kd) (cm^3/g)	Soil-Air Partition Coeffient (Kas) (g/cm^3)	Particle Density (r) (g/cm^3)	Alpha (a) (cm^3/cm-sec)	Time (T) (sec)	Conversion Factor (C.F) (l/cm^3)	Emission Rate (E_i) (mg/sec)
n-Butylbenzene	ND	1 2E+07	0 064	0 284	0 434	5 12E-03	1 25E-03	5 13E-02	2 48E+03	0 02	49 66	1 032E-03	2 65	7 90E-07	3 15E+07	1 00E-03	NA
sec-Butylbenzene	0 015	1 2E+07	0 064	0 284	0 434	5 12E-03	1 14E-02	4 67E-01	8 91E+02	0 02	17 82	2 623E-02	2 65	2 08E-05	3 15E+07	1 00E-03	5 49E-03
1 1-Dichloroethane	0 12	1 2E+07	0 074	0 284	0 434	5 93E-03	5 62E-03	2 30E-01	3 16E+01	0 02	0 63	3 646E-03	2 65	3 07E-04	3 15E+07	1 00E-03	6 41E-03
cis-1,2-Dichloroethene	0 14	1 2E+07	0 074	0 284	0 434	5 89E-03	4 08E-03	1 67E-01	3 55E+01	0 02	0 71	2 356E-03	2 65	2 00E-04	3 15E+07	1 00E-03	6 67E-03
trans-1 2-Dichloroethene	0 018	1 2E+07	0 071	0 284	0 434	5 65E-03	9 38E-03	3 85E-01	5 25E+01	0 02	1 05	3 663E-03	2 65	2 94E-04	3 15E+07	1 00E-03	1 56E-03
Ethylbenzene	0 007	1 2E+07	0 075	0 284	0 434	6 00E-03	7 88E-03	3 23E-01	3 63E+02	0 02	7 26	4 456E-02	2 65	3 97E-05	3 15E+07	1 00E-03	1 47E-03
Isopropylbenzene	0 016	1 2E+07	0 068	0 284	0 434	5 44E-03	5 58E-03	2 29E-01	2 82E+03	0 02	56 36	4 059E-03	2 65	3 30E-06	3 15E+07	1 00E-03	7 50E-03
Isopropyltoluene	ND	1 2E+07	0 064	0 284	0 434	5 12E-03	1 10E-02	4 51E-01	2 41E+03	0 02	48 20	9 357E-03	2 65	7 16E-06	3 15E+07	1 00E-03	NA
Naphthalene	0 005	1 2E+07	0 059	0 284	0 434	4 72E-03	4 83E-04	1 98E-02	2 00E+03	0 02	40 00	4 951E-04	2 65	3 50E-07	3 15E+07	1 00E-03	5 41E-04
n-Propylbenzene	0 009	1 2E+07	0 068	0 284	0 434	5 44E-03	1 08E-02	4 43E-01	7 41E+02	0 02	14 83	2 987E-02	2 65	2 42E-05	3 15E+07	1 00E-03	3 02E-03
Tetrachloroethene	0 12	1 2E+07	0 072	0 284	0 434	5 76E-03	1 84E-02	7 54E-01	1 55E+02	0 02	3 10	2 434E-01	2 65	2 02E-04	3 15E+07	1 00E-03	2 51E-02
Toluene	0 25	1 2E+07	0 087	0 284	0 434	6 96E-03	6 64E-03	2 72E-01	1 82E+02	0 02	3 64	7 479E-02	2 65	7 70E-05	3 15E+07	1 00E-03	3 70E-02
Trichloroethene	0 19	1 2E+07	0 079	0 284	0 434	6 32E-03	1 03E-02	4 22E-01	1 66E+02	0 02	3 32	1 272E-01	2 65	1 18E-04	3 15E+07	1 00E-03	3 20E-02
1,2,4-Trimethylbenzene	0 12	1 2E+07	0 068	0 284	0 434	5 44E-03	5 70E-03	2 34E-01	3 72E+03	0 02	74 31	3 145E-03	2 65	2 56E-06	3 15E+07	1 00E-03	6 53E-02
1,3,5-Trimethylbenzene	0 011	1 2E+07	0 068	0 284	0 434	5 44E-03	6 73E-03	2 76E-01	6 61E+02	0 02	13 21	2 088E-02	2 65	1 69E-05	3 15E+07	1 00E-03	2 75E-03
Vinyl Chloride	0 11	1 2E+07	0 106	0 284	0 434	8 48E-03	2 70E-02	1 11E+00	1 86E+01	0 02	0 37	2 976E+00	2 65	2 61E-03	3 15E+07	1 00E-03	1 38E-02
Xylene	0 075	1 2E+07	0 087	0 284	0 434	6 96E-03	6 73E-03	2 76E-01	3 86E+02	0 02	7 73	3 571E-02	2 65	3 70E-05	3 15E+07	1 00E-03	1 62E-02

Step 2 Calculate Indoor Air Concentrations-Noncarcinogenic Health Risks

$C_{in} = (E_i * F)/((ACH/CF) * V)$

Chemical	Emission Rate (E_i) (mg/sec)	Frctn of Flr that is Crkd (F)	Air Exchange Rate (ACH) $(hr)^{-1}$	Volume of Air in Bldg (V) (m^3)	Conversion Factor (sec/hr)	Indoor Air Conc (C_{in}) (mg/m^3)
n-Butylbenzene	NA	0 001	1 5	3600	3600	NA
sec-Butylbenzene	5 49E-03	0 001	1 5	3600	3600	3 66E-06
1 1-Dichloroethane	6 41E-03	0 001	1 5	3600	3600	4 28E-06
cis-1,2-Dichloroethene	6 67E-03	0 001	1 5	3600	3600	4 45E-06
trans-1 2-Dichloroethene	1 56E-03	0 001	1 5	3600	3600	1 04E-06
Ethylbenzene	1 47E-03	0 001	1 5	3600	3600	9 83E-07
Isopropylbenzene	7 50E-03	0 001	1 5	3600	3600	5 00E-06
Isopropyltoluene	NA	0 001	1 5	3600	3600	NA
Naphthalene	5 41E-04	0 001	1 5	3600	3600	3 61E-07
n-Propylbenzene	3 02E-03	0 001	1 5	3600	3600	2 01E-06
Tetrachloroethene	2 51E-02	0 001	1 5	3600	3600	1 67E-05
Toluene	3 70E-02	0 001	1 5	3600	3600	2 46E-05
Trichloroethene	3 20E-02	0 001	1 5	3600	3600	2 13E-05
1 2,4- Trimethylbenzene	6 53E-02	0 001	1 5	3600	3600	4 35E-05
1,3,5-Trimethylbenzene	2 75E-03	0 001	1 5	3600	3600	1 83E-06
Vinyl Chloride	1 38E-02	0 001	1 5	3600	3600	9 22E-06
Xylene	1 62E-02	0 001	1 5	3600	3600	1 08E-05

GEOMATRIX

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker: Reasonable Maximum Exposure (RME) Scenario

Step 1 Estimate Flux from Groundwater-Carcinogenic Health Risks

Emission Rate = (2 *A* Dei * Pa * Cw*H' * CF)/(π * α * T)^0.5

Where
α = (Dei * Pa)/(Pa + (n*(1-Pa)/Kas))
Dei = Di * ($Pa^{3.333}$/Pt^2)
Kas = (H/Kd)*41

H' = H * 41
Kd = Koc*foc

Chemical	GW Conc (Cw) (mg/l)	Emissions Area (A) (cm^2)	Diffusivity in Air (Di) (cm^2/sec)	Air-Filled Soil Porosity (Pa) (cm^3/cm^3)	Total Porosity (Pt) (cm^3/cm^3)	Effective Diffusivity (Dei) (cm^3/cm-sec)	Henry's Law Constant (H) (atm-m^3/mole)	Dimensionless Henry's Law Constant (H') (cm^3/cm^3)	Organic Carbon Partition Coefficient (Koc) (ml/g)	Fraction of Organic Carbon (foc) (Unitless)	Soil-Water Partition Coeffient (Kd) (cm^3/g)	Soil-Air Partition Coeffient (Kas) (g/cm^3)	Particle Density (r) (g/cm^3)	Alpha (a) (cm^3/cm-sec)	Time (T) (sec)	Conversion Factor (CF) (l/cm^3)	Emission Rate (E_i) (mg/sec)
n-Butylbenzene	ND	1 2E+07	0 064	0 284	0 434	5 12E-03	1 25E-03	5 13E-02	2 48E+03	0 02	49 66	1 03E 03	2 65	7 90E-07	7 88E+08	1 00E-03	NA
sec-Butylbenzene	0 015	1 2E+07	0 064	0 284	0 434	5 12E-03	1 14E-02	4 67E-01	8 91E+02	0 02	17 82	2 62E-02	2 65	2 00E-05	7 88E+08	1 00E-03	1 10E-03
1,1-Dichloroethane	0 12	1 2E+07	0 074	0 284	0 434	5 93E-03	5 62E-03	2 30E-01	3 16E+01	0 02	0 63	3 65E-01	2 65	3 07E-04	7 88E+08	1 00E-03	1 28E-03
cis-1,2-Dichloroethene	0 14	1 2E+07	0 074	0 284	0 434	5 89E-03	4 08E-03	1 67E-01	3 55E+01	0 02	0 71	2 36E-01	2 65	2 00E-04	7 88E+08	1 00E-03	1 33E-03
trans-1 2-Dichloroethene	0 018	1 2E+07	0 071	0 284	0 434	5 65E-03	9 38E-03	3 85E-01	5 25E+01	0 02	1 05	3 66E-01	2 65	2 94E-04	7 88E+08	1 00E-03	3 13E-04
Ethylbenzene	0 007	1 2E+07	0 075	0 284	0 434	6 00E-03	7 88E-03	3 23E-01	3 63E+02	0 02	7 26	4 45E-02	2 65	3 97E-05	7 88E+08	1 00E-03	2 95E-04
Isopropylbenzene	0 016	1 2E+07	0 068	0 284	0 434	5 44E-03	5 58E-03	2 29E-01	2 82E+03	0 02	56 36	4 06E-03	2 65	3 30E-06	7 88E+08	1 00E-03	1 50E-03
Isopropyltoluene	ND	1 2E+07	0 064	0 284	0 434	5 12E-03	1 10E-02	4 51E-01	2 41E+03	0 02	48 20	9 36E-03	2 65	7 16E-06	7 88E+08	1 00E-03	NA
Naphthalene	0 005	1 2E+07	0 059	0 284	0 434	4 72E-03	4 83E-04	1 98E-02	2 00E+03	0 02	40 00	4 95E-04	2 65	3 50E-07	7 88E+08	1 00E-03	1 08E-04
n-Propylbenzene	0 009	1 2E+07	0 068	0 284	0 434	5 44E-03	1 08E-02	4 43E-01	7 41E+02	0 02	14 83	2 99E-02	2 65	2 42E-05	7 88E+08	1 00E-03	6 03E-04
Tetrachloroethene	0 12	1 2E+07	0 072	0 284	0 434	5 76E-03	1 84E-02	7 54E-01	1 55E+02	0 02	3 10	2 43E-01	2 65	2 02E-04	7 88E+08	1 00E-03	5 02E-03
Toluene	0 25	1 2E+07	0 087	0 284	0 434	6 96E-03	6 64E-03	2 72E-01	1 82E+02	0 02	3 64	7 48E-02	2 65	7 70E-05	7 88E+08	1 00E-03	7 39E-03
Trichloroethene	0 19	1 2E+07	0 079	0 284	0 434	6 32E-03	1 03E-02	4 22E-01	1 66E+02	0 02	3 32	1 27E-01	2 65	1 18E-04	7 88E+08	1 00E-03	6 39E-03
1 2 4-Trimethylbenzene	0 12	1 2E+07	0 068	0 284	0 434	5 44E-03	5 70E-03	2 34E-01	3 72E+03	0 02	74 31	3 15E-03	2 65	2 56E-06	7 88E+08	1 00E-03	1 31E-02
1,3 5-Trimethylbenzene	0 011	1 2E+07	0 068	0 284	0 434	5 44E-03	6 73E-03	2 76E-01	6 61E+02	0 02	13 21	2 09E-02	2 65	1 69E-05	7 88E+08	1 00E-03	5 49E-04
Vinyl Chloride	0 11	1 2E+07	0 106	0 284	0 434	8 48E-03	2 70E-02	1 11E+00	1 86E+01	0 02	0 37	2 98E+00	2 65	2 61E-03	7 88E+08	1 00E-03	2 77E-03
Xylene	0 075	1 2E+07	0 087	0 284	0 434	6 96E-03	6 73E-03	2 76E-01	3 86E+02	0 02	7 73	3 57E-02	2 65	3 70E-05	7 88E+08	1 00E-03	3 24E-03

Step 2 Calculate Indoor Air Concentrations Carcinogenic Health Risks

C_{in} = (E_i*F)/((ACH/CF)*V)

Chemical	Emission Rate (E_i) (mg/sec)	Fretn of Flr that is Crkd (F)	Air Exchange Rate (ACH) (hr)$^{-1}$	Volume of Air in Bldg (V) (m^3)	Conversion Factor (sec/hr)	Indoor Air Conc (C_{in}) (mg/m^3)
n-Butylbenzene	NA	0 001	1 5	3600	3600	NA
sec-Butylbenzene	1 10E-03	0 001	1 5	3600	3600	7 33E-07
1,1-Dichloroethane	1 28E-03	0 001	1 5	3600	3600	8 55E-07
cis-1,2-Dichloroethene	1 33E-03	0 001	1 5	3600	3600	8 89E-07
trans-1,2-Dichloroethene	3 13E-04	0 001	1 5	3600	3600	2 09E-07
Ethylbenzene	2 95E-04	0 001	1 5	3600	3600	1 97E-07
Isopropylbenzene	1 50E-03	0 001	1 5	3600	3600	1 00E-06
Isopropyltoluene	NA	0 001	1 5	3600	3600	NA
Naphthalene	1 08E-04	0 001	1 5	3600	3600	7 22E-08
n-Propylbenzene	6 03E-04	0 001	1 5	3600	3600	4 02E-07
Tetrachloroethene	5 02E-03	0 001	1 5	3600	3600	3 35E-06
Toluene	7 39E-03	0 001	1 5	3600	3600	4 93E-06
Trichloroethene	6 39E-03	0 001	1 5	3600	3600	4 26E-06
1,2 4-Trimethylbenzene	1 31E-02	0 001	1 5	3600	3600	8 71E-06
1,3 5-Trimethylbenzene	5 49E-04	0 001	1 5	3600	3600	3 66E-07
Vinyl Chloride	2 77E-03	0 001	1 5	3600	3600	1 84E-06
Xylene	3 24E-03	0 001	1 5	3600	3600	2 16E-06

GEOMATRIX

APPENDIX H

EQUATIONS USED FOR ESTIMATING PHYSICAL CONSTANTS OF SELECTED CHEMICALS OF POTENTIAL CONCERN

APPENDIX H

EQUATIONS USED FOR ESTIMATING PHYSICAL CONSTANTS OF SELECTED CHEMICALS OF POTENTIAL CONCERN

The diffusivity in air coefficient (Di) was calculated for several chemicals of potential concern using the following equation from U.S. EPA's Superfund Exposure Assessment Manual (1988b), the calculations are shown in the attached calculation spreadsheet.

$$Di = \frac{0.001 \times T^{1.75} \sqrt{\frac{1}{MWi} + \frac{1}{MWa}}}{Pa\left[\left(\sum Vi\right)^{1/3} + \left(\sum Va\right)^{1/3}\right]^2}$$

Where:

Di = Diffusivity in air (cm^2/sec)

T = Absolute temperature (°Kelvin)

MWi = Molecular weight of toxic substance (g/mole)

MWa = Molecular weight of air (g/mole)

Pa = Absolute pressure (atm.)

$\sum Vi$ = Molecular diffusion volumes of toxic substance (cm^3/mole)

$\sum Va$ = Molecular diffusion volumes of air (cm^3/mole)

Human Health Risk Assessment
Rix Property
Emeryville, California

Calculation of Diffusivity in Air Coefficients Using Equation in U.S. EPA Guidance Manuals (Superfund Exposure Assessment Manual)

C atom	16.5
H atom	1.98
O atom	5.48
N atom	5.69
Cl atom	19.5
Aromatic	-20.2
Heterocyc	-20.2

$$Di = (0.001T^{1.75}*(1/MWi + 1/MWa)^{0.5}) / (Pa * [(Vi)^{1/3} + (Va)^{1/3})]^2)$$

Chemical	MWi (g/mole)	# Carbons	# Hydrogens	# Oxygen	# Nitrogen	# Chlorine	# Aromatic Rings	# Heterocyclic	Vi (cm^3/mole)
n-Butylbenzene	134.22	10	14	0	0	0	1	0	172.5
sec-Butylbenzene	134.22	10	14	0	0	0	1	0	172.5
Isopropylbenzene	120.19	9	12	0	0	0	1	0	152.1
Isopropyltoluene	134.22	10	14	0	0	0	1	0	172.5
n-Propylbenzene	120.19	9	12	0	0	0	1	0	152.1
1,2,4-Trimethylbenzene	120.19	9	12	0	0	0	1	0	152.1
1,3,5-Trimethylbenzene	120.19	9	12	0	0	0	1	0	152.1

Chemical	Constant	Temp (K)	MWi (g/mole)	MWa (g/mole)	Pa (atm)	Vi (cm^3/mole)	Va (cm^3/mole)	Di (cm^2/sec)
n-Butylbenzene	0.001	298	134.22	28.8	1	172.5	20.1	0.064
sec-Butylbenzene	0.001	298	134.22	28.8	1	172.5	20.1	0.064
Isopropylbenzene	0.001	298	120.19	28.8	1	152.1	20.1	0.068
Isopropyltoluene	0.001	298	134.22	28.8	1	172.5	20.1	0.064
n-Propylbenzene	0.001	298	120.19	28.8	1	152.1	20.1	0.068
1,2,4-Trimethylbenzene	0.001	298	120.19	28.8	1	152.1	20.1	0.068
1,3,5-Trimethylbenzene	0.001	298	120.19	28.8	1	152.1	20.1	0.068

GEOMATRIX

APPENDIX I

HUMAN HEALTH RISK ASSESSMENT CALCULATION SPREADSHEETS

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker: Reasonable Maximum Exposure (RME) Scenario

Inhalation of Soil Vapors AADD = (Cin*IRa*EF*ED)/(BW*AT) Hazard Quotient = AADD/RfDi

Chemical	Indoor Air (Soil) Concentration (Cin) (mg/m^3)	Inhalation Rate (IR_a) (m^3/day)	Exposure Frequency (EF) (days/year)	Exposure Duration (ED) (years)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Annual Average Daily Dose (AADD) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Hazard Quotient
n-Butylbenzene	1.76E-05	20	250	25	70	9125	3.45E-06	1.0E-02	3E-04
sec-Butylbenzene	8.22E-05	20	250	25	70	9125	1.61E-05	1.0E-02	2E-03
1,1-Dichloroethane	NA	20	250	25	70	9125	NA	1.0E-02	NA
cis-1,2-Dichloroethene	NA	20	250	25	70	9125	NA	1.0E-02	NA
trans-1,2-Dichloroethene	NA	20	250	25	70	9125	NA	1.0E-02	NA
Ethylbenzene	5.80E-07	20	250	25	70	9125	1.14E-07	2.9E-01	4E-07
Isopropylbenzene	2.22E-05	20	250	25	70	9125	4.34E-06	2.6E-03	2E-03
Isopropyltoluene	2.53E-06	20	250	25	70	9125	4.95E-07	NA	NA
Naphthalene	9.20E-06	20	250	25	70	9125	1.80E-06	4.0E-02	5E-05
n-Propylbenzene	8.90E-05	20	250	25	70	9125	1.74E-05	1.0E-02	2E-03
Tetrachloroethene	NA	20	250	25	70	9125	NA	1.0E-02	NA
Toluene	NA	20	250	25	70	9125	NA	1.0E-02	NA
Trichloroethene	NA	20	250	25	70	9125	NA	1.0E-02	NA
1,2,4-Trimethylbenzene	9.28E-06	20	250	25	70	9125	1.82E-06	1.7E-03	1E-03
1,3,5-Trimethylbenzene	1.76E-05	20	250	25	70	9125	3.45E-06	1.7E-03	2E-03
Vinyl Chloride	NA	20	250	25	70	9125	NA	1.7E-03	NA
Xylene	2.05E-05	20	250	25	70	9125	4.02E-06	2.0E-01	2E-05
								Total	9E-03

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker: Reasonable Maximum Exposure (RME) Scenario

Inhalation of Groundwater Vapors AADD = (Cin*IRa*EF*ED)/(BW*AT) Hazard Quotient = AADD/RfDi

Chemical	Indoor Air (Soil) Concentration (Cin) (mg/m^3)	Inhalation Rate (IR_a) (m^3/day)	Exposure Frequency (EF) (days/year)	Exposure Duration (ED) (years)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Annual Average Daily Dose (AADD) (mg/kg-day)	Inhalation Reference Dose (RfDi) (mg/kg-day)	Hazard Quotient
n-Butylbenzene	NA	20	250	1	70	9125	NA	1.00E-02	NA
sec-Butylbenzene	3 66E-06	20	250	1	70	9125	2.87E-08	1.00E-02	3E-06
1,1-Dichloroethane	4.28E-06	20	250	1	70	9125	3 35E-08	1.40E-01	2E-07
cis-1,2-Dichloroethene	4.45E-06	20	250	1	70	9125	3 48E-08	1 00E-02	3E-06
trans-1,2-Dichloroethene	1.04E-06	20	250	1	70	9125	8.16E-09	2 00E-02	4E-07
Ethylbenzene	9.83E-07	20	250	1	70	9125	7 70E-09	2.90E-01	3E-08
Isopropylbenzene	5 00E-06	20	250	1	70	9125	3.92E-08	1 10E-01	4E-07
Isopropyltoluene	NA	20	250	1	70	9125	NA	NA	NA
Naphthalene	3 61E-07	20	250	1	70	9125	2.82E-09	8.60E-04	3E-06
n-Propylbenzene	2.01E-06	20	250	1	70	9125	1.57E-08	1.00E-02	2E-06
Tetrachloroethene	1.67E-05	20	250	1	70	9125	1 31E-07	1.10E-01	1E-06
Toluene	2.46E-05	20	250	1	70	9125	1.93E-07	1.10E-01	2E-06
Trichloroethene	2.13E-05	20	250	1	70	9125	1.67E-07	6.00E-03	3E-05
1,2,4-Trimethylbenzene	4.35E-05	20	250	1	70	9125	3.41E-07	1.70E-03	2E-04
1,3,5-Trimethylbenzene	1.83E-06	20	250	1	70	9125	1 43E-08	1.70E-03	8E-06
Vinyl Chloride	9.22E-06	20	250	1	70	9125	7.22E-08	NA	NA
Xylene	1.08E-05	20	250	1	70	9125	8.46E-08	2.00E-01	4E-07
								Total	3E-04

Human Health Risk Assessment
Rix Property
Emeryville, California

Current and Future On-Site Commercial Worker: Reasonable Maximum Exposure (RME) Scenario

Inhalation of Groundwater Vapors LADD = (Cin*IRa*EF*ED)/(BW*AT) Excess Cancer Risk = LADD*SFi

Chemical	Indoor Air (Soil) Concentration (Cin) (mg/m^3)	Inhalation Rate (IR_a) (m^3/day)	Exposure Frequency (EF) (days/year)	Exposure Duration (ED) (years)	Body Weight (BW) (kg)	Averaging Time (AT) (days)	Lifetime Average Daily Dose (LADD) (mg/kg-day)	Inhalation Slope Factors (SFi) (mg/kg-day)	Excess Cancer Risk
n-Butylbenzene	NA	20	250	25	70	25550	NA	NA	NA
sec-Butylbenzene	7.33E-07	20	250	25	70	25550	5 12E-08	NA	NA
1,1-Dichloroethane	8.55E-07	20	250	25	70	25550	5.98E-08	NA	NA
cis-1,2-Dichloroethene	8 89E-07	20	250	25	70	25550	6.21E-08	NA	NA
trans-1,2-Dichloroethene	2.09E-07	20	250	25	70	25550	1.46E-08	NA	NA
Ethylbenzene	1.97E-07	20	250	25	70	25550	1 37E-08	NA	NA
Isopropylbenzene	1 00E-06	20	250	25	70	25550	6.99E-08	NA	NA
Isopropyltoluene	NA	20	250	25	70	25550	NA	NA	NA
Naphthalene	7.22E-08	20	250	25	70	25550	5.04E-09	NA	NA
n-Propylbenzene	4.02E-07	20	250	25	70	25550	2.81E-08	NA	NA
Tetrachloroethene	3.35E-06	20	250	25	70	25550	2 34E-07	2 10E-02	5E-09
Toluene	4.93E-06	20	250	25	70	25550	3 44E-07	NA	NA
Trichloroethene	4.26E-06	20	250	25	70	25550	2.98E-07	1.00E-02	3E-09
1,2,4-Trimethylbenzene	8 71E-06	20	250	25	70	25550	6.09E-07	NA	NA
1,3,5-Trimethylbenzene	3.66E-07	20	250	25	70	25550	2 56E-08	NA	NA
Vinyl Chloride	1.84E-06	20	250	25	70	25550	1 29E-07	2 70E-01	3E-08
Xylene	2.16E-06	20	250	25	70	25550	1 51E-07	NA	NA
								Total	4E-08

GEOMATRIX

APPENDIX J

LEAD SPREAD MODEL OUTPUT SHEETS FOR HUMAN HEALTH RISK ASSESSMENT

LEAD RISK ASSESSMENT SPREADSHEET

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Current and Future On-Site Worker - Reasonable Maximum Exposure Scenario

INPUT		OUTPUT								
MEDIUM	LEVEL		percentiles					PRG-99	PRG-95
			50th	90th	95th	98th	99th	(ug/g)	(ug/g)
LEAD IN AIR (ug/m^3)	0.15								
LEAD IN SOIL (ug/g)	430.0	BLOOD Pb, ADULT (ug/dl)	NA	NA	NA	NA	NA	NA	NA
LEAD IN WATER (ug/l)	15	BLOOD Pb, CHILD (ug/dl)	NA	NA	NA	NA	NA	NA	NA
PLANT UPTAKE? 1=YES 0=NO	1	BLOOD Pb, PICA CHILD (ug/dl)	NA	NA	NA	NA	NA	NA	NA
RESPIRABLE DUST (ug/m^3)	50	**BLOOD Pb, INDUSTRIAL (ug/dl)**	**2.2**	**3.4**	**3.8**	**4.4**	**4.9**	4262.5	6306.5

EXPOSURE PARAMETERS

		residential			industrial
	units	adults	children	children with pica	adults
General					
Days per week	days/wk	7	7	7	5
Dermal Contact					
Skin area	cm^2	3700	2800	2800	5800
Soil adherence	mg/cm^2	0.5	0.5	0.5	0.5
Route-specific constant	(ug/dl)/(ug/day)	0.00011	0.00011	0.00011	0.00011
Soil ingestion					
Soil ingestion	mg/day	25	55	790	25
Route-specific constant	(ug/dl)/(ug/day)	0.0176	0.0704	0.0704	0.0176
Inhalation					
Breathing rate	m^3/day	20	10	10	20
Route-specific constant	(ug/dl)/(ug/day)	0.082	0.192	0.192	0.082
Water ingestion					
Water ingestion	l/day	1.4	0.4	0.4	1.4
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Food ingestion					
Food ingestion	kg/day	2.2	1.3	1.3	2.2
Route-specific constant	(ug/dl)/(ug/day)	0.04	0.16	0.16	0.04
Dietary concentration	ug/kg	20.1	20.1	20.1	10.0
Lead in produce	ug/kg	193.5	193.5	193.5	

PATHWAYS, ADULTS

	Residential		Industrial		
Pathway	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	Concentration in medium
SOIL CONTACT:	0.08	NA	0.09	4%	430 ug/g
SOIL INGESTION:	0.19	NA	0.14	6%	430 ug/g
INHALATION:	0.28	NA	0.20	9%	0.17 ug/m^3
WATER INGESTION:	0.84	NA	0.84	39%	15 ug/l
FOOD INGESTION:	1.77	NA	0.88	41%	20.1 ug Pb/kg diet

PATHWAYS, CHILDREN

	Typical		with pica		
Pathway	Blood Pb ug/dl	percent of total	Blood Pb ug/dl	percent of total	Concentration in medium
SOIL CONTACT:	0.06	NA	0.06	NA	430 ug/g
SOIL INGESTION:	1.66	NA	23.91	NA	430 ug/g
INHALATION:	0.33	NA	0.33	NA	0.17 ug/m^3
WATER INGESTION:	0.96	NA	0.96	NA	15 ug/l
FOOD INGESTION:	4.18	NA	4.18	NA	20.1 ug Pb/kg diet