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Environmental Services

3160-5TNPH

Risk Screening Analysis

Telegraph Business Park
5427 Telegraph Avenue
Oakland, California

prepared for

Telegraph Business Properties
1401 Griffith Street
San Francisco, California

March 6, 1997

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EXECUTIVE SUMMARY

The purpose of this Risk Screening Analysis is to evaluate the potential threat to human health, safety and the environment from residual stoddard solvent which may be present in soils and ground water beneath the Telegraph Business Park (TBP) and surrounding areas. This work is in response to the request of the Alameda County Environmental Health Department to facilitate closure of this site.

Seventeen USTs at the site were removed in 1992. USTs containing stoddard solvent, a dry cleaning agent, showed evidence of leakage. Most of the impacted soil was excavated during UST removal activities. Subsurface investigations were conducted in 1994 and 1996, including soil and grab ground water borings and installation of monitoring wells. The lateral and vertical extent of impacted ground water was defined.

The historical use of the property and analytic data collected from the subsurface investigations indicate that the primary chemical of concern for this site is stoddard solvent. Other petroleum hydrocarbons and volatile organic compounds (VOCs) identified at the site were not present at concentrations which pose a significant health risk.

An assessment of the possible pathways of exposure for potential receptors at the site and the surrounding area was completed. This exposure assessment included a Conceptual Site Model (CSM) using the existing analytic and geologic data from previous investigations. Based on the CSM, the only two potentially complete pathways of concern for human exposure would be: (1) use of groundwater as a drinking water source; and (2) inhalation of vapors that are volatilized from impacted ground water which then migrate upward through the soil and surface pavement, and into indoor surface structures. The two possible receptor populations that could be impacted by these pathways are workers within the business park, and residents located in off-site housing.

To evaluate potential pathway (1), a ground water well survey was conducted in order to address the potential for drinking water use. No drinking water wells were found within 1500 feet of the site. An irrigation well is located at the Children's Hospital, about 1500 feet south of the site. Therefore, the potential drinking water exposure pathway is considered to be incomplete.

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To evaluate potential pathway (2), a toxicity study and evaluation of the pathway was completed.

The toxicity of stoddard solvent in ambient air was evaluated by considering known occupational standards, surrogate compounds with similar physio-chemical and toxicological properties, and preliminary remediation goals (PRGs). The most stringent exposure concentration derived for potential residential exposures was determined to be based on PRGs. This approach produced a risk-based concentration of 31 parts per billion (ppb) in air assuming a Hazard Quotient of 1.0 for stoddard solvent.

Indoor air samples were collected from selected areas within the business park facility. These areas were selected as representative of a "worst-case" exposure via indoor air accumulation of stoddard solvent vapors. Samples were collected using SUMMA canisters and analyzed by gas chromatography/mass spectrometry technology. The results of the testing indicated that no detectable concentrations of stoddard solvents were present in the indoor air above the laboratory reporting limit of 0.88 to 0.90 ppb. The potential exposure pathway for stoddard solvent vapor migration into indoor structures was determined to be incomplete by field testing.

Based on the evaluation of potential exposure pathways identified in the CSM, the residual stoddard solvent in the soil or ground water does not pose a significant risk to public health or safety. SES recommends no further action at this site, and the case should be forwarded to Alameda County and the Regional Water Quality Control Board for closure.

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1.0 INTRODUCTION

1.1 Scope of Work

The intent of this work was to evaluate the potential human health threat of residual total petroleum hydrocarbons as stoddard solvent (TPH[S]) present in soil and ground water located at this site. Historical soil and ground water test results were used to determine the chemicals of concern and potential pathways of exposure. In addition, these data were used to evaluate potential exposure risks at the site. The following summarizes the scope of work completed at this site.

1. Risk Screening Analysis: Evaluate potential chemicals of concern, conduct exposure assessments, develop Conceptual Site Model for monitoring strategy, develop a toxicity assessment, and develop a residential ambient air standard for the chemical of concern.

2. Area Water Well Survey: Review files at the Department of Water Resources in Sacramento, California for well permits issued within 1500 feet of TBP, identify well uses within the study area.

3. Ambient Air Sampling: Develop air sampling protocol, collect indoor air samples from selected areas within the Telegraph Business Park (TBP), analyze air samples for volatile organic compounds and stoddard solvent using USEPA Modified Method TO-14.

4. Evaluation and Reporting: Evaluate air sampling results, well survey data; report results and provide conclusions.

1.2 Site History and Current Site Use

The site was formerly a large-scale dry cleaning establishment (Figure 1, Appendix A). The on-site underground storage tanks were used by previous occupants to store stoddard solvent, stoddard solvent waste and vehicle fuel.

In May 1992, Sierra Environmental Services (SES) personnel supervised the removal of 17 underground storage tanks from the site. Total petroleum hydrocarbons as gasoline, diesel and stoddard solvent, and BTEX were detected in sidewall samples taken from the tank excavations. Analytic results are reported in the 1992 SES report (SES, 1992).

On December 13 and 14, 1993, SES supervised the drilling of twelve on-site soil borings. Ground water monitoring wells (MW-1 through MW-3) were installed in three of the soil borings. The monitoring well and soil boring locations are shown on Figure 2 (Appendix A). Results of the investigation are discussed in the SES report dated April 15, 1994 (SES, 1994).

On September 24, September 25, and October 31, 1996, SES supervised the drilling of thirteen off-site borings (B-18 through B-30). The soil boring locations are shown on Figure 2 (Appendix A). Results of the investigation are discussed in the SES report dated December 27, 1996 (SES, 1996). Analytic results for soil and ground water are presented in Tables 1, 2 and 3 (Appendix B).

Since the installation of the monitoring wells, SES has conducted monthly water level measurements and quarterly ground water sampling. Results of the monthly water level measurements and the quarterly ground water sampling are presented in the most recent ground water monitoring report, dated November 27, 1996 (SES, 1996a). Analytic results for ground water are presented in Tables 2 and 3 (Appendix B).

2.0 TOPOGRAPHIC & GEOLOGIC SETTING

The site is located in the City of Oakland, Alameda County, California. The topography of the site is relatively flat (USGS, 1980). The average ground water flow direction and gradient based on previous water level measurements on the site from February 1994 to November 1996 is toward the west-southwest at 0.023 ft/ft (SES, 1996a). The closest surface water body is Glenn Echo Creek located approximately one-half mile southeast of the site. Glen Echo Creek flows into Lake Merritt. The site is approximately 118 feet above mean sea level. The site is located in an area of both commercial and residential use.

The site is underlain by Late Pleistocene alluvial (Temescal Formation) which consists of weakly consolidated, slightly weathered, poorly sorted, irregular interbedded clay, silt, sand and gravel (Helley, 1979 and Radbruch, 1957). Soils encountered in off-site borings surrounding the site consisted of sandy clays and clayey sands with small gravels to a maximum depth of approximately 30 feet below ground surface (BGS).

3.0 AREA WATER WELL SURVEY

A well survey was completed on January 30, 1997, by SES personnel searching the records at the Department of Water Resources at Sacramento, California for all wells located within 1500 feet of the business park. This study indicated that no drinking water wells are present within the study area. The well survey was confirmed by inspecting all properties within the search radius for the possible presence of wells. One irrigation well is located at Children's Hospital, approximately 1500 feet from the site. Other monitoring, industrial and cathodic protection wells were noted in the study area. The absence of drinking water wells indicates that this potential exposure pathway is incomplete.

4.0 RISK SCREENING ANALYSIS

Under order of the Alameda County Department of Environmental Health (ACDEH, 1996), an investigation into the potential public health risks due to subsurface conditions at the site was initiated. The historical and current subsurface contamination data were evaluated in terms of the potential public heath risks to on-site and off-site human receptor populations.

The potential current and hypothetical future human receptor population health risks were evaluated on the basis of existing regulatory guidelines and current human heath risk assessment protocols. These include, but are not necessarily limited to, the following regulatory criteria:

- US EPA Risk Assessment Guidance for Superfund (1989)
- CAL-EPA Supplemental Guidance for Human Health Multimedia Risk Assessment (1992)
- US EPA Region IX Preliminary Remediation Goals (PRGs) (First Half, 1995)
- US EPA Region III Risk-Based Concentration Table (1995)
- ATSDR Minimal Risk Levels (MRLs) for Hazardous Substances (1996)
- Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites (ASTM Designation E 1739-95)

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4.1 Chemicals of Concern

Based on the information from historical records of process operations at this site and analytic data from soil and ground water samples collected during subsequent subsurface investigations, the primary chemical of potential concern has been identified as stoddard solvent ($C_9 H_{20}$; CAS # 8052-41-3). Evidence of leakage from the stoddard solvent USTs was observed during the tank removal. Results of soil and ground water samples collected during two subsequent subsurface investigations also indicated the presence of stoddard solvent. Therefore, stoddard solvent is the primary subsurface soil and ground water chemical of concern at this site.

The concentrations of benzene, toluene, ethylbenzene and xylenes (BTEX) and other VOCs in ground water are shown in Tables 2 and 3 (Appendix B). Only ground water data from MW-2 and MW-3 have reported concentrations of benzene. No other petroleum hydrocarbon or VOC data appear to represent levels of concern.

The potential human heath risk from this site was evaluated by consideration of the known, or projected, human toxicity of stoddard solvent. The potential complete environmental exposure pathways were evaluated, along with the potential for uptake and absorption by potential human receptors, and the subsequent estimate(s) of potential human heath risks, given the possible environmental exposure conditions.

4.2 Exposure Assessment

On-Site Receptors

The businesses operating in TBP include furniture refinishing, auto detailing, a dry cleaning store front with actual cleaning done at another location, antique furniture retail and other retail and service establishments. There are two food preparation businesses in the area; a Mexican-style food distributor and a beer manufacturer. These potential receptors are classified as occupational. There are no children located at the site, except for occasional visitors. The various businesses are separated by either permanent walls and/or plywood partitioning. The floor of the entire facility is concrete slab. The integrity of the concrete slab, in the areas visited, appears to reflect the age of the building.

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Off-Site Receptors

A multi-building residential apartment complex (Keller Plaza) is located immediately to the south of the site. The actual population number is not known, but is known to consist of both children and adults, young and old. The average duration of residence is not known, so the standard EPA-promulgated exposure duration was used for this risk screening assessment. There are two occupied houses to the immediate north of the facility. A commercial building is located immediately to the northeast. There were no visible day-care centers or nursing homes within a quarter of a mile of the site. Children's Hospital is located approximately 1500 feet to the south of the site.

Conceptual Site Model

One of the primary tools of the risk assessment process is the development of a site-specific Conceptual Site Model (CSM). In this model, the following aspects of a site are identified and the movement of any potential chemical of concern to potential receptors is specified:

- Primary Source(s)
- Primary Physical Release Mechanism(s)
- Secondary Source(s)
- Secondary Release Mechanism(s)
- Tertiary Source(s)
- Exposure Route(s)
- Potential Human Receptors

The CSM identifies which environmental exposure pathways may be "complete" and/or "incomplete". The CSM identifies which environmental media would need to be sampled for purposes of risk assessment. It also identifies the human exposure routes, uptake processes in the body, and the potential target organ(s). The comparison of the results of the CSM with the toxicity of the chemical of concern at a site allows the potential human health risks to be evaluated.

The CSM for TBP is presented in Figure 3 (Appendix A). The primary source has been identified as the leaking USTs on the northern side of the building. There are two primary physical release mechanisms, acute, (short-term, direct contact during excavation activities), and chronic (long-term, through percolation and leaching).

The potential direct contact pathway is shown as involving subsurface soils during excavation. Although Health & Safety practices were in place during excavation of the USTs, all three uptake (exposure) routes are shown as potentially complete under any potential future construction activity involving deep excavation. Dermal contact with any unprotected skin and any incidental hand-to-mouth activities (eg. cigarette smoking, contact with food), and the involuntary inhalation of VOCs released during exposure of the impacted subsurface soils constitute the possible ways this exposure pathway might be complete. However, these potential exposure scenarios would remain incomplete with appropriate institutional controls and will not be considered further.

The primary physical release mechanism at TBP is considered to be the percolation/leaching of stoddard solvent released to the subsurface soils from perforated USTs. This has been confirmed by results from subsurface soil sampling. Analytical data for soil samples are shown in Table 2 (Appendix B). Two secondary physical release mechanisms have been identified in the CSM.

One secondary physical release mechanism is equilibrium partitioning between soil and soil gas with diffusion and volatilization of volatile organic compounds (VOCs) from subsurface soil gas upwards through the vadose zone, surficial soils and pavement into the ambient air above. This mechanism can result from two sources. The first source would have been the subsurface soils while the USTs were still present and acting as the primary source. Historically, this exposure pathway was complete under these conditions for the inhalation pathway. However, since 1992 when the USTs and visibly contaminated soils were excavated and removed, this exposure pathway could only derive its VOC diffusion source from any remaining contaminated subsurface soils. The second source would be from VOCs out gassing from contaminated ground water, diffusing through subsurface soils and volatilizing into air. This latter exposure pathway is depicted in the CSM by the arrow pathway coming off the tertiary source, ground water. Both of these release mechanisms would most likely be in a state of semi-steady equilibrium condition.

The other secondary physical release mechanism is via percolation/leaching into ground water, as depicted on the CSM. The exposure pathway involving the potential use of ground water as a drinking water source would involve all three uptake routes. Ingestion is obvious. Inhalation and dermal exposures would occur during showering, bathing and/or cooking. This potential

exposure pathway would only be considered complete if drinking water production wells were found to be on-site or down-gradient of the facility.

Exposure Assessment Strategy

The toxicological importance of the ambient air pathway lies in the potential for VOCs that might be volatilizing into air to penetrate enclosed spaces above and accumulate, creating potentially higher concentrations than those being released into the atmosphere. The presence of on-site and off-site buildings creates a potentially complete exposure pathway for inhalation.

While this is a relatively new potential exposure pathway to be evaluated in human health risk assessments, the indoor air accumulation of volatile gases coming from out gassing from ground water and/or contaminated subsurface soils is known to be a viable exposure pathway. It was first posed as the process by which radon gas entered and accumulated in basements (Nazaroff, et.al., 1988). Since then, numerous studies (both laboratory and field) have verified the existence of VOC migration from subsurface contamination into indoor air. This can occur in basements and in buildings that sit flush with the ground surface, with or without a foundation slab (Fischer and Uchrin, 1996; Fischer, et.al., 1996).

Various fate and transport models have been developed in order to predict what indoor air concentrations and, thus, potential human health risks might exist at any site. Some of these have been field-tested for calibration and verification (Fischer, et.al., 1996). The stated goal of these models is the prediction of indoor air concentrations or "exposure point concentrations".

In order to estimate potential human health risks, a risk assessment must begin its calculations with krfown, or estimated, exposure point concentrations of the chemical(s) of concern. This constitutes the basis for any subsequent calculations involving uptake, absorption, bioaccumulation and, eventually, toxicity. In the case of volatile organics, absorption is usually complete and bioaccumulation does not occur, except in the case of certain metabolites (contaminant transformations which occur biologically).

At the TBP site, several exposure considerations are important for the evaluation of any potential human health risks to on-site and off-site receptors. First, since the source of any VOC release and migration will be contaminated subsurface soils and/or ground water, the risk

assessment must develop the necessary exposure point concentrations at the receptor(s). The exposure point concentrations can be determined by two different approaches: (1) theoretical; and (2) empirical.

Theoretical Modeling - Exposure Point Concentrations

The theoretical approach would entail the use of the previously mentioned fate and transport models. For the on-site (occupational) receptors inside the building, the models would require the use of a partitioning equation (ie. Raoult's Law for non-aqueous phase liquids) to estimate the soil gas vapor phase. This data would be coupled to a Fickian diffusion model to estimate eventual release concentrations at the surface. These vapor flux emissions would then be used with a fate and transport model simulating the migration of VOCs into indoor air.

For the off-site (residential) receptors at the apartment complex, the measured ground water concentrations in on-site locations would be the source terms for a lateral transport ground water migration model. The exposure point concentrations of any contaminate at a location underneath the apartment buildings would be predicted by the results of the ground water migration model.

Empirical Measurements - Exposure Point Concentrations

The second approach would be empirical measurements. Empirical measurements of exposure point concentrations would directly measure the ambient air concentrations inside the on-site building as a "worst-case" analysis. Several important reasons favor the use of this approach over theoretical modeling.

- Stoddard solvent can be measured in ambient air at concentrations that are relevant to human toxicity;
- There is considerable uncertainty involved with the use of any environmental fate and transport modeling effort. Starting with the last phase of modeling that would have to be done, the prediction of indoor air concentrations has been shown to be highly site-specific (Fischer, et.al., 1996). Few of the relevant parameters are known for the site. Additionally, very few of the relevant geological parameters are known for the site for use in both the vapor diffusion and ground water transport modeling. Furthermore, the apartment complex buildings all rest on top of full-size automobile parking garages, which are flush with the ground surface. Each of these structures were built to code, insuring adequate ventilation by the open

nature of the structural walls.

- The owner of this site can provide access for the 8-hr field sampling period.
- If the ambient air measurements in the TBP building, which directly overlies the subsurface ground water plume of stoddard solvent, result in stoddard solvent concentrations that represent negligible human health risks, then the off-site apartment locations should also be at negligible risk (when adjustments are made for residential versus occupational exposures). The on-site building directly overlies the source of contamination and the latest round of grab ground water samples show stoddard solvent concentrations to be below laboratory reporting limits down-gradient of the apartment complex.

The two potentially complete exposure pathways under current and potential future uses at the site are the potential indoor air inhalation exposure, and the potential direct use of contaminated ground water pathway. Collection and evaluation of field sampling data was completed to determine if either of the two potential exposure pathways are complete and pose a potential human health risk under current and/or future conditions.

4.3 Toxicity Assessment

Stoddard solvent (also known as Mineral Spirits and/or White Spirits) is the primary contaminant of concern. Stoddard solvent is a clear, colorless petroleum solvent. There are four types of stoddard solvent, depending upon flash point, odor and rate of evaporation (McDermott, 1975). Most stoddard solvent types have a kerosene-like odor that is perceptible at around 1 ppm (5.25 mg/m3).

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Physical and Chemical Characteristics

Stoddard solvent is a mixture of straight and branched chain paraffins, naphthenes (cycloparaffins) and alkyl aromatic hydrocarbons whose typical composition is:

- Paraffins: 30 - 50%
- Naphthenes: 30 - 40 %
- Aromatics: 10 - 20 %

The following table lists the major physical properties of stoddard solvent:

molecular weight	135 -145 (average)
vapor pressure	1.0 - 4.5 mmHg
vapor density	0.4
specific gravity	0.8 (water - 1.0)
flash point	100 °F.
solubility	insoluble in water
1.0 ppm	5.25 mg/m3

Regulatory Standards

Occupational Standards

The following table lists the regulatory standards of relevance for stoddard solvent at the TBP site. The regulatory standards are published through and/or enforced by the Occupational Safety and Health Administration (OSHA), the National Institute of Occupational Safety and Health (NIOSH), and the American Conference of Governmental Industrial Hygienists (ACGIH). The regulatory standards are all listed as an 8-hr Time Weighted Average (TWA) exposure:

Agency	TWA	
OSHA	500 ppm	2900 mg/m3
NIOSH	**66 ppm**	**350 mg/m3**
ACGIH	100 ppm	525 mg/m3

CAL EPA Ambient air Standard

The regulatory standards are promulgated for adults in good health and do not allow for any sensitive sub-populations (e.g. asthmatics, elderly, etc.). The almost 3-to-1 difference in these "allowable" ambient air concentrations stems from the differences in the various exposure parameters (eg. exposure frequency, strength of experimental data, etc.). Since the NIOSH standard is the most conservative, it will be used as the stoddard solvent regulatory value in this risk screening evaluation for on-site receptors.

The NIOSH exposure value (350 mg/m3 for an 8-hr TWA) is also the value promulgated by the Department of Defense (DOD) for exposures to aviation gas vapors (such as JP4-8). A comparison of gas chromatographic patterns indicates that stoddard solvent is most similar to JP-4 jet fuel.

Residential Standards

The results of a very thorough search of the available toxicological and regulatory literature indicated that no Federal, State or local ambient air standards exist for stoddard solvent in terms of residential exposures. The search included an existing draft review document from CAL-EPA on allowable chronic exposure levels to ambient air toxins and a personal communication with Ms. Pat Holmes of the Bay Area Air Quality Management District. Several different approaches were used to develop a relevant stoddard solvent regulatory exposure level for evaluation of potential off-site exposures at the apartment complex adjacent to the site. These approaches are addressed in the following section.

Stoddard Solvent Toxicity

General Considerations

As an organic solvent with the physical and chemical characteristics previously discussed, stoddard solvent has three primary physiological uptake routes: (1) inhalation; (2) dermal/ocular contact; and (3) ingestion. The exposure pathway of ingestion would only be relevant if contaminated ground water was actively used as a drinking water source. There are no known quantitative toxicological data by which to evaluate this potential exposure pathway, although it is well known that ingestion of kerosene and other petroleum products will induce indigestion and vomiting.

Dermal Exposures

As with many petroleum distillates, direct dermal exposure to stoddard solvent is known to result in primary skin toxicity. Skin toxicity takes the form of dehydration and defatting, with the resulting dermatitis. However, stoddard solvent is not known to be absorbed through intact skin into the systemic blood system, even at toxic levels to the skin.

Ocular Exposures

Eye irritation is often the first sign of overexposure to stoddard solvent vapors. Exposure results in general eye irritation, tearing, burning sensations and conjunctivitis. The toxicological-based exposure standards derived in the next Section rely upon human experiments reflecting these physiological criteria.

Inhalation Exposures

Animal Studies

The chemical-specific toxicological data on stoddard solvent is limited. The data which do exist indicate that stoddard solvent has decided species-specific toxicity. For instance, when cats were exposed for up to an 8-hr stoddard solvent exposure at 1700 ppm in air, 4 of 4 test animals died (Carpenter, et al, 1975), due primarily to central nervous system toxicity. However, when rats were exposed to 1400 ppm stoddard solvent in air for up to 65 days, no mortalities occurred (0/15).

In the rats that were exposed to stoddard solvent for 65 days, an 8-hr No-Observed-Adverse-Effect-Level (NOAEL) was determined to be at 420 ppm, while the same tests in dogs showed the NOAEL to be 510 ppm, based on eye irritation, nose bleeding and a decrease in overall central nervous system (CNS) coordination. The study also indicated that rats exposed to 332 ppm stoddard solvent (1.9 mg/ml) showed definite signs of kidney (renal) toxicology.

Thus, in the few available animal studies, it appears that ambient air stoddard solvent concentrations in the order of 300 - 550 ppm can result in acute toxicity in various test animals.

Human Studies

In the singular known human toxicity study on the inhalation of stoddard solvent in humans, two separate toxicological endpoints were investigated (Carpenter, et.al., 1975). The first was the esthetically-based criterion of odor detection. The second toxicological endpoint was concerned with the adverse effects on the visual system.

Odor Threshold

In a panel of six (6) volunteers, there was no detection of the stoddard solvent exposure below 0.09 ppm in air. However, at 0.9 ppm, 5/6 test subjects detected stoddard solvent, while at 9.0 ppm, 6/6 test subjects detected the stoddard solvent exposures. Thus, the human odor detection threshold for stoddard solvent rests somewhere in between 0.09 ppm and 0.9 ppm.

The toxicological importance of the human odor detection threshold for stoddard solvent is that any ambient stoddard solvent exposure will result in a perception of an exogenous air contaminant (ie. stoddard solvent) at a finite concentration which is less than the air concentration of human health concern for stoddard solvent, based on animal studies.

Sensory (Toxicological) Threshold

Based on a suite of human toxicological endpoints (eg. throat irritation, eye irritation, tearing, dizziness and taste), the following toxicological threshold endpoints were determined (Carpenter, et.al., 1975):

NOAEL = 24 ppm (0/6)
LOAEL = 150 ppm (1/6)
AEL = 470 ppm (6/6)

The NOAEL level was previously defined, while the LOAEL is the Lowest-Observed-Adverse-Effect-Level where a consistent, minimal health effect is seen, and the AEL (Adverse Effect Level) is a level where frank toxicity is observed.

4.4 Development of a Residential Ambient Air Concentration of Concern for Stoddard Solvent

As discussed earlier, a thorough study of the available literature did not reveal any residential (ambient) air exposure limits or regulatory standards for stoddard solvent. In the absence of any such data, and in order to have a residential exposure level to compare with the on-site occupational level, the task of developing a residential ambient air concentration of concern for stoddard solvent was undertaken.

There are several possible approaches to the development of a regulatory value:

a) Modification of the existing 8-hr TWA occupational exposure standards for a hypothetical 24-hr residential exposure;

b) Adoption of a physiochemical and toxicologically equivalent surrogate chemical which has an existing regulatory exposure standard; or

c) Development of either a ASTM-based Risk Based Corrective Action (RBCA) concentration level or a human health-based Preliminary Remediation Goal (PRG), as per current EPA guidelines for ambient air exposures.

a). Modification of an Occupational Standard

If the most conservative occupational standard is used, this would be the NIOSH standard of 66 ppm (350 mg/m3) for an 8-hr TWA. Thus,

1) 8/24 hr TWA = 66 ppm

thus,

24/24 hr TWA = 22 ppm (116.7 mg/m3)

b). Adoption of a Surrogate Chemical and Standard

A common toxicological approach to generate exposure standards is to adopt a surrogate chemical that is most similar to the chemical of concern. The selection of a surrogate chemical is based on structure-activity relationships, similar chemical properties and/or toxicological endpoints. The following table depicts some of the potential chemical surrogates:

CHEMICAL	OSHA	ACGIH	TOXICITY
n-heptane	500 ppm	400 ppm	skin, respiration, peripheral nervous system
xylene	1000 ppm	0.1 ppm*	central nervous system, eyes, digestive system, lung
hexane	500 ppm	50 ppm	respiration, eye, skin, central nervous system
JP-4 Jet Fuel	350 mg/m3**	N/A	central nervous system, respiration, eyes

* = ATSDR
** = DOD

c). Development of an EPA-based Preliminary Remediation Goal (PRG)

A PRG is a health-based exposure, preliminary remediation standard that is derived using promulgated exposure parameters and chemical-specific toxicity data. From a purely risk-based consideration viewpoint, the PRG approach is superior to the previous two approaches in that it provides for a more realistic determination of a health-protective standard, regardless of the environmental media.

For ambient air exposures to a non-carcinogenic air contaminant, the following root equation exists:

$$(1)\ RBC_{ug/m3} = \frac{THQ \times RfDi \times BW \times AT \times 1000\ ug/m3}{EF \times ED \times IRA}$$

where:

RBC = Risk-Based Concentration (ug/m3)
THQ = Target Hazard Quotient (1.0, unitless)
RfD inh = Inhalation Risk Reference Dose (mg/kg/dy)
BW = Body Weight (adult = 70 kg)
AT = Averaging Time (ED yr x 365 dy/yr)
1000 ug/mg = units conversion factor (1000 ug/mg)
EF = Exposure Frequency (350 dy/yr)
ED = Exposure Duration Total (30 yr)
IRA = Adult Inhalation Rate (20 m3/dy)

where:

$$(2)\quad RfDi = \frac{NOAEL \text{ or } LOAEL}{UF_1 \times UF_2 \times UF_3 \times MF}$$

where: NOAEL = dose level with no observed adverse effects
LOAEL = dose level with lowest observed adverse effects
UF_1 = Uncertainty Factor $_1$ (10; for general population var.)
UF_2 = Uncertainty Factor $_2$ (10; for NOAEL from sub-chronic, rather than chronic studies:
UF_3 = Uncertainty Factor $_3$ (10; for LOAEL instead of NOAEL)
MF = Modifying Factor (5; for study uncertainty from 1-10)

From the human studies reported above (Carpenter, et.al., 1975), a toxicological LOAEL was reported to be 150 ppm (788 mg/m3) for inhalation exposures to stoddard solvent, then:

(3) RfDi (mg/kg/day) = $\frac{\text{RfDi (mg/m3) x 20 m3/day}}{\text{70 kg}}$

$= \frac{\text{788 mg/m3 x 20 m3/day}}{\text{70 kg}}$

= 225 mg/kg/day

(4) RfDi = $\frac{\text{225 mg/kg/day}}{\text{10x10x10x5}}$

$= \frac{\text{225 mg/kg/day}}{\text{5000}}$

= 0.045 mg/kg/day

Therefore,

(5) $RBC_{ug/m3} = \frac{\text{THQ x RfDi x BW x AT x 1000}}{\text{EF x ED x IRA}}$

$= \frac{\text{1 x 0.045 x 70 x (30 x 365) x 1000}}{\text{350 x 30 x 20}}$

= 164.25 ug/m3

= 0.16 mg/m3 (31 ppb)

Thus, a summary table of the derived alternative residential ambient air concentrations for stoddard solvent is as follows:

METHOD USED	STANDARD (PPM)	MG/M^3
a) Modification of Occupational Standard	22	116.7
b) Chemical Surrogate: n-heptane	500 (OSHA) 400(ACGIH)	2,000 1,600
xylene	1,000 (OSHA) 0.1 (ATSDR)	4,800 0.48
hexane	500 (OSHA) 50 (ACGIH)	1,800 180
c) PRG Development	**0.031**	0.16

Based on the principal of conservatism in terms of public health protection, the most restrictive exposure level (31 ppb) will be used in this screening risk analysis for off-site receptors. If the measured ambient air concentrations inside TBP do not exceed this value, then there should be no risk to the public health. As discussed earlier, based on a worst-case analysis scenario, if the ambient air stoddard solvent concentrations within TBP do not exceed this PRG, then the off-site locations should, likewise, be at acceptable risk levels.

5.0 AMBIENT AIR SAMPLING

As discussed in the previous section on Exposure Assessment, determination of whether or not stoddard solvent vapors outgassing from ground water, diffusive migration through sub-subsurface soils and subsequent accumulation into indoor air represents a complete and viable exposure pathway that results in potentially toxic exposures could be investigated in one of two approaches. First, a series of linked fate and transport models could be use to estimate both on-site and off-site indoor concentrations of stoddard solvent (theoretical approach). Alternatively, an empirical approach, based on the direct measurement of indoor ambient air concentrations of stoddard solvent can be used.

The direct ambient air measurements approach was the preferred and chosen method for this risk screening analysis. This approach was selected based on several factors:

- relative ease of implementation,
- introduction of fewer environmental uncertainties,
- lower initial cost, and
- faster results.

A "worst-case" analysis of potential indoor air exposures could be completed by sampling the indoor ambient air in the building, which is directly over the original soil source and ground water plume of stoddard solvent. If the stoddard solvent concentrations obtained in this building did not represent a public health threat, then any off-site exposures (eg. apartment complex buildings) would, likewise, not pose a potential public health risk as long as the derived stoddard solvent concentration of concern for residential exposures (31 ppb) was not exceeded.

5.1 Air Sampling Protocols

Methodology

Two 6-Liter SUMMA canisters were obtained from Air Toxics Ltd. of Folsom, California. Each canister was placed in a selected area of the Telegraph Business Park. Sample A-1 was collected in the Brewery Area and sample A-2 was collected in the Alpha Omega Area. The location of each sample collection point is shown in Figure 2 (Appendix A). These sampling locations were chosen with regards to their respective spatial relationship to the known historical locations of the leaking USTs, the existing ground water plume and the lack of potential ambient air interferences, due to ongoing activities.

Each canister was received from the laboratory containing a vacuum pressure of 7.0 inches Hg and 7.5 inches Hg, respectively. On November 19, 1996, one of the canisters was placed in the selected area and opened for period of 8 hours (from 9:30 AM to 5:30 PM). At the end of the sampling period, the canister was sealed and forwarded under chain of custody documentation the Air Toxics Ltd. for analysis. Air Toxics conducted the analytical chemistry testing of the exposed canisters using a stoddard solvent standard for positive identification in the test samples.

Analytical Testing

The samples were analyzed by EPA Method TO-14 GC/MS Full Scan. A stoddard solvent standard was used for identification of gas chromatograph patterns. A laboratory blank was also analyzed for quality assurance. Tentatively Identified Compounds (TICs) were also requested for up to twenty peaks.

5.2 Results of Air Sampling

Since stoddard solvent is a petroleum distillate, the chromatographic pattern it produces contains many components. Identification of stoddard solvent in unknown samples is performed by comparing the chromatogram of the unknown with that of a standard. The chromatogram for each sample, the stoddard solvent standard, and the laboratory blank are identified by the "Client ID" reference as A-1, A-2, HS-005N, and Lab Blank, respectively (Appendix C). The chromatographic pattern for stoddard solvent is a cluster of peaks beginning at approximately 20 minutes. This pattern is clearly absent from the sample A-1, A-2 and Lab Blank chromatograms. Therefore, stoddard solvent is not present in either sample or laboratory blank.

EPA Method TO-14 utilizes a gas chromatographic instrument with a mass selective detector which analyzes air samples for a specific list of target compounds. These compounds are listed in the laboratory report (Appendix C). The peaks present in the sample chromatogram that are not identified as a target compound are subject to a library search to tentatively identify these compounds. The Tentatively Identified Compounds (TICs) search is limited to twenty of the largest non-target peaks.

The results of the two sample analyses are presented in Table 4 (Appendix B). The Sample A-1 results indicate that, while there were low ppb range detects for BTEX compounds and 1,2,4-Trimethylbenzene, stoddard solvent was not detected above the detection limit of 0.88 ppb. Sample A-2, with a slightly higher detection limit of 0.90 ppb, showed the same pattern of results. Again, stoddard solvent was not detected. The laboratory blank did not contain any detectable target compounds. The laboratory analytic reports, chain of custody documentation and raw gas chromatographic data are included in Appendix C. SES is not responsible for any laboratory omissions or errors.

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6.0 CONCLUSIONS

Evaluation of the available site characterization information, the historical field sampling data, on-site and off-site reconnaissance, and a toxicologically-based evaluation of all of the information available on potential human receptor populations and the potential environmental exposure pathways has yielded a site-specific Conceptual Site Model (CSM). The CSM identifies the potential sources, routes and uptake pathways for current or future exposures.

The site-specific CSM identifies only two potential "complete" current or future environmental exposure pathways: (1) direct exposure to contaminated ground water which might be used as a drinking water source; and (2) inhalation of contaminated soil gas that has migrated into indoor air in buildings, either from contaminated subsurface soils and/or from outgassing from contaminated ground water back into subsurface soils and, subsequently, into indoor air compartments.

An additional potential exposure pathway exists for any potential future excavation of contaminated subsurface soils below the facility. The excavation of contaminated soil potential exposure pathway is not further considered in this risk screening evaluation since institutional controls could easily be put in place during excavation activities to effectively eliminate this exposure pathway.

The potential exposure pathway (1) has been shown to be incomplete by the results of a ground water well survey in the area of this facility. No drinking water wells are located within 1500 feet of the site; and the closest ground water well is an irrigation well (activity currently unknown) at Children's Hospital, about 1500 feet to the south of the site.

Potential environmental exposure pathway (1), involving direct contact with a drinking water source (i.e. ingestion, inhalation, dermal contact), is considered to be an "incomplete" exposure pathway. Therefore, according to the current protocol of human risk assessments, no risk screening evaluation of the potential exposure pathway is warranted.

Potential exposure pathway (2) has been shown to be incomplete by completing a toxicity study and evaluation of the pathway.

The toxicity of stoddard solvent in ambient air was evaluated by considering known occupational standards, surrogate compounds with similar physio-chemical and toxicological properties, and preliminary remediation goals (PRGs). The most stringent exposure concentration derived for potential residential exposures was determined to be based on PRGs. This approach produced a risk-based concentration of 31 parts per billion (ppb) in air assuming a Hazard Quotient of 1.0 for stoddard solvent.

Indoor air samples were collected from selected areas within the business park facility. These areas were representative of a "worst-case" exposure via indoor air accumulation of stoddard solvent vapors. Samples were collected using SUMMA canisters and analyzed by gas chromatography/mass spectrometry technology. The results of the testing indicated that no detectable concentrations of stoddard solvents were present in the indoor air above the laboratory reporting limit of 0.88 to 0.90 ppb. The potential exposure pathway for stoddard solvent vapor migration into indoor structures was determined to be incomplete by field testing.

Based on the evaluation of potential exposure pathways identified in the CSM, the residual stoddard solvent in the soil or ground water does not pose a significant risk to public health or safety. SES recommends no further action at this site, and the case should be forwarded to Alameda County and the Regional Water Quality Control Board for closure.

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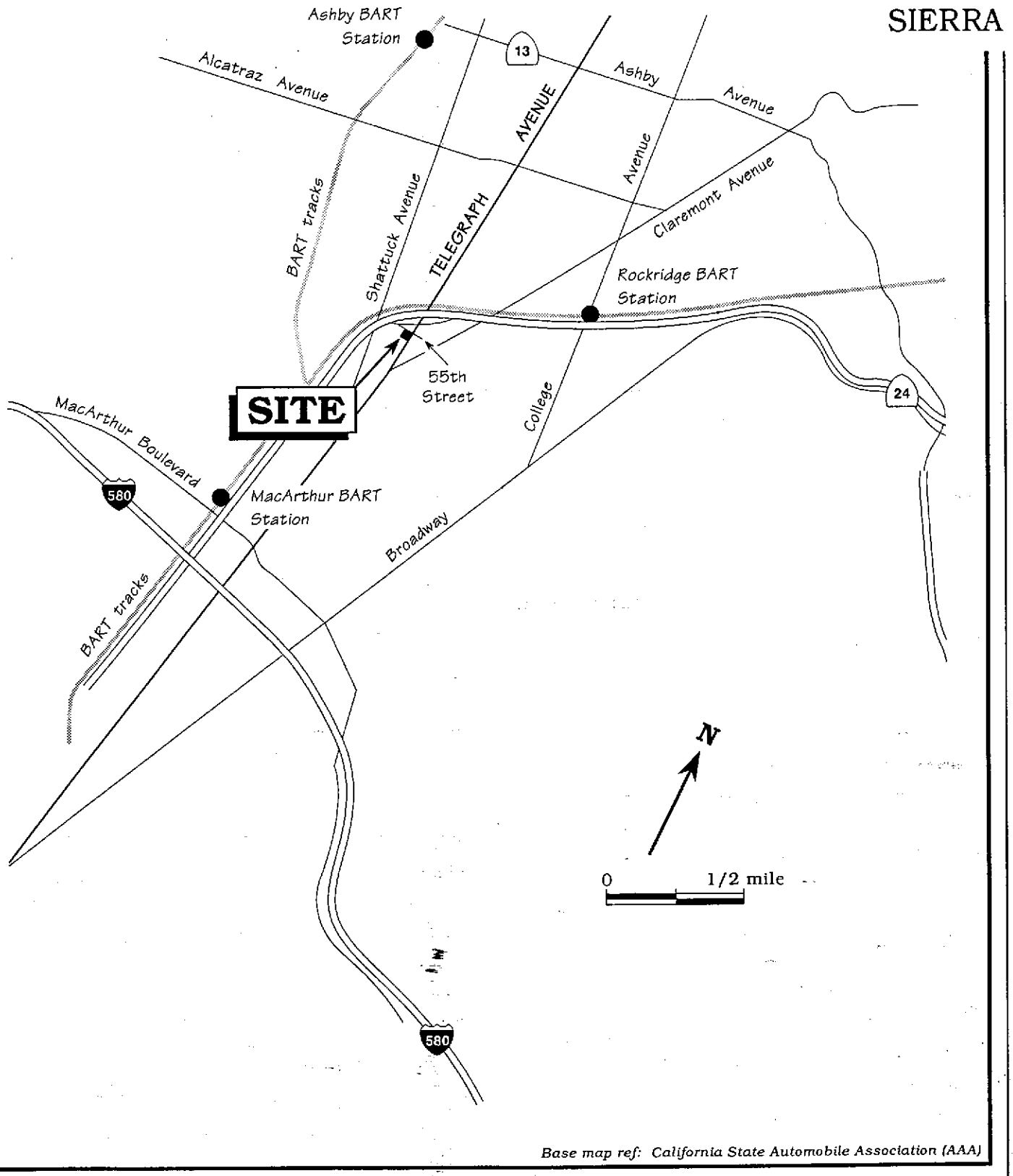

Base map ref: California State Automobile Association (AAA)

Figure 1. Site Location Map - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

4-719-04 [Site loc] 11/08/95

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2 different days

where air sampling collected?

VOC's?

Target VC B

1) Calc. Benzene for SS & compare to RBCA

GARAGE

B-30 is located ~ 199 ft north (measured from inside curb)

55TH STREET

B-28 B-23 B-29

CALTRANS PROPERTY

HIGHWAY 24 (elevated)

SHATTUCK AVENUE

TELEGRAPH AVENUE

B-22

B-9 B-8 B-4 MW-1 B-3 B-7 B-1 B-2 MW-2 B-6 MW-3 B-5 B-10 B-11 B-12 B-13 B-14 B-15 B-16 B-17 B-18 B-19 B-20 B-21 B-24 B-25 B-26 B-27

concrete wall

residence

residence

BUILDING

former 10,000 gal. gasoline tank

former Stoddard Solvent waste tank

former diesel tank

former 5,000 and 3,500 gal. Stoddard Solvent tanks

former Stoddard Solvent waste tanks

food processing

brewery storage area

parking

communication tower

CALTRANS PROPERTY (grassy slope)

apartment parking area

apartments

apartments

apartments

apartments

apartments

open grassy area

parking

54TH STREET

53TH STREET

RESIDENTIAL

RESIDENTIAL

RESIDENTIAL

COMMERCIAL

N

0 40 80 ft.

Ground water flow direction (February 1994 through August 1996)

EXPLANATION

◐	Air sampling location
⊕ MW-3	Monitoring well
○ B-9	Previous ground water sampling location (12/93)
● B-17	Previous ground water sampling location (11/94 & 1/95)
▲ B-30	Soil boring location (SES geoprobe, 9/96 & 10/96)

4-719-12 [MW/SB locs] 2/28/97

Figure 2. Monitoring Well, Soil Sampling, Air Sampling and Grab Ground Water Sampling Locations – October, 1996 – Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

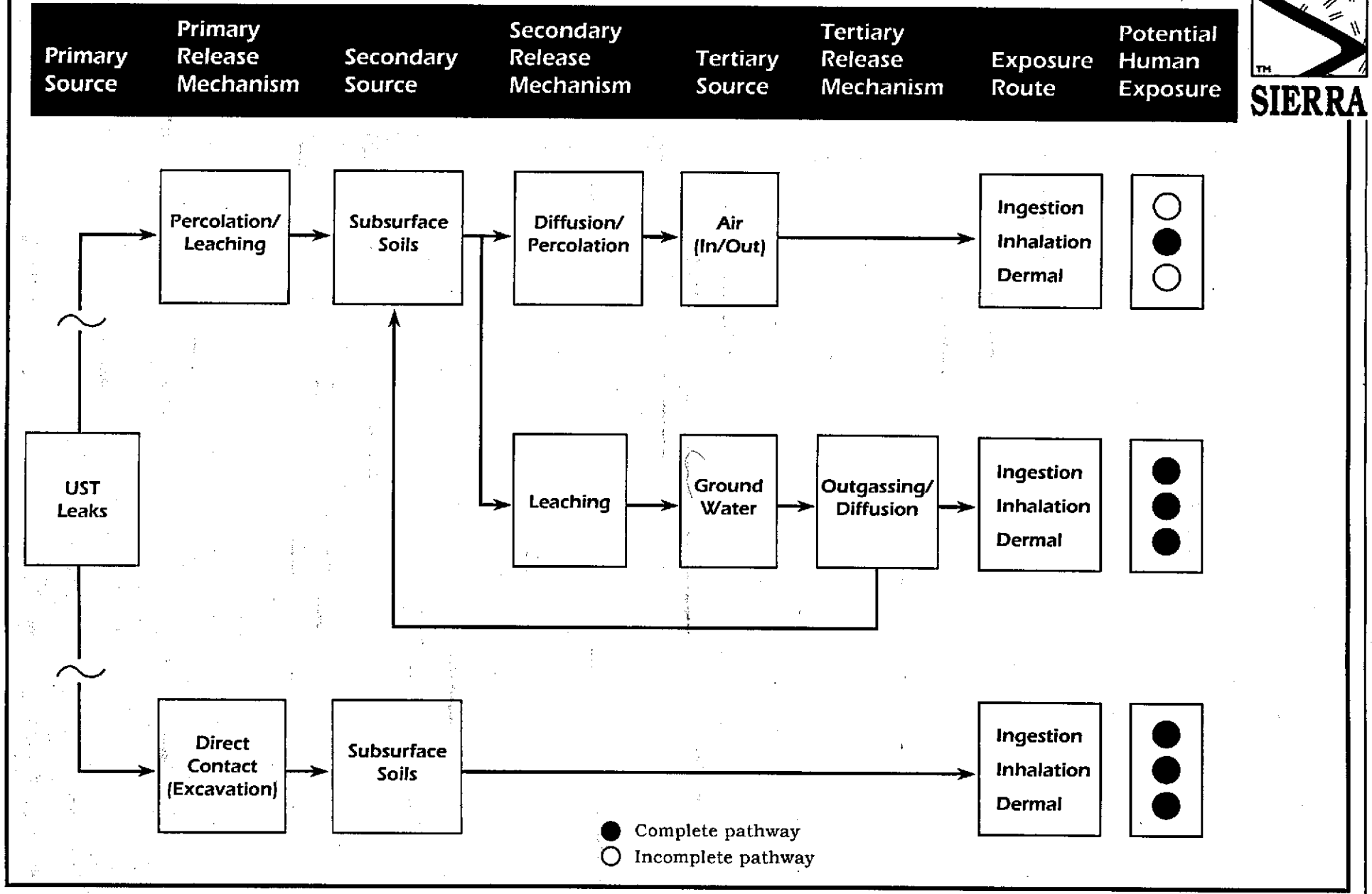

Figure 3. Conceptual Site Model – Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

4-719-16 [Conceptual Model] 2/28/97

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Table 1. Analytic Results for Soil - Petroleum Hydrocarbons/VOCs - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

Sample ID	Depth (Feet, BGS)	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	B	T	E	X	VOCs
				<----------	ppm	----------	----------	----------	----------	---------->
B-1	2.5	12/13/93	LUFT	<10	980	---	---	---	---	---
	8.5	12/13/93	LUFT	<10	2,000	---	---	---	---	---
B-2	5.5	12/13/93	LUFT	<10	1,640	---	---	---	---	---
	10.5	12/13/93	LUFT	<10	3,060	---	---	---	---	---
B-3	5.5	12/13/93	LUFT	13	1,900	---	---	---	---	---
B-4	5.5	12/13/93	LUFT	<10	100	---	---	---	---	---
B-5	5.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
B-6	5.5	12/14/93	LUFT	190	110	---	---	---	---	---
	10.5	12/14/93	LUFT	11	150	---	---	---	---	---
B-7	5.5	12/14/93	LUFT	11	1,380	---	---	---	---	---
	10.5	12/14/93	LUFT	14	920	---	---	---	---	---
B-8	5.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
	10.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
	15.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
	20.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
B-9	5.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
	10.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
MW-1	5.5	12/14/93	LUFT	15	2,320	---	---	---	---	---
	9.5	12/14/93	LUFT	<1.0	1.2	---	---	---	---	---
	15.5	12/14/93	LUFT	<1.0	7.5	---	---	---	---	---
	20.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
MW-2	5.5	12/14/93	LUFT	<10	2,780	---	---	---	---	---
	10.5	12/14/93	LUFT	<10	6,500	---	---	---	---	---
	15.5	12/14/93	LUFT	<1.0	18	---	---	---	---	---
	20.5	12/14/93	LUFT	<1.0	<1.0	---	---	---	---	---
	25.5	12/14/93	LUFT	<10	200	---	---	---	---	---
MW-3	5.5	12/14/93	LUFT	2.9	2.6	---	---	---	---	---

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Table 1: Analytic Results for Soil - Petroleum Hydrocarbons/VOCs - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Depth (Feet, BGS)	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	B	T	E	X	VOCs
				<----------ppm---------->						
	10.5	12/14/93	LUFT	<10	260	---	---	---	---	---
	15.5	12/14/93	LUFT	2.5	34	---	---	---	---	---
B-21	16.0	9/24/96	8015/8020/8240	---	<10	<0.005	<0.005	<0.005	<0.005	ND[1]
B-22	15.5	9/24/96	8015/8020/8240	---	<10	<0.005	<0.005	<0.005	<0.005	ND[1]
B-23	10.5	9/25/96	8015/8020/8240	---	<10	<0.005	<0.005	<0.005	0.044	ND[1]
B-24	16.0	9/25/96	8015/8020/8240	---	<10	<0.005	<0.005	<0.005	<0.005	ND[1]
B-25	16.0	9/25/96	8015/8020/8240	---	<10	<0.005	<0.005	<0.005	<0.005	ND[2]

EXPLANATION:

TPH(D) = Total Petroleum Hydrocarbons, as Diesel
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
VOCs = Volatile Organic Compounds
BGS = Below ground surface
ND = Not detected at detection limits noted
ppm = Parts per million
--- = Not analyzed/Not applicable

ANALYTIC LABORATORY:

Samples taken on 12/13/93 and 12/14/93 were analyzed by Precision Analytical Laboratory, Richmond, California.

Samples collected on 9/24/96 and 9/25/96 were analyzed by Superior Analytical Laboratory of Martinez, California.

ANALYTIC METHODS:

LUFT = Department of Health Services LUFT Manual Method for TPH(D) and Stoddard Solvent.
8020 = EPA Method 5030/8020 for BTEX.
8015 = EPA Method 8015 modified for Stoddard.
8015 = EPA Method 8015 modified for TPH(D).
8240 = EPA Method 8240 for VOCs.

NOTES:

[1] Volatile Organic Compounds not detected at detection limits ranging from 0.005 to 0.2 ppm.
[2] Sample contains 0.0052 ppm benzene. All other Volatile Organic Compounds not detected at detection limits ranging from 0.005 to 0.2 ppm.

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Table 2. Analytic Results for Ground Water - Petroleum Hydrocarbons - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

Sample ID	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	O&G	B	T	E	X
			<----------		ppb	----------			---------->
B-1	12/13/93	LUFT	1,200	93,000	---	---	---	---	---
B-2	12/13/93	LUFT	4,000	1,400,000	---	---	---	---	---
B-3	12/13/93	LUFT	3,700	780,000	---	---	---	---	---
B-4	12/13/93	LUFT	90	15,000	---	---	---	---	---
B-5	12/14/93	LUFT	100	1,600	---	---	---	---	---
B-6	12/14/93	LUFT	460	9,000	---	---	---	---	---
B-7	12/14/93	LUFT	390	18,000	---	---	---	---	---
B-8	12/14/93	LUFT	<50	<50	---	---	---	---	---
B-9	12/14/93	LUFT	<50	60	---	---	---	---	---
B-10	11/30/94	LUFT/5520/602	---	120,000	<10,000	<0.3	<0.3	<0.3	<0.3
B-11	11/30/94	LUFT/5520/602	---	210	<10,000	<0.3	<0.3	<0.3	<0.3
B-12	11/30/94	LUFT/5520/602	---	150	<10,000	<0.3	<0.3	<0.3	<0.3
B-13	11/30/94	LUFT/5520/602	---	220	<10,000	2.3	0.80	<0.3	4
B-14	11/30/94	LUFT/5520/602	---	150	<10,000	<0.3	<0.3	<0.3	0.80
B-15	1/23/95	LUFT/5520/602	---	9,100	<10,000	40 ppb	<3.0	60	<3.0
B-16	1/23/95	LUFT/5520/602	---	52[1]	<13,000	<0.3	<0.3	<0.3	1.3
B-17	1/23/95	LUFT/5520/602	---	<50	<10,000	<0.3	<0.3	<0.3	<0.3
B-18	9/24/96	8015/8020	---	<50	---	<0.5	0.5	<0.5	<0.5
B-19	9/24/96	8015/8020	---	<50[6]	---	<0.5	0.7	<0.5	0.7

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Table 2. Analytic Results for Ground Water - Petroleum Hydrocarbons - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	O&G	B	T	E	X
			<--------		ppb				-------->
B-20	9/24/96	8015/8020	---	<50	---	<0.5	<0.5	<0.5	<0.5
B-21	9/24/96[7]	8015/8020	---	---	---	---	---	---	---
B-22	9/24/96[7]	8015/8020	---	---	---	---	---	---	---
B-23	9/25/96	8015/8020	---	4,600	---	<0.5	0.7	100	540
B-24	9/25/96[7]	8015/8020	---	---	---	---	---	---	---
B-25	9/25/96[7]	8015/8020	---	---	---	---	---	---	---
B-26	9/25/96	8015/8020	---	<50	---	<0.5	<0.5	<0.5	<0.5
B-27	9/25/96	8015/8020	---	<50	---	<0.5	0.5	<0.5	<0.5
W-B28	10/31/96	8015/8020	<50	<50[8]	---	<0.5	<0.5	<0.5	<0.5
W-B29	10/31/96	8015/8020	<50	<50	---	<0.5	<0.5	<0.5	<0.5
W-B30	10/31/96	8015/8020	<50	<50[12]	---	1.4[9]	0.6[9]	3.0[10]	5.1[11]
MW-1	1/5/94	LUFT/602	500	1,000	6,300*	3.3	1.6	<0.3	6
	4/6/94	LUFT/602/5520	800	1,400	<5,000	5.6	4.5	<0.3	11
	7/7/94	LUFT/602/5520	400	1,200	8,300*	1.5	0.80	<0.3	1.9
	10/11/94	LUFT/602/5520	<5.0	700	<5,000	<0.3	<0.3	<0.3	<0.3
	1/20/95	LUFT/602	---	1,500	---	3.9	2	<0.3	3.9
	4/7/95	602/5030	2,500	500	---	3.2	1.1	<0.3	1.7
	7/26/95[2,3]	8015/8020	---	1,500	---	3.1	3.2	12	16
	10/25/95	8015/8020	---	660	---	0.6	1.4	20	14
	1/29/96	8015/8020	---	2,500	---	1.8	0.7	8.0	13
	4/26/96	8015/8020	---	4,600	---	<2.5	<2.5	9.5	21
	7/25/96[5]	8015/8020	---	2,200[4]	---	1.6	1.6	11	51
	10/28/96[14]	8015/8020	---	1,300	---	1.5	1.3[13]	3.6[13]	11[13]
MW-2	1/5/94	LUFT/602	200	35,000	<5,000	12	38	<3.0	150

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Table 2. Analytic Results for Ground Water - Petroleum Hydrocarbons - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	O&G	B	T	E	X
			<--------		ppb	--------			------->
	4/6/94	LUFT/602/5520	2,200	94,000	15,600	21	22	<6.0	110
	7/7/94	602	---	---	---	16	16	<1.5	1,510
	7/11/94	LUFT/5520	800	43,000	14,500*	---	---	---	---
	10/11/94	LUFT/5520/602	<5.0	31,000	<5,000	17	13	14	0.3
	1/20/95	LUFT/602	---	26,000	---	18	13	12	50
	4/7/95	602/5030	900	70,000	---	17.5	11	<0.6	74.6
	7/26/95	8015/8020	---	21,000	---	17	<0.5	26	94
	10/25/95	8015/8020	---	38,000	---	63	70	440	1,100
	1/29/96	8015/8020	---	74,000	---	7.4	8.6	66	330
	4/26/96	8015/8020	---	81,000	---	<250	<250	3,100	15,000
	7/25/96[5]	8015/8020	---	48,000	---	17	9.4	59	200
	10/28/96[14]	8015/8020	---	6,200	---	19	30	58[13]	310[13]
MW-3	1/5/94	LUFT/5520/602	70	1,100	<5,000	180	20	85	10
	4/6/94	LUFT/5520/602	<50	1,000	<5,000	140	13	60	<12
	7/7/94	602	---	---	---	120	7.5	8.0	<3.0
	7/11/94	LUFT/5520	270	1,000	<5,000*	---	---	---	---
	10/11/94	LUFT/5520/602	<5.0	1,100	<5,000	200	11	23	<0.3
	1/20/95	LUFT/602	---	2,100	---	36	3.5	4.8	<0.3
	4/7/95	602/5030	90	600	---	32.7	1.7	4.7	1.9
	7/26/95[3]	8015/8020	---	1,200	---	98	3.2	12	16
	10/25/95	8015/8020	---	2,300	---	32	3.4	4.7	9.6
	1/29/96	8015/8020	---	1,100	---	22	1.2	6.4	12
	4/26/96	8015/8020	---	1,300	---	5.6	0.6	4.6	14
	7/25/96[5]	8015/8020	---	2,900	---	120	6.4	23	36
	10/28/96[14]	8015/8020	---	2,000	---	170	6.6	16[13]	26[13]
Trip Blank									
TB-LB	1/5/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	4/6/94	602	---	---	---	<0.3	<0.3	<0.3	<0.6
	7/7/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	10/11/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	11/30/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	1/20/95	LUFT/602	---	<50	---	<0.3	<0.3	<0.3	<0.3
	1/23/95	LUFT/602	---	<50	---	<0.3	<0.3	<0.3	<0.3
	4/7/95	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	7/26/95	8020	---	---	---	<0.5	<0.5	<0.5	<0.5

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Table 2. Analytic Results for Ground Water - Petroleum Hydrocarbons - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Date Sampled	Analytic Method	TPH(D)	Stoddard Solvent	O&G	B	T	E	X
			<----------		----------	ppb	----------		---------->
	10/25/95	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	1/29/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	4/26/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	7/25/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	9/25/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	10/28/96[14]	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	10/31/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
Bailer Blank									
BB	1/5/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	4/6/94	602	---	---	---	<0.3	0.8	<0.3	<0.6
	7/11/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	11/30/94	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	1/20/95	LUFT/602	---	<50	---	<0.3	<0.3	<0.3	<0.3
	1/23/95	LUFT/602	---	<50	---	<0.3	<0.3	<0.3	<0.3
	4/7/95	602	---	---	---	<0.3	<0.3	<0.3	<0.3
	7/26/95	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	10/25/95	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	1/29/96	---	---	---	---	---	---	---	---
	4/26/96	8020	---	---	---	<0.5	<0.5	<0.5	<0.5
	7/25/96	---	---	---	---	---	---	---	---

EXPLANATION:

TPH(D) = Total Petroleum Hydrocarbons as Diesel
O&G = Oil and Grease
B = Benzene
T = Toluene
E = Ethylbenzene
X = Xylenes
ppb = Parts per billion
--- = Not analyzed/Not applicable

ANALYTIC METHODS:

LUFT = Department of Health Services LUFT Manual Method for TPH(D), Stoddard Solvent and O&G.
602 = EPA Method 602 for BTEX.
8020 = EPA Method 8020/5030 for BTEX.
8015 = EPA Method 8015 modified for Diesel.
8015 = EPA Method 8015 modified for Stoddard.
5520 = Standard Methods Method 5520 F for non-polar O&G

ANALYTIC LABORATORY:

NOTES:

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Table 2. Analytic Results for Ground Water - Petroleum Hydrocarbons - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Samples were analyzed by Precision Analytical Laboratory, of Richmond, California, prior to July 1995.

Samples were analyzed by Chromolab Environmental Services, of Pleasanton, California July 26, 1995.

Samples were analyzed by Superior Analytical Laboratory of Martinez, California from October, 1995 to present.

* This result represents both naturally occurring organics and petroleum hydrocarbons due to its analysis by Standard Methods Method 5520B.

[1] Stoddard gas range hydrocarbon does not match with stoddard gas standard.

[2] Unknown hydrocarbons in the diesel range were observed in sample.

[3] Unknown compounds in the motor oil range were observed in sample.

[4] Sample appears to be a mixture of stoddard and heavier unknown hydrocarbons.

[5] Hydrocarbons were found in the range of gasoline, but do not resemble a gasoline fingerprint. Possible Stoddard.

[6] Heavy hydrocarbons were found at 50 ppb in the range of diesel, but do not resemble a diesel fingerprint. Possible motor oil.

[7] No ground water was found.

[8] Heavier hydrocarbons were found at 80 ppb in the range of stoddard, but do not resemble a stoddard fingerprint. Possible weathered diesel or motor oil.

[9] There is a greater than 25% difference for detected concentration between the two GC columns.

[10] A level of 3.7 ppb ethylbenzene was reported in this sample after analysis for Volatile Organics by EPA 8240.

[11] A level of 6.9 ppb xylenes was reported in this sample after analysis for Volatile Organics by EPA 8240.

[12] Hydrocarbons were found at 100 ppb in the range of stoddard, but do not resemble a stoddard fingerprint.

[13] There is a greater than 25% difference for detected concentration between the two GC columns. TPH extractables are interferring with results.

[14] Analytic results are from SES Quarterly Monitoring Report, dated November 27, 1996.

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Table 3. Analytic Results for Ground Water - Volatile Organic Compounds - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

Sample ID	Date Sampled	Analytic Method	VC	1,1-DCA	t-1,2-DCE	c-1,2-DCE	C	1,2-DCA	TCE	PCE	1,2-DCB	Other HVOCs	Other VOCs
			<----------				ppb						---------->
B-10	11/30/94	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
B-11	11/30/94	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
B-12	11/30/94	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
B-13	11/30/94	8240	430	32	7.9	810	<3	<2	340	360	<4	---	ND[10]
B-14	11/30/94	8240	<2	12	<3	35	<3	<2	21	59	<4	---	ND[10]
B-15	1/23/95	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
B-16	1/23/95	8240	<2	<3	<3	<3	<3	<2	8	290	<4	---	ND[10]
B-17	1/23/95	8240	<2	<3	<3	14	<3	<2	13	53	<4	---	ND[10]
B-18	9/24/96	8240	<10	<3	<3	16	<3	<1	10	24	<3	---	ND[25]
B-19	9/24/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]
B-20	9/24/96	8240	<10	<3	<3	<3	<3	<1	<3	8.4	<3	---	ND[25]
B-21	9/24/96[23]	---	---	---	---	---	---	---	---	---	---	---	---
B-22	9/24/96[23]	---	---	---	---	---	---	---	---	---	---	---	---
B-23	9/25/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]
B-24	9/25/96[23]	---	---	---	---	---	---	---	---	---	---	---	---
B-25	9/25/96[23]	---	---	---	---	---	---	---	---	---	---	---	---
B-26	9/25/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]
B-27	9/25/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]

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Table 3. Analytic Results for Ground Water - Volatile Organic Compounds - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Date Sampled	Analytic Method	VC	1,1-DCA	t-1,2-DCE	c-1,2-DCE	C	1,2-DCA	TCE	PCE	1,2-DCB	Other HVOCs	Other VOCs
			<----------ppb---------->										
W-B28	10/31/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]
W-B29	10/31/96	8240	<10	<3	<3	<3	<3	<1	<3	<3	<3	---	ND[25]
W-B30	10/31/96	8240	<10	<3	<3	14	<3	<1	<3	<3	<3	---	ND[25]
MW-1	1/5/94	8010	<1	<0.3	<0.2	0.44	0.35	<0.2	<0.3	<2	0.36	ND[1]	---
	4/6/94	8010	<1	<0.3	<0.2	0.32	<0.2	<0.2	<0.3	<2	0.21	ND[4]	---
	7/7/94	8010	<1	<0.2	<0.2	<0.2	<0.1	<0.5	<0.2	<2	<0.2	ND[7]	---
	10/11/94	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
	1/20/95	8240	<2	<3	<3	<3	<3	<2	<3	<2	<1	---	ND[11]
	4/7/95	8010	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	ND[14]	---
	7/26/95	8010	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ND[14]	---
	10/25/95	8010	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	---	---
	1/29/96	8010	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ND	---
	4/26/96	8010	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ND	---
	7/25/96	8010	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ND	---
	10/28/96	8010	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	ND	---
MW-2	1/5/94	8010	<1	10	1.1	130	5.6	2.7	2.6	<2	0.90	ND[2]	---
	4/6/94	8010	<1	0.40	<0.2	4.3	<0.2	<0.2	<0.3	<2	0.80	ND[5]	---
	7/7/94	8010	<1	3.4	<0.2	15	<0.1	0.60	0.60	<2	0.40	ND[8]	---
	10/11/94	8240	<2	<3	<3	31	<3	<2	<3	<2	<4	---	ND[10]
	1/20/95	8240	<2	5	<3	14	<3	<2	<3	<2	<1	---	ND[11]
	4/7/95	8010	4.9	4.3	<0.5	18	<0.5	1.4	<0.5	0.8	<0.5	ND[12,14]	---
	7/26/95	8010	8.1	5.1	<0.5	20	<0.5	<0.5	<0.5	1.6	<0.5	ND[14]	---
	10/25/95	8010	17	5.4	<0.5	40	<0.5	<0.5	1.7	9.4	<0.5	ND[16]	---
	1/29/96	8010	4.2	4.1	<0.5	27	<0.5	<0.5	1.3	0.9	0.7	ND	---
	4/26/96	8010	3.3	0.8	<0.5	4.4	<0.5	<0.5	<0.5	<0.5	1.0	ND[19]	---
	7/25/96	8010	0.8	2.3	<0.5	1.5	<0.5	<0.5	<0.5	<0.5	0.5	ND[21]	---
	10/28/96	8010	<2.5	4.3	<2.5	36	<2.5	<2.5	<2.5	<2.5	<2.5	ND	---
MW-3	1/5/94	8010	<1	0.70	<0.2	5.2	1.3	0.20	<0.3	<2	1.5	ND[3]	---
	4/6/94	8010	<1	0.40	<0.2	4.2	<0.2	<0.2	<0.3	<2	0.80	ND[6]	---

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Table 3. Analytic Results for Ground Water - Volatile Organic Compounds - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

Sample ID	Date Sampled	Analytic Method	VC	1,1-DCA	t-1,2-DCE	c-1,2-DCE	C	1,2-DCA	TCE	PCE	1,2-DCB	Other HVOCs	Other VOCs
			<----------ppb---------->										
MW-3	7/7/94	8010	<1	0.30	<0.2	2.9	<0.1	<0.5	<0.2	<2	1.3	ND[9]	---
	10/11/94	8240	<2	<3	<3	<3	<3	<2	<3	<2	<4	---	ND[10]
	1/20/95	8240	<2	<3	<3	6	<3	<2	<3	<2	1	---	ND[11]
	4/7/95	8010	8.8	<0.5	<0.5	13	<0.5	0.7	<0.5	<0.5	2	ND[13,14]	---
	7/26/95	8010	9.6	<0.5	<0.5	6.3	<0.5	<0.5	<0.5	<0.5	<0.5	ND[15]	---
	10/25/95	8010	4.2	<0.5	<0.5	4.1	<0.5	<0.5	<0.5	<0.5	1.6	ND[17]	---
	1/29/96	8010	2.0	<0.5	<0.5	2.8	<0.5	<0.5	<0.5	<0.5	1.5	ND[18]	---
	4/26/96	8010	3.6	<0.5	<0.5	3.4	<0.5	<0.5	<0.5	<0.5	2.7	ND[20]	---
	7/25/96	8010	1.5	<0.5	<0.5	1.0	<0.5	<0.5	<0.5	<0.5	2.0	ND[22]	---
	10/28/96	8010	1.2	<0.5	<0.5	5.9	<0.5	<0.5	<0.5	<0.5	<0.5	ND[24]	---

for VOCs average 1996

EXPLANATION:

VC = Vinyl Chloride
1,1-DCA = 1,1-Dichloroethane
t-1,2-DCE = trans-1,2-Dichloroethene
c-1,2-DCE = cis-1,2-Dichloroethene
C = Chloroform
1,2-DCA = 1,2-Dichloroethane
TCE = Trichloroethene
PCE = Tetrachloroethene
1,2-DCB = 1,2-Dichlorobenzene
HVOCs = Halogenated Volatile Organic Compounds
VOCs = Volatile Organic Compounds
ppb = Parts per billion
ND = Not detected
--- = Not analyzed/not applicable

ANALYTIC LABORATORY:

Samples collected prior to July 1995 were analyzed by Precision Analytical Laboratory, Richmond, California.

Samples collected in July 1995 were analyzed by Chromalab Environmental Services, of Pleasanton, California.

Samples collected from Octoboer 1995 to present were analyzed by Superior Analytical Laboratory of Martinez, California.

ANALYTIC METHODS:

8010 = EPA Method 5030/8010 for HVOCs
8240 = EPA Method 8240 for VOCs

NOTES:

1. 1,4-Dichlorobenzene was detected at 0.34 ppb. Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
2. 1,2-Dichloropropene, T-1,3-Dichloropropene, and 1,4-Dichlorobenzene were detected at 18, 1.0 and 1.0 ppb, respectively. Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
3. Chlorobenzene and 1,4-Dichlorobenzene were detected at 0.70 and 0.30 ppb, respectively. Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
4. 1,4-Dichlorobenzene was detected at 0.21 ppb. Other HVOCs not detected at detection limits of 0.2 to 2.2 ppb.
5. Chlorobenzene was detected at 1.7 ppb. Other HVOCs not detected at detection limits of 0.2 to 2.2 ppb.

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Table 3. Analytic Results for Ground Water - Volatile Organic Compounds - Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California (continued)

[6] Chlorobenzene was detected at 1.6 ppb. Other HVOCs not detected at detection limits of 0.2 to 2.2 ppb.
[7] 1,4-Dichlorobenzene was detected at 0.26 ppb. Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
[8] 1,2-Dichloropropene, tetrachloroethene and 1,4-Dichlorobenzene were detected at 6.5, 1.4 and 0.34 ppb, respectively. Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
[9] Other HVOCs not detected at detection limits of 0.2 to 2.0 ppb.
[10] Benzene, toluene, ethylbenzene and xylene results are included on Table 2. Other VOCs not detected at detection limits of 2 to 50 ppb.
[11] Benzene, toluene, ethylbenzene and xylene results are included on Table 2. Other VOCs not detected at detection limits of 1 to 7 ppb.
[12] 1,2-dichloropropane was detected at 8.0 ppb.
[13] Chlorobenzene was detected at 7.3 ppb.
[14] Other HVOCs were not detected at a detection limit of 0.5 ppb.
[15] Chlorobenzene was detected at 4.0 ppb.
[16] 1,2 Dichloropropane was detected at 9.0 ppb.
[17] Chlorobenzene was detected at 1.7 ppb.
[18] Benzene, toluene, ethylbenzene and xylene results included in Table 2.
[19] 1,2-Dichloropropane was detected at 2.0 ppb.
[20] Chlorobenzene was detected at 6.1 ppb.
[21] 1,2-Dichloropropane was detected at 4.1 ppb.
[22] Chlorobenzene was detected at 3.2 ppb.
[23] No ground water found in borehole.
[24] Chlorobenzene was detected at 1.6 ppb. All other HVOCs were not detected at a detection limit of 0.5 ppb.
[25] Benzene, toluene, ethylbenzene and xylene results are included on Table 2. Other VOCs not detected at detection limits of 2 to 40 ppb.

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Table 4. Analytic Results for Air - Organic Compounds- Telegraph Business Park, 5427 Telegraph Avenue, Oakland, California

Sample ID	Date Sampled	Analytic Lab	Analytic Method	Stoddard Solvent	B	T	E	m,p-X	o-X	1,2,4-TMB	Other VOCs
				<----------			ppbv				---------->
A-1	11/19/96	ATL	TO-14	<0.88	2.1	7.0	2.1	1.6	1.2	1.2	ND[1]
A-2	11/19/96	ATL	TO-14	<0.90	2.1	4.2	<0.90	1.3	<0.90	<0.90	ND[2]
Lab Blank	NA	ATL	TO-14	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	ND[3]

EXPLANATION:

B = Benzene
T = Toluene
E = Ethylbenzene
m,p-X = m,p-Xylenes
o-X = o-Xylenes
1,2,4-TMB = 1,2,4-Trimethylbenzene
ppbv = Parts per billion by volume
GC/MS = Gas chromatogram/mass spectrometer
TICs = Tentatively Identified Compounds
NA = Not applicable
ND = Not detected

ANALYTIC LABORATORY:

ATL = Air Toxics LTD. of Folsom, California

ANALYTIC METHODS:

TO-14 = EPA Method TO-14 for GC/MS Full Scan

NOTES:

[1] Other VOCs were not detected at a laboratory reporting limit of 0.88 ppbv. Sample A-1 is reported to contain six TICs: acetaldehyde, 2-propanone, dichloromethane, butanal, hexanal and octanal at concentrations of 6.7, 10, 6.3, 20, 6.0 and 4.6 ppbv, respectively.

[2] Other VOCs were not detected at a laboratory reporting limit of 0.90 ppbv. Sample A-2 is reported to contain 2 TICs: 2-hydroxybenzaldehyde and (E)-4-dodecene at concentrations of 7.3 and 5.3 ppbv, respectively.

[3] Other VOCs were not detected at a laboratory reporting limit of 0.50 ppbv. Laboratory Blank did not contain any TICs.

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APPENDIX C

CHAIN OF CUSTODY DOCUMENTATION
LABORATORY ANALYTIC REPORTS
RAW CHROMATOGRAPHIC DATA

AIR TOXICS LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

CHAIN-OF-CUSTODY RECORD

№ 009374

Page 1 of 1

Contact Person: Jim Green
Company: Sierra Environmental Services
Address: P.O. Box 2546 City: Martinez State: CA Zip: 94553
Phone: 510-370-1280 FAX: 510-370-795
Collected By: Signature: Jim Green

Project info:
P.O. # 4115
Project # 4-719-16
Project Name: TBP

Turn Around Time:
☒ Normal
☐ Rush _____ Specify

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum Initial	Final	Receipt
01A	A-1	11/19/96 9:25-17:25	TO-14 : as previously agreed			7.0"Hg
02A	A-2	11/19/96 9:30-17:30	TO-14 "			7.5"Hg

Relinquished By: (Signature) Date/Time: 11/20/96 9:50 — Print Name: Jeanette Sanazin — Jim Green 11/20/96 10:00am
Received By: (Signature) Date/Time: 11/20/96 4:07
Relinquished By: (Signature) Date/Time: 11/20/96 4:05 PM — John Engelen
Received By: (Signature) Date/Time: 11/21/96 8:00 AM

Notes:

Lab Use Only	Shipper Name	Air Bill #	Opened By:	Date/Time	Temp. (°C)	Condition	Custody Seals Intact?	Work Order #
	CA Overnight	NP	TS	11/21/96 800	Ambient	Good	Yes No (None) N/A	9611238

Form 1293 rev. 06

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9611238

Work Order Summary

CLIENT: Mr. Jim Green
Sierra Environmental Services
1320 Arnold, Suite 170
Martinez, CA 94553

BILL TO: Mr. Jim Green
Sierra Environmental Services
P.O. Box 2546
Martinez, CA 94553

PHONE: 510-370-1280
FAX: 510-370-7959
DATE RECEIVED: 11/21/96
DATE COMPLETED: 12/9/96
DATE RE-ISSUED: 12/20/96 To add analyte per client's request.

INVOICE # 12631
P.O. # 4115
PROJECT # 4-719-16 TBP

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.
01A	A-1	TO-14/TIC's	7.0 "Hg
02A	A-2	TO-14/TIC's	7.5 "Hg
03A	Lab Blank	TO-14/TIC's	NA

LAB NARRATIVE:
Stoddard standard solvent scan for samples A-1 and A-2 was not detected.

CERTIFIED BY: Walter McCauley
for Laboratory Director

DATE: 12-23-96

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA 95630
(916) 985-1000 • (800) 985-5955 • FAX (916) 985-1020

AIR TOXICS LTD.

SAMPLE NAME: A-1

ID#: 9611238-01A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	9120313	Date of Collection:	11/19/96
Dil. Factor:	1.75	Date of Analysis:	12/3/96

Compound	Det. Limit (ppbv)	Amount (ppbv)
Benzene	0.88	2.1
Toluene	0.88	7.0
Ethyl Benzene	0.88	2.1
m,p-Xylene	0.88	1.6
o-Xylene	0.88	1.2
Styrene	0.88	Not Detected
1,3,5-Trimethylbenzene	0.88	Not Detected
1,2,4-Trimethylbenzene	0.88	1.2
4-Ethyltoluene	3.5	Not Detected
Stoddard Solvent Scan	0.88	Not Detected

TENTATIVELY IDENTIFIED COMPOUNDS - Top 20 Reported

Compound	CAS Number	Match Quality	Amount (ppbv)
Acetaldehyde	75-07-0	Manual ID	6.7
2-Propanone	67-64-1	Manual ID	10
Methane, dichloro-	75-09-2	91 %	6.3
Butanal	123-72-8	83 %	20
Hexanal	66-25-1	72 %	6.0
Octanal	124-13-0	72 %	4.6

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
Octafluorotoluene	104	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	107	70-130

AIR TOXICS LTD.

SAMPLE NAME: A-2

ID#: 9611238-02A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	9120314	Date of Collection:	11/19/96
Dil. Factor:	1.79	Date of Analysis:	12/3/96

Compound	Det. Limit (ppbv)	Amount (ppbv)
Benzene	0.90	2.1
Toluene	0.90	4.2
Ethyl Benzene	0.90	Not Detected
m,p-Xylene	0.90	1.3
o-Xylene	0.90	Not Detected
Styrene	0.90	Not Detected
1,3,5-Trimethylbenzene	0.90	Not Detected
1,2,4-Trimethylbenzene	0.90	Not Detected
4-Ethyltoluene	3.6	Not Detected
Stoddard Solvent Scan	0.90	Not Detected

TENTATIVELY IDENTIFIED COMPOUNDS - Top 20 Reported

Compound	CAS Number	Match Quality	Amount (ppbv)
Benzaldehyde, 2-hydroxy-	90-02-8	81 %	7.3
4-Dodecene, (E)-	7206-15-7	Manual ID	5.3

Container Type: 6 Liter Summa Canister

Surrogates	% Recovery	Method Limits
Octafluorotoluene	105	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	105	70-130

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank

ID#: 9611238-03A

EPA METHOD TO-14 GC/MS Full Scan

File Name:	9120306	Date of Collection:	NA
Dil. Factor:	1.00	Date of Analysis:	12/3/96

Compound	Det. Limit (ppbv)	Amount (ppbv)
Benzene	0.50	Not Detected
Toluene	0.50	Not Detected
Ethyl Benzene	0.50	Not Detected
m,p-Xylene	0.50	Not Detected
o-Xylene	0.50	Not Detected
Styrene	0.50	Not Detected
1,3,5-Trimethylbenzene	0.50	Not Detected
1,2,4-Trimethylbenzene	0.50	Not Detected
4-Ethyltoluene	2.0	Not Detected
Stoddard Solvent Scan	0.50	Not Detected

TENTATIVELY IDENTIFIED COMPOUNDS - Top 20 Reported

Compound	CAS Number	Match Quality	Amount (ppbv)
None Identified			

Container Type: NA

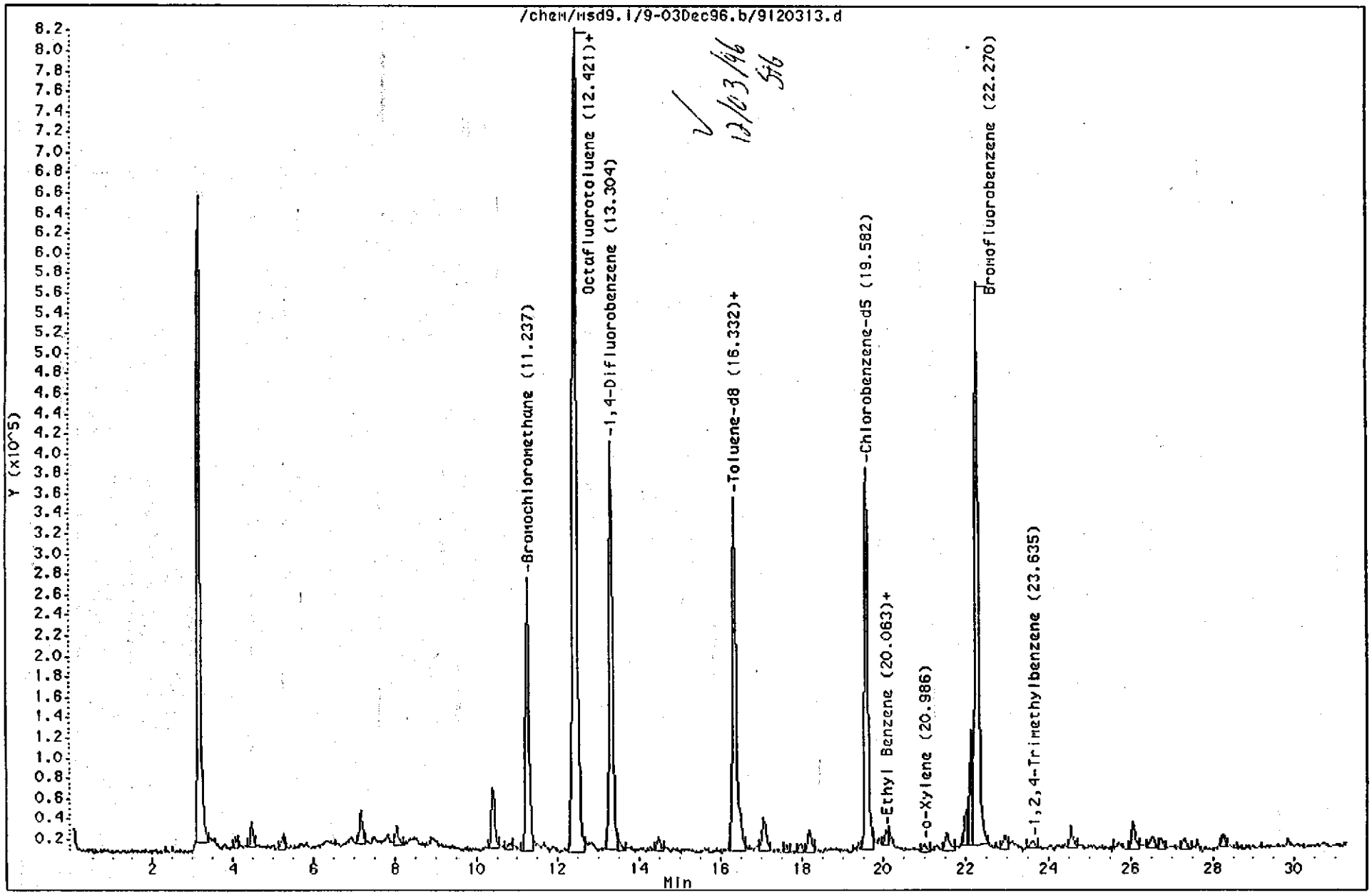
Surrogates	% Recovery	Method Limits
Octafluorotoluene	104	70-130
Toluene-d8	107	70-130
4-Bromofluorobenzene	109	70-130

Data File: /chem/msd9.i/9-03Dec96.b/9120313.d
Date : 03-DEC-96 15:39
Client ID: A-1
Sample Info: 1.0L Can# 22678

Instrument: msd9.i

Operator: DP
Column diameter: 0.58

Column phase: RTx-624

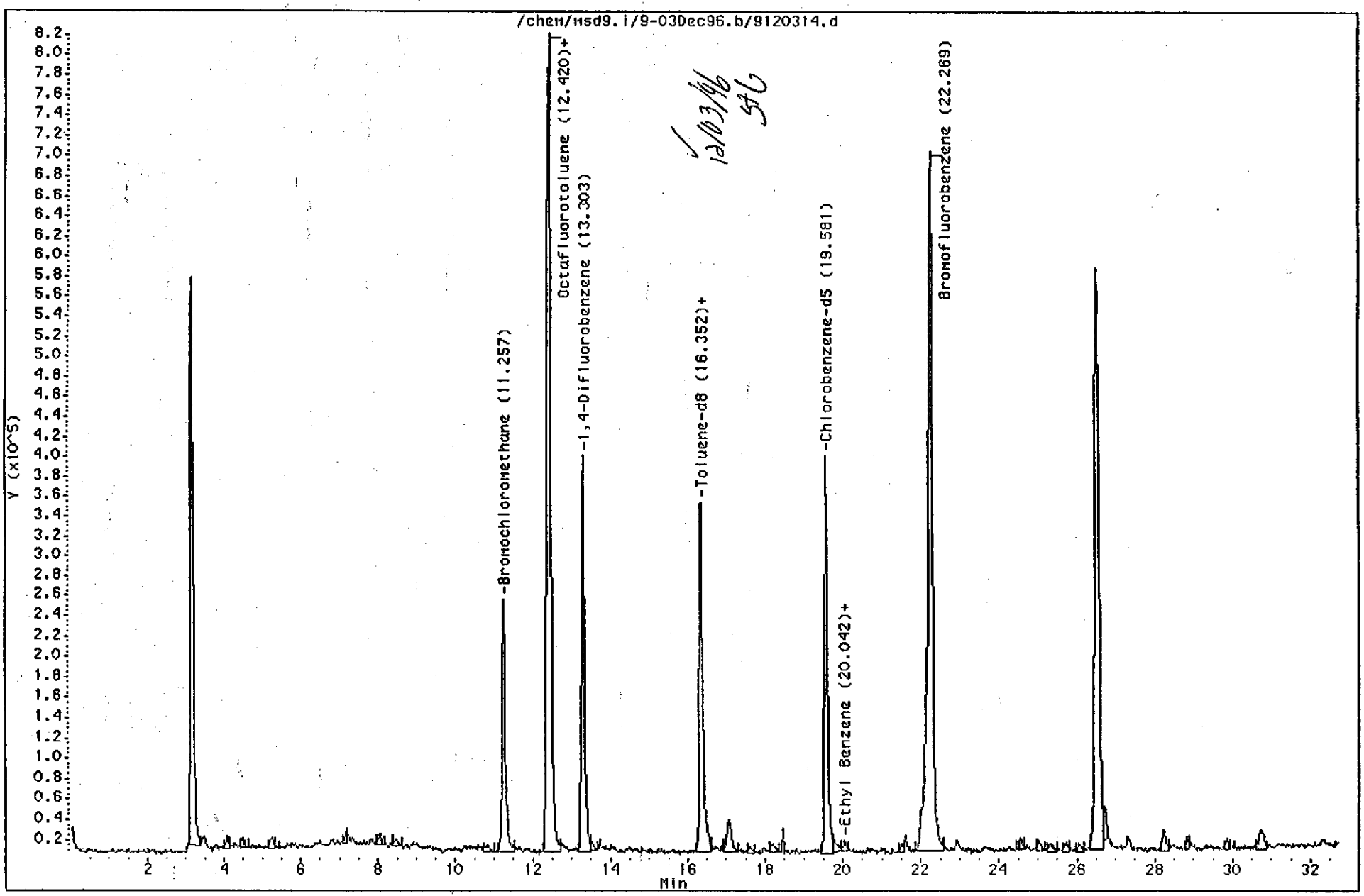


Data File: /chem/msd9.i/9-03Dec96.b/9120314.d
Date : 03-DEC-96 16:16
Client ID: A-2
Sample Info: 1.0L can#-05356

Instrument: msd9.i

Operator: STG
Column diameter: 0.58

Column phase: RTx-624

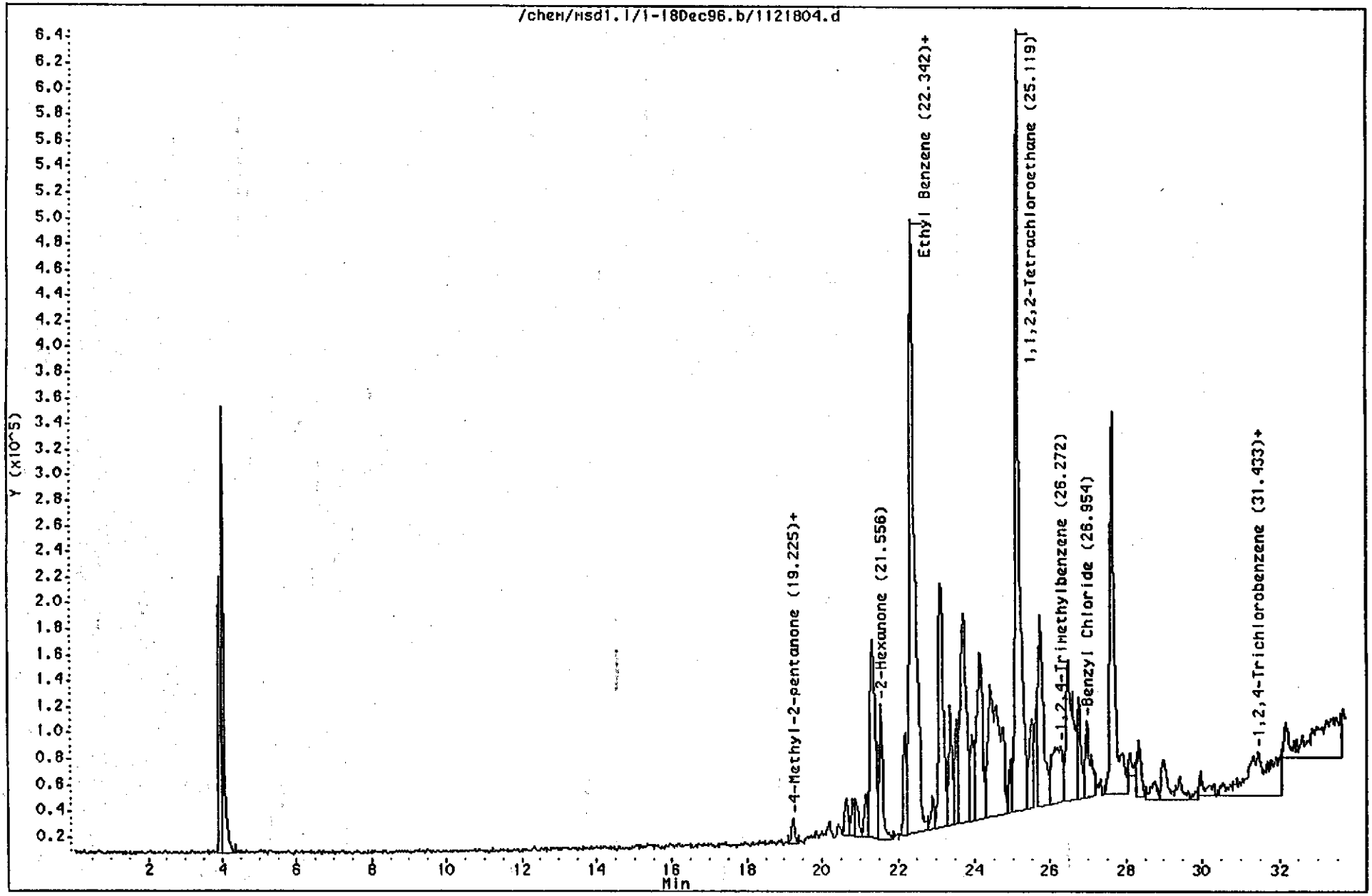


Data File: /chem/msd1.i/1-18Dec96.b/1121804.d
Date : 18-DEC-96 11:04
Client ID: HS-005N
Sample Info: 10ul HS-005N

Column phase: RTx-624

Instrument: msd1.i

Operator: STG
Column diameter: 0.53



Data File: /chem/msd9.i/9-03Dec96.b/9120306.d
Date : 03-DEC-1996 10:33
Client ID: Lab Blank
Sample Info: Lab Blank, 1L, can # 11030

Column phase: RTx-624

Instrument: msd9.i

Operator: LTS
Column diameter: 0.58

DP 12-3-96