REMEDIAL INVESTIGATION REPORT

LIVERMORE ARCADE SHOPPING CENTER
Livermore, California

April 1992

Prepared For:

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San Francisco, California

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Project No.: 48016.08

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LIVERMORE ARCADE SHOPPING CENTER
Livermore, California

SUBMITTED BY: **DATE**

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1.0 EXECUTIVE SUMMARY

Ground water and soil testing performed by H+GCL Inc. (formerly Hygienetics, Inc.) identified the Livermore Arcade Shopping Center as the source of a release of dry-cleaning solvents, a regulated hazardous waste, into the environment. A Site Assessment of the Livermore Arcade Shopping Center conducted in February 1990 detected concentrations of the chlorinated solvent tetrachloroethene (also referred to as perchloroethene or PCE) and its degradation products in ground water in wells near Mike's One Hour Cleaners (Mike's Cleaners). Gasoline components (hydrocarbons, benzene, toluene, and xylene) were also found in ground water near the southeast corner of the Arcade property.

A subsequent investigation determined that the original operators of Mike's Cleaners (the Neely brothers) had disposed of their PCE-laden solvent waste down their floor drain between the years of 1982 to 1986. A videotaped reconnaissance of the drain found pipe displacement at a location approximately 70 feet away from the floor drain. Solvent waste could enter the soil at this location and migrate down through the soil into the ground water.

To date, eighteen ground water monitoring wells, four soil borings, and a soil gas survey have characterized the concentrations of chlorinated solvent present in the soil and ground water. In 1990, the ground water plume was defined to extended almost 950 feet to the northwest.

Ground water sampling detected concentrations of gasoline components in several wells. Subsequent investigation determined that the Beacon Oil Station located just southeast and up-gradient of the Livermore Arcade Shopping Center, was the most probable source of a separate gasoline component plume at the site.

The soil vapor study identified two areas with high concentrations of PCE vapor. One area is the immediate vicinity of Mike's Cleaners and the second is adjacent to Paul's Sparkle Cleaners (Paul's Cleaners). Paul's Cleaners is located 450 feet down-gradient (northwest) of Mike's Cleaners and is in the center of the chlorinated solvent ground water plume. Paul's Cleaners is a generator of PCE solvent waste and is a potential contributor to the plume.

Historical ground water data collected from Alameda County shows that the ground water table has dropped over fifty feet since 1982. The ground water elevations at the Arcade site monitoring wells agree with data presented in regional hydrographs. Between 1982 and 1985, the top of the water table at the site was located in the upper gravelly and more permeable zone of the shallow aquifer . Hydrogeologic calculations show that ground water is capable of moving at horizontal velocities of several hundred feet per year through permeable gravels. By the mid 1980s, the water table had fallen down into the clayey, less permeable zones of the aquifer resulting in a slower migration rate for the plume. Test pumping of the surface aquifer in 1990 and 1992 demonstrated very low permeability in the lower clayey zones. Hydrogeologic modeling of this zone showed the velocity of the ground water to be a maximum of 3 feet per year. A release of chlorinated solvents to the soil and ground water would have had to occurred in 1982 and 1983 for ground water flow velocities to create the observed plume

Study of the regional ground water flow showed that its direction changed from the west northwest to north northwest between 1982 and 1990. The west northwest direction of the plume supports the hypothesis that the plume began during the early 1980s when the ground water flow was to the west northwest.

A baseline health risk assessment (HRA) found no significant risk to employees or potential residents of the Arcade site due to inhalation, dermal exposure, or ingestion of water from a deeper aquifer under the Arcade site. A significant cancer and chronic risk was found for ingestion of drinking water from the surface aquifer, although the surface aquifer is not being used as a drinking water source.

Potential human and environmental exposure pathways have been evaluated for the ground water plume, and it was determined that if the drinking water aquifers used by the City of Livermore become impacted, a significant threat to human health could occur. These drinking water aquifers are located directly below the Livermore Arcade Shopping Center, but are separated from the surface ground water aquifer by a several continuous clay rich layers.

Most of the PCE contamination presently is retained in the shallow soils, with some of the PCE also present in the shallow ground water. Although the transport mechanisms between the shallow and deeper aquifer are not fully characterized, no connection between these aquifers beneath the site has been identified. Even if a connection between the two aquifers is present off-site, it is not anticipated that present PCE contamination of the shallow aquifer will result in contamination of the deeper aquifer at levels of concern (i.e. above the maximum contaminant level of 5 ppb). Soil vapor extraction, particularly if combined with air sparging, would reduce the total amounts of PCE in the shallow aquifer even further.

However, unless remediated, the PCE in the soil will result in additional contamination of the shallow aquifer, particularly when shallow ground water levels rise in the future. This additional contamination would significantly increase the threat to the deeper aquifer.

Two California Water Service (CWS) drinking water supply wells are located close to the chlorinated solvent plume. Periodic sampling of these wells has been performed and no chlorinated solvents or gasoline components have been detected. A CWS well located approximately one mile north from the site was found to have PCE contamination in 1988. This problem, however, does not appear related to the release from the Arcade site.

The RWQCB has taken an active role in overseeing the investigation activities. Preliminary remediation options were discussed with the RWQCB. During monitoring of the site, H^{+}GCL discovered a 35 foot decrease in the ground water table in the last quarter of 1991. Two deeper monitoring wells were installed close to the first underlying clay layer and soil and ground water testing was performed. The results show that contaminated ground water has been held in the newly created vadose zone of the aquifer and that only several feet of ground water are present above the underlying clayey layers.

Changing ground water conditions have rendered previously identified cleanup options, specifically pumping and treating contaminated ground water, infeasible or ineffective. Several options which should be closely explored during the Feasibility Study process include replacement or repair of the disjointed sewer pipe leading from Mike's Cleaners and implementation of a pilot test study of a vapor extraction system. While the ground water remains low, the option of vapor extraction is now a timely alternative for remediation of almost the entire shallow aquifer near Mike's Cleaners.

2.0 INTRODUCTION

On behalf of Grubb and Ellis, H+GCL performed a Remedial Investigation of the Livermore Arcade Shopping Center (Arcade site) in Livermore, California. The principal objective of this investigation was to evaluate the nature and extent of solvent and gasoline contamination at the Arcade site. The secondary objective was to conduct a Baseline Public Health Evaluation of the site. The resulting data will be used to determine the level of risk presented by the site and the appropriate remedial response alternatives.

It is the intention of Grubb and Ellis to evaluate the data, select an appropriate remedial response, and implement a private party cleanup at the site. This report is based on previous reports, recently collected data from published sources, and new scientific investigation.

On December 6, 1991, representatives of the RWQCB met with Grubb & Ellis to request that a work plan be submitted for a Remedial Investigation/Feasibility Study (RI/FS) to address recent changes in ground water conditions at the Arcade site. The plan was subsequently completed and circulated to interested parties in January 1992. (H+GCL, 1992). Sampling and other activities described in the work plan were carried out during January, February, and March of 1992. The following report summarizes these remedial investigation activities; the final document will be circulated for public comment.

At the conclusion of the RI/FS investigation, a Feasibility Study (FS) will be developed, in part, from the data presented in this RI report. The purpose of the FS will be to identify and evaluate various remedial alternatives for controlling potential exposure to chlorinated solvents at the site.

This RI has been conducted in accordance with the provisions of the following: the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601, et. seq.); the National Contingency Plan (NCP) (40 CFR 300 et. seq.) with revisions effective February 6, 1990; "Guidance for Conducting Remedial Investigations and Feasibility Studies" (OSWER Directive 9355.3-01, October 1988); Sections 25250 and 25356.1 of the California Health and Safety Code; and the State Water Resource Control Board Resolution No. 68-16. The RI also conforms generally to the Expenditure Plan for the Hazardous Substance Cleanup Bond Act of 1984, as revised (originally published January 1985). References are provided in Section 7.0.

The public is encouraged to review this document and to submit comments to Grubb & Ellis. Based on evaluation of the remediation alternatives in the FS and on public comment, Grubb & Ellis will select and implement a remediation strategy for the site. The selected alternatives will be protective of human health and the environment, will meet applicable, relevant, and appropriate requirements, and will be cost-effective.

2.1 Location

The City of Livermore, California is located approximately 25 miles east of San Francisco Bay along Highway 580 (Figure 1). Livermore is located in the east central portion of the Livermore-Amador Valley. The Livermore Arcade Shopping Center is located at the northwest corner of First and South P Streets in downtown Livermore (Figure 2). Railroad Avenue borders the Arcade site to the north. South S Street borders the site on the west. Millers Outpost Shopping Center is directly north of the Livermore Arcade Shopping Center and the Southern Pacific Railroad line is to the northeast. Commercial businesses are south of the Arcade site, an apartment complex is on the east, and a hospital lies to the west.

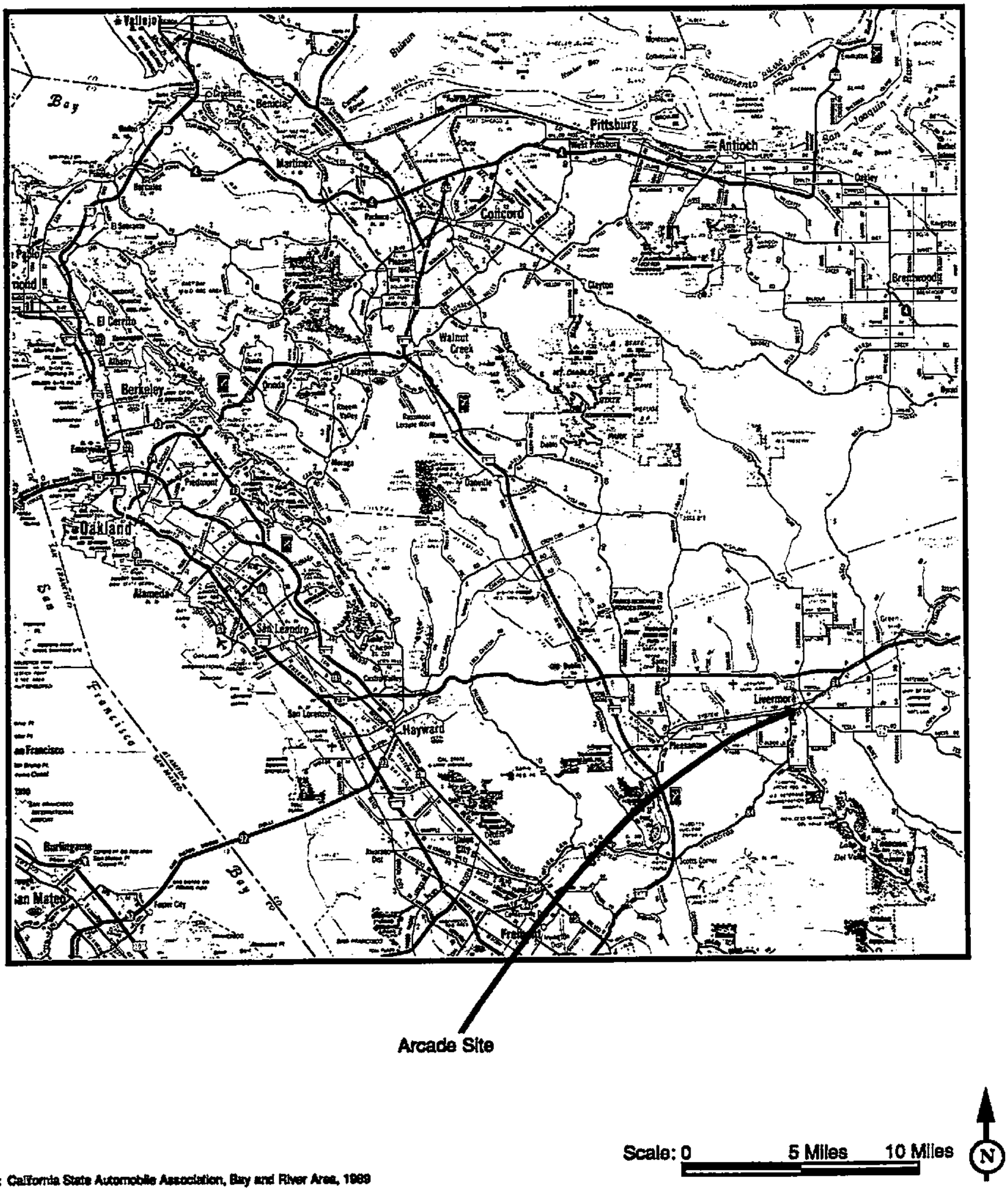
2.2 Statement Of The Problem

Chlorinated solvents and petroleum hydrocarbon constituents are present in the soil and ground water throughout the Arcade site at concentrations that exceed regulatory action levels (Figure 3). Used dry cleaning solvents were disposed of through the sanitary sewer system at Mike's Cleaners in the Livermore Arcade Shopping Center. A break in the sanitary sewer line leading from Mike's Cleaners to the main line at the Arcade Center created a pathway for the dry cleaning solvent tetrachloroethene (PCE) to enter the subsurface. Beneath and down-gradient from the break in the sanitary sewer line, PCE and its decay products are present in soil and shallow ground water.

Paul's Cleaners in the Miller's Outpost Shopping Center is also located in the area overlying the chlorinated solvent ground water plume. A recent survey of PCE vapor concentrations in the monitoring wells at the Arcade site showed anomalous areas (high concentrations) at both Mike's Cleaners and Paul's Cleaners.

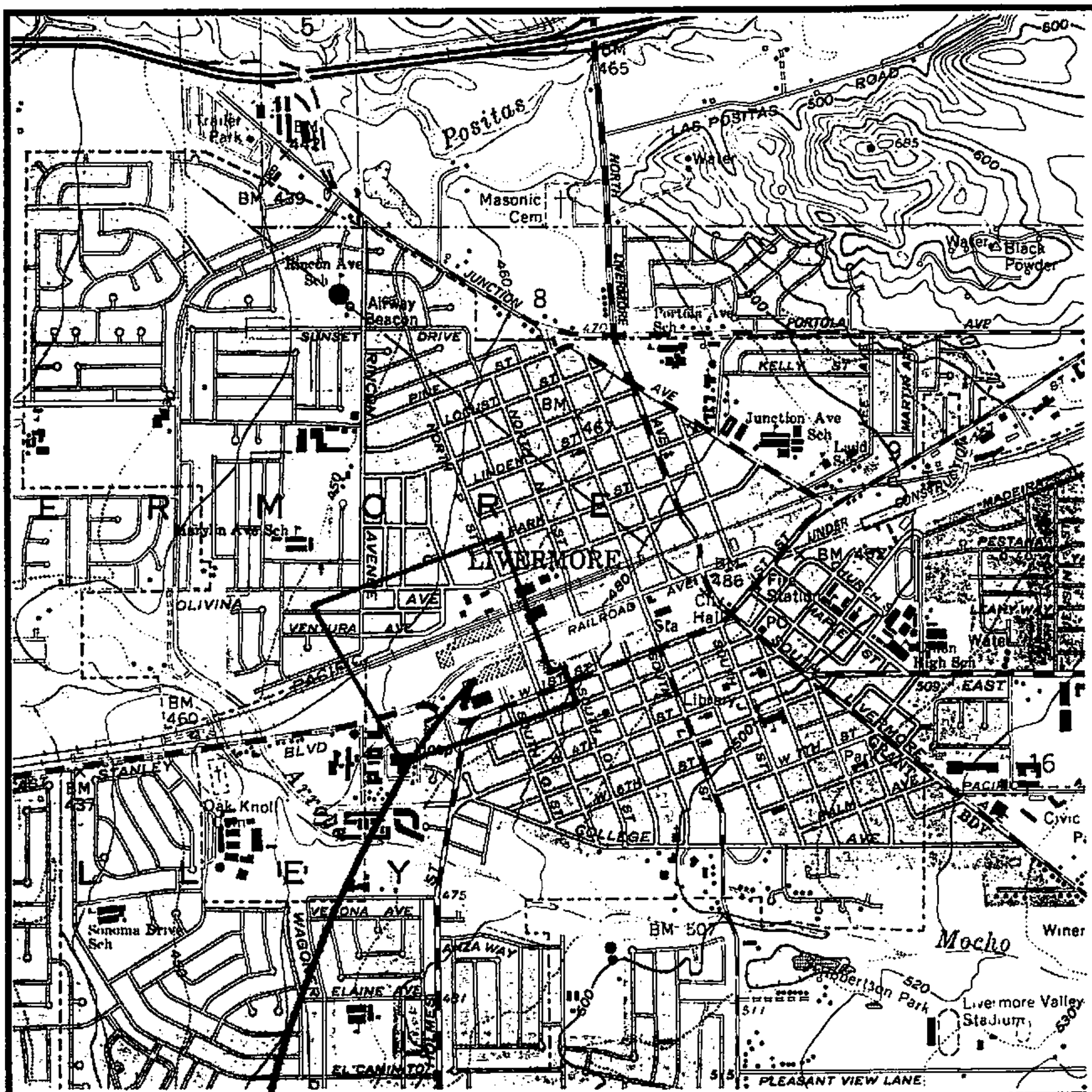
The highest concentrations of PCE in the soil and ground water beneath the Arcade site were found in a soil boring, Boring 1, which extends 59 feet into the subsurface immediately north of Mike's Cleaners. Through this and other evidence, H+GCL determined that chlorinated solvents have migrated through contaminated soils into the shallow ground water system. The plume extends about 950 feet northwest through the subsurface, beneath Miller's Outpost Shopping Center, under the Union Pacific Railroad tracks, and ending beneath a residential area.

Figure 1: Location Map



Source: California State Automobile Association, Bay and River Area, 1989

Figure 2: Site Map



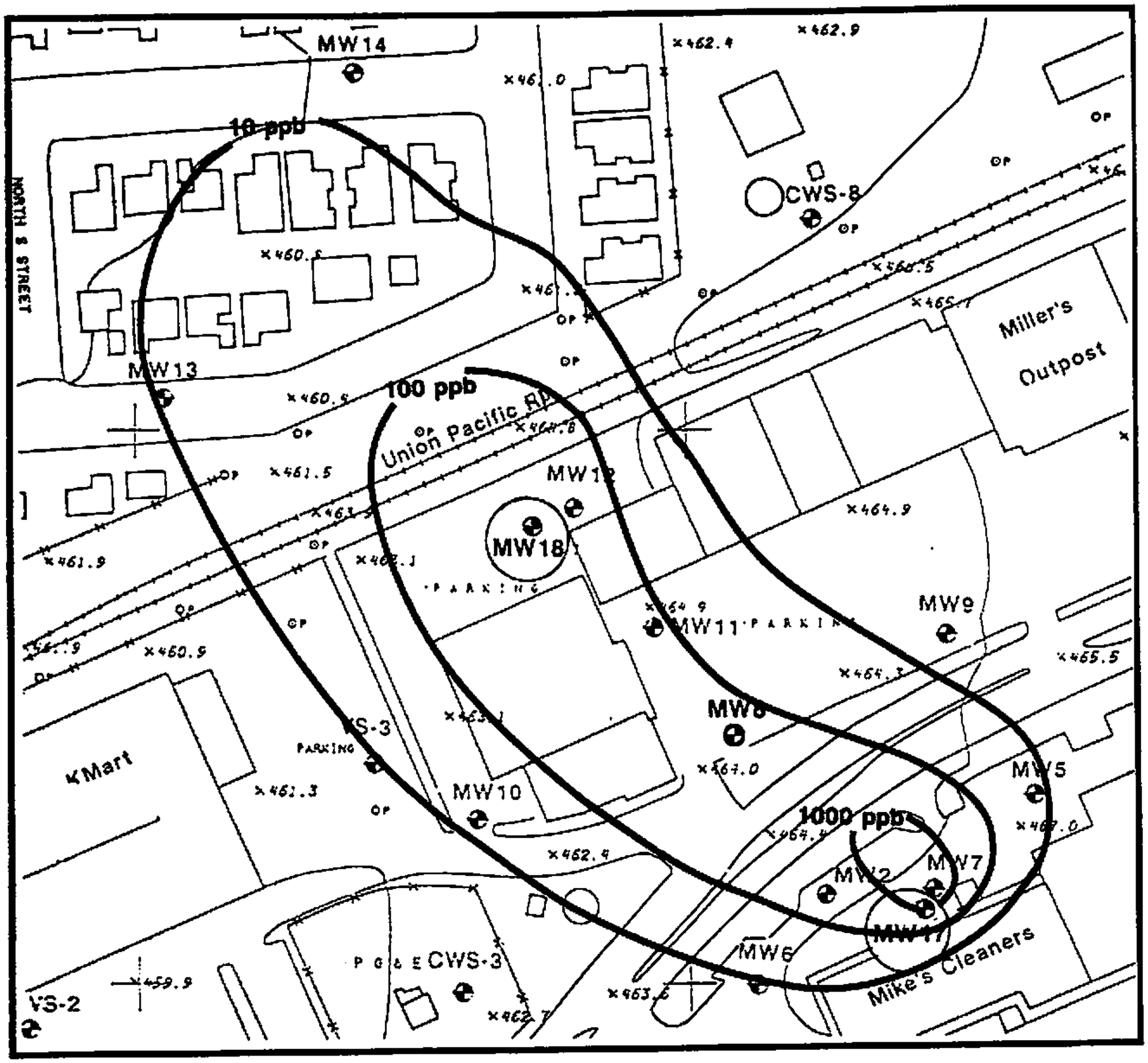
Area of Site Investigation

Scale: 0 24,000 feet 48,000 feet

N

Source: USGS Livermore Quadrangle, Alameda County, 1961, Photorevised 1980.

Figure 3: PCE Ground Water Plume



__Legend__

MW-10 H+GCL Monitoring Well

VS-1 Versar Monitoring Well

CWS-3 California Water Service Well

10 ppb PCE Concentration Contours 1990-1991 (parts per billion)

MW-17 Latest Monitoring Well

Scale: 0 100 feet 200 feet N

Two drinking water supply wells (CWS-3 and CWS-8) operated by California Water Service (CWS) are located beneath the west and north boundaries of the chlorinated solvent plume. Water sample analyses from these wells have not detected chlorinated solvents or gasoline components. The CWS supply wells are screened in deeper aquifers, which are separated from the impacted shallow aquifer by several low permeability clay-rich layers.

Migration of chlorinated solvents from contaminated soils into the shallow ground water system could eventually impact the water quality of the underlying aquifer and move into water supply wells. Elimination of the chlorinated solvents from the soil beneath and down-gradient from the Arcade site will remove any significant potential risk to human health and the environment.

2.3 Previous Investigations

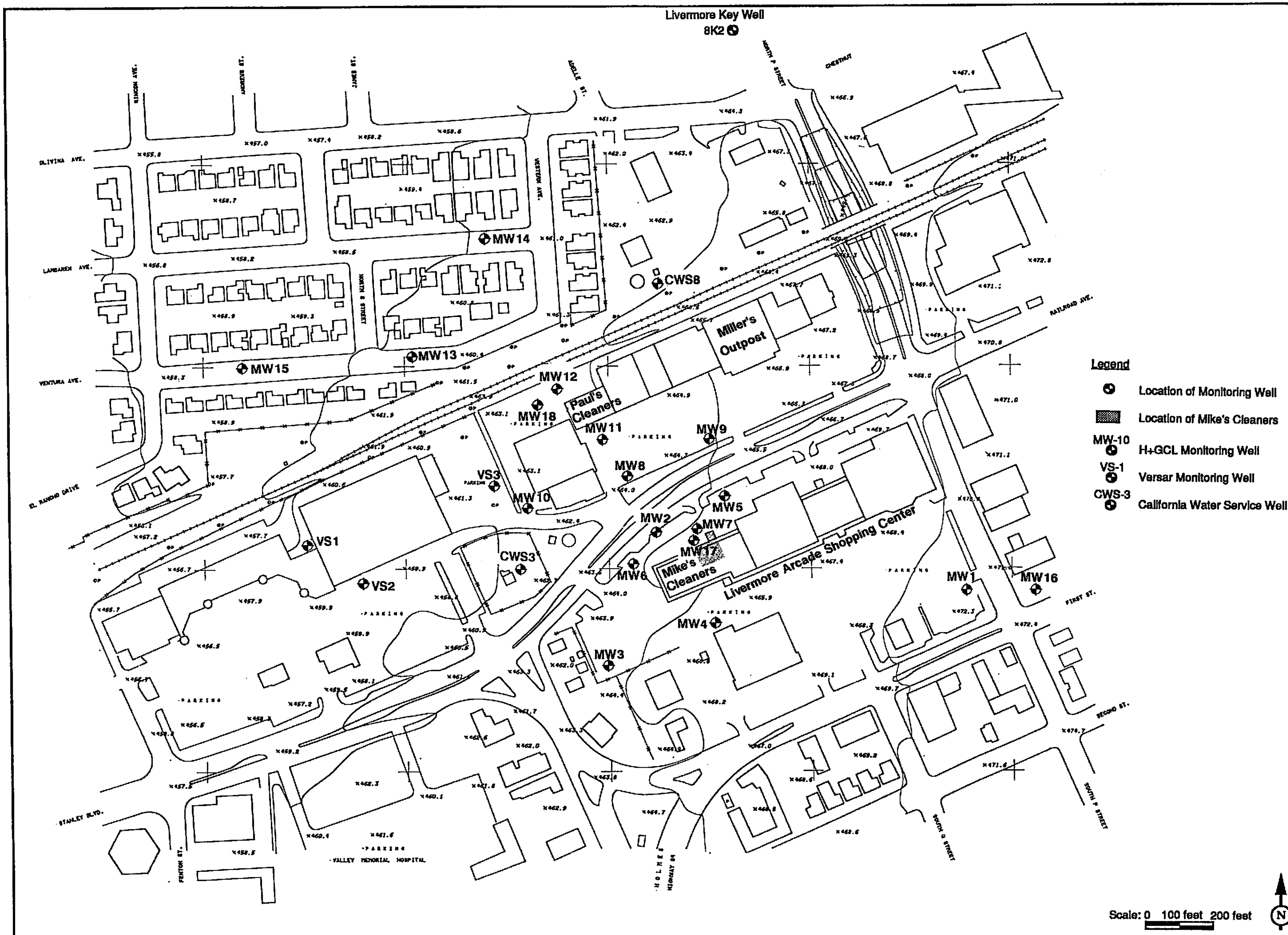
A pre-purchase Phase I Site Assessment for a potential buyer of the Livermore Arcade Shopping Center was conducted in February 1990 (Hygienetics, 1990). Pertinent findings from this report are as follows:

1) The Arcade site is located in a critical water table recharge area and is underlain by a series of drinking water aquifers.

2) Several neighboring properties were identified as potential off-site sources of contamination that could potentially impact the Livermore Arcade Shopping Center.

3) While examining the Arcade tenant spaces, the inspector observed a fill pipe for dry cleaning solvent positioned near a floor drain at Mike's Cleaners. This floor drain has since been sealed. H^+GCL recommended the installation of three ground water monitoring wells in order to sample and analyze the water quality beneath the site.

A Phase II Subsurface Investigation was conducted by H^+GCL in March, 1990. Three monitoring wells (MW-1, MW-2 , and MW-3) were installed at the Livermore Arcade Shopping Center (Plate 1). Ground water samples were collected and analyzed for purgeable priority pollutants and for total petroleum hydrocarbons (TPH). Significant concentrations of chlorinated solvents were detected in MW-2 located near Mike's Cleaners and a high concentration of gasoline components was detected in MW-1 located near the southeast corner of the Arcade property. No contamination was detected in MW-3 located in the southwest corner of the Arcade property. H^+GCL then recommended that the wells be re-sampled and that the subsurface investigation



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March 1992

Plate I

be continued for the purpose identifying the sources of the ground water contamination (Hygienetics, April 1990).

Re-sampling in April 1990 confirmed the levels of contamination previously identified in monitoring wells at the site. A land and ground water elevation survey was performed that confirmed the ground water flow was to the northwest. The investigation determined that the source of gasoline contamination is located off-site to the southeast of the Arcade property.

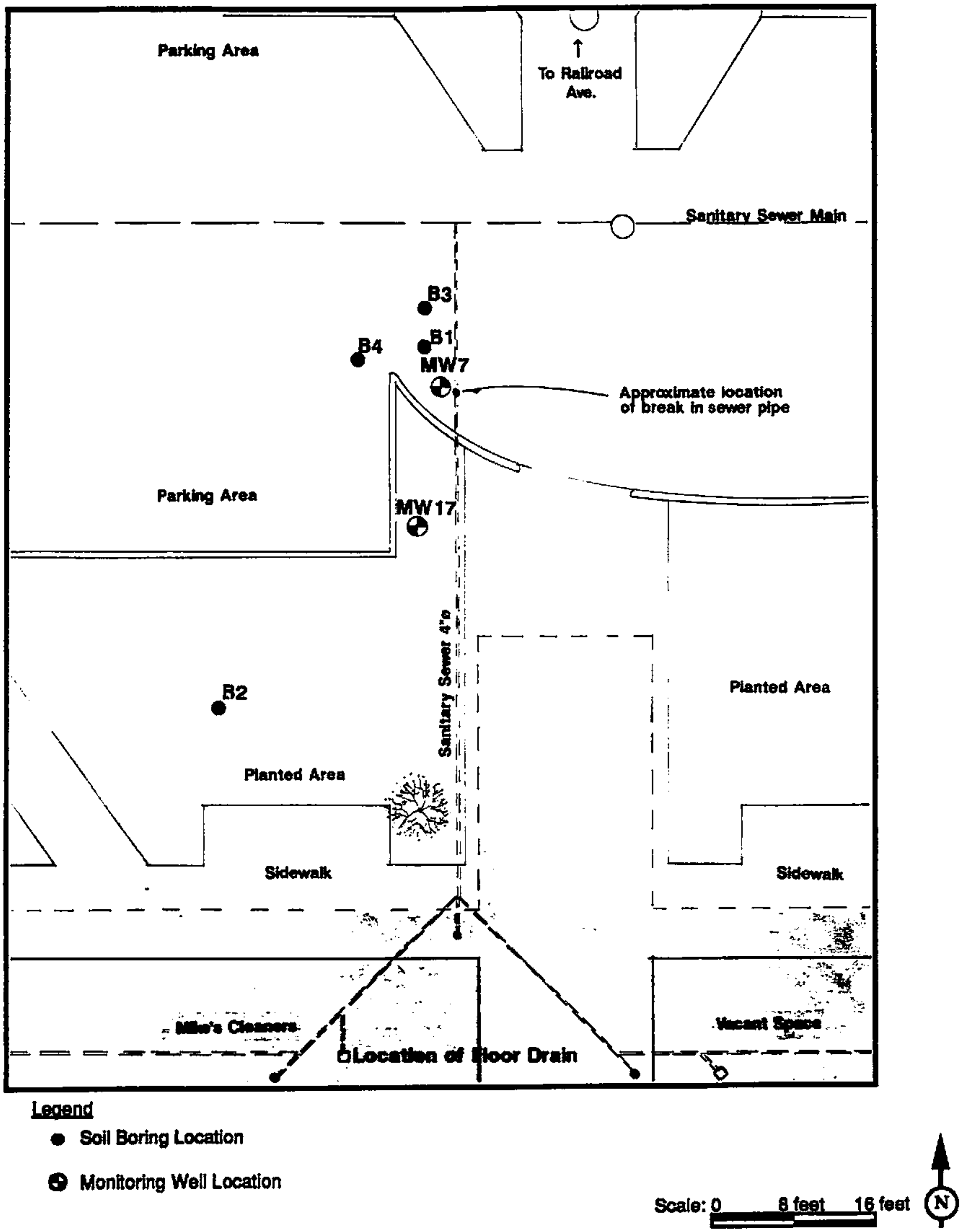
The investigation then focused on the potential on-site source of chlorinated solvent contamination. Mike's Cleaners at the Livermore Arcade Shopping Center was identified as the primary source of chlorinated solvent contamination. The floor drain in Mike's Cleaners leads to a broken four-inch diameter sewer line that is the source of the release of chlorinated solvents into the soil. A constant flow of water through the line dissolved the chlorinated solvents and carried them down through the soil. The dissolved-phase solvents entered the ground water and spread northwest in the direction of ground water movement. The concentrations of chlorinated solvents detected in the soil beneath the drain pipe at Mike's Cleaners suggest that the release was highly diluted or dissolved.

The sewer drain pipe at Mike's Cleaners was inspected by a licensed plumber who inserted a television camera into the pipe. This inspection determined that the pipe was damaged, allowing effluent to be discharged to the soil before it reached the sanitary sewer main. This procedure was repeated in 1992 and videotaped. Hygienetics April 13, 1990, report recommended that additional monitoring wells be installed to determine the lateral distribution of the chlorinated solvent contamination and to determine background levels up-gradient from of Mike's Cleaners. Soil samples were collected around the drain pipe in Mike's Cleaners (Figure 4).

H^+GCL continued the subsurface investigation for the property owner Grubb & Ellis and presented a report (Subsurface Investigation, Hygienetics, October 12, 1990) to the California RWQCB who have taken an active role in overseeing Grubb & Ellis' investigation activities.

During the 1990 investigations, H^+GCL installed a total of fifteen additional monitoring wells throughout the Arcade site and north of the site. Dissolved phase chlorinated solvent contamination was found in the shallow ground water (40 - 65 feet). No detectable levels of chlorinated solvents or gasoline components were found in drinking water supply wells CWS-3 and CWS-8. These wells are screened in the deeper aquifers (120 - 400 feet) below the depth of

Figure 4: Pipe Alignment



the chlorinated solvent or gasoline component plumes. H^+GCL found clay rich layers approximately 75 feet below the ground surface during investigations and confirmed their presence with historical CWS well boring logs. These layers generally protect the lower aquifers from contamination in the upper aquifer. In the final Phase III report (Hygienetics, October 13, 1991), H^+GCL defined the extent of the chlorinated solvent ground water plume.

H^+GCL defined the chlorinated solvent ground water plume to the satisfaction of the RWQCB and the Alameda County. H^+GCL reviewed the most appropriate, proven and effective remedial action alternatives based on the results of the site investigation. After developing a model from pump test data collected in October 1990 at the Arcade site, a ground water extraction system with liquid phase carbon adsorption drums was discussed with the RWQCB and Alameda County as a plan to control and reduce the concentrations of chlorinated solvents in the shallow ground water. A preliminary remedial action plan was approved by both agencies in December 1990. The RWQCB specifically indicated that a PCE ground water cleanup level to a 5 parts per billion would be required. A quarterly ground water monitoring plan was implemented in March 1991.

Preliminary design of a ground water extraction system was completed and quarterly monitoring continued through 1991. In the quarterly ground water monitoring throughout 1991, H^+GCL detected very little change in the chlorinated solvent concentrations but discovered a significant decrease in the ground water table in the last quarter of 1991. The November 1991 quarterly monitoring of the ground water elevation at the Arcade site showed that the ground water had fallen below 65 feet (the depth of the deepest ground water monitoring well, MW-7), The ground water elevation had previously been measured at depths between 40 and 44 feet.

As a result of the change in ground water conditions, Grubb & Ellis again met with the RWQCB. The RWQCB requested that Grubb & Ellis perform additional testing to characterize the recent change in the subsurface conditions and to evaluate a vapor extraction system as a primary remedial option. With the decline of the ground water table, the vapor extraction system technology became a very sound clean-up alternative. A work plan was prepared (H^+GCL, 1992) and this remedial investigation was performed to support a feasibility study for the Arcade site.

Due to the current owner's initiative in addressing the site contamination, regulatory agencies have not issued any investigation or cleanup orders. The site has not been listed on either Federal or State priority lists for cleanup.

3.0 METHODS OF INVESTIGATION

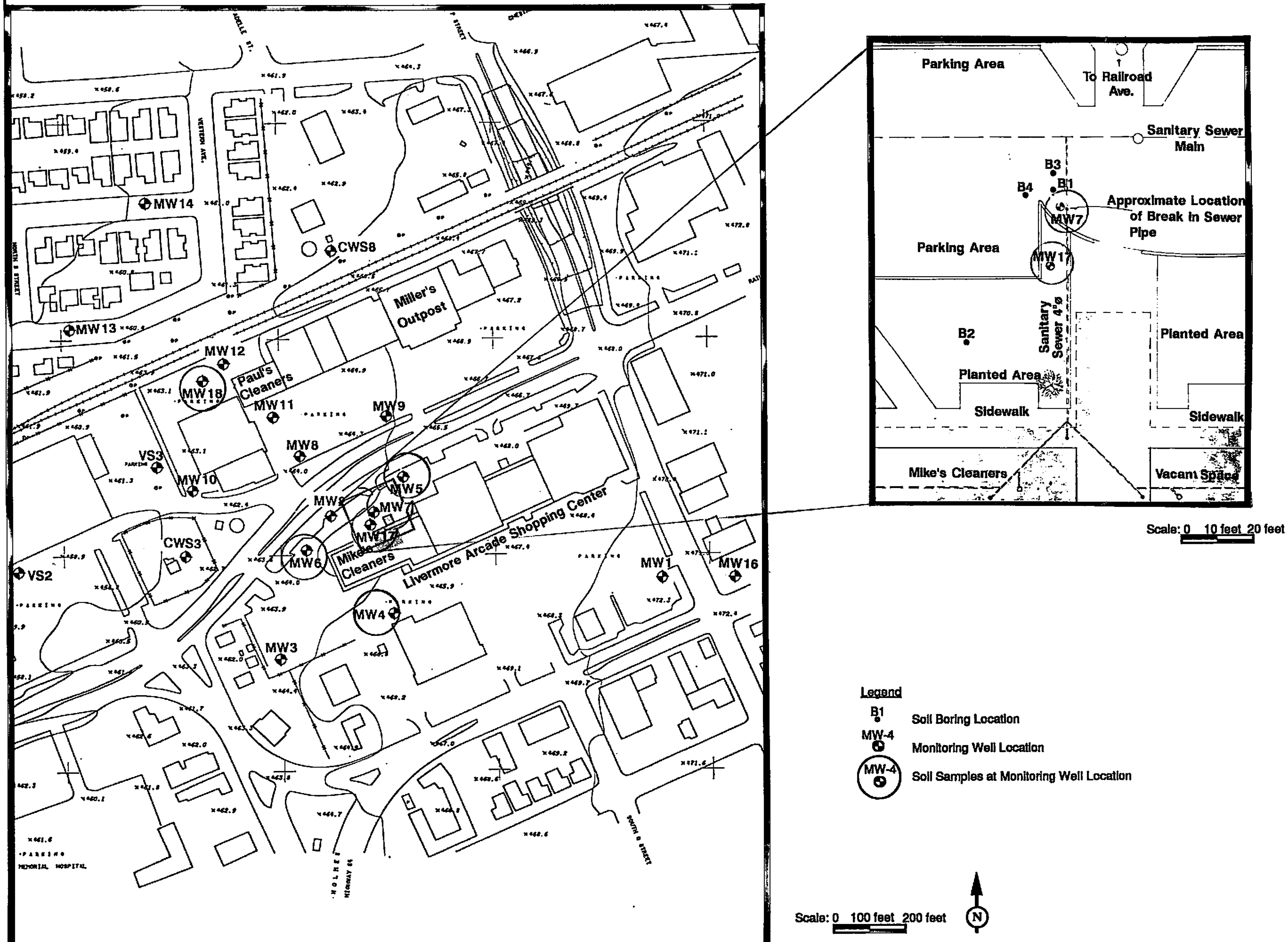
The results of previous H^+GCL activities at the Arcade site are presented and discussed within this remedial investigation report. This section does not repeat methodology that has been published in earlier H^+GCL documents. Soil and ground water monitoring, and a soil vapor survey were conducted to characterize the subsurface conditions at the site. Eighteen ground water monitor wells were installed at the Arcade site and sampled periodically. Thirty-four soil samples were collected throughout the Arcade site and analyzed at a certified laboratory. Soil vapor samples were collected from ten of the monitoring wells at the Arcade site and analyzed using a portable gas chromatograph. The recent information was collected to characterize the subsurface distribution of contaminants due to the changing ground water conditions at the Arcade site.

All field and laboratory work for this remedial investigation was performed according to methods described in the site specific Quality Assurance/Quality Control document and the Sampling and Analysis Plan (SAP). All field personnel involved with the subsurface investigation tasks followed procedures presented in the Health and Safety Plan specifically designed for the Arcade site. One copy of the Health and Safety Plan is kept on-site at all times during field investigations. All of these documents were presented as appendices to the Arcade Work Plan, dated January 1992

3.1 Soil Borings and Soil Sampling

In 1990, four soil borings were placed in the area of the broken sewer line at Mike's Cleaners and other soil samples were collected prior to the installation of various monitoring wells located throughout the Arcade site (Plate 2). In January 1992, two soil borings were drilled; one at Mike's Cleaners near MW-7, and one down-gradient near MW-12 at Paul's Cleaners. The specific methodology presented here is for borings at monitor wells MW-17 and MW-18. A total of thirty-four soil samples have now been collected and analyzed at the Arcade site. The depths of the samples ranged from 4 to 81 feet below the ground surface.

Monitoring Well-17 is located near the source of the chlorinated solvent release at Mike's Cleaners (Figure 5). This is the location of the highest levels of chlorinated solvent contamination previously detected in the soil and ground water beneath the site. Current soil sampling results from the boring at MW-17 present the vertical distribution of the highest chlorinated solvent contaminated area beneath the site.



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Soil Sample Locations

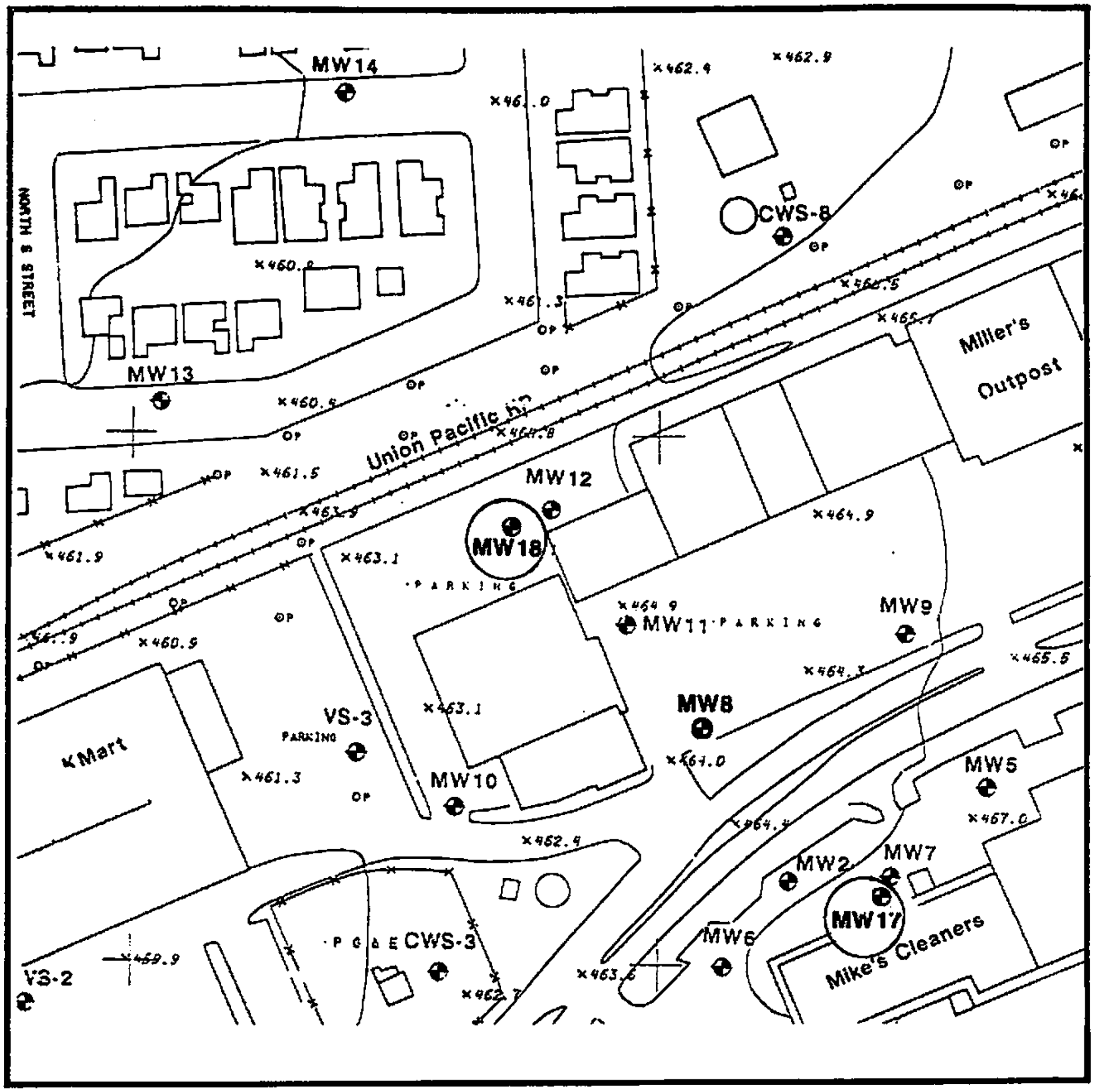
DATE April 1992

Plate 2

SHEET OF

16833

Figure 5: Well Locations of MW-17 and MW-18



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MW-10 H+GCL Monitoring Well

VS-1 Versar Monitoring Well

CWS-3 California Water Service Well

MW-17 Latest Monitoring Well

Scale: 0 100 feet 200 feet

N

Monitoring Well-18 is located on the north side of Paul's Cleaners located in the Miller's Outpost Shopping Center. The levels of chlorinated solvent contamination detected in the ground water at MW-18 represent the down-gradient portion of the chlorinated solvent plume. Soil sampling results present the vertical distribution of chlorinated solvent concentrations in the soil at that location.

Prior to drilling, an underground utility search was conducted to ensure that the borehole sites were not located over obstructions. Bore-hole drilling was conducted using either an eight-inch or ten-inch diameter hollow-stem auger powered by a mobile drilling rig such as a B-61 or a CME 75.

In MW-17 and MW-18, the H+GCL on-site geologist collected samples from each boring at five foot intervals or where changes in lithology were encountered to a depth of approximately 30 to 40-feet below ground surface (bgs). The samples were collected using a 2-inch or a 2.5-inch diameter, modified California split-spoon sampler, which was lowered through the auger bit. The sampler was driven a minimum of 12-inches into the soil beyond the cutting head by dropping a 140-pound hammer from a height of 30 inches. Partially disturbed soil samples were collected using the split spoon sampler, visually inspected, and classified on boring logs by the on-site geologist (Appendix 1). Other field notes were recorded in a bound field notebook.

Continuous coring began at 40-feet bgs in the boring of monitor well MW-17 and at 30-feet bgs in the boring of monitor well MW-18. Continuous borings had been previously collected in the boring at MW-7 (from ground surface to 70-feet bgs). The on-site geologist recorded the recovery (length), lithology, color (including staining), odor, moisture, condition, etc., of the recovered soil in the logbook. Continuous coring procedures were followed as described in H+GCL Standard Operating Procedures (SOP) document which has been provided as an appendix in the Livermore Arcade Work Plan, January 1992.

The associated equipment was steam cleaned between each boring to minimize the potential for cross contamination. All samples were collected in appropriate containers as specified by the SAP and were immediately placed on ice. The soil samples collected from the borings were delivered to a certified laboratory under chain-of-custody protocol.

Soil samples were analyzed for aromatic and halogenated hydrocarbons using approved EPA Methods 8240 and 8010, as referenced in EPA Publication SW-846. In addition, one soil sample from MW-17 and MW-18 was analyzed for California Title 26 Metals, for semi-volatile organics (including pesticides) by EPA Method 8270, and for polychlorinated biphenyls (PCBs) by EPA Method 8080.

An HNu photoionization detector with a 10.2 electron-volt ionization source lamp was used to field screen soil samples at the down-gradient boring location MW-18, and to help select the samples to be sent to the laboratory for analysis. The ionization potential for PCE is less than 10.2 electron volts ensuring that it can be detected with this source lamp. The HNu was also used to monitor the breathing zone during all on-site field activities.

3.2 Monitor Well Installation and Ground Water Sampling

During 1990-1991, sixteen ground water monitoring wells were installed throughout the Arcade site. In January 1992, two additional ground water monitoring wells, MW-17 and MW-18, were installed at the site in January 1992. All of the monitoring wells at the site were constructed of either 2-inch or 4-inch inner diameter, flush jointed, schedule 40 polyvinyl chloride (PVC) risers attached to factory perforated, 0.010-inch or 0.020-inch slotted PVC well screen sections (Appendix 1). Monitoring wells, MW-17 and MW-18, were constructed with 4-inch inner diameter, flush jointed, schedule 40 polyvinyl chloride (PVC) risers attached to factory perforated, 0.010-inch slotted PVC well screen sections. The base of each well was fitted with a threaded PVC plug. The annuli between the screen and the auger hole was packed with Lonestar or Monterey sand to a depth of approximately 2 feet above the screen. A two-foot thick bentonite chip seal was then placed above the filter pack. The remaining annular spaces around the riser sections were grouted to near grade using Portland cement mixed with 5% bentonite powder.

A cast iron Christie box with a galvanized steel apron was set in concrete over each monitoring well and finished flush with the surrounding asphalt pavement. The top of each well casing was fitted with a water-tight cap. Construction diagrams for monitoring wells are presented in Appendix 1.

On January 27, 1992, H$^+$GCL developed MW-17 using a surge and bail method. Well water was bailed using a 20-foot long bailer to remove clay and silt that had settled in the bottom of the well. Then a surge plug was attached to a steel rod and lowered into the well casing. The screened section of the well was swabbed to surge water through the screen. This process removed fine soil from the well screen, the filter pack, and the formation immediately surrounding the borehole. All equipment used for well development was steam cleaned prior to use in each well. No water was present at MW-18 until several weeks after completion due to the seasonally depressed water table.

Prior to sampling the wells, water was purged from each well utilizing a pre-cleaned disposable bailer. All samples were collected in appropriate containers as specified by the SAP and were immediately placed on ice. Ground water samples were collected from each monitoring well and were delivered to a certified laboratory under chain-of-custody protocol.

Ground water samples were analyzed for aromatic and halogenated hydrocarbons using approved EPA Methods 624, 8020 and 8010 as referenced in EPA Publication SW-846. In addition, ground water samples from MW-17 and MW-18 were analyzed for Title 26 Metals and for semi-volatiles compounds (including pesticides) by EPA Method 8270. EPA Method 8080 was also conducted for PCBs.

H^+GCL also monitored deeper aquifer zones by periodically sampling the CWS water supply wells. The analyses were performed using EPA Method 524.2 for purgeable organics. This method was used for compliance with the Safe Drinking Water Act and provided a lower detection limit than other comparable analyses.

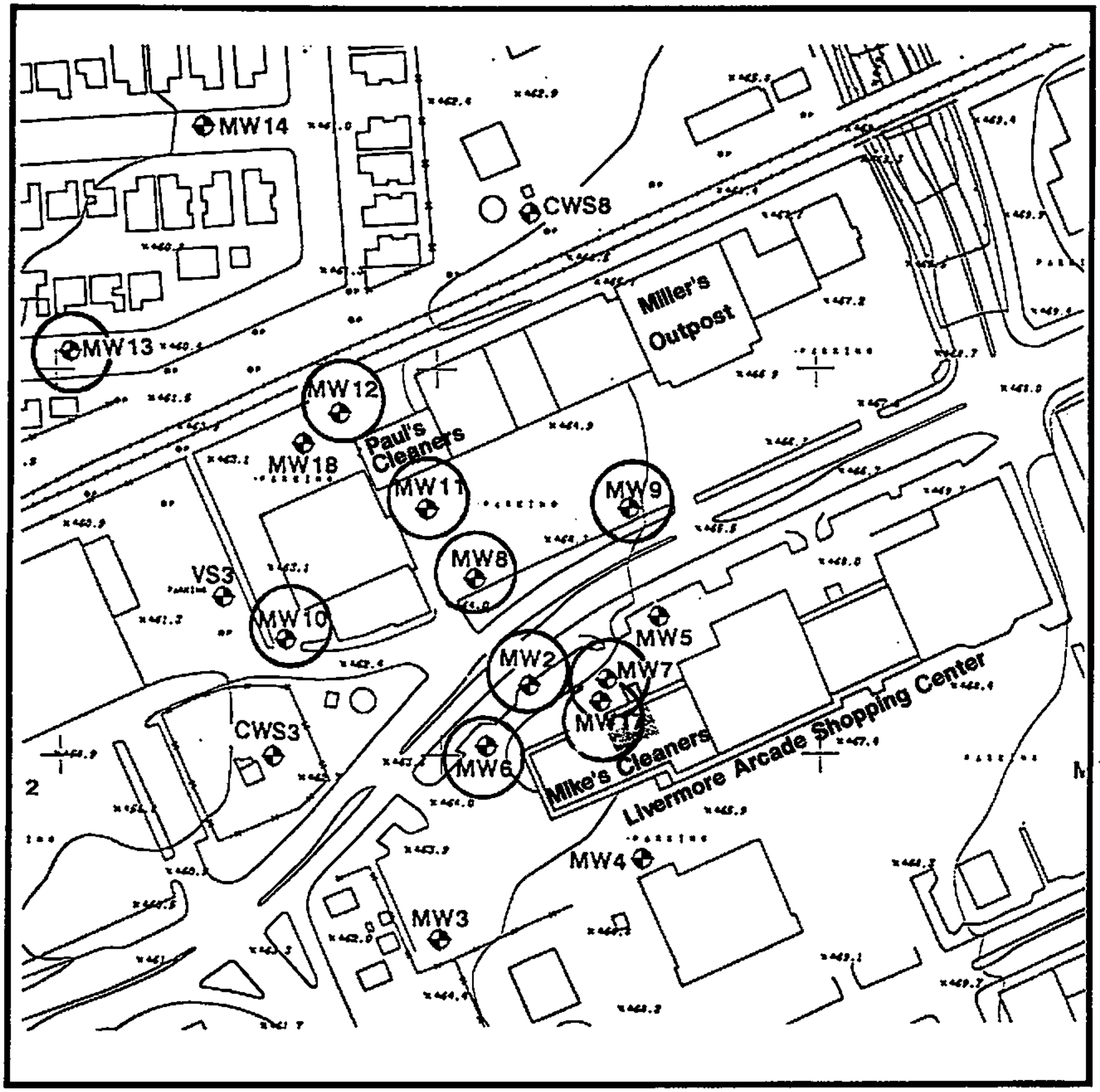
3.3 Land Surveying

All of the monitoring wells at the Arcade site were surveyed by H^+GCL staff to determine relative ground water elevations. An aerial survey was also conducted for the preparation of a site plan. In March 1992, a licensed surveyor surveyed the surface elevations of the 18 monitoring wells at the site with a measurement accuracy of 0.001 foot. The elevations were tied to a mean sea level (MSL) bench mark. The elevations were measured from the top of the casing of each well.

3.4 Soil Vapor in Monitoring Wells

A soil vapor survey is commonly used as a rapid and cost-effective method for approximating the aerial extent of a known volatile organic compound (VOC). The PCE contamination at the Arcade site was distributed at a depth which would limit the effectiveness of the common shallow soil gas survey. Vapor samples were collected for analysis from various monitor wells. The detected VOC concentration in each sample is considered to be representative of the soil

Figure 6: Vapor Sample Locations



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MW-10 H+GCL Monitoring Well

VS-1 Versar Monitoring Well

CWS-3 California Water Service Well

MW-10 Monitoring Well Vapor Sample Location

Scale: 0 100 feet 200 feet

N

vapor present in the soil around the screened interval of the well. QA/QC procedures were followed throughout the survey.

Vapor samples were collected from ten monitoring wells at the Arcade site (Figure 6). Prior to collecting a vapor sample, a total of two well volumes were evacuated from each well using a gas tight well cap modified for use with a portable air pump. The volume of air comprising a well volume was calculated for each well and then evacuated. Air flow was measured using a bubble gauge attached to the outflow of the pump. Air samples for chromatographic analysis were collected prior to the air entering the pump.

A portable gas chromatograph (a Photovac 10S70) was calibrated at the site prior to sampling vapors at the various monitoring well locations. Calibration was performed for the analytes benzene, toluene, ethylbenzene, total xylene isomers, trichloroethane, trichloroethene, and tetrachloroethene. These analytes were calibrated using commercially prepared standard gases. In addition, instrument performance was checked several times during the day by analyzing standard gases of known composition. The calibration and performance analyses indicated acceptable instrument performance throughout the day's activities (Appendix 3).

3.5 Test Pumping

Aquifer pumping tests were conducted at the Arcade Site on October 16, and 17, 1990, and again on March 23, and 24, 1992. For both tests, a submersible pump was used to help sustain a constant flow rate and drawdown in the target well. Aquifer hydrologic parameters were evaluated using the Theis, Cooper-Jacob, and Neuman (1975) unconfined aquifer analysis options and the Theis recovery analysis in the AQTESOLV™ aquifer test analysis program (1989, Version 1.00) as shown on figures in Appendix 5.

For the October 1990 test, monitoring well MW-12 was chosen as the pumping well based on its location within the chlorinated solvent plume defined at the Arcade site. This well is a 60.5-foot deep well screened between 25 and 60 feet below grade. The 0.020-inch slotted PVC screen is completed within a gravel unit with varying amounts of silty sands and clays.

Monitoring wells MW-8, MW-11, MW-13, and MW-14 were used as observation wells during the pump test to determine if a hydraulic response could be observed. Ground water elevation in all monitoring wells and in the pumping well were measured by hand using water level indicators. The pumping test was initiated at 6:30 a.m. on October 16, 1990, at an approximate discharge rate of 1 gallon per minute.

Over the next 13.5 hours the pumping rate remained fairly constant at an average discharge rate of approximately 0.7 gallons per minute.

Aquifer hydrogeologic parameters were evaluated using the Neuman (1975) unconfined aquifer analysis option in the AQTESOLV™ aquifer test analysis program (Geraghty & Miller, 1989, Version 1.00). The first analysis was performed using data only from the initial 8-hour period of the test, up to the time at which maximum drawdown (8.85 feet) was achieved. The second analysis included data from that initial 8 hours and continued through the first 13.5 hours of test operations, when a break in the pumping occurred due to mechanical pump problems.

A second aquifer pump test was conducted at the Arcade site on March 23 and 24, 1992. Monitoring well MW-17 was used as the pumping well. Monitoring well MW-7, at a radial distance of 14.5 feet from MW-17, was used as an observation well. Ground water elevations in both the pumping and observation wells were measured by hand using water level indicators.

The pumping test was initiated at 12:05 p.m. on March 23, 1992, at an approximate discharge rate of 0.8 gpm. The average discharge rate for the 12-hour test was 0.632 gpm. The pump was shut off at 11:52 p.m. on March 23, 1992. Recovery measurements were obtained for both the pumping and the observation well for a period of 128 minutes following cessation of pumping.

H+GCL calculated transmissivity and storage coefficient values from observation well analyses. These values are typically more reliable than those estimated from the pumping well, which is subject to fluctuations and disturbances caused by the pumping action.

3.6 Risk Assessment

Environmental Risk Sciences, Inc. conducted the baseline health risk assessment (HRA) in March 1992. The entire original assessment for the Livermore Arcade is included in Appendix 4. The following is a summary of the methods of investigation employed by ERS.

The chemicals evaluated for this HRA include volatile organic compounds (VOCs) and acid/base neutral organic chemicals.

Solvents

- Trichloroethene (C)
- cis-1,2-Dichloroethene (NC)
- Methylene chloride (C/NC)
- Tetrachloroethene (N/NC)
- 1,1,1-Trichloroethane (NC)

Disinfection Products

- Bromodichloromethane (C/NC)
- Bromoform (C/NC)
- Chloroform (C/NC)
- Dibromochloromethane (C/NC)

Gasoline Components

- Benzene (C)
- Ethylbenzene (NC)
- Toluene (NC)
- Total Xylene Isomers (NC)

Miscellaneous

- bis (2-Ethylhexyl) Phthalate (C/NC)
- Freon 12 (NC)
- Phenol (NC)

Additionally, soil and ground water were analyzed for total hydrocarbons and Title 26 metals. The estimation of human health risk follows a health conservative methodology recommended by the U.S. EPA and the California EPA Department of Toxic Substances Control (DTSC). The baseline HRA uses conservative exposure assumptions, and therefore tends to overestimate the actual health risks posed by the organic compounds at the Livermore Arcade Shopping Center.

As recommended in U.S. EPA guidance, the baseline HRA considers both present and future case land use scenarios. In keeping with a health conservative approach, the HRA assumes the following future land use scenario: an individual residing at the property who is an adult for the full duration of exposure (30 years), and an individual who is a child for six years of the exposure period (from ages 1 through 6) and an adult for the remaining exposure duration (ages 7 through 30). These potential receptors are respectively called the future on-site adult resident. The future on-site adult and child/adult residents are conservatively assumed to come in contact with the organic compounds in soil, soil gas and ground water 24 hours/day, 365 days/year for 30 years.

The future on-site residents are assumed to be exposed to the detected organic compounds via soil ingestion, dermal absorption of soil, and the inhalation of soil gas. Additionally, it is conservatively assumed that ground water wells used for drinking water purposes may be constructed on the site. Future on-site residents may then be exposed to ground water via ingestion, dermal absorption, or inhalation of the organic compounds volatilizing during residential water usage. Two of the monitoring wells (MW-13 and MW-14) sampled by H+GCL are located off-site in a residential area to the north of the Livermore Arcade Shopping Center property. These wells are included as sources of drinking water supplies in the HRA.

This analysis assumes that ground water at the Livermore Arcade Shopping Center property is confined to two aquifers. The shallow aquifer is presently encountered approximately 60 feet below grade. This aquifer has a thickness ranging from approximately 13 to 32 feet based on ground water measurement tests conducted in the last two years. Beneath the shallow aquifer is a series of clay and clayey sand layers that extend for approximately 40 feet. These layers serve as an aquitard. The second aquifer at the site, called the deep aquifer in this analysis, is encountered at approximately 120 feet below grade, and is assumed to have a thickness ranging from 35 to 40 feet.

Analysis of exposure and risk from ground water are conducted under two different conditions. The first estimates the chemical exposures and subsequent health risks directly from the chemical concentrations detected in ground water samples collected by H+GCL from the monitoring wells. Exposures and risks are calculated separately for each ground water well, rather than combining data across all wells.

The second condition involves a containment fate and transport model that allows the chemicals detected in soils to migrate downward through the unsaturated zone until they reach the shallow aquifer. It is additionally assumed that the organic compounds that reach the shallow aquifer are also able to impact the deep aquifer existing beneath the site.

Estimation of health risk begins with the determination of representative concentrations (RCs) and exposure point concentrations (EPCs) for each chemical in each environmental medium. These are calculated in accordance with health conservative methodology recommended by the U.S. EPA and the DTSC. RCs and EPCs for soil and ground water are estimated directly from the chemical concentrations detected in the site characterization studies. A second set of EPCs for ground water are estimated via the contaminant fate and transport model described in the previous paragraph. EPCs for the soil gas inhalation pathway are derived using a conservative chemical transport model that estimates the soil gas concentrations in ambient air where they may be inhaled by the future on-site residents.

The HRA uses the health criteria published by the U.S. EPA in either the Integrated Risk Information System (IRIS), or the Health Effects Assessment Summary Tables (HEAST). Health criteria are quantitative estimates reflecting the inherent toxicity of a chemical in terms of its ability to induce carcinogenic and/or non-carcinogenic adverse health effects. The health criteria provided in IRIS and HEAST are either U.S. EPA-approved, or interim criteria currently undergoing U.S. EPA review. In the final step of the HRA, the health criteria are mathematically combined with the exposure estimates (CDIs) to calculate estimates of health risk.

4.0 RESULTS OF THE INVESTIGATION

4.1 Site History

4.1.1 Early History and Land Use

In the early 1800s the Spanish established a large cattle industry that reached its peak in the 1850s when about 50,000 cattle were in the area. The first settlement, called Amador, was established in the early 1850s, and the 1860 census reported that 513 people lived in the valley. In the late 1850s and early 1860s, agriculture became the predominant industry in the valley. The most common crops in the early years were wheat, barley, and hay. In the 1880s, irrigated agriculture became established. Agriculture continues to be the predominant industry in the valley, but has declined in recent years because of the loss of farmland to urbanization and gravel-mining operations (DWR Bulletin 118.2).

The population in Livermore rapidly increased as Lawrence Livermore Laboratories began operations east of Livermore in the early 1950s. The rapid growth of the San Francisco Bay Area has greatly influenced the population increase in Livermore from 1970 to 1990. The population in Livermore has increased by 85% from 1980 to 1990. The area is devoted to agriculture and industry, while the contiguous uplands are principally rangeland.

The Southern Pacific Railroad once operated along what is now Railroad Avenue, immediately north of the Arcade site and currently is located immediately north of the Miller's Outpost Shopping Center. Sanborn Fire Insurance maps show the site in 1907, 1917, and 1944. The 1907 map shows the existence of warehouses (hay and grain) along the Southern Pacific Railroad tracks and on the eastern portion of the site. The 1917 maps shows two buildings at the site. One was J. Winneger's Grain Warehouse and the other was J. Winneger's Hay Warehouse. On the northeast corner of the intersection of North P Street and Railroad Avenue (adjacent to the Arcade site) there was an oil pump station. The 1944 map shows J. Winneger's Warehouses on the site as they were in the past. The map also shows the oil pump station with a magnisite coal bunker next to it, both apparently associated with railroad activities (Hygienetics, 1990).

A 1958 aerial photograph provided by Alameda County Flood Control District, Zone 7 Flood Control (hereinafter referred to as Zone 7) shows the site with the original warehouses and some other unidentified buildings. The railroad was still in place where Railroad Avenue currently exists.

Livermore Historian Barbara Bunshah of the Livermore Heritage Guild stated that in the 1960s there was a grocery store located at the Livermore Arcade Shopping Center where Orchard Supply is presently. The Livermore Arcade Shopping Center was first developed in 1972. The portion of the Arcade presently containing Mike's Cleaners was originally a pet shop. City of Livermore Building Department records indicate that significant alterations, including plumbing work, occurred in late 1981 and early 1982, when Mike's Cleaners was established by Perry J. Neely and Michael Neely.

The property covers approximately 11.5 acres, including large asphalt parking areas. It is currently improved with five single story buildings containing 15 businesses, including Safeway, Sears Roebuck, Orchard Supply, Long's Drugs, as well as a number of smaller businesses, including Mike's Cleaners. The center also has a parking area for 558 cars. The topography is relatively flat with runoff moving to the north and west. Ornamental vegetation on the property consists of grass, bushes, and small trees. Most of the site is covered either with paved parking surfaces or buildings.

In 1979, Southern Pacific Land Company (now known as Catellus) purchased the Livermore Arcade Shopping Center and later sold it to Stark Investment Company in 1983. Grubb and Ellis, representing the current title holder, bought the property in December 1988.

Commercial businesses border the Livermore Arcade Shopping Center to the south on First Street and north across Railroad Avenue at Miller's Outpost Shopping Center. A residential area exists north of the Miller's Outpost Shopping Center. The Valley Memorial Hospital is one block west and the Mills Spring Park Apartment Complex is east of the site across North P Street.

4.1.2 History of Waste Management Practices

Mr. Steve Song, the second and current operator of Mike's Cleaner is listed with the Bay Area Air Quality Management District under Permit # 4725. The dry cleaning unit is a Multi Matic, 35 lbs. dry to dry, vented with no abatement device. Mr. Song reportedly bought the dry cleaning equipment with the purchase of the business from the Neelys, the original operators. Mr. Song maintains copies of hazardous waste manifests documenting proper transportation and disposal of his dry cleaning solvents since he began operations in 1987. These manifests were examined by H^{+}GCL. It was calculated that an average of 55 gallons per year of chlorinated solvent waste has been taken off-site and disposed of by a licensed hazardous waste transporter since Mr. Song took over operation of the dry cleaner.

As reported in the previous reports (Hygienetics, October 12, 1991), an investigation found that the original owner discharged PCE laden solvent waste to the sewer during their five year tenure (1982 - 1986). Based upon Mr. Song's present chlorinated solvent usage and assuming a uniform level of chlorinated solvent usage by the previous operator, it is estimated that as much as 250 gallons of waste chlorinated solvent may have been disposed of down the sewer drain during the years of 1982 through 1986.

Based on the chlorinated solvent concentration distribution in the ground water at the Arcade site, the amount of chlorinated solvent in the ground water has been estimated to be 2.5 to 5 gallons. Previous investigations have reported that a broken sewer pipe was the apparent pathway for discharged chlorinated solvents to leak into the soil. The measured chlorinated solvent levels in the soil and ground water indicates that only one percent to two percent of the discharged chlorinated solvent would need to have leaked through the broken pipe in order to produce the measured soil and ground water plume.

The California Hazardous Waste Control Law (CHWCL) was established in 1972 to provide comprehensive regulation of hazardous wastes. The California Department of Health Services developed CHWCL regulations for identifying hazardous waste based upon: toxicity, bioaccumulation, ignitability, reactivity, corrosivity or a specially designated hazardous waste. California Administrative Code Title 22 §66680 designates perchloroethene (also tetrachloroethene or PCE) as a hazardous waste or material based upon its toxicity. The transport and disposal of chlorinated solvents is closely regulated by the CHWCL. The unauthorized disposal of chlorinated solvents to a sewer line is a violation of this regulation.

4.2 Meteorology

Meteorology affects the subsurface conditions at the Arcade site. Ground water elevations beneath the site vary as a result of the precipitation in the area. A five year drought in northern California reduced the amount of available surface water which had a two fold effect. The Zone 7 artificial recharge program was discontinued and limited availability of surface water forced California Water Service to drastically increase ground water well pumping rates. The combined effect was a significant reduction in the surface ground water table elevation at the site. Following these events, in the first few months of 1992, heavy rains in northern California, including the Livermore area, provided significant ground water recharge causing the ground water table to rise over ten feet in the shallow aquifer beneath the site. A description of the local and regional meteorology provides a background perspective of the conditions observed at the site (Roy F. Weston, 1992).

4.2.1 Temperature

The mean annual temperatures for the 30-year period from 1951 through 1980 was 14.5° C (58.1° F) with daily extremes ranging from - 8° (18° F) to 45° C (113° F).

4.2.2 Winds

The bowl-shaped Livermore Valley measures approximately 14 miles in length and 3 to 5 miles in width. The surrounding hills range from 984 to 1968 feet above the valley floor. The site and the City of Livermore lie within the southeast portion of the valley floor.

As airflow moves east through the Dublin Gap, it diverges until it encounters Mt. Diablo and the Altamont Hills to the north. These obstructions turn the flow towards the southeast. South of the Dublin Gap, the influence of the foothills of the Diablo Mountain Range and the surrounding Altamont Hills then diverts the airflow towards the northeast. Airflow exits the valley through Altamont Pass. Large-scale upper-air influences either weaken or enhance this surface flow pattern (Roy F. Weston, 1992).

During the summer months, winds are predominantly from the south or southwest as a result of the sea breeze. The sea breeze is created when air over land is heated by solar radiation. This forms a low pressure zone which creates a convection current with the high pressure zone over the Pacific Ocean. Strong afternoon winds are formed as the cool air over the ocean moves inland. During this period of circulation, (which general occurs between 14:00 and 16:00 Pacific Standard Time) the wind velocity increases. This "differential heating", rarely occurs during the winter months when winds are more evenly distributed. The even wind distribution results from the passage of winter storms and because the differential temperature between the land surface and ocean water decreases during the wet season (Roy F. Weston, 1992).

4.2.3 Storm Events and Precipitation

Most rainfall in the Livermore Valley occurs between October and April (Roy F. Weston, 1992). The average annual precipitation for the region is 14.9 inches (NOAA, 1980-1990). The Livermore Valley rarely experiences severe weather. Thunderstorms occur fewer than 10 days per year and are not intense; hail occurs even less frequently. The greatest annual rainfall which has occurred between 1931 and 1990 was 41 inches (NOAA, 1980-1990). During the five years between 1986 and 1991, Livermore area experienced less than normal precipitation, which is 14.9 inches. Annual rainfall for the Livermore region for the years 1986 through 1990 was only 10.9 inches, which is 28% below normal (Roy F. Weston, 1992). This is significantly less than the 20.0 inches average for an earlier 5-year period (1980 through 1984), which is 34 percent above normal. A series of storm events in February and March 1992, brought the 1992 precipitation total closer to normal levels.

4.3 Ecology

The information in this section is a brief summary of the ecological characteristics and the status of threatened and endangered species as they relate to the Arcade site.

4.3.1 Vegetation

Vegetation at the Livermore Arcade Shopping Center property includes ornamental species in decorative planters and grass lawns. The types of vegetation include various shrubs, small trees, and some species of ivy. The native vegetation was altered in the 1800s when livestock grazing was established in the Central Valley. The intensity of grazing which occurred on this site in unknown, however it is likely that the native perennial grassland and riparian plant communities were adversely affected by grazing and agricultural activities (Warner, 1981). Plant communities were destroyed at the site with the development of the property in the early 1900s, as the railroad and associated warehouses began operations. There are no native plant communities remaining on the site.

4.3.2 Fish and Wildlife

The present operations on the Arcade site result in minimal impact to wildlife resources since all of the activities occur in developed areas that do not contain important wildlife habitat. There are no perennial streams or permanent bodies of water on the site and there are no wetland areas. Development of the site and the downtown area of the City of Livermore has resulted in the destruction of the perennial grassland habitat which originally characterized the native ecosystem. There is no longer any native habitat located on the site. However, some bird species has been observed in planted ornamental trees on-site. Nesting species known to inhabit the Livermore area include the American crow, American robin, house finch, mocking bird and house sparrow. No threatened or endangered species have been observed on the Arcade site.

4.4 Geology

4.4.1 Regional Geology

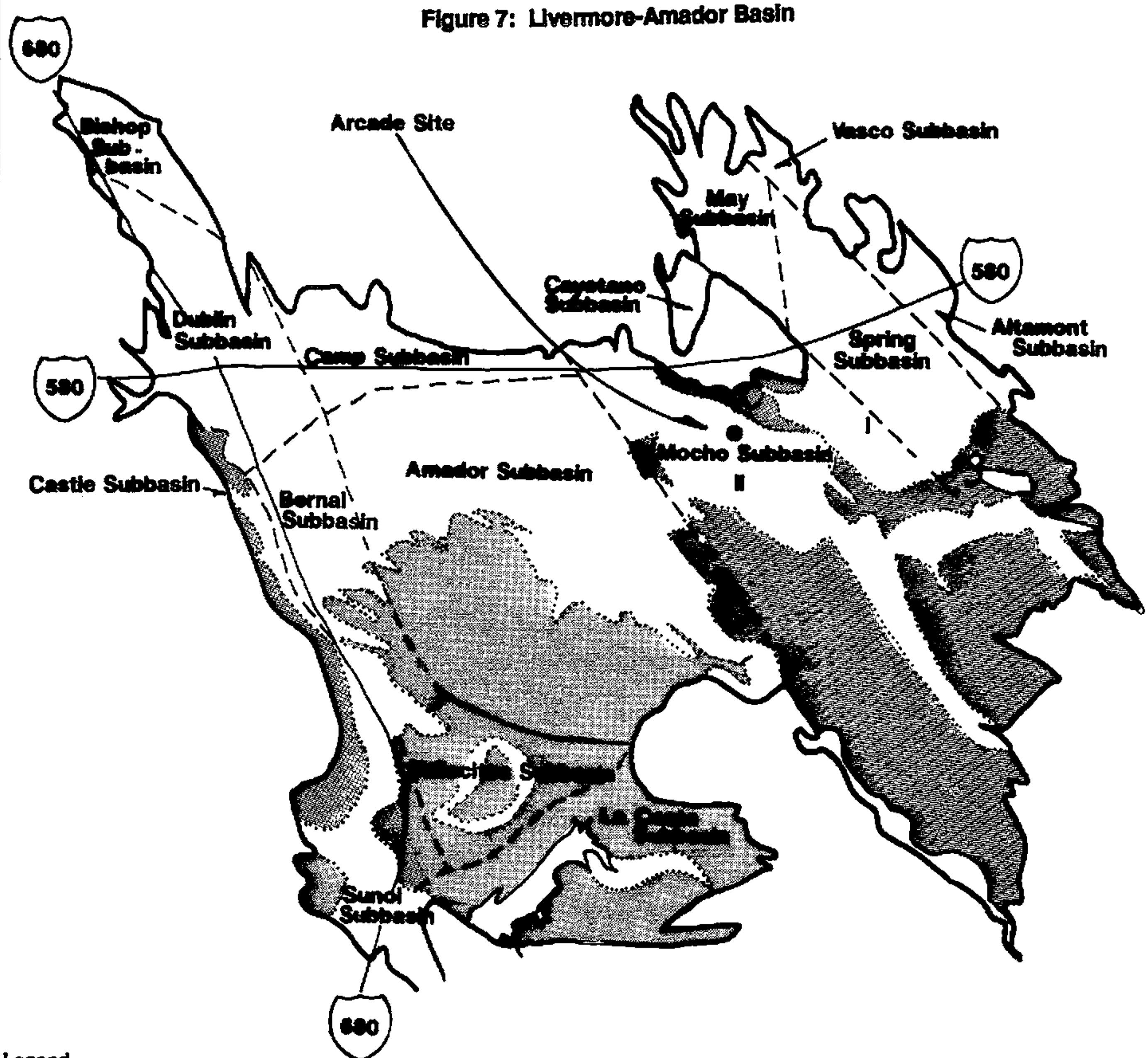
The Livermore Valley is located in the California Coastal Range geologic province characterized by low rugged mountains and relatively narrow valleys. The City of Livermore is located in the southeastern portion of the Livermore Valley (Figure 7). The valley forms an irregularly shaped lowland area about 16 miles long east to west and 7 to 10 miles wide north to south. The valley floor slopes to the west at about 20 feet per mile (DWR Bulletin 118.2).

The sediments beneath the Livermore Valley range in age from Jurassic to Quaternary. A large volume of valley sediment is composed of late Tertiary and Quaternary alluvial sediments known as the Livermore Formation.

The Livermore Formation is of Pliocene-Pleistocene age. It is exposed over broad regions south of Livermore Valley. It also occurs in limited exposures north of the City of Livermore. It is almost ubiquitous beneath the valley floor, at depths ranging from a few tens of feet to over 400 feet. Sediments of the Livermore Formation are divided into two facies: a clay facies found only in Livermore Valley, and a more predominate gravel facies.

The clay facies is comprised of interbedded dark colored, massive siltstone and claystone, with only a few thin zones of clayey gravel. This facies crops out only along Greenville Road, in the southeastern part of Livermore Valley. Similar siltstone and claystone beds, which are reported on well logs as blue clay, underlie the valley floor at various depths. The beds of this facies were deposited in an alluvial or lacustrine environment, and are believed to be the lower portion of the Livermore Formation.

Figure 7: Livermore-Amador Basin



Legend

- Valley lands underlain by Holocene Sediments
- Uplands underlain by the Livermore Formation
- Ground water basin boundary
- Subbasin boundary
- Valley floor boundary
- Subbasin interior boundary
- I, II Region within subbasin

Source: Isherwood et. al., 1990

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The gravel facies, which predominates, and is more typical of the Livermore Formation, makes up all other surficial exposures of the formation. The gravels also underlie much of the valley floor, and are reported on many well logs as cemented gravel. The gravels, which were responsible for the formation originally being named the Livermore Gravels, are composed of cobbles and boulders derived from Jurassic-Cretaceous rocks to the south. The rock fragments are contained in a sandy clay matrix that typically is reddish brown.

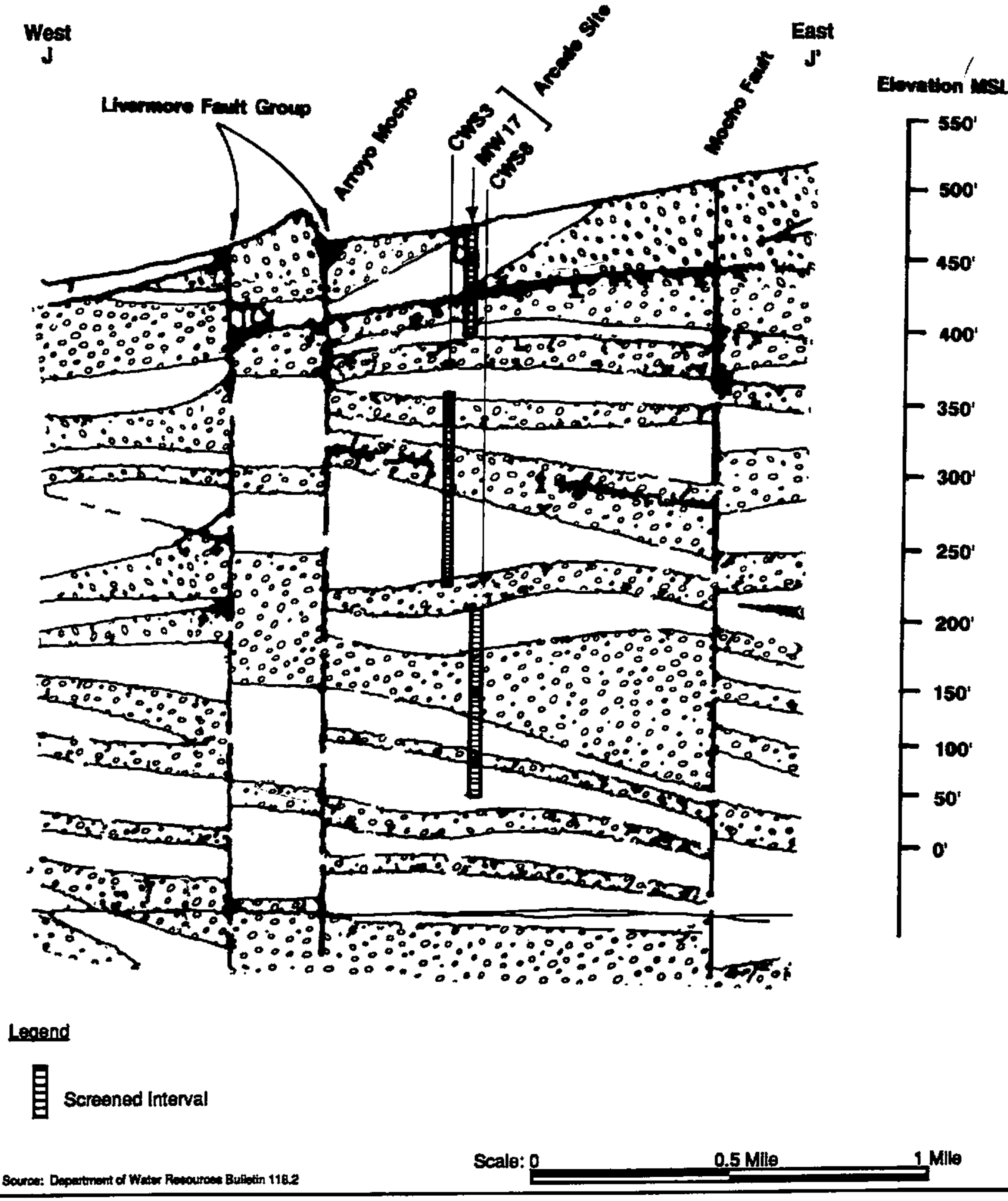
The Valley Fill materials overlie the Livermore Formation. Terrace deposits of Pleistocene to Holocene age occur in Livermore Valley along certain reaches of Arroyo Mocho and some of the other arroyos. These deposits are composed of poorly bedded boulders, cobbles, pebbles, sand, and silt derived by the reworking of the Livermore gravels. The surface soils of the terrace deposits are classed as Positas gravelly loam and Shedd silt loam (USDA, Soil Survey of Alameda County).

Deposits of gravelly alluvial fan detritus occur in the central and south-eastern portion of Livermore Valley. These deposits consist of reworked Livermore gravels and terrace gravels, and were formed by outwash along Arroyo Mocho and other arroyos in the vicinity. They consist of a heterogeneous mixture of semi-consolidated cobbles, pebbles, sand, and silt in a matrix of silty sand. Beds of this mixture may be several tens of feet in thickness, separated by thinner beds of sandy silt. The City of Livermore is situated on the distal end of the Arroyo Mocho gravelly fan. The gravelly alluvial fans have been mapped as Livermore gravelly loam and Livermore gravelly coarse sandy loam (USDA, Soil Survey of Alameda County).

The Mocho Fault is a major structural feature of the Diablo Range. This zone diverges from the Madrone Springs Fault in southern Santa Clara County, passes east of Mt. Hamilton, and runs the entire length of the Arroyo Mocho. North of Livermore Valley it swings northwestward and apparently merges with the Calaveras Fault near San Ramon. In Livermore Valley the Mocho Fault passes directly beneath the City of Livermore and passes about three thousand feet east of the Arcade site (Figure 8).

The Livermore Fault consists of three parallel zones which extend across Livermore Valley from the vicinity of Del Valle Dam to an intersection with the Mocho Fault near the mouth of Doolan Canyon. Of the three zones, the easterly zone has the least effect on ground water and has no measurable displacement of sediments. This easterly zone has been mapped approximately 2000 feet west of the Arcade site. The shearing evidence located on the eastern side of Oak Knoll has been attributed to this zone. Movement along the middle zone

Figure 8: Geological Cross Section
Mocho Subbasin



Source: Department of Water Resources Bulletin 118.2

apparently explains the presence of the low hills which make up Oak Knoll located about 2000 feet southwest of the Arcade site. This movement apparently has downdropped the Livermore sediments to the west and uptilted the block to the east. The westerly zone also has little effect on the movement of ground water (DWR, Bulletin 118.2).

There is one syncline in the Livermore Formation which affects deeper, confined ground water in the Livermore Valley. The axis of this east-west trending feature passes beneath the City of Livermore. To the west it has been truncated by movement along the Livermore fault.

4.4.2 Site Geology

The Arcade site is relatively flat gently sloping to the northwest from an elevation of 472 in the southwest corner of the Arcade site to 460 feet in the northwest corner MSL. Holocene alluvium was encountered at the Arcade site through the installation of 18 ground water monitoring wells and four soil borings with total depth ranging from 50 to 81 feet below surface.

The stratigraphy consists of alluvial fan deposits which have been cut by channels of the ancestral Arroyo Mocho. Fluvial deposits later filled the channels as the stream cut through the valley. The sediments encountered during drilling and sampling events were described on lithologic logs as predominantly unsorted gravel with clayey fine sand or silty clay matrix, occasionally interrupted with sandy clay lenses. Soil samples collected in the saturated zone showed wet gravel lenses within a clayey fine sand matrix. The matrix material was not saturated which indicates that the water is transmitted primarily through the thin, clean gravel zones.

The deepest borings drilled at the Arcade site (MW-17 and MW-18) encountered a clay rich, fine sand at approximately 390 MSL which correlates with a thick clay unit described on driller's logs from CWS-8 and CWS-3. This clay rich unit is considered to be one of the aquitards separating the surface aquifer from the lower aquifers. The CWS wells are screened below 341 MSL to draw water from the lower aquifers for public water supply. The aquitard which is likely continuous throughout the Arcade site was not mapped as a structural feature because only two wells (MW-17 and MW-18) were completed deep enough to impact the unit and verify its elevation. The measured elevation of the top of the clay rich aquitard at MW-18 is higher than the elevation of the top of the aquitard at MW-17. This explains why, during a brief period, ground water was present in MW-17, and not present in the down-gradient direction at MW-18.

The shallow subsurface materials at the Arcade site appear to be unaffected by the Livermore and Mocho faults. A cross section through the Arcade site utilizing site lithology logs was not included because a correlation of the logs between each well location was not clear. This only verifies the discontinuity of the bedding in the zone of investigation, although cleaner sand and gravel beds were consistently found in the upper 25 feet of the surface aquifer. Cross section J-J' (shown on Figure 8) which passes near the site shows general stratigraphy as presented in DWR Bulletin 118.2. The alluvium is composed of overlapping interbedded lenses and stringers of gravel, sand, silt and clay. Individual layers are not extensive enough to be traced between well logs, because they change their physical nature over very short distances and are no longer recognizable. The exact thickness of the alluvium at the site is difficult to determine because of the similarity in the descriptions of alluvium and the underlying formation reported on well logs.

Cross section J-J' shows the Mocho subbasin structure consisting of the Livermore formation overlain with alluvium. The subbasin is bounded on the west and east by the Livermore fault and the Mocho fault, respectively. The Mocho subbasin is upthrown in relation to its east and west boundaries which is evidenced by the fault drag on the units at both fault contacts. The general slope of the alluvial bedding planes is to the north which influences the ground water flow within the subbasin.

4.5 Hydrology

4.5.1 Surface Water

No surface water lies within the current boundaries of the solvent plume. Surface water, however, plays an important role in the dynamic subsurface conditions at the Arcade site. Natural and artificial recharge impacting the Arroyo Mocho affects the ground water elevations beneath the site. A description of the local and regional surface water features provides a background perspective of features encountered at the site.

4.5.1.1 *Surface Water Bodies*

Intermittent stream flow into the eastern Livermore Valley originates in the surrounding uplands and low hills, and merges onto the valley floor. Surface flow occurs intermittently from October to April, during the wet season. The four major intermittent streams that drain into the eastern Livermore Valley are Arroyo Mocho, Arroyo Seco, Las Positas, and Altamont

Creek. Recharge to the sediments underlying the Livermore Valley is primarily from the arroyos that originate in the eastern foothills and flow across the valley. When surface flow occurs in these channels, water infiltrates into the underlying alluvium and eventually percolates to the aquifers within the Valley (Roy F. Weston, 1982).

There are more than 30 assorted ponds located in the eastern Livermore Valley. The majority of the ponds are used for private water storage for livestock watering. Some have other uses including ornamental and recreational uses. The Patterson Reservoir covers an area of approximately 3.2 acres and contains a water volume of approximately 100 acre feet. The South Bay Aqueduct is an open canal that circumvents the Livermore Valley and delivers water to the south San Francisco Bay area.

4.5.1.2 *Surface Water Uses*

In the City of Livermore there are several private and governmental water purveyors and wholesalers that have been established to provide water for domestic and industrial uses. These agencies include CWS, City of Livermore Water Service, and Zone 7.

Until 1962, most of the water used in the Livermore-Amador Valley was provided by ground water, with small quantities coming from local streams. This dependence on ground water caused a serious overdraft in the valley, with water levels dropping 100 feet or more in some areas. In order to correct this overdraft situation, Zone 7 signed an agreement with the California State Water Project to provide water from the South Bay aqueduct starting in 1962. Zone 7 now operates two water treatment plants in the Livermore Valley to directly treat the South Bay aqueduct water for domestic and industrial uses. Zone 7 also releases South Bay Aqueduct water to Arroyo Mocho and Arroyo Valle for ground water recharge. The recharge mechanism for these arroyos is by stream infiltration. These arroyos provide recharge to the alluvial aquifer in the eastern portion of the Livermore Valley. The releases from the South Bay Aqueduct that affect the stream flows near the Arcade site are the ones from Altamont Turnout to Arroyo Mocho.

4.5.2 Regional Hydrogeology

Within the Livermore Valley water basin, faults are the major structural features known to affect the movement of ground water. Faults in this region tend to act as barriers to the lateral movement of ground water with the result that ground water elevations are higher on the up-gradient side. Three largely concealed faults beneath Livermore Valley, the Livermore, Pleasanton, and Parks faults, were first recognized because of the pronounced difference in water levels observed in wells on either side of them. Any fault that cuts the water-bearing sediments in this region may act as a barrier to the movement of ground water.

Valley lands and certain upland areas are water-bearing and thus receive and transmit ground water to varying degrees. In contrast, other uplands and the steeper highlands are nonwater-bearing and consequently are of little importance to ground water.

Livermore Valley has two major sources of ground water. These are the alluvial deposits, which make up the valley floor and the Livermore Formation, which is adjacent to and underlies the valley floor. The Livermore Valley Ground Water Basin has surface exposures of both the alluvium and the Livermore Formation. A third water-producing unit, the Tassajara Formation, underlies the northern portion of Livermore Valley and has a large area of exposure to the north of the valley. Wells that draw from this formation have relatively low yields.

The City of Livermore is located in the Mocho subbasin. The subbasin is one of the most important in the Livermore Valley Ground Water Basin. It is also the largest, occupying 9,181 acres of valley lands and 13,946 acres of contiguous uplands. The Mocho subbasin has been divided into Mocho I (eastern) and Mocho II (western) provinces. The Mocho I province is drained by Arroyo Seco, while Mocho II province is drained by Arroyo Mocho. Arroyo Mocho meanders through the City of Livermore and can be located 2000 feet south and 2000 feet west of the Arcade site.

The Mocho subbasin is bounded on the east by the Tesla Fault and on the west by the central zone of the Livermore Fault. To the south the valley floor blends into the Livermore Uplands, which in turn lap onto a mountainous area composed of nonwater-bearing marine rocks. To the north, the Mocho subbasin is in contact with the contiguous ground water upland formed by the Tassajara Formation. There is no subsurface flow across the contact because of a lack of hydraulic continuity. There is also no flow of ground water across the southern boundary of the subbasin which is at the contact between the Livermore Formation and the nonwater-bearing marine rocks.

The Tesla Fault forms the eastern boundary of the subbasin and separates it from the Spring subbasin. Above a depth of 50 feet, the Tesla Fault does not transect the aquifers and does not restrict subsurface flow into the subbasin. Below a depth of 50 feet, the elevation and configuration of the potentiometric surfaces are different on opposite sides of the fault zone, and it is concluded that the Tesla Fault transects the aquifers below this depth.

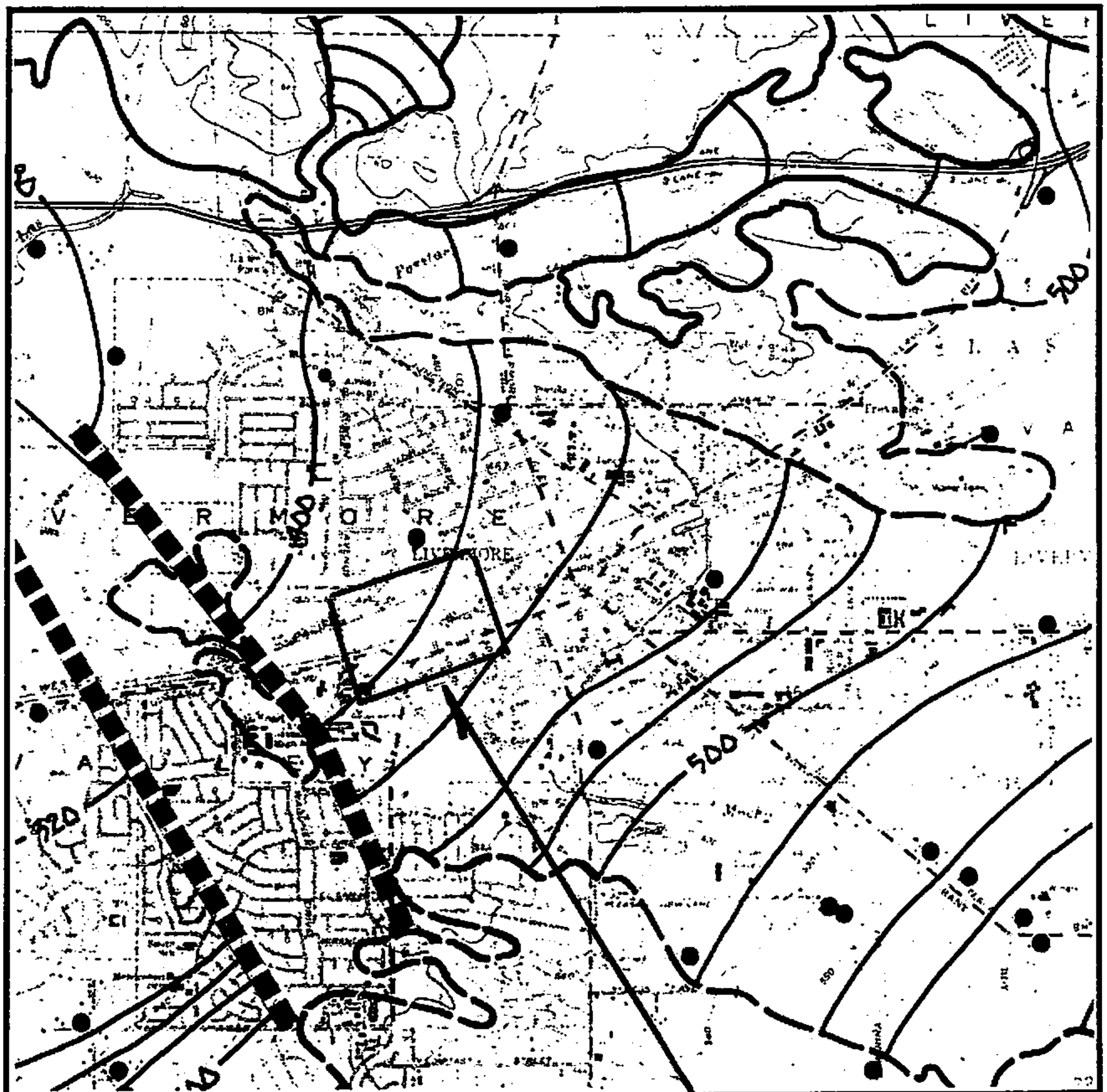
The western boundary of the Mocho subbasin is formed by the middle zone of the Livermore Fault group. This middle zone has a marked effect on adjacent water levels. The difference in water levels between the two sides is on the order of 150 feet, and indicates that subsurface flow from the Mocho subbasin to the Amador subbasin is greatly restricted by the Livermore Fault. Farther north, in the vicinity of the ancestral Arroyo Mocho channel, ground water moves essentially unimpeded across the fault zone. The breaching of the Livermore Fault by the ancestral Arroyo Mocho is confirmed by the continuity of ground water quality from the surface flow of Arroyo Mocho in the hills to ground water in the Mocho II province and in the northern portion of the Amador subbasin (DWR, Bulletin 118.2).

Ground water level contours in the Livermore Valley from 1977 through 1991 are shown on Figure 9 through 17. Regional ground water movement is in the generally north west and in the direction of the gravel pits. The gravel operations pump large quantities of water from the pits to facilitate gravel mining, thus creating a large artificial depression in the Livermore Valley ground water system. The gravel pit operators also backfill some of the pits with silt and clay to minimize further recharge and ground water movement in the area. Regional ground water contour maps show a gradual change in the direction of ground water flow over the last 10 years from west northwest to north northwest.

Zone 7 sells treated water to municipal water agencies and companies and retails untreated water to individuals for agricultural uses. Zone 7, under a contract with the State, purchases imported water to supplement the local water supply within the Zone. It takes delivery of the imported water through the South Bay Aqueduct of the State Water Project. The Zone also extracts ground water from several locations, including a well field along Hopyard Road.

CWS is a private water supply company that provides water to approximately 15,000 residents of the City of Livermore. The water is collected from a number of ground water wells located throughout Livermore and also from surface water delivered through the South Bay Aqueduct by Zone 7.

Figure 9: Water Level Contours
Fall 1977



Legend

—300— Water Level Contour and Elevation. Contour Interval is 20 feet

- - - - Valley Floor Boundary

▬ ▬ ▬ Apparent Groundwater Barrier

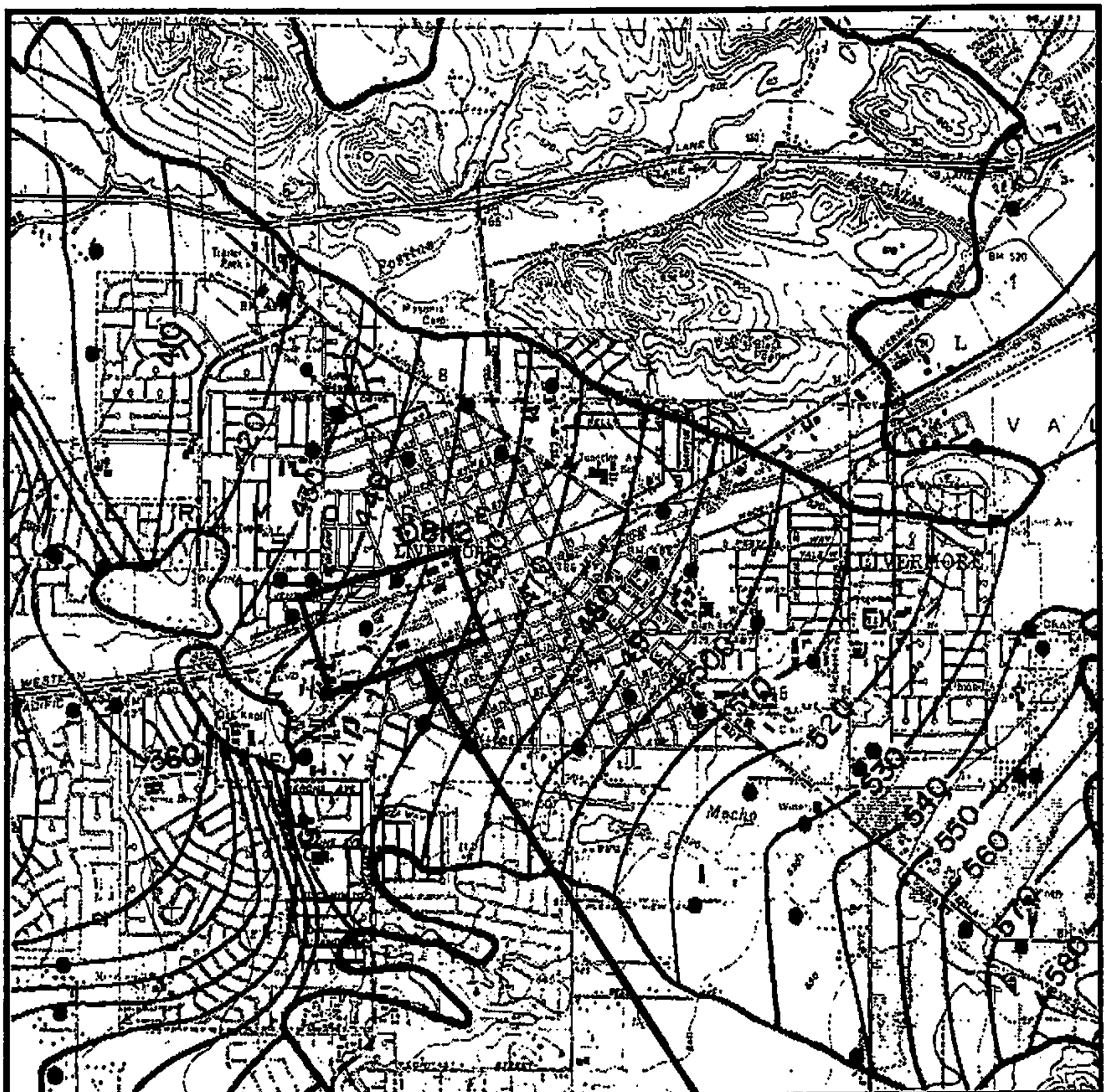
• Well Data Point

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1977, Groundwater Contours

Figure 10: Water Level Contours
Spring 1983



Legend

—300— Water Level Contour and Elevation. Contour Interval is 10 feet

——— Groundwater Basin Boundary

● Well Data Point

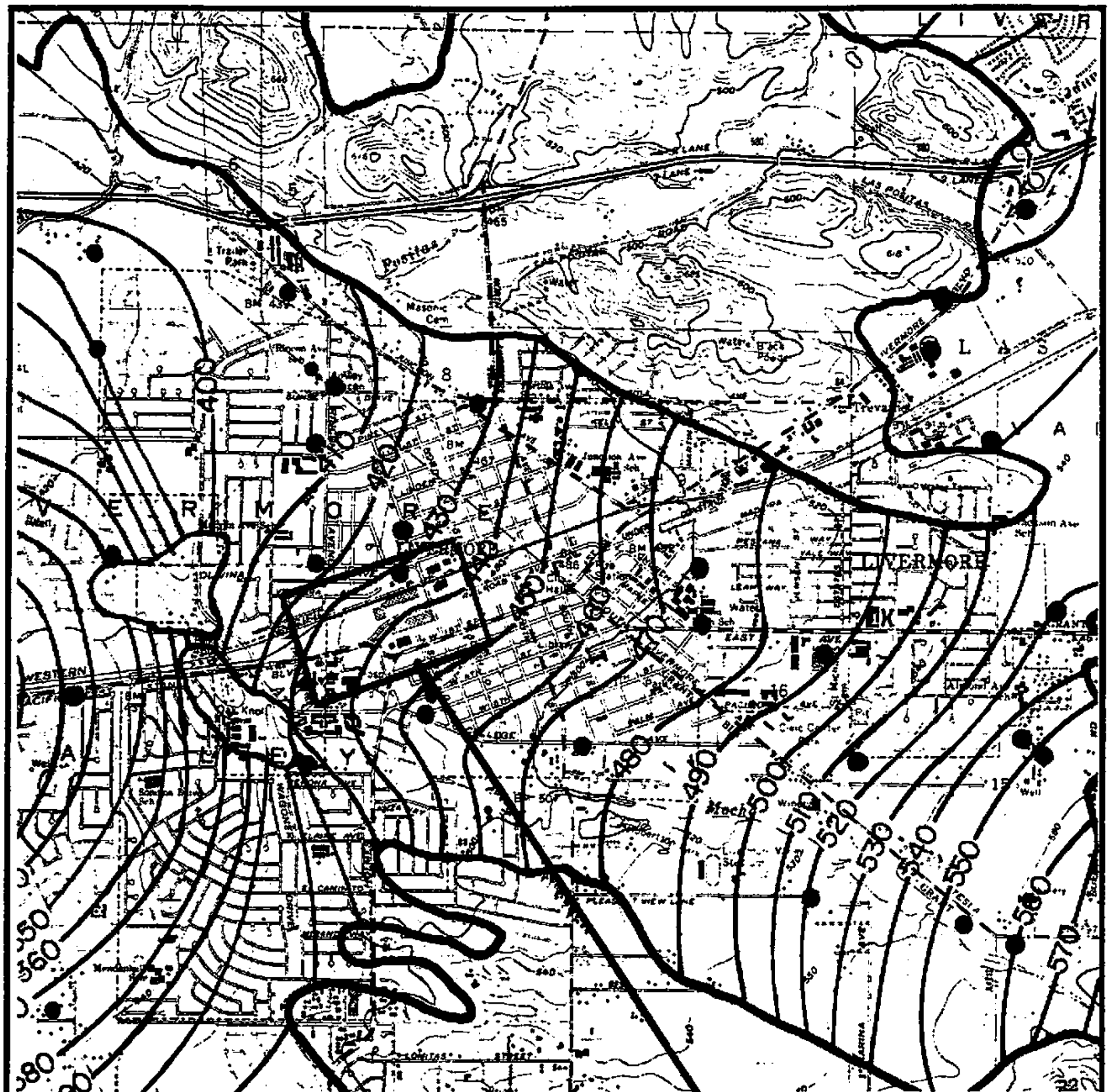
○8K2 Key Well Number

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Spring 1983, Groundwater Contours

Figure 11: Water Level Contours
Fall 1986



Legend

—300— Water Level Contour and Elevation. Contour Interval is 10 feet

——— Groundwater Basin Boundary

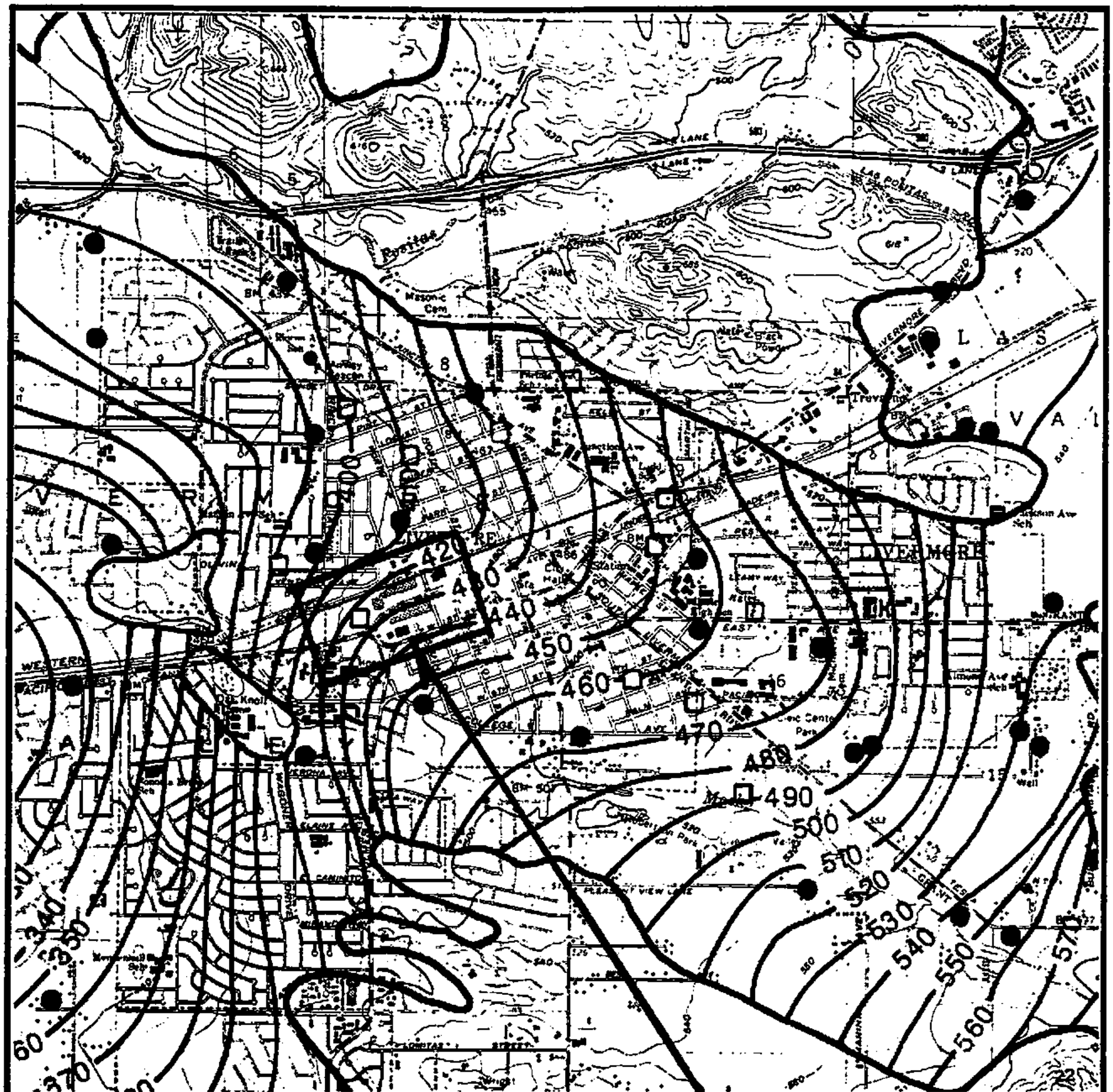
• Well Data Point

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1986, Groundwater Contours

Figure 12: Water Level Contours
Fall 1987



Legend

—300— Water Level Contour and Elevation. Contour Interval is 10 feet

——— Groundwater Basin Boundary

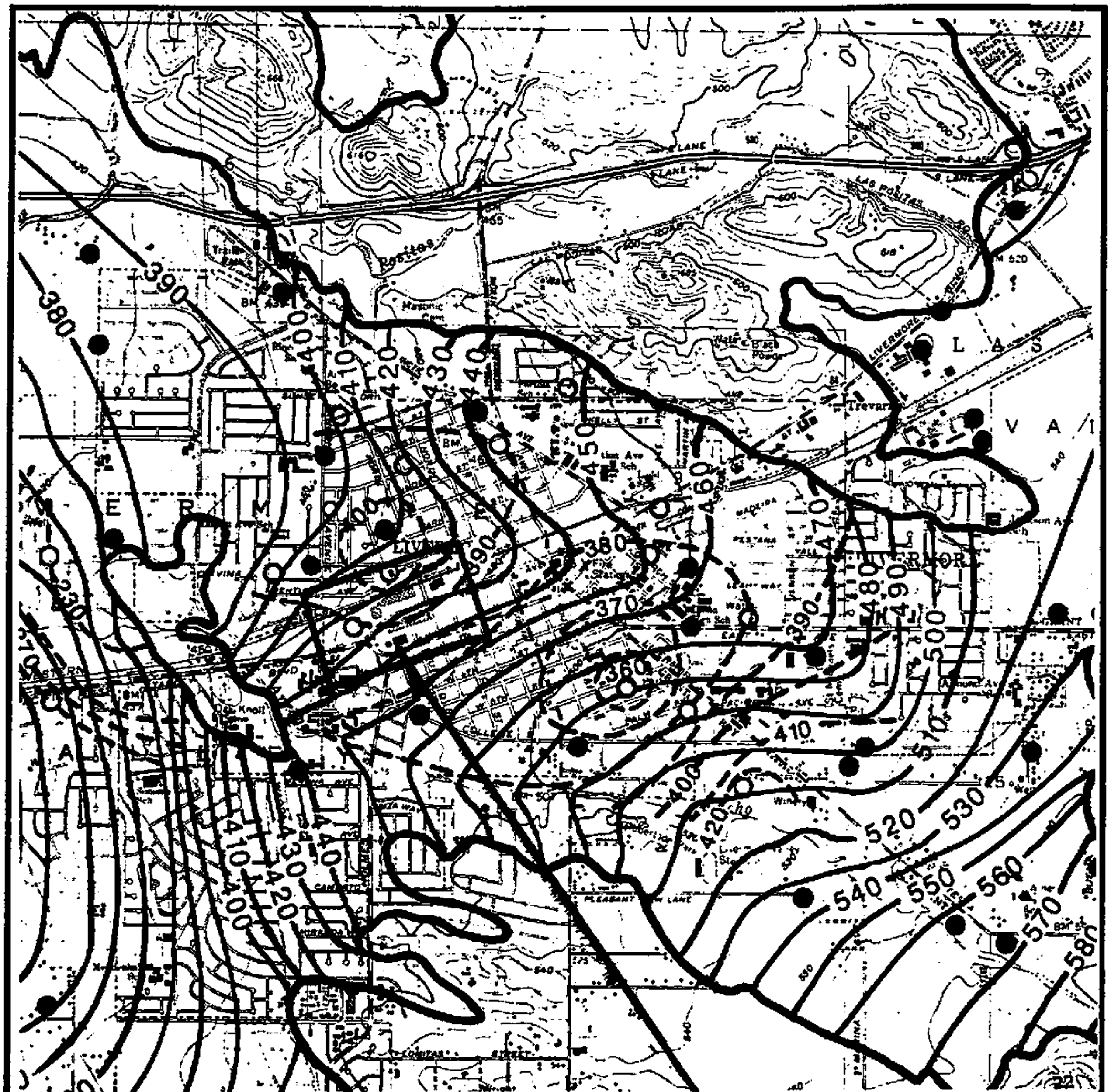
• Well Data Point

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1987, Groundwater Contours

Figure 13: Water Level Contours
Fall 1988



Legend

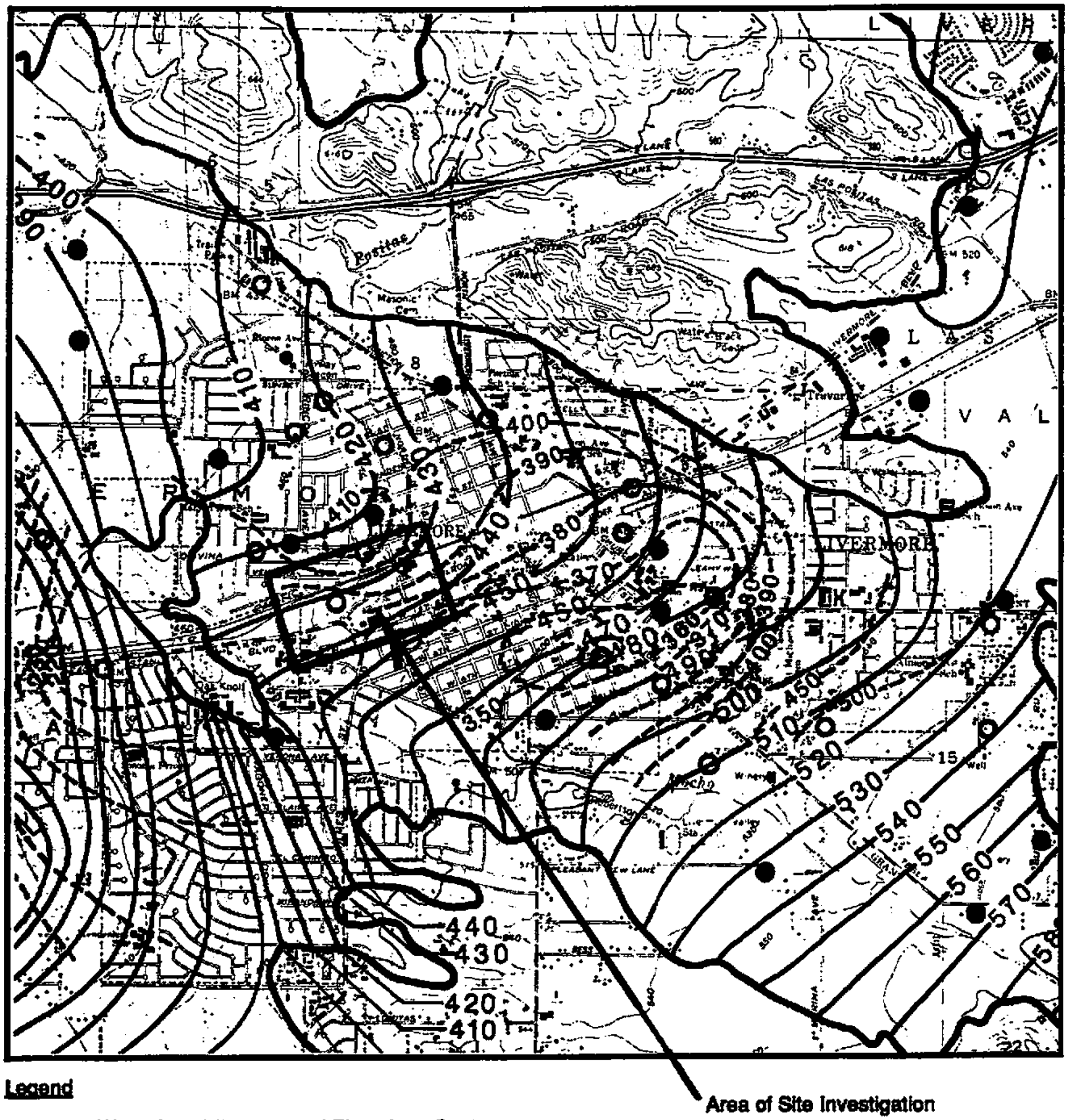
—300—	Water Level Contour and Elevation. Contour Interval is 10 feet
--250--	Water Level of Underlying Aquifer
———	Recent Alluvium Boundary
●	Well Data Point
o	Well in Lower Aquifer

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1988, Groundwater Contours

Figure 14: Water Level Contours
Fall 1989



Legend

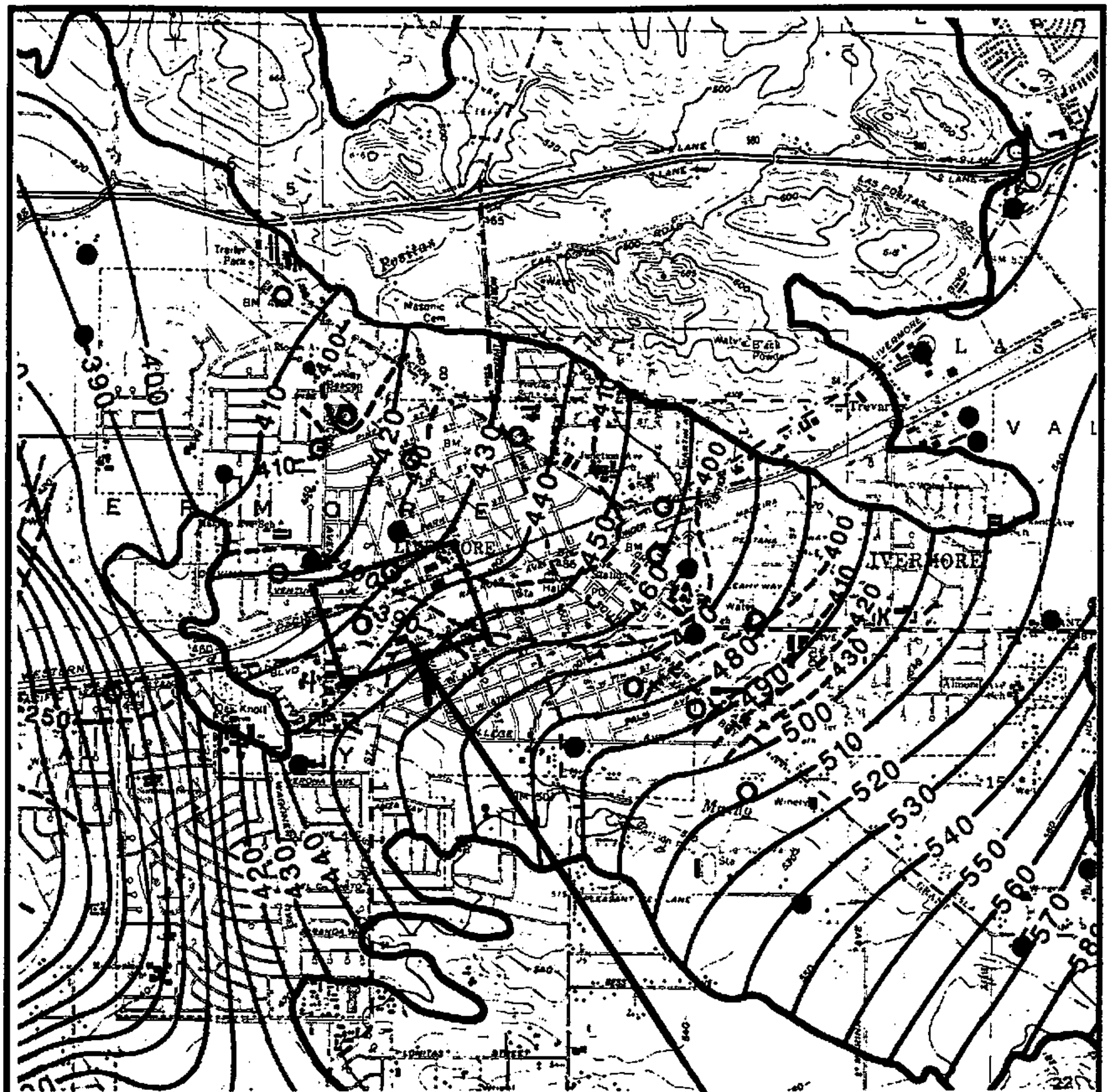
—300—	Water Level Contour and Elevation. Contour interval is 10 feet
- -250- -	Water Level of Underlying Aquifer
———	Recent Alluvium Boundary
●	Well Data Point
o	Well in Lower Aquifer

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1989, Groundwater Contours

Figure 15: Water Level Contours
Spring 1990



Legend

—300— Water Level Contour and Elevation. Contour interval is 10 feet

- -250- - Water Level of Underlying Aquifer

——— Recent Alluvium Boundary

● Well Data Point

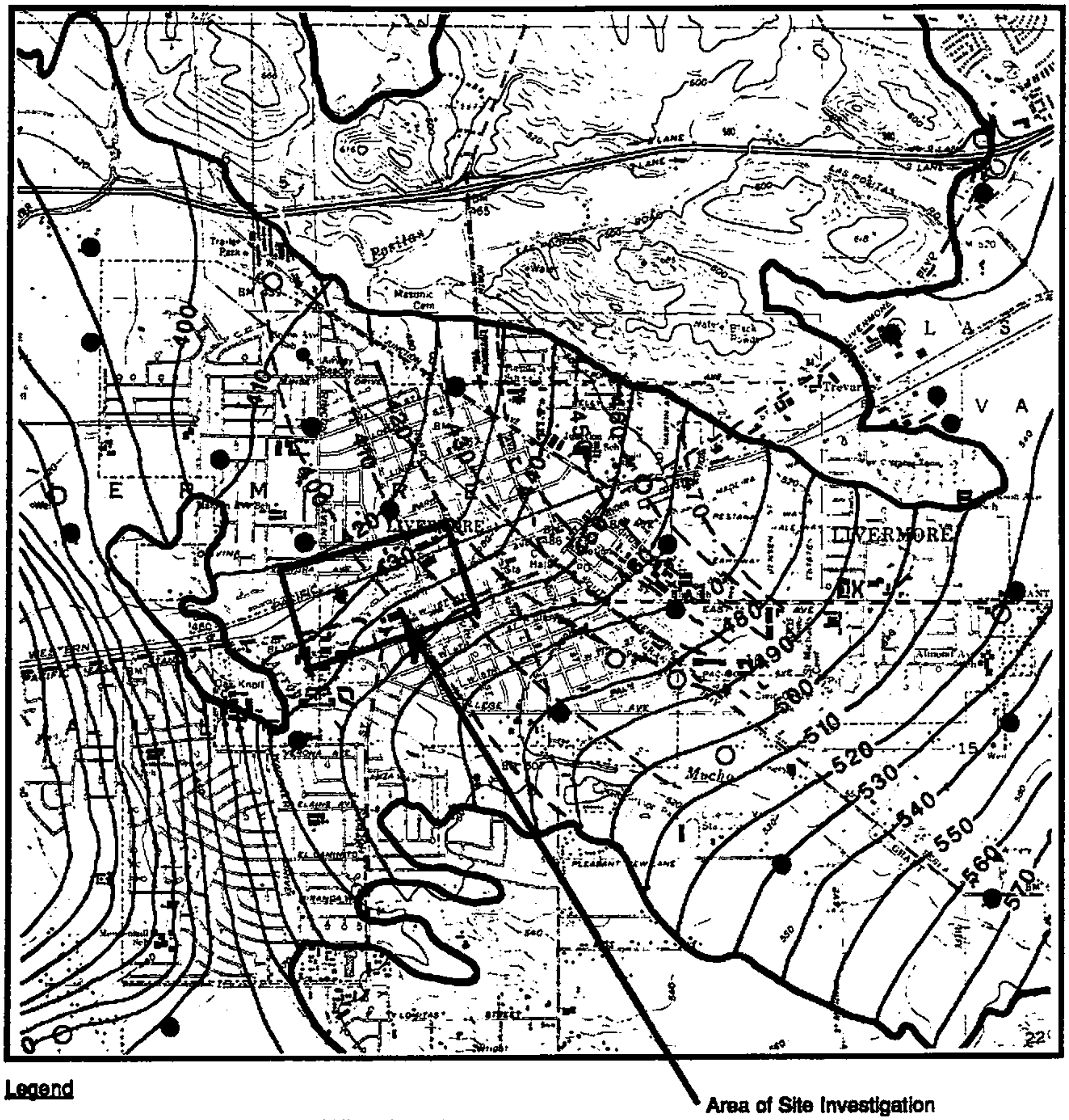
○ Well in Lower Aquifer

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Spring 1990, Groundwater Contours

Figure 16: Water Level Contours
Fall 1990



Legend

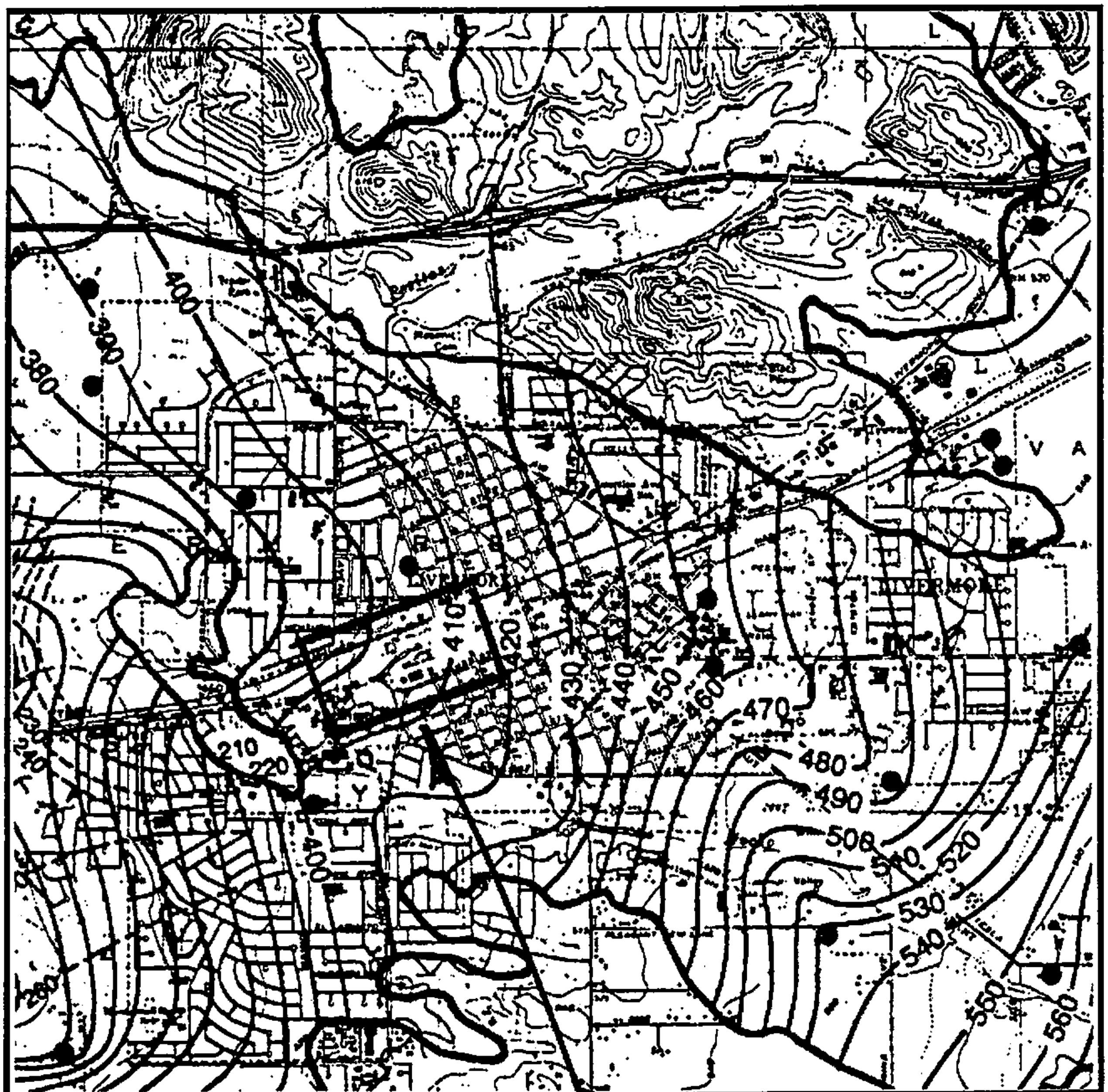
- —300— Water Level Contour and Elevation. Contour interval is 10 feet
- - -250- - Water Level of Underlying Aquifer
- ——— Recent Alluvium Boundary
- ● Well Data Point
- ○ Well in Lower Aquifer

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1990, Groundwater Contours

Figure 17: Water Level Contours
Fall 1991



Area of Site Investigation

Legend

- —300— Water Level Contour and Elevation. Contour interval is 10 feet
- - -250- - Water Level of Underlying Aquifer
- ——— Recent Alluvium Boundary
- ● Well Data Point
- ○ Well in Lower Aquifer

Scale: 0 3,000 feet 6,000 feet

N

Source: Alameda County, Zone 7 Water Agency, Fall 1991, Groundwater Contours

4.5.3 Site Hydrogeology

The Livermore Formation is one of the principal water-bearing formations in Livermore Valley. All of the deep wells in the eastern half of the valley produce from this formation. Yields to wells are adequate for most irrigation, industrial, or municipal purposes; however, specific capacities usually are in the range of from 5 to 40 gallons per minute per foot of drawdown. This is much less than that of the overlying materials. Ground water in this formation is a sodium bicarbonate water of good to excellent quality. Some deleterious mineral constituents, such as boron, may be present in certain areas (DWR Bulletin 118.2).

The valley fill materials overlie the Livermore Gravel Formation and are reported to be the most generous suppliers of ground water to wells. Yields from properly designed wells have reported specific capacities generally in the range from 50 to over 200 gallons per minute per foot of drawdown. Ground water quality ranges from poor to excellent, depending on location and source of recharge (DWR, Bulletin 118.2).

According to the Historical Guild of Livermore, agricultural land use and the accompanying requirements for water, and the number of ground water wells in the Livermore area increased steadily between 1900 and 1950. Ground water levels gradually declined over this period, while fluctuating with the short term wet and dry seasons. Since that time, however, residential and commercial uses have become the predominant use. Ground water requirements declined through the 1960s. Ground water resources were supplemented with surface water from the South Bay Aqueduct and the aquifers started to recover. This is clearly shown in the historical hydrograph (Figure 18).

CWS personnel confirm that as the population of the Livermore area has risen, the water requirement has also risen. Livermore continues to obtain a significant amount of it's water from local ground water resources. This has resulted in a flattening of the hydrograph through the 1970s and a reduction in the 1980s (Figure 19). Zone 7 has indicated that an artificial ground water recharge program using Delta water from the South Bay Aqueduct began in 1962 to help maintain the ground water elevation. Recently, five consecutive dry years have reduced the amount of natural and artificial recharge water available. The reduction in surface water supplies have resulted in an increase in the pumping of ground water resources in the Livermore area.

Figure 18: Historical Livermore Spring Ground Water Data
Key Well 3S/2E 8K2

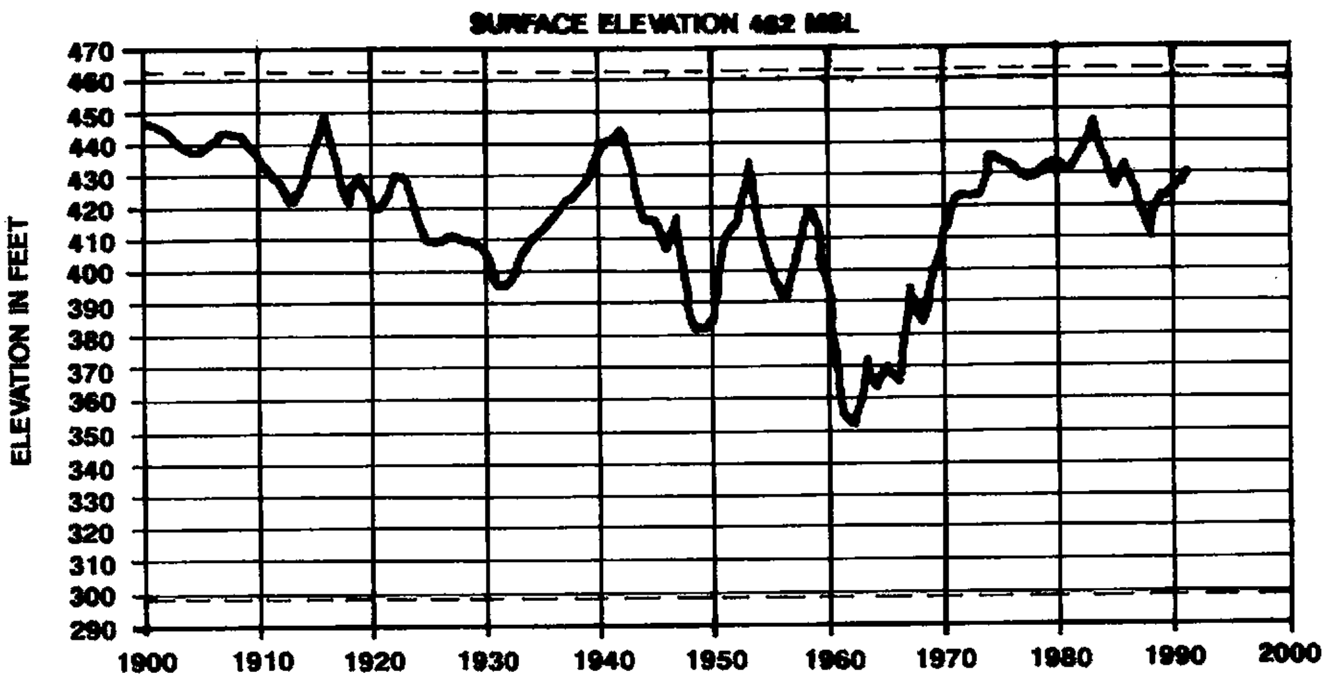
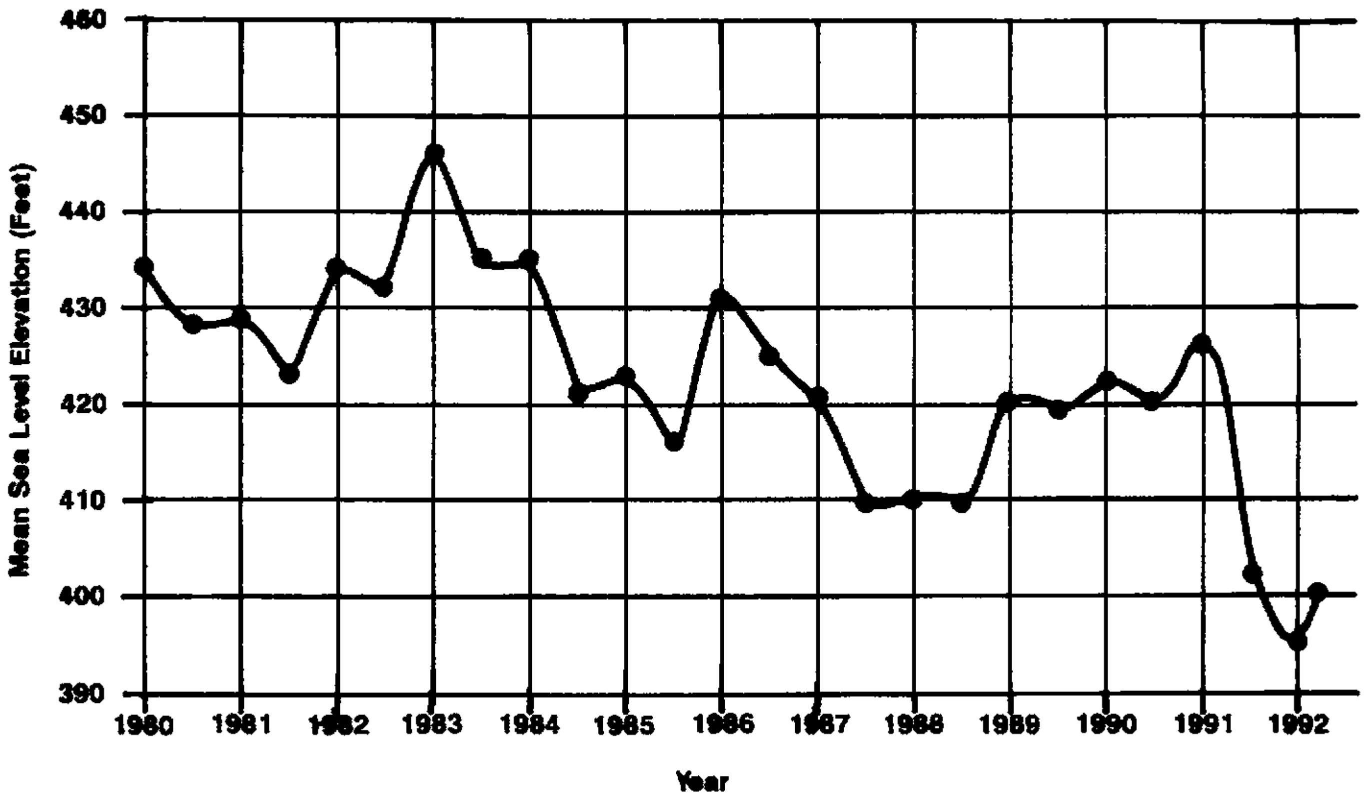


Figure 19: Ground Water Hydrograph Key Well 3S/2E 8K2
For Water Years 1980 -1992



The combination of the drought, the increased rate of ground water pumping, and the hold on artificial recharge has resulted in the sharp drop in the ground water elevation in Livermore observed on the 1991-92 hydrograph (Figure 20). Between the period of April 1991 and November 1991, the ground water dropped 35 feet in the Livermore area. This represents the lowest ground water level since 1968.

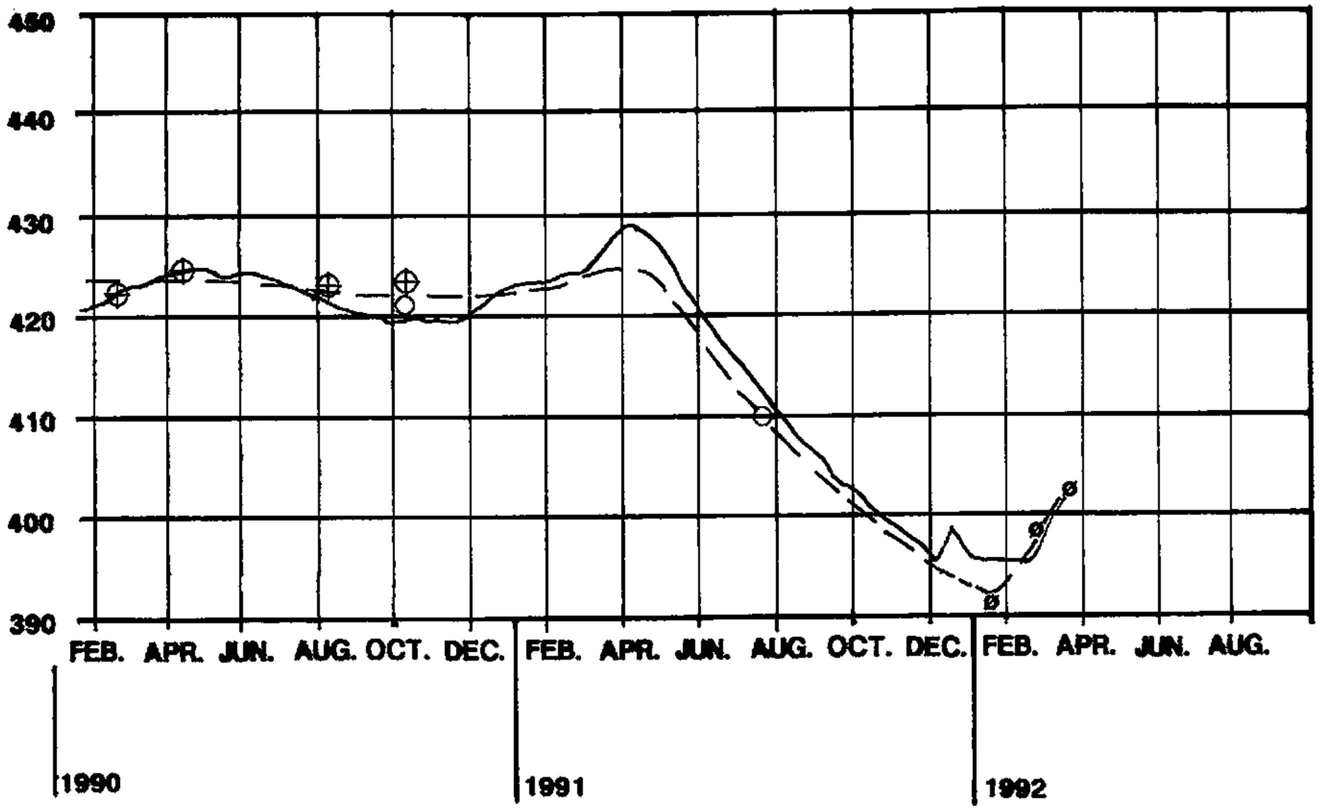
The heavy rains of the 1991-92 winter and a subsequent reduction in ground water pumping by CWS has resulted in the an immediate rise of about ten feet in the ground water table during the months of February and March, 1992.

Ground water in the Livermore area occurs in both deeper aquifers at a depth of between 330 feet MSL and 50 feet MSL, and in a shallow aquifer at a maximum depth of about 380 feet MSL. Boring logs to a depth of 20 feet MSL have demonstrated numerous clay layers separating the two aquifers. Hydraulic connection may only occur along the Livermore and Mocho faults. It has been documented by Zone 7 that as the deep aquifer is heavily pumped, the shallow aquifer will eventually begin to decline, however, pump tests in the deep aquifer have not shown a direct hydraulic connection between the two aquifers. The ground water plume at Mike's Cleaners appears to have moved independently of the heavy pumping by CWS wells CWS-3 and CWS-8, located on the west and northeast sides of the plume. Leakage to the deep aquifer may be occurring up-gradient of the Arcade site through the nearby faults.

Water well data provided by the Alameda County, Zone 7, Water Resources Engineering Ground Water Level Monitoring Report, February 1992, reports both monthly ground water levels as well as historical trends for a selected "Key Well" in the Livermore area. Data for Livermore Key Well 3S/2E 8K2, which is located approximately 950 feet north from Mike's Cleaners, have been collected and compiled since before the year 1900. The well is located at an elevation of 462 feet MSL . Monitoring wells MW-2, MW-5, MW-6, MW-7, and MW-17 near Mike's Cleaners are located at close to 464 feet MSL (Table 1).

Historical data shows that the Spring ground water level, which is typically the highest of the year, had been between 420 and 450 feet MSL during the period between 1900 and 1920 and has gradually dropped until reaching a low of 350 feet MSL in 1962. The ground water subsequently recovered and neared its highest recorded level of 450 feet in 1983. Since that time, the spring ground water has fluctuated around the 430 foot elevation.

Figure 20: Ground Water Hydrographs Well 3S/2E 8K2, MW-2, MW-9, MW-17
For Water Years 1990, 1991, 1992*



* Comparison of Well 3S/2E 8K2 monthly data with combined data from MW-2, MW-9, and MW-17 is required due to well depths and construction dates. Regional hydrologic trends are demonstrated despite slight differences in well elevations.

Legend

	Well	Elevation (ft.)
—	3S/2E 8K2	462 MSL
⊕	MW-2	463.7 MSL
O	MW-9	464.4 MSL
ø	MW-17	465.1 MSL

Table 1 - Livermore Arcade Groundwater Data
Elevation in Feet

	Surface Elev. (MSL)	Well Depth (BGS)	Well Depth (MSL)	DTG (BGS) 3/24/90	GWE (MSL) 3/24/90	DTG (BGS) 4/10/90	GWE (MSL) 4/10/90	DTG (BGS) 8/7/90	GWE (MSL) 8/7/90	DTG (BGS) 10/11/90	GWE (MSL) 10/11/90
MW-1	470.7	59.6	411.1	42.6	428.1	42.0	428.7	43.6	427.1	45.0	425.7
MW-2	463.7	50.0	413.7	39.3	424.4	37.7	426.0	39.8	423.9	40.1	423.6
MW-3	463.8	59.3	404.5	34.3	429.5	34.1	429.7	35.6	428.2	35.4	428.4
MW-4	465.4	49.6	415.8					38.4	427.0	38.4	427.1
MW-5	465.7	50.0	415.7					41.7	424.0	42.3	423.4
MW-6	464.7	49.8	414.9					41.7	423.0	40.8	424.0
MW-7	464.8	64.8	400.0					40.8	424.0	40.9	423.9
MW-8	463.1	55.0	408.1					39.9	423.2	40.1	423.0
MW-9	464.4	55.0	409.4					41.0	423.4	42.1	422.3
MW-10	460.9	55.0	405.9							38.2	422.7
MW-11	463.4	55.0	408.4							41.9	421.5
MW-12	463.2	60.0	403.2							43.0	420.2
MW-13	459.5	56.0	403.5							40.9	418.6
MW-14	459.3	56.0	403.6							42.2	417.1
MW-15	457.3	55.0	402.3							36.7	420.6
MW-16	472.4	51.0	421.4								
MW-17	465.1	75.0	390.1								
MW-18	463.3	69.5	393.8								

Notes:

BGS = below ground surface
DTG = depth to ground water
GWE = ground water elevation
MSL = mean sea level

Table 1 - Livermore Arcade Groundwater Data
Elevation in Feet

	Surface Elev. (MSL)	Well Depth (BGS)	Well Depth (MSL)	DTG (BGS)	GWE (MSL)	DTG (BGS)	GWE (MSL)	DTG (BGS)	GWE (MSL)	DTG (BGS)	GWE (MSL)
				7/25/91		8/21/91		11/12/91		1/30/92	
MW-1	470.7	59.6	411.1					NW			
MW-2	463.7	50.0	413.7	NW				NW			
MW-3	463.8	59.3	404.5					NW			
MW-4	465.4	49.6	415.8					NW			
MW-5	465.7	50.0	415.7					NW			
MW-6	464.7	49.8	414.9					NW			
MW-7	464.8	64.8	400.0					NW			
MW-8	463.1	55.0	408.1					NW			
MW-9	464.4	55.0	409.4	53.3	411.1			NW			
MW-10	460.9	55.0	405.9					NW			
MW-11	463.4	55.0	408.4					NW			
MW-12	463.2	60.0	403.2					NW			
MW-13	459.5	56.0	403.5	52.5	407.0			NW			
MW-14	459.3	56.0	403.6	51.9	407.4			NW			
MW-15	457.3	55.0	402.3					NW			
MW-16	472.4	51.0	421.4			47.0	457.3	NW			
MW-17	465.1	75.0	390.1							72.7	392.4
MW-18	463.3	69.5	393.8							NW	

Notes:

BGS = below ground surface
DTG = depth to ground water
GWE = ground water elevation
MSL = mean sea level
NW = no water in well

Table 1 - Livermore Arcade Groundwater Data
Elevation in Feet

	Surface Elev. (MSL)	Well Depth (BGS)	Well Depth (MSL)	DTG (BGS) 2/24/92	GWE (MSL)	DTG (BGS) 3/18/92	GWE (MSL)	DTG (BGS)	GWE (MSL)	DTG (BGS)	GWE (MSL)
MW-1	470.7	59.6	411.1	NW		NW					
MW-2	463.7	50.0	413.7	NW		NW					
MW-3	463.8	59.3	404.5	NW		NW					
MW-4	465.4	49.6	415.8	NW		NW					
MW-5	465.7	50.0	415.7	NW		NW					
MW-6	464.7	49.8	414.9	NW		NW					
MW-7	464.8	64.8	400.0	NW		60.5	404.3				
MW-8	463.1	55.0	408.1	NW		NW					
MW-9	464.4	55.0	409.4	NW		NW					
MW-10	460.9	55.0	405.9	NW		NW					
MW-11	463.4	55.0	408.4	NW		NW					
MW-12	463.2	60.0	403.2	NW		NW					
MW-13	459.5	56.0	403.5	NW		NW					
MW-14	459.3	56.0	403.6	NW		NW					
MW-15	457.3	55.0	402.3	NW		NW					
MW-16	472.4	51.0	421.4	NW		NW					
MW-17	465.1	75.0	390.1	68.1	397.0	61.7	403.5				
MW-18	463.3	69.5	393.8	64.8	398.5	63.9	399.5				

Notes:

BGS = below ground surface
DTG = depth to ground water
GWE = ground water elevation
MSL = mean sea level
NW = no water in well

Recent monthly data for Key Well 3S/2E 8K2 showed a gradual rise in the ground water elevation during the 1991 spring months of 1991 to an elevation of just under 430 feet MSL. This was followed by a sharp decline to a low of 395 feet MSL in the winter months. No ground water recovery was measured until February 1992.

The ground water elevations recorded for monitoring wells used for the investigation of the chlorinated solvent plume from Mike's Cleaners closely follow the hydrograph of Key Well 3S/2E 8K2. Ground water elevation data collected in 1990 show a maximum elevation of 430 MSL in the spring and then a slight decline through the year. The next readings in 1991 mirror the sharp drop shown by Key Well 3S/2E 8K2. The sharp decline in ground water elevation continued until all of the wells involved in the investigation went dry in November 1991.

Ground water elevation data have been collected historically from Livermore Key Well 3S/2E 8K2 since the year 1900. These data show that fluctuations of the ground water table have been frequent. Spring ground water elevations have varied between 350 feet MSL and 450 feet MSL.

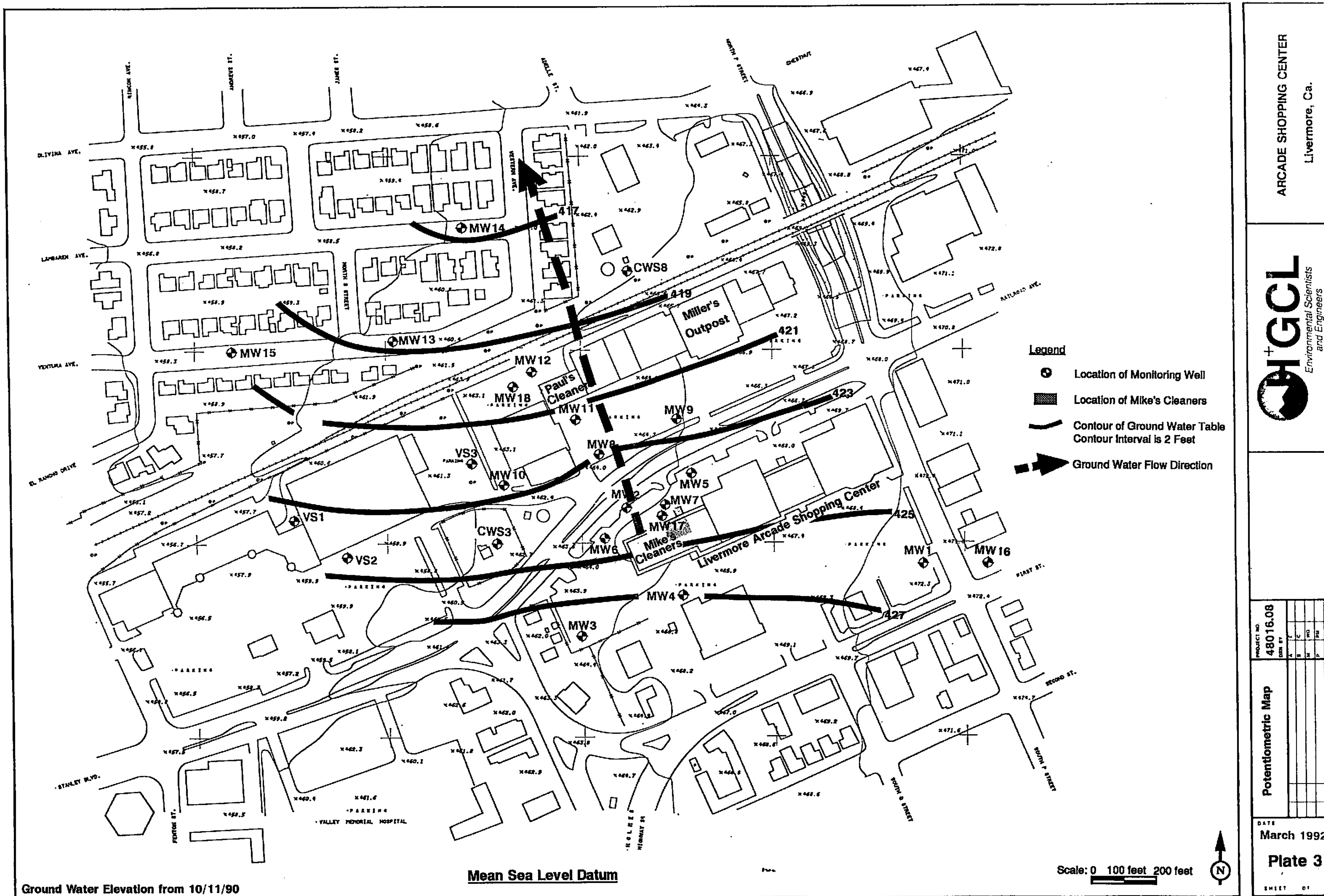
Zone 7 identified one private ground water well that is located within a one mile radius of the Arcade site and that produces water out of the shallow aquifer. The well is operated at Granada High School which is located about 2800 feet southwest (up-gradient) of the Arcade site. The well is screened at approximately 40-feet and is used to irrigate the lawn. It is not used as a drinking water source.

On-site measurements of ground water flow direction taken in 1990 showed a north northwest gradient (Plate 3). Regional maps show that the ground water flow direction has changed during the last ten years from west northwest to north northwest (Figure 21). The locally measured gradient closely matches the regional gradient for Fall 1990.

4.5.4 Pump Test Results

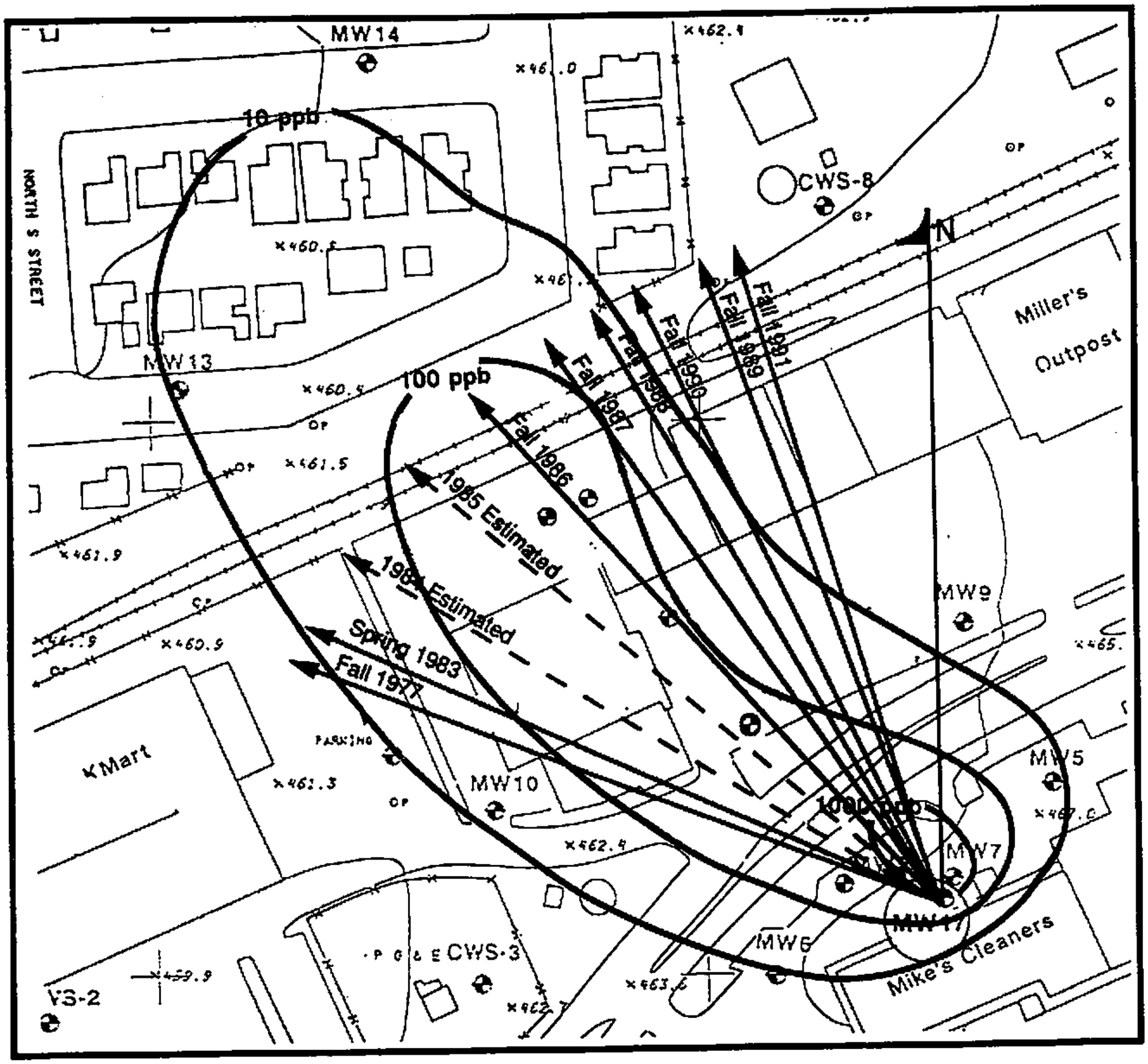
For the October 1990 pump test at MW-12, the screened zone extended from approximately 422 to 406 MSL. None of the observation wells (MW-8, MW-11, MW-13, and MW-14) showed any measurable response to pumping at MW-12 over the test period. Thus, H+GCL analyzed data from the pumping well only for the purpose of estimating aquifer hydrologic parameters.

H+GCL calculated transmissivity and storage coefficient values from monitor well MW-12 analyses using the average aquifer hydrologic parameters (transmissivity 36 gpd/ft), a hydraulic gradient of



ARCADE SHOPPING CENTER
Livermore, Ca.
HGCL
Environmental Scientists and Engineers
PROJECT NO. 48016.08
Potentiometric Map
DATE
March 1992
Plate 3
Legend
Location of Monitoring Well
Location of Mike's Cleaners
Contour of Ground Water Table
Contour Interval is 2 Feet
Ground Water Flow Direction
Scale: 0 100 feet 200 feet
N
Mean Sea Level Datum
Ground Water Elevation from 10/11/90
Miller's Outpost
Paul's Cleaners
Mike's Cleaners
Livermore Arcade Shopping Center
MW1
MW3
MW4
MW5
MW6
MW7
MW8
MW9
MW10
MW11
MW12
MW13
MW14
MW15
MW16
MW17
MW18
VS1
VS2
VS3
CWS3
CWS8
417
419
421
423
425
427
OLIVINA AVE.
LAMBAREN AVE.
VENTURA AVE.
EL RANCHO DRIVE
STANLEY BLVD.
RAILROAD AVE.
FIRST ST.
SECOND ST.
CHESTNUT
NORTH P STREET
SOUTH P STREET
NORTH S STREET
SOUTH S STREET
VALLEY MEMORIAL HOSPITAL

Figure 21: Ground Water Flow Direction 1977 to 1991



Legend

Measured direction of regional ground water flow

Estimated direction of regional ground water flow

10 ppb PCE Concentration Contours 1990-1991 (parts per billion)

Scale: 0 100 feet 200 feet N

0.0082, and an aquifer thickness of 16.75 feet. The calculated hydraulic conductivity is 1.29 feet/year and ground water velocity is approximately 1 foot per year.

The zone between 405 and 391 MSL was saturated during the March 1992 pump test at MW-17. Observation well MW-7 showed a measurable response to pumping approximately 20 minutes into the test. Approximately 175 minutes into the test, the discharge rate variations became more erratic, and the drawdown data in the pumping well showed variations related to this erratic pumping behavior. This response is in the log-log plot of drawdown vs. time for the Newman analysis of MW-17. Recovery at the end of this period was approximately 79% complete in pumping well MW-17, but only 6% complete in observation well MW-7. Thus, only recovery data for MW-17 were deemed sufficiently reliable for the calculation of aquifer hydrologic parameters.

H+GCL calculated transmissivity and storage coefficient values from observation well analyses. Using the average aquifer hydrologic parameters calculated for observation well MW-7 (transmissivity - 119 gpd/ft), a hydraulic gradient of 0.0082, and an aquifer thickness of 16.8 feet, the calculated hydraulic conductivity is 0.58 feet/year and ground water velocity is approximately 3 feet per year.

4.6 Description of Chemical Compounds

The analysis of soil, soil gas, and ground water samples revealed a number of chemical contaminants including chlorinated solvents, aromatic hydrocarbons, and disinfection products. This section provides a brief discussion of the chemical characteristics and toxicology of some of these substances (Gosselin et. al.). The compounds identified on the site are listed in Table 2.

Table 2

Organic Chemicals - Livermore Arcade Shopping Center

	Chemical	Classification	Soil	Soil Gas	Groundwater
1.	cis-1,2-Dichloroethene	Chlorinated solvent		√	√
2.	Methylene chloride	Chlorinated solvent	√		
3.	Tetrachloroethene	Chlorinated solvent	√	√	√
4.	1,1,1-Trichloroethane	Chlorinated solvent	√		
5.	Toluene	Aromatic hydrocarbon		√	√
6.	Trichloroethene	Chlorinated solvent		√	√
7.	Xylene	Aromatic hydrocarbon		√	√
8.	Benzene	Aromatic hydrocarbon			√
9.	bis (2-Ethylhexyl) Phthalate	Plasticiser			√
10.	Bromodichloromethane	Disinfection byproduct			√
11.	Bromoform	Disinfection byproduct			√
12.	Chloroform	Disinfection byproduct			√
13.	Dibromochloromethane	Disinfection byproduct			√
14.	Ethyl benzene	Aromatic hydrocarbon			√
15.	Freon 12	Fluorocarbon propellant			√
16.	Phenol	Disinfection product			√

(1) cis-1,2-Dichloroethene

Also known as ethylene dichloride, or EDC, this compound is a colorless liquid, which is heavier then water and has a sweet odor. It is commonly used as an insecticide fumigant in stored crops and in soil. It is also used as a component in gasoline, as a metal degreasing agent and as a solvent in printing inks and adhesives. EDC is a hepto-neuro toxin. Acute exposure is known to cause central nervous system depression, reduced blood pressure, and cardiac impairment. Symptoms of EDC exposure include signs of intoxication, headaches, nausea, vomiting, dizziness, watery stools, internal bleeding, cyancosis, weak and rapid pulse, and loss of consciousness. EDC can be a degradation product of PCE.

(2) Methylene Chloride

Methylene chloride is a volatile liquid used as a paint remover, degreasing solvent, aerosol propellant and grain fumigant. Although it is considered one of the least toxic of the chlorinated hydrocarbons, methylene chloride may produce central nervous system depression. It is easily absorbed through the skin, and dermal exposure for as little as two minutes has been found to cause severe pain. Exposure of 2300 ppm for 30 minutes is said to cause nausea and narcosis.

(3) Tetrachloroethene

Tetrachloroethene (PCE), also called perchloroethylene, is a clean, colorless volatile liquid with an ether-like odor. It is non-combustible, insoluble in water, and has vapors heavier than air. It is used as a dry cleaning and vapor degreasing solvent, a drying agent for metals, and for the manufacture of other chemicals. It is widely used as an anthelmintic in veterinary medicine, and has been used as an oral treatment for hookworms in humans. The vapors are irritating to skin, eyes, and the upper respiratory tract.

(4) 1,1,1-Trichloroethane

Also known as Methyl chloroform, Chlorothene, and Trichloroethane, this liquid is used widely as a solvent. It is also found in consumer aerosol formulations. Human deaths have resulted from very high levels of exposure in enclosed spaces; high vapor concentrations cause central nervous system depression, leading to respiratory arrest. Exposure to normal household or industrial concentrations has little or no significant toxicological effect. The compound is irritating to eyes but causes only mild irritation to skin.

(5) Toluene

Toluene is a clear colorless liquid with a characteristic aromatic odor. It is used in aviation and automotive fuels, as a solvent for many materials, and in the manufacture of other chemicals. It has a flash point of 40° F, is lighter then water and is insoluble in water. The toluene vapors are heavier then air. High concentrations of toluene are irritating to the skin and eyes and cause headaches, nausea, vomiting, breathing difficulties and narcosis. Very high exposure may result in death due to respiratory arrest and consequent asphyxia.

(6) Trichloroethene

Trichloroethene (TCE) is a clean colorless volatile liquid having a chloroform-like odor. It is an important industrial degreasing agent and solvent. It is also used as an inhalation anesthetic in obstetrics and for short operative procedures. The general public can be exposed to TCE in cleaning fluids, and as an additive in some decaffinated coffees and spice abstracts. Acute intoxication can result from inhalation of vapors and through accidental ingestion. Symptoms of acute inhalation include depressed consciousness, headaches, nausea, incoordination and mild excitation or euphoria. TCE is a degradation product of PCE.

(7) Xylene

Xylene is a colorless, liquid which is lighter then water and has a sweet odor. It is flammable and produces a irritating vapor. Like toluene, xylene is widely used in industry. It is found as a common ingredient in many consumer products including paints, paint removers, degreasing cleaners, lacquers, glues, cements and as a vehicle in pesticides. Xylene is toxic by all portals of entry, although dermal absorptions is generally too slow to produce symptoms of acute poisoning. Skin contact however results in dermatitis, which has been attributed to the removal of protective fat. Acute exposure to xylene results in local irritation, central nervous system excitation and depression. Like toluene, very high exposure may result in death due to respiratory arrest and consequent asphyxia.

(8) Benzene

Benzene is a clean colorless liquid with a characteristic aromatic odor. It is used as a gasoline additive, as a solvent, and in the production of other chemicals. It is flammable, has a flash point of 12° F., and solidifies at 42° F. It is lighter then water, insoluble in water, and it's vapors are heavier then air. It is irritating to the eyes, nose, and throat, and if inhaled can cause headaches, breathing difficulties, and/or loss of consciousness. Benzene is more toxic then any of the other aromatic hydrocarbons.

(9) Bis (2 ethylhexyl) phthalate

Bis (2 ethylhexyl) phathlate, also known as Di-2-ethylhexyl phthalate (DEHP) is commonly used as a plasticiser in polyvinyl chloride, especially in the manufacture of medical devices. Since it is soluble in blood and other fluids containing lipoproteins, DEHP has been found to leach into food and blood stored in PVC wrap. Adult humans has been found to experience mild gastric disturbance after ingestion. DHEP is considered an environmental contaminant with the potential for bio-accumulation through the food chain.

(10) Bromodichloromethane

Bromodichloromethane is a byproduct of the chlorination process used in the disinfection of public water supplies. In the concentrations found in the ground water on the site, it is not considered hazardous.

(11) Bromoform

Bromoform is a byproduct of the chlorination process used in the disinfection of public water supplies. In the concentrations found in the ground water on the site, it is not considered hazardous.

(12) Chloroform

Chloroform is a clear, colorless, heavy liquid with a characteristic odor. It is heavier then water, and slightly water soluble. It is used as a solvent, as a fumigant, and to make other chemicals. It is classified as a mild toxin , and is suspected of being a carcinogen. It is also a gastrointestinal irritant and a central nervous system depressant. The mean lethal dose is probably about 1 fluid ounce. It can cause illness by inhalation, skin absorption, and/or ingestion. Symptoms of exposure include fainting, vomiting, dizziness, salivation, nausea, fatigue and headaches. Other symptoms include chronic depression, coma, and kidney and liver damage.

(13) Dibromochloromethane

Bromoform is a byproduct of the chlorination process used in the disinfection of public water supplies. In the concentrations found in the ground water on the site, it is not considered hazardous.

(14) Ethyl benzene

Ethyl benzene is a colorless, liquid which is lighter then water and has a sweet odor. It is flammable and produces a irritation vapor. It is used in gasoline, as a solvent, and to make other chemicals. It has a flashpoint of 59° F, is lighter then water, insoluble in water, and produces vapors which are heavier then air. The vapor is irritating to the eyes nose and throat, and if inhaled it will cause dizziness or breathing difficulties. In the liquid phase, is will burn the skin and eyes, and is known to have harmful effects if swallowed.

(15) Freon 12

Dichlorodifluoromethane, also known as Freon 12, is used as a propellant in insect aerosol bombs. It is not toxic except for causing lung irritation at very high concentrations. In contact with an open flame or a very hot surface, chlorinated hydrocarbons can decompose into highly irritant and toxic gases. Exposure to high vapor concentrations (e.g. 20%) may cause confusion, pulmonary irritation, tremors, and on rare occasions, coma.

(16) Phenol

Phenol also known as Carbonic acid, Phenylic acid, Hydroxybenzene, or Oxybenzene, is found in many commercial products including antiseptics. It is commonly used domestically as a disinfectant, barn deodorant, and sanitizer. Phenol is available either as a pure crystal, or in a liquefied preparation (88% C_6H_5OH with about 10% H_20). Although dilute solutions are used medically as an antipuritic preparation for the skin, phenol is now commonly recognized as a general protoplasmic poison which is toxic to all cells. The dangers of dermal or inhalation of phenol are poorly understood, although it is known to be rapidly absorbed through the skin. The most common manifestations of phenol poisoning in humans includes central nervous system depression, coma, hypothermia, loss of vasoconstrictor tone, coardia depression, and respiratory arrest.

4.7 Sources of Contamination

Three sources of contamination at the Arcade site have been identified. These include Mike's Cleaners, Paul's Cleaners, and the Beacon Oil Station.

The extent of the chlorinated solvent ground water contamination has been defined through the installation of eighteen monitoring wells throughout the Arcade site. The chlorinated solvent plume remained approximately the same size during 1990 and 1991 monitoring, as it approaches 950 feet in length and 400 feet in width. Including PCE, sixteen organic compounds have been detected in the soil and ground water at the Arcade site (Tables 3 and 4).

No detectable concentrations of pesticides or PCBs were found in soil or ground water samples taken from MW-17 and MW-18. Inorganic compounds were found in soil and ground water at concentrations less than regional background levels (Tables 5 and 6).

Soil vapors from ten monitoring wells at the Arcade site were analyzed with a portable gas chromatograph which detected PCE, toluene, trichloroethene, and p and m xylenes (Table 7). These contaminants are typical of the solvent and gasoline contaminants present at the Arcade site. The highest PCE vapor concentrations were located in MW-7 at Mike's Cleaners and in MW-12 at Paul's Cleaners.

4.7.1 Mike's Cleaners

The most significant source of contamination at the Arcade Site is Mike's Cleaners, as discussed previously. Significant ground water, soil and soil vapor contamination has been found in the area immediately adjacent to and below the break in the sewer pipe leading from that source.

PCE has been detected in a ground water grab sample from boring B-1 at a concentration of 5800 ug/l. Soil analyses from this boring found PCE concentrations as high as 2300 ug/kg. Trichloroethene was detected in the ground water at a level of 140 ug/l. Soil vapor analyses of MW-7 near Mike's Cleaners detected PCE at 772,000 parts per billion and trichlorethene at 3070 parts per billion.

A typical vertical profile of soil and ground water PCE concentration data below Mike's Cleaners shows the highest concentrations near the 1990 ground water level of 422 MSL. PCE concentrations decline rapidly to non-detectable below this elevation (Figure 22).

GENERAL DATA	Boring 1	Boring 1	Boring 1	Boring 1	Boring 2	Boring 2	Boring 3
Boring Depth	12'	16'	44'	54'	4'	54'	12.5'
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
H+GCL I.D. No.	B1-12	B1-16	B1-44	B1-54	B2-4	B2-54	B3-12.5
Date Sampled	5/25/90	5/25/90	5/25/90	5/25/90	5/25/90	5/25/90	7/26/90
Lab I.D. No.	05-802-1	05-802-2	05-802-3	05-802-4	05-802-5	05-802-6	07-628-2
COMPOUNDS							
Benzene	<200	<200	<200	<200	<200	<200	<200
C6-C13 Hydrocarbons							
C10 Hydrocarbon				4,000			
cis-1-2-Dichloroethene	<200	<200	<200	<200	<200	<200	<200
Methylene chloride	<200	<200	<200	<200	<200	<200	<1,000
Tetrachloroethene	**<200**	**300**	**2,300**	**200**	**500**	**200**	**300**
1,1,1-Trichloroethane	<200	1,000	900	1,900	<200	1,700	<200

Table 3 - Organic Chemicals in Soil (ug/kg)

GENERAL DATA	Boring 3	Boring 4	Boring 4	Boring 4	MW4	MW5	MW6
Boring Depth	16.5'	6.5'	11.5'	17.5'	21'	26'	20'
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
H+GCL I.D. No.	B3-16.5	B4-6.5	B4-11.5	B4-17.5	MW-4-21	MW-5-26	MW-6-20
Date Sampled	31618	7/26/90	7/26/90	7/26/90	5/29/90	5/29/90	5/31/90
Lab I.D. No.	07-628-1	07-628-3	07-628-4	07-628-5	05-842-1	05-842-2	05-908-1
COMPOUNDS							
Benzene	<200	<200	<200	<200	<200	<200	<200
C6-C13 Hydrocarbons							
C10 Hydrocarbon							
cis-1-2-Dichloroethene	<200	<200	<200	<200	<200	<200	<200
Methylene chloride	<1,000	<1,000	<1,000	<1,000	<200	<200	<200
Tetrachloroethene	**500**	**<200**	**500**	**300**	**<200**	**<200**	**<200**
1,1,1-Trichloroethane	<200	<200	<200	<200	<200	3,500	<200

Table 3 - Organic Chemicals in Soil (ug/kg)

GENERAL DATA	MW7	MW7	MW7	MW7	MW7	MW17	MW17
Boring Depth	19.5'	31'	41.3'	61'	66.5'	42'	45'
Laboratory	BCA	BCA	BCA	BCA	BCA	C & T	C & T
H+GCL I.D. No.	MW-7-19.5	MW-7-31	MW-7-41.3	MW-7-61	MW-7-66.5	1191015	1191030
Date Sampled	6/1/90	6/1/90	6/1/90	6/1/90	6/1/90	1/19/92	1/19/92
Lab I.D. No.	06-048-1	06-048-2	06-048-3	06-048-4	06-048-5	106309-9	106309-2
COMPOUNDS							
Benzene	<200	<200	<200	<200	<200	<5	<5
C6-C13 Hydrocarbons				60,000			
C10 Hydrocarbon							
cis-1-2-Dichloroethene	<200	<200	<200	<200	<200	<5	<5
Methylene chloride	<200	<200	<200	<200	<200	<5	<5
Tetrachloroethene	**<200**	**300**	**400**	**<200**	**<200**	**570.0**	**79**
1,1,1-Trichloroethane	500	<200	<200	300	<200	<5	<5

Table 3 - Organic Chemicals in Soil (ug/kg)

GENERAL DATA	MW17	MW17	MW17	MW17	MW17	MW17	MW17
Boring Depth	50'	55'	60'	65'	70'	74'	81'
Laboratory	C & T	C & T	C & T	C & T	C & T	C & T	C & T
H+GCL I.D. No.	11911046	1191105	1191119	1191120	10191146	1191210	1191245
Date Sampled	1/19/92	1/19/92	1/19/92	1/19/92	1/19/92	1/19/92	1/19/92
Lab I.D. No.	106309-4	106309-1	106309-5	106309-6	106309-3	106309-8	106309-7
COMPOUNDS							
Benzene	<5	<25	<5	3.3	<5	<5	<5
C6-C13 Hydrocarbons							
C10 Hydrocarbon							
cis-1-2-Dichloroethene	<5	15	2.9	2.9	<5	<5	<5
Methylene chloride	11.0	<25	<5	11.0	11.0	8.3	<5
Tetrachloroethene	**34.0**	**43**	**3.5**	**3.9**	**<5**	**<5**	**<5**
1,1,1-Trichloroethane	<5	<25	<5	<5	<5	<5	<5

Table 3 - Organic Chemicals in Soil (ug/kg)

GENERAL DATA	MW18	MW18	MW18	MW18	MW18	MW18
Boring Depth	40'	46'	51'	55.5'	60'	69'
Laboratory	C & T	C & T	C & T	C & T	C & T	C & T
H+GCL I.D. No.	40	46	51	55.5	60	69
Date Sampled	1/28/92	1/28/92	1/28/92	1/28/92	1/28/92	1/28/92
Lab I.D. No.	106403-2	106403-1	106403-3	106403-4	106403-5	106403-6
COMPOUNDS						
Benzene	<5	<5	<5	<5	<5	<5
C6-C13 Hydrocarbons						
C10 Hydrocarbon						
cis-1-2-Dichloroethene	<5	<5	<5	<5	<5	<5
Methylene chloride	<5	<5	<5	<5	<5	<5
Tetrachloroethene	**25**	**11**	**10**	<5	<5	<5
1,1,1-Trichloroethane	<5	<5	<5	<5	<5	<5

Table 3 - Organic Chemicals in Soil (ug/kg)

GENERAL DATA	Boring 1	Boring 2	CWS-3	CWS-3	CWS-3A	CWS-8	CWS-8
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
Date Sampled	5/25/90	5/25/90	2/4/92	3/3/92	11/26/91	2/4/92	3/3/92
H+GCL I.D. No.	B1	B2	CWS-3	CWS-3	CWS-3A	CWS-8B	CWS-8
Lab I.D. No.	05-801-1	05-801-2	02-035-1	03-065-1	11-649-1	02-035-2	03-065-2
COMPOUNDS							
Alcohol(C6H120)							
Benzene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
1,1 Dichloroethene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
Bis(2-ethylhexyl)phthalate							
Bromoform	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
Bromochloromethane			<.2	<.2		<.2	0.8
Bromodichloromethane	<50.0	<5.0	<.2	0.5	<.5	<.2	<.2
C4-C12 Hydrocarbons							
C5-C9 Hydrocarbons							
C5-C13 Hydrocarbons							
C5-C15 Hydrocarbons							
C6 Hydrocarbons							
C7-C35 Hydrocarbons							
C15-C35 Hydrocarbon							
Carbon Disulfide	<50.0	<5.0					
Chloroform	<50.0	<5.0	<.2	0.7	<.5	0.3	0.4
cis-1,2,-Dichloroethene	79.0	<5.0	<.2	<.2	<.5	<.2	<.2
Dibromochloromethane	<50.0	<5.0	<.2	0.2	<.5	<.2	<.2
Dichlorodifluoromethane					<.5		
Diflorochloromethane							
Ethylbenzene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
Methylene chloride	<50.0	<5.0	<1.0	<1.0	<.5	<1.0	<1.0
Phenol							
Toluene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
Tetrachloroethene	**5,800.0**	**820.0**	**<.2**	**<.2**	**<.5**	**<.2**	**<.2**
trans-1,2-Dichloroethene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2
Trichloroethene	140.0	<5.0	<.2	<.2	<.5	<.2	<.2
Xylene	<50.0	<5.0	<.2	<.2	<.5	<.2	<.2

Table 4 - Organic Chemicals in Ground Water (ug/L)

GENERAL DATA	CWS-8A	MW-1	MW-1	MW-1	MW-2	MW-2	MW-2
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
Date Sampled	11/26/91	3/23/90	3/23/90	4/10/90	3/24/90	3/24/90	4/10/90
H+GCL I.D. No.	CWS-8A	M1(A)	M1(B)	MW-1	M2(B)	M2(A)	MW-2
Lab I.D. No.	11-649-2	03-827-1	03-827-4	04-206-3	03-827-5	03-827-2	04-206-2
COMPOUNDS							
Alcohol(C6H120)							
Benzene	<.5		11,000.0	14,000.0	<1.0		<5.0
1,1 Dichloroethene	<.5		<100.0	<100.0	<1.0		<5.0
Bis(2-ethylhexyl)phthalate							
Bromoform	<.5		<100.0	<100.0	<1.0		<5.0
Bromochloromethane							
Bromodichloromethane	<.5		<100.0	<100.0	<1.0		<5.0
C4-C12 Hydrocarbons		84,000.0		69,000.0		100.0	60.0
C5-C9 Hydrocarbons							
C5-C13 Hydrocarbons			20,000.0	20,000.0			
C5-C15 Hydrocarbons							
C6 Hydrocarbons							
C7-C35 Hydrocarbons							
C15-C35 Hydrocarbon							
Carbon Disulfide			<100.0	<100.0	<1.0		<5.0
Chloroform	<.5		<100.0	<100.0	<1.0		<5.0
cis-1,2,-Dichloroethene	<.5		<100.0	<100.0	<1.0		<5.0
Dibromochloromethane	<.5		<100.0	<100.0	<1.0		<5.0
Dichlorodifluoromethane	<.5						
Diflorochloromethane							
Ethylbenzene	<.5		3,400.0	3,500.0	<1.0		<5.0
Methylene chloride	<.5		<100.0	<100.0	<1.0		<5.0
Phenol							
Toluene	<.5		22,000.0	25,000.0	<1.0		<5.0
Tetrachloroethene	**<.5**		**<100.0**	**<100.0**	**330.0**		**350.0**
trans-1,2-Dichloroethene	<.5		<100.0	<100.0	<1.0		<5.0
Trichloroethene	<.5		<100.0	<100.0	<1.0		<5.0
Xylene	<.5		20,000.0	20,000.0	<1.0		<5.0

Table 4 - Organic Chemicals in Ground Water (ug/L)

GENERAL DATA	MW-3	MW-3	MW-3	MW-4	MW-5	MW-6	MW-6
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
Date Sampled	3/23/90	3/23/90	4/10/90	5/30/90	5/30/90	6/4/90	3/5/91
H+GCL I.D. No.	M3(A)	M3(B)	MW-3	MW-4	MW-5	MW-6	MW-6
Lab I.D. No.	03-827-3	03-827-6	04-206-1	05-880-1	05-880-2	06-048-6	03-113-1
COMPOUNDS							
Alcohol(C6H120)							
Benzene		<1.0	<1.0	<1.0	400.0	<1.0	<1.0
1,1 Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate							
Bromoform		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bromochloromethane							
Bromodichloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
C4-C12 Hydrocarbons	<50.0		<50.0			<50.0	
C5-C9 Hydrocarbons							
C5-C13 Hydrocarbons							
C5-C15 Hydrocarbons					500.0		
C6 Hydrocarbons							
C7-C35 Hydrocarbons							
C15-C35 Hydrocarbon							
Carbon Disulfide		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chloroform		<1.0	<1.0	<1.0	<1.0	<1.0	1.0
cis-1,2,-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibromochloromethane		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dichlorodifluoromethane							
Diflorochloromethane							
Ethylbenzene		<1.0	<1.0	<1.0	31.0	<1.0	<1.0
Methylene chloride		<1.0	<1.0	<1.0	<1.0	<1.0	<5.0
Phenol							
Toluene		<1.0	<1.0	<1.0	22.0	<1.0	<1.0
Tetrachloroethene		**<1.0**	**<1.0**	**<1.0**	**2.0**	**35.0**	**43.0**
trans-1,2-Dichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trichloroethene		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Xylene		<1.0	<1.0	<1.0	45.0	<1.0	<1.0

Table 4 - Organic Chemicals in Ground Water (ug/L)

GENERAL DATA	MW-6	MW-7	MW-7	MW-7	MW-8	MW-9	MW-9
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
Date Sampled	7/25/91	6/4/90	3/5/91	7/26/91	7/26/90	7/26/90	3/5/91
H+GCL I.D. No.	MW-6	MW-7	MW-7	MW-7	MW-8	MW-9	MW-9
Lab I.D. No.	07-597-4	06-048-7	03-113-2	07-618-1	07-628-7	07-682-6	03-113-3
COMPOUNDS							
Alcohol(C6H120)							
Benzene	<.5	63.0	<20.0	31.0	<1.0	<1.0	<1.0
1,1 Dichloroethene	<.5	<10.0	<20.0	<20.0	<1.0	<1.0	<1.0
Bis(2-ethylhexyl)phthalate							
Bromoform	<.5	<10.0	<20.0	<20.0	<1.0	2.0	<1.0
Bromochloromethane							
Bromodichloromethane	<.5	<10.0	<20.0	<20.0	2.0	10.0	<1.0
C4-C12 Hydrocarbons		12,000.0					
C5-C9 Hydrocarbons		30.0					
C5-C13 Hydrocarbons							
C5-C15 Hydrocarbons							
C6 Hydrocarbons							
C7-C35 Hydrocarbons							
C15-C35 Hydrocarbon							
Carbon Disulfide	<.5	<10.0	<20.0	<20.0	<1.0	<1.0	<1.0
Chloroform	1.1	<10.0	<20.0	<20.0	2.0	20.0	2.0
cis-1,2,-Dichloroethene	<.5	140.0	37.0	120.0	6.0	<1.0	<1.0
Dibromochloromethane	<.5	<10.0	<20.0	<20.0	<1.0	7.0	<1.0
Dichlorodifluoromethane							
Diflorochloromethane							
Ethylbenzene	<.5	<10.0	<20.0	<20.0	<1.0	3.0	<1.0
Methylene chloride	<2.0	<10.0	<100.0	<100.0	<5.0	<5.0	<5.0
Phenol							
Toluene	<.5	11.0	<20.0	<20.0	<1.0	<1.0	<1.0
Tetrachloroethene	**74.0**	**900.0**	**1,700.0**	**1,600.0**	**580.0**	**<1.0**	**<1.0**
trans-1,2-Dichloroethene	<.5	<10.0	<20.0	<20.0	<1.0	<1.0	<1.0
Trichloroethene	<.5	26.0	190.0	230.0	17.0	<1.0	<1.0
Xylene	<.5	840.0	<20.0	<20.0	<1.0	<1.0	<1.0

Table 4 - Organic Chemicals in Ground Water (ug/L)

GENERAL DATA	MW-9	MW-10	MW-10	MW-11	MW-12	MW-13	MW-13
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	BCA
Date Sampled	7/25/91	8/25/90	7/26/91	8/25/90	9/6/90	9/24/90	9/28/90
H+GCL I.D. No.	MW-9	MW10-A & B	MW-10	MW11-A & B	MW-12	MW-13	MW-13
Lab I.D. No.	07-597-3	08-592-2	07-618-2	08-592-1	09-101-1	09-477-1	09-598-1
COMPOUNDS							
Alcohol(C6H120)							
Benzene	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
1,1 Dichloroethene	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Bis(2-ethylhexyl)phthalate							
Bromoform	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Bromochloromethane							
Bromodichloromethane	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
C4-C12 Hydrocarbons							
C5-C9 Hydrocarbons							
C5-C13 Hydrocarbons							
C5-C15 Hydrocarbons							
C6 Hydrocarbons							
C7-C35 Hydrocarbons							
C15-C35 Hydrocarbon							
Carbon Disulfide	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Chloroform	1.0	<1.0	<1.0	<5.0	1.0	<1.0	<1.0
cis-1,2,-Dichloroethene	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Dibromochloromethane	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Dichlorodifluoromethane							
Diflorochloromethane							
Ethylbenzene	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Methylene chloride	<2.0	<5.0	<5.0	<20.0	<2.0	<5.0	<5.0
Phenol							
Toluene	<.5	<1.0	<1.0	<5.0	1.4	<1.0	<1.0
Tetrachloroethene	**<.5**	**35.0**	**22.0**	**100.0**	**170.0**	**23.0**	**36.0**
trans-1,2-Dichloroethene	<.5	<1.0	<1.0	<5.0	<.5	<1.0	<1.0
Trichloroethene	<.5	<1.0	<1.0	<5.0	1.1	<1.0	<1.0
Xylene	0.7	<1.0	<1.0	<5.0	<.5	<1.0	<1.0

Table 4 - Organic Chemicals in Ground Water (ug/L)

GENERAL DATA	MW-13	MW-13	MW-14	MW-14	MW-14	MW-15	MW-17	MW-17	MW-18
Laboratory	BCA	BCA	BCA	BCA	BCA	BCA	C & T	BCA	BCA
Date Sampled	3/5/91	7/25/91	9/24/90	3/5/91	7/25/91	10/10/90	1/21/92	3/3/92	3/3/92
H+GCL I.D. No.	MW-13	MW-13	MW-14	MW-14	MW-14	MW-15	1210500	MW-17	MW-18
Lab I.D. No.	03-113-4	07-597-2	09-477-2	03-113-5	07-597-1	10-242-1	106331-1	03-065-4	03-065-5
COMPOUNDS									
Alcohol(C6H120)								10.0	
Benzene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	1.0	59.0	<1.0
1,1 Dichloroethene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	190.0	<1.0
Bis(2-ethylhexyl)phthalate								20.0	<4.0
Bromoform	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
Bromochloromethane									
Bromodichloromethane	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
C4-C12 Hydrocarbons									
C5-C9 Hydrocarbons									
C5-C13 Hydrocarbons									
C5-C15 Hydrocarbons									
C6 Hydrocarbons									
C7-C35 Hydrocarbons								1,000.0	
C15-C35 Hydrocarbon									500.0
Carbon Disulfide	<1.0	<.5	<1.0	<1.0	<.5	<1.0			
Chloroform	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
cis-1,2,-Dichloroethene	<1.0	<.5	5.0	<1.0	2.1	<1.0	12.0	190.0	<1.0
Dibromochloromethane	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
Dichlorodifluoromethane								<5.0	7.0
Diflorochloromethane					20.0				
Ethylbenzene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
Methylene chloride	<5.0	<2.0	<5.0	6.0	<2.0	<5.0	1.1	<5.0	<1.0
Phenol								5.0	<5.0
Toluene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
Tetrachloroethene	**34.0**	**30.0**	**5.0**	**<1.0**	**1.1**	**<1.0**	**49.0**	**540.0**	**200.0**
trans-1,2-Dichloroethene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0
Trichloroethene	<1.0	<.5	1.0	<1.0	0.7	<1.0	1.1	70.0	2.0
Xylene	<1.0	<.5	<1.0	<1.0	<.5	<1.0	<1.0	<5.0	<1.0

Table 4 - Organic Chemicals in Ground Water (ug/L)

Table 5 - Inorganic Chemicals Concentrations in Soil

General Data Boring Depth Laboratory H+GCL I. D. No. Date Sampled Lab I. D. No.	MW-17 42' C & T 1191015 1/19/92 106406-1	MW-18 40' C & T 40 1/27/92 106403-2	Regional Background Concentrations*
Compound	mg/kg	mg/kg	mg/kg
Antimony	<3	<3	
Arsenic	<2.5	<2.5	
Barium	117	115	70 - 5,000
Beryllium	0.250	0.260	<1 - 15
Cadmium	<0.250	<0.250	
Chromium	50.1	51.2	3 - 2,000
Cobalt	17.9	15.5	<3 - 50
Copper	23.1	28.6	2 - 300
Lead	<3	3	<10 - 700
Mercury	0.290	<0.100	<0.01 - 4.6
Molybdenum	<0.700	<0.700	
Nickel	145	129	<5 - 700
Selenium	<2.5	<2.5	
Silver	<0.500	<0.500	
Thallium	<2.5	<2.5	
Vanadium	22.1	20.7	7 - 500
Zinc	40.3	40	10 - 2,100

* Surficial Soils, Western U. S. A. (USGS, 1984; 1975)

Table 6- Inorganic Chemical Concentrations in Water			
General Data Laboratory H+GCL I. D. No. Date Sampled Lab I. D. No.	MW-17 BCA MW-17 3/3/92 03-065-4	MW-18 BCA MW-18 3/3/92 03-065-5	Maximum Contaminant Levels
Compound	mg/L	mg/L	mg/L
Antimony	<0.200	<0.200	
Arsenic	0.004	0.004	0.05
Barium	0.190	0.080	1.0
Beryllium	<0.010	<0.010	
Cadmium	<0.050	<0.050	0.010
Chromium	<0.050	<0.050	0.05
Cobalt	<0.050	<0.050	
Copper	<0.050	<0.050	
Lead	<0.200	<0.200	0.05
Mercury	<0.0002	<0.0002	0.002
Molybdenum	<0.200	<0.200	
Nickel	<0.100	<0.100	
Selenium	<0.002	<0.002	0.01
Silver	<0.050	<0.050	0.05
Thallium	<0.200	<0.200	
Vanadium	<0.050	<0.050	
Zinc	0.050	0.090	

Table 7 - Gas Chromatograph Analytical Results for Well Vapors

Well	Benzene	Toluene	Ethylbenzene	P, M-Xylene	O-Xylene	1,1,1-TCA	TCE	PCE
MW-2								977
MW-6								25,300
MW-7		937					3,070	772,000
MW-8								2,910
MW-9							258	570
MW-10								601
MW-11								4,280
MW-12								292,000
MW-13								5,390
MW-17		5,570		53				10,800

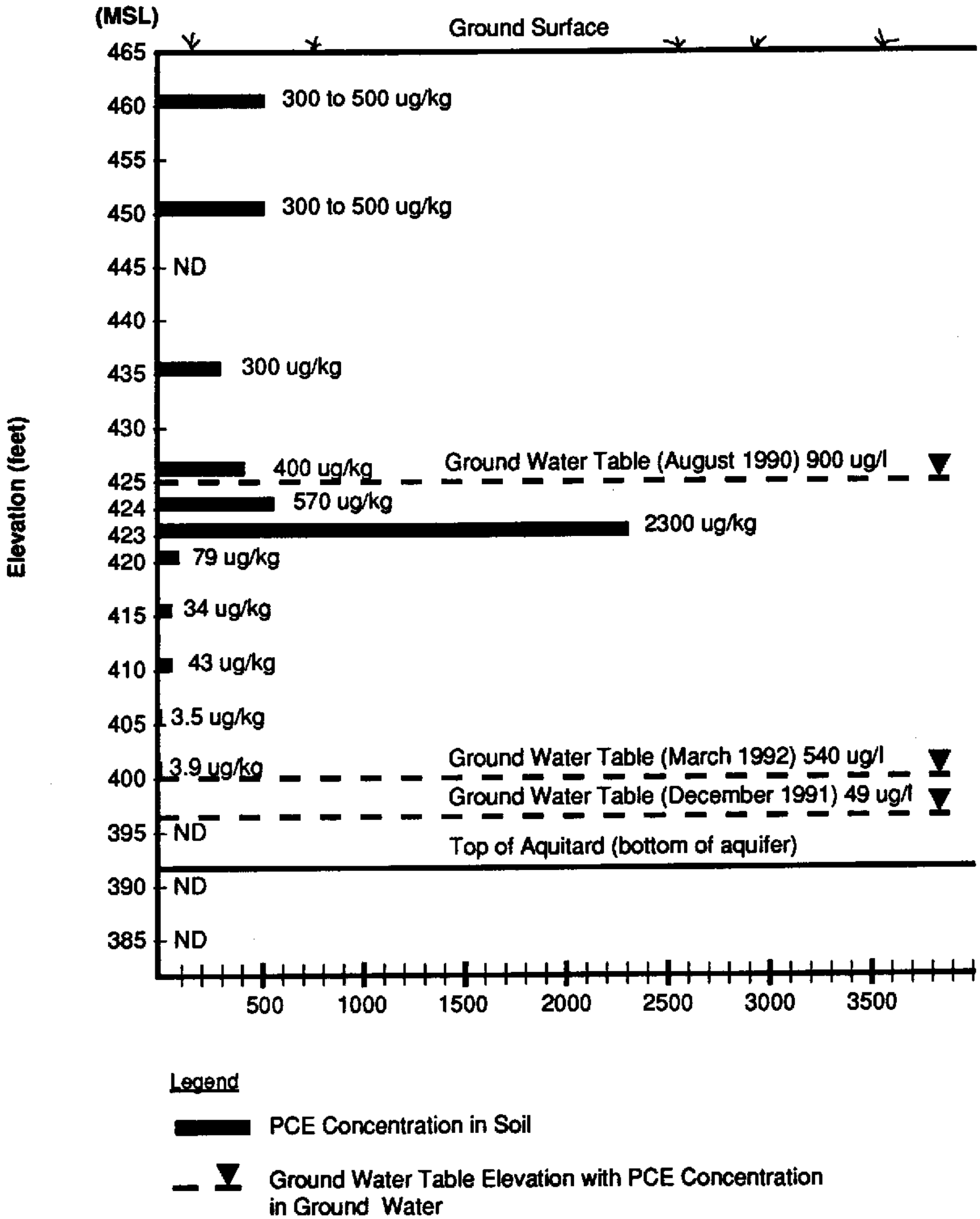
Notes:

ND = None Detected
1,1,1-TCA = Trichloroethane
TCE = Trichloroethylene
PCE = Tetrachloroethylene

All analytical data is reported in (ug/L) parts per billion by volume.

Figure 22: Typical Profile of PCE near Mike's Cleaners

(combined soil and ground water analysis data from MW-7, MW-17, B1, B2, B3, B4 demonstrating maximum PCE concentrations at 1990 ground water table elevations)



4.7.2 Paul's Cleaners

An increase in chlorinated solvent concentrations was detected in MW-12 at Paul's Cleaners. A PCE concentration of 100 ug/l was detected in MW-11 directly up-gradient from Paul's Cleaners while a PCE concentration of 170 ug/l was detected in MW-12, directly down-gradient of Paul's Cleaners. Soil vapor analyses at MW-12 near Paul's Cleaners detected PCE at 292,000 parts per billion.

A typical vertical profile of soil and ground water PCE concentration data below Paul's Cleaners shows concentrations near the 1990 ground water level of 420 MSL (Figure 23).

4.7.3 Beacon Oil Station

The Beacon Oil Station located southeast of the Livermore Arcade Shopping Center is reported to have had leaking underground gasoline storage tanks. Data from MW-1, MW-5, MW-7, and MW-17 demonstrate that a gasoline contaminant plume has impacted the eastern side of the Arcade site and has originated in the vicinity of Beacon. Benzene, ethylbenzene, toluene, and xylene were detected at concentration levels representing saturation of the ground water in MW-1. No current or historical use of gasoline has been discovered at the Livermore Arcade Shopping Center. No gasoline or fuel product constituents have been detected in the soil at the Arcade site.

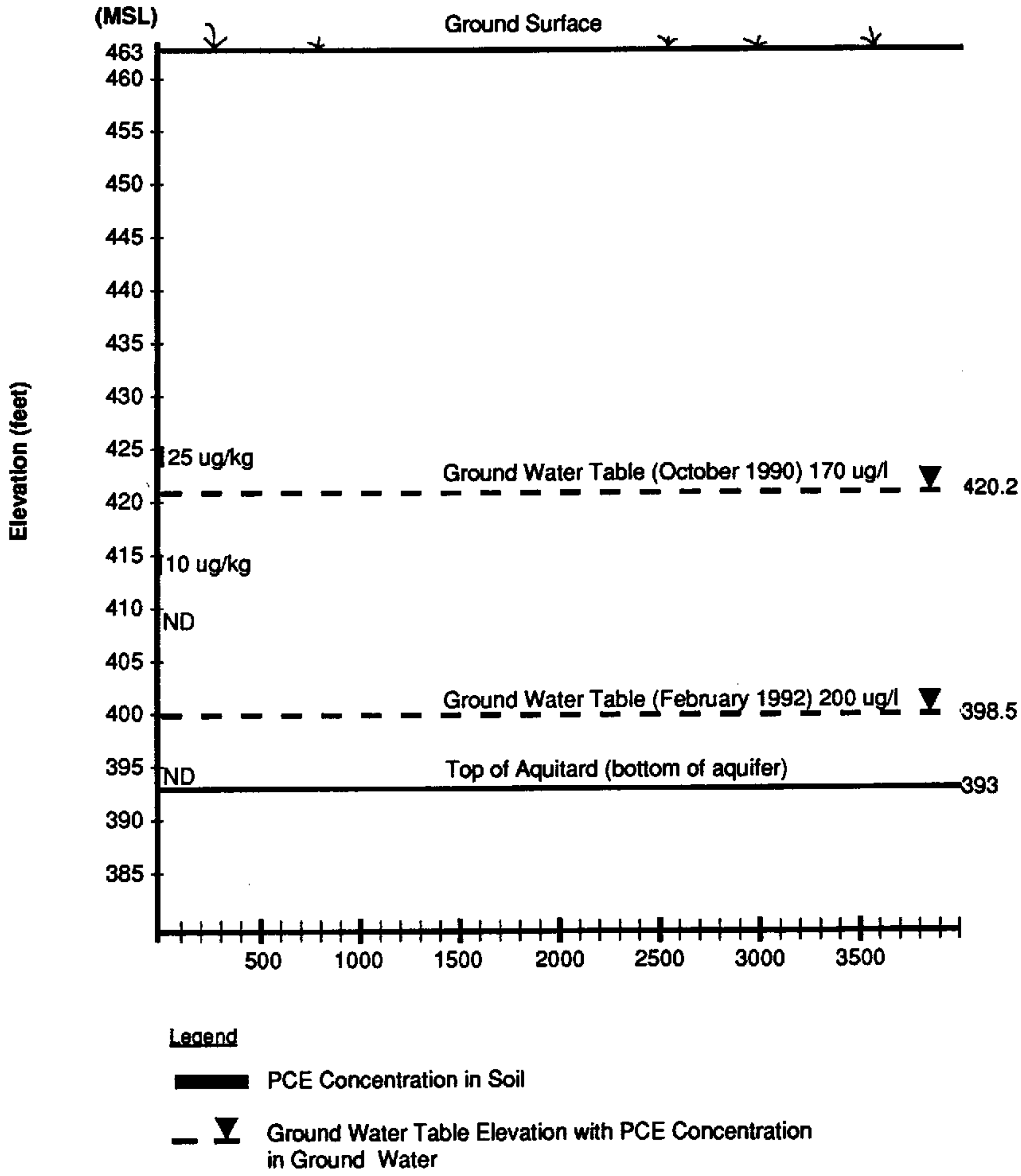
4.7.4 Other Sources

Phthalate contaminant may have occurred from the sampling equipment. Phenol may have entered the sewer drain and leaked through the sewer pipe in the same manner as the solvents. Methylene chloride was detected in in several ground water samples analyzed at the Curtis and Tompkins Laboratory. The appearance of this compound was a result of cross contamination within the laboratory. This is documented in the original analytical results provided in Appendix 2.

Drinking water disinfection byproducts were discovered in monitoring wells MW-1, MW-8, MW-9, CWS-8 and CWS-3. These chemicals are byproducts of the drinking water disinfectant process and will not require remediation. Leaking domestic water lines may be a source of these chemicals. Bromodichloromethane, bromochloromethane, bromoform, and chloroform were detected at concentrations of 11 ug/l or less.

Figure 23: Typical Profile of PCE near Paul's Cleaners

(combined soil and ground water analysis data from MW-12 and MW-18)



4.8 Risk Assessment

Following a health conservative methodology, the lifetime upperbound cancer risk to the future on-site adult and child/adult resident is calculated via the soil ingestion, dermal absorption of soil, and soil gas inhalation pathways. These lifetime cancer risk estimates range from 1E-08 to 2E-07. The highest risks are estimated for the soil dermal absorption and soil gas inhalation pathways (child/adult scenario) as 2E-07 (two cases of cancer per ten million exposed individuals). These lifetime cancer risks are negligible as the DTSC considers 1E-06, or one-in-a-million cases of cancer as a potential benchmark of regulatory concern. This level is also below the 1E-05 level applied by Proposition 65.

Hazard Index (HI) estimates were calculated reflecting the potential for adverse health effects to occur in the future on-site residents from exposures to non-carcinogens. The HI estimates for the soil ingestion, dermal absorption and soil gas inhalation exposure pathways range from 6E-05 to 2E-02. Because the HI estimates are less than unity (one), the regulatory level of concern, no adverse health effects attributable to exposure to non-carcinogens via the soil ingestion, dermal absorption, and soil gas inhalation pathways are expected to occur in the future on-site adult or child/adult residential populations.

Since health risks to the future on-site residents are estimated as negligible via the soil gas inhalation exposure pathway, it is reasonable to conclude that health risks to potential present case receptors via soil gas inhalation exposure pathway, it is reasonable to conclude that health risks to potential present case receptors via soil gas inhalation is even more negligible. The asphalt and concrete currently covering the shopping center would decrease the ability of the soil gas VOCs to volatilize upward into the breathing zone, such that CDI estimates for receptors in the present case scenario would be significantly less than CDI's estimated for the future case receptors. Therefore, resulting health risks to receptors in the present case scenario, conservatively assuming daily exposure, 24 hours/day for 30 years, would be less than the health risks estimated for the future on-site residents.

The results from the estimation of cancer risk and non-carcinogenic adverse health effects to the future on-site adult and child/adult residents from exposure to ground water, however, suggest that the organic compounds in ground water may pose a health risk to these receptors. As described above, carcinogenic lifetime cancer risk and non-carcinogenic HIs are estimated for each ground water well separately. The highest cancer risk estimates for the future on-site adult resident are 1E-02 at MW-1, arising primarily from benzene, and 4E-03 at B1-U, contributed by PCE. Fifteen of 19 wells pose potential risks greater than the 1E-06 benchmark. The cancer risk estimate is 1E-06 or greater from all

19 ground water wells for the future on-site child/adult resident. The highest calculated risks were 1E-02 at MW-1 (benzene), and 5E-03 at B1-U (PCE).

HIs for nine of the 19 wells are equal to or exceed the 1E+00 benchmark for both the future on-site adult and child/adult residents. MW-1 and B1-U are also the locations generating the highest HIs. The HI for the future on-site adult is 1E+01 at MW-1 and 4E+01 at B1-U. The HI for the future on-site child/adult is 2E+01 at MW-1 and 4E+01 at B1-U. Toluene and total xylenes drive the HI for MW-1, while the high HI at B1-U arises from PCE.

The baseline HRA also provides health risk estimates for ground water use based on the results of the environmental fate and transport modeling for two cases. The modeling is conducted to estimate the extent of migration for the organic chemicals detected in soil and their potential impacts on ground water. Case #1 provides estimated ground water concentrations and health risk estimates assuming that precipitation at the site can infiltrate through the soils and impact ground water. Case #2 models VOCs migration assuming that the water table of the upper aquifer will rise in the future and will desorb the VOCs detected in the lower soils thereby increasing VOC concentrations in ground water. Both of these cases assume that the upper and lower aquifers are connected.

The results of both of these cases indicate that the lifetime cancer risks and hazard indices for ground water use are higher in the upper aquifer compared to the lower aquifer. For Case #1, the lifetime cancer risks for the future on-site adult resident range from 5E-06 to 1E-05 in the upper aquifer and 3E-06 to 4E-06 in the lower aquifer. The range of lifetime cancer risks from exposures to VOCs in the upper and lower aquifers for the child/adult resident are 7E-06 to 1E-05, and 4E-06 to 5E-06, respectively. The risk estimates are presented as a range because the thickness of the water bearing zone in the upper aquifer is dynamic and it is certain that the thickness will vary in the future. HI estimates for the future on-site resident are negligible. The maximum HIs are associated with the upper aquifer and range fro 6E-02 to 2E-01 and 1E-01 to 2E-01 for the future on-site adult and child/adult, respectively. As indicated by these results, risk levels in Case #2 (which assumes recontamination of the upper aquifer from contamination presently in the soil) are up to 100 times higher than Case #1 (where no recontamination is assumed). Eliminating PCE from the shallow soils will prevent this recontamination, thus resulting in up to a 100-fold decrease in risk to public health.

The estimated health risks for Case #2 are higher than the risks estimated for Case #1. The lifetime cancer risk for the future on-site adult resident are estimated as 5E-04 for the upper aquifer and 2E-04 for the lower aquifer. The lifetime cancer rise estimates for the child/adult resident are derived as 7E-04 and 4E-04 for the upper and lower aquifers. All of the estimated hazard indices are greater than unity indicating the potential for adverse non-carcinogenic health impacts in the future populations. The HIs for the future on-site adult resident are estimated as 6E+00 for the upper aquifer and 3E+00 for the lower aquifer. The HI estimates for the child/adult resident are 7E+00 and 3E+00 for the upper and lower aquifers, respectively.

Since health conservative assumptions have been used throughout the HRA, the risk estimates should be viewed as upper-bound estimates of the potential risk arising from the organic compounds detected at the Livermore Arcade Shopping Center. Using this methodology, it is likely that the actual risks posed by these chemicals are considerably less than the risk estimates derived in the baseline HRA.

5.0 DISCUSSION AND CONCLUSIONS

5.1 Summary of Major Findings

Several important findings relevant to determining a remedial action for the site are presented below.

1. The Livermore Arcade was constructed in 1972. Before that time, the general area was occupied by warehouses. A grocery store existed on the site in the 1960s.

2. Mike's Cleaners began dry cleaning operations in early 1982. Before that time, the unit was occupied by a pet shop.

3. The sanitary sewer pipe between the site of Mike's Cleaners and the main sewer line is disjointed, exposing the soils near this breach to wastewater within the pipe.

4. Waste manifests from 1987 to the present show that the current owner of Mike's Cleaners disposes of approximately 55 gallons of dry cleaning solvent (PCE) per year to an off-site facility.

5. There are no records of off-site waste disposal of dry cleaning solvents before 1987.

6. The waste disposal manifests of 1987 show that approximately 100 gallons of spent solvent (PCE) was removed from the site. This waste was shipped when the new owner of Mike's Cleaners took position of the facility.

7. Soil samples taken from a boring adjacent to the sanitary sewer line breach show concentrations of PCE in excess of 2000 ppb.

8. Concentrations of PCE in soil are highest near the sewer line breach and decrease with horizontal distance from the breach.

9. Concentrations of PCE in soil vapors obtained from monitoring well casings near Mike's Cleaners and Paul's Cleaners are 10 or 100 times higher than other monitoring well locations.

10. The earth materials beneath Mike's Cleaners and the general area are characterized by interbedded gravels, silts and clays.

11. At a depth of approximately 75 feet below land surface (390 feet above MSL) the top of a clay-rich aquitard is correlated between deep borings MW-17 and MW-18 and the two nearby CWS water supply wells.

12. In publication DWR Bulletin 118.2, the Department of Water Resources identifies this aquitard as the unit which separates the "shallow aquifer", which is not extensively used as a water supply source, from the "deep aquifer" which is the principal source of ground water for Livermore in the area of the site.

13. Overlying this aquitard are 55 feet of fine-grained clays and silts with some interbedded gravel. The top of these fine-grained sediments is distinct. Coarse-grained gravel is the dominant lithology in all on-site boreholes from the ground surface to a depth of approximately 20 feet (445 feet above MSL).

14. Hydrographs of a nearby water supply well, Well 3S/2E 8K2, show that the ground water elevation in this general area has dropped as much as 35 feet since the time period 1980 to 1989. In 1983, ground water elevations were the highest recorded in the history of water level measurements for this well.

15. Hydrographs of on-site monitoring wells correlate with data from the nearby Well 3S/2E 8K2.

16. From February 1990 to June 1991, the saturated thickness of the shallow aquifer was approximately 30 feet. Prior to February, 1990, water levels were not recorded for the Arcade site.

17. Since July 1991, the shallow aquifer at the site exhibited a saturated thickness of less than 10 feet.

18. Test pumping of the shallow aquifer in October 1990 showed the calculated transmissivity of the saturated sediments near well MW-12 to be 36 gpd/ft. The calculated ground water flow velocity at approximately 422 to 406 MSL is 1 foot per year.

19. In March 1992 a second aquifer test was conducted resulting in a calculated transmissivity of 119 gpd/ft for the saturated sediments near wells MW-17 and MW-7. The ground water flow velocity at approximately 405 to 391 MSL is calculated to be 3 feet per year.

20. Since 1990, the hydraulic gradient of the shallow aquifer determined from on-site wells is approximately 0.008 in a NNW direction (as measured from Mike's Cleaners).

21. In the area of the Arcade site, the regional gradient exhibited a 52° shift in direction since 1980. In 1980, the hydraulic gradient at the site trends NWW. In 1990, the gradient had shifted to NNW.

22. The PCE concentrations in ground water samples from the area around Mike's Cleaners and from the down-gradient edge of the plume have not changed significantly over the period of observation (3/90 - 3/92).

23. Soil samples from borings show that PCE concentrations are close to or below detection limits in the lower portion of the shallow aquifer.

24. Water samples from nearby public water supply wells have not detected PCE.

25. Petroleum hydrocarbons have impacted ground water quality in wells located at the eastern edge of the identified PCE plume.

27. The Beacon Oil Company station repaired leaking pipelines for their underground storage tanks in the late 1980s.

5.2 Potential Contaminant Sources

The major findings strongly suggest that storage, use, or disposal of dry cleaning solvent (PCE) did not occur at the Arcade Shopping Center before operations at Mike's Cleaners. The findings also demonstrate that concentrations of PCE in soil and ground water are highest immediately beneath the breach in the sewer pipe leading from Mike's Cleaners. The monitor well located up-gradient from Mike's Cleaners, MW-4, did not detect any PCE in ground water. A floor drain adjacent to the dry cleaning machines in Mike's Cleaners is connected to the sewer line and could have been used for the disposal of spent solvent. We conclude that Mike's Cleaners is the principal source of the observed PCE in soil and ground water.

The major findings demonstrate that high concentrations of PCE were detected in vapors obtained from ground water monitor wells adjacent to Mike's Cleaners (MW-7) and Paul's Cleaners (MW-12). Presumably Paul's Cleaners stores, uses and disposes of dry cleaning solvent (PCE). The similarity of soil vapor concentrations between MW-7 and MW-12 suggest that similar contaminant conditions may exist at these two locations. We conclude that Paul's Cleaners cannot be eliminated as a contributor to the observed PCE in soil and ground water.

5.3 Horizontal Extent of Soil and Ground Water Contamination

The horizontal extent of contamination has been clearly defined through the installation, sampling and analysis of 18 ground water monitor wells located on and adjacent to the site. Soil contamination is limited to the area beneath the breach in the sewer pipe between Mike's Cleaners and the main sewer line and to areas where PCE in ground water has impacted saturated sediments.

Ground water shows the highest levels of PCE beneath the sewer line breach. Concentrations of PCE decrease away from this area to form an elongated plume. The plume is approximately 400 feet wide and 950 feet long. Upgradient from Mike's cleaners, PCE is not detected in ground water samples. Monitor well MW-14, which is directly down gradient from wells showing levels of PCE in excess of acceptable limits, did not detect excessive levels of PCE in ground water samples.

We conclude that the horizontal extent of contamination has been adequately defined by the existing monitoring well network.

5.4 Vertical Extent of Contamination

Analyses of ground water samples from monitoring wells demonstrate that PCE has impacted the entire shallow aquifer within the defined horizontal limits of the plume. Soil samples from the underlying aquitard do not detect PCE. Lithologic evaluation of samples from the aquitard suggest that the unit acts as an efficient barrier to the vertical flow of contaminants.

Some vertical flow through zones of the aquitard is anticipated. Where these areas of communication between the shallow aquifer and the deep aquifer would occur, the flux of contaminants is anticipated to be small. The major findings show that PCE is not detected in water samples from nearby wells producing from the deep aquifer.

We conclude that the vertical extent of PCE contamination is limited to the shallow aquifer.

5.5 Fate and Transport of Contaminants

The historical uses of the property show that PCE was not used, stored or disposed on-site before early 1982 when Mike's Cleaners was established in the Arcade Shopping Center. We conclude that a PCE release at the facility could not have occurred before 1982.

Waste disposal manifests demonstrate that PCE was removed from the site beginning in 1987 when Mr. Song took over operation of the facility. The excess solvent (68 gallons) may have been accumulating at Mike's Cleaners before occupation of the facility by Mr. Song. This amount of solvent reflects approximately two years usage, although it may have accumulated over a longer period, with continuing discharge to the floor drain of the remainder of the spent solvents. We conclude that PCE waste solvent was not disposed on-site after 1987. We also conclude that on-site waste disposal stopped in 1987 or as early as 1985.

The breach in the pipeline could have occurred during initial construction, during subsequent construction activities, during a seismic event or it could be a result of differential settling of the soil. Disjointing of sewer pipe during trench backfilling operations is not uncommon. This is especially true where two pipes of dissimilar materials are joined, such as is believed to be the case at the Arcade site. We conclude that the most likely cause of the breach in the sewer pipe is original construction activity.

We conclude that PCE entered the subsurface at the sewer line breach between Mike's Cleaners and the main sewer line. PCE then migrated vertically through the soil and horizontally with ground water. The time required to form the ground water plume observed today can be estimated. In order to estimate the time required to form the observed plume geometry, we have made the following assumptions which are based upon our major findings:

A. The breach in the sewer line was present when Mike's Cleaners began operation.

B. A harmless release of domestic wastewater into the soil and underlying ground water occurred at the site from initial occupancy until 1982.

C. The release of domestic wastewater created saturated conditions between the pipe breach and ground water.

D. Spent dry cleaning solvent (PCE) was disposed in the drains at Mike's Cleaners from 1982-1987.

E. PCE migrated under saturated flow conditions from the pipe into ground water.

F. PCE-impacted the soil and ground water under the pipe breach and migrated with ground water to form the ground water plume presently observed.

G. Transport of PCE in ground water is subject to attenuation factors such as sorption, volatilization, etc. These mechanisms retard the transport of PCE molecules relative to water molecules. The retardation coefficient for PCE is assumed to be 13.54.

H. The hydraulic conductivity of the saturated sediments at the site, calculated from test pumping data range from 1.29 feet/day (1992 test) to 0.58 feet/day (1990 test)

I. The hydraulic gradient at the site was 0.008 in 1992 and 0.008 in 1990

J. The porosity of fine-grained, poorly sorted alluvial sediments ranges from 25% to 35% (Freeze and Cherry, 1979), 25% porosity is assumed for this unsorted alluvial sediment

K. Formulae used for estimating the rate of transport of PCE in ground water are:

$$\text{pore velocity} = \frac{\text{hydraulic conductivity}}{\text{porosity}} \times \text{hydraulic gradient}$$

PCE transport = pore velocity x retardation factors x dispersion and dilution factors

These calculations were developed by the U.S. Environmental Protection Agency for the rapid assessment of contaminant transport. This method provides an estimate of the time required for a plume to develop, given knowledge or estimates of specific environmental parameters. When the parameters listed above are entered into the EPA nomograph method, the observed geometry of the plume cannot be duplicated. Based upon a release date of 1982, the plume would be significantly smaller than is observed. Using the values from the test pumping the rate of PCE transport is estimated to be less than 10 feet/year.

The current rate of transport can be estimated by observing concentration changes in monitor wells over time. Evaluation of sampling results for down gradient wells MW-9 show that the plume is not spreading toward the east. Analytical results from MW-10 suggest that western migration of the plume is also insignificant. Comparison of results from MW-12 (1990) and MW-18 (1992) and MW-13 (1990 and 1991) show that the down gradient edge of the plume is also stabilized. Thus, chemical evidence demonstrates that the PCE is not significantly migrating under current hydrogeologic conditions.

5.5.1 Fate and Transport Hypotheses

The previous findings lead to the following hypotheses regarding the transport of PCE in ground water at the Livermore Arcade site:

I. The determinations of hydraulic conductivity from the test pumping are incorrect.

II. The release of PCE occurred prior to 1982.

III. Mike's Cleaners is not the only significant source of PCE in ground water.

IV. Transport of PCE occurs in thin beds of coarse-grained gravel which characterize the saturated sediments.

V. Transport occurred during 1982-1984, the time of highest ground water levels, when the well-sorted gravel deposits of the uppermost zone of the shallow aquifer were saturated.

Hypothesis I appears incorrect. Two aquifer pumping tests were performed resulting in similar results. The results are consistent with a heterogeneous, poorly-sorted, sand-gravel-clay alluvial fan unit. The horizontal stability of the plume observed during the last two years of monitoring confirms the low hydraulic conductivities measured by the pump tests.

Hypotheses II appears incorrect. No source of PCE existed at the site prior to 1982.

Hypothesis III appears incorrect. The PCE concentrations observed in soil and ground water clearly identity the break in the sewer pipe between Mike's Cleaners and the main sewer line as the major source of PCE, although, Paul's Cleaners may be contributing to the northeastern portion of the plume.

Hypothesis IV probably occurs, but contributes much less to plume transport than Hypothesis V. Detailed lithologic examination of the continuous cores from MW-17 and MW-18 demonstrate the existence of thin zones of clean sand and gravel interbedded with a clay-rich sand and gravel matrix. Unlike the uppermost continuous clean gravel unit observed at the site, the interconnection of these thin gravels is incomplete. Thus ground water and PCE would migrate at a slower rate than that estimated for the upper zone continuous gravels and at a faster rate than is predicted by the pumping tests results. Monitoring of this complex formation has shown the overall rate of migration to correlate with the test pump calculations. Measurement of the plume direction has shown that the greatest movement of the plume had to have occurred when the ground water table was in the upper continuous gravel zones as suggested by Hypothesis V.

Hypothesis V is probable. Ground water levels during this time frame where high enough to saturate the uppermost clean gravel unit observed at the site. The hydraulic conductivity of these clean gravels would be several orders of magnitude greater than that calculated based upon the test pumping data. Considering the observed gradient and a hydraulic conductivity representative of sandy gravels (300 ft/day, Freeze and Cherry, 1979), the transport rate of PCE is calculated to be over 200 feet per year. Thus, if PCE was entering ground water during this time period of high ground water levels, as we conclude, then rapid down gradient transport of PCE is possible. The plume geometry could be created under these circumstances (Figure 24).

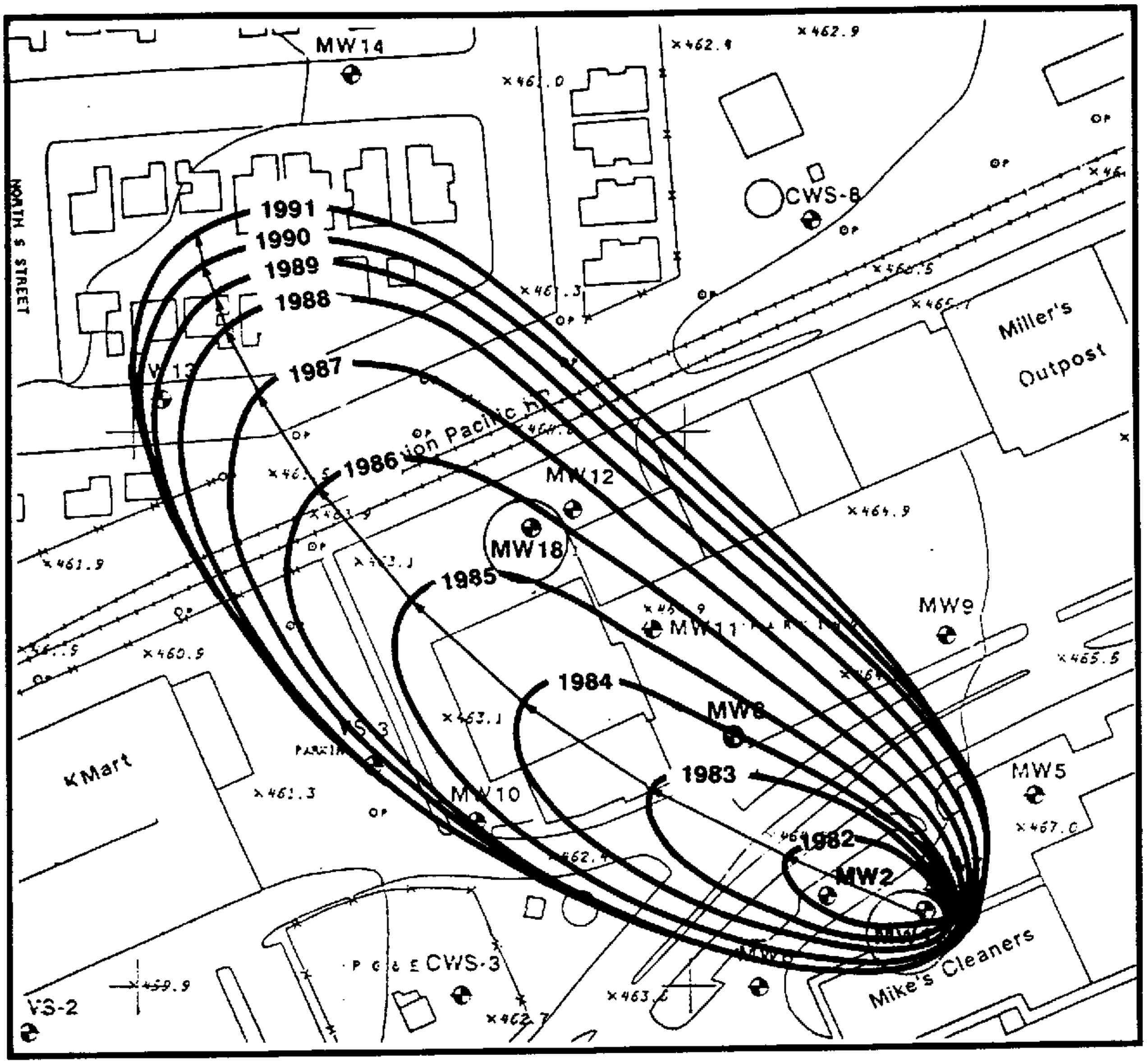
We therefore conclude that Hypothesis V accurately explains the current plume geometry.

5.5.2 Fate and Transport Conclusions

Based upon the observed plume geometry, hydrogeologic conditions at the site and the history of PCE use at the site, we conclude the following:

1. PCE entered ground water in 1982 at the site of the breach in the sewer pipe between Mike's cleaners and the main sewer line.
2. For a short period of time, rapid transport of PCE occurred in the continuous gravels which characterize the uppermost portion of the shallow aquifer. As a result of partitioning, a significant portion of the released PCE remained in the soil near Mike's Cleaners.
3. Since the water levels dropped in the mid 1980s, transport in the saturated zone continued within the thin zones of clean gravel at a rate considerably slower than one would expect in the continuous gravels but at a faster rate than would be calculated by the test pumping.
4. Under current hydrogeologic conditions, the PCE plume is in dynamic equilibrium and is not migrating beyond the identified limits.
5. A rise in ground water elevation which would saturate the uppermost continuous gravel layer could cause rapid migration of PCE far beyond the presently identified limits.

Figure 24: Yearly PCE Ground Water Plume Movement



<u>Legend</u>

Yearly Ground Water Flow Vector

1991 **Yearly Plume Movement**

Scale: 0 100 feet 200 feet N

6.0 RECOMMENDATIONS

6.1 Recommended Remedial Action Objectives

PCE, its decay products, and gasoline components have been detected at concentrations exceeding action levels in soil and ground water in the vicinity of and down-gradient of Mike's Cleaners.

The principal recommended remedial action objective is to reduce the total quantity of PCE in the vadose soils through cost-effective means. This will result in a corresponding reduction in the risk of recontamination of the shallow aquifer that would be anticipated to occur as ground water levels rise in the future. As demonstrated by the HRA, eliminating the potential for recontamination will result in a 100 fold decrease in the risk presented by the site.

Specific actions are recommended to address the chlorinated solvent problem at the site and are subject to more detailed evaluation in the feasibility study:

1. A "no action" alternative in the vicinity of Mike's Cleaners appears to be an inappropriate choice for the Arcade site. PCE concentrations in the soil are at a level where they will continue to recontaminate ground water. The low ground water table presents an opportunity to efficiently remediate PCE which is more difficult to remediate when ground water rises again.

2. The "no action" alternative appears to be appropriate for the Arcade site in the area outside of the immediate vicinity of Mike's Cleaners. The low concentrations of PCE and other organic contaminants held in the soil can volatilize and biodegrade naturally. No health risk is presented to occupants of the Arcade site during this period from inhalation or dermal exposure. The source area at Mike's Cleaners should be remediated so that no recontamination can occur.

3. Immediately replace or repair the broken sewer pipe leading from Mike's Cleaners to the sewer main. This will eliminate further leakage of water and allow the soil to dry out. Increased vapor phase in the soil will encourage volatilization, biodegradation, and enhance vapor extraction. In addition, flow will be prevented that may currently carry soil contamination down into

the lower portions of the aquifer. Videotape and photodocument the replacement procedure.

4. The ground water table has fallen to its lowest elevation in 20 years. The vertical profile of PCE contamination near Mike's Cleaners shows that the highest concentration of PCE in the soil lies in the area which was formerly the saturated interface along the top of the October 1990 ground water table. This zone is now exposed and has become unsaturated because of the decline in the ground water table.

   Ground water analyses have also shown a decline in the PCE concentrations in the ground water indicating that PCE is being retained by the soil through adsorption or through retainage of dissolved phase ground water.

   The soil should be remediated before the ground water has an opportunity to rise back to its pre-1991 levels. The most highly contaminated zone of the aquifer can then be remediated while in an unsaturated state.

5. SVE should be evaluated as a likely remedial option. SVE is a proven and effective method to remove volatile organic compounds, including chlorinated solvents, from the vadose zone. SVE has been shown to address both soil and mild ground water contamination. By establishing and maintaining a vacuum in the unsaturated zone, PCE that is adsorbed to the soil will volatilize and be removed. PCE in the dissolved phase above and at the ground water table interface will seek equilibrium with the vapor phase and leave solution, subsequently being removed from the subsurface. A carbon adsorption system can be set up in series with the vacuum pump to collect all volatiles.

   Articles by Johnson et. al., and Kent et. al., demonstrate the theoretical effectiveness of soil vapor extraction in removing volatile organics from the vadose zone and also discuss the successful application of SVE technology at many volatile organic contaminated sites throughout the United States. Field studies have shown SVE to be capable of removing the vast majority of adsorbed volatile organic contaminants

Kent et. al., recommends a pilot test in the field as part of the evaluation process of the Feasibility Study prior to the start of a full scale remediation program. A pilot test study should be implemented immediately to evaluate the effectiveness of SVE for the Feasibility Study. After the first month of operation, the SVE system will be fully evaluated in the feasibility study. An additional three months of operation will provide data on the long term effectiveness of this system while the feasibility study is developed.

6. The RWQCB should consider encouraging Paul's Cleaners to perform additional site characterization of solvent contamination near and under his building. Remediation of soil may be required to prevent recontamination of the ground water table when it rises.

7. The RWQCB should encourage the Beacon Oil Station to complete the investigation of the vertical and horizontal extent of the gasoline contaminant plume. Benzene related to this gasoline plume has been shown to present a potentially significant health risk at the Arcade site.

6.2 Recommended Data Collection During Feasibility Study

It is recommended that ground water levels be monitored closely during the completion of the Feasibility Study. Quarterly ground water sampling and analysis should continue and CWS wells should be periodically sampled and analyzed for chlorinated solvents.

A pilot test for a SVE system should be performed so that the effectiveness of the system can be fully evaluated for the Feasibility Study. It is recommended that the system be installed as soon as possible in order to take advantage of chlorinated solvent contamination exposed above the low ground water table.

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REMEDIAL INVESTIGATION

LIVERMORE ARCADE SHOPPING CENTER
Livermore, California

April 1992

APPENDICES 1 THROUGH 3

APPENDIX 1

BORING LOGS

AND

WELL CONSTRUCTION DIAGRAMS

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: West, Behind la Torina restaurant.	PROJECT: Livermore Arcade	BORING NO.: (MW10)
		TOTAL DEPTH: 57.5'
	PROJECT NO.: 48001.36	LOGGED BY: Mike Luksic,Wright
	PROJECT MGR.:	EDITED BY:
	DRILLING CONTRACTOR: Datum Exploration	
	DRILL RIG TYPE: B 61	
	DRILLERS NAME: Mike Sloan	INSPECTOR:
	STARTED. TIME: 0915	DATE: 8-24-90
SURFACE ELEV.:	COMPLETED. TIME: 1415	DATE: 8-24-90
DATUM:	BORING DEPTH (ft.)	
BORING DIAMETER: 8"	CASING DEPTH (ft.)	
	WATER DEPTH (ft.)	

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

TIME:
DATE:
BACKFILLED. TIME: DATE: BY:

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									6" of Asphalt pavement
									Brown sandy clay - 10% pea sized gravel
									obstruction "rocks"
							5		Brown sandy clay- 10% pea sized gravel
1	2'	3/8	Soil		6,12,12		10		Sample Depth
									Brown sandy clay progressing to more clay.
							15		

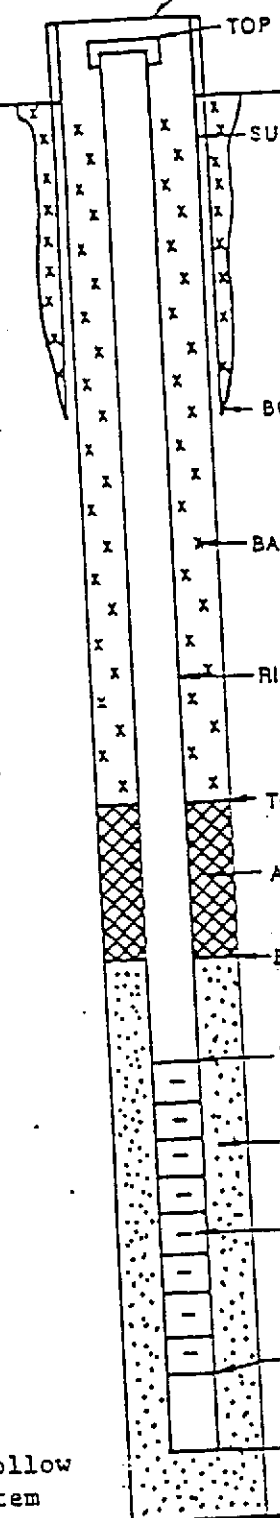
GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER		SUMMARY:
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	COHESIONLESS DENSITY	COHESIVE CONSISTENCY	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	0-4 VERY LOOSE	0-2 VERY SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	4-10 LOOSE	2-4 SOFT	SAMPLES ____
A = AUGER	AND 35 TO 50%	10-30 MED. DENSE	4-8 MED. STIFF	HOLE NO.
V = VANE TEST		30-50 DENSE	8-15 STIFF	
UT = UNDISTURBED THINWALL		50+ VERY DENSE	15-30 VERY STIFF	
SS = SPLIT SPOON			30+ HARD	

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Livermore JOB NO. 48001.36	WELL NO. MW 10
DRILLING CONTRACTOR: Datum Expl.	COORDINATES: behind La Yorina restaurant, by sidewalk	
RUN: 1415 SHED:	SUPERVISOR: Mike Cooper DRILLER: Datum	WELL SITE: Livermore Arcade	WATER LEV. DEPTH/EL. 41' 8.5"

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



		DEPTH IN	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE			
SURFACE CASING	DIA.: TYPE: None		
BOTTOM OF SURFACE CASING			
BACKFILL: Cement	TYPE: Portland Type 2		
RISER CASING	DIA.: 4" TYPE: PVC	20	
TOP OF SEAL			
ANNULAR SEAL	TYPE: Bentonite (Volclay)	23'	
BOTTOM OF SEAL		25'	
TOP OF SCREEN			
FILTER MATERIAL	TYPE: #3 Monterrey Sand		
SCREEN	DIA.: 4'' TYPE: PVC OPENING WIDTH: .02" TYPE: Slotted	55'	
BOTTOM OF SCREEN		55'6"	
BOTTOM OF SUMP	55'	65'	
BOTTOM OF HOLE			

METHOD DRILLED: Hollow Stem Auger

HOLE DIAMETER 8"

METHOD DEVELOPED:

COMMENTS:

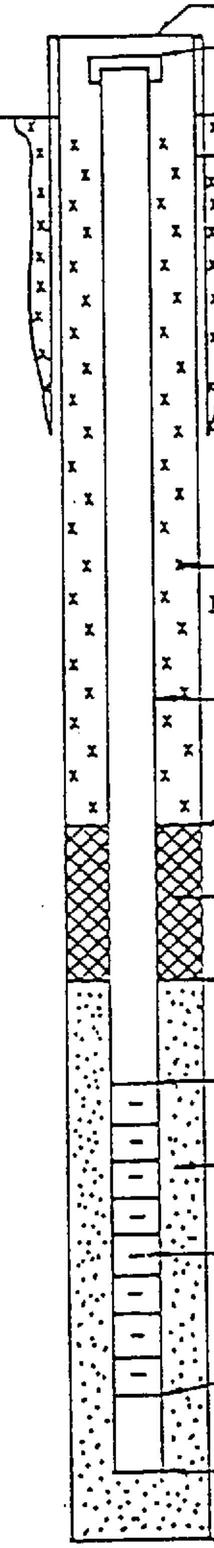
TIME DEVELOPED:

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: ARCADE II JOB NO. 48001.33	WELL NO. MW1
DRILLING CONTRACTOR: DATUM EXPLORATION	COORDINATES:	

BEGUN: 9:00am	SUPERVISOR: MW	WELL SITE: Southeast	WATER LEV. DEPTH/EL.
FINISHED: 3:00pm	DRILLER: Steve		

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



	DEPTH IN feet (bgs)	ELEV. IN feet (msl)
TOP OF SURFACE CASING		
TOP OF RISER CASING		
GROUND SURFACE	0	470
SURFACE CASING: DIA.: NA TYPE: NA		
BOTTOM OF SURFACE CASING	NA	NA
BACKFILL: TYPE: Bentonite/Portland		
RISER CASING: DIA.: 2" TYPE: PVC		
TOP OF SEAL	34	436
ANNULAR SEAL: TYPE: 3/8" Volclay Tablets Bentonite		
BOTTOM OF SEAL	36	434
TOP OF SCREEN	44.6	425.4
FILTER MATERIAL: TYPE: #2 Monterey Sand		
SCREEN: DIA.: 2" TYPE: PVC OPENING WIDTH: 0.02: TYPE:		
BOTTOM OF SCREEN	59.6	410.4
BOTTOM OF SUMP	60	410
BOTTOM OF HOLE	65	405

METHOD DRILLED: Hollow Stem Auger

METHOD DEVELOPED:

HOLE DIAMETER 8"

COMMENTS:

TIME DEVELOPED:

SHEET 1 OF 2

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: S.E. Corner of Site at South P & First Street	PROJECT: Arcade II	BORING NO.: MW1	TOTAL DEPTH: 65'
	PROJECT NO.: 48001.33	LOGGED BY: MW	
	PROJECT MGR.:	EDITED BY:	
	DRILLING CONTRACTOR: Datum Exploration		
	DRILL RIG TYPE: CME-75		
	DRILLERS NAME: Steve	INSPECTOR:	
	STARTED, TIME: 9:00	DATE: 3/21/90	
SURFACE ELEV.: 470'	COMPLETED, TIME:	DATE:	
DATUM:			
BORING DIAMETER: 8"			

BORING DEPTH (ft.)	65			
CASING DEPTH (ft.)	60			
WATER DEPTH (ft.)	45'			
TIME:				
DATE:				

BACKFILLED, TIME: DATE: BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCKS-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									asphalt 4'
									brown silt with gravel
									med. rd.
			A				5		
			"A"				10		gravel with brown silt, no odor
							15		gravel with brown silt, slight moisture
									gravel poorly sorted, med. rd.
			A				20		
							22		brown clayey silt to
									silty clay, moist
			A				25		

GROUND SURFACE TO ______ USED ______ CASING: THEN ______

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ___
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ___
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ___
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	HOLE NO.
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade II	PROJECT NO.: 48001.33	LOGGED BY: MW	BORING NO.: MW1

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
			A				30		brown silty clay, some gravel, moist, stiff, no odor
			A				35		
			A				40		
			A				45		brown silty clay and gravel, med. sorting moist, no odor, wet @ 45'
			A				50		gravel and brown silty clay
			A				55		gravel and brown silty clay
			A				60		gravel and brown silty clay
			A				65		T.D.

GROUND SURFACE TO ________ USED ________ CASING THEN ________

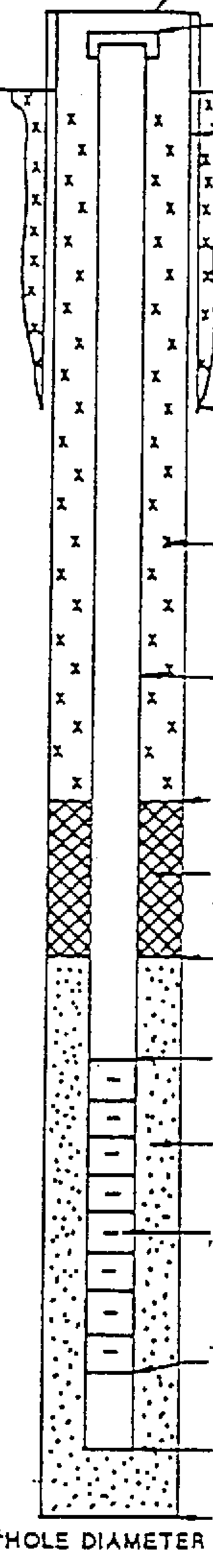
SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER		SUMMARY
		COHESIONLESS DENSITY	COHESIVE CONSISTENCY	
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLED ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: ARCADE JOB NO. 48001.33	WELL NO. MW2
DRILLING CONTRACTOR: DATUM EXPLORATION	COORDINATES:	

BEGUN:	SUPERVISOR: M.W.	WELL SITE:	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Steve	Northwest	

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



	DEPTH IN feet (bgs)	ELEV. IN feet (msl)
TOP OF SURFACE CASING		
TOP OF RISER CASING		
GROUND SURFACE	0	462.5
SURFACE CASING: DIA.: TYPE:		
BOTTOM OF SURFACE CASING Bentonite/Portland	NA	NA
BACKFILL: TYPE:		
RISER CASING DIA.: 2" TYPE: PVC		
TOP OF SEAL	31	431.5
ANNULAR SEAL: Bentonite TYPE: 3/8" Volclay Tablets		
BOTTOM OF SEAL	33	429.5
TOP OF SCREEN	35	427.5
FILTER MATERIAL: Sd TYPE: #2		
SCREEN: DIA.: 2" TYPE: PVC OPENING WIDTH: TYPE:		
BOTTOM OF SCREEN	513	412/5
BOTTOM OF SUMP	50.3	412.2
BOTTOM OF HOLE	55	407.5

HOLE DIAMETER 8"

METHOD DRILLED: Hollw Stem Auger

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

SHEET 1 OF 2

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: NW corner of Site NW of Mike's 1 hr. Cleaners	PROJECT: Arcade II	BORING NO.: MW2
		TOTAL DEPTH: 55'
	PROJECT NO.:	LOGGED BY: MW
	PROJECT MGR.:	EDITED BY:
	DRILLING CONTRACTOR: Datam Exploration	
	DRILL RIG TYPE: CME-75	
	DRILLERS NAME: Steve	INSPECTOR:
	STARTED, TIME: 3:30pm	DATE: 3/21/90
SURFACE ELEV.: 462.5'	COMPLETED, TIME:	DATE:
DATUM:	BORING DEPTH (ft.)	
BORING DIAMETER: 8"	CASING DEPTH (ft.)	
	WATER DEPTH (ft.)	
	TIME:	
	DATE:	
	BACKFILLED, TIME:	DATE: BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.	2"		
HAMMER WT.			BIT
HAMMER FALL			

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									asphalt about 3", brown silt with gravel
			A				5		slightly silty clay, dark brown
									moist, gravels poorly sorted
			A				10		gravel and brown silty clay matrix
									(gravels are serpentine, SS, siltstone, etc.)
									some rounding, no odor
			A				15		gravel with brown silty clay
									more % silty clay, moist
			A				20		
									no odor
			A				25		brown silty clay, trace gravel
									moist, no odor

GROUND SURFACE TO ________ USED ________ CASING: THEN ________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	HOLE NO.
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade II	PROJECT NO.: 48001.33	LOGGED BY: MW	BORING NO.: MW2

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
			A				30		brown silty clay with gravel
			A				35		no odor, moist
			A				40		wet at 41' gravel and brown silty clay
			A				45		
			A				50		gravel and brown silty clay
			A				55		gravel and brown silty clay

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

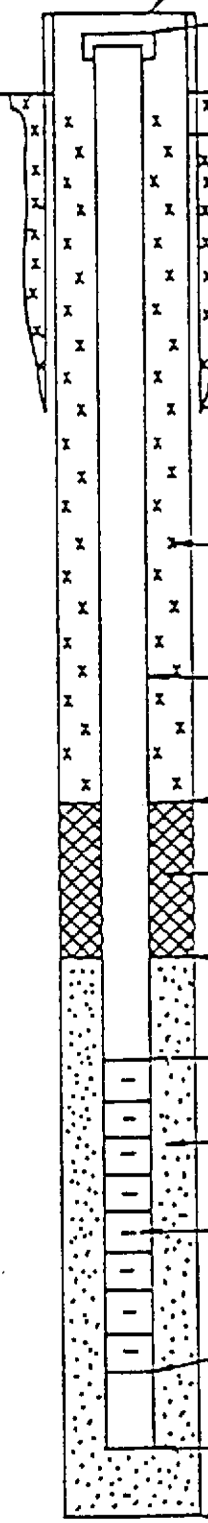
EARTH BORING __________
ROCK CORING __________
SAMPLES __________

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: ARCADE II JOB NO. 48001.33	WELL NO. MW3
DRILLING CONTRACTOR: DATUM EXPLORATION	COORDINATES:	

BEGUN:	SUPERVISOR: M.W.	WELL SITE: Southwest	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Steve		

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN feet (bgs)	ELEV. IN feet (msl)
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	467.6
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING		NA	NA
BACKFILL: Bentonite & Portland	TYPE:		
RISER CASING	DIA.: 2" TYPE: PVC		
TOP OF SEAL		35'	427.6
ANNULAR SEAL: Bentonite	TYPE: 3/8" Volclay Tablets		
BOTTOM OF SEAL		37	425.6
TOP OF SCREEN		39.3	423.3
FILTER MATERIAL:	TYPE: #2 Monterey Sand		
SCREEN:	DIA.: 2" TYPE: PVC OPENING WIDTH: 0.02" TYPE:		
BOTTOM OF SCREEN		59'.3	403.3
BOTTOM OF SUMP		59'.7	402.9
BOTTOM OF HOLE		60	402.6

HOLE DIAMETER 8"

METHOD DRILLED: Hollow Stem Auger

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

SHEET 1 OF

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: SW corner by empty lot	PROJECT: Arcade II	BORING NO.: MW3	
		TOTAL DEPTH: 60'	
	PROJECT NO.: 48001-33	LOGGED BY: MW	
	PROJECT MGR.:	EDITED BY:	
	DRILLING CONTRACTOR: Datum Exploration		
	DRILL RIG TYPE: CME-75		
	DRILLERS NAME: Steve	INSPECTOR:	
	STARTED, TIME: 10:30am	DATE: 3/22/90	
SURFACE ELEV.: 462.6	COMPLETED, TIME:	DATE:	
DATUM:	BORING DEPTH (ft.)		
BORING DIAMETER: 8"	CASING DEPTH (ft.)		
	WATER DEPTH (ft.)		
	TIME:		
	DATE:		
	BACKFILLED, TIME:	DATE:	BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									asphalt 3"-4", black claey silt changing to
									brown with gravel
			A				5		brown silt with gravel
			A				10		gravel with brown silt matrix
									no odor, loose
			A				15		gravel with brown silty matrix
									no odor
			A				20		gravel with slightly clayey silt
			A				25		silty clay with gravel, no odor

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER		SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	COHESIONLESS DENSITY	COHESIVE CONSISTENCY	EARTH BORING ___
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	0-4 VERY LOOSE	0-2 VERY SOFT	ROCK CORING ___
TP = TEST PIT	SOME 20 TO 35%	4-10 LOOSE	2-4 SOFT	SAMPLES ___
A = AUGER	AND 35 TO 50%	10-30 MED. DENSE	4-8 MED. STIFF	HOLE NO.
V = VANE TEST		30-50 DENSE	8-15 STIFF	
UT = UNDISTURBED THINWALL		50+ VERY DENSE	15-30 VERY STIFF	
SS = SPLIT SPOON			30+ HARD	

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade II	PROJECT NO.: 48001-33	LOGGED BY: MW	BORING NO.: MW3

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
			A				30		gravels and brown silty clay
									no odor
			A				35		brown silty clay and gravel
			A				40		brown silty clay and gravel
									*groundwater between 40'-45'
			A				45		brown slightly silty clay, very moist with fine gravels, no odor, wet
			A				50		brown clay and gravels, wet
									no odor
			A				55		gravels with b.s.c., wet
			A				60		gravels with b.s.c., wet

GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING:	
PROJECT:	Arcade
BORING NO.:	B1
TOTAL DEPTH:	44'
PROJECT NO.:	48001.36
LOGGED BY:	Karl Novak
PROJECT MGR.:	Karl Novak
EDITED BY:	
DRILLING CONTRACTOR:	Datum
DRILL RIG TYPE:	B-57
DRILLERS NAME:	Jim
INSPECTOR:	
STARTED, TIME:	DATE:
COMPLETED, TIME:	DATE:
SURFACE ELEV.:	
DATUM:	
BORING DIAMETER:	8"

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

BACKFILLED, TIME: DATE: BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION
									3" asphalt
							1		
							2		
							3		
									brown silty clayey gravel
							4		
							5		
									wet
							7		
									sandy gravel-very wet
									some clay, wet
							10		
									dry, hard, sub angular gravel
			2x 3 rings		50/6"		12		w/brown silty clay matrix
			2x 3" ring				15		

GROUND SURFACE TO ________ USED ________ CASING: THEN ________

SAMPLE TYPE

PROPORTIONS USED

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY | COHESIVE CONSISTENCY

SUMMARY

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001-36 | LOGGED BY: Karl Novak | BORING NO.: B1

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							16		
									gravel w/silty clay matrix
							20		
									brown clay, moist
									gravel w/silty clay
							25		
									gravel w/silty·clay
							30		gravel w/silty clay
									gravel w/silty clay
							35		
									gravel w/silty clay
							40		

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

D = DRY C = CORED V = VANED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	1 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ______
ROCK CORING ______
SAMPLES ______

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Karl Novak	BORING NO.: B1

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							42		
							43		
			2x 3" brass tubes				44		brown silty clayey gravels
							45		
									Soil Gas (PID)
							50		B1-10' 8.0 ppm
									B1-14' 3.7 ppm
									B1-16' 0.0 ppm
									B1-44' 76.0 ppm
									B1-54' 23.4 ppm
							55		
									Total depth
							60		

GROUND SURFACE TO __________ USED __________ CASING THEN ____________________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE 1 TO 10%
LITTLE 10 TO 20%
SOME 20 TO 35%
AND 35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

SHEET 1 OF

Hygienetics Inc.
TEST BORING LOG

LOCATION OF BORING:	PROJECT: Arcade	BORING NO.: B2
deviated hole on north side of dry cleaners approximately 25° towards the building		TOTAL DEPTH:
	PROJECT NO.: 48001.36	LOGGED BY: Karl Novak
	PROJECT MGR.: Karl Novak	EDITED BY:
	DRILLING CONTRACTOR: Datum Exploration	
	DRILL RIG TYPE: B-57	
	DRILLERS NAME: Jim & Gene	INSPECTOR:
	STARTED, TIME:	DATE:
SURFACE ELEV.:	COMPLETED, TIME:	DATE:
DATUM:	BORING DEPTH (ft.)	
BORING DIAMETER: 8"	CASING DEPTH (ft.)	
	WATER DEPTH (ft.)	
	TIME:	
	DATE:	
	BACKFILLED, TIME:	DATE: BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.	4"	2"	
HAMMER WT.		149 lbs	BIT
HAMMER FALL		30'	

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, % CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									dark brown (black) organic
									clayey silt
							5		
									gravel w/light brown silty
									clay matrix
							10		
							15		
									dry
							20		more clay w/some gravels
									moist
							25		

GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER: COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLED ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	HOLE NO.
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

SHEET 2 OF 2

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Karl Novak | BORING NO.: B2

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							30		gravel w/brown silty clay matrix
							35		gravel w/brown silty sandy clay matrix
							40		
							45		
							50		wet gravels w/sandy clay matrix
							55		total depth (on 25° angle)

PID depth (25°)	ppm
4'	92
45'	0.0

GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

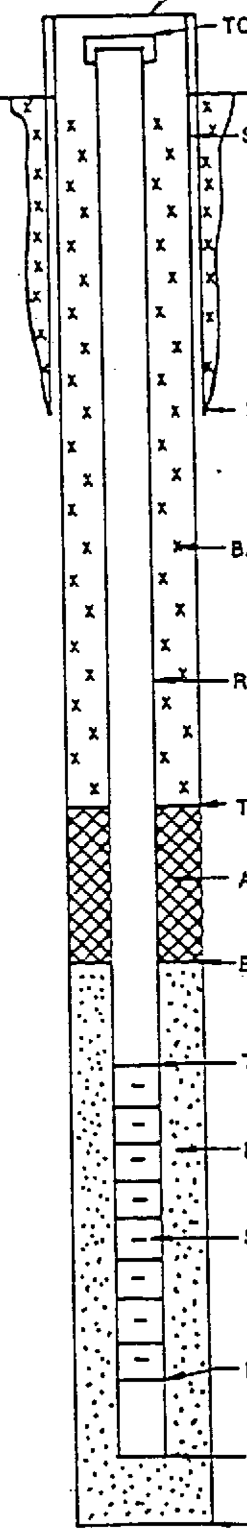
SUMMARY

EARTH BORING ______
ROCK CORING ______
SAMPLED ______

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade	JOB NO. 48001.36	WELL NO. MW4
DRILLING CONTRACTOR: Datum	COORDINATES:		
BEGUN: 10:30 / FINISHED: 1:30	SUPERVISOR: Mike Wright / DRILLER: Jim & Gene	WELL SITE: MW4	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN Feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland/Bentonite		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		25	
ANNULAR SEAL	TYPE: Volclay 3/8" Tablets		
BOTTOM OF SEAL		28	
TOP OF SCREEN		30	
FILTER MATERIAL	TYPE: #2 graded Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC; OPENING WIDTH: 0.01 TYPE: slotted		
BOTTOM OF SCREEN			
BOTTOM OF SUMP		58	
BOTTOM OF HOLE		58	

METHOD DRILLED:
hollow stem auger

HOLE DIAMETER 8"

METHOD DEVELOPED:

COMMENTS:

TIME DEVELOPED:

SHEET 1 OF 2

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: approximately 70' south of cleaners	PROJECT: Arcade	BORING NO.: MW4	
		TOTAL DEPTH:	
	PROJECT NO.: 48001.36	LOGGED BY: Mike Wright	
	PROJECT MGR.: Karl Novak	EDITED BY:	
	DRILLING CONTRACTOR: Datum Exploration		
	DRILL RIG TYPE: B-57		
	DRILLERS NAME: Jim and Gene	INSPECTOR:	
	STARTED, TIME: 10:30 am	DATE: 5/29/90	
	COMPLETED, TIME: 1:30 pm	DATE: 5/29/90	

	CASING	SAMPLER	CORE BAR
SURFACE ELEV.:			
DATUM:			
BORING DIAMETER:			
TYPE			
SIZE I.D.			
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30 lbs.	

BORING DEPTH (ft.)	58'			
CASING DEPTH (ft.)	50'			
WATER DEPTH (ft.)				
TIME:				
DATE:				
BACKFILLED, TIME:		DATE:		BY:

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL, ETC., ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									2" asphalt
							1		
							2		
							3		
							4		medium brown sandy clayey gravel
							5		
									rounded to sub angular gravel
									w/silty clayey sand
									medium round gravel w/silty clayey sand
1	6"	1	SS	10	29		10		no odor
									gravels w/silty, clayey, sand
							15		

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER		SUMMARY
		COHESIONLESS DENSITY	COHESIVE CONSISTENCY	

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Mike Wright | BORING NO.: MW4

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER		CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
								16		
								17		
								18		
								19		sandy unsorted gravel w/silty
1	18"	1	SS	21.5	67			20		clay matrix-more clay
										than above, hard, reddish brown
										dry to moist clay w/fine gravels
								25		
										gravels w/more clay
1	18"	2/3	SS	31	18	21		30		slightly moist, unsorted gravel
										w/silty clayey matrix
										more % clays
										unsorted gravels w/silty sandy clay, dry
								35		
										gravel w/silty clay, dry
								40		
								41		

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

SHEET 3 OF 3

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Mike Wright	BORING NO.: MW4

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
									silty clay w/gravels
							42		gravels w/silty clay matrix
							43		sub angular, unsorted gravels
							44		
							45		
									wet
									gravel w/ silty, sandy, clay
							50		
									sands are saturated
									clay nodules are dry to moist
									wet
1	18"	1	SS	55	50		55		
									Total Depth
							60		

GROUND SURFACE TO ______ USED ______ CASING THEN ______

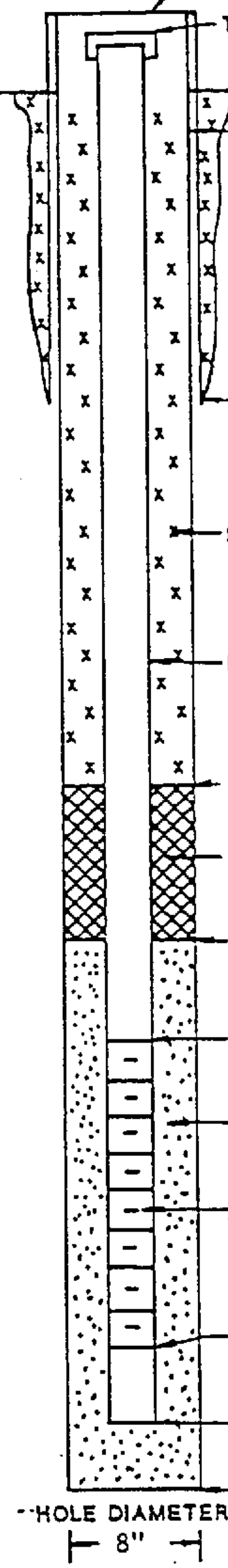
SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade JOB NO. 48001-36	WELL NO. MW5
DRILLING CONTRACTOR: Datum	COORDINATES:	

BEGUN: FINISHED:	SUPERVISOR: DRILLER:	WELL SITE: MW5	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN Feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland/Bentonite		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		20	
ANNULAR SEAL	TYPE: Volclay 3/8" Tablets		
BOTTOM OF SEAL		23	
TOP OF SCREEN		30	
FILTER MATERIAL	TYPE: #2 Grade Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.01" TYPE: Slotted		
BOTTOM OF SCREEN		50	
BOTTOM OF SUMP		50.25	
BOTTOM OF HOLE		60	

HOLE DIAMETER 8"

METHOD DRILLED:

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

Hygienetics Inc.
TEST BORING LOG

SHEET ___ OF ___

LOCATION OF BORING:	PROJECT: Arcade	BORING NO.: MW5
		TOTAL DEPTH: 55'
	PROJECT NO.: 48001.36	LOGGED BY: Mike Wright
	PROJECT MGR.: Karl Novak	EDITED BY:
	DRILLING CONTRACTOR: Datum Exploration	
	DRILL RIG TYPE: B-57	
	DRILLERS NAME: Jim and Gene	INSPECTOR:
	STARTED. TIME: 3:00 pm	DATE: 5/29/90
SURFACE ELEV.:	COMPLETED. TIME: 4:30 pm	DATE: 5/29/90

DATUM:				BORING DEPTH (ft.)	55'				
BORING DIAMETER:				CASING DEPTH (ft.)	50'				
	CASING	SAMPLER	CORE BAR	WATER DEPTH (ft.)	41'				
TYPE				TIME:					
SIZE I.D.				DATE:					
HAMMER WT.			BIT	BACKFILLED. TIME:		DATE:		BY:	
HAMMER FALL									

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS ETC.)
									3" asphalt, black silty sand (fill)
									unsorted gravel, subangular
									brown silty matrix
							5		
									unsorted subangular gravel
1	18"	2/3	SS	10.5	37		10		w/brown sandy clayey silt matrix
									pea gravel w/dry clay no odor
							15		
							20		
									more silty clay in gravel, no odor
									brown silty clay, stiff
									slightly moist
1	18"	1	SS	25	11/12		25		

GROUND SURFACE TO __________ USED __________ CASING. THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER		SUMMARY
		COHESIONLESS DENSITY	COHESIVE CONSISTENCY	
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-10 LOOSE	0-4 SOFT	EARTH BORING ___
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	10-30 MED DENSE	4-8 MED STIFF	ROCK CORING ___
TP = TEST PIT	SOME 20 TO 35%	30-50 DENSE	8-15 STIFF	SAMPLES ___
A = AUGER	AND 35 TO 50%	50+ VERY DENSE	15-30 VERY STIFF	HOLE NO. ___
V = VANE TEST			30+ HARD	
UT = UNDISTURBED THINWALL				
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Mike Wright | BORING NO.: MW5

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER			CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
									30		more unsorted (pea-1" dia) with silty clay matrix
									35		brown silty clay with little gravel
											increase in % gravel
Tried to sample-hit rock									40		wet at 41'
											unsorted gravels w/silty clay matrix
	18"	1	SS	45	18	27	40		45		(dry zones of clay-wet in gravels)
									50		(dry zones of clay-wet in gravels)
									55		(dry zones of clay-wet in gravels)
									60		Total Depth
									65		

GROUND SURFACE TO __________ USED __________ CASING THEN ______________________

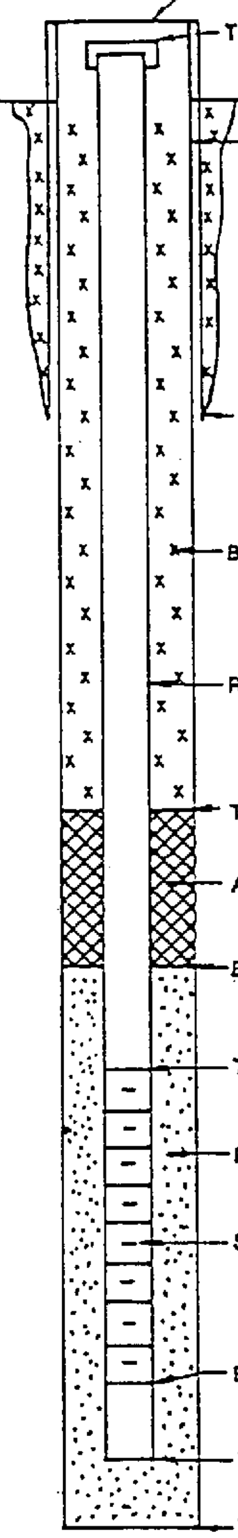
SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade	JOB NO. 48001-36	WELL NO. MW6
DRILLING CONTRACTOR: Datum	COORDINATES:		

BEGUN:	SUPERVISOR: Karl Novak	WELL SITE: MW6	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Jim and Gene		

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN Feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland/Bentonite		
RISER CASING	DIA.: 4" TYPE: PVC Blank		
TOP OF SEAL		22	
ANNULAR SEAL	TYPE: Volclay 3/8" Tablets		
BOTTOM OF SEAL		25	
TOP OF SCREEN		30	
FILTER MATERIAL	TYPE: #2 Graded Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.01 TYPE: Slotted	49.75	
BOTTOM OF SCREEN		50	
BOTTOM OF SUMP		50	
BOTTOM OF HOLE			

HOLE DIAMETER 8"

METHOD DRILLED:
Iollow Stem Auger

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

Hygienetics Inc.
TEST BORING LOG

LOCATION OF BORING:

PROJECT: Arcade

BORING NO.: MW6

TOTAL DEPTH: 60'

PROJECT NO.: 48001.36

LOGGED BY: Karl Novak

PROJECT MGR.: Karl Novak

EDITED BY:

DRILLING CONTRACTOR: Datum Exploration

DRILL RIG TYPE: B-57

DRILLERS NAME: Jim and Gene

INSPECTOR:

STARTED, TIME:

DATE:

COMPLETED, TIME:

DATE:

SURFACE ELEV.:

DATUM:

BORING DIAMETER:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

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

BACKFILLED, TIME: DATE: BY:

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									3" Asphalt
									Dark brown (black) silty, sandy, gravel
									slightly moist
							5		
									gravel w/brown silty clay matrix
			SS 2 x 3" rings		21/22		10		
									gravel w/brown silty clay matrix
									gravel w/brown silty clay matrix
							15		
									gravel w/brown silty clay matrix
							20		brown slightly moist clay
			SS 1 x 6"						with gravel
							25		

GROUND SURFACE TO ________ USED ________ CASING: THEN ________

SAMPLE TYPE	PROPORTIONS USED
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%
TP = TEST PIT	SOME 20 TO 35%
A = AUGER	AND 35 TO 50%
V = VANE TEST	
UT = UNDISTURBED THINWALL	
SS = SPLIT SPOON	

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY:

EARTH BORING ______

ROCK CORING ______

SAMPLES ______

HOLE NO. ______

SHEET 2 OF

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Karl Novak	BORING NO.: MW6

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION
							30		more gravels
							35		brown clay w/trace gravels
									moist
							40		gravel w/brown silty sandy clay matrix
			SS 2x 3"	41					ground water at 41'
							45		gravel w/brown silty sandy clay matrix
									gravel w/brown silty sandy clay matrix
							50		
									gravel w/brown silty sandy clay matrix
							55		
									gravel w/brown silty sandy clay matrix
							60		drilled to 60'
									hole collapsed to 50'
							65		

GROUND SURFACE TO __________ USED __________ CASING THEN ____________________

SAMPLE TYPE | PROPORTIONS USED | 140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER | SUMMARY

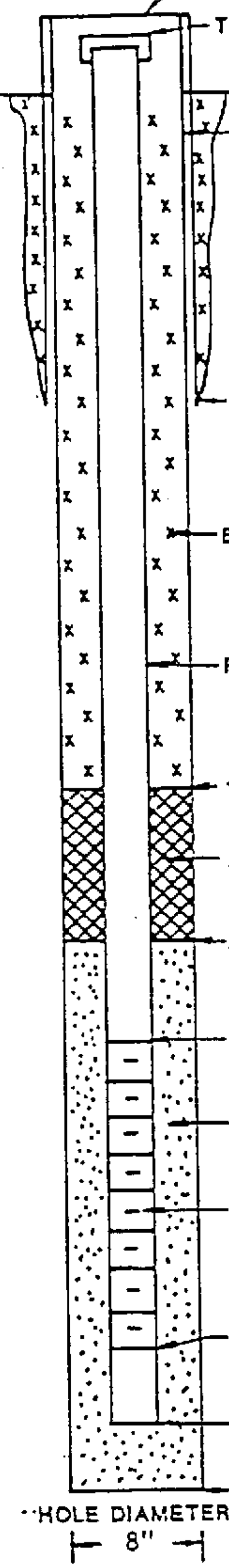
COHESIONLESS DENSITY | COHESIVE CONSISTENCY

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade JOB NO. 48001.36	WELL NO. MW7
DRILLING CONTRACTOR: Datum	COORDINATES:	

BEGUN: 5:00 FINISHED: 8:00	SUPERVISOR: Mike Wright DRILLER: Steve Moore	WELL SITE: MW7	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN Feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland/Bentonite		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		20	
ANNULAR SEAL	TYPE: Volclay 3/8" tablets		
BOTTOM OF SEAL		23	
TOP OF SCREEN		30	
FILTER MATERIAL	TYPE: #2 Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.01" TYPE: Slot		
BOTTOM OF SCREEN		64.75	
BOTTOM OF SUMP		65	
BOTTOM OF HOLE		70	

HOLE DIAMETER 8"

METHOD DRILLED: hollow stem auger

METHOD DEVELOPED:

TIME DEVELOPED:

COMMENTS:

Hygienetics Inc.
TEST BORING LOG

LOCATION OF BORING:

PROJECT: Arcade		BORING NO.: MW7	
		TOTAL DEPTH: 70'	
PROJECT NO.: 48001.36		LOGGED BY: Dr. Vonder Haar	
PROJECT MGR.: Karl Novak		EDITED BY:	
DRILLING CONTRACTOR: Datum Exploration			
DRILL RIG TYPE: CME-75			
DRILLERS NAME: Steve		INSPECTOR:	
STARTED, TIME: 9:31AM		DATE: 6/1/90	
COMPLETED, TIME:		DATE:	
BORING DEPTH (ft.)	70'		
CASING DEPTH (ft.)	65'		
WATER DEPTH (ft.)			
TIME:			
DATE:			
BACKFILLED, TIME:		DATE:	BY:

SURFACE ELEV.:
DATUM:
BORING DIAMETER: 8" hollow stem

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.	4"		
HAMMER WT.		140 lbs.	BIT
HAMMER FALL		30'	

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS ETC.)
									asphalt gravel
									dark brown, loamy soil; no odor, damp
									gravel, possible fill or dry natural
			Hollow stem split spoon for continuous sampling		11/19/23	2.5"			
							5		gravel w/mixed sand, silt and clay, dry
					14/17/14	2"			brown to tan gravel, sandy gravel moist to damp, not much clay
									sandy gravel to gravelly sand, dry
									more clayey sand in gravel interval dry to damp
					18/21/16	1.5"	10		
					14/26/22	2.5"			gravel seam, dry to moist
									clayey sandy gravel
					10/26/26				gravel 2.5"(+) diameter {tan, grey, dry to moist, clayey, sandy
					26/26/26	2"			clayey, sandy, gravel; moist to dry
							15		more clayey 1" zone

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE
D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED
TRACE 1 TO 10%
LITTLE 10 TO 20%
SOME 20 TO 35%
AND 35 TO 50%

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY
EARTH BORING ______
ROCK CORING ______
SAMPLES ______
HOLE NO. ______

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Dr. VonderHaar	BORING NO.: MW7

SAMPLE NO. / PEN / REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER			CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams and etc.)
			15	15	22	2.5"	15		gravel w/sand and clay, moist to dry -good sand zone
									2.5" diameter gravel pieces
									moist clayey sandy gravel
									various mixtures of clayey sandy gravel
			20	25	45	2"			slightly moist zones
									sandy gravel
								19.5	brown, stiff, clay; no odor
(packed soil sample)	gravel clay interface		10	11	7	1.5"	20		
									medium brown damp clay; no odor
									(some gravel in auger 10%
							25		w/predominantly clay)
									clay-same as above, no odor,
									no water
							30		stiff damp clay 31' sampled, no odor
sample 31'	at		14	6	8				
									medium brown damp clay
							35		stiff silty brown clay, damp, some 1/2"
6"			5	6	7	25"			rounded pebbles in clay.
									clay
									-gravel; dry to damp
									gravel and sandy gravel, moist
							40		wet, clayey gravel-perhaps first water

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

PROPORTIONS USED

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY | COHESIVE CONSISTENCY

SUMMARY

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY Dr. VonderHaar | BORING NO.: MW7

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER			CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
											Augering; clayey gravel, wet
											dark brownclayey gravel, saturated
		Brass Tube sampled at 41'3"									
											--smoking clay zone, moist to dry
									45		clayey gravel
											moist not very wet; not like flowing cement-clay in MW5
									50		clayey, sandy, gravel
									55		
											cement gravel
											inner rod spun loose plunging sampler-free fall
	Sample at 61								60		wet/saturated clayey gravel
					29	24	42	1.5" 33			
											gravel, clayey, wet, no good
											clay layer, no odor
											only 3" recovery of wet sandy gravel
				3"	4	9	14		65		

GROUND SURFACE TO __________ USED __________ CASING THEN ____________________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Dr. VonderHaar	BORING NO.: MW7

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6	ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
Hand packed sample in brass tube wet clayey gravel					24	45	4"-2.5	66		
								67		good clayey gravel, wet, solid
								68		4pm 5 gallons of tap water added
								69		to help pull rods free
								70		clayey gravel - rod pulling sluff
								71		into auger-5 gal. tap water added
								72		
								73		
								74		
								75		

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
[illegible]	TRACE [illegible]	[illegible]	[illegible]	EARTH BORING ___
	LITTLE [illegible]			ROCK CORING ___
	SOME [illegible]			SAMPLES ___
	AND [illegible]			

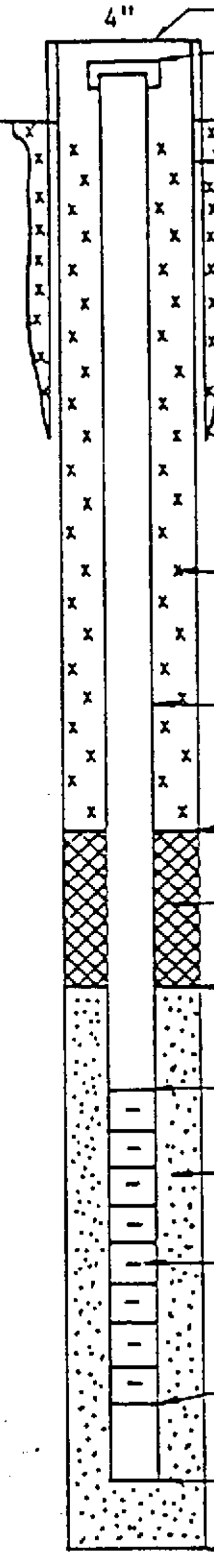
GROUND WATER MONITOR WELL INSTALLATION	PROJECT: LIVERMORE ARCADE JOB NO.	WELL NO. MW-8
DRILLING CONTRACTOR: Datum Exploration	COORDINATES: Miller's Outpost	

BEGUN:	SUPERVISOR: S. Vonder Haar	WELL SITE:	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Jim		First Water 41 ft.

REFERENCE POINT & ELEVATION:

DEPTH IN feet | ELEV. IN

GENERALIZED GEOLOGIC LOG



TOP OF SURFACE CASING

TOP OF RISER CASING

GROUND SURFACE — 0

SURFACE CASING: DIA.: TYPE:

BOTTOM OF SURFACE CASING

BACKFILL: TYPE: Portland Cement

RISER CASING: DIA.: 4" TYPE: PVC Blank

TOP OF SEAL — 20

ANNULAR SEAL: TYPE: Bentonite Pellets

BOTTOM OF SEAL — 22

Bridging "flowing gravel" — 35

TOP OF SCREEN

FILTER MATERIAL: TYPE: #2 Monterey Sand

SCREEN: DIA.: TYPE: PVC

OPENING WIDTH: TYPE: 4"

BOTTOM OF SCREEN — 55

BOTTOM OF ~~SUMP~~ CAP — 55.5

BOTTOM OF HOLE — 58

HOLE DIAMETER 8"

METHOD DRILLED: Hollow stem auger

METHOD DEVELOPED:

COMMENTS:

TIME DEVELOPED:

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade | PROJECT NO.: | LOGGED BY: S. VonderHaar | BORING NO.: MW8

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION
							5		Tan dry sandy gravel with clay; rounded gravel 1" to 2"
							20		no odor
2									more clay, damp clay in auger, no odor
							25		trace medium sand in brown "clay" or clayey silt
3							30		damp brown sandy "clay" (clayey silt")
									more of a clavey silty, verv fine sand
									brown (augered) sandv, siltv, gravel, "clay"
									no odor
							35		
									not in water yet
4							40		clay first water in gravelly zone; no odor
									isut slightly wet/moist sandy gravel clay

SOIL IDENTIFICATION: REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.

GROUND SURFACE TO ________ USED ________ CASING THEN ____________________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY | COHESIVE CONSISTENCY	SUMMARY
			EARTH BORING ____
			ROCK CORING ____
			SAMPLES ____

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING :

PROJECT : Livermore Arcade

BORING NO.: MW-8

TOTAL DEPTH: Bored to 58'

PROJECT NO. :

LOGGED BY: Stephen VonderHaa

PROJECT MGR. : Karl Novak

EDITED BY:

DRILLING CONTRACTOR : Datum Exploraiton, S.F.

DRILL RIG TYPE : CME

DRILLERS NAME : Jim - Frank

INSPECTOR:

STARTED. TIME : 8:46 am

DATE: 23 July 1990

COMPLETED. TIME :

DATE:

SURFACE ELEV. :

DATUM :

BORING DIAMETER : 8"

	CASING	SAMPLER	CORE BAR
TYPE	PVC		
SIZE I.D.	4"		
HAMMER WT.			BIT
HAMMER FALL			

BORING DEPTH (ft.)	58'			
CASING DEPTH (ft.)				
WATER DEPTH (ft.)	first 41			
TIME :	1300			
DATE :				

BACKFILLED. TIME : DATE : BY :

Mike Brubaker and Mike Wright

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION #2 Clementina sand REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.
							0		Asphalt in parking lot, with gravel fill ~~by Auger; dark brown~~
									gravelly clay no odor damp
									more clay
									more clay
									gravelly
			A				5		dry to damp - clayey, sandy to gravelly for
									continuous sampling gravel 3" dia.
									more dry clayey sand to silt with gravel
									tan dry sandy gravel;packed sample; poor recover
			A				10		
									tan dry silty, clayey, gravel sand; course to fi
									changing bit - clay apparent
							15		

GROUND SURFACE TO ______ USED ______ CASING: THEN ______

SAMPLE TYPE

D = DRY C = CORED V = VANED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb WT. X 30' FALL ON O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	<2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ____

ROCK CORING ____

SAMPLES ____

HOLE NO. ____

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: S. VonderHaar	BORING NO.: MW8

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							40		
									brown graveley sandy silty "clay", very clayey, no odor
							45		
									moderately stiff clay
									as above
							50		
									no odor; as above
							55		wet graveley sandy clayey sand
									wet "cement gravel"
				total	depth		58		Note: the core at 56'6" was much less wet, while the 56' core had a gravel zone, wet very thin graveley zone with water.

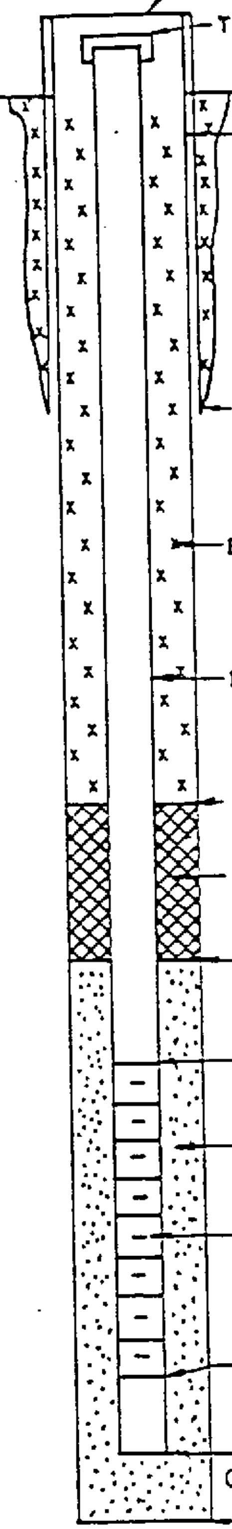
GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER		SUMMARY
		COHESIONLESS DENSITY	COHESIVE CONSISTENCY	
D = DRY C = CORED W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Livermore Arcade JOB NO.	WELL NO. MW-9
DRILLING CONTRACTOR: Datum Exploration	COORDINATES: Miller's Outpost	

BEGUN:	SUPERVISOR: S. Vonder Haar	WELL SITE:	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Jim		First Water 41 ft.

REFERENCE POINT & ELEVATION:



		DEPTH IN feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland Cement		
RISER CASING	DIA.: 4" PVC TYPE: Blank		
TOP OF SEAL		25	
ANNULAR SEAL	TYPE: Bentonite Pellets		
BOTTOM OF SEAL		27	
TOP OF SCREEN		35	
FILTER MATERIAL	TYPE: #2 Monterey Sand		
SCREEN	DIA.: TYPE: PVC OPENING WIDTH: TYPE: 4" Dia.		
BOTTOM OF SCREEN		55	
~~BOTTOM OF SUMP~~ CAP		55.5	
BOTTOM OF HOLE		58	

GENERALIZED GEOLOGIC LOG

METHOD DRILLED: Hollow Stem Auger

HOLE DIAMETER 8"

METHOD DEVELOPED:

COMMENTS:

TIME DEVELOPED:

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING:	
PROJECT: Livermore Arcade	BORING NO.: MW9
	TOTAL DEPTH:
PROJECT NO.:	LOGGED BY: S. VonderHaar
PROJECT MGR.: Karl Novak	EDITED BY:
DRILLING CONTRACTOR: Datum Exploration	
DRILL RIG TYPE: CME Exploration	
DRILLERS NAME: Jim and Frank	INSPECTOR:
STARTED, TIME: 8:50	DATE:
COMPLETED, TIME:	DATE:

SURFACE ELEV.:
DATUM:
BORING DIAMETER: 8"

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

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

BACKFILLED, TIME: DATE: BY:

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.) Sunny, strong breeze
							0		Asphalt (parking lot) & gravel subgrade
									dark brown gravel with clay, no odor
									~~damp, gravel rounded to 1- 1 2" diam.~~
									gravel; flat; rounded to max. 2 1/2"
									not much sand or fines; could be fill
									gravel
									sampled into plastic bag
			A				5		
							10		dark brown, no odor, gravel with sand & fines; i
									brass tubes show fines, auger shows almost all
									gravel
			brass tube						gravel by auger
							15		

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE
D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED
TRACE 0 TO 10%
LITTLE 10 TO 20%
SOME 20 TO 35%
AND 35 TO 50%

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY
EARTH BORING ____
ROCK CORING ____
SAMPLES ____
HOLE NO.

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade	PROJECT NO.:	LOGGED BY: S. VonderHaar	BORING NO.: MW9

SOIL IDENTIFICATION 7-24-90

REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION
							15		Clayey, sandy gravel as above, damp (pulled augers; fines smeared onto auger blades; gravel up in hollow stem) ~~matrix is dark brown~~
									much more clay & silt
							20		
2			brass tube		8 10 26				dark brown clayey, sandy gravel to gravelly clay, no odor
							25		
									gravel to 2" dia.
3			brass tube		8 18 24		30		clayey, sandy gravel no PCE type odor
									damp, med. brown sandy clay gravel; no odor
							35		
							40		first water, wet but no extensive
					9 26 21				clayey gravel

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade	PROJECT NO.:	LOGGED BY: S. VonderHaar	BORING NO.: MW9

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING, TIME, SEAMS AND ETC.)
							40		
									clayey gravel, (with sand & silt) [very few cuttings;]
							45		
			brass tube				50		Med. brown (with sand & silt) ~~damp to wet clayey gravel 11:16~~ no PCE or VOC type odor
									[very few cuttings]
									clayey gravel
							55		
									total depth 58'

DUND. SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade Livermore	PROJECT NO.: 48001.48	LOGGED BY: Mike Luksic	BORING NO.: MW10

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							18		Brown silty sand/ gravel w/ clay
							20		
									Brown silty /sandy clay - no odor
							25		
									Brown silty / sandy gravel to pea size w/ clay
							30		some 2" gravel pieces
									Brown silty / sandy gravel , no odor
							35		
									Brown clay, sandy clay
							38		
							40		Light brown / grey sorted silty sand to pea size gravel -- less clay

GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY:

EARTH BORING __________
ROCK CORING __________
SAMPLES __________

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Mike Luksic | BORING NO.: MW 1

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION REMARKS INCLUDE COLOR, GRADATION TYPE OF SOIL ETC. ROCK-COLOR TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.
							45		Brown silty clay - wet clay -no odor
							50		Brown silty clay -- wet clay no odor
							55		Brown silty clay - very wet- no odor
							60		Brown wet clay - no odor
							65		Bottom- wet silty clay - no odor- Light brown

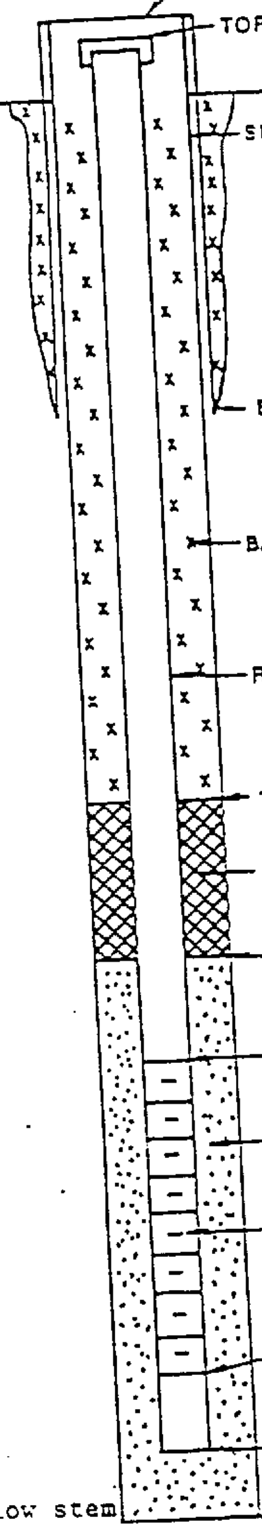
GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE	PROPORTIONS USED	140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER		SUMMARY
		COHESIONLESS DENSITY	COHESIVE CONSISTENCY	
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	0-2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Livermore JOB NO. 48001.36	WELL NO. MW II
DRILLING CONTRACTOR: Datum Expl.	COORDINATES: Handicap parking space by dry cleaners	
	WELL SITE: Shopping Center	WATER LEV. DEPTH/EL. 38' 6.5"
...UN: / ...NISHED:	SUPERVISOR: Rick Cooper / DRILLER:	

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



DEPTH IN	ELEV. IN	Item	Details
		TOP OF SURFACE CASING	
		TOP OF RISER CASING	
		GROUND SURFACE	
		SURFACE CASING	DIA.: None TYPE:
		BOTTOM OF SURFACE CASING	
		BACKFILL: Portland	TYPE: Cement Type II
		RISER CASING	DIA.: 4" TYPE: PVC
20'		TOP OF SEAL	
23'		ANNULAR SEAL: 3/8"	TYPE: Bentonite Volclay
25'		BOTTOM OF SEAL	
		TOP OF SCREEN	
		FILTER MATERIAL	TYPE: #3 Monterey Sand
		SCREEN: DIA.: 4'	TYPE: PVC; OPENING WIDTH: .02" TYPE: Slotted
55'			
55.5'	Threaded Plug	BOTTOM OF SCREEN	
57.5'		BOTTOM OF SUMP	
		BOTTOM OF HOLE	

HOLE DIAMETER 8"

METHOD DRILLED: Auger, hollow stem

METHOD DEVELOPED:

COMMENTS:

TIME DEVELOPED:

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING: South side of dry cleaners- Wash- Dry, at Miller outpost shopping center- in handicapped parking space.	PROJECT: Livermore arcade	BORING NO.: 1 (MWII)
		TOTAL DEPTH: 57.5'
	PROJECT NO.: 48001.36	LOGGED BY: Mike Luksic
	PROJECT MGR.:	EDITED BY:
	DRILLING CONTRACTOR: Datum Exploration	
	DRILL RIG TYPE: B 61 (Rick Cooper)	
	DRILLERS NAME: Rick/ Mike	INSPECTOR:
	STARTED TIME: 10:00	DATE: 8 / 23 / 90
	COMPLETED TIME: 15:00	DATE: 8 / 23 / 90

SURFACE ELEV.:				
DATUM:				
BORING DIAMETER: 8"				
	CASING	SAMPLER	CORE BAR	
TYPE				
SIZE I.D.				
HAMMER WT.			BIT	
HAMMER FALL				

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

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL, ETC. ROCKS-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									4" of Asphalt pavement
							5		unsorted gravel up to 2" w/silt (fill)
							10		unsorted gravel - pea size w/clay- silt
							15		unsorted gravel , pea size- w/ clay- silt

GROUND SURFACE TO ________ USED ________ CASING: THEN ________

SAMPLE TYPE

D = DRY C = CORED V = VASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY:

EARTH BORING ________
ROCK CORING ________
SAMPLES ________
HOLE NO.

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Mike Luksic | BORING NO.: 1 (MWII

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER			CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION — REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.
2	2'	100	soil	3"	30	35	23 28		20		2" gravel -sandy clay brown/ light grey
											Brown sandy clay less gravel
											moist clay
									25		
											Brown sandy clay - moist -
									30		
3	2'		soil	3"	3	3	5 9		35		Brown silty clay wet - no odors
									40		Brown silty clay wet - no gravel -no odors

GROUND SURFACE TO __________ USED __________ CASING: THEN ____________________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY:

EARTH BORING ________
ROCK CORING ________
SAMPLES ________

Hygienetics Inc.

TEST BORING LOG

PROJECT: Livermore Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Mike Luksic | BORING NO.: 1 (MWII)

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							45		light brown sandy clay
									moist consolidated clay
							50		silty sandy clay w/ some pea size gravel
									*** Pulled rods- wet- @ about 40'
									Sandy clay (brown)
							55		add distilled water to the well,
									3 gallons
							57.5		Bottom of the hole -sandy clay w/ pea size gra

GROUND SURFACE TO __________ USED __________ CASING: THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

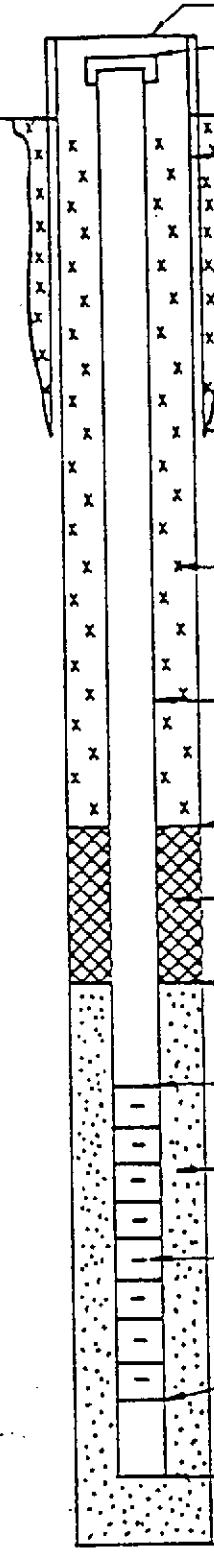
SUMMARY:

EARTH BORING ______
ROCK CORING ______
SAMPLES ______

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade	JOB NO. 48001.36	WELL NO. MW12
DRILLING CONTRACTOR: Datum Exploration	COORDINATES: Behind Cleaners (northside) Miller's Outpost		
BEGUN: / FINISHED:	SUPERVISOR: MW / DRILLER: Rick	WELL SITE:	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



		DEPTH IN	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0'	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	TYPE: Portland		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		20'	
ANNULAR SEAL	TYPE: 3/8 Volclay Tablets		
BOTTOM OF SEAL		23'	
TOP OF SCREEN		25'	
FILTER MATERIAL	TYPE: #3 Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.02" TYPE: Slotted		
BOTTOM OF SCREEN		60'	
BOTTOM OF SUMP		60.5'	
BOTTOM OF HOLE			

HOLE DIAMETER 8"

METHOD DRILLED:
Hollow stem auger

METHOD DEVELOPED:
Pump and Swab

TIME DEVELOPED:

COMMENTS:

Hygienetics Inc.
TEST BORING LOG

LOCATION OF BORING: North of Cleaners about 25' on corner	PROJECT: Arcade	BORING NO.: MW12
		TOTAL DEPTH:
	PROJECT NO.: 48001.36	LOGGED BY: MW
	PROJECT MGR.:	EDITED BY:
	DRILLING CONTRACTOR:	
	DRILL RIG TYPE: CME 75	
	DRILLERS NAME: Rick	INSPECTOR:
	STARTED, TIME: 2:00	DATE: 9/4/90
SURFACE ELEV.:	COMPLETED, TIME:	DATE:
DATUM:	BORING DEPTH (ft.)	
BORING DIAMETER: 8"	CASING DEPTH (ft.)	
	WATER DEPTH (ft.)	
	TIME:	
	DATE:	
	BACKFILLED, TIME:	DATE: BY:

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.	4"		
HAMMER WT.			BIT
HAMMER FALL			

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL, ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									4" asphalt
							1		unsoiled gravel with silty sand matrix
							2		
							3		
							4		
			A				5		dry pea gravel
									some silty sand
									mostly gravel
									dry no odor
			A				10		pea gravel
									with silty sand
							15		

GROUND SURFACE TO ________ USED ________ CASING THEN ________________

140 lb WT. X 30" FALL ON O.D. SAMPLER

SAMPLE TYPE	PROPORTIONS USED	COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY C = CORED W = WASHED	TRACE 0 TO 10%	0-4 VERY LOOSE	<2 VERY SOFT	EARTH BORING ___
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ___
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ___
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	HOLE NO.
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

SHEET __ OF __

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: MW	BORING NO.: MW

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (Remarks include color, gradation, type of soil etc. Rock-color, type, condition, hardness, drilling time, seams and etc.)
							20		pea gravel unsorted
									[0.8 on PID]
									pea gravel so_e silty sand
							25		some of clays
									(more clay coming out of hole)
							30		gravels & silty clay
									gravels with silty clay
									moist
							35		
									more clays , moist
									and gravels
							40		gravel and silty sandy
									clays

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	1 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: MW | BORING NO.: MW1

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6" ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION
							45		gravels and silty clays - no odor - moist
Down at 4:30 sheared key stock on rig, up @ 5:15							50		gravel and silty sandy clay- moist - no odor
							55		checked rods for water (no water in hole) can hear it seeping in hole
							60		wet clay
							65		wet clay

GROUND SURFACE TO __________ USED __________ CASING THEN ____________________

SAMPLE TYPE

PROPORTIONS USED

TRACE

LITTLE

SOME

AND

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
VERY LOOSE	VERY SOFT
LOOSE	SOFT
MED. DENSE	MED. STIFF
DENSE	STIFF
VERY DENSE	VERY STIFF
	HARD

SUMMARY

EARTH BORING ____

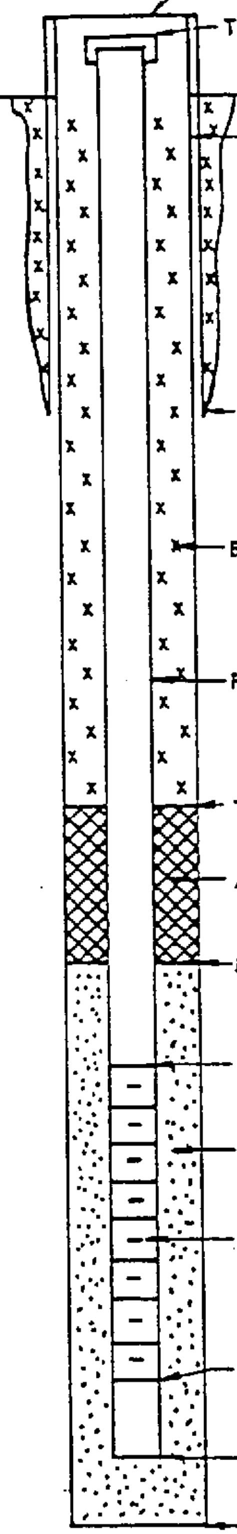
ROCK CORING ____

SAMPLES ____

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade	JOB NO. 48001.36	WELL NO. MW13
DRILLING CONTRACTOR: Layne	COORDINATES:		

BEGUN: 7am	SUPERVISOR: Michael Wright	WELL SITE: Ventura, N "S" St.	WATER LEV. DEPTH/EL.
FINISHED:	DRILLER: Mike Sloan		

REFERENCE POINT & ELEVATION:



GENERALIZED GEOLOGIC LOG

Item	Details	DEPTH IN feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			
BACKFILL	Portland TYPE: II		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		20	
ANNULAR SEAL	TYPE: Volclay 3/8" Tablets		
BOTTOM OF SEAL		23	
TOP OF SCREEN		26	
FILTER MATERIAL	TYPE: #3 Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.02" TYPE: Slotted		
BOTTOM OF SCREEN	Thread Plug	56	
BOTTOM OF SUMP		56.5	
BOTTOM OF HOLE			

HOLE DIAMETER 8"

METHOD DRILLED: Hollow Stem Auger

METHOD DEVELOPED: Pump and Swab

TIME DEVELOPED:

COMMENTS: Well produces approximately 1.5 gal/min.

Hygienetics Inc.
TEST BORING LOG

LOCATION OF BORING: 8' from curb on northside on Ventura Avenue east of N "S" Street.	PROJECT: Arcade
	PROJECT NO.: 48001.36
	PROJECT MGR.:
	DRILLING CONTRACTOR:
	DRILL RIG TYPE:
	DRILLERS NAME: Mike Sloan
	STARTED, TIME: 7:00 am
	COMPLETED, TIME: 11:00 am
SURFACE ELEV.:	
DATUM:	
BORING DIAMETER: 8"	

BORING NO.: MW13	
TOTAL DEPTH:	
LOGGED BY: Michael Wright	
EDITED BY:	
INSPECTOR:	
DATE: 9/21/90	
DATE: 9/21/90	

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.			
HAMMER WT.			BIT
HAMMER FALL			

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

BACKFILLED, TIME: DATE: BY:

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS, ETC.)
									3" asphalt
							1		dark brown silt with gravel
							2		
							3		
							4		
			A				5		unsorted gravel with silt with fine sand
							6		
							7		
							8		
							9		unsorted gravel with silt and fine sand
			A				10		
									unsorted gravel with siltv and
							15		fine sand

GROUND SURFACE TO ________ USED ________ CASING: THEN ____________

SAMPLE TYPE

PROPORTIONS USED

140 lb WT. X 30" FALL ON O.D. SAMPLER

COHESIONLESS DENSITY | COHESIVE CONSISTENCY

SUMMARY:

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Michael Wright	BORING NO.: MW13

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION
									unsorted subangular gravel
							16		with silty matrix
							17		
							18		no odor
							19		
							20		moist clay at about 21-22 feet
									no odor
									moist clay
							25		
									moist silty clay with some
									unsorted gravel
							30		
									moist silty clay with
									gravel and fine sands
							35		
									silty clay with
									unsorted pea gravel
									moist silty clay with
							40		little unsorted pea gravel

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE | PROPORTIONS USED | 140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER | SUMMARY

COHESIONLESS DENSITY | COHESIVE CONSISTENCY

TRACE

LITTLE

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Michael Wright | BORING NO.: MW13

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							41		
									moist silty clay with some
							45		unsorted subangular pea gravel
									no odor
									unsorted gravel and very moist silty clay - no odor
							50		fine sandy
									wet
							55		wet gravel with silty sandy clay
									saturated
							60		

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE 1 TO 10%
LITTLE 10 TO 20%
SOME 20 TO 35%
AND 35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	<2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

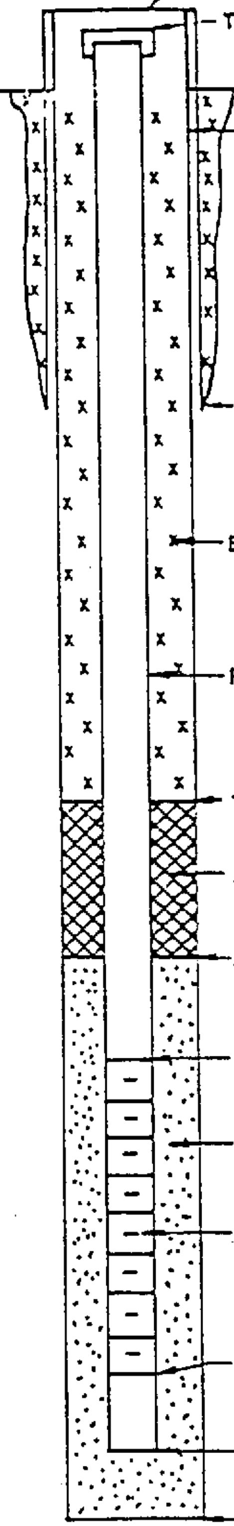
EARTH BORING ______
ROCK CORING ______
SAMPLES ______

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade	JOB NO. 48001.36	WELL NO. MW14
DRILLING CONTRACTOR: Layne	COORDINATES:		

BEGUN: / FINISHED:	SUPERVISOR: Michael Wright / DRILLER:	WELL SITE: Lambaren (Near Western)	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



		DEPTH IN feet	ELEV. IN
TOP OF SURFACE CASING	flush mounted		
TOP OF RISER CASING	0		
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:	NA	-
BOTTOM OF SURFACE CASING			
BACKFILL	Portland TYPE: II		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		21	
ANNULAR SEAL	TYPE: Volclay 3/8" Tablets		
BOTTOM OF SEAL		24	
TOP OF SCREEN		26	
FILTER MATERIAL	TYPE: #3 Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC OPENING WIDTH: 0.02" TYPE: Slotted		
BOTTOM OF SCREEN		56	
BOTTOM OF SUMP	Threaded Plug	56.5	
BOTTOM OF HOLE			

HOLE DIAMETER 8"

METHOD DRILLED: Hollow Stem Auger

METHOD DEVELOPED: Pump and Bail

TIME DEVELOPED:

COMMENTS:

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Michael Wright | BORING NO.: MW14

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.
									Begin 1:00pm 9/21/90
							1		asphalt about 3" dark brown silty fill with gravel
							2		unsorted gravel
							3		with dark silty sandy matrix
							4		
							5		
									unsorted grav(ls clayey silt and
							10		fine sand matrix, dry
									more clay, moist
							15		brown silty clay, moist
									with little pea gravel
									brown silty, moist clay with a little pea gravel
							20		
									silt may be very fine sand
									brown silty clay with large size gravel - unsorted
							25		moist - no odor
							26		

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	1 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY:

EARTH BORING ______
ROCK CORING ______
SAMPLES ______

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade | PROJECT NO.: 48001.36 | LOGGED BY: Michael Wright | BORING NO.: MW14

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION
							27		
							28		unsorted - subangular
							29		more gravels with silty sandy clay
							30		matrix - moist
									unsorted gravels
							35		in silty clay
									moist
									unsorted subangular
							40		gravels with moist brown
									silty sandy clay matrix
									*rate of penetration change
							45		no odor
									lots of fine gravel in
							50		sandy silty clay matrix
									moist - no odor

GROUND SURFACE TO __________ USED __________ CASING THEN __________

SAMPLE TYPE: [illegible]

PROPORTIONS USED: [illegible]

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY | COHESIVE CONSISTENCY: [illegible]

SUMMARY: [illegible]

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: Michael Wright	BORING NO.: MW14

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER		CASING BLOWS PER FOOT	DEPTH (FT)	GRAPHIC LOG	SOIL IDENTIFICATION
								51		
								52		
								53		
								54		wet
								55		
										saturated zone
										fine sandy
										silty clay
										with gravel
								60		
										total depth 63' @ 2:15pm
								65		

GROUND SURFACE TO ________ USED ________ CASING THEN ________

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

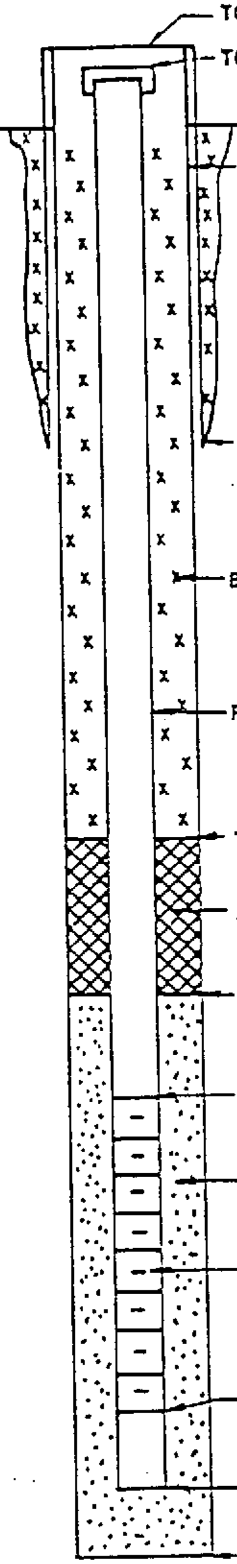
SAMPLE TYPE | PROPORTIONS USED | COHESIONLESS DENSITY | COHESIVE CONSISTENCY | SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Arcade JOB NO. 48001.36	WELL NO. MW15
DRILLING CONTRACTOR: Layne	COORDINATES:	
BEGUN: 9:45am SUPERVISOR: Michael Wright FINISHED: 1:30p DRILLER: Mike Sloan	WELL SITE: Ventura/Rincon	WATER LEV. DEPTH/EL.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



Item	Details	DEPTH IN feet	ELEV. IN
TOP OF SURFACE CASING			
TOP OF RISER CASING			
GROUND SURFACE		0	
SURFACE CASING	DIA.: TYPE:		
BOTTOM OF SURFACE CASING			-
BACKFILL	TYPE: Portland/Bentonite		
RISER CASING	DIA.: 4" TYPE: PVC		
TOP OF SEAL		27	
ANNULAR SEAL	TYPE: Volclay 3/8" tablets		
BOTTOM OF SEAL		30	
TOP OF SCREEN		35	
FILTER MATERIAL	TYPE: #2 Monterey Sand		
SCREEN	DIA.: 4" TYPE: PVC; OPENING WIDTH: 0.02"; TYPE: slotted		
BOTTOM OF SCREEN		55	
BOTTOM OF SUMP	threaded plug	55.5	
BOTTOM OF HOLE		58	

METHOD DRILLED:
Hollow Stem Auger

METHOD DEVELOPED:
Pump and Bail

TIME DEVELOPED:

HOLE DIAMETER 8"

COMMENTS:

Hygienetics Inc.

TEST BORING LOG

LOCATION OF BORING:	
PROJECT:	Arcade
BORING NO.:	MW15
TOTAL DEPTH:	
PROJECT NO.:	48001.36
LOGGED BY:	MW
PROJECT MGR.:	
EDITED BY:	
DRILLING CONTRACTOR:	Layne
DRILL RIG TYPE:	CME 75
DRILLERS NAME:	Mike/Brian
INSPECTOR:	
STARTED, TIME:	9:45am
DATE:	10/5/90
COMPLETED, TIME:	1:30pm
DATE:	10/5/90
SURFACE ELEV.:	
DATUM:	
BORING DIAMETER:	8"

	CASING	SAMPLER	CORE BAR
TYPE			
SIZE I.D.	4"		
HAMMER WT.			BIT
HAMMER FALL			

BORING DEPTH (ft.)				
CASING DEPTH (ft.)	55'			
WATER DEPTH (ft.)				
TIME:				
DATE:				

BACKFILLED, TIME: DATE: BY:

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADUATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS ETC.)
									asphalt about 3" dark brown fill
							1		dark brown silt with little gravel
							2		(light brown sandy silt with gravel
							3		subangular gravel, unsorted)
							4		
							5		
									subangular unsorted gravel
									with sandy silt
							10		
									clayey sandy silt and
							15		gravel

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE	PROPORTIONS USED	140 lb WT. X 30" FALL ON O.D. SAMPLER — COHESIONLESS DENSITY	COHESIVE CONSISTENCY	SUMMARY
D = DRY, C = CORED, W = WASHED	TRACE 1 TO 10%	0-4 VERY LOOSE	<2 VERY SOFT	EARTH BORING ____
UP = UNDISTURBED PISTON	LITTLE 10 TO 20%	4-10 LOOSE	2-4 SOFT	ROCK CORING ____
TP = TEST PIT	SOME 20 TO 35%	10-30 MED. DENSE	4-8 MED. STIFF	SAMPLES ____
A = AUGER	AND 35 TO 50%	30-50 DENSE	8-15 STIFF	HOLE NO.
V = VANE TEST		50+ VERY DENSE	15-30 VERY STIFF	
UT = UNDISTURBED THINWALL			30+ HARD	
SS = SPLIT SPOON				

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001.36	LOGGED BY: MW	BORING NO.: MW1

SAMPLE NO.	SAMPLE PEN	SAMPLE REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							16		sandy silty clay, moist
									no gravel, no odor
							20		moist clay, brown
									silty moist clay no gravel
									moisture increase
							25		
									~~moist clay trace gravel~~
							30		
									fine sandy silty moist clay
									trace unsorted pea gravel
							35		
									sandy silty
									moist clay with some unsorted
									small pea gravels
							40		

GROUND SURFACE TO __________ USED __________ CASING THEN ______________________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	0 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	<2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

SHEET 3 OF

Hygienetics Inc.

TEST BORING LOG

PROJECT: Arcade	PROJECT NO.: 48001-36	LOGGED BY: MW	BORING NO.: MW15

SAMPLE NO.	PEN	REC.	TYPE OF SAMPLE	SAMPLE DEPTHS	BLOWS PER 6 ON SAMPLER	CASING BLOWS PER FOOT	DEPTH (ft)	GRAPHIC LOG	SOIL IDENTIFICATION (REMARKS INCLUDE COLOR, GRADATION, TYPE OF SOIL ETC. ROCK-COLOR, TYPE, CONDITION, HARDNESS, DRILLING TIME, SEAMS AND ETC.)
							41		more gravels in clay
							42		unsorted
							45		
									drilling rate of penetration increase
									silty clay with some gravel
							50		
									gravel % increase
									moisture increase
									saturated zone
									fine sand silty clay
							55		and unsorted gravel
									Total Depth 58'
							60		
							65		

GROUND SURFACE TO ________ USED ________ CASING THEN ________

SAMPLE TYPE

D = DRY C = CORED W = WASHED
UP = UNDISTURBED PISTON
TP = TEST PIT
A = AUGER
V = VANE TEST
UT = UNDISTURBED THINWALL
SS = SPLIT SPOON

PROPORTIONS USED

TRACE	1 TO 10%
LITTLE	10 TO 20%
SOME	20 TO 35%
AND	35 TO 50%

140 lb. WT. X 30" FALL ON 2" O.D. SAMPLER

COHESIONLESS DENSITY	COHESIVE CONSISTENCY
0-4 VERY LOOSE	0-2 VERY SOFT
4-10 LOOSE	2-4 SOFT
10-30 MED. DENSE	4-8 MED. STIFF
30-50 DENSE	8-15 STIFF
50+ VERY DENSE	15-30 VERY STIFF
	30+ HARD

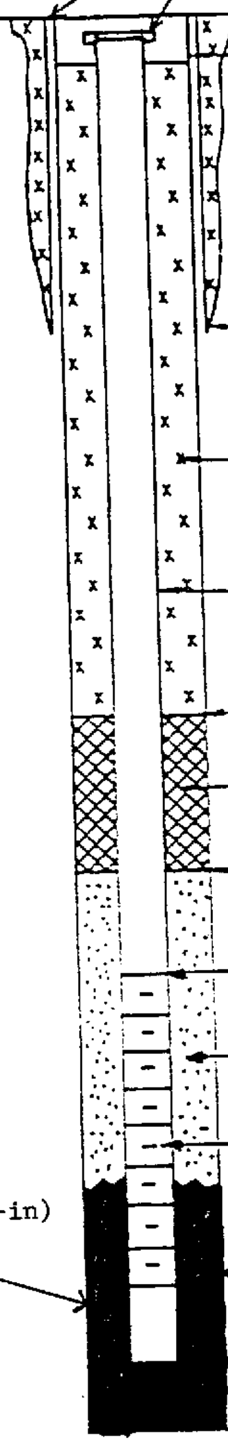
SUMMARY

EARTH BORING ____
ROCK CORING ____
SAMPLES ____

GROUND WATER MONITOR WELL INSTALLATION	PROJECT: Livermore Arcade	JOB NO. 48016.10	WELL NO. MW16
DRILLING CONTRACTOR: Layne Environ.	COORDINATES:		
BEGUN: 6/11/91 FINISHED: 6/12	SUPERVISOR: Karl Novak DRILLER: Tim/ Dana	WELL SITE: SPB	WATER LEV. DEPTH/EL. 47' est.

REFERENCE POINT & ELEVATION:

GENERALIZED GEOLOGIC LOG



TOP OF SURFACE CASING

TOP OF RISER CASING

GROUND SURFACE

SURFACE CASING: DIA.: 10" TYPE: Steel

Bentonite, Cement, Grout

BOTTOM OF SURFACE CASING

Bentonite, Cement, Grout

BACKFILL: TYPE:

RISER CASING: DIA.: 2" TYPE: PVC

TOP OF SEAL

ANNULAR SEAL: Bentonite TYPE: 3/8" Volclay Tablets

BOTTOM OF SEAL

TOP OF SCREEN

FILTER MATERIAL: TYPE: #2 Monterey Sand

SCREEN: DIA.: 2" TYPE: PVC OPENING WIDTH: 0.02" TYPE: Slotted

Native (caved-in) Material

BOTTOM OF SCREEN

BOTTOM OF SUMP

BOTTOM OF HOLE

HOLE DIAMETER 8"

DEPTH IN	ELEV. IN
1'	
35'	
39'	
44'	
G.W.T. 47'	
51'	
63.5'	
64'	

METHOD DRILLED: Hollow Stem Auger

METHOD DEVELOPED:

COMMENTS: 2" Casing

TIME DEVELOPED:

Hygienetics/GCL
Industrial Hygienists
Architects / Engineers
Environmental Consultants
Environmental Partners

Test Boring Log No: MW- 16

Location of boring: See Well Location Diagram	Project Name: Livermore Arcade	Total Depth: 65' Diameter: 8" Page 1
	Project Number: 48016.10 Project Manager: Mike Wright	Logged By: Karl Novak
	Drilling contractor: Layne / Drill rig type: Hollow Stem Auger	
	Drillers name: Tim / Dana	Inspector:
	Start time: 08:10 to 15:00	Date: 6\12\91
	Complete time: 07:10 to 10:00	Date: 6\13\91
	Boring depth: 65' Casing depth:	
	Water depth: 54' approximately	
	Backfilled time: Date:	By:

Samples Pen.	Rec.	Type	Depth	Blows per 6"	Depth	Graphic Log	Soil Identification remarks include color, gradation, type of soil/rock, condition,particle size, moisture, odor, hardness, etc.
					0		3' Asphalt Pavement (Drum 1 = 0' to 20' soil, no odor, non-hazard
					1		
					2		Silty, Clayey, Gravel
					3		
					4		
					5		
					6		
					7		Silty Gravel w\ clay , Brown, Dry
					8		
					9		
					10		
					11		Gravel, W\ Trace Silt, Brown
					12		
					13		
					14		
					15		Fine Gravel, Grey, Dry
					16		
					17		Rounded
					18		
					19		Gravel, little clay, Grey
					20		

Proportions Used	140 lb. wt. X 30" fall on 2" O.D. sampler COHESIONLESS DENSITY		COHESIVE CONSISTENCY		Graphic Legend
Trace 0 to 10 %	0 to 4	very loose	0 to 2	VERY SOFT	clay
Little 10 to 20 %	4 to 10	loose	2 to 4	SOFT	silt
Some 20 to 35 %	10 to 30	med dense	4 to 8	MED. STIFF	sand
And 35 to 50 %	30 to 50	dense	8 to 15	STIFF	gravel
	50+	very dense	15 to 30	VERY STIFF	
			30 +	HARD	

GCL

Test Boring Log No: MW-16

Project Number: 48016.10 Project Name: Livermore Arcade Page 2

Samples: Pen.	Rec.	Type	Depth	Blows per 6"	Depth	Graphic Log	Soil Identification remarks include color, gradation, type of soil/rock, condition,particle size, moisture, odor, hardness, etc.
						gravel	(Drum 2 = 20' to 40', No odor, Non- hazardous)
					21	gravel	
					22	gravel	
					23	gravel	Dry, Medium Gravel, Little Clay\ Silt (tight)
					24	gravel	
					25	gravel	Drilling very slow
					26	gravel	
					27	gravel	
					28	gravel	
					29	clay	Brown , Gravelly Clay, Moist
					30	clay	
					31	clay	
					32	clay	
					33	clay	Gravelly Clay, Brown, Moist
					34	clay	(W\ Medium Gravel)
					35	clay	
					36	clay	
					37	clay	
					38	clay	
					39	clay	
					40	clay	(Drum 3 = 40' to 55', no odor, non-hazard)
					41	clay	
					42	clay	
					43	clay	
					44	gravel	Clayey Gravel, Moist , Brown
					45	gravel	
					46	gravel	
					47	gravel	

Proportions Used	140 lb. wt. X 30" fall on 2" O.D. sampler COHESIONLESS DENSITY		COHESIVE CONSISTENCY		Graphic Legend
Trace 0 to 10 %	0 to 4	very loose	0 to 2	VERY SOFT	clay
Little 10 to 20 %	4 to 10	loose	2 to 4	SOFT	silt
Some 20 to 35 %	10 to 30	med dense	4 to 8	MED. STIFF	sand
And 35 to 50 %	30 to 50	dense	8 to 15	STIFF	gravel
	50+	very dense	15 to 30	VERY STIFF	
			30 +	HARD	

Test Boring Log No: MW-16

Project Number: 48016.10 Project Name: Livermore Arcade Page 3

Samples: Pen.	Rec.	Type	Depth	Blows per 6"	Depth	Graphic Log	Soil Identification (remarks include color, gradation, type of soil/rock, condition, particle size, moisture, odor, hardness, etc.)
							Clayey Gravel, Moist, Brown
					47		
					48		
					49		
					50		
					51		
					52		
					53		Estimated Ground Water Table
					54		
					55		
					56		
					57		
					58		Wet, Gravelley Clay
					59		
					60		
					61		
					62		
					63		
					64		
					65		Bottom of hole, 65'
					66		
					67		
					68		Auger removal very slowly. Hole caved to 47' upon removal of augers.
					69		Work stopped 15:00
					70		Work resumed 07:10 5\12\91 Redrilled to 65'
							Odor of gasoline on removal of last 10' of augers.

Proportions Used	140 lb. wt. X 30" fall on 2" O.D. sampler: COHESIONLESS DENSITY		COHESIVE CONSISTENCY		Graphic Legend
Trace 0 to 10 %	0 to 4	very loose	0 to 2	VERY SOFT	clay
Little 10 to 20 %	4 to 10	loose	2 to 4	SOFT	silt
Some 20 to 35 %	10 to 30	med dense	4 to 8	MED. STIFF	sand
And 35 to 50 %	30 to 50	dense	8 to 15	STIFF	gravel
	50+	very dense	15 to 30	VERY STIFF	
			30 +	HARD	

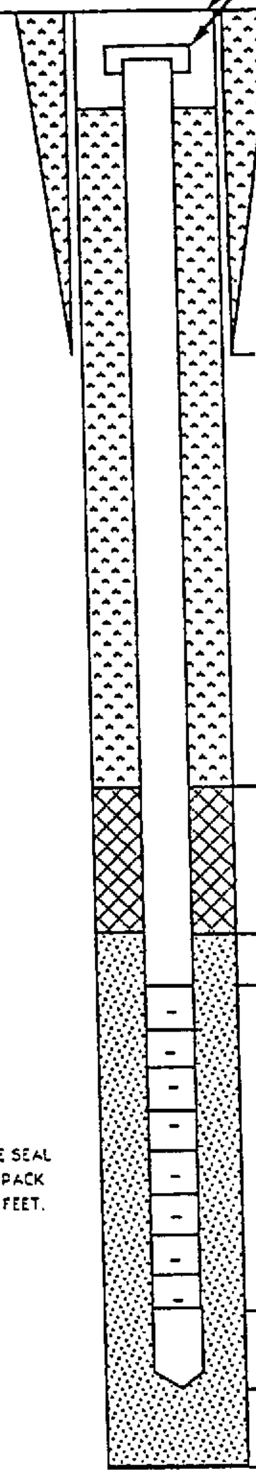
GROUND WATER MONITOR WELL: INSTALLATION:	PROJECT: LIVERMORE ARCADE / JOB NO. 48016.08		WELL NO. 17
DRILLING CONTRACTOR: WESTEX	COORDINATES: N11597.2428 E.11224.8453	DRAWN BY: DLO	DISK: DLOHA23/MW
BEGUN: 1/19/92 FINISHED: 1/20/92 / SUPERVISOR: MW DRILLER: RUSS & TONY	WELL SITE: MIKE'S ONE HOUR CLEANERS	WATER LEV. 72 FEET	DEPTH /EL.

REFERENCE POINT & ELEVATION

TOP OF SURFACE CASING

TOP OF RISER CASING

GROUND SURFACE



SURFACE CASING

DIA:

TYPE:

BACKFILL

TYPE: PORTLAND/BENTONITE GROUT

RISER CASING

DIA: 4-INCH

TYPE: PVC

ANNULAR SEAL

TYPE: VOLCLAY BENTONITE PELLETS

FILTER MATERIAL

TYPE: 2 X 12 MONTEREY SAND

SCREEN

DIA: 4-INCH

TYPE: PVC

OPENING WIDTH: 0.010 - INCH

TYPE: SLOTTED

BENTONITE SEAL IN FILTER PACK AT 62-63 FEET.

	DEPTH IN FEET	GENERALIZED GEOLOGIC LOG	ELEV. IN FEET MSL
BOTTOM OF SURFACE CASING	NA		NA
TOP OF SEAL	36		429
BOTTOM OF SEAL	38		427
TOP OF SCREEN	40		425
BOTTOM OF SCREEN	75		390
BOTTOM OF SUMP	75.5		389.5
BOTTOM OF HOLE	81		384

METHOD DRILLED: HOLLOW STEM AUGER

METHOD DEVELOPED: BAIL, SWAB, PUMP

TIME DEVELOPED: 2 HOURS

HOLE DIAMETER

10"

COMMENTS: WATER AT 72' FEET

BACKFILL ANNULAR SEAL FILTER MATERIAL

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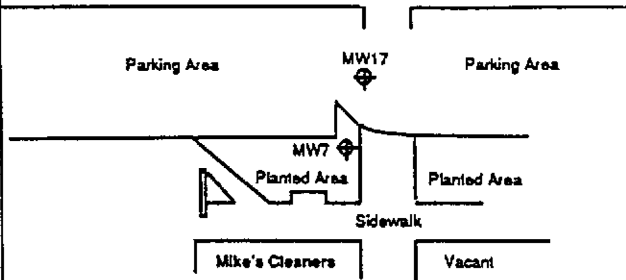
Environmental Scientists and Engineers

Test Boring Log No: MW-17

Location of boring: Railroad Avenue



Livermore Arcade Shopping Center

Project Name:	Livermore Arcade
Project Number:	48016.08
Project Manager:	M. Wright
Drilling Contractor:	Westex
Drillers Name:	Russ Deike
Drill Rig Type:	B-61
Start Time:	8:20
Complete Time:	12:00
Boring Depth:	81'
Casing Depth:	75'
Water Depth:	72'
Backfilled Time:	

Page 1

Total Depth:	81'
Diameter:	10"
Logged By:	M. Luksic
Inspector:	
Date:	Time:
Date:	1/19/92
Date:	1/20/92
Drawn By:	Dlo
Disk Name:	DloHaz 3/LA48016.08
Date:	By: Russ Deike

Sample Information / Soil Identification

Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						1		ML	Dark brown , sandy , clayey silt with a little gravel,
						2			(20%, 5%, 60%, 15%), low plasticity, moist to damp,
						3			no odor, medium dense.
						4			
						5		GM	Unsorted, sub angular, serpentine, gravel with
						6			silty sand matrix, (70%, 10%, 20%, 0%, moist).
						7			
						8			
						9			
						10		GW	Grading to unsorted gravel with coarse sand matrix,
						11			(70%, 30%, 0%, 0%), dry to moist, no odor.
						12			
						13			
						14			
						15		GW	Unsorted, sub angular gravel
						16			clayey, silty, coarse sand matrix, (60%, 35%, 4%, 1%),
						17			moist, no odor.
						18			
						19			
						20		SC	Reddish brown, clayey, fine grained sand with pea gravel
									(10%, 60%, 5%, 25%), wet, stiff, no odor.

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY 140 lb. wt. X 30" fall on 2" O.D. sampler		COHESIVE CONSISTENCY		GRAPHIC LEGEND
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-17

Project Number: 48016.08 Project Name: Livermore Arcade

Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order: gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						21			
						22			
						23			
						24		GW	Unsorted sub angular gravel with coarse sand matrix.
						25			
						26			
						27			
						28			
						29			
						30		ML	Reddish brown, clayey, fine grained sand with very little gravel, (5%, 20%), damp, stiff.
						31			
						32			
						33			
						34			
						35		CL	With some pea gravel, 15%, 60%, 5%, 20%), damp.
						36			
						37			
						38			
						39			
						40		SP	Sorted, coarse grained sand and angular gravles, damp grading to, unsorted angular gravel with clay silt, very fine grained sand matrix.
						41			
					9201191015	42			
						43			
						44			
					9201191030	45		GW	Unsorted gravel to cobbles with very coarse sand matrix.
						46			
						47			

Notes:

PROPORTIONS USED	
Trace	0 % to 10%
Little	10% to 20%
Some	20% to 35%
And	35% to 50%

COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)	
0 to 4	very loose
4 to 10	loose
10 to 30	med. dense
30 to 50	dense
50+	very dense

COHESIVE CONSISTENCY	
0 to 2	very soft
2 to 4	soft
4 to 8	med. soft
8 to 15	stiff
15 to 30	very stiff
30+	hard

GRAPHIC LEGEND: gravel, sand, silt, clay

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-17

Project Number: 48016.08 **Project Name:** Livermore Arcade

Depth Interval	Pen/Rec.	Type	P.I.D. (ppm)	BPF	ID #	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order: gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						48	gravel	GW	
						49	clay		
					9201191046	50	clay	ML	Dark, reddish brown, clayey silty, very fine grained sand or clay silt, (2%, 40%, 18%, 40%), damp, stiff, no odor.
						51			
						52	gravel	GW	Unsorted gravel with unsorted sand matrix (60%, 30%, 8%, 2%). Moist, stiff, no odor.
						53			
						54			
					9201191105	55	gravel	GC	Unsorted gravel with clayey, sandy, matrix (60%, 25%, 5%, 10%), Moist, strong odor.
						56			
						57			
						58			
						59	gravel	GM	Unsorted, sub angular gravel with silty, clayey, sandy, matrix, (60% 15%, 20%, 5%), damp, no odor.
					9201191119	60			
						61			
						62			
						63			
						64			
					9201191120	65	gravel	GW	Unsorted, sub angular to rounded gravel with coarse to very coarse sand matrix, (60%, 35%, 4%, 1%), damp, no odor.
						66			
						67			
						68			
						69	sand	SP	Sorted sand, medium to coarse grained with a little fine gravel, (5%, 90%, 4%, 1%).
					9201191146	70			
						71			
						72			
						73	gravel	GM	Unsorted gravel with silty sand matrix, a little clay, (60%, 30%, 9%, 1%), wet saturated, no odor.
					9201191210	74			

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY		COHESIVE CONSISTENCY		GRAPHIC LEGEND
		140 lb. wt. X 30" fall on 2" O.D. sampler				
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

H⁺GCL
Environmental Scientists and Engineers

Test Boring Log No: MW-17

Project Number: 48016.08 Project Name: Livermore Arcade Page 4

Sample Information: Depth Interval	Pen/Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
								GM	Unsorted gravel with silty sand matrix, a little clay,
						75			(60%, 30%, 9%, 1%), wet, saturated, no odor.
						76		ML	Reddish brown, sandy, silty clay with a little gravel,
						77			(10%, 40%, 20%, 30%), moist to dry, no odor, stiff,
						78			grading to reddish brown, clayey silt, very fine grained
						79			clayey, sand, dry.
						80			
					9201191245	81			
						82			
						83			
						84			
						85			
						86			
						87			
						88			
						89			
						90			
						91			
						92			
						93			
						94			
						95			
						96			
						97			
						98			
						99			
						100			
						101			

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY		COHESIVE CONSISTENCY		GRAPHIC LEGEND
		140 lb. wt. X 30" fall on 2" O.D. sampler				
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

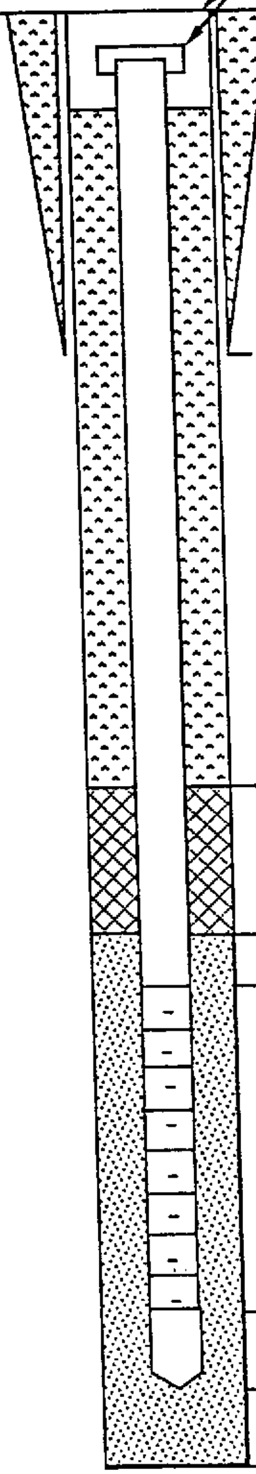
GROUND WATER MONITOR WELL: INSTALLATION:	PROJECT: LIVERMORE ARCADE	JOB NO. 4801608	WELL NO. 18
DRILLING CONTRACTOR: WESTEX	COORDINATES: N119343671 E10871.2341	DRAWN BY: DLO	DISK: DloHaz3/MW
BEGUN: 1/27/82 FINISHED: 1/27/92	SUPERVISOR: MW DRILLER: CHRIS MINER	WELL SITE: MILLER'S OUTPOST	WATER LEV. DEPTH /EL.

REFERENCE POINT & ELEVATION:

TOP OF SURFACE CASING

TOP OF RISER CASING

GROUND SURFACE



	DEPTH IN FEET	GENERALIZED GEOLOGIC LOG	ELEV. IN FEET MSL
SURFACE CASING DIA: TYPE: BOTTOM OF SURFACE CASING	NA		NA
BACKFILL TYPE: PORTLAND/BENTONITE GROUT RISER CASING DIA: 4-INCH TYPE: PVC TOP OF SEAL	31		432.3
ANNULAR SEAL TYPE: VOLCLAY BENTONITE PELLETS BOTTOM OF SEAL	33		430.3
TOP OF SCREEN	34.5		428.8
FILTER MATERIAL TYPE: 2 X 12 MONTEREY SAND SCREEN DIA: 4-INCH TYPE: PVC OPENING WIDTH: 0.010-INCH TYPE: SLOTTED BOTTOM OF SCREEN	69.5		393.8
BOTTOM OF SUMP	70		393.3
BOTTOM OF HOLE	76		387.3

METHOD DRILLED: HOLLOW STEM AUGER

METHOD DEVELOPED:

TIME DEVELOPED:

HOLE DIAMETER 10"

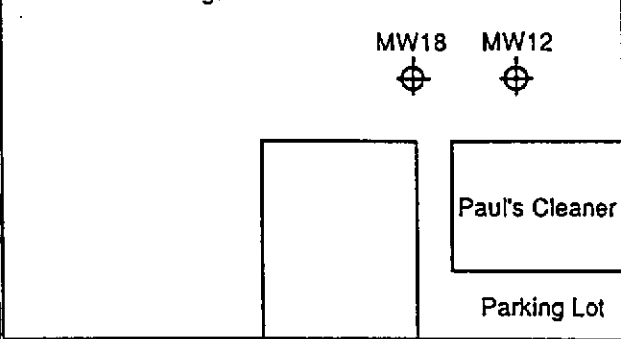
COMMENTS: NO WATER

BACKFILL ANNULAR SEAL FILTER MATERIAL

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-18

Location of boring:



Project Name:	Livermore Arcade	Total Depth: 76'	Page 1
Project Number:	48016.08	Diameter: 10'	
Project Manager:	M. Wright	Logged By: M. Luksic	
Drilling Contractor:	Westex	Inspector:	
Drillers Name:		Date:	Time:
Drill Rig Type:	HDX-B61/Hollow Stem Auge		
Start Time:	09:20	Date:	1/27/92
Complete Time:	22:00	Date:	1/27/92
Boring Depth:	76'	Drawn By:	Dlo
Casing Depth:	70'	Disk Name:	DloHaz3/LA
Water Depth:			
Backfilled Time:		Date:	By:

Sample Information									Soil Identification
Depth Interval	Pen/ Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
					9202271035	1			2" of pavement. Sampled at 1'.
1-1.5	18/18	ss						GM	Dark, coarse gravels and cobbles with fine silt.
						2			
						3			
						4		GM	Moist, coarse gravels and cobbles with fine grained sand.
						5			
						6			
						7			
						8			
						9		GM	Angular, unsorted pea gravels, coarse gravels and sand.
						10			
						11			
						12			
						13			
						14		GM	Angular, unsorted pea gravels and coarse grained sand.
						15		GP	Coarse, angular gravel and cobbles.
						16			
						17			
						18			
						19			
						20		GM	Coarse gravels and pea gravels with sand.

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY		COHESIVE CONSISTENCY		GRAPHIC LEGEND
		140 lb. wt. X 30" fall on 2" O.D. sampler				
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-18

Project Number: 48016.08 **Project Name:** Livermore Arcade Page 2

Depth Interval	Pen/Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Soil Identification (Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.)
						21	gravel		
						22	gravel		
						23	gravel		
						24	gravel	GM	Pea gravel, rounded coarse gravel and sand with fine
						25	gravel		grained, moist sand.
						26	gravel		
						27	gravel	GC	Moist gravel, and silty sand. First clods of clay
						28	gravel		
30-31.5	18/9	ss			9202271150	29	gravel		
						30	gravel		
						31	gravel		
						32	gravel	GM	Moist, fine gravel and fine grained sand. 10% coarse
						33	gravel		gravel.
35-36.5	18/12	ss			9202271220	34	gravel		
						35	gravel		
						36	sand	SC	Moist, silty sand with clay.
						37	sand		
						38	sand		
40-41.5	18/12	ss	46		9202271306	39	sand		
						40	sand	SC	Moist, silty sand with clay.
						41	sand		
						42	sand		
						43	sand		
						44	sand		
46-47.5	18/18	ss	24		9202271322	45	sand		
						46	gravel	GC	Moist to wet, clayey gravel, pea size, coarse, no odor,
						47	gravel		wet sample.

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY		GRAPHIC LEGEND
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-18

Project Number: 48016.08 **Project Name:** Livermore Arcade

Depth Interval	Pen/Rec.	Type	P.I.D. (ppm)	BPF	ID#	Depth (feet)	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order: gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						48		
						49	GC	Moist to wet, clayey gravel, pea to cobble size,
						50		serpentine and quartzite gravels, no odor.
50-51.5	18/18	ss	0.0		9202271341	51		
						52		
						53		
						54	GC	Wet, clayey gravels with cobble, clayey sand matrix,
						55		no odor.
						56		
						57		
						58		
					9202271402	59	GC	Wet clayey gravels with cobble, clayey sand matrix,
						60		no odor.
						61		
						62		
						63	GC	Gravelly cobble with silty sand matrix, wet, no odor.
65-66.5	18/12	ss	0.0		9202271421	64		
						65		
						66	GC	Sitly, clayey, gravel, wet, oxidized lenses reddish brown.
						67		Silty, clayey, gravel, moist to wet, oxidized reddish
						68	GC	brown, fine silt lenses.
70-75.5	18/18	ss	0.0		9202271441	69		
						70		
						71		
72-73.5	18/18	ss	0.0		9202271450	72		
						73		
						74	ML	Fine, sandy, silty, clay. Dry to slightly moist.

Notes:

PROPORTIONS USED		COHESIONLESS DENSITY (140 lb. wt. X 30" fall on 2" O.D. sampler)		COHESIVE CONSISTENCY		GRAPHIC LEGEND
Trace	0 % to 10%	0 to 4	very loose	0 to 2	very soft	gravel
Little	10% to 20%	4 to 10	loose	2 to 4	soft	sand
Some	20% to 35%	10 to 30	med. dense	4 to 8	med. soft	silt
And	35% to 50%	30 to 50	dense	8 to 15	stiff	clay
		50+	very dense	15 to 30	very stiff	
				30+	hard	

HGCL Environmental Scientists and Engineers

Test Boring Log No: MW-18

Project Number: 48016.08	Project Name: Livermore Arcade	Page 4

Depth Interval	Pen/Rec.	Type	P.I.D. (ppm)	BPF	I D #	Depth (feet)	Graphic Log	USCS	Soil Identification: Remarks include color, gradation, type of soil/rock, (visual % order : gravel, sand, silt, clay) condition, particle size, moisture, odor, hardness, etc.
						75		ML	Fine, sandy, silty, clay. Dry to slightly moist.
						76			Bottom of hole, 76'.

Notes:

PROPORTIONS USED	
Trace	0 % to 10%
Little	10% to 20%
Some	20% to 35%
And	35% to 50%

COHESIONLESS DENSITY / COHESIVE CONSISTENCY — 140 lb. wt. X 30" fall on 2" O.D. sampler

COHESIONLESS DENSITY		COHESIVE CONSISTENCY	
0 to 4	very loose	0 to 2	very soft
4 to 10	loose	2 to 4	soft
10 to 30	med. dense	4 to 8	med. soft
30 to 50	dense	8 to 15	stiff
50+	very dense	15 to 30	very stiff
		30+	hard

GRAPHIC LEGEND

gravel

sand

silt

clay

Analytical Report

RECEIVED
APR 19 1990

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

4/17/90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-1	M1(A)	23 MAR 90
03-827-2	M2(A)	24 MAR 90
03-827-3	M3(A)	23 MAR 90
03-827-4	M1(B)	23 MAR 90
03-827-5	M2(B)	24 MAR 90

PARAMETER	03-827-1	03-827-2	03-827-3	03-827-4	03-827-5
TPH - Volatile Hydrocarbons					
Date Analyzed	03.27.90	03.26.90	03.26.90	---	---
Dilution Factor, Times	50	1	1	---	---
C4 to C12 Hydrocarbons, ug/L	84000	100	<50	---	---
Fuel Characterization, .	GAS	GAS	---	---	---

This Fuel characterization is a qualitative identification based upon a visual comparison of sample chromatograms with those from authentic standards.

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-1	M1(A)	23 MAR 90
03-827-2	M2(A)	24 MAR 90
03-827-3	M3(A)	23 MAR 90
03-827-4	M1(B)	23 MAR 90
03-827-5	M2(B)	24 MAR 90

PARAMETER	03-827-1	03-827-2	03-827-3	03-827-4	03-827-5
Purgeable Priority Pollutants					
Date Extracted	---	---	---	03.26.90	03.26.90
1,1,1-Trichloroethane, ug/L	---	---	---	<100	<1
1,1,2,2-Tetrachloroethane, ug/L	---	---	---	<100	<1
1,1,2-Trichloroethane, ug/L	---	---	---	<100	<1
1,1-Dichloroethane, ug/L	---	---	---	<100	<1
1,1-Dichloroethene, ug/L	---	---	---	<100	<1
1,2-Dichloroethane, ug/L	---	---	---	<100	<1
1,2-Dichloropropane, ug/L	---	---	---	<100	<1
1,3-Dichloropropene, ug/L	---	---	---	<100	<1
2-Chloroethylvinylether, ug/L	---	---	---	<100	<1
2-Hexanone, ug/L	---	---	---	<100	<1
Acetone, ug/L	---	---	---	<1000	<10
Acrolein, ug/L	---	---	---	<1000	<10
Acrylonitrile, ug/L	---	---	---	<1000	<10
Bromodichloromethane, ug/L	---	---	---	<100	<1
Bromomethane, ug/L	---	---	---	<100	<1
Benzene, ug/L	---	---	---	11000	<1
Bromoform, ug/L	---	---	---	<100	<1
Chlorobenzene, ug/L	---	---	---	<100	<1
Carbon Tetrachloride, ug/L	---	---	---	<100	<1
Chloroethane, ug/L	---	---	---	<100	<1
Chloroform, ug/L	---	---	---	<100	<1

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-1	M1(A)	23 MAR 90
03-827-2	M2(A)	24 MAR 90
03-827-3	M3(A)	23 MAR 90
03-827-4	M1(B)	23 MAR 90
03-827-5	M2(B)	24 MAR 90

PARAMETER	03-827-1	03-827-2	03-827-3	03-827-4	03-827-5
Chloromethane, ug/L	---	---	---	<100	<1
Carbon Disulfide, ug/L	---	---	---	<100	<1
Dibromochloromethane, ug/L	---	---	---	<100	<1
Ethylbenzene, ug/L	---	---	---	3400	<1
Freon 113, ug/L	---	---	---	<100	<1
Methyl ethyl ketone, ug/L	---	---	---	<2000	<20
Methyl isobutyl ketone, ug/L	---	---	---	<100	<1
Methylene chloride, ug/L	---	---	---	<100	<1
Styrene, ug/L	---	---	---	<100	<1
Trichloroethene, ug/L	---	---	---	<100	<1
Trichlorofluoromethane, ug/L	---	---	---	<100	<1
Toluene, ug/L	---	---	---	22000	<1
Tetrachloroethene, ug/L	---	---	---	<100	330
Vinyl acetate, ug/L	---	---	---	<100	<1
Vinyl chloride, ug/L	---	---	---	<100	<1
Total Xylene Isomers, ug/L	---	---	---	20000	<1
cis-1,2-Dichloroethene, ug/L	---	---	---	<100	<1
trans-1,2-Dichloroethene, ug/L	---	---	---	<100	<1
trans-1,3-Dichloropropene, ug/L	---	---	---	<100	<1
Semi-Quantified Results **					
C5-C13 Hydrocarbons, ug/L	---	---	---	20000	---

1255 Powell Street
Emeryville, CA 94608

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BCA B C Analytical

Analytical Report

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-1	M1(A)	23 MAR 90
03-827-2	M2(A)	24 MAR 90
03-827-3	M3(A)	23 MAR 90
03-827-4	M1(B)	23 MAR 90
03-827-5	M2(B)	24 MAR 90

PARAMETER	03-827-1	03-827-2	03-827-3	03-827-4	03-827-5

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Analytical Report

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-6	M3(B)	23 MAR 90

PARAMETER	03-827-6
Purgeable Priority Pollutants	
Date Extracted	03.26.90
1,1,1-Trichloroethane, ug/L	<1
1,1,2,2-Tetrachloroethane, ug/L	<1
1,1,2-Trichloroethane, ug/L	<1
1,1-Dichloroethane, ug/L	<1
1,1-Dichloroethene, ug/L	<1
1,2-Dichloroethane, ug/L	<1
1,2-Dichloropropane, ug/L	<1
1,3-Dichloropropene, ug/L	<1
2-Chloroethylvinylether, ug/L	<1
2-Hexanone, ug/L	<1
Acetone, ug/L	<10
Acrolein, ug/L	<10
Acrylonitrile, ug/L	<10
Bromodichloromethane, ug/L	<1
Bromomethane, ug/L	<1
Benzene, ug/L	<1
Bromoform, ug/L	<1
Chlorobenzene, ug/L	<1
Carbon Tetrachloride, ug/L	<1
Chloroethane, ug/L	<1
Chloroform, ug/L	<1
Chloromethane, ug/L	<1
Carbon Disulfide, ug/L	<1
Dibromochloromethane, ug/L	<1
Ethylbenzene, ug/L	<1

Analytical Report

LOG NO: E90-03-827

Received: 26 MAR 90
Reported: 28 MAR 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-827-6	M3(B)	23 MAR 90

PARAMETER	03-827-6
Freon 113, ug/L	<1
Methyl ethyl ketone, ug/L	<20
Methyl isobutyl ketone, ug/L	<1
Methylene chloride, ug/L	<1
Styrene, ug/L	<1
Trichloroethene, ug/L	<1
Trichlorofluoromethane, ug/L	<1
Toluene, ug/L	<1
Tetrachloroethene, ug/L	<1
Vinyl acetate, ug/L	<1
Vinyl chloride, ug/L	<1
Total Xylene Isomers, ug/L	<1
cis-1,2-Dichloroethene, ug/L	<1
trans-1,2-Dichloroethene, ug/L	<1
trans-1,3-Dichloropropene, ug/L	<1

Verbal results were reported to Kevin Skaritt on 03.28.90. T. Blake
Report revised to correct gasoline result on sample MW-1. T. Blake 04.17.90

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

CHAIN OF CUSTODY RECORD

BCA Log Number 9003527

Client name Hygienetics	Project or PO# Arcade
Address 2200 Powell St. St. 880	Phone # 547 3886
City, State, Zip Emeryville, CA	Report attention Michael Wright

Sampled by

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	TPH	624						Hazardous sample Special handling required	Remarks
M1(A)	3/23	2:00pm	GW H_2O		1	X								Headspace
M1(B)	3/23	2:00pm	GW H_2O		1		X							Headspace
M2(A)	3/24	3:00pm	GW H_2O		1	X								
M2(B)	3/24	3:00pm	GW H_2O		1		X							
M3(A)	3/23	3:00pm	GW H_2O		1	X								Headspace
M3(B)	3/23	3:00pm	GW H_2O		1		X							
														48hr. Turn Around

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Wright	Michael Wright	Hygienetics	3/26/90	10:36am
Received by	[illegible]	[illegible]	BCA	3/26/90	10:36
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

801 Western Avenue, Glendale, CA 91201 (818) 247-5737

1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0110

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

RECEIVED
APR 18 1990

LOG NO: E90-04-206

Received: 10 APR 90
Reported: 13 APR 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.33

REPORT OF ANALYTICAL RESULTS

Page 1

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
04-206-1	MW3	10 APR 90
04-206-2	MW2	10 APR 90
04-206-3	MW1	10 APR 90

PARAMETER	04-206-1	04-206-2	04-206-3
TPH - Volatile Hydrocarbons			
Date Analyzed	04.11.90	04.11.90	04.12.90
Dilution Factor, Times	1	1	50
C4 to C12 Hydrocarbons, ug/L	<50	60	69000
Fuel Characterization, .	---	GASOLINE	GASOLINE

MW 1, 2, 3
retest

Analytical Report

LOG NO: E90-04-206

Received: 10 APR 90
Reported: 13 APR 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.33

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
04-206-1	MW3	10 APR 90
04-206-2	MW2	10 APR 90
04-206-3	MW1	10 APR 90

PARAMETER	04-206-1	04-206-2	04-206-3
Vol.Pri.Poll. (EPA-624)			
Date Analyzed	04.11.90	04.11.90	04.11.90
Dilution Factor, Times	1	5	100
1,1,1-Trichloroethane, ug/L	<1	<5	<100
1,1,2,2-Tetrachloroethane, ug/L	<1	<5	<100
1,1,2-Trichloroethane, ug/L	<1	<5	<100
1,1-Dichloroethane, ug/L	<1	<5	<100
1,1-Dichloroethene, ug/L	<1	<5	<100
1,2-Dichloroethane, ug/L	<1	<5	<100
1,2-Dichlorobenzene, ug/L	<1	<5	<100
1,2-Dichloropropane, ug/L	<1	<5	<100
1,3-Dichlorobenzene, ug/L	<1	<5	<100
1,3-Dichloropropene, ug/L	<1	<5	<100
1,4-Dichlorobenzene, ug/L	<1	<5	<100
2-Chloroethylvinylether, ug/L	<1	<5	<100
2-Hexanone, ug/L	<1	<5	<100
4-Methyl-2-Pentanone, ug/L	<1	<5	<100
Acetone, ug/L	<10	<50	<1000
Acrolein, ug/L	<10	<50	<1000
Acrylonitrile, ug/L	<10	<50	<1000
Bromodichloromethane, ug/L	<1	<5	<100
Bromomethane, ug/L	<1	<5	<100
Benzene, ug/L	<1	<5	14000
Bromoform, ug/L	<1	<5	<100
Chlorobenzene, ug/L	<1	<5	<100

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-04-206

Received: 10 APR 90
Reported: 13 APR 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.33

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
04-206-1	MW3	10 APR 90
04-206-2	MW2	10 APR 90
04-206-3	MW1	10 APR 90

PARAMETER	04-206-1	04-206-2	04-206-3
Carbon Tetrachloride, ug/L	<1	<5	<100
Chloroethane, ug/L	<1	<5	<100
Chloroform, ug/L	<1	<5	<100
Chloromethane, ug/L	<1	<5	<100
Carbon Disulfide, ug/L	<1	<5	<100
Dibromochloromethane, ug/L	<1	<5	<100
Ethylbenzene, ug/L	<1	<5	3500
Freon 113, ug/L	<1	<5	<100
Methyl ethyl ketone, ug/L	<20	<100	<2000
Methylene chloride, ug/L	<1	<5	<100
Styrene, ug/L	<1	<5	<100
Trichloroethene, ug/L	<1	<5	<100
Trichlorofluoromethane, ug/L	<1	<5	<100
Toluene, ug/L	<1	<5	25000
Tetrachloroethene, ug/L	<1	350	<100
Vinyl acetate, ug/L	<1	<5	<100
Vinyl chloride, ug/L	<1	<5	<100
Total Xylene Isomers, ug/L	<1	<5	20000
cis-1,2-Dichloroethene, ug/L	<1	<5	<100
trans-1,2-Dichloroethene, ug/L	<1	<5	<100
trans-1,3-Dichloropropene, ug/L	<1	<5	<100
Semi-Quantified Results **			
C5-C13 Hydrocarbons, ug/L	---	---	20000

Analytical Report

LOG NO: E90-04-206

Received: 10 APR 90
Reported: 13 APR 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.33

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
04-206-1	MW3	10 APR 90
04-206-2	MW2	10 APR 90
04-206-3	MW1	10 APR 90

PARAMETER	04-206-1	04-206-2	04-206-3

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

[redacted]

Client Name: Hygienetics Inc.

Address: 2200 Powell St Suite 880

City, State, Zip: Emeryville CA 94608

Project or PO#: 48001.33

Phone #: 547-3886

Report attention: Karl Novak

BCA Log Number: 900-

Sampled by: M. Brubaker

Analyses required: 1 pil, 624, Hazardous sample Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	1 pil	624						Hazardous sample Special handling required	Remarks
01A	4.10.90	700	GW	GROUND WATER	1									
01B	4.10.90	700	GW	"	1									MW3
01C	4.10.90	700	GW	"	1									
01D	4.10.90	700	GW	"	1									
02A	4.10.90	700	GW	"	1									
02B	4.10.90	700	GW	"	1									MW2
02C	4.10.90	700	GW	"	1									
02D	4.10.90	700	GW	"	1									
03A	4.10.90	700	GW	"	1									
03B	4.10.90	700	GW	"	1									MW1
03C	4.10.90	700	GW	"	1									
03D	4.10.90	700	GW	"	1									
					1									

48 hr. called Tony 4/10/90 @ 1:50pm

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Y. Brubaker	Michael Y. Brubaker	Hygienetics	4/10	12:00
Received by	D. Lowe	D. Lowe	BCA	4/10/90	noon
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300
☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737
☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ____________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

RECEIVED
JUN - 6 1990

LOG NO: E90-05-801

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
05-801-1	B1U	25 MAY 90
05-801-2	B2U	25 MAY 90

PARAMETER	05-801-1	05-801-2
Vol.Pri.Poll. (EPA-8240)		
Date Analyzed	05.29.90	05.29.90
Date Extracted	05.29.90	05.29.90
Dilution Factor, Times	50	5
1,1,1-Trichloroethane, ug/L	<50	<5
1,1,2,2-Tetrachloroethane, ug/L	<50	<5
1,1,2-Trichloroethane, ug/L	<50	<5
1,1-Dichloroethane, ug/L	<50	<5
1,1-Dichloroethene, ug/L	<50	<5
1,2-Dichloroethane, ug/L	<50	<5
1,2-Dichlorobenzene, ug/L	<50	<5
1,2-Dichloropropane, ug/L	<50	<5
1,3-Dichlorobenzene, ug/L	<50	<5
1,3-Dichloropropene, ug/L	<50	<5
1,4-Dichlorobenzene, ug/L	<50	<5
2-Chloroethylvinylether, ug/L	<50	<5
2-Hexanone, ug/L	<50	<5
4-Methyl-2-Pentanone, ug/L	<50	<5
Acetone, ug/L	<500	<5
Acrolein, ug/L	<500	<50
Acrylonitrile, ug/L	<500	<50
Bromodichloromethane, ug/L	<50	<5
Bromomethane, ug/L	<50	<5
Benzene, ug/L	<50	<5
Bromoform, ug/L	<50	<5
Chlorobenzene, ug/L	<50	<5

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-05-801

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
05-801-1	B1U	25 MAY 90
05-801-2	B2U	25 MAY 90

PARAMETER	05-801-1	05-801-2
Carbon Tetrachloride, ug/L	<50	<5
Chloroethane, ug/L	<50	<5
Chloroform, ug/L	<50	<5
Chloromethane, ug/L	<50	<5
Carbon Disulfide, ug/L	<50	<5
Dibromochloromethane, ug/L	<50	<5
Ethylbenzene, ug/L	<50	<5
Freon 113, ug/L	<50	<5
Methyl ethyl ketone, ug/L	<1000	<100
Methylene chloride, ug/L	<50	<5
Styrene, ug/L	<50	<5
Trichloroethene, ug/L	140	<5
Trichlorofluoromethane, ug/L	<50	<5
Toluene, ug/L	<50	<5
Tetrachloroethene, ug/L	5800	820
Vinyl acetate, ug/L	<50	<5
Vinyl chloride, ug/L	<50	<5
Total Xylene Isomers, ug/L	<50	<5
cis-1,2-Dichloroethene, ug/L	79	<5
trans-1,2-Dichloroethene, ug/L	<50	<5
trans-1,3-Dichloropropene, ug/L	<50	<5

Preliminary verbal results were given to you on 05.29.90. T. Blake

S. D. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

Analytical Report

JUN 18 [illegible]

LOG NO: E90-05-802

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-802-1	B1-12'	25 MAY 90
05-802-2	B1-16'	25 MAY 90
05-802-3	B1-44'	25 MAY 90
05-802-4	B1-54'	25 MAY 90
05-802-5	B2-4'	25 MAY 90

PARAMETER	05-802-1	05-802-2	05-802-3	05-802-4	05-802-5
Vol.Pri.Poll. (EPA-8240)					
Date Analyzed	05.31.90	05.31.90	05.31.90	05.31.90	05.31.90
Date Extracted	05.29.90	05.29.90	05.29.90	05.29.90	05.29.90
Dilution Factor, Times	1	1	1	1	1
1,1,1-Trichloroethane, mg/kg	<0.2	1.0	0.9	1.9	<0.2
1,1,2,2-Tetrachloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloropropane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Chloroethylvinylether, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Hexanone, mg/kg	<2	<2	<2	<2	<2
4-Methyl-2-Pentanone, mg/kg	<2	<2	<2	<2	<2
Acetone, mg/kg	<5	<5	<5	<5	<5
Acrolein, mg/kg	<5	<5	<5	<5	<5
Acrylonitrile, mg/kg	<2	<2	<2	<2	<2
Bromodichloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromomethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-05-802

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-802-1	B1-12'	25 MAY 90
05-802-2	B1-16'	25 MAY 90
05-802-3	B1-44'	25 MAY 90
05-802-4	B1-54'	25 MAY 90
05-802-5	B2-4'	25 MAY 90

PARAMETER	05-802-1	05-802-2	05-802-3	05-802-4	05-802-5
Benzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromoform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Tetrachloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Disulfide, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Freon 113, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Methyl ethyl ketone, mg/kg	<2	<2	<2	<2	<2
Methylene chloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Styrene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene, mg/kg	<0.2	0.3	2.3	0.2	0.5
Vinyl acetate, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Vinyl chloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylene Isomers, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-05-802

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-802-1	B1-12'	25 MAY 90
05-802-2	B1-16'	25 MAY 90
05-802-3	B1-44'	25 MAY 90
05-802-4	B1-54'	25 MAY 90
05-802-5	B2-4'	25 MAY 90

PARAMETER	05-802-1	05-802-2	05-802-3	05-802-4	05-802-5
trans-1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Semi-Quantified Results **					
C10 Hydrocarbon, mg/kg	---	---	---	4	---

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-05-802

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-802-6	B2-54'	25 MAY 90

PARAMETER	05-802-6
Vol.Pri.Poll. (EPA-8240)	
Date Analyzed	05.31.90
Date Extracted	05.29.90
Dilution Factor, Times	1
1,1,1-Trichloroethane, mg/kg	1.7
1,1,2,2-Tetrachloroethane, mg/kg	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2
1,1-Dichloroethane, mg/kg	<0.2
1,1-Dichloroethene, mg/kg	<0.2
1,2-Dichloroethane, mg/kg	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2
1,2-Dichloropropane, mg/kg	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2
1,3-Dichloropropene, mg/kg	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2
2-Chloroethylvinylether, mg/kg	<0.2
2-Hexanone, mg/kg	<2
4-Methyl-2-Pentanone, mg/kg	<2
Acetone, mg/kg	<5
Acrolein, mg/kg	<5
Acrylonitrile, mg/kg	<2
Bromodichloromethane, mg/kg	<0.2
Bromomethane, mg/kg	<0.2
Benzene, mg/kg	<0.2
Bromoform, mg/kg	<0.2
Chlorobenzene, mg/kg	<0.2
Carbon Tetrachloride, mg/kg	<0.2

Analytical Report

LOG NO: E90-05-802

Received: 25 MAY 90
Reported: 31 MAY 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-802-6	B2-54'	25 MAY 90

PARAMETER	05-802-6
Chloroethane, mg/kg	<0.2
Chloroform, mg/kg	<0.2
Chloromethane, mg/kg	<0.2
Carbon Disulfide, mg/kg	<0.2
Dibromochloromethane, mg/kg	<0.2
Ethylbenzene, mg/kg	<0.2
Freon 113, mg/kg	<0.2
Methyl ethyl ketone, mg/kg	<2
Methylene chloride, mg/kg	<0.2
Styrene, mg/kg	<0.2
Trichloroethene, mg/kg	<0.2
Trichlorofluoromethane, mg/kg	<0.2
Toluene, mg/kg	<0.2
Tetrachloroethene, mg/kg	0.2
Vinyl acetate, mg/kg	<0.2
Vinyl chloride, mg/kg	<0.2
Total Xylene Isomers, mg/kg	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2
trans-1,3-Dichloropropene, mg/kg	<0.2

Results were transmitted to you by facsimile on 05.31.90. T. Blake

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD

BCA Log Number 90-05-80

Client name HYGIENETICS	Project or PO# Livermore Arcade
Address 7200 Powell St. Suite 830	Phone #
City, State, Zip EMERYVILLE CA	Report attention KARL NOVAK

Sampled by KARL NOVAK

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	5240 - Rush - 24 hr 1007		8240 - 48 hour 1007					Hazardous sample Special handling required	Remarks
B1W	5/25		AQ	GROUNDWATER - UNBAILED hole	2	✓								Vials Received w. Headspace in each
B2W	5/25		AQ	GROUNDWATER - UNBAILED hole	2	✓								
B1-12'			SO	Soil	1			✓						RUSH
B1-16'			SO	Soil	1			✓						
B1-4'			SO	"	1			✓						9005802
~~B2~~			~~SO~~											
B1-31'			SO	"	1			✓						
B2-4'			SO	"	1			✓						
B2-5'(4.5')			SO	"	1			✓						

	Signature	Print Name	Company	Date	Time
Relinquished by	x Karl Novak	KARL NOVAK	HYGIENETICS	5/25/90	18:00
Received by	Larry E. Penfold	Larry E. Penfold	BC Analytical	5/25/90	18:00
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E90-05-880

Received: 30 MAY 90
Reported: 01 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
05-880-1	MW 4	30 MAY 90
05-880-2	MW 5	30 MAY 90

PARAMETER	05-880-1	05-880-2
Vol.Pri.Poll. (EPA-624)		
Date Analyzed	06.01.90	06.01.90
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, ug/L	<1	<1
1,1,2,2-Tetrachloroethane, ug/L	<1	<1
1,1,2-Trichloroethane, ug/L	<1	<1
1,1-Dichloroethane, ug/L	<1	<1
1,1-Dichloroethene, ug/L	<1	<1
1,2-Dichloroethane, ug/L	<1	<1
1,2-Dichlorobenzene, ug/L	<1	<1
1,2-Dichloropropane, ug/L	<1	<1
1,3-Dichlorobenzene, ug/L	<1	<1
1,3-Dichloropropene, ug/L	<1	<1
1,4-Dichlorobenzene, ug/L	<1	<1
2-Chloroethylvinylether, ug/L	<1	<1
2-Hexanone, ug/L	<1	<1
4-Methyl-2-Pentanone, ug/L	<1	<1
Acetone, ug/L	<10	<10
Acrolein, ug/L	<10	<10
Acrylonitrile, ug/L	<10	<10
Bromodichloromethane, ug/L	<1	<1
Bromomethane, ug/L	<1	<1
Benzene, ug/L	<1	400
Bromoform, ug/L	<1	<1
Chlorobenzene, ug/L	<1	<1
Carbon Tetrachloride, ug/L	<1	<1

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-05-880

Received: 30 MAY 90
Reported: 01 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
05-880-1	MW 4	30 MAY 90
05-880-2	MW 5	30 MAY 90

PARAMETER	05-880-1	05-880-2
Chloroethane, ug/L	<1	<1
Chloroform, ug/L	<1	<1
Chloromethane, ug/L	<1	<1
Carbon Disulfide, ug/L	<1	<1
Dibromochloromethane, ug/L	<1	<1
Ethylbenzene, ug/L	<1	31
Freon 113, ug/L	<1	<1
Methyl ethyl ketone, ug/L	<20	<20
Methylene chloride, ug/L	<1	<1
Styrene, ug/L	<1	<1
Trichloroethene, ug/L	<1	<1
Trichlorofluoromethane, ug/L	<1	<1
Toluene, ug/L	<1	22
Tetrachloroethene, ug/L	<1	2
Vinyl acetate, ug/L	<1	<1
Vinyl chloride, ug/L	<1	<1
Total Xylene Isomers, ug/L	<1	45
cis-1,2-Dichloroethene, ug/L	<1	<1
trans-1,2-Dichloroethene, ug/L	<1	<1
trans-1,3-Dichloropropene, ug/L	<1	<1
Semi-Quantified Results **		
C5-C15 Hydrocarbons, ug/L	---	500

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Analytical Report

LOG NO: E90-05-880

Received: 30 MAY 90
Reported: 01 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore Arcade

REPORT OF ANALYTICAL RESULTS

Results were transmitted to you by facsimile on 06.01.90. T. Blake

Sim D. Lessley, Ph.D., Laboratory Director

CHAIN OF CUSTODY RECORD

BCA Log Number 9005380

Client name HYGIENETICS	Project or PO# Livermore Arcade
Address 4 Admiral Dr. #432	Phone # 547-3086
City, State, Zip Emeryville	Report attention Karl Novak

Sampled by

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	Analyses required: [illegible]	624						Hazardous sample Special handling required	Remarks
MW4	5/30		AQ	V.O. vial 40ml	2		✓							48 hour turnaround
MW5	5/30		AQ	" "	2		✓							48 hour turnaround

	Signature	Print Name	Company	Date	Time
Relinquished by	Karl Novak	KARL NOVAK	Hygienetics	5/30	1:55pm
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	M. Scott	Monika Scott	BCA	5-30-90	4:55pm

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ____________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

JUN 14 1990

LOG NO: E90-05-908

Received: 31 MAY 90
Reported: 06 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-908-1	MW6-20 Ring	31 MAY 90

PARAMETER	05-908-1
Vol.Pri.Poll. (EPA-8240)	
Date Analyzed	06.05.90
Date Extracted	06.04.90
Dilution Factor, Times	1
1,1,1-Trichloroethane, mg/kg	<0.2
1,1,2,2-Tetrachloroethane, mg/kg	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2
1,1-Dichloroethane, mg/kg	<0.2
1,1-Dichloroethene, mg/kg	<0.2
1,2-Dichloroethane, mg/kg	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2
1,2-Dichloropropane, mg/kg	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2
1,3-Dichloropropene, mg/kg	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2
2-Chloroethylvinylether, mg/kg	<0.2
2-Hexanone, mg/kg	<2
4-Methyl-2-Pentanone, mg/kg	<2
Acetone, mg/kg	<5
Acrolein, mg/kg	<5
Acrylonitrile, mg/kg	<2
Bromodichloromethane, mg/kg	<0.2
Bromomethane, mg/kg	<0.2
Benzene, mg/kg	<0.2
Bromoform, mg/kg	<0.2
Chlorobenzene, mg/kg	<0.2
Carbon Tetrachloride, mg/kg	<0.2

Analytical Report

LOG NO: E90-05-908

Received: 31 MAY 90
Reported: 06 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: Livermore

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-908-1	MW6-20 Ring	31 MAY 90

PARAMETER	05-908-1
Chloroethane, mg/kg	<0.2
Chloroform, mg/kg	<0.2
Chloromethane, mg/kg	<0.2
Carbon Disulfide, mg/kg	<0.2
Dibromochloromethane, mg/kg	<0.2
Ethylbenzene, mg/kg	<0.2
Freon 113, mg/kg	<0.2
Methyl ethyl ketone, mg/kg	<2
Methylene chloride, mg/kg	<0.2
Styrene, mg/kg	<0.2
Trichloroethene, mg/kg	<0.2
Trichlorofluoromethane, mg/kg	<0.2
Toluene, mg/kg	<0.2
Tetrachloroethene, mg/kg	<0.2
Vinyl acetate, mg/kg	<0.2
Vinyl chloride, mg/kg	<0.2
Total Xylene Isomers, mg/kg	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2
trans-1,3-Dichloropropene, mg/kg	<0.2

Results were transmitted to Karl Novak on 06.06.90. T. Blake

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

[redacted]

CHAIN OF CUSTODY RECORD

BCA Log Number

Client name HYGIENETICS	Project or PO# Livermore
Address ~~4 Admiral Dr. #43~~	Phone # 547-3886
City, State, Zip Emeryville CA	Report attention Karl Novak

Sampled by

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers		8240						Hazardous sample Special handling required	Remarks
MW6-20	5/31		SO	RING	1		✓							48 hour Turnaround

	Signature	Print Name	Company	Date	Time
Relinquished by	Karl Novak	KARL NOVAK	HYGIENETICS	5/31	
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	Tony Blake	Tony Blake	BCA	5/31	4:35 pm

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements:

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E90-05-842

Received: 29 MAY 90
Reported: 04 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-37

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-842-1	MW-4-21'	29 MAY 90
05-842-2	MW-5-26'	29 MAY 90

PARAMETER	05-842-1	05-842-2
Vol.Pri.Poll. (EPA-8240)		
Date Analyzed	06.02.90	06.02.90
Date Extracted	05.30.90	05.30.90
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, mg/kg	<0.2	3.5
1,1,2,2-Tetrachloroethane, mg/kg	<0.2	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2	<0.2
1,1-Dichloroethane, mg/kg	<0.2	<0.2
1,1-Dichloroethene, mg/kg	<0.2	<0.2
1,2-Dichloroethane, mg/kg	<0.2	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2	<0.2
1,2-Dichloropropane, mg/kg	<0.2	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2	<0.2
1,3-Dichloropropene, mg/kg	<0.2	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2	<0.2
2-Chloroethylvinylether, mg/kg	<2	<2
2-Hexanone, mg/kg	<2	<2
4-Methyl-2-Pentanone, mg/kg	<5	<5
Acetone, mg/kg	<5	<5
Acrolein, mg/kg	<2	<2
Acrylonitrile, mg/kg	<0.2	<0.2
Bromodichloromethane, mg/kg	<0.2	<0.2
Bromomethane, mg/kg	<0.2	<0.2
Benzene, mg/kg	<0.2	<0.2
Bromoform, mg/kg	<0.2	<0.2
Chlorobenzene, mg/kg	<0.2	<0.2

Analytical Report

LOG NO: E90-05-842

Received: 29 MAY 90
Reported: 04 JUN 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-37

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
05-842-1	MW-4-21'	29 MAY 90
05-842-2	MW-5-26'	29 MAY 90

PARAMETER	05-842-1	05-842-2
Carbon Tetrachloride, mg/kg	<0.2	<0.2
Chloroethane, mg/kg	<0.2	<0.2
Chloroform, mg/kg	<0.2	<0.2
Chloromethane, mg/kg	<0.2	<0.2
Carbon Disulfide, mg/kg	<0.2	<0.2
Dibromochloromethane, mg/kg	<0.2	<0.2
Ethylbenzene, mg/kg	<0.2	<0.2
Freon 113, mg/kg	<0.2	<0.2
Methyl ethyl ketone, mg/kg	<2	<2
Methylene chloride, mg/kg	<0.2	<0.2
Styrene, mg/kg	<0.2	<0.2
Trichloroethene, mg/kg	<0.2	<0.2
Trichlorofluoromethane, mg/kg	<0.2	<0.2
Toluene, mg/kg	<0.2	<0.2
Tetrachloroethene, mg/kg	<0.2	<0.2
Vinyl acetate, mg/kg	<0.2	<0.2
Vinyl chloride, mg/kg	<0.2	<0.2
Total Xylene Isomers, mg/kg	<0.2	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2	<0.2
trans-1,3-Dichloropropene, mg/kg	<0.2	<0.2

Results were transmitted to you by facsimile on 06.04.90. T. Blake

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD

BCA Log Number 9005842

Client name: Hygienetics Inc.	Project or PO#: 48001-37
Address: 2200 Powell St.	Phone #: 547 3886
City, State, Zip: Emeryville	Report attention: Karl Novak / Michael Wright

Sampled by:

Analyses required: ~~[illegible]~~ 8240; Hazardous sample Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	~~[illegible]~~	8240						Hazardous sample Special handling required	Remarks
MW4-21'	5/29	"	So	Soil in brass tube	1		X							48 hour turnaround
MW5-26'	5/29		So	Soil " " "	1		X							48 hour turnaround

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Wright	Michael Wright	Hygienetics	5/29	7:15pm
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	[signature]	KARMI FLORES	BCA	5/29	7:15pm

B C ANALYTICAL

- ☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300
- ☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737
- ☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

JUN 25 1990

LOG NO: E90-06-048

Received: 04 JUN 90.
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
06-048-1	19.5'/MW-7/Brass Ring	01 JUN 90
06-048-2	31'/MW-7/Brass Ring	01 JUN 90
06-048-3	41.3'/MW-7/Brass Ring	01 JUN 90
06-048-4	61'/MW-7/Brass Ring	01 JUN 90
06-048-5	66.5'/MW-7/Brass Ring	01 JUN 90

PARAMETER	06-048-1	06-048-2	06-048-3	06-048-4	06-048-5
Vol.Pri.Poll. (EPA-8240)					
Date Analyzed	06.06.90	06.06.90	06.06.90	06.06.90	06.06.90
Date Extracted	06.05.90	06.05.90	06.05.90	06.05.90	06.05.90
Dilution Factor, Times	1	1	1	1	1
1,1,1-Trichloroethane, mg/kg	0.5	<0.2	<0.2	0.3	<0.2
1,1,2,2-Tetrachloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloropropane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Chloroethylvinylether, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Hexanone, mg/kg	<2	<2	<2	<2	<2
4-Methyl-2-Pentanone, mg/kg	<2	<2	<2	<2	<2
Acetone, mg/kg	<5	<5	<5	<5	<5
Acrolein, mg/kg	<5	<5	<5	<5	<5
Acrylonitrile, mg/kg	<2	<2	<2	<2	<2
Bromodichloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromomethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

Analytical Report

LOG NO: E90-06-048

Received: 04 JUN 90
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
06-048-1	19.5'/MW-7/Brass Ring	01 JUN 90
06-048-2	31'/MW-7/Brass Ring	01 JUN 90
06-048-3	41.3'/MW-7/Brass Ring	01 JUN 90
06-048-4	61'/MW-7/Brass Ring	01 JUN 90
06-048-5	66.5'/MW-7/Brass Ring	01 JUN 90

PARAMETER	06-048-1	06-048-2	06-048-3	06-048-4	06-048-5
Benzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromoform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Tetrachloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Disulfide, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Freon 113, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Methyl ethyl ketone, mg/kg	<2	<2	<2	<2	<2
Methylene chloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Styrene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene, mg/kg	<0.2	0.3	0.4	<0.2	<0.2
Vinyl acetate, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Vinyl chloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylene Isomers, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

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BCA B C Analytical

Analytical Report

LOG NO: E90-06-048

Received: 04 JUN 90
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
06-048-1	19.5'/MW-7/Brass Ring	01 JUN 90
06-048-2	31'/MW-7/Brass Ring	01 JUN 90
06-048-3	41.3'/MW-7/Brass Ring	01 JUN 90
06-048-4	61'/MW-7/Brass Ring	01 JUN 90
06-048-5	66.5'/MW-7/Brass Ring	01 JUN 90

PARAMETER	06-048-1	06-048-2	06-048-3	06-048-4	06-048-5
trans-1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Semi-Quantified Results **					
C6-C13 Hydrocarbon, mg/kg	---	---	---	60	---

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Analytical Report

LOG NO: E90-06-048

Received: 04 JUN 90
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
06-048-6	MW-6	04 JUN 90
06-048-7	MW-7	04 JUN 90

PARAMETER	06-048-6	06-048-7
TPH - Volatile Hydrocarbons		
Date Analyzed	06.05.90	06.06.90
Dilution Factor, Times	1	10
C4 to C12 Hydrocarbons, ug/L	<50	12000
Other TPH - Volatile Hydrocarbons	---	---

Analytical Report

LOG NO: E90-06-048

Received: 04 JUN 90
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
06-048-6	MW-6	04 JUN 90
06-048-7	MW-7	04 JUN 90

PARAMETER	06-048-6	06-048-7
Vol.Pri.Poll. (EPA-624)		
Date Analyzed	06.06.90	06.06.90
Dilution Factor, Times	1	06.06.90
1,1,1-Trichloroethane, ug/L	<1	<10
1,1,2,2-Tetrachloroethane, ug/L	<1	<10
1,1,2-Trichloroethane, ug/L	<1	<10
1,1-Dichloroethane, ug/L	<1	<10
1,1-Dichloroethene, ug/L	<1	<10
1,2-Dichloroethane, ug/L	<1	<10
1,2-Dichlorobenzene, ug/L	<1	<10
1,2-Dichloropropane, ug/L	<1	<10
1,3-Dichlorobenzene, ug/L	<1	<10
1,3-Dichloropropene, ug/L	<1	<10
1,4-Dichlorobenzene, ug/L	<1	<10
2-Chloroethylvinylether, ug/L	<1	<10
2-Hexanone, ug/L	<1	<10
4-Methyl-2-Pentanone, ug/L	<1	<10
Acetone, ug/L	<10	<100
Acrolein, ug/L	<10	<100
Acrylonitrile, ug/L	<10	<100
Bromodichloromethane, ug/L	<1	<10
Bromomethane, ug/L	<1	<10
Benzene, ug/L	<1	63
Bromoform, ug/L	<1	<10
Chlorobenzene, ug/L	<1	<10
Carbon Tetrachloride, ug/L	<1	<10

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Emeryville, CA 94608

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BCA B C Analytical

Analytical Report

LOG NO: E90-06-048

Received: 04 JUN 90
Reported: 18 JUN 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
06-048-6	MW-6	04 JUN 90
06-048-7	MW-7	04 JUN 90

PARAMETER	06-048-6	06-048-7
Chloroethane, ug/L	<1	<10
Chloroform, ug/L	<1	<10
Chloromethane, ug/L	<1	<10
Carbon Disulfide, ug/L	<1	<10
Dibromochloromethane, ug/L	<1	<10
Ethylbenzene, ug/L	<1	<10
Freon 113, ug/L	<1	<10
Methyl ethyl ketone, ug/L	<20	<200
Methylene chloride, ug/L	<1	<10
Styrene, ug/L	<1	<10
Trichloroethene, ug/L	<1	26
Trichlorofluoromethane, ug/L	<1	<10
Toluene, ug/L	<1	11
Tetrachloroethene, ug/L	35	900
Vinyl acetate, ug/L	<1	<10
Vinyl chloride, ug/L	<1	<10
Total Xylene Isomers, ug/L	<1	840
cis-1,2-Dichloroethene, ug/L	<1	140
trans-1,2-Dichloroethene, ug/L	<1	<10
trans-1,3-Dichloropropene, ug/L	<1	<10
Semi-Quantified Results **		
C5-C9 Hydrocarbons, ug/L	---	30

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

CHAIN OF CUSTODY RECORD

BCA Log Number 9006048

Client name: Hygienetics		Project or PO#: 48001-36	
Address: 2200 Powell Suite 880		Phone #: 547 3886	
City, State, Zip: Emeryville CA 94608		Report attention: Michael Wright / Karl Novak	

Sampled by:

Analyses required: 8240, 624

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	8240	624						Hazardous sample Special handling required	Remarks
1	6/1		SO	19.5' / MW-7 / Brass Ring	1	+								<48 hr.
1	6/1		SO	31' / MW-7 / Brass Ring	1	+								
1	6/1		SO	41'3" / MW-7 / Brass Ring	1	+								
1	6/1		SO	61' / MW-7 / Brass Ring	1	+								
1	6/1		SO	66.5' / MW-7 / Brass Ring	1	+								
4	6/4		AQ	40ml / MW-7	4		+							
4	6/4		AQ	40ml / MW-7	4		X							

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Wright	Michael Wright	Hygienetics	6/4/90	6:15 pm
Received by					
Relinquished by					
Received by					
Reli[illegible]					
[illegible]	[signature]	KATHI FLORES	BCA	6/4	6:1[illegible]

[illegible]yville, CA 94608 (415) 428-2300
[illegible]dale, CA 91201 (818) 247-5737
[illegible]eim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______

*KEY: AQ—Aqueous NA—Nonaqueous SL—S[illegible]
GW—Groundwater SO—Soil OT—Other [illegible]

Analytical Report

RECEIVED
3 1990

LOG NO: E90-07-628

Received: 26 JUL 90
Reported: 31 JUL 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
07-628-1	B3-16.5	26 JUL 90
07-628-2	B3-12.5	26 JUL 90
07-628-3	B4-6.5	26 JUL 90
07-628-4	B4-11.5	26 JUL 90
07-628-5	B4-17.5	26 JUL 90

PARAMETER	07-628-1	07-628-2	07-628-3	07-628-4	07-628-5
Vol.Pri.Poll. (EPA-8240)					
Date Analyzed	07.27.90	07.27.90	07.28.90	07.28.90	07.28.90
Date Extracted	07.26.90	07.26.90	07.26.90	07.26.90	07.26.90
Dilution Factor, Times	1	1	1	1	1
1,1,1-Trichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2,2-Tetrachloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1,2-Trichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,1-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dichloropropane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
1,4-Dichlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Chloroethylvinylether, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
2-Hexanone, mg/kg	<2	<2	<2	<2	<2
4-Methyl-2-Pentanone, mg/kg	<2	<2	<2	<2	<2
Acetone, mg/kg	<5	<5	<5	<5	<5
Acrolein, mg/kg	<5	<5	<5	<5	<5
Acrylonitrile, mg/kg	<2	<2	<2	<2	<2
Bromodichloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromomethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

1255 Powell Street
Emeryville, CA 94608

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Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-07-628

Received: 26 JUL 90
Reported: 31 JUL 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
07-628-1	B3-16.5	26 JUL 90
07-628-2	B3-12.5	26 JUL 90
07-628-3	B4-6.5	26 JUL 90
07-628-4	B4-11.5	26 JUL 90
07-628-5	B4-17.5	26 JUL 90

PARAMETER	07-628-1	07-628-2	07-628-3	07-628-4	07-628-5
Benzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Bromoform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chlorobenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Tetrachloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloroform, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Chloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon Disulfide, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dibromochloromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Freon 113, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Methyl ethyl ketone, mg/kg	<2	<2	<2	<2	<2
Methylene chloride, mg/kg	<1	<1	<1	<1	<1
Styrene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Trichlorofluoromethane, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Tetrachloroethene, mg/kg	0.5	0.3	<0.2	0.5	0.3
Vinyl acetate, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Vinyl chloride, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Total Xylene Isomers, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
cis-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2

1255 Powell Street
Emeryville, CA 94608

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Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-07-628

Received: 26 JUL 90
Reported: 31 JUL 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, SOIL SAMPLES	DATE SAMPLED
07-628-1	B3-16.5	26 JUL 90
07-628-2	B3-12.5	26 JUL 90
07-628-3	B4-6.5	26 JUL 90
07-628-4	B4-11.5	26 JUL 90
07-628-5	B4-17.5	26 JUL 90

PARAMETER	07-628-1	07-628-2	07-628-3	07-628-4	07-628-5
trans-1,3-Dichloropropene, mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Other Vol.Pri.Poll. (EPA-8240)	---	---	---	---	---

Analytical Report

LOG NO: E90-07-628

Received: 26 JUL 90
Reported: 31 JUL 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-628-6	MW-9	26 JUL 90
07-628-7	MW-8	26 JUL 90

PARAMETER	07-628-6	07-628-7
Vol.Pri.Poll. (EPA-8240)		
Date Analyzed	07.30.90	07.27.90
Date Extracted	07.30.90	07.27.90
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, ug/L	<1	<1
1,1,2,2-Tetrachloroethane, ug/L	<1	<1
1,1,2-Trichloroethane, ug/L	<1	<1
1,1-Dichloroethane, ug/L	<1	<1
1,1-Dichloroethene, ug/L	<1	<1
1,2-Dichloroethane, ug/L	<1	<1
1,2-Dichlorobenzene, ug/L	<1	<1
1,2-Dichloropropane, ug/L	<1	<1
1,3-Dichlorobenzene, ug/L	<1	<1
1,3-Dichloropropene, ug/L	<1	<1
1,4-Dichlorobenzene, ug/L	<1	<1
2-Chloroethylvinylether, ug/L	<1	<1
2-Hexanone, ug/L	<1	<1
4-Methyl-2-Pentanone, ug/L	<1	<1
Acetone, ug/L	<10	<10
Acrolein, ug/L	<10	<10
Acrylonitrile, ug/L	<10	<10
Bromodichloromethane, ug/L	10	2
Bromomethane, ug/L	<1	<1
Benzene, ug/L	<1	<1
Bromoform, ug/L	2	<1
Chlorobenzene, ug/L	<1	<1

Analytical Report

LOG NO: E90-07-628

Received: 26 JUL 90
Reported: 31 JUL 90

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-628-6	MW-9	26 JUL 90
07-628-7	MW-8	26 JUL 90

PARAMETER	07-628-6	07-628-7
Carbon Tetrachloride, ug/L	<1	<1
Chloroethane, ug/L	<1	<1
Chloroform, ug/L	20	2
Chloromethane, ug/L	<1	<1
Carbon Disulfide, ug/L	<1	<1
Dibromochloromethane, ug/L	7	<1
Ethylbenzene, ug/L	3	<1
Freon 113, ug/L	<1	<1
Methyl ethyl ketone, ug/L	<20	<20
Methylene chloride, ug/L	<5	<5
Styrene, ug/L	<1	<1
Trichloroethene, ug/L	<1	17
Trichlorofluoromethane, ug/L	<1	<1
Toluene, ug/L	<1	<1
Tetrachloroethene, ug/L	<1	580
Vinyl acetate, ug/L	<1	<1
Vinyl chloride, ug/L	<1	<1
Total Xylene Isomers, ug/L	<1	<1
cis-1,2-Dichloroethene, ug/L	<1	6
trans-1,2-Dichloroethene, ug/L	<1	<1
trans-1,3-Dichloropropene, ug/L	<1	<1
Other Vol.Pri.Poll. (EPA-8240)	---	---

Results were transmitted by facsimile to Mike Wright on 07.30.90 and on 07.31.90
T. Blake 07.31.90

S. D. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD

BCA Log Number 9007628

Client name Hygienetics	Project or PO# 48001-36
Address 2200 Powell Suite 880	Phone # 415 547 3886
City, State, Zip Emeryville CA 94608	Report attention Michael Wright/Karl Novak

Analyses required: VOA 8240.HSL; 8240.HSL; Hazardous sample; Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sampled by / Sample description	Number of containers	VOA 8240.HSL	8240.HSL						Hazardous sample Special handling required	Remarks
1	7/26	12:00pm	GW	40ml } MW 8	1	✓								48hr
2	7/26	"	GW	40ml }	1	✓								turnaround!
3	7/26	"	GW	40ml } MW 9	1	✓								"
4	7/26	"	GW	40ml }	1	✓								"
5	7/24	"	SO	Brass Tube B3-16.5'	1		✓							"
6	7/24	"	SO	Brass Tube B3-12.5'	1		✓							"
7	7/24	"	SO	Brass Tube B4-6.5'	1		✓							"
8	7/24	"	SO	Brass Tube B4-11.5'	1		✓							"
9	7/24	"	SO	Brass Tube B4-17.5'	1		✓							"

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Wright	Michael Wright	Hygienetics	7/26/90	2:20pm
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	Monika Scott	Monika Scott	BCA	7-26-90	2:20pm

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E90-08-592

Received: 27 AUG 90
Reported: 28 AUG 90

Mr. Mike Luksic
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
08-592-1	MW-11 A & B	25 AUG 90
08-592-2	MW-10 A & B	25 AUG 90

PARAMETER	08-592-1	08-592-2
Purgeable Priority Pollutants		
Date Analyzed	08.27.90	08.27.90
Date Extracted	08.27.90	08.27.90
Dilution Factor, Times	5	1
1,1,1-Trichloroethane, ug/L	<5	<1
1,1,2,2-Tetrachloroethane, ug/L	<5	<1
1,1,2-Trichloroethane, ug/L	<5	<1
1,1-Dichloroethane, ug/L	<5	<1
1,1-Dichloroethene, ug/L	<5	<1
1,2-Dichloroethane, ug/L	<5	<1
1,2-Dichlorobenzene, ug/L	<5	<1
1,2-Dichloropropane, ug/L	<5	<1
1,3-Dichlorobenzene, ug/L	<5	<1
1,4-Dichlorobenzene, ug/L	<5	<1
2-Chloroethylvinylether, ug/L	<5	<1
2-Hexanone, ug/L	<5	<1
4-Methyl-2-Pentanone, ug/L	<5	<1
Acetone, ug/L	<50	<10
Acrolein, ug/L	<50	<10
Acrylonitrile, ug/L	<50	<10
Bromodichloromethane, ug/L	<5	<1
Bromomethane, ug/L	<5	<1
Benzene, ug/L	<5	<1
Bromoform, ug/L	<5	<1
Chlorobenzene, ug/L	<5	<1
Carbon Tetrachloride, ug/L	<5	<1

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-08-592

Received: 27 AUG 90
Reported: 28 AUG 90

Mr. Mike Luksic
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001.36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
08-592-1	MW-11 A & B	25 AUG 90
08-592-2	MW-10 A & B	25 AUG 90

PARAMETER	08-592-1	08-592-2
Chloroethane, ug/L	<5	<1
Chloroform, ug/L	<5	<1
Chloromethane, ug/L	<5	<1
Carbon Disulfide, ug/L	<5	<1
Dibromochloromethane, ug/L	<5	<1
Ethylbenzene, ug/L	<5	<1
Freon 113, ug/L	<5	<1
Methyl ethyl ketone, ug/L	<100	<20
Methylene chloride, ug/L	<20	<5
Styrene, ug/L	<5	<1
Trichloroethene, ug/L	<5	<1
Trichlorofluoromethane, ug/L	<5	<1
Toluene, ug/L	<5	<1
Tetrachloroethene, ug/L	100	35
Vinyl acetate, ug/L	<5	<1
Vinyl chloride, ug/L	<5	<1
Total Xylene Isomers, ug/L	<5	<1
cis-1,2-Dichloroethene, ug/L	<5	<1
cis-1,3-Dichloropropene, ug/L	<5	<1
trans-1,2-Dichloroethene, ug/L	<5	<1
trans-1,3-Dichloropropene, ug/L	<5	<1

Results were transmitted to Mike Luksic by facsimile on 08.28.90. T. Blake

Hedy J. Ficklin for
Sim D. Lessley, Ph.D., Laboratory Director

CHAIN OF CUSTODY RECORD

BCA Log Number 9008592

Client name	Hygienetics Inc.	Project or PO#	48001.36
Address	2200 Powell St. suite 880	Phone #	547 3886
City, State, Zip	Emeryville, CA 94608	Report attention	Mike Luksic / Mike Wright

Sampled by:

Analyses required: Method 8240; Hazardous sample Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	Method 8240							Hazardous sample Special handling required	Remarks
MW11A	8-25-90	17:00	Ground Water	-1	2	✓								24-48 hr rush
MW11B	"	18:00												turnaround
MW10A	8/25/90	16:00	GW	-2	2	✓								
MW10B	"	16:30												

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	Hygienetic Inc.	8-27-90	0810
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	Tony Blake	Tony Blake	BCA	8-27-90	8:10

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E90-09-101

Received: 06 SEP 90

Mailed: MAR 17 1992

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48001.36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-101-1	Well #12	06 SEP 90

PARAMETER	09-101-1
Volatile Organics (EPA 8240)	
Date Analyzed	09.06.90
Date Extracted	09.06.90
Dilution Factor, Times	0.5
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	<0.5
1,1-Dichloroethene, ug/L	<0.5
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
2-Hexanone, ug/L	<0.5
4-Methyl-2-Pentanone, ug/L	<0.5
Acetone, ug/L	<5
Acrolein, ug/L	<5
Acrylonitrile, ug/L	<5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Benzene, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	1.0

1255 Powell Street
Emeryville, CA 94608

510/428-2300
Fax: 510/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-09-101

Received: 06 SEP 90

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48001.36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-101-1	Well #12	06 SEP 90

PARAMETER	09-101-1
Chloromethane, ug/L	<0.5
Carbon Disulfide, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5
Ethylbenzene, ug/L	<0.5
Freon 113, ug/L	<0.5
Methyl ethyl ketone, ug/L	<10
Methylene chloride, ug/L	<2
Styrene, ug/L	<0.5
Trichloroethene, ug/L	1.1
Trichlorofluoromethane, ug/L	<0.5
Toluene, ug/L	1.4
Tetrachloroethene, ug/L	170
Vinyl acetate, ug/L	<0.5
Vinyl chloride, ug/L	<0.5
Total Xylene Isomers, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	<0.5
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

510/428-2300
Fax: 510/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD

BCA Log Number [illegible]

Client name	Hygienetics, inc.
Project or PO#	48001.36
Address	2200 Powell St. suite 880
Phone #	547-3886
City, State, Zip	Emeryville, CA 94608
Report attention	Mike Wright / Luksic
Sampled by	

Analyses required: 8240; Hazardous sample / Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	8240							Hazardous sample / Special handling required	Remarks
MW12 A	9-6-90	10:30	GW	Well #12 40 ml bottles	2	✓								
MW12 B		11:00												

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	Hygienetics	9-6-90	11:30
Received by	D Lowe	D Lowe	BCA	9/6/90	11:30
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

RECEIVED
OCT - 2 1990

LOG NO: E90-09-477

Received: 24 SEP 90
Reported: 25 SEP 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-477-1	MW13 Ventura	24 SEP 90
09-477-2	MW14 Lambaron	24 SEP 90

PARAMETER	09-477-1	09-477-2
Purgeable Priority Pollutants		
Date Analyzed	09.25.90	09.25.90
Date Extracted	09.25.90	09.25.90
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, ug/L	<1	<1
1,1,2,2-Tetrachloroethane, ug/L	<1	<1
1,1,2-Trichloroethane, ug/L	<1	<1
1,1-Dichloroethane, ug/L	<1	<1
1,1-Dichloroethene, ug/L	<1	<1
1,2-Dichloroethane, ug/L	<1	<1
1,2-Dichlorobenzene, ug/L	<1	<1
1,2-Dichloropropane, ug/L	<1	<1
1,3-Dichlorobenzene, ug/L	<1	<1
1,4-Dichlorobenzene, ug/L	<1	<1
2-Chloroethylvinylether, ug/L	<1	<1
2-Hexanone, ug/L	<1	<1
4-Methyl-2-Pentanone, ug/L	<1	<1
Acetone, ug/L	<10	<10
Acrolein, ug/L	<10	<10
Acrylonitrile, ug/L	<10	<10
Bromodichloromethane, ug/L	<1	<1
Bromomethane, ug/L	<1	<1
Benzene, ug/L	<1	<1
Bromoform, ug/L	<1	<1
Chlorobenzene, ug/L	<1	<1
Carbon Tetrachloride, ug/L	<1	<1

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-09-477

Received: 24 SEP 90
Reported: 25 SEP 90

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

Project: 48001-36

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-477-1	MW13 Ventura	24 SEP 90
09-477-2	MW14 Lambaron	24 SEP 90

PARAMETER	09-477-1	09-477-2
Chloroethane, ug/L	<1	<1
Chloroform, ug/L	<1	<1
Chloromethane, ug/L	<1	<1
Carbon Disulfide, ug/L	<1	<1
Dibromochloromethane, ug/L	<1	<1
Ethylbenzene, ug/L	<1	<1
Freon 113, ug/L	<1	<1
Methyl ethyl ketone, ug/L	<20	<20
Methylene chloride, ug/L	<5	<5
Styrene, ug/L	<1	<1
Trichloroethene, ug/L	<1	1
Trichlorofluoromethane, ug/L	<1	<1
Toluene, ug/L	<1	<1
Tetrachloroethene, ug/L	23	5
Vinyl acetate, ug/L	<1	<1
Vinyl chloride, ug/L	<1	<1
Total Xylene Isomers, ug/L	<1	<1
cis-1,2-Dichloroethene, ug/L	<1	5
cis-1,3-Dichloropropene, ug/L	<1	<1
trans-1,2-Dichloroethene, ug/L	<1	<1
trans-1,3-Dichloropropene, ug/L	<1	<1

This report includes results reported verbally and by facsimile to M. Wright on September 25, 1990. B. Bowman.

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD

BCA Log Number

Client name: Hygienetics Inc	Project or PO#: 48001-36
Address: 2200 Powell St Suite 880	Phone #: 415 547 3886
City, State, Zip: Emeryville CA 94608	Report attention: Michael Wright

Sampled by:

Analyses required: 8240; Hazardous sample Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	8240	Remarks
13a	9/24	1:30	GW	40 ml } MW13	1	X	24 hr
13b	9/24	1:31	GW	40ml } ~~[illegible]~~ Ventura	1	X	
							Turn
14a	9/24	2:20	GW	40 ml } MW14	1	X	Around
14b	9/24	2:21	GW	40 ml } Lambaron	1	X	

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Wright	Michael Wright	Hygienetics.	9/24/90	3:46pm
Received by					
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory	Tony Blake	Tony Blake	BCA	9/24/90	4:00pm

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements:

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E90-09-598

Received: 28 SEP 90
Reported: 01 OCT 90

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-598-1	MW13	28 SEP 90

PARAMETER	09-598-1
Purgeable Priority Pollutants	
Date Analyzed	09.28.90
Date Extracted	09.28.90
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<1
1,1,2,2-Tetrachloroethane, ug/L	<1
1,1,2-Trichloroethane, ug/L	<1
1,1-Dichloroethane, ug/L	<1
1,1-Dichloroethene, ug/L	<1
1,2-Dichloroethane, ug/L	<1
1,2-Dichlorobenzene, ug/L	<1
1,2-Dichloropropane, ug/L	<1
1,3-Dichlorobenzene, ug/L	<1
1,4-Dichlorobenzene, ug/L	<1
2-Chloroethylvinylether, ug/L	<1
2-Hexanone, ug/L	<1
4-Methyl-2-Pentanone, ug/L	<1
Acetone, ug/L	<10
Acrolein, ug/L	<10
Acrylonitrile, ug/L	<10
Bromodichloromethane, ug/L	<1
Bromomethane, ug/L	<1
Benzene, ug/L	<1
Bromoform, ug/L	<1
Chlorobenzene, ug/L	<1
Carbon Tetrachloride, ug/L	<1
Chloroethane, ug/L	<1

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

Analytical Report

LOG NO: E90-09-598

Received: 28 SEP 90
Reported: 01 OCT 90

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
09-598-1	MW13	28 SEP 90

PARAMETER	09-598-1
Chloroform, ug/L	<1
Chloromethane, ug/L	<1
Carbon Disulfide, ug/L	<1
Dibromochloromethane, ug/L	<1
Ethylbenzene, ug/L	<1
Freon 113, ug/L	<1
Methyl ethyl ketone, ug/L	<20
Methylene chloride, ug/L	<5
Styrene, ug/L	<1
Trichloroethene, ug/L	<1
Trichlorofluoromethane, ug/L	<1
Toluene, ug/L	<1
Tetrachloroethene, ug/L	36.
Vinyl acetate, ug/L	<1
Vinyl chloride, ug/L	<1
Total Xylene Isomers, ug/L	<1
cis-1,2-Dichloroethene, ug/L	<1
cis-1,3-Dichloropropene, ug/L	<1
trans-1,2-Dichloroethene, ug/L	<1
trans-1,3-Dichloropropene, ug/L	<1

Results were transmitted by facsimile to Mike Wright on 10.01.90. T. Blake

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

LOG NO: E90-10-242

Received: 10 OCT 90
Reported: 11 OCT 90

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-242-1	MW-15	10 OCT 90

PARAMETER	10-242-1
Purgeable Priority Pollutants	
Date Analyzed	10.10.90
Date Extracted	10.10.90
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<1
1,1,2,2-Tetrachloroethane, ug/L	<1
1,1,2-Trichloroethane, ug/L	<1
1,1-Dichloroethane, ug/L	<1
1,1-Dichloroethene, ug/L	<1
1,2-Dichloroethane, ug/L	<1
1,2-Dichlorobenzene, ug/L	<1
1,2-Dichloropropane, ug/L	<1
1,3-Dichlorobenzene, ug/L	<1
1,4-Dichlorobenzene, ug/L	<1
2-Chloroethylvinylether, ug/L	<1
2-Hexanone, ug/L	<1
4-Methyl-2-Pentanone, ug/L	<1
Acetone, ug/L	<10
Acrolein, ug/L	<10
Acrylonitrile, ug/L	<10
Bromodichloromethane, ug/L	<1
Bromomethane, ug/L	<1
Benzene, ug/L	<1
Bromoform, ug/L	<1
Chlorobenzene, ug/L	<1
Carbon Tetrachloride, ug/L	<1
Chloroethane, ug/L	<1

LOG NO: E90-10-242

Received: 10 OCT 90
Reported: 11 OCT 90

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville California 94608

REPORT OF ANALYTICAL RESULTS

Page 2

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
10-242-1	MW-15	10 OCT 90

PARAMETER	10-242-1
Chloroform, ug/L	<1
Chloromethane, ug/L	<1
Carbon Disulfide, ug/L	<1
Dibromochloromethane, ug/L	<1
Ethylbenzene, ug/L	<1
Freon 113, ug/L	<1
Methyl ethyl ketone, ug/L	<20
Methylene chloride, ug/L	<5
Styrene, ug/L	<1
Trichloroethene, ug/L	<1
Trichlorofluoromethane, ug/L	<1
Toluene, ug/L	<1
Tetrachloroethene, ug/L	<1
Vinyl acetate, ug/L	<1
Vinyl chloride, ug/L	<1
Total Xylene Isomers, ug/L	<1
cis-1,2-Dichloroethene, ug/L	<1
cis-1,3-Dichloropropene, ug/L	<1
trans-1,2-Dichloroethene, ug/L	<1
trans-1,3-Dichloropropene, ug/L	<1

im D. Lessley, Ph.D., Laboratory Director

MW 15

CHAIN OF CUSTODY RECORD

BCA Log Number 9010242

Client name: HYGIENETICS
Project or PO#:
Address: 2200 POWELL Street
Phone #: 547-3886
City, State, Zip: EMERYVILLE CA
Report attention: MIKE WRIGHT
Sampled by: MIKE BRUBAKER

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	Analyses required: 8240							Hazardous sample Special handling required	Remarks
01	10/10	10:30		Water Sample	3	X								
02	"													
03	"													

	Signature	Print Name	Company	Date	Time
Relinquished by	Michael Y. Brubaker	Michael Y. Brubaker	Hygienetics Inc	10/10/90	12:00
Received by	[signature]	Phoin Thongkham	BCA	10/10/90	1200
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300
☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737
☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E91-03-113

Received: 05 MAR 91
Mailed : 21 MAR 91

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville, California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-113-1	MW-6	05 MAR 91
03-113-2	MW-7	05 MAR 91
03-113-3	MW-9	05 MAR 91
03-113-4	MW-13	05 MAR 91
03-113-5	MW-14	05 MAR 91

PARAMETER	03-113-1	03-113-2	03-113-3	03-113-4	03-113-5
Volatile Organics (EPA 624)					
Date Analyzed	03.07.91	03.12.91	03.07.91	03.07.91	03.15.91
Date Extracted	03.07.91	03.12.91	03.07.91	03.07.91	03.15.91
Dilution Factor, Times	1	20	1	1	1
1,1,1-Trichloroethane, ug/L	<1	<20	<1	<1	<1
1,1,2,2-Tetrachloroethane, ug/L	<1	<20	<1	<1	<1
1,1,2-Trichloroethane, ug/L	<1	<20	<1	<1	<1
1,1-Dichloroethane, ug/L	<1	<20	<1	<1	<1
1,1-Dichloroethene, ug/L	<1	<20	<1	<1	<1
1,2-Dichloroethane, ug/L	<1	<20	<1	<1	<1
1,2-Dichlorobenzene, ug/L	<1	<20	<1	<1	<1
1,2-Dichloropropane, ug/L	<1	<20	<1	<1	<1
1,3-Dichlorobenzene, ug/L	<1	<20	<1	<1	<1
1,4-Dichlorobenzene, ug/L	<1	<20	<1	<1	<1
2-Chloroethylvinylether, ug/L	<1	<20	<1	<1	<1
2-Hexanone, ug/L	<1	<20	<1	<1	<1
4-Methyl-2-Pentanone, ug/L	<1	<20	<1	<1	<1
Acetone, ug/L	<10	<200	<10	<10	<10
Acrolein, ug/L	<10	<200	<10	<10	<10
Acrylonitrile, ug/L	<10	<200	<10	<10	<10
Bromodichloromethane, ug/L	<1	<20	<1	<1	<1
Bromomethane, ug/L	<1	<20	<1	<1	<1
Benzene, ug/L	<1	<20	<1	<1	<1

1255 Powell Street
Emeryville, CA 94608

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BCA B C Analytical

Analytical Report

LOG NO: E91-03-113

Received: 05 MAR 91
Mailed : 21 MAR 91

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville, California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-113-1	MW-6	05 MAR 91
03-113-2	MW-7	05 MAR 91
03-113-3	MW-9	05 MAR 91
03-113-4	MW-13	05 MAR 91
03-113-5	MW-14	05 MAR 91

PARAMETER	03-113-1	03-113-2	03-113-3	03-113-4	03-113-5
Bromoform, ug/L	<1	<20	<1	<1	<1
Chlorobenzene, ug/L	<1	<20	<1	<1	<1
Carbon Tetrachloride, ug/L	<1	<20	<1	<1	<1
Chloroethane, ug/L	<1	<20	<1	<1	<1
Chloroform, ug/L	1	<20	2	<1	<1
Chloromethane, ug/L	<1	<20	<1	<1	<1
Carbon Disulfide, ug/L	<1	<20	<1	<1	<1
Dibromochloromethane, ug/L	<1	<20	<1	<1	<1
Ethylbenzene, ug/L	<1	<20	<1	<1	<1
Freon 113, ug/L	<1	<20	<1	<1	<1
Methyl ethyl ketone, ug/L	<20	<400	<1	<20	<20
Methylene chloride, ug/L	<5	<100	<5	<5	6
Styrene, ug/L	<1	<20	<1	<1	<1
Trichloroethene, ug/L	<1	190	<1	<1	<1
Trichlorofluoromethane, ug/L	<1	<20	<1	<1	<1
Toluene, ug/L	<1	<20	<1	<1	<1
Tetrachloroethene, ug/L	43	1700	<1	34	<1
Vinyl acetate, ug/L	<1	<20	<1	<1	<1
Vinyl chloride, ug/L	<1	<20	<1	<1	<1
Total Xylene Isomers, ug/L	<1	<20	<1	<1	<1
cis-1,2-Dichloroethene, ug/L	<1	37	<1	<1	<1
cis-1,3-Dichloropropene, ug/L	<1	<20	<1	<1	<1
trans-1,2-Dichloroethene, ug/L	<1	<20	<1	<1	<1

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BCA B C Analytical

Analytical Report

LOG NO: E91-03-113

Received: 05 MAR 91
Mailed : 21 MAR 91

Mr. Michael Wright
Hygienetics
2200 Powell Street Suite 1095
Emeryville, California 94608

Project: Arcade

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-113-1	MW-6	05 MAR 91
03-113-2	MW-7	05 MAR 91
03-113-3	MW-9	05 MAR 91
03-113-4	MW-13	05 MAR 91
03-113-5	MW-14	05 MAR 91

PARAMETER	03-113-1	03-113-2	03-113-3	03-113-4	03-113-5
trans-1,3-Dichloropropene, ug/L	<1	<20	<1	<1	<1

Tony Blake for

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

415/428-2300
Fax: 415/547-3643

BCA B C Analytical

BCA Log Number 9103113

CHAIN OF CUSTODY RECORD ARCADE

Client name	Hygienetics
Project or PO#	
Address	2200 Powell St.
Phone #	415 547 3886
City, State, Zip	Emeryville 94608
Report attention	Michael Wright
Sampled by	

Analyses required: 624; Hazardous sample Special handling required

	Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	624							Hazardous sample Special handling required	Remarks
1	MW 6	3/5	2:50pm	GW	40 ml VOA	1	✓								
2	7	3/5	3:45	GW	40 ml VOA	1	✓								
3	9	3/5	2:15	GW	40 ml VOA	1	✓								
4	13	3/5	1:45	GW	40 ml VOA	1	✓								
5	14	3/5	12:55	GW	40 ml VOA	1	✓								

	Signature	Print Name	Company	Date	Time
Relinquished by	[signature]	Michael Wright	Hygienetics	3/5/91	4:50pm
Received by	[signature]	P. THONGKHAM	BCA	3/5/91	4:50
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

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Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E91-07-597

Received: 25 JUL 91

Mailed: AUG 13 1991

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48016-04

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-597-1	MW-14-01,02	25 JUL 91
07-597-2	MW-13-03,04	25 JUL 91
07-597-3	MW-09-05,06	25 JUL 91
07-597-4	MW-06-08	25 JUL 91

PARAMETER	07-597-1	07-597-2	07-597-3	07-597-4
Volatile Organics (EPA 624)				
Date Analyzed	08.03.91	08.03.91	08.03.91	08.03.91
Date Extracted	08.03.91	08.03.91	08.03.91	08.03.91
Dilution Factor, Times	0.5	0.5	0.5	0.5
1,1,1-Trichloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
1,1,2-Trichloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
1,1-Dichloroethene, ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichlorobenzene, ug/L	<0.5	<0.5	<0.5	<0.5
1,2-Dichloropropane, ug/L	<0.5	<0.5	<0.5	<0.5
1,3-Dichlorobenzene, ug/L	<0.5	<0.5	<0.5	<0.5
1,4-Dichlorobenzene, ug/L	<0.5	<0.5	<0.5	<0.5
2-Chloroethylvinylether, ug/L	<0.5	<0.5	<0.5	<0.5
2-Hexanone, ug/L	<0.5	<0.5	<0.5	<0.5
4-Methyl-2-Pentanone, ug/L	<0.5	<0.5	<0.5	<0.5
Acetone, ug/L	<5	<5	<5	<5
Acrolein, ug/L	<5	<5	<5	<5
Acrylonitrile, ug/L	<5	<5	<5	<5
Bromodichloromethane, ug/L	<0.5	<0.5	<0.5	<0.5
Bromomethane, ug/L	<0.5	<0.5	<0.5	<0.5
Benzene, ug/L	<0.5	<0.5	<0.5	<0.5
Bromoform, ug/L	<0.5	<0.5	<0.5	<0.5
Chlorobenzene, ug/L	<0.5	<0.5	<0.5	<0.5

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BCA B C Analytical

Analytical Report

LOG NO: E91-07-597

Received: 25 JUL 91

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48016-04

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-597-1	MW-14-01,02	25 JUL 91
07-597-2	MW-13-03,04	25 JUL 91
07-597-3	MW-09-05,06	25 JUL 91
07-597-4	MW-06-08	25 JUL 91

PARAMETER	07-597-1	07-597-2	07-597-3	07-597-4
Carbon Tetrachloride, ug/L	<0.5	<0.5	<0.5	<0.5
Chloroethane, ug/L	<0.5	<0.5	<0.5	<0.5
Chloroform, ug/L	<0.5	<0.5	1.0	1.1
Chloromethane, ug/L	<0.5	<0.5	<0.5	<0.5
Carbon Disulfide, ug/L	<0.5	<0.5	<0.5	<0.5
Dibromochloromethane, ug/L	<0.5	<0.5	<0.5	<0.5
Ethylbenzene, ug/L	<0.5	<0.5	<0.5	<0.5
Freon 113, ug/L	<0.5	<0.5	<0.5	<0.5
Methyl ethyl ketone, ug/L	<10	<10	<10	<10
Methylene chloride, ug/L	<2	<2	<2	<2
Styrene, ug/L	<0.5	<0.5	<0.5	<0.5
Trichloroethene, ug/L	0.7	<0.5	<0.5	<0.5
Trichlorofluoromethane, ug/L	<0.5	<0.5	<0.5	<0.5
Toluene, ug/L	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene, ug/L	1.1	30	<0.5	74
Vinyl acetate, ug/L	<0.5	<0.5	<0.5	<0.5
Vinyl chloride, ug/L	<0.5	<0.5	<0.5	<0.5
Total Xylene Isomers, ug/L	<0.5	<0.5	0.7	<0.5
cis-1,2-Dichloroethene, ug/L	2.1	<0.5	<0.5	<0.5
cis-1,3-Dichloropropene, ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5	<0.5	<0.5	<0.5
Semi-Quantified Results **				
Difluorochloromethane, ug/L	20	---	---	---

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Emeryville, CA 94608

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BCA B C Analytical

Analytical Report

LOG NO: E91-07-597

Received: 25 JUL 91

Mr. Mike Wright
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48016-04

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-597-1	MW-14-01,02	25 JUL 91
07-597-2	MW-13-03,04	25 JUL 91
07-597-3	MW-09-05,06	25 JUL 91
07-597-4	MW-06-08	25 JUL 91

PARAMETER	07-597-1	07-597-2	07-597-3	07-597-4

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Sim D. Lessley, Ph.D., Laboratory Director

Analytical Report

LOG NO: E91-07-618

Received: 26 JUL 91

Mailed: AUG 15 1991

Mr. Mike Bennett
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48016-04

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-618-1	MW-7	26 JUL 91
07-618-2	MW-10	26 JUL 91

PARAMETER	07-618-1	07-618-2
Volatile Organics (EPA 624)		
Date Analyzed	08.09.91	08.09.91
Date Extracted	08.09.91	08.09.91
Dilution Factor, Times	20	1
1,1,1-Trichloroethane, ug/L	<20	<1
1,1,2,2-Tetrachloroethane, ug/L	<20	<1
1,1,2-Trichloroethane, ug/L	<20	<1
1,1-Dichloroethane, ug/L	<20	<1
1,1-Dichloroethene, ug/L	<20	<1
1,2-Dichloroethane, ug/L	<20	<1
1,2-Dichlorobenzene, ug/L	<20	<1
1,2-Dichloropropane, ug/L	<20	<1
1,3-Dichlorobenzene, ug/L	<20	<1
1,4-Dichlorobenzene, ug/L	<20	<1
2-Chloroethylvinylether, ug/L	<20	<1
2-Hexanone, ug/L	<20	<1
4-Methyl-2-Pentanone, ug/L	<20	<1
Acetone, ug/L	<200	<10
Acrolein, ug/L	<200	<10
Acrylonitrile, ug/L	<200	<10
Bromodichloromethane, ug/L	<20	<1
Bromomethane, ug/L	<20	<1
Benzene, ug/L	31	<1
Bromoform, ug/L	<20	<1
Chlorobenzene, ug/L	<20	<1
Carbon Tetrachloride, ug/L	<20	<1
Chloroethane, ug/L	<20	<1

Analytical Report

LOG NO: E91-07-618

Received: 26 JUL 91

Mr. Mike Bennett
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

Project: 48016-04

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
07-618-1	MW-7	26 JUL 91
07-618-2	MW-10	26 JUL 91

PARAMETER	07-618-1	07-618-2
Chloroform, ug/L	<20	<1
Chloromethane, ug/L	<20	<1
Carbon Disulfide, ug/L	<20	<1
Dibromochloromethane, ug/L	<20	<1
Ethylbenzene, ug/L	<20	<1
Freon 113, ug/L	<20	<1
Methyl ethyl ketone, ug/L	<400	<20
Methylene chloride, ug/L	<100	<5
Styrene, ug/L	<20	<1
Trichloroethene, ug/L	230	<1
Trichlorofluoromethane, ug/L	<20	<1
Toluene, ug/L	<20	<1
Tetrachloroethene, ug/L	1600	22
Vinyl acetate, ug/L	<20	<1
Vinyl chloride, ug/L	<20	<1
Total Xylene Isomers, ug/L	<20	<1
cis-1,2-Dichloroethene, ug/L	120	<1
cis-1,3-Dichloropropene, ug/L	<20	<1
trans-1,2-Dichloroethene, ug/L	<20	<1
trans-1,3-Dichloropropene, ug/L	<20	<1

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

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Fax: 415/547-3643

BCA B C Analytical

[illegible]

CHAIN OF CUSTODY RECORD

BCA Log Number 9107514

Client name Hygienetics	Project or PO# 48016-04
Address 2200 Powell st. suite 880	Phone # 415-547-3886
City, State, Zip Emeryville, CA 94608	Report attention Mike Wright

Sampled by Mike Luksic & Rib Fitzburg

Analyses required: 624 | Hazardous sample Special handling required

	Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	624							Hazardous sample Special handling required	Remarks
1	01	7-25	1220	GW	40 ml VOA MW-14-01	1									
	02	7-25	1220	GW	40 ml VOA MW-14-02	1									
2	03	7-25	1255	GW	40 ml VOA MW-13-03	1									
	04	7-25	1255	GW	40 ml VOA MW-13-04	1									
3	05	7-25	1440	GW	40 ml VOA MW 9-05	1									
	06	7-25	1440	GW	40 ml VOA MW-9-06	1									
4	08	7-25	1550	GW	40 ml VOA MW-6-08	1									

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	Hygienetics	7-25-91	1750
Received by	J. Anderson	J. Anderson	BCA	7/25/91	1750
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

- [ ] 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300
- [ ] 801 Western Avenue, Glendale, CA 91201 (818) 247-5737
- [ ] 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______________________

*KEY: AQ—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

CHAIN OF CUSTODY RECORD

BCA Log Number 9107618

Client name	Hygienetics
Address	2200 Powell st. suite 880
City, State, Zip	Emeryville, CA 94608
Project or PO#	48016-04
Phone #	415-547-3886
Report attention	Mike Wright
Sampled by	Mike Luksic

Analyses required: 624; Hazardous sample Special handling required

	Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	624	Remarks
MW7	09	7-26	945	GW	40 mL VOA	1	MW-7	
"	10	7-26	945	GW	"	1	MW-7	
MW10	11	7-26	1030	GW	"	1	MW-10	
"	12	7-26	1030	GW	"	1	MW-10	

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	Hygienetics	7-26-91	12:20
Received by	Kathy O'Brien	Kathy O'Brien	BCA	7-26-91	12:20
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

☐ 1255 Powell Street, Emeryville, CA 94608 (415) 428-2300

☐ 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

☐ 1200 Pacifico Avenue, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ____

*KEY: AO—Aqueous NA—Nonaqueous SL—Sludge GW—Groundwater SO—Soil OT—Other PE—Petroleum

Analytical Report

LOG NO: E91-11-307

Received: 12 NOV 91
Mailed : 06 DEC 91

Mr. Mike Luksic
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-307-1	MW-14	12 NOV 91
11-307-2	MW-9	12 NOV 91
11-307-3	MW-6	12 NOV 91
11-307-4	MW-7	12 NOV 91

PARAMETER	11-307-1	11-307-2	11-307-3	11-307-4
Volatile Organics (EPA 624)				
Date Analyzed	11.24.91	11.24.91	11.24.91	11.24.91
Date Extracted	11.24.91	11.24.91	11.24.91	11.24.91
Dilution Factor, Times	1	1	1	10
1,1,1-Trichloroethane, ug/L	<1	<1	<1	<10
1,1,2,2-Tetrachloroethane, ug/L	<1	<1	<1	<10
1,1,2-Trichloroethane, ug/L	<1	<1	<1	<10
1,1-Dichloroethane, ug/L	<1	<1	<1	<10
1,1-Dichloroethene, ug/L	<1	<1	<1	<10
1,2-Dichloroethane, ug/L	<1	<1	<1	<10
1,2-Dichlorobenzene, ug/L	<1	<1	<1	<10
1,2-Dichloropropane, ug/L	<1	<1	<1	<10
1,3-Dichlorobenzene, ug/L	<1	<1	<1	<10
1,4-Dichlorobenzene, ug/L	<1	<1	<1	<10
2-Chloroethylvinylether, ug/L	<1	<1	<1	<10
2-Hexanone, ug/L	<1	<1	<1	<10
4-Methyl-2-Pentanone, ug/L	<1	<1	<1	<10
Acetone, ug/L	<10	<10	<10	<100
Acrolein, ug/L	<10	<10	<10	<100
Acrylonitrile, ug/L	<10	<10	<10	<100
Bromodichloromethane, ug/L	<1	<1	<1	<10
Bromomethane, ug/L	<1	<1	<1	<10

1255 Powell Street
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BCA B C Analytical

Analytical Report

LOG NO: E91-11-307

Received: 12 NOV 91
Mailed : 06 DEC 91

Mr. Mike Luksic
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-307-1	MW-14	12 NOV 91
11-307-2	MW-9	12 NOV 91
11-307-3	MW-6	12 NOV 91
11-307-4	MW-7	12 NOV 91

PARAMETER	11-307-1	11-307-2	11-307-3	11-307-4
Benzene, ug/L	<1	<1	<1	<10
Bromoform, ug/L	<1	<1	<1	<10
Chlorobenzene, ug/L	<1	<1	<1	<10
Carbon Tetrachloride, ug/L	<1	<1	<1	<10
Chloroethane, ug/L	<1	<1	<1	<10
Chloroform, ug/L	<1	<1	<1	<10
Chloromethane, ug/L	<1	<1	<1	<10
Carbon Disulfide, ug/L	2	<1	<1	<10
Dibromochloromethane, ug/L	<1	<1	<1	<10
Ethylbenzene, ug/L	<1	<1	<1	<10
Freon 113, ug/L	<1	<1	<1	<10
Methyl ethyl ketone, ug/L	<20	<20	<20	<200
Methylene chloride, ug/L	<5	<5	<5	<50
Styrene, ug/L	<1	<1	<1	<10
Trichloroethene, ug/L	<1	<1	1	220
Trichlorofluoromethane, ug/L	<1	<1	<1	<10
Toluene, ug/L	<1	<1	<1	<10
Tetrachloroethene, ug/L	<1	<1	310	670
Vinyl acetate, ug/L	<1	<1	<1	<10
Vinyl chloride, ug/L	<1	<1	<1	<10
Total Xylene Isomers, ug/L	<1	<1	<1	<10
cis-1,2-Dichloroethene, ug/L	<1	<1	<1	130

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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
11-307-1	MW-14	12 NOV 91
11-307-2	MW-9	12 NOV 91
11-307-3	MW-6	12 NOV 91
11-307-4	MW-7	12 NOV 91

PARAMETER	11-307-1	11-307-2	11-307-3	11-307-4
cis-1,3-Dichloropropene, ug/L	<1	<1	<1	<10
trans-1,2-Dichloroethene, ug/L	<1	<1	<1	25
trans-1,3-Dichloropropene, ug/L	<1	<1	<1	<10
Semi-Quantified Results **				
C6 Hydrocarbons, ug/L	---	---	---	10

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Tony Blakio for

Sim D. Lessley, Ph.D., Laboratory Director

BCA Log Number [redacted]

CHAIN OF CUSTODY RECORD

Client name	H + GCL
Address	2200 Powell suite 880
City, State, Zip	Emeryville, CA 94608
Project or PO#	
Phone #	510-547-3886
Report attention	Mike Luksic
Sampled by	Luksic / Haroldson

Analyses required: 624

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	624								Hazardous sample Special handling required	Remarks
MW-14	11-12-91	1045	G.W	G.W. 40 ml V.O.A	32	✓									(All wells were low
MW-9	11-12-91	11:10	G.W.	G.W. "	1	✓									and only could
MW-6	11-12-91	1:00	GW	G.W. "	2	✓									be sampled.)
MW-7	11-12-91	1:30	GW	G.W. "	3	✓									

66

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	H + GCL	11-12-91	1505
Received by	[illegible]	[illegible]	BCA	11/12/91	1505 pm
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ____________________

*KEY: WW—Wastewater SU—Surface Water SO—Soil SL—Sludge PE—Petroleum OT—Other NA—Nonaqueous GW—Groundwater AQ—Aqueous

B C ANALYTICAL

1255 Powell Street, Emeryville, CA 94608 (510) 428-2300

801 Western Avenue, Glendale, CA 91201 (818) 247-5737

Analytical Report

LOG NO: E91-11-649

Received: 26 NOV 91
Mailed : 03 DEC 91

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-3B	26 NOV 91

PARAMETER	11-649-1	11-649-2
Halocarbons (EPA 601)		
Date Analyzed	11.27.91	11.27.91
Dilution Factor, Times	1	1
1,1,1-Trichloroethane, ug/L	<0.5	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5	<0.5
1,1,2-Trichloroethane, ug/L	<0.5	<0.5
1,1-Dichloroethane, ug/L	<0.5	<0.5
1,1-Dichloroethene, ug/L	<0.5	<0.5
1,2-Dichloroethane, ug/L	<0.5	<0.5
1,2-Dichlorobenzene, ug/L	<0.5	<0.5
1,2-Dichloroethene (Total), ug/L	<0.5	<0.5
1,2-Dichloropropane, ug/L	<0.5	<0.5
1,3-Dichlorobenzene, ug/L	<0.5	<0.5
1,4-Dichlorobenzene, ug/L	<0.5	<0.5
2-Chloroethylvinylether, ug/L	<0.5	<0.5
Bromodichloromethane, ug/L	<0.5	<0.5
Bromomethane, ug/L	<0.5	<0.5
Bromoform, ug/L	<0.5	<0.5
Chlorobenzene, ug/L	<0.5	<0.5
Carbon Tetrachloride, ug/L	<0.5	<0.5
Chloroethane, ug/L	<0.5	<0.5
Chloroform, ug/L	<0.5	<0.5
Chloromethane, ug/L	<0.5	<0.5
Dibromochloromethane, ug/L	<0.5	<0.5
Dichlorodifluoromethane, ug/L	<0.5	<0.5
Freon 113, ug/L	<0.5	<0.5
Methylene chloride, ug/L	<0.5	<0.5

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BCA B C Analytical

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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-3B	26 NOV 91

PARAMETER	11-649-1	11-649-2
Trichloroethene, ug/L	<0.5	<0.5
Trichlorofluoromethane, ug/L	<0.5	<0.5
Tetrachloroethene, ug/L	<0.5	<0.5
Vinyl chloride, ug/L	<0.5	<0.5
cis-1,2-Dichloroethene, ug/L	<0.5	<0.5
cis-1,3-Dichloropropene, ug/L	<0.5	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5	<0.5
Other Halocarbons (EPA 601)	---	---
Vol.Aromatics (EPA-602)		
Date Analyzed	11.27.91	11.27.91
Dilution Factor, Times	1	1
1,2-Dichlorobenzene, ug/L	<0.5	<0.5
1,3-Dichlorobenzene, ug/L	<0.5	<0.5
1,4-Dichlorobenzene, ug/L	<0.5	<0.5
Benzene, ug/L	<0.5	<0.5
Chlorobenzene, ug/L	<0.5	<0.5
Ethylbenzene, ug/L	<0.5	<0.5
Toluene, ug/L	<0.5	<0.5
Total Xylene Isomers, ug/L	<0.5	<0.5
Other Vol.Aromatics (EPA-602)	---	---

Analytical Report

LOG NO: E91-11-649

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Hygienetics
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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-3	CWS-8A	26 NOV 91
11-649-4	CWS-8B	26 NOV 91

PARAMETER	11-649-3	11-649-4
Sample Held, Not Analyzed	HELD	HELD

Tony Blake for
Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
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BCA B C Analytical

Analytical Report

LOG NO: E91-11-649

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REVISED FEB 12 1992

Mr. Karl Novak
Hygienetics
2200 Powell Street Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-8A	26 NOV 91
11-649-3	CWS-3B	26 NOV 91
11-649-4	CWS-8B	26 NOV 91

PARAMETER	11-649-1	11-649-2	11-649-3	11-649-4
Sample Held, Not Analyzed	---	---	HELD	HELD

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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-8A	26 NOV 91
11-649-3	CWS-3B	26 NOV 91
11-649-4	CWS-8B	26 NOV 91

PARAMETER	11-649-1	11-649-2	11-649-3	11-649-4
Halocarbons (EPA 601)				
Date Analyzed	11.27.91	11.27.91	---	---
Dilution Factor, Times	1	1	---	---
1,1,1-Trichloroethane, ug/L	<0.5	<0.5	---	---
1,1,2,2-Tetrachloroethane, ug/L	<0.5	<0.5	---	---
1,1,2-Trichloroethane, ug/L	<0.5	<0.5	---	---
1,1-Dichloroethane, ug/L	<0.5	<0.5	---	---
1,1-Dichloroethene, ug/L	<0.5	<0.5	---	---
1,2-Dichloroethane, ug/L	<0.5	<0.5	---	---
1,2-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
1,2-Dichloroethene (Total), ug/L	<0.5	<0.5	---	---
1,2-Dichloropropane, ug/L	<0.5	<0.5	---	---
1,3-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
1,4-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
2-Chloroethylvinylether, ug/L	<0.5	<0.5	---	---
Bromodichloromethane, ug/L	<0.5	<0.5	---	---
Bromomethane, ug/L	<0.5	<0.5	---	---
Bromoform, ug/L	<0.5	<0.5	---	---
Chlorobenzene, ug/L	<0.5	<0.5	---	---
Carbon Tetrachloride, ug/L	<0.5	<0.5	---	---
Chloroethane, ug/L	<0.5	<0.5	---	---
Chloroform, ug/L	<0.5	<0.5	---	---
Chloromethane, ug/L	<0.5	<0.5	---	---
Dibromochloromethane, ug/L	<0.5	<0.5	---	---
Dichlorodifluoromethane, ug/L	<0.5	<0.5	---	---

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LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-8A	26 NOV 91
11-649-3	CWS-3B	26 NOV 91
11-649-4	CWS-8B	26 NOV 91

PARAMETER	11-649-1	11-649-2	11-649-3	11-649-4
Freon 113, ug/L	<0.5	<0.5	---	---
Methylene chloride, ug/L	<0.5	<0.5	---	---
Trichloroethene, ug/L	<0.5	<0.5	---	---
Trichlorofluoromethane, ug/L	<0.5	<0.5	---	---
Tetrachloroethene, ug/L	<0.5	<0.5	---	---
Vinyl chloride, ug/L	<0.5	<0.5	---	---
cis-1,2-Dichloroethene, ug/L	<0.5	<0.5	---	---
cis-1,3-Dichloropropene, ug/L	<0.5	<0.5	---	---
trans-1,2-Dichloroethene, ug/L	<0.5	<0.5	---	---
trans-1,3-Dichloropropene, ug/L	<0.5	<0.5	---	---
Other Halocarbons (EPA 601)	---	---	---	---

1255 Powell Street
Emeryville, CA 94608

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BCA **B C Analytical**

Analytical Report

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Hygienetics
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Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, AQUEOUS SAMPLES	DATE SAMPLED
11-649-1	CWS-3A	26 NOV 91
11-649-2	CWS-8A	26 NOV 91
11-649-3	CWS-3B	26 NOV 91
11-649-4	CWS-8B	26 NOV 91

PARAMETER	11-649-1	11-649-2	11-649-3	11-649-4
Vol.Aromatics (EPA-602)				
Date Analyzed	11.27.91	11.27.91	---	---
Dilution Factor, Times	1	1	---	---
1,2-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
1,3-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
1,4-Dichlorobenzene, ug/L	<0.5	<0.5	---	---
Benzene, ug/L	<0.5	<0.5	---	---
Chlorobenzene, ug/L	<0.5	<0.5	---	---
Ethylbenzene, ug/L	<0.5	<0.5	---	---
Toluene, ug/L	<0.5	<0.5	---	---
Total Xylene Isomers, ug/L	<0.5	<0.5	---	---
Other Vol.Aromatics (EPA-602)	---	---	---	---

NOTE: This report was revised 2/11/92 to correct sample descriptions for 11-649-2 (from CWS-3B to CWS-8A) and 11-649-3 (from CWS-8A to CWS-3B).
R. Bauer 2/11/92

S. Lessley

Sim D. Lessley, Ph.D., Laboratory Director

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

LABORATORY CONTROL STANDARDS

PARAMETER	DATE ANALYZED	BATCH NUMBER	LC RESULT	LT RESULT	UNIT	PERCENT RECOVERY
EPA Method 8010						
1,1,1-Trichloroethane	11.27.91	91703	18	20	ug/L	90
1,1,2,2-Tetrachloroethane	11.27.91	91703	20	20	ug/L	100
1,1,2-Trichloroethane	11.27.91	91703	23	20	ug/L	115
1,1-Dichloroethane	11.27.91	91703	18	20	ug/L	90
1,1-Dichloroethene	11.27.91	91703	13	20	ug/L	65
1,2-Dichloroethane	11.27.91	91703	22	20	ug/L	110
1,2-Dichlorobenzene	11.27.91	91703	20	20	ug/L	100
1,2-Dichloroethene (Total)	11.27.91	91703	32	40	ug/L	80
1,2-Dichloropropane	11.27.91	91703	20	20	ug/L	100
1,3-Dichlorobenzene	11.27.91	91703	18	20	ug/L	90
1,4-Dichlorobenzene	11.27.91	91703	21	20	ug/L	105
2-Chloroethylvinylether	11.27.91	91703	20	20	ug/L	100
Bromodichloromethane	11.27.91	91703	21	20	ug/L	105
Bromomethane	11.27.91	91703	18	20	ug/L	90
Bromoform	11.27.91	91703	19	20	ug/L	95
Chlorobenzene	11.27.91	91703	19	20	ug/L	95
Carbon Tetrachloride	11.27.91	91703	19	20	ug/L	95
Chloroethane	11.27.91	91703	18	20	ug/L	90
Chloroform	11.27.91	91703	22	20	ug/L	110
Chloromethane	11.27.91	91703	18	20	ug/L	90
Dibromochloromethane	11.27.91	91703	21	20	ug/L	105
Dichlorodifluoromethane	11.27.91	91703	17	20	ug/L	85
Freon 113	11.27.91	91703	15	20	ug/L	75
Methylene chloride	11.27.91	91703	17	20	ug/L	85
Trichloroethene	11.27.91	91703	20	20	ug/L	100
Trichlorofluoromethane	11.27.91	91703	17	20	ug/L	85
Tetrachloroethene	11.27.91	91703	21	20	ug/L	105
Vinyl chloride	11.27.91	91703	18	20	ug/L	90
cis-1,2-Dichloroethene	11.27.91	91703	16	20	ug/L	80
cis-1,3-Dichloropropene	11.27.91	91703	39	32	ug/L	122
trans-1,2-Dichloroethene	11.27.91	91703	16	20	ug/L	80
trans-1,3-Dichloropropene	11.27.91	91703	6.9	7.6	ug/L	91
EPA Method 8020						
1,2-Dichlorobenzene	11.27.91	91703	21	20	ug/L	105
1,3-Dichlorobenzene	11.27.91	91703	21	20	ug/L	105
1,4-Dichlorobenzene	11.27.91	91703	22	20	ug/L	110

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

LABORATORY CONTROL STANDARDS

PARAMETER	DATE ANALYZED	BATCH NUMBER	LC RESULT	LT RESULT	UNIT	PERCENT RECOVERY
Benzene	11.27.91	91703	19	20	ug/L	95
Chlorobenzene	11.27.91	91703	20	20	ug/L	100
Ethylbenzene	11.27.91	91703	19	20	ug/L	95
Toluene	11.27.91	91703	18	20	ug/L	90
Total Xylene Isomers	11.27.91	91703	38	40	ug/L	95

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

MATRIX QC PRECISION (DUPLICATE SPIKES)

PARAMETER	DATE ANALYZED	BATCH NUMBER	S1 RESULT	S2 RESULT	UNIT	RELATIVE %DIFF
Halocarbons (EPA 601)						
1,1,1-Trichloroethane	11.27.91	91703	13	12	ug/L	8
1,1-Dichloroethane	11.27.91	91703	12	12	ug/L	0
1,1-Dichloroethene	11.27.91	91703	8.8	11	ug/L	22
1,2-Dichloroethane	11.27.91	91703	15	15	ug/L	0
1,2-Dichloropropane	11.27.91	91703	14	13	ug/L	7
Bromodichloromethane	11.27.91	91703	15	14	ug/L	7
Bromoform	11.27.91	91703	11	13	ug/L	17
Carbon Tetrachloride	11.27.91	91703	13	13	ug/L	0
Chloroform	11.27.91	91703	15	15	ug/L	0
Dibromochloromethane	11.27.91	91703	13	13	ug/L	0
Methylene chloride	11.27.91	91703	10	11	ug/L	10
Trichloroethene	11.27.91	91703	14	13	ug/L	7
Tetrachloroethene	11.27.91	91703	13	13	ug/L	0
Vol.Aromatics (EPA-602)						
1,2-Dichlorobenzene	11.27.91	91703	9.7	11	ug/L	13
1,3-Dichlorobenzene	11.27.91	91703	9.9	12	ug/L	19
1,4-Dichlorobenzene	11.27.91	91703	11	12	ug/L	9
Benzene	11.27.91	91703	10	10	ug/L	0
Chlorobenzene	11.27.91	91703	11	11	ug/L	0
Ethylbenzene	11.27.91	91703	10	9.9	ug/L	1
Toluene	11.27.91	91703	10	9.7	ug/L	3
Total Xylene Isomers	11.27.91	91703	20	20	ug/L	0

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

MATRIX QC ACCURACY (SPIKES)

PARAMETER	DATE ANALYZED	BATCH NUMBER	SBAR RESULT	TRUE RESULT	RBAR RESULT	UNIT	PERCENT RECOVERY
Halocarbons (EPA 601)							
1,1,1-Trichloroethane	11.27.91	91703	12.5	12	<0.5	ug/L	104
1,1-Dichloroethane	11.27.91	91703	12	12	<0.5	ug/L	100
1,1-Dichloroethene	11.27.91	91703	9.9	12	<0.5	ug/L	83
1,2-Dichloroethane	11.27.91	91703	15	12	<0.5	ug/L	125
1,2-Dichloropropane	11.27.91	91703	13.5	12	<0.5	ug/L	113
Bromodichloromethane	11.27.91	91703	14.5	12	<0.5	ug/L	121
Bromoform	11.27.91	91703	12	12	<0.5	ug/L	100
Carbon Tetrachloride	11.27.91	91703	13	12	<0.5	ug/L	108
Chloroform	11.27.91	91703	15	12	<0.5	ug/L	125
Dibromochloromethane	11.27.91	91703	13	12	<0.5	ug/L	108
Methylene chloride	11.27.91	91703	10.5	12	<0.5	ug/L	88
Trichloroethene	11.27.91	91703	13.5	12	<0.5	ug/L	113
Tetrachloroethene	11.27.91	91703	13	12	<0.5	ug/L	108
Vol.Aromatics (EPA-602)							
1,2-Dichlorobenzene	11.27.91	91703	10.35	12	<0.5	ug/L	86
1,3-Dichlorobenzene	11.27.91	91703	10.95	12	<0.5	ug/L	91
1,4-Dichlorobenzene	11.27.91	91703	11.5	12	<0.5	ug/L	96
Benzene	11.27.91	91703	10	12	<0.5	ug/L	83
Chlorobenzene	11.27.91	91703	11	12	<0.5	ug/L	92
Ethylbenzene	11.27.91	91703	9.95	12	<0.5	ug/L	83
Toluene	11.27.91	91703	9.85	12	<0.5	ug/L	82
Total Xylene Isomers	11.27.91	91703	20	24	<0.5	ug/L	83

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

METHOD BLANKS AND REPORTING DETECTION LIMIT (RDL)

PARAMETER	DATE ANALYZED	BATCH NUMBER	BLANK RESULT	RDL	UNIT	METHOD
EPA Method 8010						
Date Analyzed	11.27.91	91703	1.27.91	NA	Date	8010
1,1,1-Trichloroethane	11.27.91	91703	0	0.5	ug/L	8010
1,1,2,2-Tetrachloroethane	11.27.91	91703	0	0.5	ug/L	8010
1,1,2-Trichloroethane	11.27.91	91703	0	0.5	ug/L	8010
1,1-Dichloroethane	11.27.91	91703	0	0.5	ug/L	8010
1,1-Dichloroethene	11.27.91	91703	0	0.5	ug/L	8010
1,2-Dichloroethane	11.27.91	91703	0	0.5	ug/L	8010
1,2-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8010
1,2-Dichloroethene (Total)	11.27.91	91703	0	0.5	ug/L	8010
1,2-Dichloropropane	11.27.91	91703	0	0.5	ug/L	8010
1,3-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8010
1,4-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8010
2-Chloroethylvinylether	11.27.91	91703	0	0.5	ug/L	8010
Bromodichloromethane	11.27.91	91703	0	0.5	ug/L	8010
Bromomethane	11.27.91	91703	0	0.5	ug/L	8010
Bromoform	11.27.91	91703	0	0.5	ug/L	8010
Chlorobenzene	11.27.91	91703	0	0.5	ug/L	8010
Carbon Tetrachloride	11.27.91	91703	0	0.5	ug/L	8010
Chloroethane	11.27.91	91703	0	0.5	ug/L	8010
Chloroform	11.27.91	91703	0	0.5	ug/L	8010
Chloromethane	11.27.91	91703	0	0.5	ug/L	8010
Dibromochloromethane	11.27.91	91703	0	0.5	ug/L	8010
Dichlorodifluoromethane	11.27.91	91703	0	0.5	ug/L	8010
Freon 113	11.27.91	91703	0	0.5	ug/L	8010
Methylene chloride	11.27.91	91703	0	0.5	ug/L	8010
Trichloroethene	11.27.91	91703	0	0.5	ug/L	8010
Trichlorofluoromethane	11.27.91	91703	0	0.5	ug/L	8010
Tetrachloroethene	11.27.91	91703	0	0.5	ug/L	8010
Vinyl chloride	11.27.91	91703	0	0.5	ug/L	8010
cis-1,2-Dichloroethene	11.27.91	91703	0	0.5	ug/L	8010
cis-1,3-Dichloropropene	11.27.91	91703	0	0.5	ug/L	8010
trans-1,2-Dichloroethene	11.27.91	91703	0	0.5	ug/L	8010
trans-1,3-Dichloropropene	11.27.91	91703	0	0.5	ug/L	8010
EPA Method 8020						
Date Analyzed	11.27.91	91703	1.27.91	NA	Date	8020
1,2-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8020

BC ANALYTICAL

BATCH QC REPORT
ORDER: E9111649

DATE REPORTED : 02/12/92

METHOD BLANKS AND REPORTING DETECTION LIMIT (RDL)

PARAMETER	DATE ANALYZED	BATCH NUMBER	BLANK RESULT	RDL	UNIT	METHOD
1,3-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8020
1,4-Dichlorobenzene	11.27.91	91703	0	0.5	ug/L	8020
Benzene	11.27.91	91703	0	0.5	ug/L	8020
Chlorobenzene	11.27.91	91703	0	0.5	ug/L	8020
Ethylbenzene	11.27.91	91703	0	0.5	ug/L	8020
Toluene	11.27.91	91703	0	0.5	ug/L	8020
Total Xylene Isomers	11.27.91	91703	0	0.5	ug/L	8020

: ORDER PLACED FOR CLIENT: Hygienetics 9111649 :
: BC ANALYTICAL : EMVL LAB : 08:05:53 12 FEB 1992 - P. 1 :

SAMPLES...	SAMPLE DESCRIPTION..	DETERM.........	DATE.... ANALYZED	METHOD.........	EQUIP.	BATCH	ID.NO
9111649*1	CWS-3A	VH.601	11.27.91	601	516-21	91703	7314
		VA.602	11.27.91	602	516-21	91703	7314
9111649*2	CWS-8A	VH.601	11.27.91	601	516-21	91703	7314
		VA.602	11.27.91	602	516-21	91703	7314
9111649*3	CWS-3B	HOLD	11.27.91			911	7365
9111649*4	CWS-8B	HOLD	11.27.91			911	7365

***

Notes: Equipment = BC Analytical identification number for a particular piece of analytical equipment.

ID.NO = BC Analytical employee identification number of analyst.

B C Analytical

BATCH QC REPORT: Definitions and Terms

BCA

Accuracy	The ability of a procedure to determine the "true" concentration of an analyte
Precision	The reproducibility of a procedure demonstrated by the agreement between analyses performed on either duplicates of the same sample or a pair of duplicate spikes
Batch	A group of samples analyzed sequentially using the same calibration curve, reagents, and instrument
Laboratory Control Standard (LCS)	Laboratory reagent water spiked with known compounds and subjected to the same procedures as the samples. The LCS thus indicates the accuracy of the analytical method and, because it is prepared from a different source than the standard used to calibrate the instrument, it also serves to double-check the calibration
Matrix QC	Quality control tests performed on actual client samples. For most inorganic analyses, the laboratory uses a pair of duplicate samples and a spiked sample. For most organic analyses, the laboratory uses a pair of spiked samples (duplicate spikes)
LC Result	Laboratory result of an LCS analysis
LT Result	Expected result, or true value, of the LCS analysis
R1, R2 Result:	Result of the analysis of replicate aliquots of a sample, with R1 indicating the first analysis of the sample and R2 its corresponding duplicate; used to determine precision
S1, S2 Result	Result of the analysis of replicate spiked aliquots, with S1 indicating one spike of the sample and S2 the second spike; used to determine precision and accuracy
R Bar Result	The average of replicate analysis results
S Bar Result:	The average of spike analysis results
True value	The theoretical, or expected, result of a spike sample analysis
Percent Recovery	The percentage of analyte recovered. For LCS, the percent recovery calculation is: $LC \div LT \times 100$ For spike recoveries, the percent recovery calculatiion is: $\frac{\text{(S Bar - Sample Concentration)}}{\text{Spike Amount}} \times 100$
Relative Percent Difference (RPD)	Calculated using one of the following: $\frac{(R1 - R2) \times 100}{(R1 + R2) \div 2}$ $\frac{(S1 - S2) \times 100}{(S1 + S2) \div 2}$
Blank Result	The result of the analysis of a method blank,which is reagent water that is analysed using the same reagents, instruments and procedures as the samples in a batch; used to determine laboratory contamination
Reporting Detection Limit (RDL)	BCA-assigned limit based on—but not the same as—method detection limits (MDLs) determined using EPA guidelines

CHAIN OF CUSTODY RECORD

BCA Log Number 9111649

Client name	Hygienetics (H+GCL)	Project or PO#	
Address	2200 Powell St. Suite 880	Phone #	547-3886
City, State, Zip	Emeryville CA	Report attention	Karl Novak

Sampled by K. Novak

Analyses required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	EPA 601	EPA 602	HOLD					Hazardous sample Special handling required	Remarks
-1	11/26	10:30am	AQ	CWS-3a	2	✓	✓							24 hour
-3	11/26	10:30am	AQ	CWS-3b	2			✓						hold if a is positive — ~~res~~ retest @ reg. turnaround
-2	11/26	10:35am	AQ	CWS-8a	2	✓	✓							24 hour
-4	11/26	10:35am	AQ	CWS-8b	2			✓	* Air bubble in one vial					hold if a is positive retest @regular turnaround

hold b's - run if a's are pos.

	Signature	Print Name	Company	Date	Time
Relinquished by	Karl Novak	KARL NOVAK	H+GCL, INC.	11/26/91	11:10 am
Received by	Phorn Thongkham	PHORN THONGKHAM	BCA	11/26/91	1110
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

1255 Powell Street, Emeryville, CA 94608 (510) 428-2300

801 Western Avenue, Glendale, CA 91201 (818) 247-5737

1200 Gene Autry Way, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ____

*KEY: WW—Wastewater SU—Surface Water SO—Soil SL—Sludge PE—Petroleum OT—Other NA—Nonaqueous GW—Groundwater AQ—Aqueous

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Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878

2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 01/20/92
DATE REQUESTED: 01/28/92
DATE REPORTED: 02/07/92

LABORATORY NUMBER: 106406

CLIENT: H+GCL, INC.

PROJECT ID: 48016.08

RESULTS: SEE ATTACHED

Kathy O'Brien
Reviewed By

Reviewed By

Berkeley Wilmington Los Angeles

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106406-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191015

DATE RECEIVED: 01/20/92
DATE REQUESTED: 01/28/92
DATE ANALYZED: 01/30-02/06/92
DATE REPORTED: 02/07/92

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	3.0	EPA 6010
Arsenic	ND	2.5	EPA 7060
Barium	117	0.5	EPA 6010
Beryllium	0.25	0.10	EPA 6010
Cadmium	ND	0.25	EPA 6010
Chromium (total)	50.1	0.50	EPA 6010
Cobalt	17.9	0.90	EPA 6010
Copper	23.1	0.50	EPA 6010
Lead	ND	3.0	EPA 7420
Mercury	0.29	0.09	EPA 7471
Molybdenum	ND	0.70	EPA 6010
Nickel	145	1.6	EPA 6010
Selenium	ND	2.5	EPA 7740
Silver	ND	0.50	EPA 6010
Thallium	ND	2.5	EPA 7841
Vanadium	22.1	0.50	EPA 6010
Zinc	40.3	1.0	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%		RPD,%	RECOVERY,%
Antimony	<1	91	Mercury	3	96
Arsenic	16	91	Molybdenum	<1	94
Barium	<1	99	Nickel	3	91
Beryllium	1	95	Selenium	7	86
Cadmium	7	92	Silver	5	95
Chromium	2	93	Thallium	3	102
Cobalt	2	95	Vanadium	1	94
Copper	<1	96	Zinc	<1	90
Lead	6	95			

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106406-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191015

DATE RECEIVED: 01/20/92
DATE REQUESTED: 01/28/92
DATE EXTRACTED: 01/30/92
DATE ANALYZED: 02/04/92
DATE REPORTED: 02/07/92

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650

BASE/NEUTRAL COMPOUNDS

N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106406-1 EPA 8270
SAMPLE ID: 9201191015

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo(a)anthracene	ND	330
Chrysene	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Benzo(a)pyrene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Benzo(g,h,i)perylene	ND	330

ND = Not detected at or above reporting limit.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106406-1 EPA 8270
SAMPLE ID: 9201191015

COMPOUND CHLORINATED PESTICIDES	RESULT ug/kg	REPORTING LIMIT ug/kg
alpha-BHC	ND	330
beta-BHC	ND	330
gamma-BHC	ND	330
delta-BHC	ND	330
Heptachlor	ND	330
Aldrin	ND	330
Heptachlor Epoxide	ND	330
Endosulfan I	ND	330
4,4'-DDE	ND	330
Dieldrin	ND	330
Endrin	ND	330
Endosulfan II	ND	330
4,4'-DDD	ND	330
Endrin Aldehyde	ND	330
Endosulfan Sulfate	ND	330
4,4'-DDT	ND	330
Chlordane	ND	1650
Toxaphene	ND	1650
Methoxychlor	ND	1650
Aroclor 1016	ND	1650
Aroclor 1221	ND	1650
Aroclor 1232	ND	1650
Aroclor 1242	ND	1650
Aroclor 1248	ND	1650
Aroclor 1254	ND	1650
Aroclor 1260	ND	1650

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Compound	%Recovery	Compound	%Recovery
2-Fluorophenol	48	Nitrobenzene-d5	60
Phenol-d6	57	2-Fluorobiphenyl	55
2,4,6-Tribromophenol	66	Terphenyl-d14	47

Chain of Custody Form

Curtis & Tompkins, Ltd
2323 Fifth Street
Berkeley, California 94710
(415) 486-0900

Samplers Lukic, Wright.

106309

Job Description
Job Number 3016.08 -Batch# SF 3297
Client Contact Lorinda

Recorder

ANALYSIS REQUESTED: 8010 / 8020, 8270, Metals

	Matrix: Water	Soil	Waste	Oil			#Containers	Method Preserved: H_2SO_4	HNO_3	Ice	None	Other	Sample Number	Yr	Mo	Dy	Time	SAMPLE NOTES	8010 / 8020	8270	Metals
1		✓								✓			01191105	92	01	14		55'	✓		
2		✓								✓			01191030	"				45'	✓		
3		✓								✓			01191146	"				70'	✓		
4		✓								✓			01191046	"				50'	✓		
5		✓								✓			01191119	"				60'	✓		
6		✓								✓			01191120	"				65'	✓		
7		✓								✓			01191245	"				81'	✓		
8		✓								✓			01191210	"				74'	✓	✓	✓
9		✓								✓			01191015	"				42	✓		

Laboratory Notes :
Thursday afternoon due date
Please report sample I D's starting each with '92 for each.

Chain of Custody Record

Relinquished by: (signature) Date/Hr	Received by (signature)
Mike Lukic 1-20-91 0820	
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Dispatched by: (signature) Date/Hr	Received for Lab by (signature) [signature] 1/20/92 08:20

Curtis & Tompkins, Ltd.

MS/MSD SUMMARY SHEET FOR EPA 8010/8020

Operator: CW
Analysis date: 2/3/92
Sample type: SOIL
Sample Number: 106403-001 1G

Spike file: 034G/H009
Spike dup file: 034G/H010
Instrument: GC05

8010 MS/MSD DATA (spiked at 20 ppb) *Ave Rec= 101 %*

SPIKE COMPOUNDS	READING	RECOVERY	STATUS	LIMITS
1,1-Dichloroethene	20.57	103 %	OK	46 - 172
Trichloroethene	20.53	103 %	OK	58 - 137
Chlorobenzene	23.40	117 %	OK	60 - 133
SPIKE DUP COMPOUNDS				
1,1-Dichloroethene	16.54	83 %	OK	46 - 172
Trichloroethene	18.44	92 %	OK	58 - 137
Chlorobenzene	21.67	108 %	OK	60 - 133
SURROGATES				
Bromobenzene (MS)	105.00	105 %	OK	74 - 132
Bromobenzene (MSD)	103.00	103 %	OK	74 - 132

8020 MS/MSD DATA (spiked at 20 ppb) *Ave Rec= 111 %*

SPIKE COMPOUNDS	READING	RECOVERY	STATUS	LIMITS
Benzene	23.20	116 %	OK	66 - 142
Toluene	23.11	116 %	OK	59 - 139
Chlorobenzene	22.62	113 %	OK	60 - 133
SPIKE DUP COMPOUNDS				
Benzene	21.67	108 %	OK	66 - 142
Toluene	21.67	108 %	OK	59 - 139
Chlorobenzene	21.29	106 %	OK	60 - 133
SURROGATES				
Bromobenzene (MS)	101.00	101 %	OK	74 - 132
Bromobenzene (MSD)	101.00	101 %	OK	74 - 132

RPD DATA *8010 RPD= 13.4 %* *8020 RPD= 6.4 %*

8010 COMPOUNDS	SPIKE	SPIKE DUP	RPD	STATUS	LIMITS
1,1-Dichloroethene	20.57	16.54	22 %	OK	< 22
Trichloroethene	20.53	18.44	11 %	OK	< 23
Chlorobenzene	23.40	21.67	8 %	OK	< 21
8020 COMPOUNDS					
Benzene	23.20	21.67	7 %	OK	< 21
Toluene	23.11	21.67	6 %	OK	< 21
Chlorobenzene	22.62	21.29	6 %	OK	< 21

REVIEWED BY: ______________________

MW 17

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878

2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 01/20/92
DATE REPORTED: 01/23/92

LABORATORY NUMBER: 106309

CLIENT: H+GCL, INC.

PROJECT ID: 48016.08

RESULTS: SEE ATTACHED

Reviewed By

Reviewed By

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191105

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound		RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane		ND	50
bromomethane		ND	50
vinyl chloride		ND	50
chloroethane		ND	50
methylene chloride		ND	25
trichlorofluoromethane		ND	25
1,1-dichloroethene		ND	25
1,1-dichloroethane		ND	25
cis-1,2-dichloroethene	detected	(15)	25
trans-1,2-dichloroethene		ND	25
chloroform		ND	25
freon 113		ND	25
1,2-dichloroethane		ND	25
1,1,1-trichloroethane		ND	25
carbon tetrachloride		ND	25
bromodichloromethane		ND	25
1,2-dichloropropane		ND	25
cis-1,3-dichloropropene		ND	25
trichloroethylene		ND	25
1,1,2-trichloroethane		ND	25
trans-1,3-dichloropropene		ND	25
dibromochloromethane		ND	25
2-chloroethylvinyl ether		ND	50
bromoform		ND	25
tetrachloroethylene		43	25
1,1,2,2-tetrachloroethane		ND	25
chlorobenzene		ND	25
1,3-dichlorobenzene		ND	25
1,2-dichlorobenzene		ND	25
1,4-dichlorobenzene		ND	25

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	114 %
Toluene-d8	103 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191105

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	25
Toluene	ND	25
Ethyl Benzene	ND	25
Total Xylenes	ND	25
Chlorobenzene	ND	25
1,4-Dichlorobenzene	ND	25
1,3-Dichlorobenzene	ND	25
1,2-Dichlorobenzene	ND	25

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	114 %
Toluene-d8	103 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191030

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	79	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	108 %
Toluene-d8	101 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191030

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	108 %
Toluene-d8	101 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-3
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191146

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	11	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	106 %
Toluene-d8	101 %
Bromofluorobenzene	102 %

LABORATORY NUMBER: 106309-3
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191146

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	106 %
Toluene-d8	101 %
Bromofluorobenzene	102 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-4
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191046

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	11	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	34	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	108 %
Toluene-d8	100 %
Bromofluorobenzene	104 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-4
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191046

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	108 %
Toluene-d8	100 %
Bromofluorobenzene	104 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-5
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191119

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound		RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane		ND	10
bromomethane		ND	10
vinyl chloride		ND	10
chloroethane		ND	10
methylene chloride		ND	5.0
trichlorofluoromethane		ND	5.0
1,1-dichloroethene		ND	5.0
1,1-dichloroethane		ND	5.0
cis-1,2-dichloroethene	detected	(2.9)	5.0
trans-1,2-dichloroethene		ND	5.0
chloroform		ND	5.0
freon 113		ND	5.0
1,2-dichloroethane		ND	5.0
1,1,1-trichloroethane		ND	5.0
carbon tetrachloride		ND	5.0
bromodichloromethane		ND	5.0
1,2-dichloropropane		ND	5.0
cis-1,3-dichloropropene		ND	5.0
trichloroethylene		ND	5.0
1,1,2-trichloroethane		ND	5.0
trans-1,3-dichloropropene		ND	5.0
dibromochloromethane		ND	5.0
2-chloroethylvinyl ether		ND	10
bromoform		ND	5.0
tetrachloroethylene	detected	(3.5)	5.0
1,1,2,2-tetrachloroethane		ND	5.0
chlorobenzene		ND	5.0
1,3-dichlorobenzene		ND	5.0
1,2-dichlorobenzene		ND	5.0
1,4-dichlorobenzene		ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	114 %
Toluene-d8	99 %
Bromofluorobenzene	107 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-5
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191119

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	114 %
Toluene-d8	99 %
Bromofluorobenzene	107 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-6
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191120

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound		RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane		ND	10
bromomethane		ND	10
vinyl chloride		ND	10
chloroethane		ND	10
methylene chloride		11	5.0
trichlorofluoromethane		ND	5.0
1,1-dichloroethene		ND	5.0
1,1-dichloroethane		ND	5.0
cis-1,2-dichloroethene		ND	5.0
trans-1,2-dichloroethene		ND	5.0
chloroform		ND	5.0
freon 113		ND	5.0
1,2-dichloroethane		ND	5.0
1,1,1-trichloroethane		ND	5.0
carbon tetrachloride		ND	5.0
bromodichloromethane		ND	5.0
1,2-dichloropropane		ND	5.0
cis-1,3-dichloropropene		ND	5.0
trichloroethylene		ND	5.0
1,1,2-trichloroethane		ND	5.0
trans-1,3-dichloropropene		ND	5.0
dibromochloromethane		ND	5.0
2-chloroethylvinyl ether		ND	10
bromoform		ND	5.0
tetrachloroethylene	detected	(3.9)	5.0
1,1,2,2-tetrachloroethane		ND	5.0
chlorobenzene		ND	5.0
1,3-dichlorobenzene		ND	5.0
1,2-dichlorobenzene		ND	5.0
1,4-dichlorobenzene		ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	110 %
Toluene-d8	98 %
Bromofluorobenzene	108 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-6
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191120

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	detected (3.3)	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	110 %
Toluene-d8	98 %
Bromofluorobenzene	108 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-7
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191245

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	109 %
Toluene-d8	99 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-7
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191245

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	109 %
Toluene-d8	99 %
Bromofluorobenzene	101 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-8
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191210

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	8.3	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	110 %
Toluene-d8	99 %
Bromofluorobenzene	107 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-8
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191210

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	110 %
Toluene-d8	99 %
Bromofluorobenzene	107 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-9
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191015

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	50
bromomethane	ND	50
vinyl chloride	ND	50
chloroethane	ND	50
methylene chloride	ND	25
trichlorofluoromethane	ND	25
1,1-dichloroethene	ND	25
1,1-dichloroethane	ND	25
cis-1,2-dichloroethene	ND	25
trans-1,2-dichloroethene	ND	25
chloroform	ND	25
freon 113	ND	25
1,2-dichloroethane	ND	25
1,1,1-trichloroethane	ND	25
carbon tetrachloride	ND	25
bromodichloromethane	ND	25
1,2-dichloropropane	ND	25
cis-1,3-dichloropropene	ND	25
trichloroethylene	ND	25
1,1,2-trichloroethane	ND	25
trans-1,3-dichloropropene	ND	25
dibromochloromethane	ND	25
2-chloroethylvinyl ether	ND	50
bromoform	ND	25
tetrachloroethylene	570	25
1,1,2,2-tetrachloroethane	ND	25
chlorobenzene	ND	25
1,3-dichlorobenzene	ND	25
1,2-dichlorobenzene	ND	25
1,4-dichlorobenzene	ND	25

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	113 %
Toluene-d8	99 %
Bromofluorobenzene	106 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-9
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 9201191015

DATE RECEIVED: 01/20/92
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	25
Toluene	ND	25
Ethyl Benzene	ND	25
Total Xylenes	ND	25
Chlorobenzene	ND	25
1,4-Dichlorobenzene	ND	25
1,3-Dichlorobenzene	ND	25
1,2-Dichlorobenzene	ND	25

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	113 %
Toluene-d8	99 %
Bromofluorobenzene	106 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	103 %
Toluene-d8	101 %
Bromofluorobenzene	100 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3983

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	103 %
Toluene-d8	101 %
Bromofluorobenzene	100 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	101 %
Toluene-d8	98 %
Bromofluorobenzene	103 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/21/92
DATE REPORTED: 01/23/92
QC BATCH: 3971A

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	101 %
Toluene-d8	98 %
Bromofluorobenzene	103 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8010 Compound List by EPA 8240
Volatile Halocarbons in Soil & Wastes

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
chloromethane	ND	10
bromomethane	ND	10
vinyl chloride	ND	10
chloroethane	ND	10
methylene chloride	ND	5.0
trichlorofluoromethane	ND	5.0
1,1-dichloroethene	ND	5.0
1,1-dichloroethane	ND	5.0
cis-1,2-dichloroethene	ND	5.0
trans-1,2-dichloroethene	ND	5.0
chloroform	ND	5.0
freon 113	ND	5.0
1,2-dichloroethane	ND	5.0
1,1,1-trichloroethane	ND	5.0
carbon tetrachloride	ND	5.0
bromodichloromethane	ND	5.0
1,2-dichloropropane	ND	5.0
cis-1,3-dichloropropene	ND	5.0
trichloroethylene	ND	5.0
1,1,2-trichloroethane	ND	5.0
trans-1,3-dichloropropene	ND	5.0
dibromochloromethane	ND	5.0
2-chloroethylvinyl ether	ND	10
bromoform	ND	5.0
tetrachloroethylene	ND	5.0
1,1,2,2-tetrachloroethane	ND	5.0
chlorobenzene	ND	5.0
1,3-dichlorobenzene	ND	5.0
1,2-dichlorobenzene	ND	5.0
1,4-dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE RECOVERIES

1,2-Dichloroethane-d4	115 %
Toluene-d8	100 %
Bromofluorobenzene	106 %

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106309-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92
QC BATCH: 3971B

EPA 8020 Compound List by EPA 8240
Volatile Aromatic Hydrocarbons in Soils

COMPOUND	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY: SURROGATE % RECOVERY

1,2-Dichloroethane-d4	115 %
Toluene-d8	100 %
Bromofluorobenzene	106 %

Chain of Custody Form

Curtis & Tompkins, Ltd
2323 Fifth Street
Berkeley, California 94710
(415) 486-0900

Samplers: Lukaic, Wright.

106309

Job Description:

Job Number: 8016.08

Client Contact: Lorinda

Recorder:

	Water	Soil	Waste	Oil			#Containers	H_2SO_4	HNO_3	Ice	None	Other	Sample Number	Yr	Mo	Dy	Time	SAMPLE NOTES	8010 / 8020
1													01191105	92	01	19		55'	
2													01191030	"				45'	
3													01191146	"				70'	
4													01191046	"				50'	
5													01191119	"				60'	
6													01191120	"				65'	
7													01191245	"				81'	
8													01191210	"				74'	
9													01191015	"				42	

ANALYSIS REQUESTED: 8010 / 8020

Laboratory Notes:
Thursday afternoon due date
Please report sample I D's starting each with '92 ~~for each~~.

Chain of Custody Record

Relinquished by: (signature) Date/Hr	Received by (signature)
Mike Lukaic 1-20-91 0820	
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Dispatched by: (signature) Date/Hr	Received for Lab by (signature) [signature] 1/20/92 08:20

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 01/21/92
DATE REPORTED: 01/23/92

LABORATORY NUMBER: 106331

CLIENT: H+GCL, INC.

PROJECT ID: 48016.08

RESULTS: SEE ATTACHED

Kathy O'Brien
Reviewed By

Reviewed By

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106331-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 01211500

DATE RECEIVED: 01/21/91
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	REPORTING LIMIT ug/L
Chloromethane	ND	2.0
Bromomethane	ND	2.0
Vinyl chloride	ND	2.0
Chloroethane	ND	2.0
Methylene chloride	ND	1.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethene	ND	1.0
1,1-Dichloroethane	ND	1.0
cis-1,2-Dichloroethene	12	1.0
trans-1,2-Dichloroethene	ND	1.0
Chloroform	ND	1.0
Freon 113	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon tetrachloride	ND	1.0
Bromodichloromethane	ND	1.0
1,2-Dichloropropane	ND	1.0
cis-1,3-Dichloropropene	ND	1.0
Trichloroethylene	1.1	1.0
1,1,2-Trichloroethane	ND	1.0
trans-1,3-Dichloropropene	ND	1.0
Dibromochloromethane	ND	1.0
2-Chloroethylvinyl ether	ND	2.0
Bromoform	ND	1.0
Tetrachloroethene	49	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
Chlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

SURROGATE RECOVERY, %	101

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106331-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
SAMPLE ID: 01211500

DATE RECEIVED: 01/21/91
DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	REPORTING LIMIT ug/L
Benzene	1.0	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

SURROGATE RECOVERY, %	101

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106331-METHOD BLANK DATE ANALYZED: 01/22/92
CLIENT: H+GCL, INC. DATE REPORTED: 01/23/92
PROJECT ID: 48016.08

EPA 8010
Purgeable Halocarbons in Water

Compound	Result ug/L	REPORTING LIMIT ug/L
Chloromethane	ND	2.0
Bromomethane	ND	2.0
Vinyl chloride	ND	2.0
Chloroethane	ND	2.0
Methylene chloride	1.1	1.0
Trichlorofluoromethane	ND	1.0
1,1-Dichloroethene	ND	1.0
1,1-Dichloroethane	ND	1.0
cis-1,2-Dichloroethene	ND	1.0
trans-1,2-Dichloroethene	ND	1.0
Chloroform	ND	1.0
Freon 113	ND	1.0
1,2-Dichloroethane	ND	1.0
1,1,1-Trichloroethane	ND	1.0
Carbon tetrachloride	ND	1.0
Bromodichloromethane	ND	1.0
1,2-Dichloropropane	ND	1.0
cis-1,3-Dichloropropene	ND	1.0
Trichloroethylene	ND	1.0
1,1,2-Trichloroethane	ND	1.0
trans-1,3-Dichloropropene	ND	1.0
Dibromochloromethane	ND	1.0
2-Chloroethylvinyl ether	ND	2.0
Bromoform	ND	1.0
Tetrachloroethene	ND	1.0
1,1,2,2-Tetrachloroethane	ND	1.0
Chlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

SURROGATE RECOVERY, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106331-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08

DATE ANALYZED: 01/22/92
DATE REPORTED: 01/23/92

EPA 8020: Volatile Aromatic Hydrocarbons in Water

COMPOUND	RESULT ug/L	REPORTING LIMIT ug/L
Benzene	ND	1.0
Toluene	ND	1.0
Ethyl Benzene	ND	1.0
Total Xylenes	ND	1.0
Chlorobenzene	ND	1.0
1,4-Dichlorobenzene	ND	1.0
1,3-Dichlorobenzene	ND	1.0
1,2-Dichlorobenzene	ND	1.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

SURROGATE RECOVERY, %	99

Chain of Custody Form

Curtis & Tompkins, Ltd
2323 Fifth Street
Berkeley, California 94710
(415) 486-0900

Samplers: Mike Luksic, Karl Novak

Job Description: H+GCL - Livermore

Job Number: 48016.08

Client Contact: Mike Luksic

Recorder:

ANALYSIS REQUESTED: 8010 / 8020

Matrix: Water	Soil	Waste	Oil	#Containers	Method Preserved: H_2SO_4	HNO_3	Ice	None	Other	Sample Number	Sampling Date: Yr	Mo	Dy	Time	SAMPLE NOTES
1							✓			01211500	92	01	21	1500	MW-17

Laboratory Notes: need by Thursday afternoon.

Chain of Custody Record

Relinquished by: (signature) Date/Hr	Received by (signature)
Mike Luksic 1-21-92	
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Relinquished by: (signature) Date/Hr	Received by (signature)
Dispatched by: (signature) Date/Hr	Received for Lab by (signature) 1/21/92 16:35

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
2323 Fifth Street, Berkeley, CA 94710, Phone (415) 486-0900

DATE RECEIVED: 01/28/92
DATE REPORTED: 02/07/92

LABORATORY NUMBER: 106403

CLIENT: H+GCL, INC.

PROJECT ID: 48016.08

LOCATION: LIVERMORE ARCADE MW-18

RESULTS: SEE ATTACHED

Kathy O'Brien
Reviewed By

Reviewed By

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-1,5
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

CASE NARRATIVE: EPA 8010 Volatile Halocarbons in Soil and Wastes
Extraction Method: EPA 5030 - Purge and Trap

The above listed samples were analyzed following EPA Method 8010 as described in Curtis and Tompkins' SOP for that analysis. The quality control criteria established for the five point calibration curve and continuing calibration verification standard were not met for 2-chloroethylvinylether, 1,1-dichloroethane, and trans-1,3-dichloropropene. Quantification for the above mentioned compounds is estimated for this batch of samples. None of these compounds are reported in the samples.

Tetrachloroethene, the analyte reported, is both qualitatively and quantitatively within acceptable operating parameters in both the five point calibration and the continuing calibration verification standards. For this reason the laboratory has confidence in the data reported for these samples.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 46

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	100
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	11	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-1
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 46

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	101

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 40

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	20
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	25	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 46

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 40

DATE RECEIVED: 01/28/92
DATE EXTRACTED: 01/30/92
DATE ANALYZED: 02/04/92
DATE REPORTED: 02/07/92

EPA 8270: Base/Neutral and Acid Extractables in Soils & Wastes
Extraction Method: EPA 3550 Sonication

ACID COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Phenol	ND	330
2-Chlorophenol	ND	330
Benzyl Alcohol	ND	330
2-Methylphenol	ND	330
4-Methylphenol	ND	330
2-Nitrophenol	ND	1650
2,4-Dimethylphenol	ND	330
Benzoic Acid	ND	1650
2,4-Dichlorophenol	ND	330
4-Chloro-3-methylphenol	ND	330
2,4,6-Trichlorophenol	ND	330
2,4,5-Trichlorophenol	ND	1650
2,4-Dinitrophenol	ND	1650
4-Nitrophenol	ND	1650
4,6-Dinitro-2-methylphenol	ND	1650
Pentachlorophenol	ND	1650

BASE/NEUTRAL COMPOUNDS

N-Nitrosodimethylamine	ND	330
Aniline	ND	330
Bis(2-chloroethyl)ether	ND	330
1,3-Dichlorobenzene	ND	330
1,4-Dichlorobenzene	ND	330
1,2-Dichlorobenzene	ND	330
Bis(2-chloroisopropyl)ether	ND	330
N-Nitroso-di-n-propylamine	ND	330
Hexachloroethane	ND	330
Nitrobenzene	ND	330
Isophorone	ND	330
Bis(2-chloroethoxy)methane	ND	330
1,2,4-Trichlorobenzene	ND	330
Naphthalene	ND	330
4-Chloroaniline	ND	330
Hexachlorobutadiene	ND	330
2-Methylnaphthalene	ND	330
Hexachlorocyclopentadiene	ND	330
2-Chloronaphthalene	ND	330
2-Nitroaniline	ND	1650

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
SAMPLE ID: 40

EPA 8270

BASE/NEUTRAL COMPOUNDS	RESULT ug/kg	REPORTING LIMIT ug/kg
Dimethylphthalate	ND	330
Acenaphthylene	ND	330
2,6-Dinitrotoluene	ND	330
3-Nitroaniline	ND	1650
Acenaphthene	ND	330
Dibenzofuran	ND	330
2,4-Dinitrotoluene	ND	330
Diethylphthalate	ND	330
4-Chlorophenyl-phenylether	ND	330
Fluorene	ND	330
4-Nitroaniline	ND	1650
N-Nitrosodiphenylamine	ND	330
Azobenzene	ND	330
4-Bromophenyl-phenylether	ND	330
Hexachlorobenzene	ND	330
Phenanthrene	ND	330
Anthracene	ND	330
Di-n-butylphthalate	ND	330
Fluoranthene	ND	330
Benzidine	ND	330
Pyrene	ND	330
Butylbenzylphthalate	ND	330
3,3'-Dichlorobenzidine	ND	1650
Benzo(a)anthracene	ND	330
Chrysene	ND	330
Bis(2-ethylhexyl)phthalate	ND	330
Di-n-octylphthalate	ND	330
Benzo(b)fluoranthene	ND	330
Benzo(k)fluoranthene	ND	330
Benzo(a)pyrene	ND	330
Indeno(1,2,3-cd)pyrene	ND	330
Dibenzo(a,h)anthracene	ND	330
Benzo(g,h,i)perylene	ND	330

ND = Not detected at or above reporting limit.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
SAMPLE ID: 40

EPA 8270

COMPOUND CHLORINATED PESTICIDES	RESULT ug/kg	REPORTING LIMIT ug/kg
alpha-BHC	ND	330
beta-BHC	ND	330
gamma-BHC	ND	330
delta-BHC	ND	330
Heptachlor	ND	330
Aldrin	ND	330
Heptachlor Epoxide	ND	330
Endosulfan I	ND	330
4,4'-DDE	ND	330
Dieldrin	ND	330
Endrin	ND	330
Endosulfan II	ND	330
4,4'-DDD	ND	330
Endrin Aldehyde	ND	330
Endosulfan Sulfate	ND	330
4,4'-DDT	ND	330
Chlordane	ND	1650
Toxaphene	ND	1650
Methoxychlor	ND	1650
Aroclor 1016	ND	1650
Aroclor 1221	ND	1650
Aroclor 1232	ND	1650
Aroclor 1242	ND	1650
Aroclor 1248	ND	1650
Aroclor 1254	ND	1650
Aroclor 1260	ND	1650

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Compound	%Recovery	Compound	%Recovery
2-Fluorophenol	54	Nitrobenzene-d5	62
Phenol-d6	61	2-Fluorobiphenyl	55
2,4,6-Tribromophenol	62	Terphenyl-d14	49

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 40

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92
DATE REVISED: 02/11/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-2
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 40

DATE RECEIVED: 01/28/92
DATE ANALYZED: 01/30/92
DATE REPORTED: 01/31/92

Title 26 Metals in Soils & Wastes
Digestion Method: EPA 3050

METAL	RESULT mg/Kg	REPORTING LIMIT mg/Kg	METHOD
Antimony	ND	3.0	EPA 6010
Arsenic	ND	2.5	EPA 7060
Barium	115	0.50	EPA 6010
Beryllium	0.26	0.10	EPA 6010
Cadmium	ND	0.25	EPA 6010
Chromium (total)	51.2	0.50	EPA 6010
Cobalt	15.5	0.90	EPA 6010
Copper	28.6	0.50	EPA 6010
Lead	3.0	3.0	EPA 7420
Mercury	ND	0.10	EPA 7471
Molybdenum	ND	0.70	EPA 6010
Nickel	129	1.6	EPA 6010
Selenium	ND	2.5	EPA 7740
Silver	ND	0.50	EPA 6010
Thallium	ND	2.5	EPA 7841
Vanadium	20.7	0.50	EPA 6010
Zinc	40.0	1.0	EPA 6010

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

	RPD,%	RECOVERY,%		RPD,%	RECOVERY,%
Antimony	<1	91	Mercury	3	96
Arsenic	1	96	Molybdenum	<1	94
Barium	<1	99	Nickel	3	91
Beryllium	1	95	Selenium	2	106
Cadmium	7	92	Silver	5	95
Chromium	2	93	Thallium	3	112
Cobalt	2	95	Vanadium	1	94
Copper	<1	96	Zinc	<1	90
Lead	6	95			

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-3
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 51

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	20
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	10	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	102

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-3
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 51

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-4
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 55.5

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	20
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	104

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-4
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 55.5

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-5
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 60

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	100
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	106

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-5
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 60

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	101

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-6
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 69

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	20
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	5.0
Bromoform	ND	10
Tetrachloroethylene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	104

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-6
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18
SAMPLE ID: 69

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403 - 2,3,4,6
CLIENT: H+GCL, INC
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW - 18

DATE RECEIVED: 01/28/92
DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

CASE NARRATIVE: EPA 8010 Volatile Halodarbons in Soil and Wastes
Extraction Method : EPA 5030 - Purge and Trap

The above listed samples were analyzed following EPA Method 8010 as described in Curtis and Tompkin's SOP for that analysis. The quality control criteria established for the five point calibration curve were not met for 2-chloroethylvinylether, 1,1-dichloroethane, and trans-1,3-dichloropropene. In addition,. the continuing calibration verification standard failed for 2-chloroethylvinylether, 1,1-dichloroethane, trichlorofluoromethane and 1,1-dichloroethene. Quantification for the above mentioned compounds is estimated for this batch of samples. None of these compounds are reported in the samples.

Tetrachloroethene, the analyte reported, is both qualitatively and quantitatively within acceptable operating parameters in both the five point calibration and the continuing calibration verification standards. For this reason the laboratory has confidence in the data reported for these samples.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18

DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18

DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8020: Volatile Aromatic Hydrocarbons in Soils & Wastes
Extraction Method: EPA 5030 - Purge & Trap

COMPOUND	Result ug/Kg	Reporting Limit ug/Kg
Benzene	ND	5.0
Toluene	ND	5.0
Ethyl Benzene	ND	5.0
Total Xylenes	ND	5.0
Chlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

% SURROGATE RECOVERY	100

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18

DATE ANALYZED: 02/01/92
DATE REPORTED: 02/03/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	20
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	103

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 106403-METHOD BLANK
CLIENT: H+GCL, INC.
PROJECT ID: 48016.08
LOCATION: LIVERMORE ARCADE MW-18

DATE ANALYZED: 02/03/92
DATE REPORTED: 02/04/92

EPA 8010: Volatile Halocarbons in Soil & Wastes
Extraction Method: EPA 5030 - Purge & Trap

Compound	RESULT ug/Kg	REPORTING LIMIT ug/Kg
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	100
Trichlorofluoromethane	ND	5.0
1,1-Dichloroethene	ND	5.0
1,1-Dichloroethane	ND	5.0
cis-1,2-Dichloroethene	ND	5.0
trans-1,2-Dichloroethene	ND	5.0
Chloroform	ND	5.0
Freon 113	ND	5.0
1,2-Dichloroethane	ND	5.0
1,1,1-Trichloroethane	ND	5.0
Carbon tetrachloride	ND	5.0
Bromodichloromethane	ND	5.0
1,2-Dichloropropane	ND	5.0
cis-1,3-Dichloropropene	ND	5.0
Trichloroethylene	ND	5.0
1,1,2-Trichloroethane	ND	5.0
trans-1,3-Dichloropropene	ND	5.0
Dibromochloromethane	ND	5.0
2-Chloroethylvinyl ether	ND	10
Bromoform	ND	5.0
Tetrachloroethylene	ND	5.0
1,1,2,2-Tetrachloroethane	ND	5.0
Chlorobenzene	ND	5.0
1,3-Dichlorobenzene	ND	5.0
1,2-Dichlorobenzene	ND	5.0
1,4-Dichlorobenzene	ND	5.0

ND = Not detected at or above reporting limit.

QA/QC SUMMARY

Surrogate Recovery, %	104

Analytical Report

LOG NO: E92-02-035

Received: 04 FEB 92

Mailed: FEB 12 1992

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
02-035-1	CWS-3	04 FEB 92
02-035-2	CWS-8	04 FEB 92

PARAMETER	02-035-1	02-035-2
EPA Method 524.2		
Date Analyzed	02.06.92	02.06.92
Date Extracted	02.06.92	02.06.92
Dilution Factor, Times	1	1
1,1,1,2-Tetrachloroethane, ug/L	<0.2	<0.2
1,1,1-Trichloroethane, ug/L	<0.2	<0.2
1,1,2,2-Tetrachloroethane, ug/L	<0.2	<0.2
1,1,2-Trichloroethane, ug/L	<0.2	<0.2
1,1-Dichloroethane, ug/L	<0.2	<0.2
1,1-Dichloroethene, ug/L	<0.2	<0.2
1,1-Dichloropropene, ug/L	<0.2	<0.2
1,2,3-Trichlorobenzene, ug/L	<0.2	<0.2
1,2,3-Trichloropropane, ug/L	<0.2	<0.2
1,2,4-Trichlorobenzene, ug/L	<0.2	<0.2
1,2,4-Trimethylbenzene, ug/L	<0.2	<0.2
1,2-Dibromo-3-chloropropane, ug/L	<2	<2
1,2-Dibromoethane, ug/L	<0.2	<0.2
1,2-Dichloroethane, ug/L	<0.2	<0.2
1,2-Dichlorobenzene, ug/L	<0.2	<0.2
1,2-Dichloropropane, ug/L	<0.2	<0.2
1,3,5-Trimethylbenzene, ug/L	<0.2	<0.2
1,3-Dichlorobenzene, ug/L	<0.2	<0.2
1,3-Dichloropropane, ug/L	<0.2	<0.2
1,4-Dichlorobenzene, ug/L	<0.2	<0.2
2,2-Dichloropropane, ug/L	<0.2	<0.2
2-Chlorotoluene, ug/L	<0.2	<0.2
4-Chlorotoluene, ug/L	<0.2	<0.2

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BCA B C Analytical

Analytical Report

LOG NO: E92-02-035

Received: 04 FEB 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
02-035-1	CWS-3	04 FEB 92
02-035-2	CWS-8	04 FEB 92

PARAMETER	02-035-1	02-035-2
Bromobenzene, ug/L	<0.2	<0.2
Bromochloromethane, ug/L	<0.2	<0.2
Bromodichloromethane, ug/L	<0.2	<0.2
Bromomethane, ug/L	<0.2	<0.2
Benzene, ug/L	<0.2	<0.2
Bromoform, ug/L	<0.2	<0.2
Chlorobenzene, ug/L	<0.2	<0.2
Carbon Tetrachloride, ug/L	<0.2	<0.2
Chloroethane, ug/L	<0.2	<0.2
Chloroform, ug/L	<0.2	0.3
Chloromethane, ug/L	<0.2	<0.2
Dibromochloromethane, ug/L	<0.2	<0.2
Dibromomethane, ug/L	<0.2	<0.2
Ethylbenzene, ug/L	<0.2	<0.2
Hexachlorobutadiene, ug/L	<0.2	<0.2
Isopropylbenzene, ug/L	<0.2	<0.2
Methylene chloride, ug/L	<1	<1
N-Butylbenzene, ug/L	<0.2	<0.2
N-Propylbenzene, ug/L	<0.2	<0.2
Naphthalene, ug/L	<0.2	<0.2
Styrene, ug/L	<0.2	<0.2
Trichloroethene, ug/L	<0.2	<0.2
Trichlorofluoromethane, ug/L	<0.2	<0.2
Toluene, ug/L	<0.2	<0.2
Tetrachloroethene, ug/L	<0.2	<0.2
Vinyl chloride, ug/L	<0.2	<0.2
cis-1,2-Dichloroethene, ug/L	<0.2	<0.2

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REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
02-035-1	CWS-3	04 FEB 92
02-035-2	CWS-8	04 FEB 92

PARAMETER	02-035-1	02-035-2
cis-1,3-Dichloropropene, ug/L	<0.2	<0.2
m- and p-Xylene Isomers, ug/L	<0.2	<0.2
o-Xylene, ug/L	<0.2	<0.2
p-Isopropyl toluene, ug/L	<0.2	<0.2
sec-Butylbenzene, ug/L	<0.2	<0.2
trans-1,2-Dichloroethene, ug/L	<0.2	<0.2
trans-1,3-Dichloropropene, ug/L	<0.2	<0.2
tert-Butylbenzene, ug/L	<0.2	<0.2
Other EPA Method 524.2	---	---

Sim D. Lessley, Ph.D., Laboratory Director

CHAIN OF CUSTODY RECORD

BCA Log Number 9202035

Client name H+GCL - Batch# SF3289	Project or PO# 48016.08
Address 2200 Powell st. suite 880	Phone # 547-3886
City, State, Zip Emeryville, CA 94608	Report attention Mike Luksic

Sampled by Luksic

Analyses required: 524.2 Drinking water standards; Hazardous sample Special handling required

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	524.2 Drinking water standards							Hazardous sample Special handling required	Remarks
CWS-3	2-4-92	1300	GW	water on ice	3-40ml									samples slighty bubbled
CWS-8	2-4-92	1305	GW	water on ice	3-40ml									

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	H+GCL	2-4-92 ~~144mc~~	1445
Received by	Litvak	Joane Litvak	BCA	2.4.92	14 45
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

[X] 1255 Powell Street, Emeryville, CA 94608 (510) 428-2300

[ ] 801 Western Avenue, Glendale, CA 91201 (818) 247-5737

[ ] 1200 Gene Autry Way, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

Disposal arrangements: ______

*KEY: WW—Wastewater SU—Surface Water SO—Soil SL—Sludge PE—Petroleum OT—Other NA—Nonaqueous GW—Groundwater AQ—Aqueous

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mailed: MAR 12 1992

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-1	CWS-3	03 MAR 92
03-065-2	CWS-8	03 MAR 92
03-065-3	CWS-10	03 MAR 92

PARAMETER	03-065-1	03-065-2	03-065-3
EPA Method 524.2			
Date Analyzed	03.11.92	03.11.92	03.11.92
Date Extracted	03.11.92	03.11.92	03.11.92
Dilution Factor, Times	1	1	1
1,1,1,2-Tetrachloroethane, ug/L	<0.2	<0.2	<0.2
1,1,1-Trichloroethane, ug/L	<0.2	<0.2	<0.2
1,1,2,2-Tetrachloroethane, ug/L	<0.2	<0.2	<0.2
1,1,2-Trichloroethane, ug/L	<0.2	<0.2	<0.2
1,1-Dichloroethane, ug/L	<0.2	<0.2	<0.2
1,1-Dichloroethene, ug/L	<0.2	<0.2	<0.2
1,1-Dichloropropene, ug/L	<0.2	<0.2	<0.2
1,2,3-Trichlorobenzene, ug/L	<0.2	<0.2	<0.2
1,2,3-Trichloropropane, ug/L	<0.2	<0.2	<0.2
1,2,4-Trichlorobenzene, ug/L	<0.2	<0.2	<0.2
1,2,4-Trimethylbenzene, ug/L	<0.2	<0.2	<0.2
1,2-Dibromo-3-chloropropane, ug/L	<2	<2	<2
1,2-Dibromoethane, ug/L	<0.2	<0.2	<0.2
1,2-Dichloroethane, ug/L	<0.2	<0.2	<0.2
1,2-Dichlorobenzene, ug/L	<0.2	<0.2	<0.2
1,2-Dichloropropane, ug/L	<0.2	<0.2	<0.2
1,3,5-Trimethylbenzene, ug/L	<0.2	<0.2	<0.2
1,3-Dichlorobenzene, ug/L	<0.2	<0.2	<0.2
1,3-Dichloropropane, ug/L	<0.2	<0.2	<0.2

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BCA B C Analytical

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-1	CWS-3	03 MAR 92
03-065-2	CWS-8	03 MAR 92
03-065-3	CWS-10	03 MAR 92

PARAMETER	03-065-1	03-065-2	03-065-3
1,4-Dichlorobenzene, ug/L	<0.2	<0.2	<0.2
2,2-Dichloropropane, ug/L	<0.2	<0.2	<0.2
2-Chlorotoluene, ug/L	<0.2	<0.2	<0.2
4-Chlorotoluene, ug/L	<0.2	<0.2	<0.2
Bromobenzene, ug/L	<0.2	<0.2	<0.2
Bromochloromethane, ug/L	<0.2	0.8	<0.2
Bromodichloromethane, ug/L	0.5	<0.2	<0.2
Bromomethane, ug/L	<0.2	<0.2	<0.2
Benzene, ug/L	<0.2	<0.2	<0.2
Bromoform, ug/L	<0.2	<0.2	<0.2
Chlorobenzene, ug/L	<0.2	<0.2	<0.2
Carbon Tetrachloride, ug/L	<0.2	<0.2	<0.2
Chloroethane, ug/L	<0.2	<0.2	<0.2
Chloroform, ug/L	0.7	0.4	<0.2
Chloromethane, ug/L	<0.2	<0.2	<0.2
Dibromochloromethane, ug/L	0.2	<0.2	<0.2
Dibromomethane, ug/L	<0.2	<0.2	<0.2
Ethylbenzene, ug/L	<0.2	<0.2	<0.2
Hexachlorobutadiene, ug/L	<0.2	<0.2	<0.2
Isopropylbenzene, ug/L	<0.2	<0.2	<0.2
Methylene chloride, ug/L	<1	<1	<1
N-Butylbenzene, ug/L	<0.2	<0.2	<0.2
N-Propylbenzene, ug/L	<0.2	<0.2	<0.2

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Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-1	CWS-3	03 MAR 92
03-065-2	CWS-8	03 MAR 92
03-065-3	CWS-10	03 MAR 92

PARAMETER	03-065-1	03-065-2	03-065-3
Naphthalene, ug/L	<0.2	<0.2	<0.2
Styrene, ug/L	<0.2	<0.2	<0.2
Trichloroethene, ug/L	<0.2	<0.2	<0.2
Trichlorofluoromethane, ug/L	<0.2	<0.2	<0.2
Toluene, ug/L	<0.2	<0.2	0.3
Tetrachloroethene, ug/L	<0.2	<0.2	<0.2
Vinyl chloride, ug/L	<0.2	<0.2	<0.2
cis-1,2-Dichloroethene, ug/L	<0.2	<0.2	<0.2
cis-1,3-Dichloropropene, ug/L	<0.2	<0.2	<0.2
m- and p-Xylene Isomers, ug/L	<0.2	<0.2	<0.2
o-Xylene, ug/L	<0.2	<0.2	<0.2
p-Isopropyl toluene, ug/L	<0.2	<0.2	<0.2
sec-Butylbenzene, ug/L	<0.2	<0.2	<0.2
trans-1,2-Dichloroethene, ug/L	<0.2	<0.2	<0.2
trans-1,3-Dichloropropene, ug/L	<0.2	<0.2	<0.2
tert-Butylbenzene, ug/L	<0.2	<0.2	<0.2
Other EPA Method 524.2	---	---	---

1255 Powell Street
Emeryville, CA 94608

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BCA B C Analytical

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Arsenic, mg/L	0.004	0.004
Selenium, mg/L	<0.002	<0.002
Fourteen CA Metals by ICAP		
Silver, mg/L	<0.05	<0.05
Barium, mg/L	0.19	0.08
Beryllium, mg/L	<0.01	<0.01
Cadmium, mg/L	<0.05	<0.05
Cobalt, mg/L	<0.05	<0.05
Chromium, mg/L	<0.05	<0.05
Copper, mg/L	<0.05	<0.05
Molybdenum, mg/L	<0.2	<0.2
Nickel, mg/L	<0.1	<0.1
Lead, mg/L	<0.2	<0.2
Antimony, mg/L	<0.2	<0.2
Thallium, mg/L	<0.2	<0.2
Vanadium, mg/L	<0.05	<0.05
Zinc, mg/L	0.05	0.09
Mercury, mg/L	<0.0002	<0.0002
Nitric Acid Digestion, Date	03.04.92	03.04.92
Nitric Acid Digestion, Date	03.04.92	03.04.92

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BCA B C Analytical

Analytical Report

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Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
B/N,A Ext.Pri.Poll. (EPA-625)		
Date Analyzed	03.10.92	03.10.92
Date Extracted	03.06.92	03.06.92
Dilution Factor, Times	1	1
1,2,4-Trichlorobenzene, ug/L	<4	<4
1,2-Dichlorobenzene, ug/L	<4	<4
1,2-Diphenylhydrazine, ug/L	<4	<4
1,3-Dichlorobenzene, ug/L	<3	<3
1,4-Dichlorobenzene, ug/L	<3	<3
2,4,5-Trichlorophenol, ug/L	<4	<4
2,4,6-Trichlorophenol, ug/L	<3	<3
2,4-Dichlorophenol, ug/L	<3	<3
2,4-Dimethylphenol, ug/L	<4	<4
2,4-Dinitrophenol, ug/L	<10	<10
2,4-Dinitrotoluene, ug/L	<10	<10
2,6-Dinitrotoluene, ug/L	<2	<2
2-Chloronaphthalene, ug/L	<3	<3
2-Chlorophenol, ug/L	<4	<4
2-Methyl-4,6-dinitrophenol, ug/L	<3	<3
2-Methylnaphthalene, ug/L	<3	<3
2-Methylphenol (o-Cresol), ug/L	<3	<3
2-Nitroaniline, ug/L	<10	<10
2-Nitrophenol, ug/L	<3	<3
3,3'-Dichlorobenzidine, ug/L	<20	<20

Analytical Report

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Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
3-Nitroaniline, ug/L	<10	<10
4-Bromophenylphenylether, ug/L	<4	<4
4-Chloro-3-methylphenol, ug/L	<4	<4
4-Chloroaniline, ug/L	<10	<10
4-Chlorophenylphenylether, ug/L	<4	<4
4-Methylphenol (p-Cresol), ug/L	<4	<4
4-Nitroaniline, ug/L	<10	<10
4-Nitrophenol, ug/L	<30	<30
Acenaphthene, ug/L	<5	<5
Acenaphthylene, ug/L	<3	<3
Aniline, ug/L	<10	<10
Anthracene, ug/L	<4	<4
Benzidine, ug/L	<50	<50
Benzo(a)anthracene, ug/L	<3	<3
Benzo(a)pyrene, ug/L	<3	<3
Benzo(b)fluoranthene, ug/L	<10	<10
Benzo(g,h,i)perylene, ug/L	<3	<3
Benzo(k)fluoranthene, ug/L	<10	<10
Benzyl alcohol, ug/L	<10	<10
Benzoic acid, ug/L	<10	<10
Butylbenzylphthalate, ug/L	<3	<3
Chrysene, ug/L	<2	<2
Di-n-octylphthalate, ug/L	<4	<4
Dibenzo(a,h)anthracene, ug/L	<3	<3

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BCA B C Analytical

Analytical Report

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Mr. Mike Luksic
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2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Dibenzofuran, ug/L	<3	<3
Dibutylphthalate, ug/L	<3	<3
Diethylphthalate, ug/L	<3	<3
Dimethylphthalate, ug/L	<3	<3
Fluoranthene, ug/L	<3	<3
Fluorene, ug/L	<3	<3
Hexachlorobenzene, ug/L	<4	<4
Hexachlorobutadiene, ug/L	<4	<4
Hexachlorocyclopentadiene, ug/L	<20	<20
Hexachloroethane, ug/L	<3	<3
Indeno(1,2,3-c,d)pyrene, ug/L	<4	<4
Isophorone, ug/L	<3	<3
N-Nitrosodimethylamine, ug/L	<10	<10
N-Nitrosodiphenylamine, ug/L	<10	<10
N-Nitrosodi-n-propylamine, ug/L	<3	<3
Nitrobenzene, ug/L	<4	<4
Naphthalene, ug/L	<3	<3
Phenanthrene, ug/L	<4	<4
Phenol, ug/L	5	<5
Pentachlorophenol, ug/L	<10	<10
Pyrene, ug/L	<2	<2
Bis(2-chloroethoxy)methane, ug/L	<3	<3
Bis(2-chloroethyl)ether, ug/L	<3	<3
Bis(2-chloroisopropyl)ether, ug/L	<3	<3

1255 Powell Street
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BCA B C Analytical

Analytical Report

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2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Bis(2-ethylhexyl)phthalate, ug/L	20	<4
Other B/N,A Ext.Pri.Poll. (EPA-625)	---	---
Semi-Quantified Results **		
C15-C35 Hydrocarbon Matrix, ug/L	---	500
C6H12O Alcohol, ug/L	10	---
C7-C35 Total Hydrocarbons, ug/L	1000	---

** Quantification based upon comparison of total ion count of the compound with that of the nearest internal standard.

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

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Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Pesticides/PCBs (EPA 8080)		
Date Analyzed	03.11.92	03.11.92
Date Extracted	03.09.92	03.09.92
Dilution Factor, Times	1	1
Aldrin, ug/L	<0.04	<0.04
Chlordane, ug/L	<0.3	<0.3
p,p'-DDD, ug/L	<0.05	<0.05
p,p'-DDE, ug/L	<0.04	<0.04
p,p'-DDT, ug/L	<0.1	<0.1
Dieldrin, ug/L	<0.03	<0.03
Endosulfan I, ug/L	<0.05	<0.05
Endosulfan II, ug/L	<0.05	<0.05
Endosulfan sulfate, ug/L	<0.1	<0.1
Endrin, ug/L	<0.05	<0.05
Endrin aldehyde, ug/L	<0.1	<0.1
Heptachlor epoxide, ug/L	<0.05	<0.05
Heptachlor, ug/L	<0.03	<0.03
Methoxychlor, ug/L	<0.2	<0.2
Aroclor 1016, ug/L	<1	<1
Aroclor 1221, ug/L	<1	<1
Aroclor 1232, ug/L	<1	<1
Aroclor 1242, ug/L	<1	<1
Aroclor 1248, ug/L	<1	<1
Aroclor 1254, ug/L	<1	<1

1255 Powell Street
Emeryville, CA 94608

510/428-2300
Fax: 510/547-3643

BCA **B C Analytical**

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Aroclor 1260, ug/L	<1	<1
Aroclor 1262, ug/L	<1	<1
Toxaphene, ug/L	<1	<1
BHC, alpha isomer, ug/L	<0.03	<0.03
BHC, beta isomer, ug/L	<0.03	<0.03
BHC, delta isomer, ug/L	<0.03	<0.03
BHC, gamma isomer (Lindane), ug/L	<0.03	<0.03

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

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Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
EPA Method 8010		
Date Analyzed	03.10.92	03.09.92
Confirmation Date	03.10.92	03.10.92
Dilution Factor, Times	10	2
1,1,1-Trichloroethane, ug/L	<5	<1
1,1,2,2-Tetrachloroethane, ug/L	<5	<1
1,1,2-Trichloroethane, ug/L	<5	<1
1,1-Dichloroethane, ug/L	<5	<1
1,1-Dichloroethene, ug/L	<5	<1
1,2-Dichloroethane, ug/L	<5	<1
1,2-Dichlorobenzene, ug/L	<5	<1
1,2-Dichloroethene (Total), ug/L	190	<1
1,2-Dichloropropane, ug/L	<5	<1
1,3-Dichlorobenzene, ug/L	<5	<1
1,4-Dichlorobenzene, ug/L	<5	<1
2-Chloroethylvinylether, ug/L	<5	<1
Bromodichloromethane, ug/L	<5	<1
Bromomethane, ug/L	<5	<1
Bromoform, ug/L	<5	<1
Chlorobenzene, ug/L	<5	<1
Carbon Tetrachloride, ug/L	<5	<1
Chloroethane, ug/L	<5	<1
Chloroform, ug/L	<5	<1
Chloromethane, ug/L	<5	<1

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BCA **B C Analytical**

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
Dibromochloromethane, ug/L	<5	<1
Dichlorodifluoromethane, ug/L	<5	7
Freon 113, ug/L	<5	<1
Methylene chloride, ug/L	<5	<1
Trichloroethene, ug/L	70	2
Trichlorofluoromethane, ug/L	<5	<1
Tetrachloroethene, ug/L	540	200
Vinyl chloride, ug/L	<5	<1
cis-1,2-Dichloroethene, ug/L	190	<1
cis-1,3-Dichloropropene, ug/L	<5	<1
trans-1,2-Dichloroethene, ug/L	<5	<1
trans-1,3-Dichloropropene, ug/L	<5	<1

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BCA B C Analytical

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

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Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, GROUND WATER SAMPLES	DATE SAMPLED
03-065-4	MW-17	03 MAR 92
03-065-5	MW-18	03 MAR 92

PARAMETER	03-065-4	03-065-5
EPA Method 8020		
Date Analyzed	03.10.92	03.09.92
Confirmation Date	03.10.92	---
Dilution Factor, Times	10	2
1,2-Dichlorobenzene, ug/L	<5	<1
1,3-Dichlorobenzene, ug/L	<5	<1
1,4-Dichlorobenzene, ug/L	<5	<1
Benzene, ug/L	59	<1
Chlorobenzene, ug/L	<5	<1
Ethylbenzene, ug/L	<5	<1
Toluene, ug/L	<5	<1
Total Xylene Isomers, ug/L	<5	<1

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BCA B C Analytical

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, BLANK WATER SAMPLES	DATE SAMPLED
03-065-6	Trip Blank	03 MAR 92

PARAMETER	03-065-6
EPA Method 8010	
Date Analyzed	03.10.92
Confirmation Date	03.11.92
Dilution Factor, Times	1
1,1,1-Trichloroethane, ug/L	<0.5
1,1,2,2-Tetrachloroethane, ug/L	<0.5
1,1,2-Trichloroethane, ug/L	<0.5
1,1-Dichloroethane, ug/L	<0.5
1,1-Dichloroethene, ug/L	<0.5
1,2-Dichloroethane, ug/L	<0.5
1,2-Dichlorobenzene, ug/L	<0.5
1,2-Dichloroethene (Total), ug/L	<0.5
1,2-Dichloropropane, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
2-Chloroethylvinylether, ug/L	<0.5
Bromodichloromethane, ug/L	<0.5
Bromomethane, ug/L	<0.5
Bromoform, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Carbon Tetrachloride, ug/L	<0.5
Chloroethane, ug/L	<0.5
Chloroform, ug/L	<0.5
Chloromethane, ug/L	<0.5
Dibromochloromethane, ug/L	<0.5

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, BLANK WATER SAMPLES	DATE SAMPLED
03-065-6	Trip Blank	03 MAR 92

PARAMETER	03-065-6
Dichlorodifluoromethane, ug/L	<0.5
Freon 113, ug/L	<0.5
Methylene chloride, ug/L	<0.5
Trichloroethene, ug/L	<0.5
Trichlorofluoromethane, ug/L	<0.5
Tetrachloroethene, ug/L	<0.5
Vinyl chloride, ug/L	<0.5
cis-1,2-Dichloroethene, ug/L	<0.5
cis-1,3-Dichloropropene, ug/L	<0.5
trans-1,2-Dichloroethene, ug/L	<0.5
trans-1,3-Dichloropropene, ug/L	<0.5

Analytical Report

LOG NO: E92-03-065

Received: 03 MAR 92

Mr. Mike Luksic
H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Project: 48016.08

REPORT OF ANALYTICAL RESULTS

LOG NO	SAMPLE DESCRIPTION, BLANK WATER SAMPLES	DATE SAMPLED
03-065-6	Trip Blank	03 MAR 92

PARAMETER	03-065-6
EPA Method 8020	
Date Analyzed	03.10.92
Dilution Factor, Times	1
1,2-Dichlorobenzene, ug/L	<0.5
1,3-Dichlorobenzene, ug/L	<0.5
1,4-Dichlorobenzene, ug/L	<0.5
Benzene, ug/L	<0.5
Chlorobenzene, ug/L	<0.5
Ethylbenzene, ug/L	<0.5
Toluene, ug/L	<0.5
Total Xylene Isomers, ug/L	<0.5
Other EPA Method 8020	---

Sim D. Lessley, Ph.D., Laboratory Director

1255 Powell Street
Emeryville, CA 94608

510/428-2300
Fax: 510/547-3643

BCA B C Analytical

CHAIN OF CUSTODY RECORD Batch SP5334 — BCA Log Number 920065

Client name: H+GCL	Project or PO#: 48016.08
Address: 2200 Powell st. suite 880	Phone #: 547-3886
City, State, Zip: Emeryville, CA 94608	Report attention: Mike Luksic

Sampled by: Mike Luksic

Lab Sample number	Date sampled	Time sampled	Type* See key below	Sample description	Number of containers	524.2	8010	8020	title 26 metal	8270-PCB+Pesticides			Hazardous sample Special handling required	Remarks
CWS-3	3-3-92	1315	GW	Tap water from aquifer	3-40ml	✓								standard turnaround
CWS-8	"	1345	GW	"	3/40ml	✓								
CWS-10	"	1258	GW	"	3/40ml	✓								
MW-17	"	1436	GW	water from aquifer	3 lit, 3 40ml		✓	✓	✓	✓				
MW-18	"	1538	GW	"	3 Lit 3 40ml		✓	✓	✓	✓				
Trip blank	"	930	AQ	Water sealed and left in cooler	2 VOA's		✓	✓						

	Signature	Print Name	Company	Date	Time
Relinquished by	Mike Luksic	Mike Luksic	H+GCL	92-03-03	17:52
Received by	Litvak	Joane Litvak	BCA	92/3/3	
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

B C ANALYTICAL

- 1255 Powell Street, Emeryville, CA 94608 (510) 428-2300
- 801 Western Avenue, Glendale, CA 91201 (818) 247-5737
- 1200 Gene Autry Way, Anaheim, CA 92805 (714) 978-0113

Note: Samples are discarded 30 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client's expense.

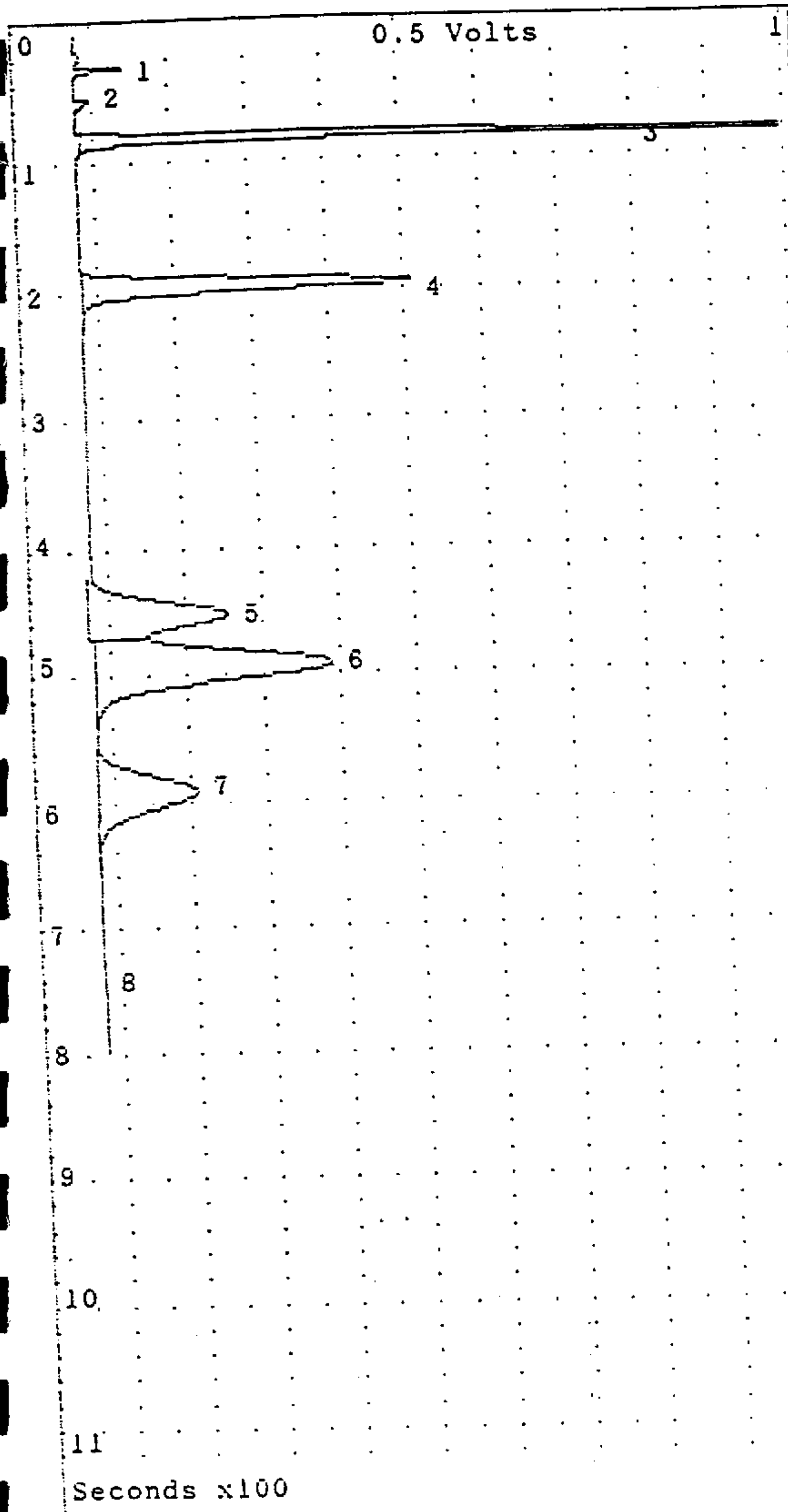
Disposal arrangements: ____________

*KEY: WW—Wastewater SU—Surface Water SO—Soil SL—Sludge PE—Petroleum OT—Other NA—Nonaqueous GW—Groundwater AQ—Aqueous

APPENDIX 3

SOIL VAPOR SURVEY RESULTS

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 13:48
Stopped at 800.0 sec

Number	2	Livermore3/2/92
Internal Temp	21	BTEX cal 100ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	28.1	125 mVS
UNKNOWN	2	54.1	46.8 mVS
benzene	3	84.1	9.28 PPM
toluene	4	199.8	8.83 PPM
ethylbenzene	5	459.2	8.11 PPM
p,m xylene	6	500.5	15.7 PPM
o xylene	7	599.9	7.75 PPM

* exceeds alarm level

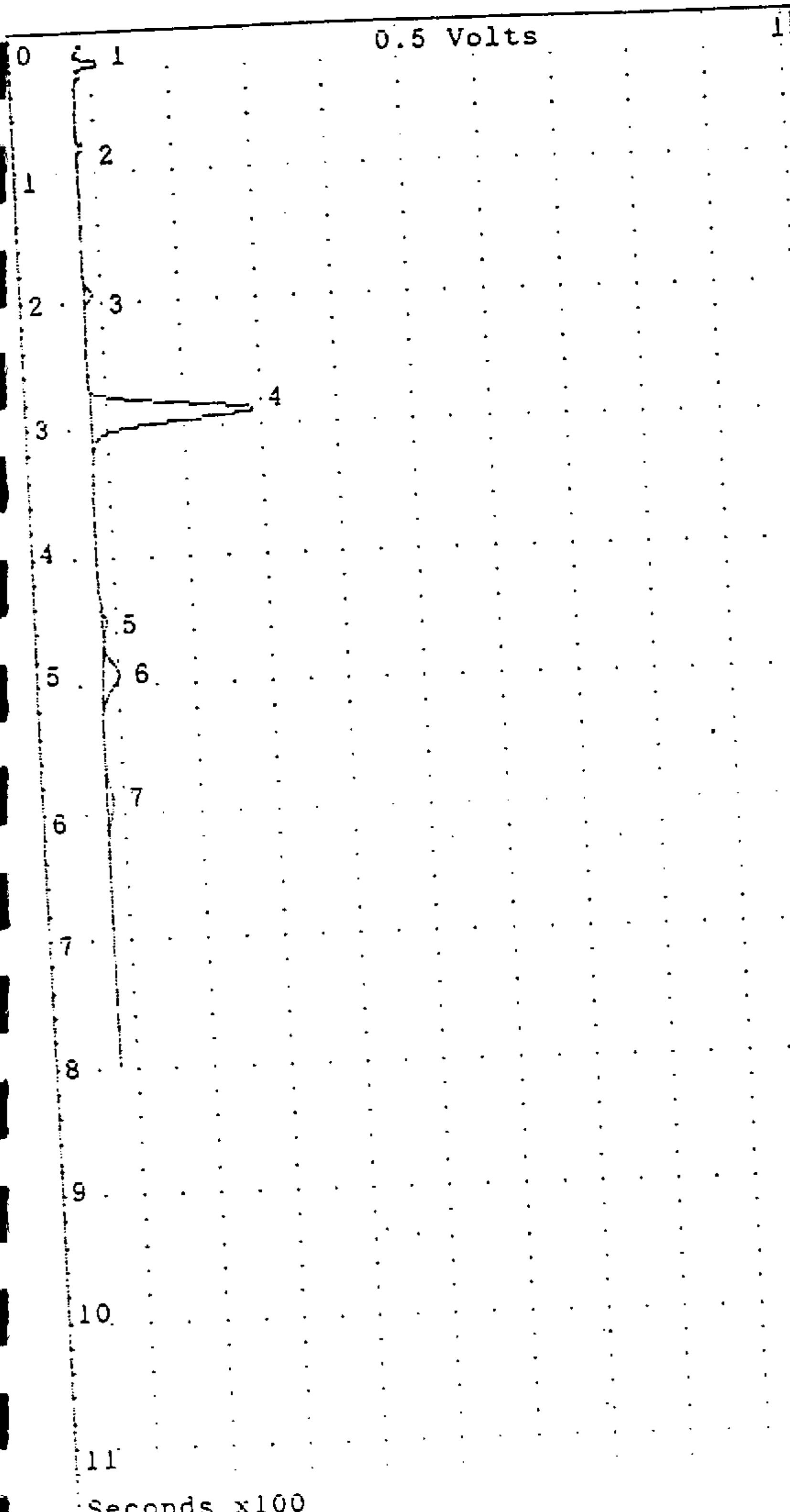
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

BTEX CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 14:11
Stopped at 800.0 sec

Number	3	Livermore3/2/92
Internal Temp	21	PCE cal 500ul
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	16.5	13.4 mVS
benzene	2	83.8	35.7 PPB
toluene	3	198.7	185 PPB
PCE	4	293.1	10.3 PPM
ethylbenzene	5	458.0	202 PPB
p,m xylene	6	499.2	817 PPB
o xylene	7	599.9	444 PPB

* exceeds alarm level

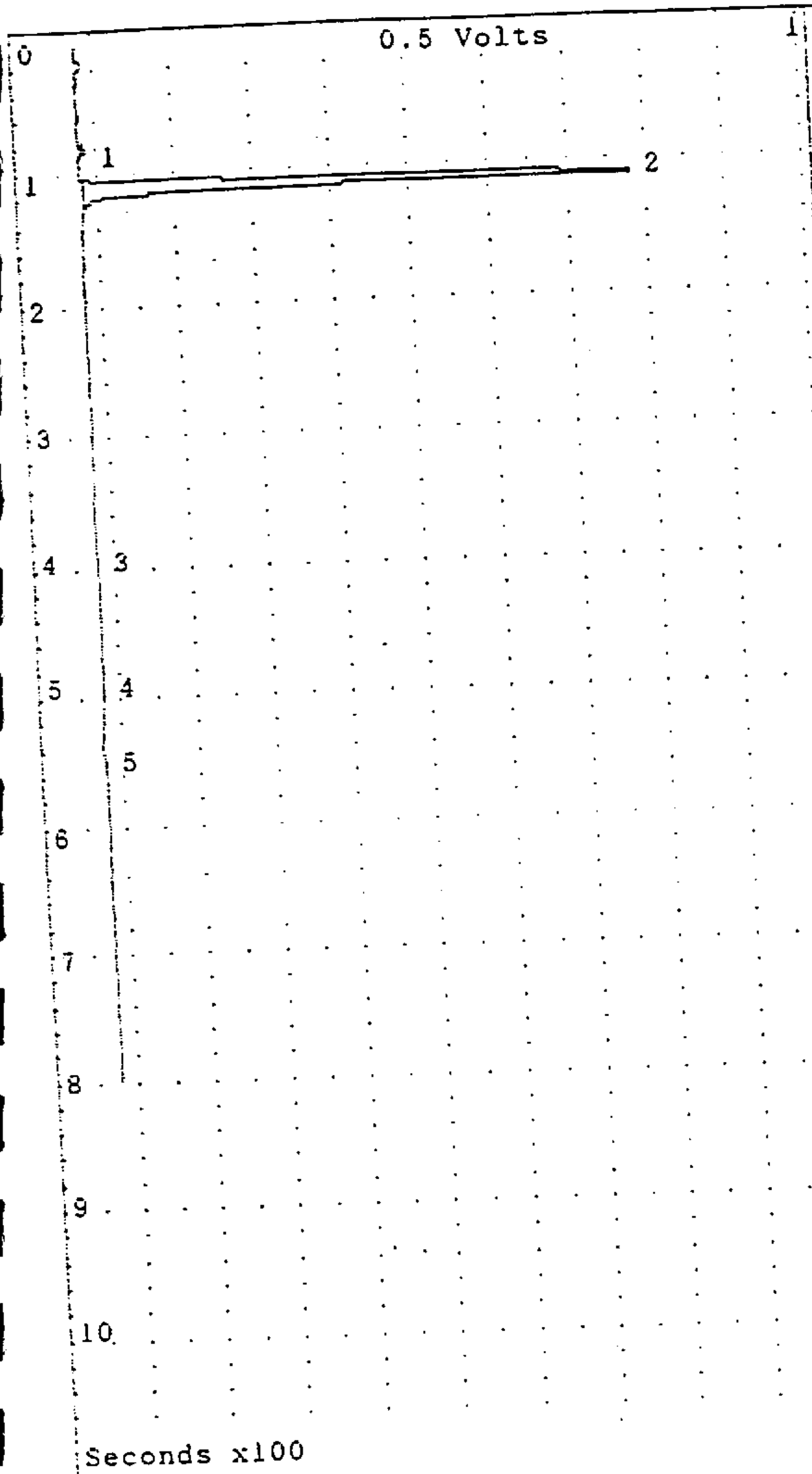
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

PCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 14:30
Stopped at 800.0 sec

Number	4	Livermore3/2/92
Internal Temp	21	TCE cal 100ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
benzene	1	84.4	61.9 PPB
TCE	2	113.2	10.4 PPM
UNKNOWN	3	403.6	11.8 mVS
p,m xylene	4	497.9	25 PPB
o xylene	5	601.5	148 PPB

* exceeds alarm level

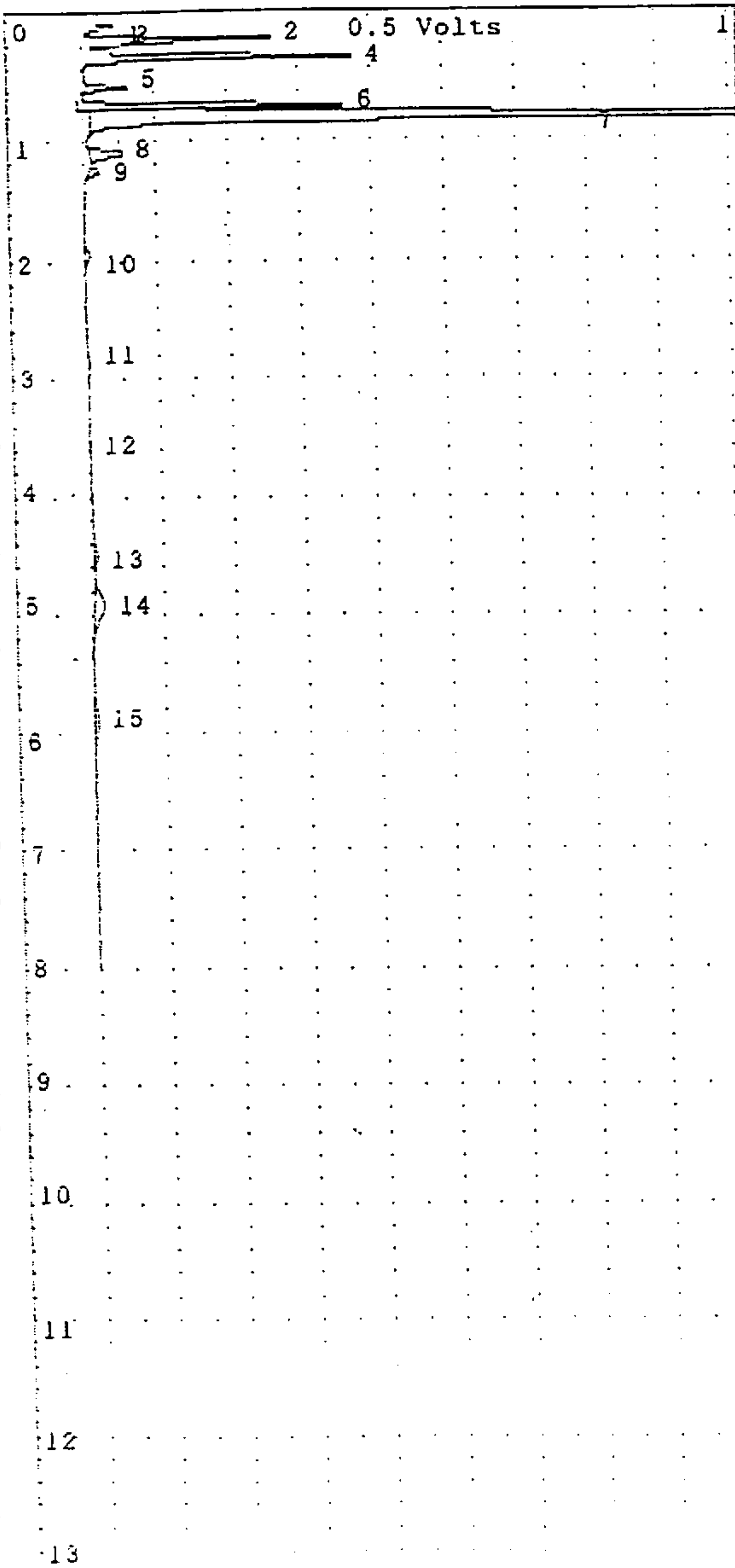
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

TCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 14:49
Stopped at 800.0 sec

Number	5	Livermore3/2/92
Internal Temp	21	111TCA cal 500ul
Gain	20	OV 30 10 ML MIN
Offset	10.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	3.9	49.6 mVS
UNKNOWN	2	16.5	1 VS
UNKNOWN	3	27.4	34.8 mVS
UNKNOWN	4	32.7	1.3 VS
UNKNOWN	5	57.7	227 mVS
111 TCA	6	74.5	10.5 PPM
benzene	7	82.7	5.29 PPM
TCE	8	112.6	182 PPB
UNKNOWN	9	128.4	74 mVS
toluene	10	198.7	28.2 PPB
PCE	11	293.1	3.98 PPB
ethylbenzene	13	456.8	34.2 PPB
p,m xylene	14	499.2	145 PPB
o xylene	15	598.3	54.8 PPB

* exceeds alarm level

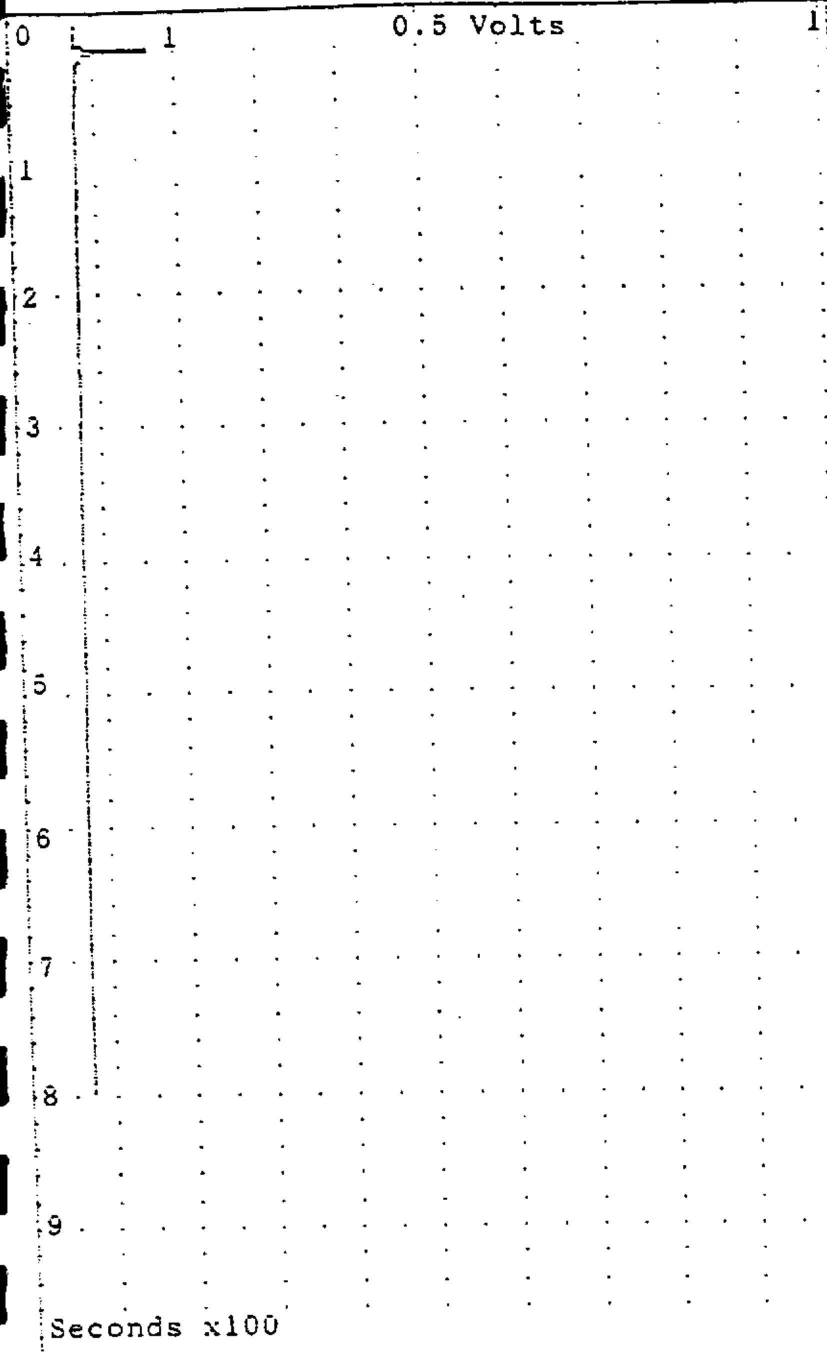
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

1,1,1-TCA CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1   MAR 2 1992   15:13
Stopped at 800.0 sec

Number	6	Livermore3/2/92
Internal Temp	21	system blnk100ul
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	21.1	174 mVS

* exceeds alarm level

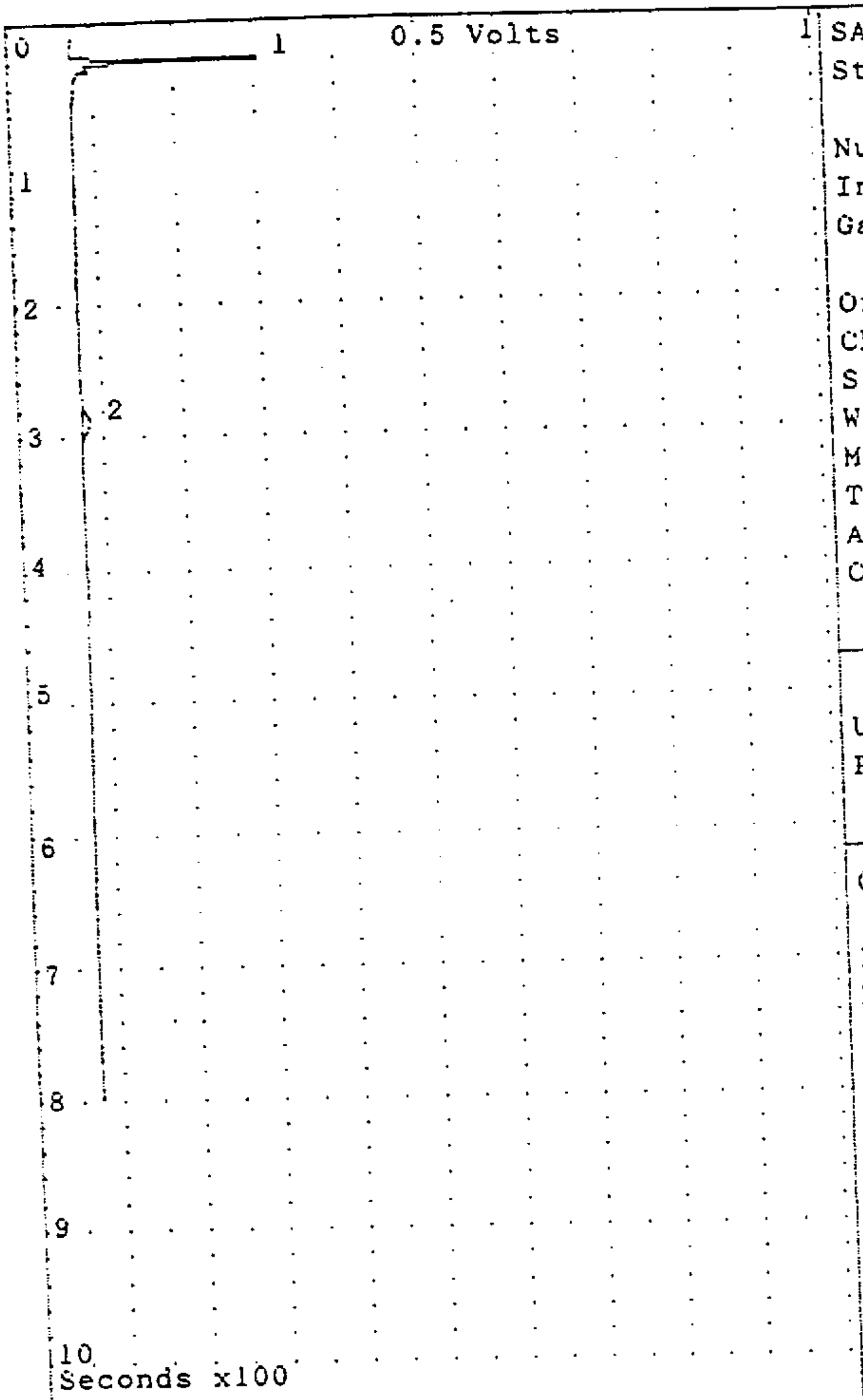
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

SYSTEM BLANK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 15:36
Stopped at 800.0 sec

Number	7	Livermore3/2/92
Internal Temp	21	MW1 1well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.7	716 mVS
PCE	2	293.9	376 PPB

* exceeds alarm level

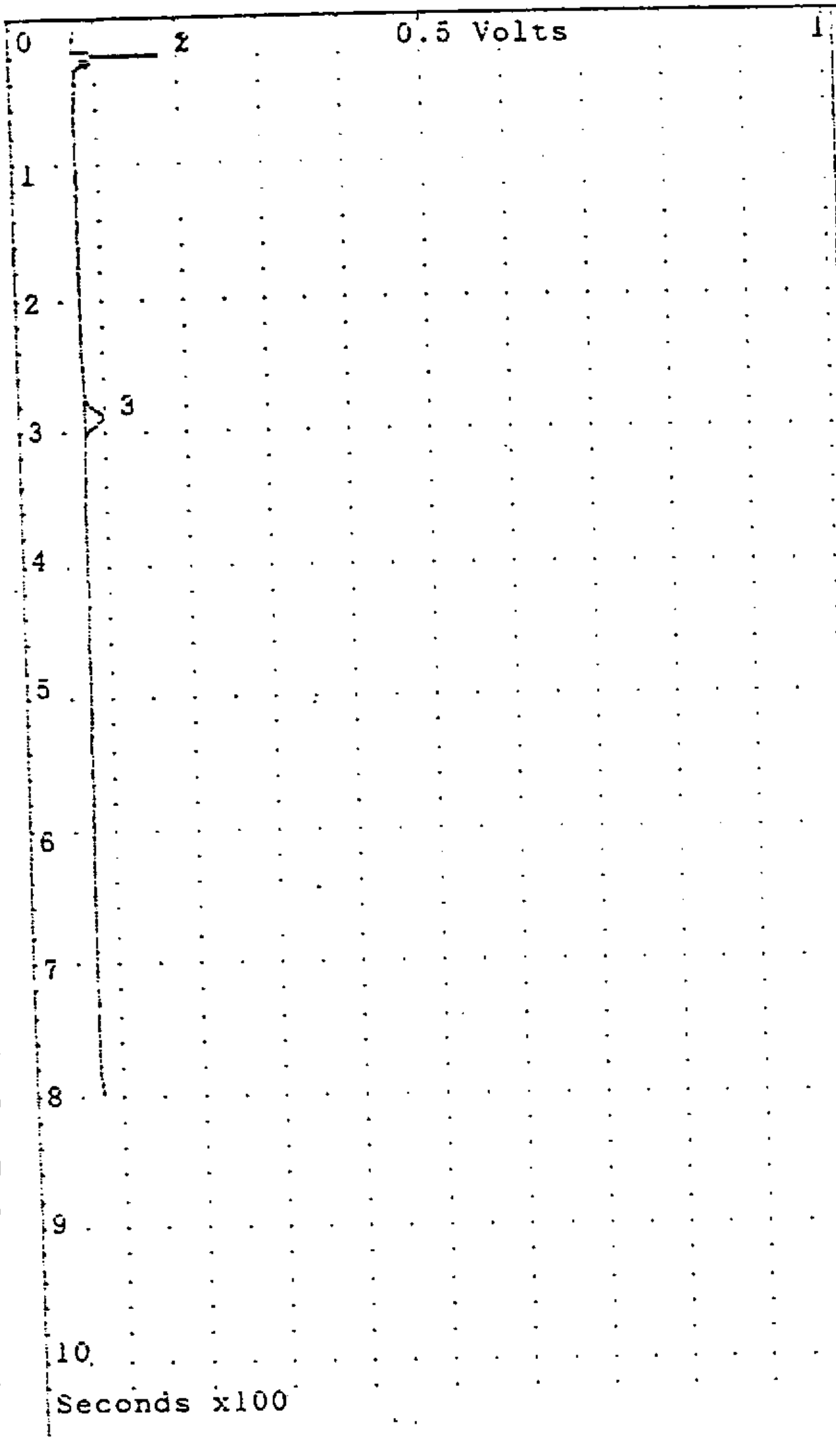
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #2
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 15:52
Stopped at 800.0 sec

Number	8	Livermore3/2/92
Internal Temp	21	MW2 2 well vols
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.5	314 mVS
UNKNOWN	2	28.0	6.7 mVS
PCE	3	293.9	977 PPB

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

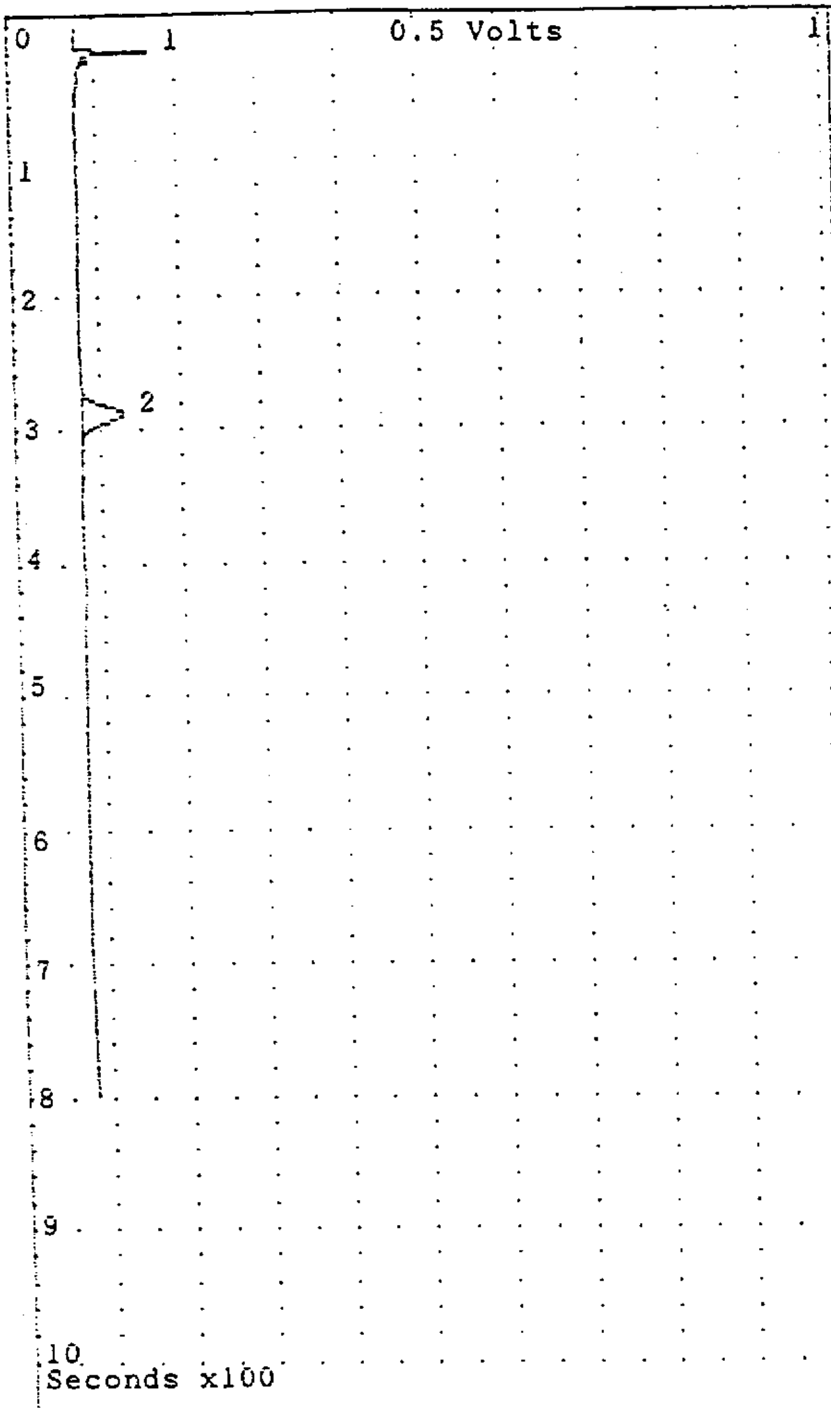
MARCH 2, 1992

MONITORING WELL #2
EVACUATION: TWO WELL VOLUMES

TD = 55'

Screen: 35' - 50

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 16: 7
Stopped at 800.0 sec

Number	9	Livermore3/2/92
Internal Temp	20	MW2 3 well vols
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.6	248 mVS
PCE	2	293.1	2.27 PPM

* exceeds alarm level

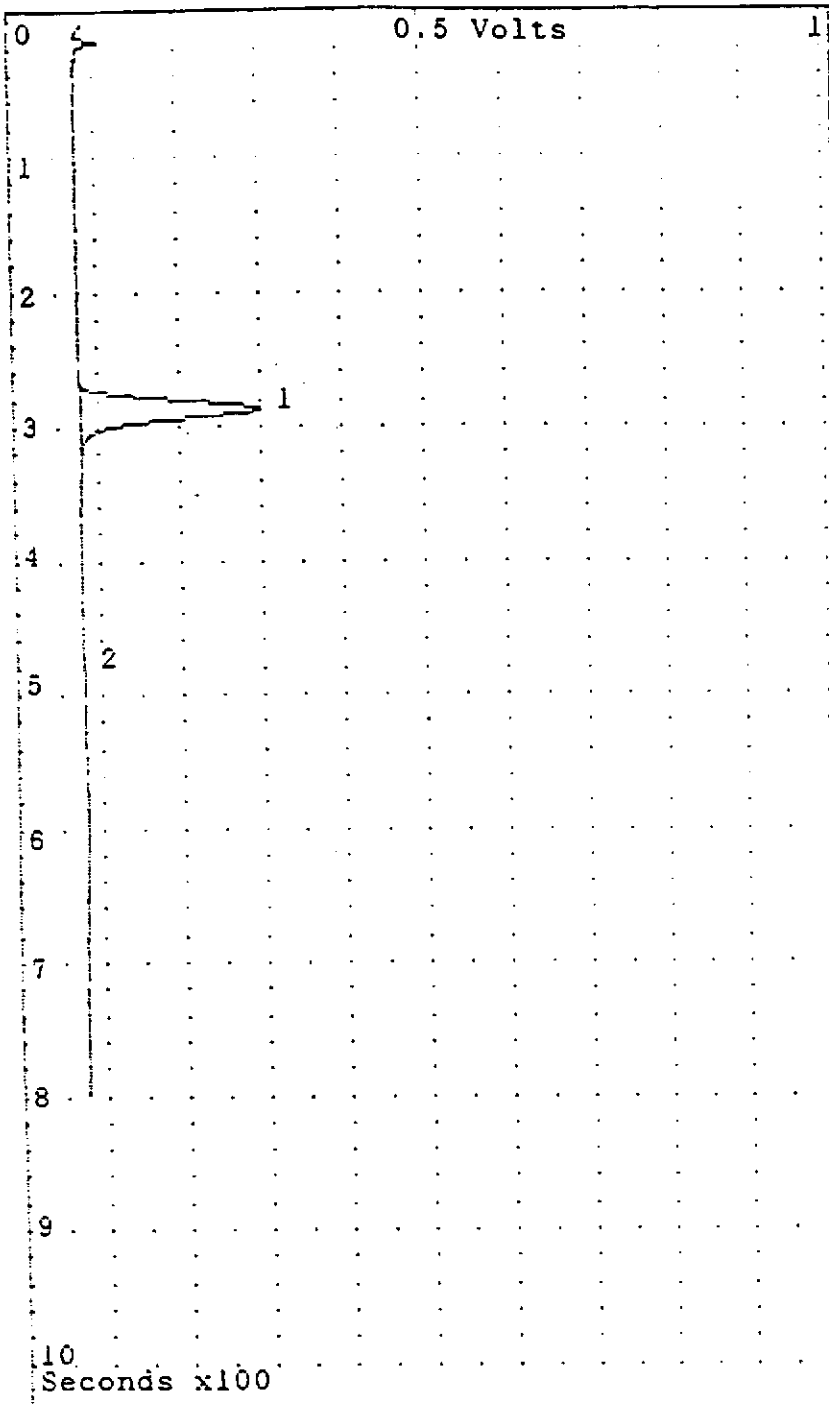
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #2
EVACUATION: THREE WELL VOLUMES

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 16:26
Stopped at 800.0 sec

Number	10	Livermore3/2/92
Internal Temp	20	PCE cal 500ul
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
PCE	1	292.3	10.9 PPM*
p,m xylene	2	500.5	15.8 PPB*

* exceeds alarm level

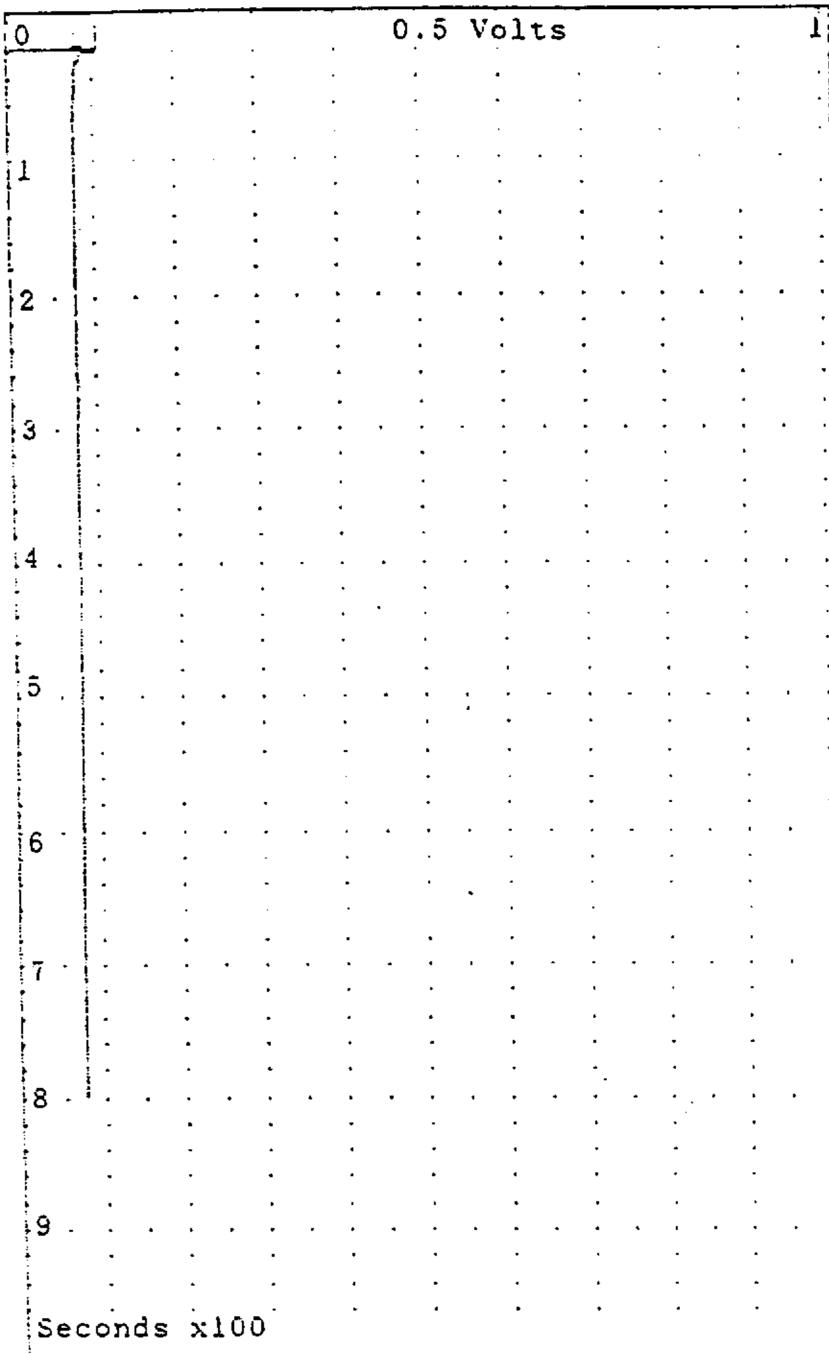
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

PCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 16:52
Stopped at 800.0 sec

Number	11	Livermore3/2/92
Internal Temp	20	system blnk100ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.9	11.5 mVS

* exceeds alarm level

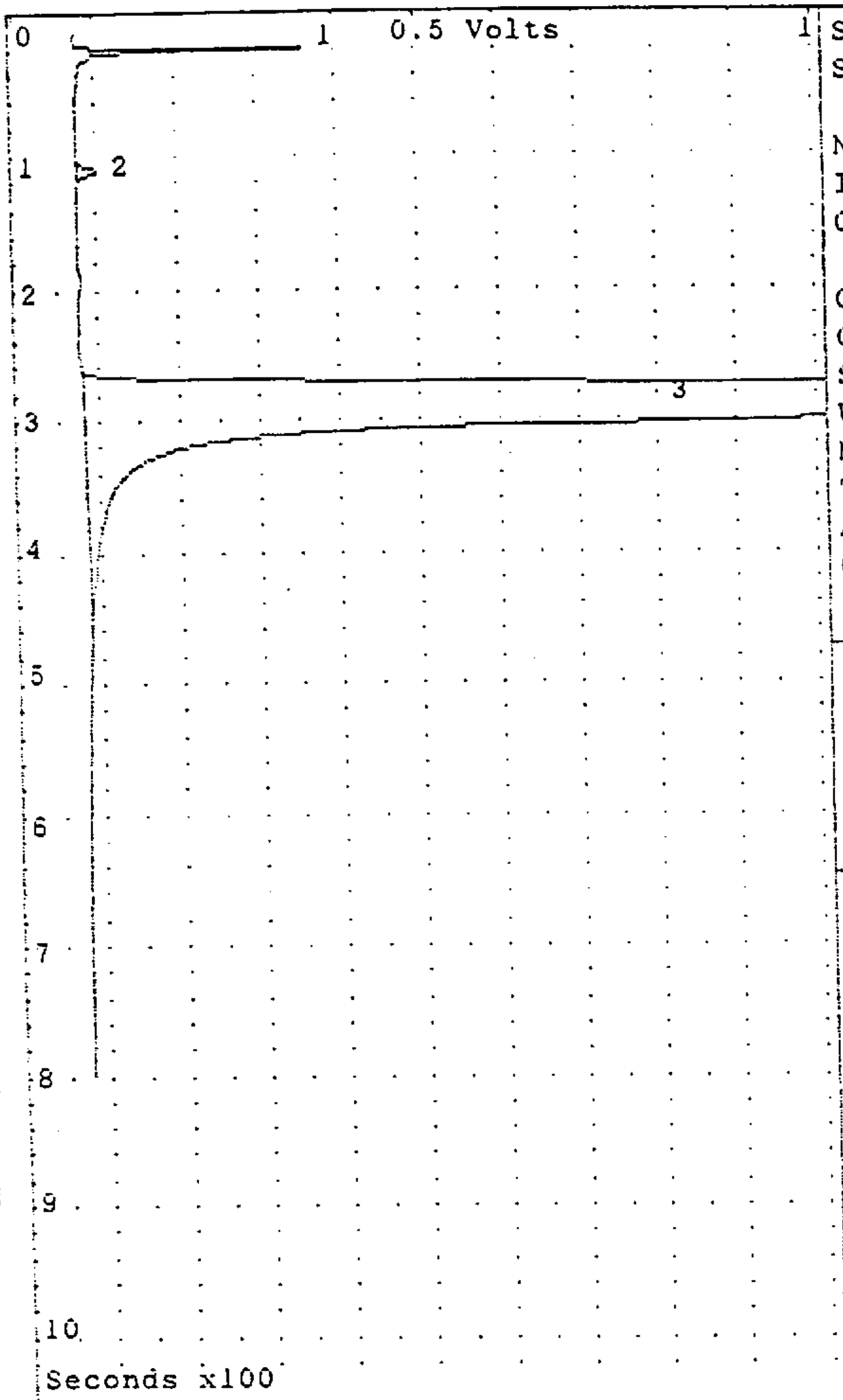
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

SYSTEM BLANK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 17:13
Stopped at 800.0 sec

Number	12	Livermore3/2/92
Internal Temp	19	MW7 1well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.9	798 mVS
TCE	2	112.9	356 PPB*
PCE	3	289.7	607 PPM*

* exceeds alarm level

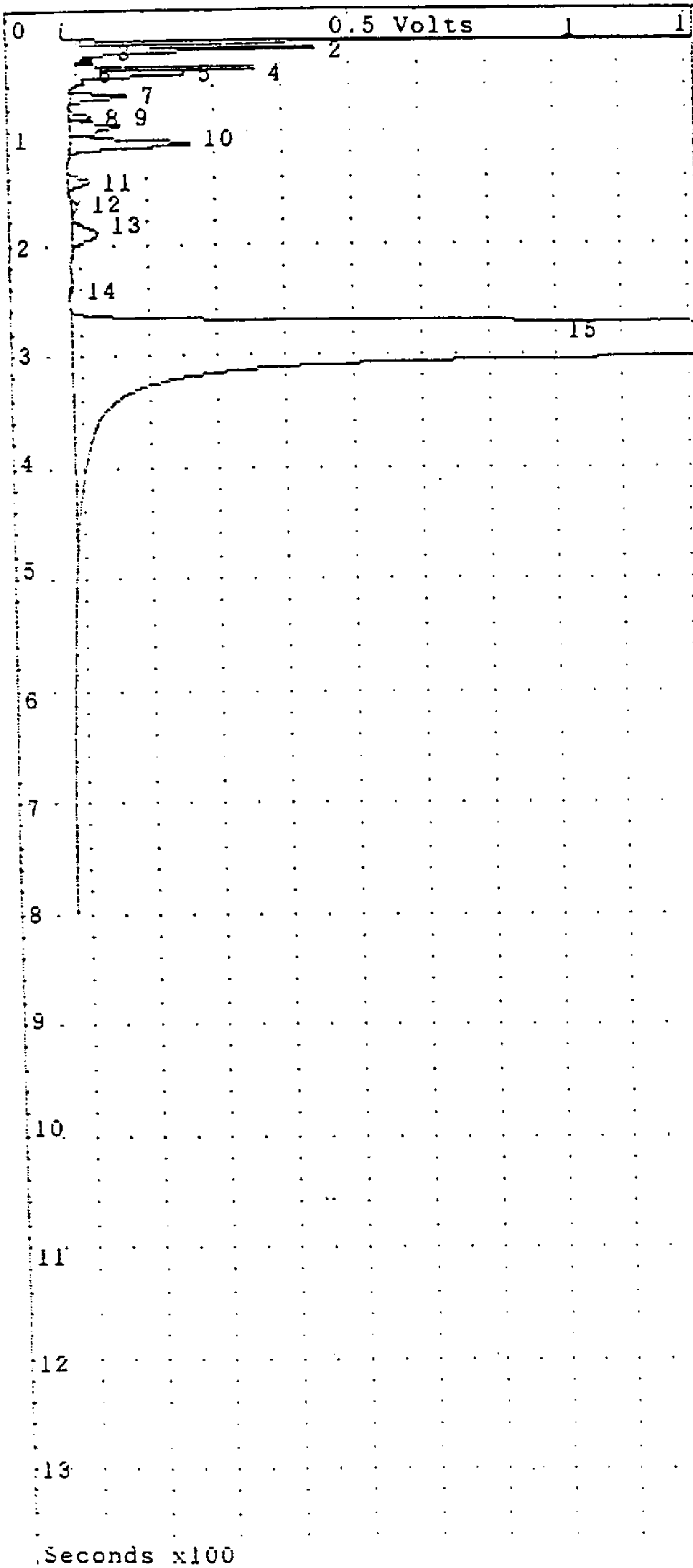
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #7
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 17:32
Stopped at 800.0 sec

Number	13	Livermore3/2/92
Internal Temp	19	MW7 2well vols
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.9	4.4 VS
UNKNOWN	2	28.1	813 mVS
UNKNOWN	3	37.7	14.6 mVS
UNKNOWN	4	46.9	1.1 VS
UNKNOWN	5	51.5	512 mVS
UNKNOWN	6	57.9	8.7 mVS
UNKNOWN	7	70.5	468 mVS
UNKNOWN	8	89.2	172 mVS
UNKNOWN	9	97.6	622 mVS
TCE	10	113.5	3.07 PPM
UNKNOWN	11	147.2	260 mVS
UNKNOWN	12	169.2	94.5 mVS
toluene	13	194.7	937 PPB
UNKNOWN	14	240.2	18.8 mVS
PCE	15	289.0	772 PPM

* exceeds alarm level

GRUBB & ELLIS

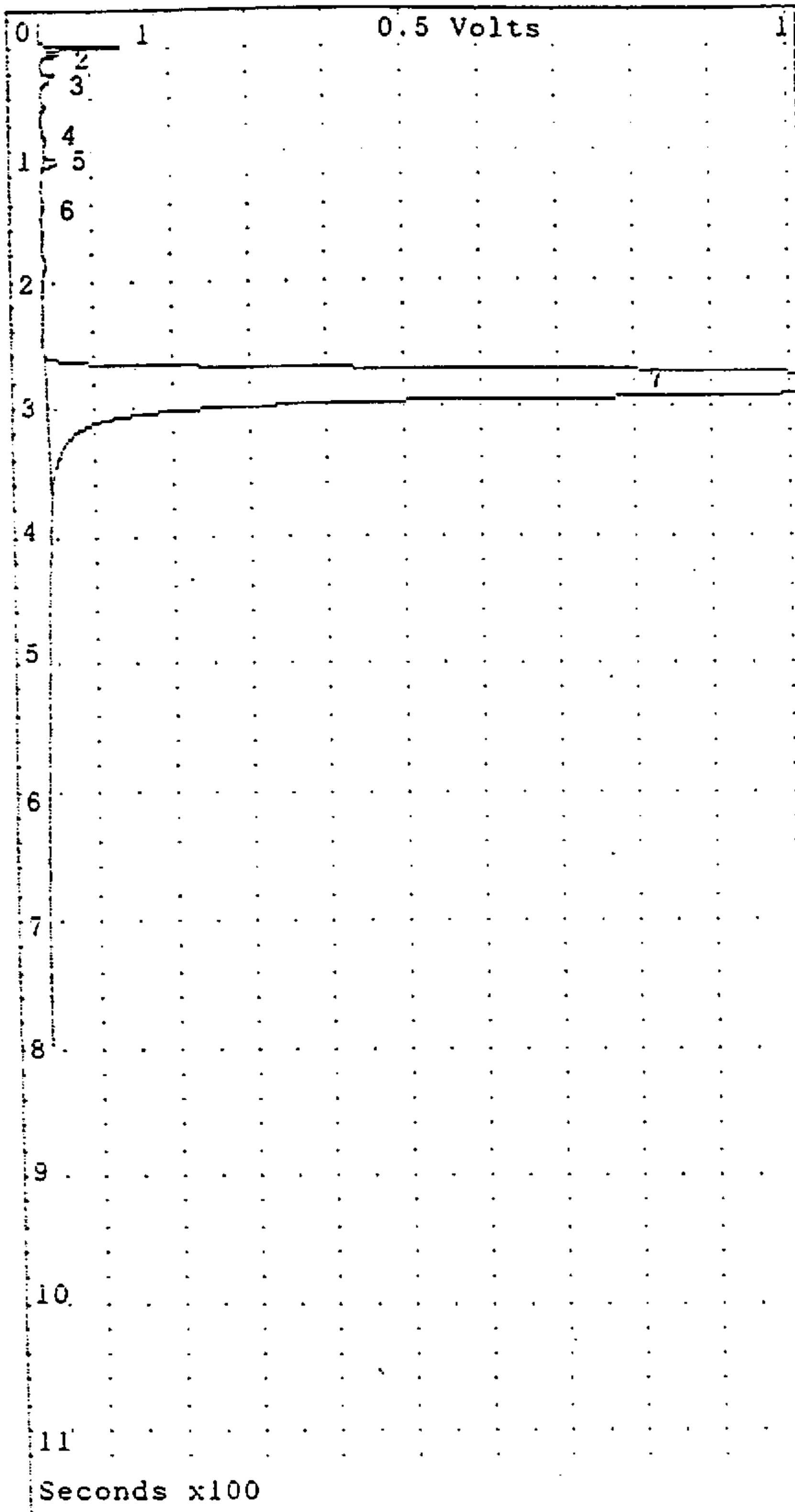
LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #7
EVACUATION: TWO WELL VOLUMES

TD = 65
screen: 30'-65'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1	MAR 2 1992	17:48
Stopped at 800.0 sec		
Number	14	Livermore3/2/92
Internal Temp	19	MW7 2well vols
Gain	2	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.8	257 mVS
UNKNOWN	2	28.0	6.6 mVS
UNKNOWN	3	46.9	25.3 mVS
UNKNOWN	4	97.6	8.6 mVS
TCE	5	112.9	583 PPB*
UNKNOWN	6	147.2	10.9 mVS
PCE	7	287.4	712 PPM*

* exceeds alarm level

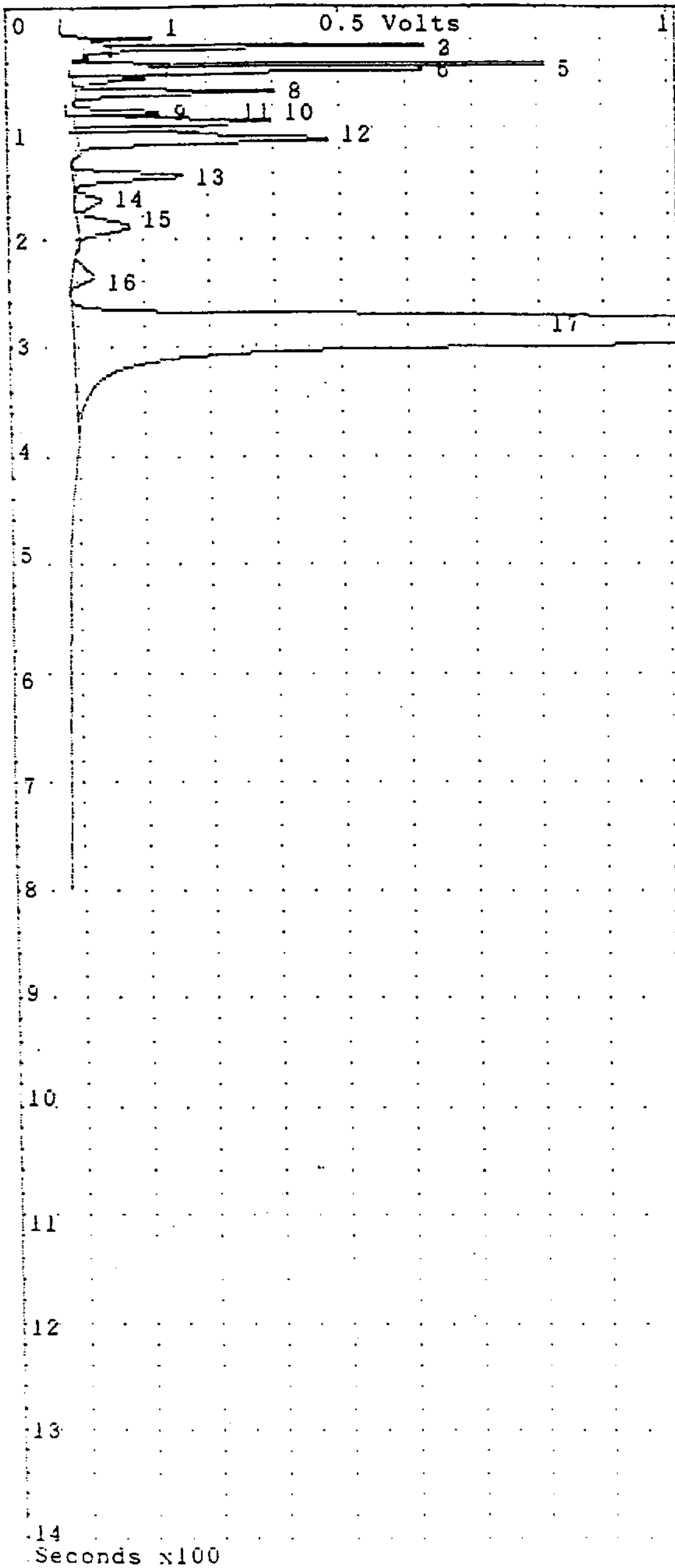
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #7
EVACUATION: TWO WELL VOLUMES

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 18: 4
Stopped at 800.0 sec

Number	15	Livermore3/2/92
Internal Temp	18	MW7 3well vols
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	21.4	385 mVS
UNKNOWN	2	28.1	1.5 VS
UNKNOWN	3	31.1	522 mVS
UNKNOWN	5	47.1	3.3 VS
UNKNOWN	6	51.7	1.9 VS
UNKNOWN	7	57.9	503 mVS
UNKNOWN	8	70.1	1.6 VS
UNKNOWN	9	89.2	778 mVS
UNKNOWN	10	97.3	1.9 VS
UNKNOWN	11	103.0	976 mVS
TCE	12	113.2	7.05 PPM
UNKNOWN	13	146.8	1.4 VS
UNKNOWN	14	168.7	500 mVS
toluene	15	193.2	2.08 PPM
UNKNOWN	16	239.5	496 mVS
PCE	17	287.7	540 PPM

* exceeds alarm level

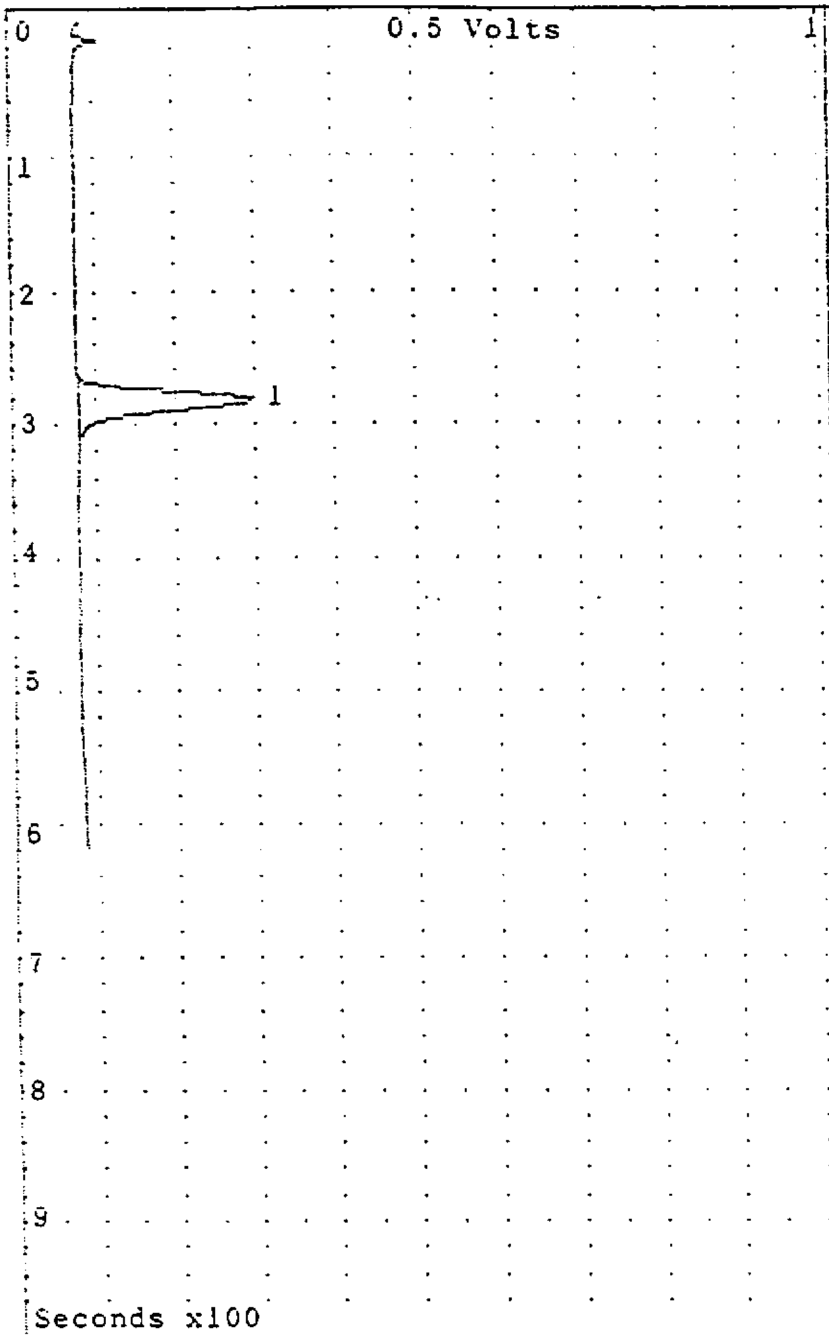
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

MONITORING WELL #7
EVACUATION: THREE WELL VOLUMES

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 18:18
Stopped at 621.1 sec

Number	16	Livermore3/2/92
Internal Temp	18	PCE cal 500ul
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
PCE	1	288.3	10.8 PPM

* exceeds alarm level

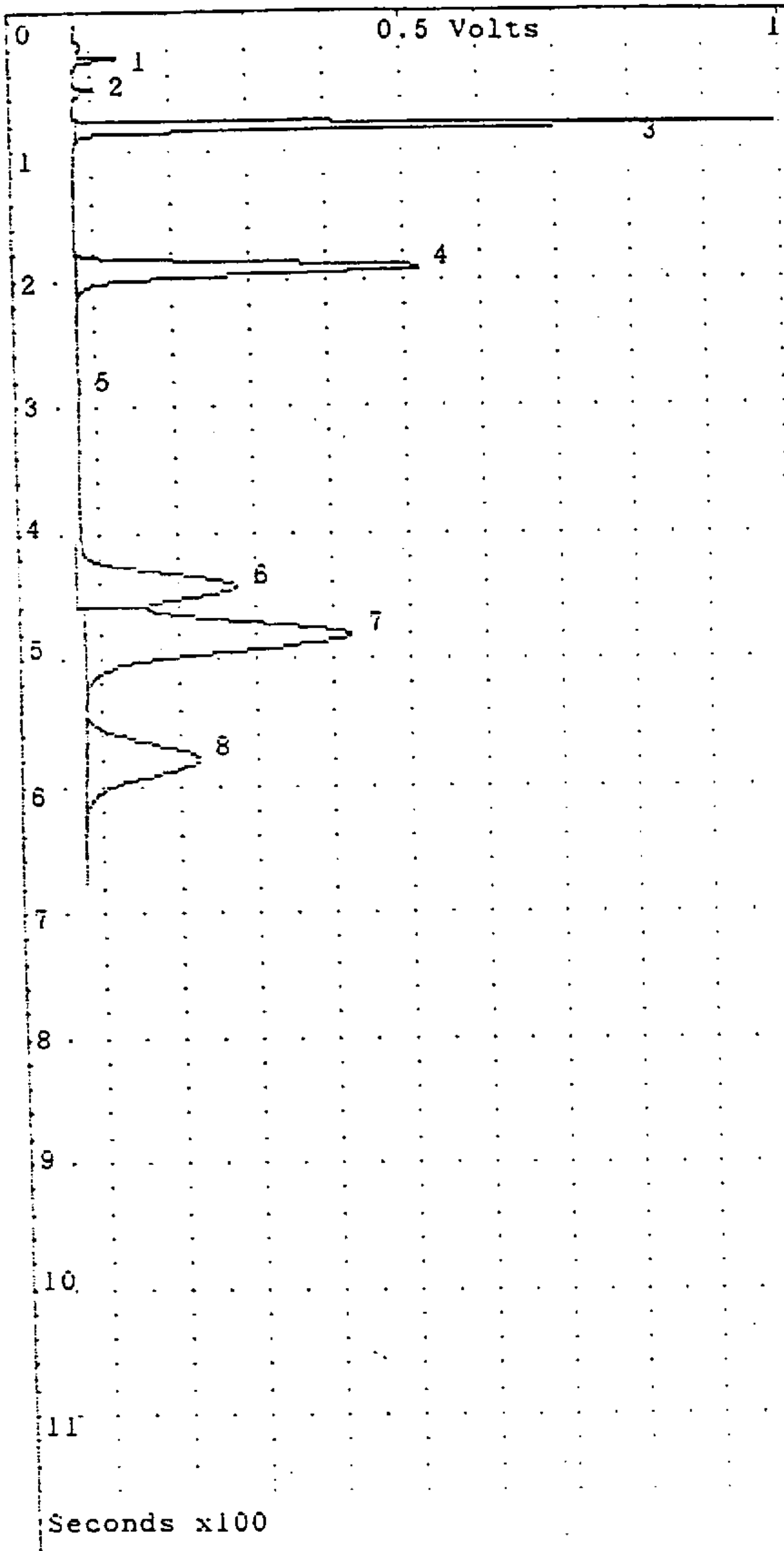
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

PCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 2 1992 18:3.
Stopped at 676.8 sec

Number	17	Livermore3/2/92
Internal Temp	18	BTEX cal 100ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	27.8	127 mVS
UNKNOWN	2	53.3	48.8 mVS
benzene	3	82.5	9.85 PPM
toluene	4	195.7	9.23 PPM
PCE	5	288.3	22.6 PPB
ethylbenzene	6	449.6	8.99 PPM
p,m xylene	7	490.1	17.7 PPM
o xylene	8	587.8	8.59 PPM

* exceeds alarm level

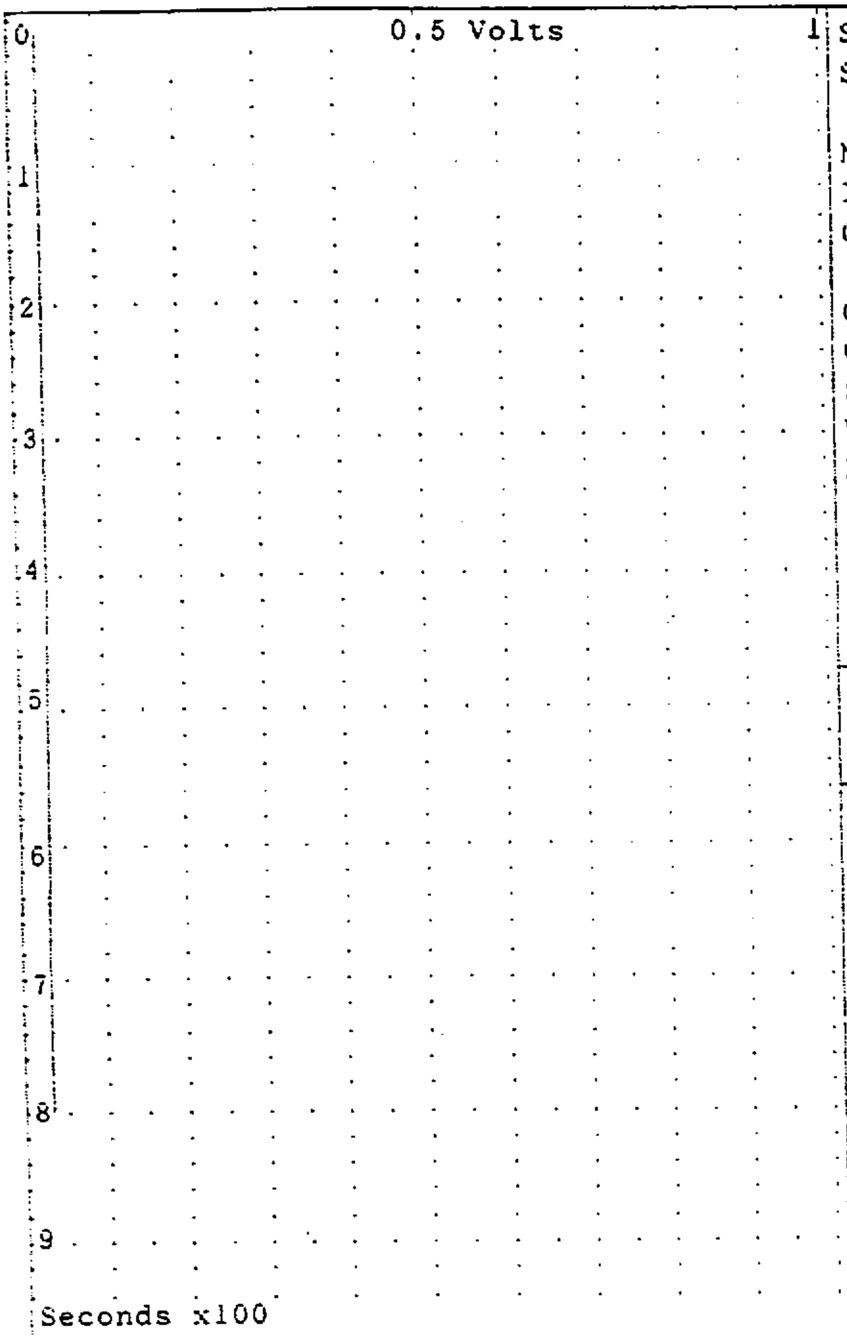
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 2, 1992

BTEX CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



Sec
Stopped at 0.4 sec

Number	1	Livermore3/2/92
Internal Temp	16	machine blank
Gain	2	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM

* exceeds alarm level

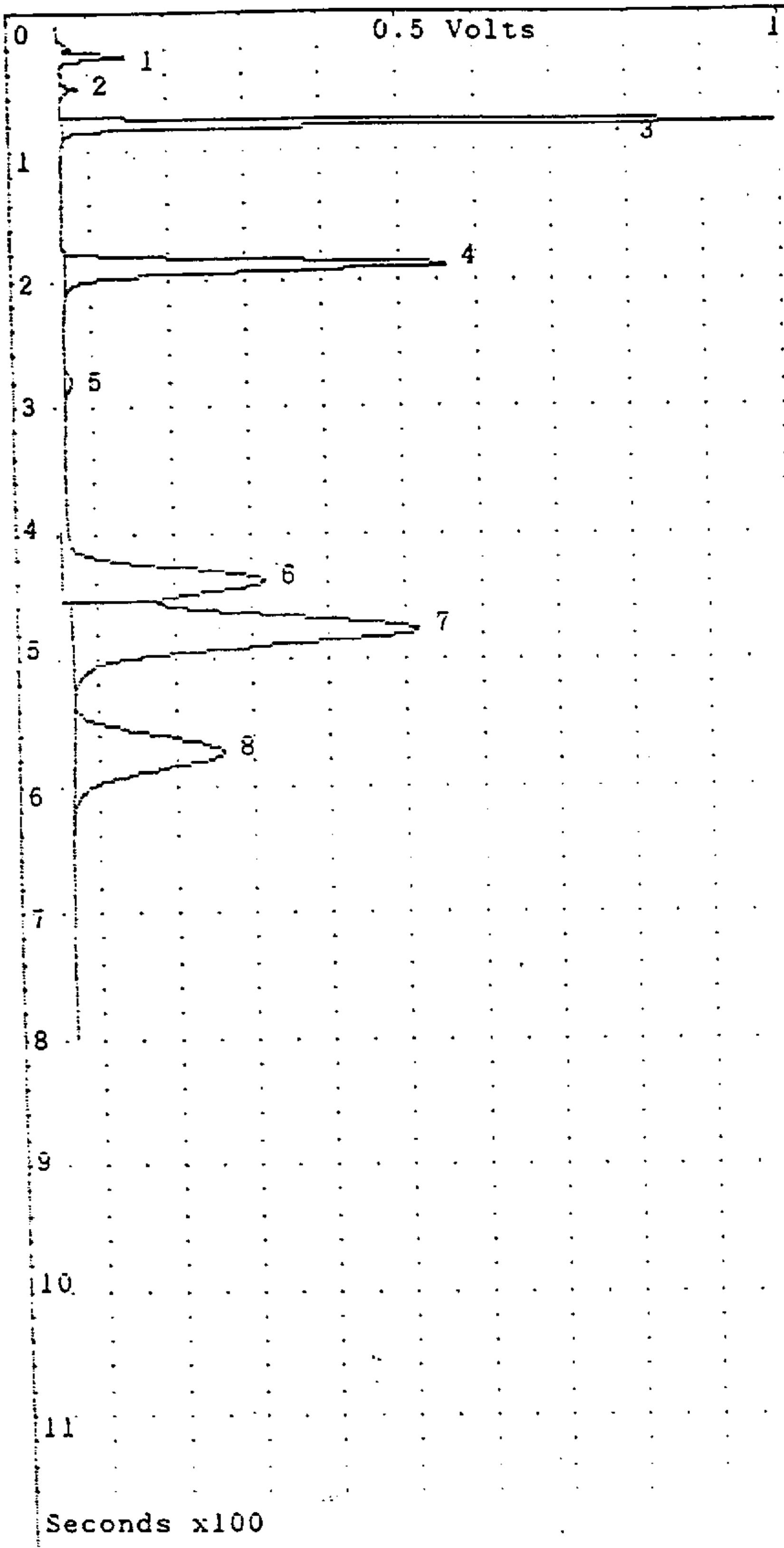
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MACHINE BLANK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 11:2
Stopped at 800.0 sec

Number	2	Livermore3/3/92
Internal Temp	20	BTEX cal 100ul
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	27.4	315 mVS
UNKNOWN	2	52.5	55.6 mVS
benzene	3	81.3	9.28 PPM
TOLUENE	4	193.7	8.83 PPM
UNKNOWN	5	285.1	118 mVS
ethylbenzene	6	444.8	8.11 PPM
p,m xylene	7	484.9	15.7 PPM
o xylene	8	581.8	7.75 PPM

* exceeds alarm level

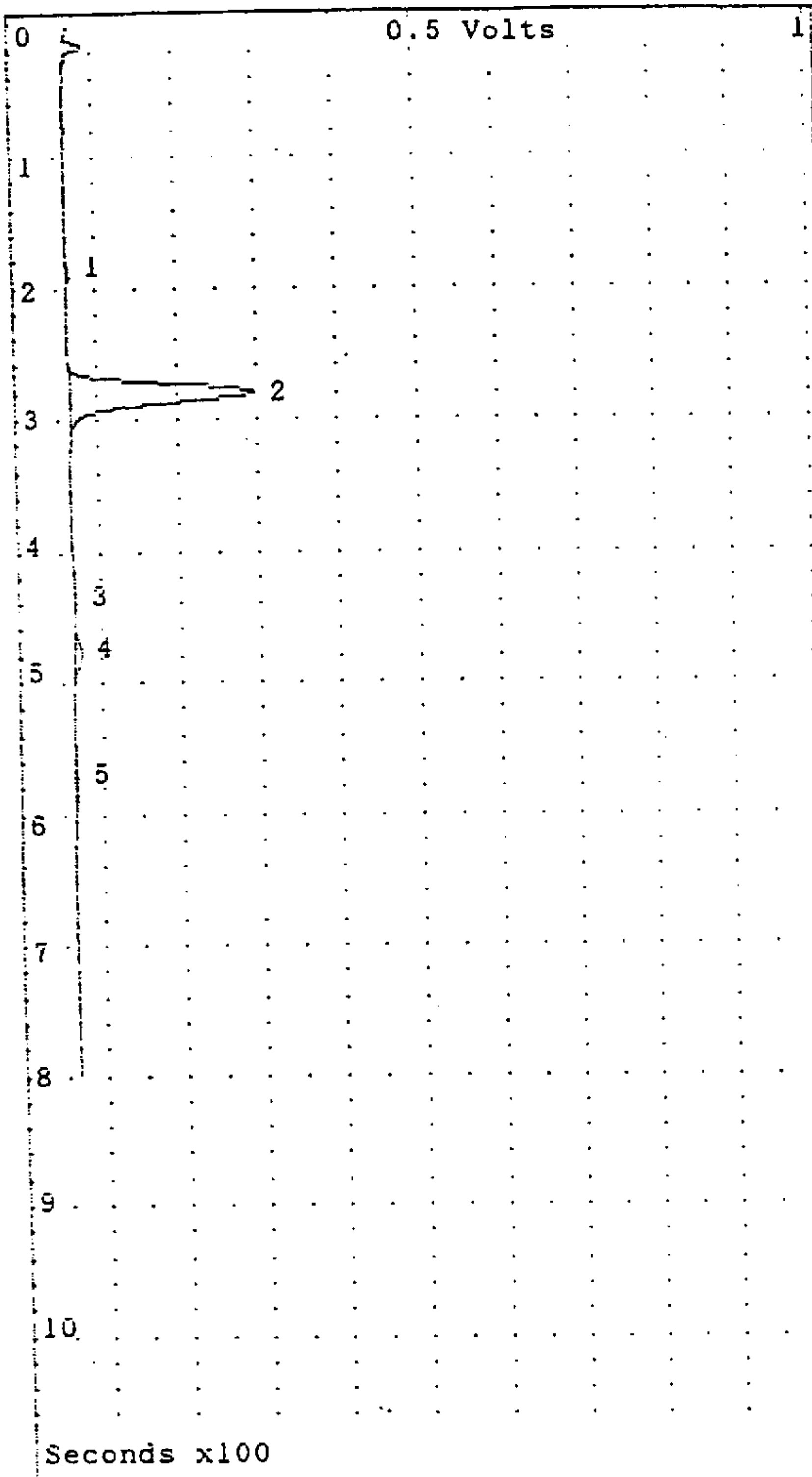
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

BTEX CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 11:5-
Stopped at 800.0 sec

Number	3	Livermore3/3/92
Internal Temp	20	PCE cal 500ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
TOLUENE	1	193.2	60.2 PPE
UNKNOWN	2	285.1	3.8 VS
ethylbenzene	3	446.0	32 PPE
p,m xylene	4	484.9	237 PPE
o xylene	5	580.3	103 PPE

* exceeds alarm level

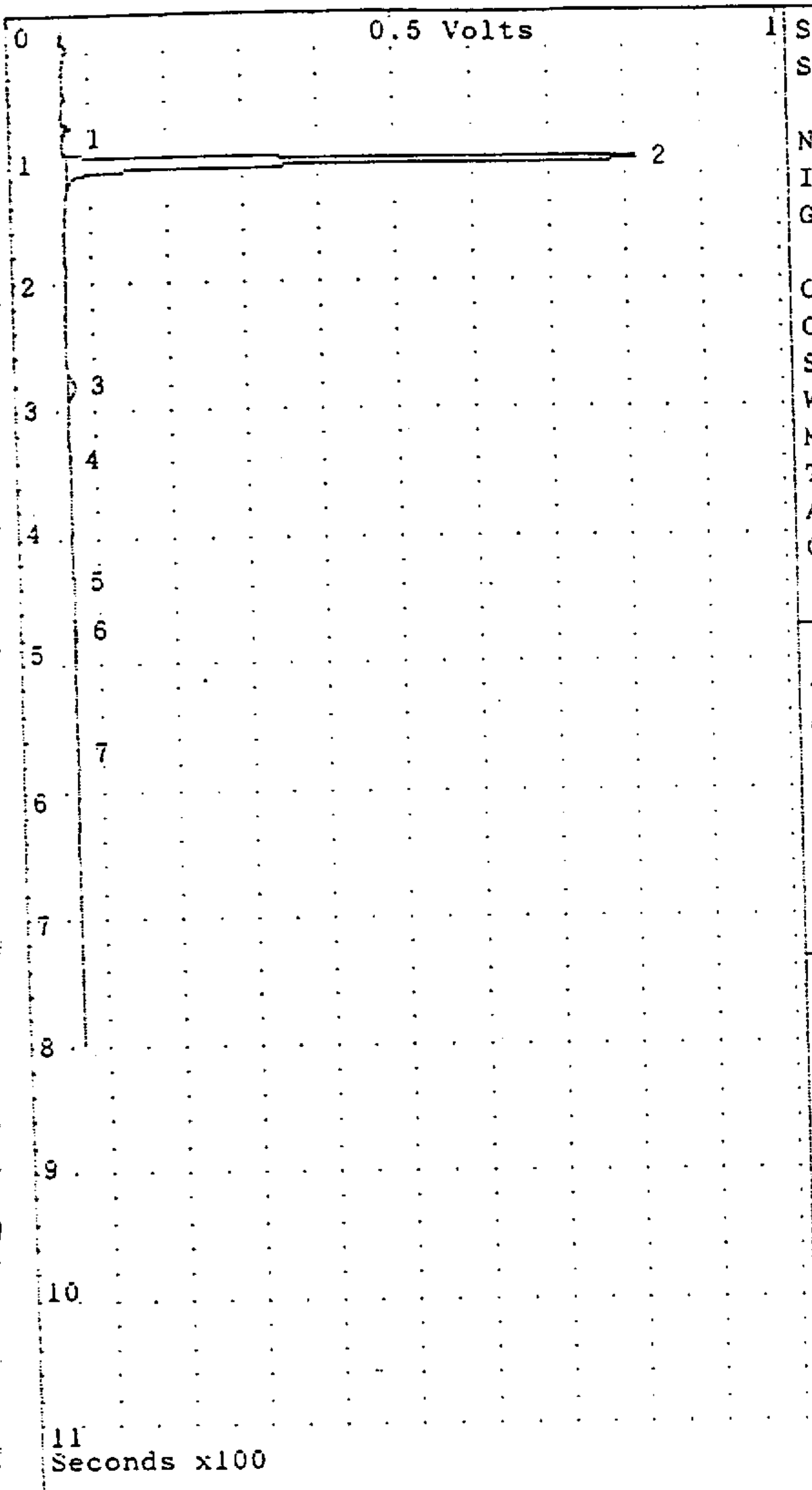
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 12:11
Stopped at 800.0 sec

Number	4	Livermore3/3/92
Internal Temp	19	TCE cal 100ul
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
benzene	1	82.0	38.6 PPB
TCE	2	110.2	10.4 PPM
PCE	3	286.7	322 PPB
UNKNOWN	4	354.7	21.3 mVS
ethylbenzene	5	447.2	36.9 PPB
p,m xylene	6	486.2	67.7 PPB

* exceeds alarm level

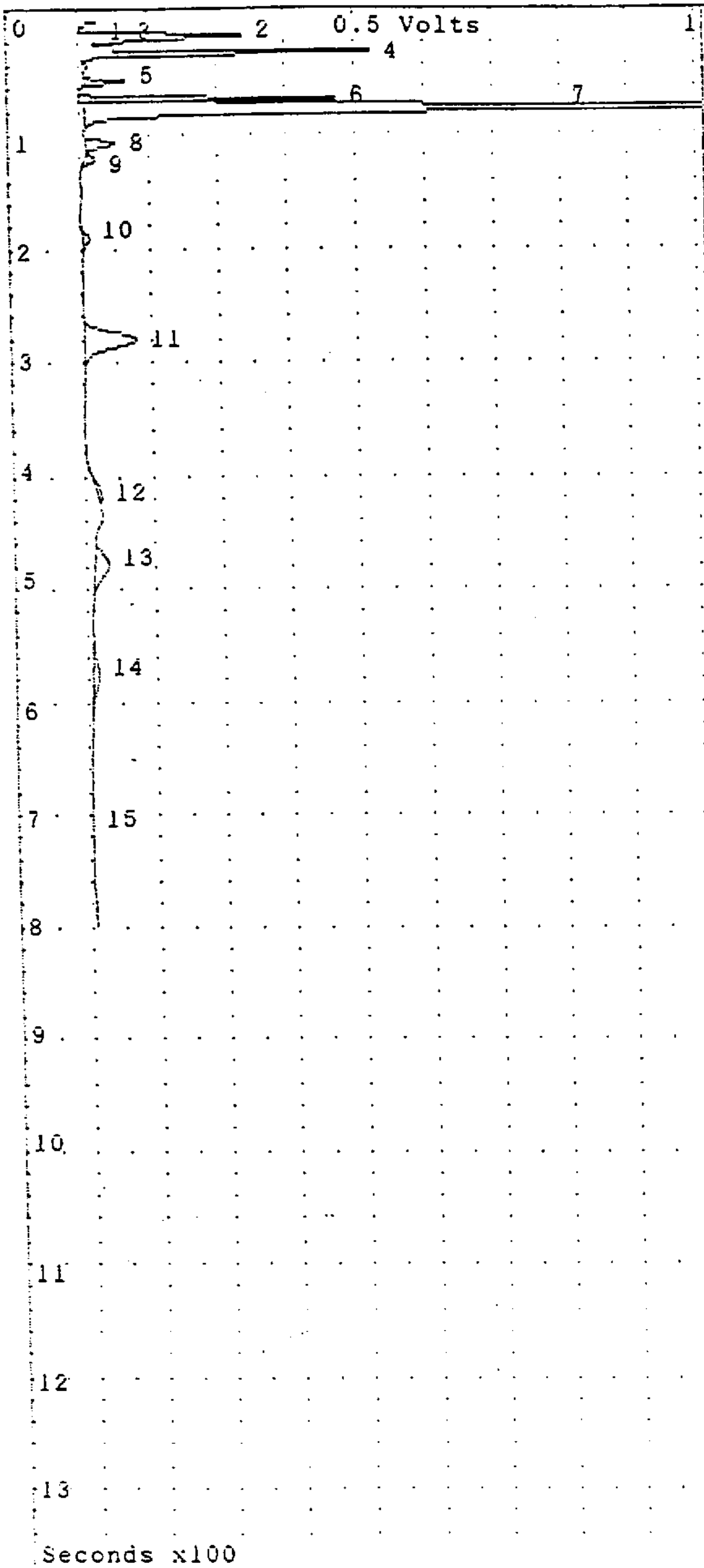
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

TCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 12:2
Stopped at 800.0 sec

Number	5	Livermore3/3/92
Internal Temp	20	TCA cal 500ul
Gain	20	OV 30 10 ML MIN

Offset	7.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	3.8	30.8 mVS
UNKNOWN	2	16.1	515 mVS
UNKNOWN	3	26.7	22.1 mVS
UNKNOWN	4	31.8	1.4 VS
UNKNOWN	5	56.1	239 mVS
111 TCA	6	72.5	10.5 PPM
benzene	7	80.5	5.05 PPM
TCE	8	109.6	144 PPB
UNKNOWN	9	124.8	84.6 mVS
TOLUENE	10	193.7	57.3 PPB
PCE	11	285.1	813 PPB
ethylbenzene	12	424.5	48.9 PPB
p,m xylene	13	486.2	140 PPB
o xylene	14	583.3	81 PPB

* exceeds alarm level

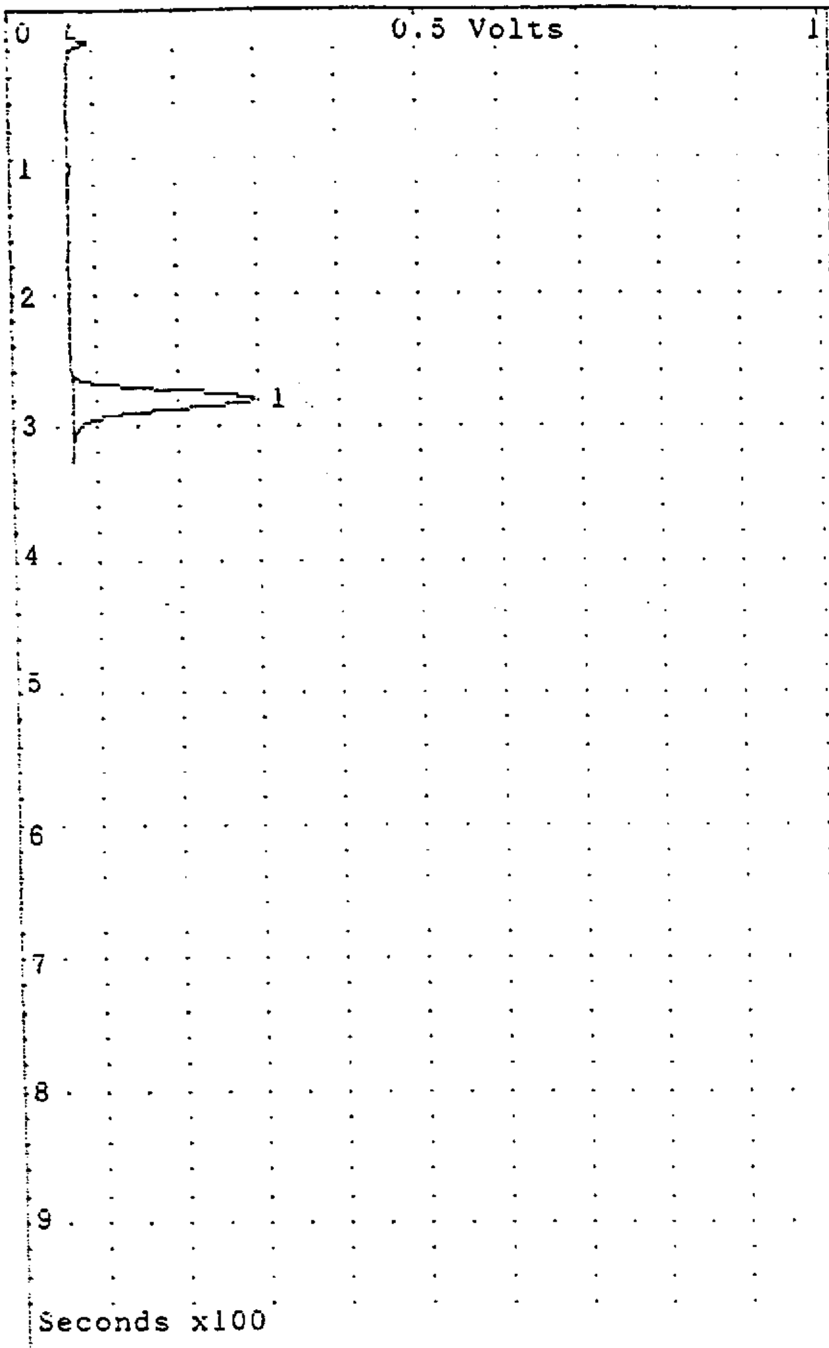
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

1,1,1-TCA CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1   MAR 3 1992   12:39
Stopped at 329.3 sec

Number	6	Livermore3/3/92
Internal Temp	19	PCE cal check
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
PCE	1	285.1	10.1 PPM

* exceeds alarm level

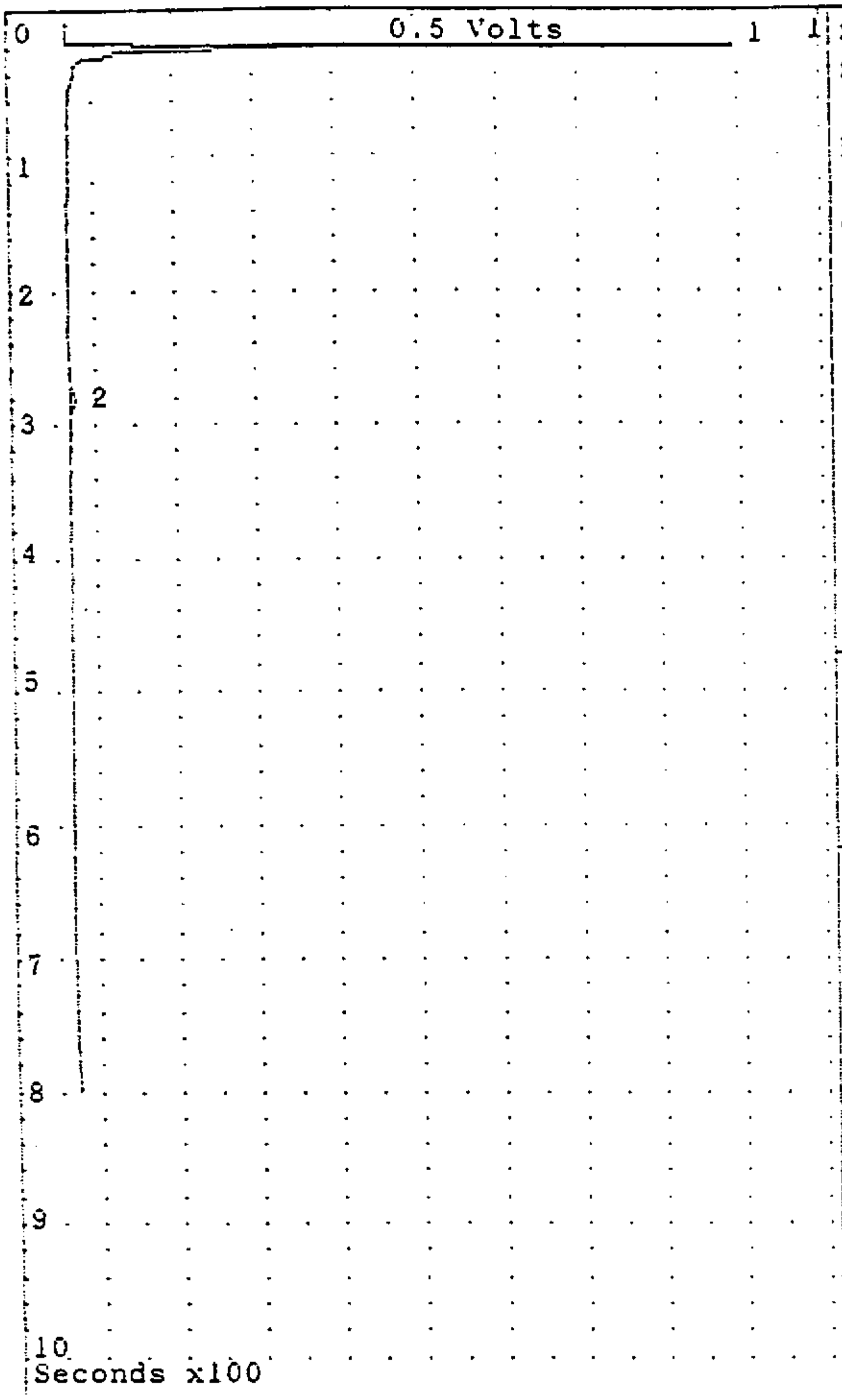
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION CHECK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 12:5
Stopped at 800.0 sec

Number	7	Livermore3/3/92
Internal Temp	20	system blank
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.5	2.7 VS
PCE	2	286.7	173 PPB

* exceeds alarm level

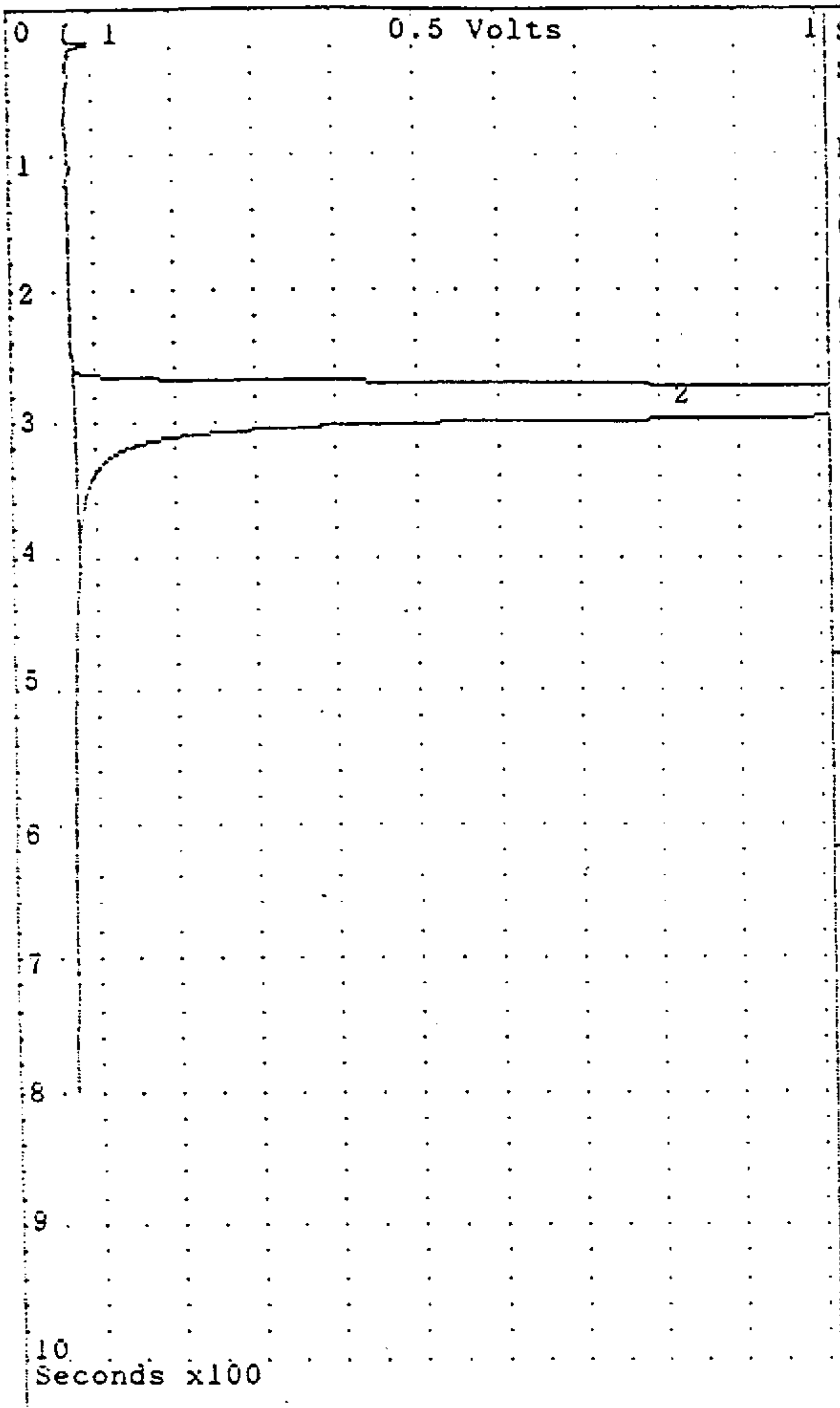
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

SYSTEM BLANK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 13:3
Stopped at 800.0 sec

Number	8	Livermore3/3/92
Internal Temp	21	MW12 1well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	19.7	38.7 mVS
PCE	2	287.0	435 PPM

* exceeds alarm level

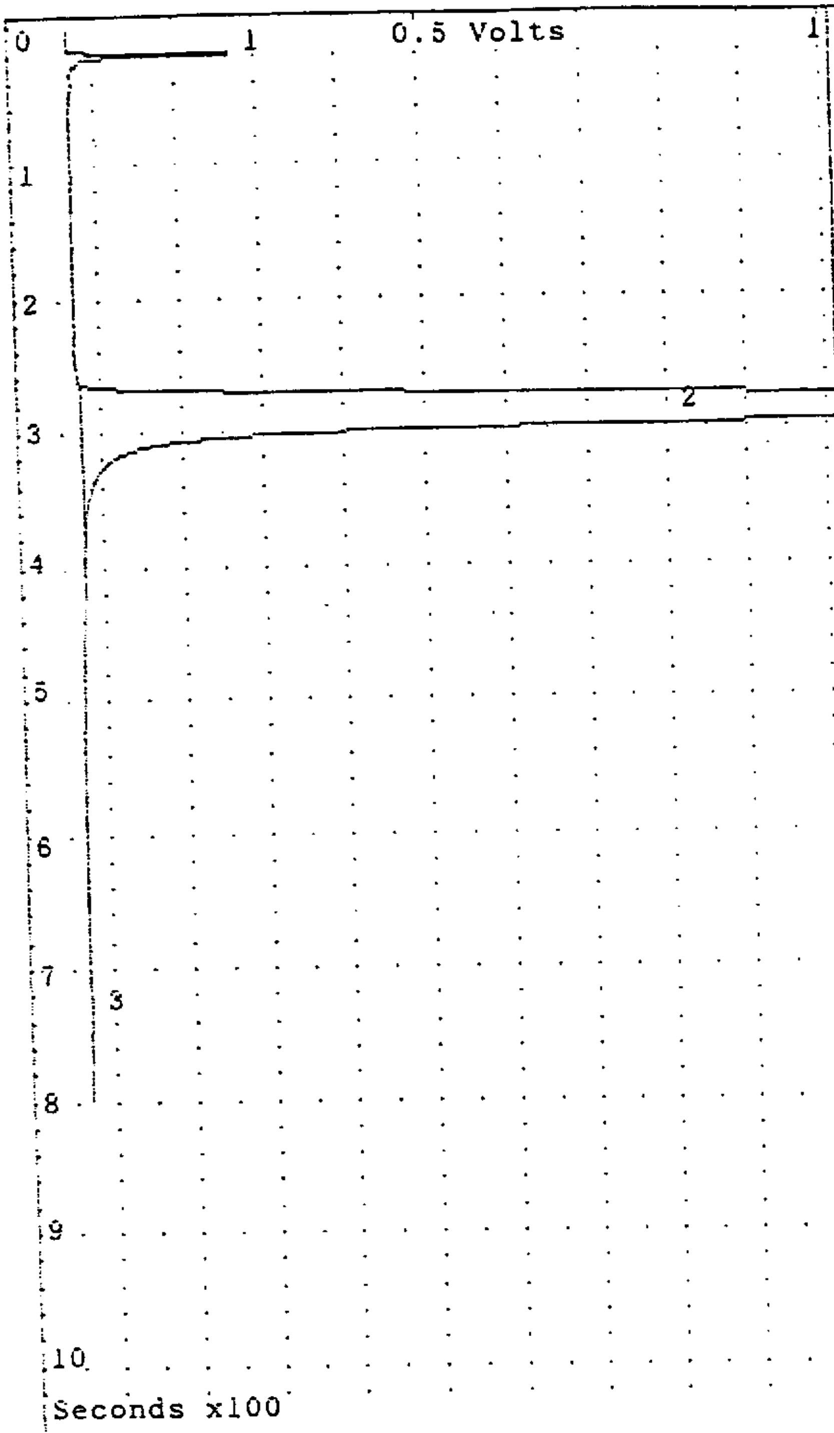
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #12
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 13:55
Stopped at 800.0 sec

Number	9	Livermore3/3/92
Internal Temp	22	MW12 2 well vols
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.7	606 mVS
PCE	2	287.1	292 PPM
UNKNOWN	3	735.8	6 mVS

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

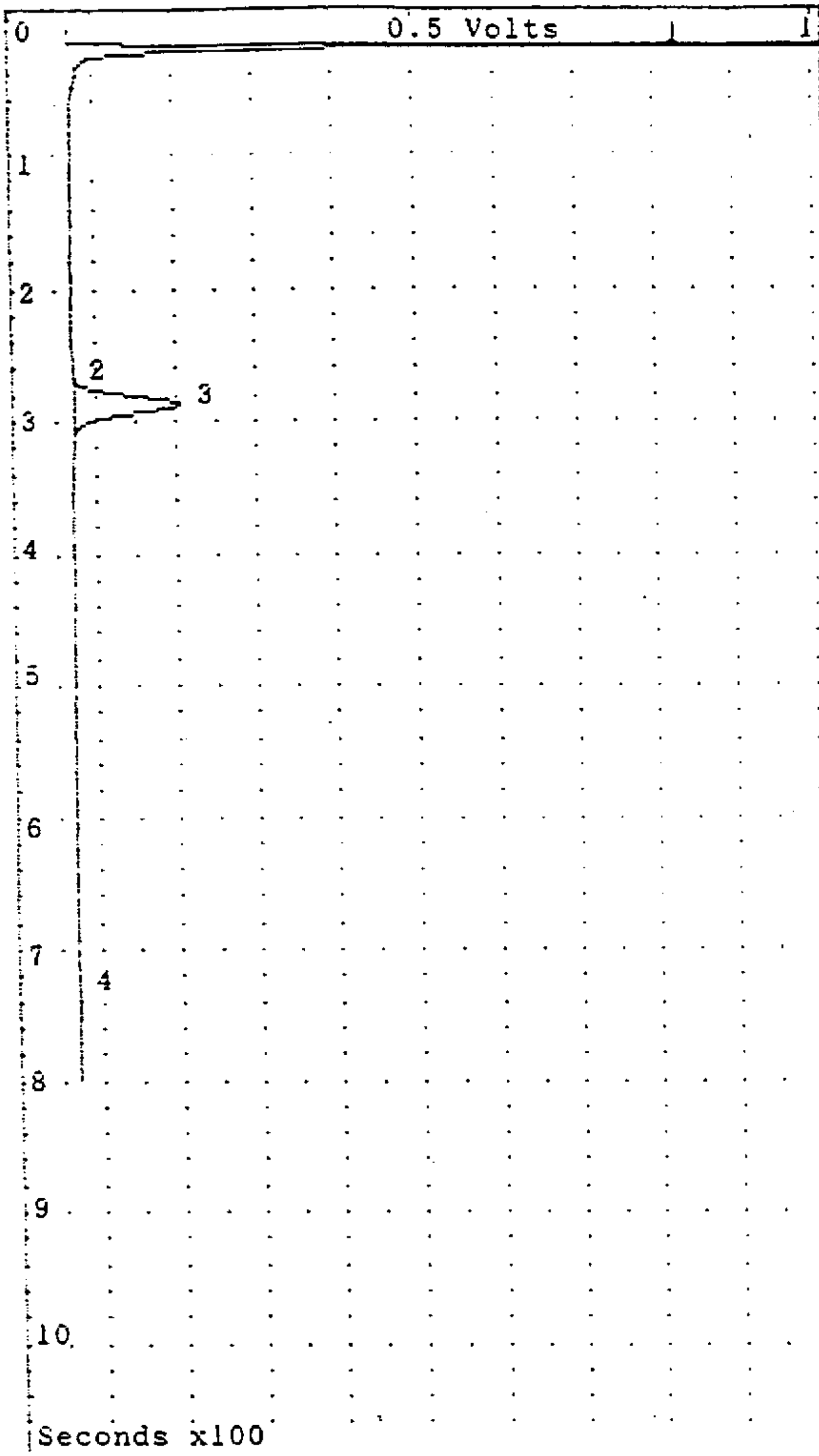
MARCH 3, 1992

MONITORING WELL #12
EVACUATION: TWO WELL VOLUMES

TD = 60'

Screen: 25-60

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 14:2
Stopped at 800.0 sec

Number	10	Livermore3/3/92
Internal Temp	22	MW13 1 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.9	4.8 VS
UNKNOWN	2	262.6	7 mVS
PCE	3	292.3	5.56 PPM
UNKNOWN	4	745.3	34.7 mVS

* exceeds alarm level

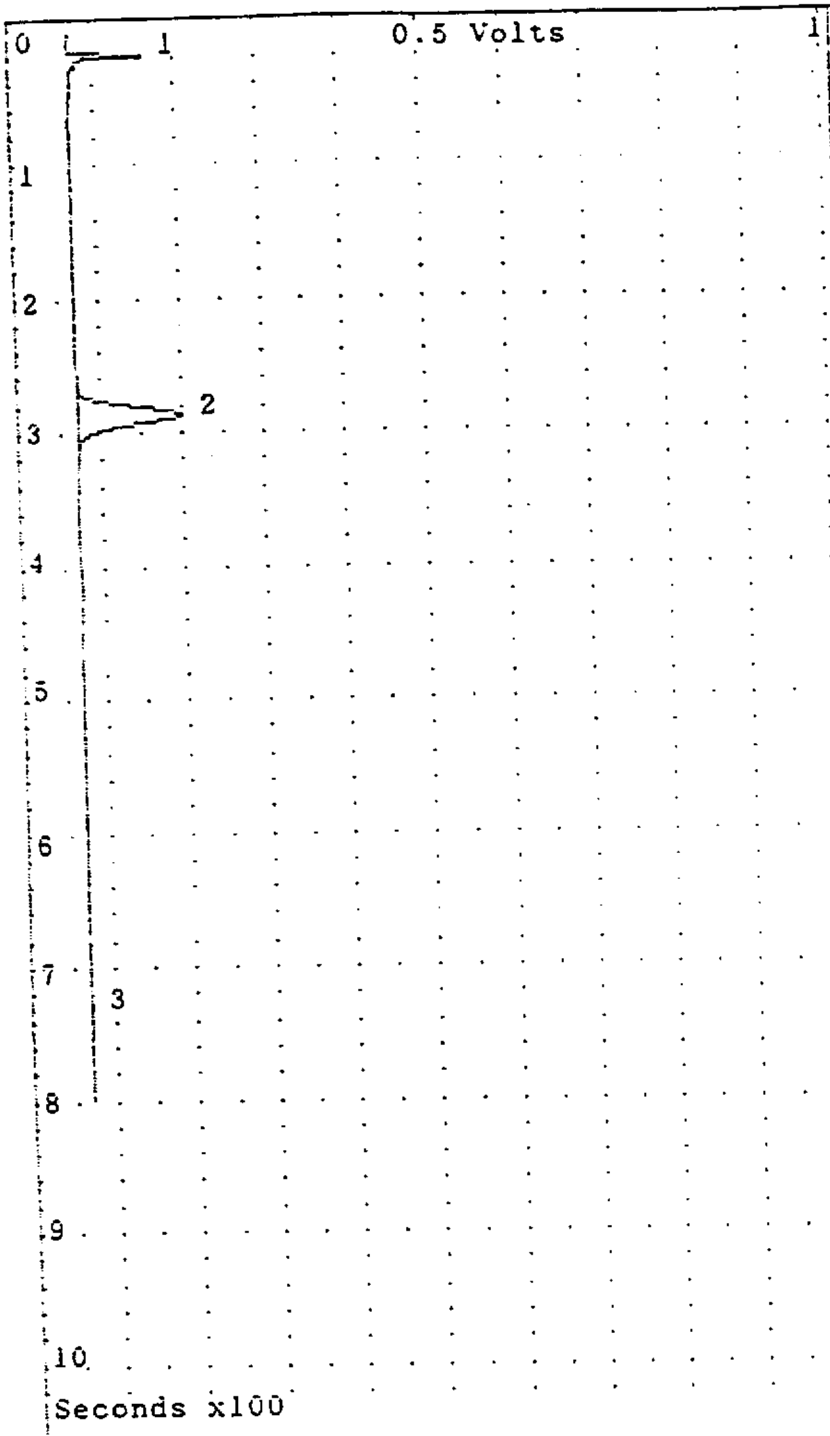
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #13
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 14:4
Stopped at 800.0 sec

Number	11	Livermore3/3/92
Internal Temp	22	MW13 2 well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.3	321 mVS
PCE	2	292.3	5.39 PPM
UNKNOWN	3	745.3	24.5 mVS

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

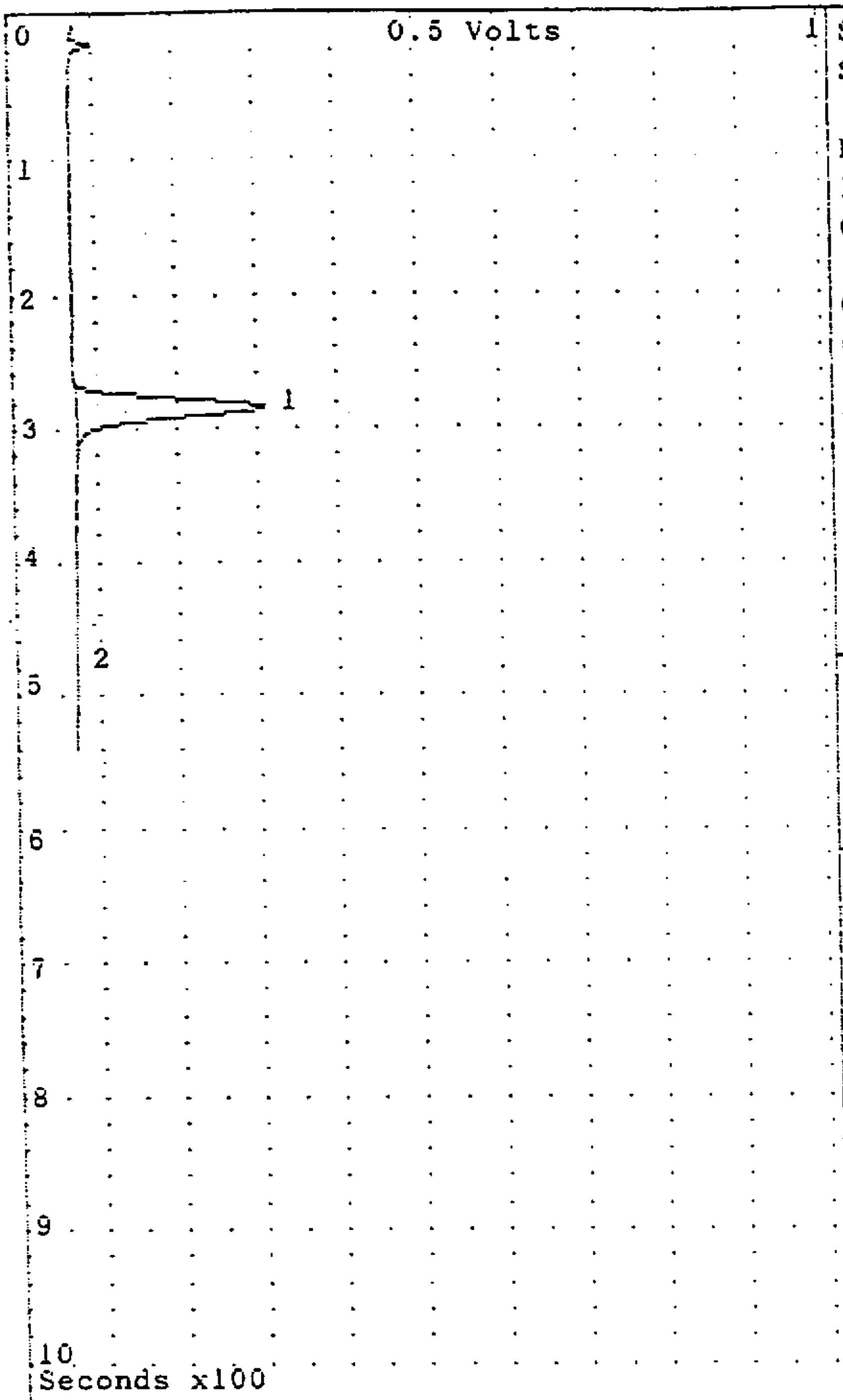
MARCH 3, 1992

MONITORING WELL #13
EVACUATION: TWO WELL VOLUMES

TD = 56'

Screen : 26-56

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 14:57
Stopped at 544.3 sec

Number	12	Livermore3/3/92
Internal Temp	22	PCE calib check
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
PCE	1	289.9	10.5 PPM
p,m xylene	2	492.7	26 PPB

* exceeds alarm level

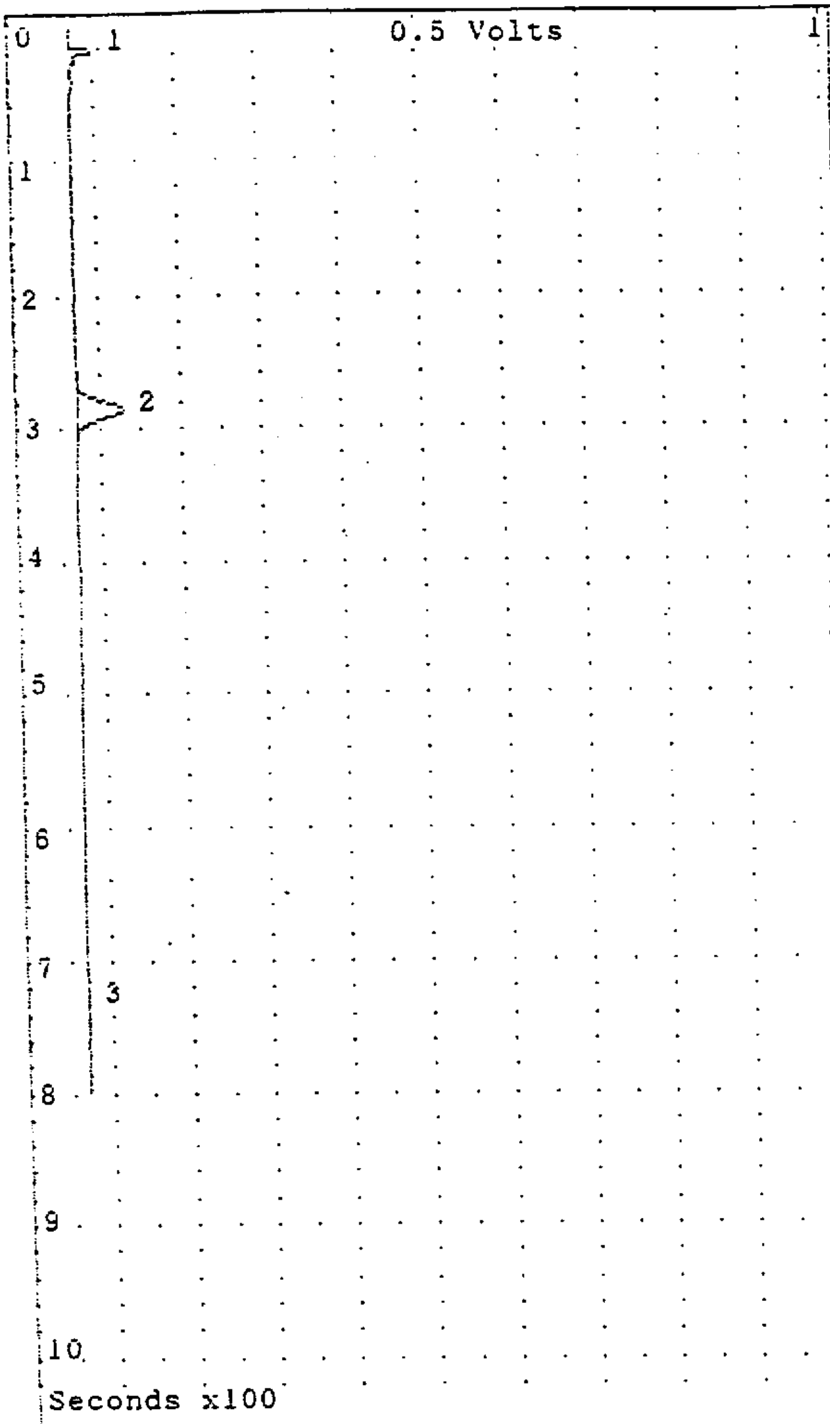
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION CHECK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 15:1
Stopped at 800.0 sec

Number	13	Livermore3/3/92
Internal Temp	22	MW10 1 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.2	57.1 mVS
PCE	2	290.7	2.38 PPM
UNKNOWN	3	737.7	5.2 mVS

* exceeds alarm level

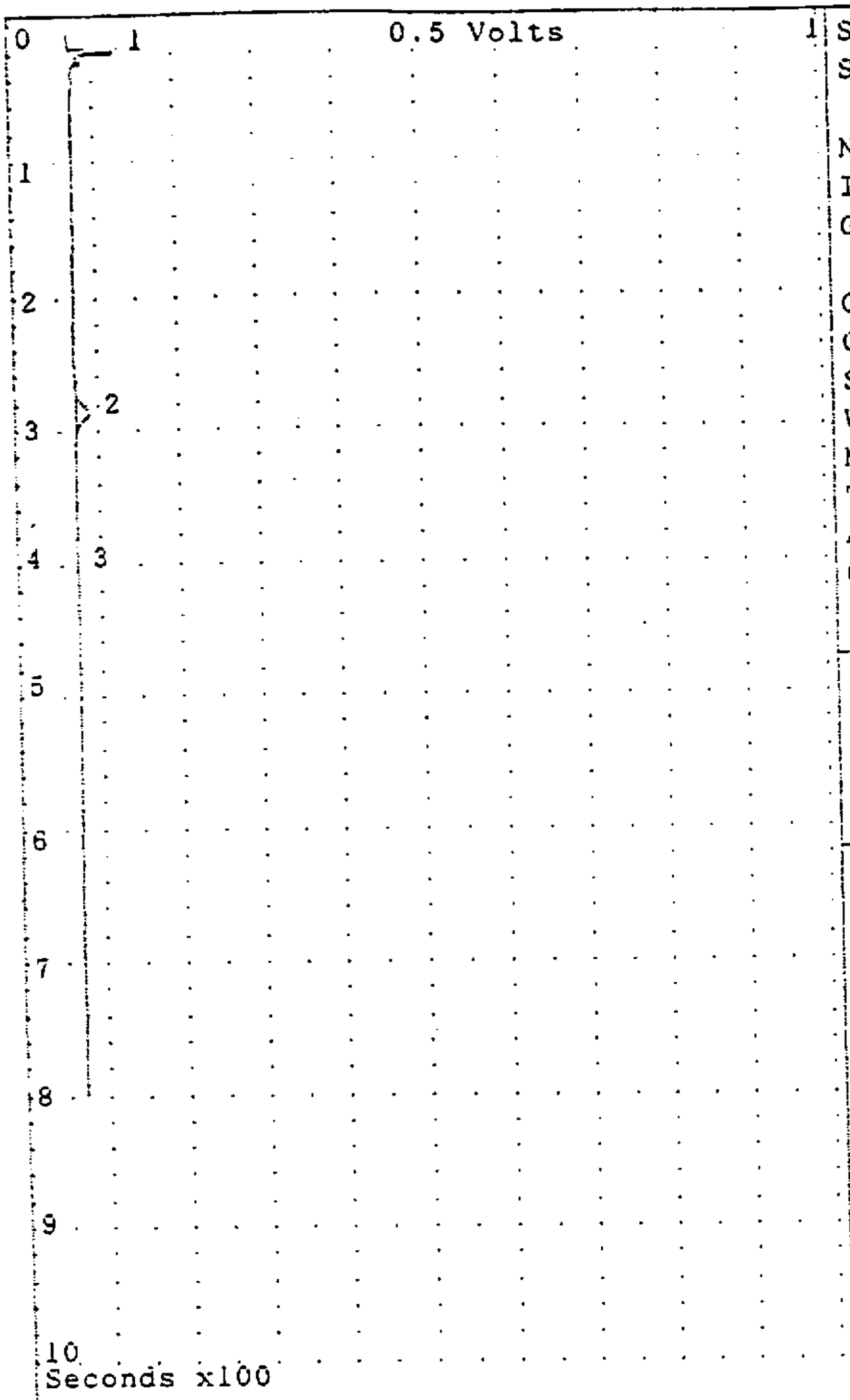
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #10
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 15:2
Stopped at 800.0 sec

Number	14	Livermore3/3/92
Internal Temp	21	MW10 2 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.5	132 mVS
PCE	2	291.5	601 PPB

* exceeds alarm level

GRUBB & ELLIS

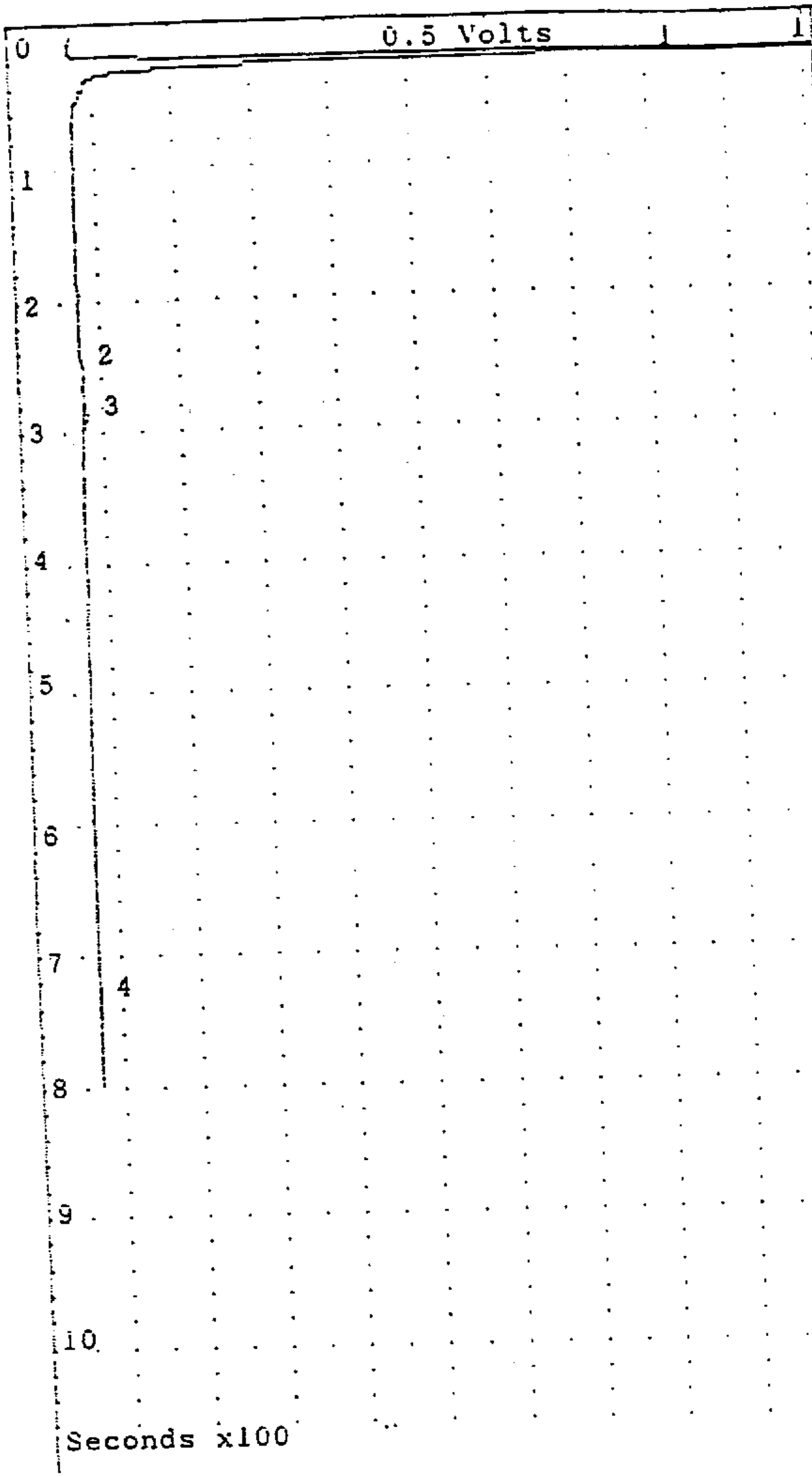
LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #10
EVACUATION: TWO WELL VOLUMES

TD = 55'
Screen : 25' - 55'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 15:5.
Stopped at 800.0 sec

Number	15	Livermore3/3/92
Internal Temp	22	MW9 1 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PP!
UNKNOWN	1	21.2	7.2 V:
UNKNOWN	2	260.5	20.9 mV:
PCE	3	290.7	182 PP:
UNKNOWN	4	745.3	48.8 mV.

* exceeds alarm level

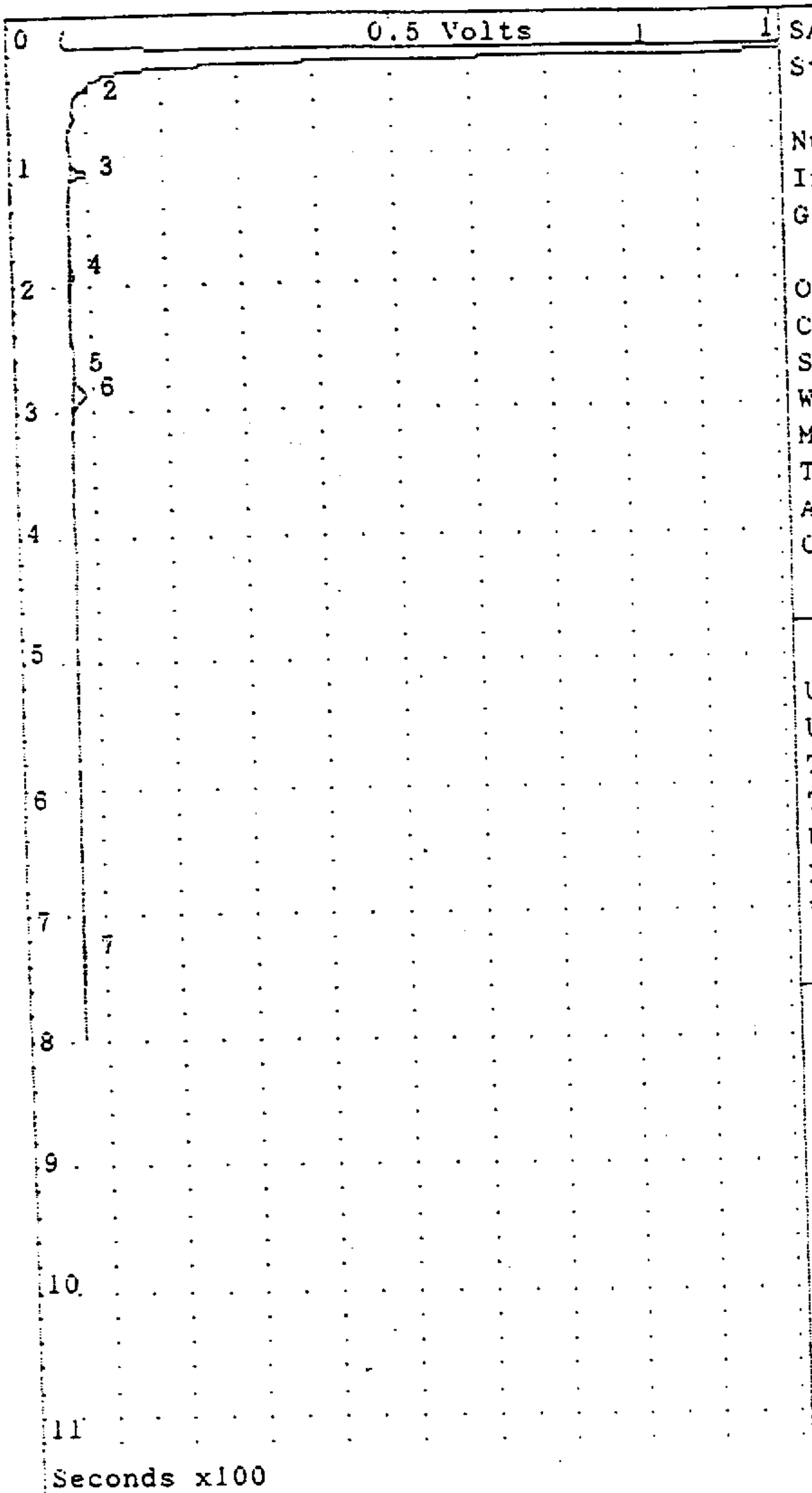
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #9
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 16:1(
Stopped at 800.0 sec

Number	16	Livermore3/3/92
Internal Temp	22	MW9 2 well vols
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	22.7	19.7 VS
UNKNOWN	2	50.1	12.2 mVS
TCE	3	115.3	258 PPE
TOLUENE	4	196.2	85.8 PPE
UNKNOWN	5	259.1	13.1 mVS
PCE	6	291.5	570 PPE
UNKNOWN	7	743.4	71.4 mVS

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

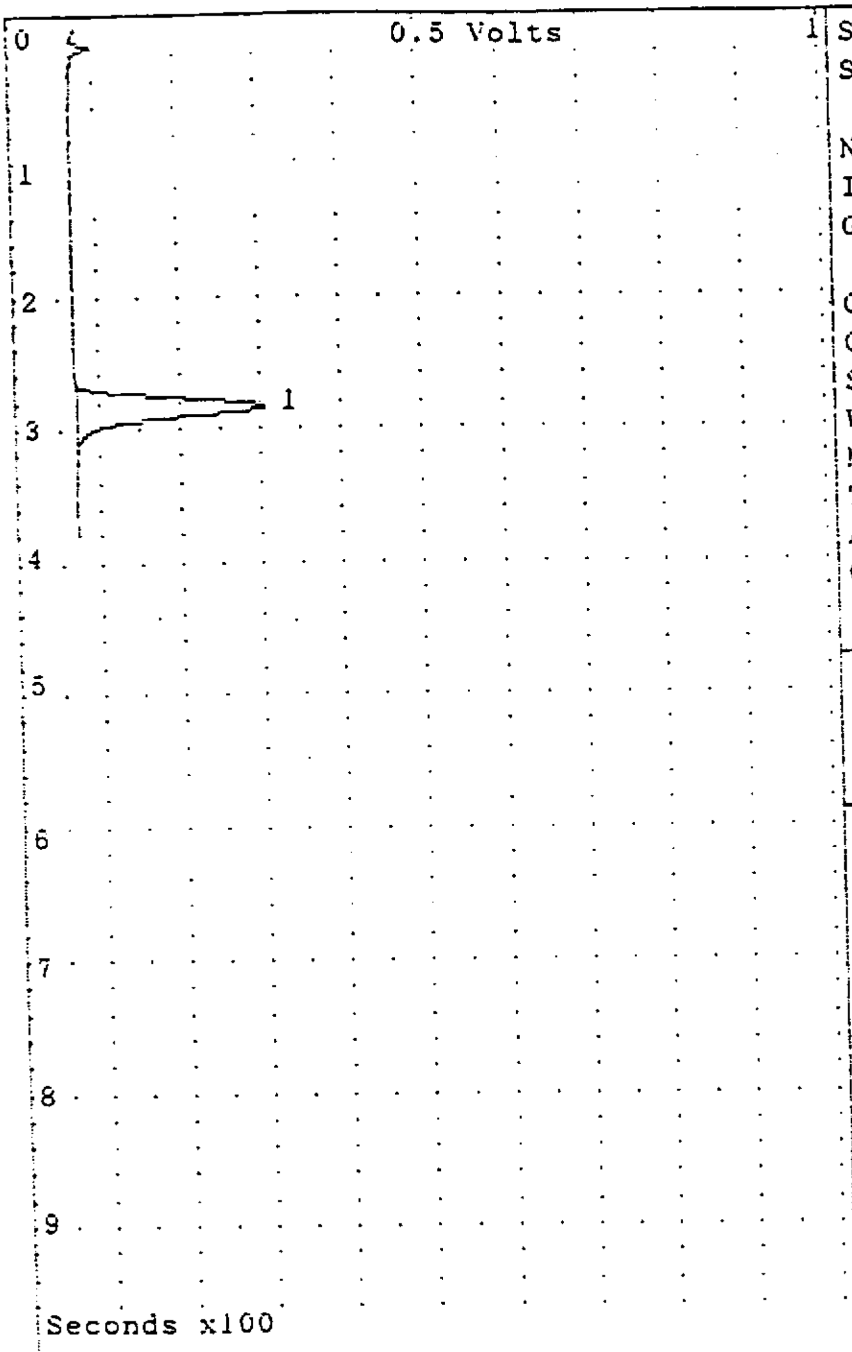
MARCH 3, 1992

MONITORING WELL #9
EVACUATION: TWO WELL VOLUMES

TD = 55

screen: 35' - 55'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 16:2
Stopped at 382.0 sec

Number	17	Livermore3/3/92
Internal Temp	22	PCE calib check
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PP!
PCE	1	289.1	10.5 PP!

* exceeds alarm level

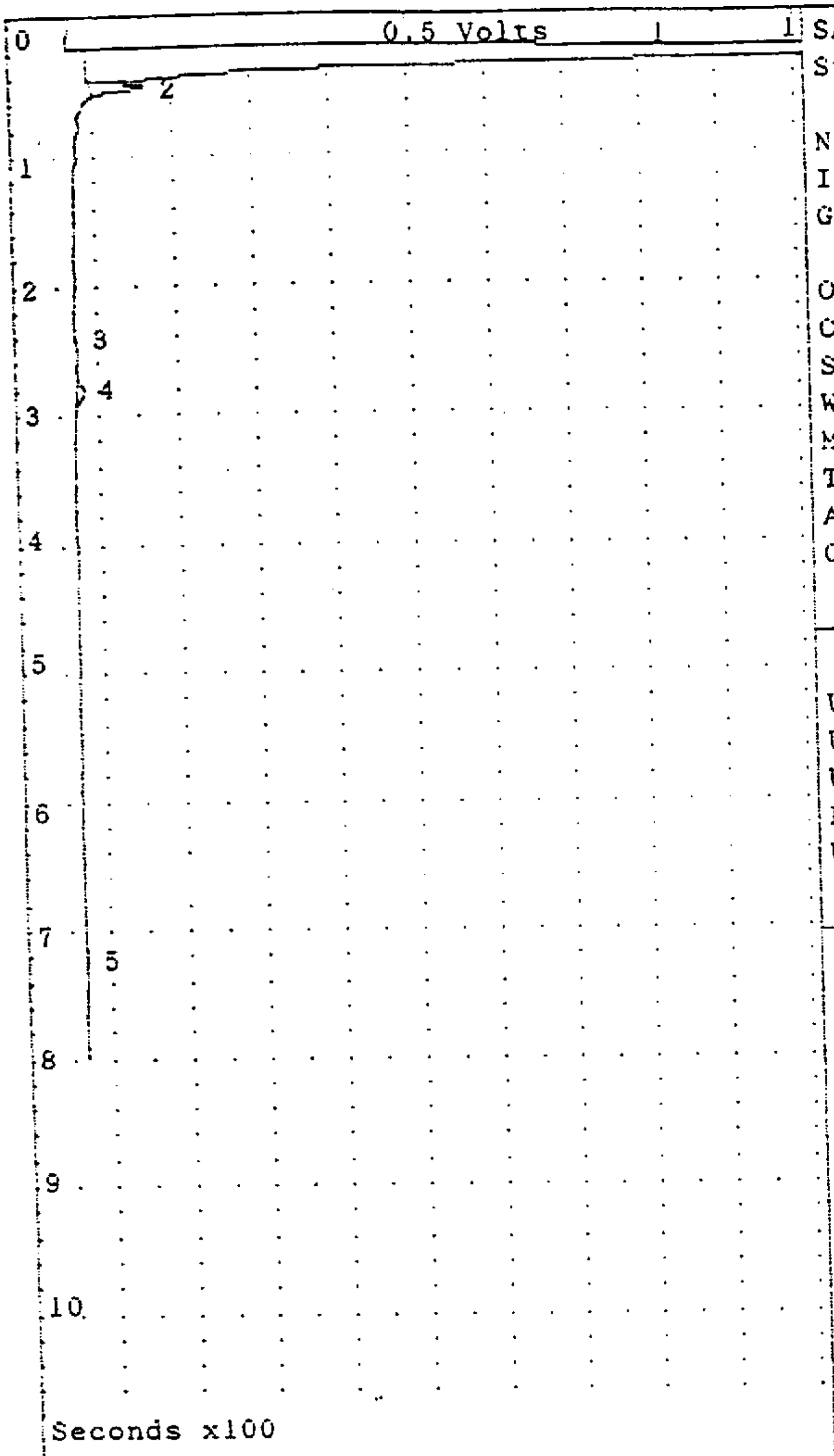
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION CHECK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 16:5

Stopped at 800.0 sec

Number	18	Livermore3/3/92
Internal Temp	19	MW8 1 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	24.2	44.1 VS
UNKNOWN	2	49.5	353 mVS
UNKNOWN	3	254.2	19.5 mVS
PCE	4	286.7	343 PPB
UNKNOWN	5	732.0	61.3 mVS

* exceeds alarm level

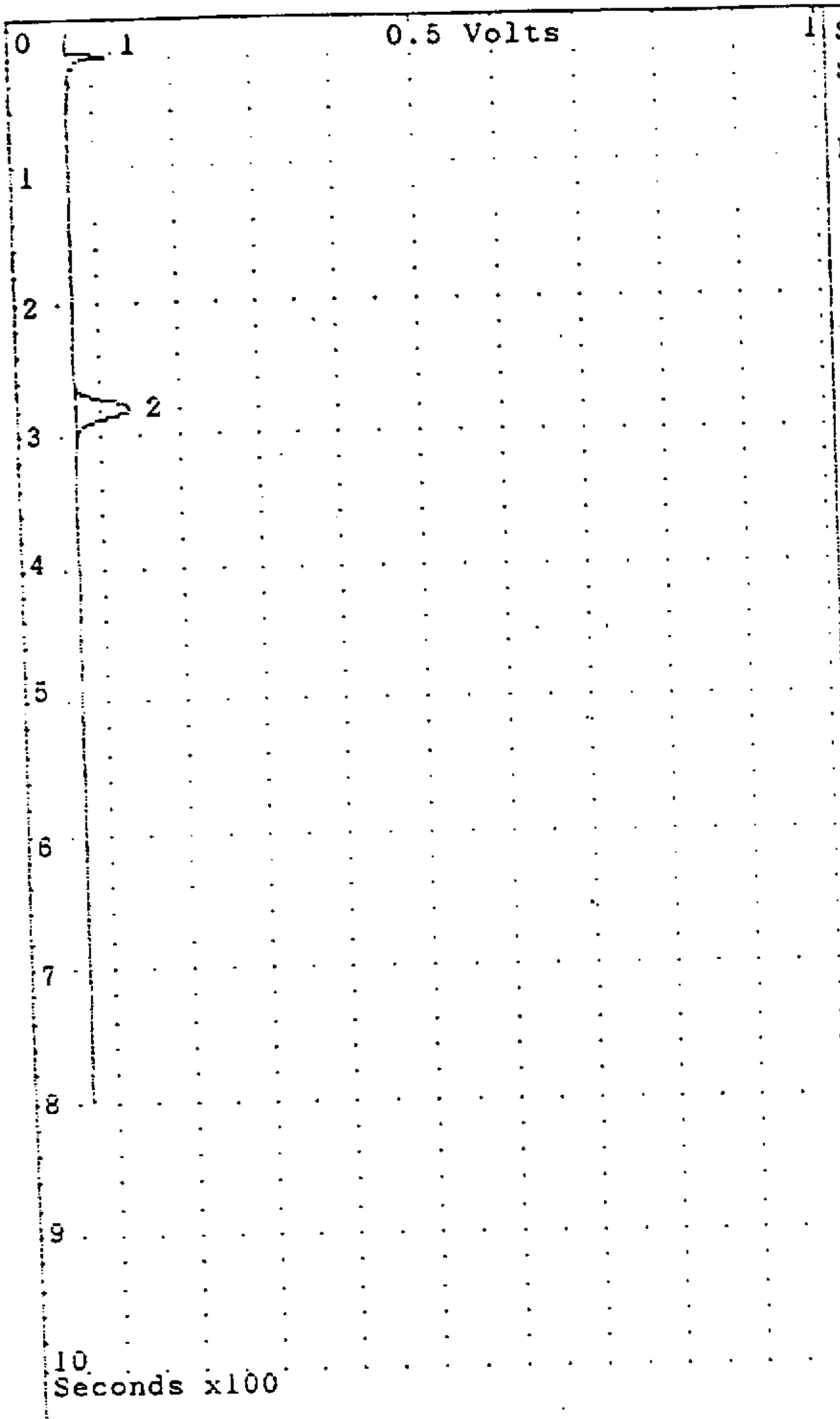
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #8
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 17:
Stopped at 800.0 sec

Number	19	Livermore3/3/92
Internal Temp	19	MW8 2 well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.3	107 mVS
PCE	2	285.1	2.91 PPM

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

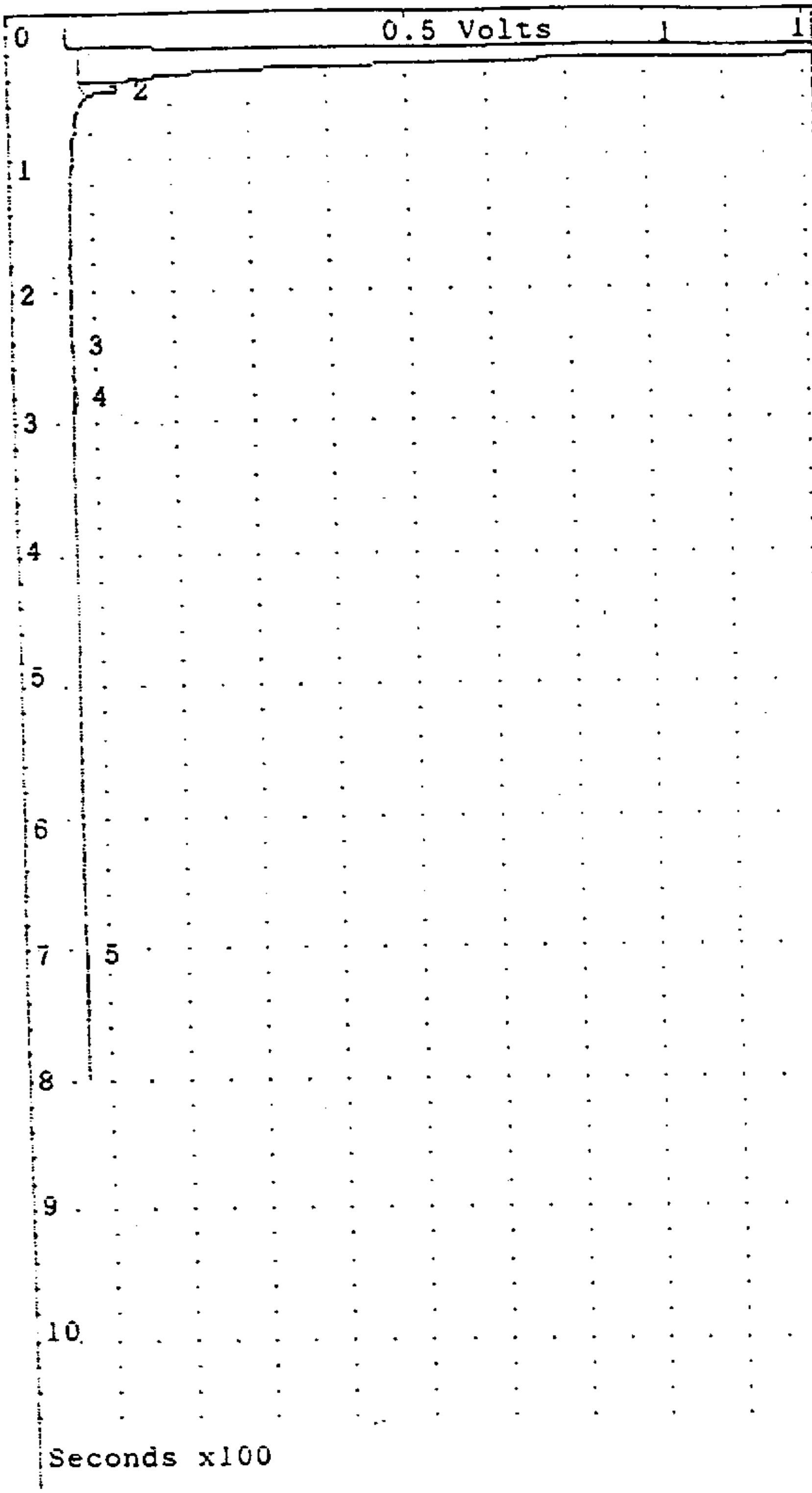
MARCH 3, 1992

MONITORING WELL #8
EVACUATION: TWO WELL VOLUMES

TD = 55.5'

screen: 35'-55'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 17:3
Stopped at 800.0 sec

Number	20	Livermore3/3/92
Internal Temp	19	MW11 1 well vol
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	23.8	33.9 VS
UNKNOWN	2	49.7	241 mVS
UNKNOWN	3	259.1	9.6 mVS
PCE	4	285.9	140 PPM
UNKNOWN	5	730.1	120 mVS

* exceeds alarm level

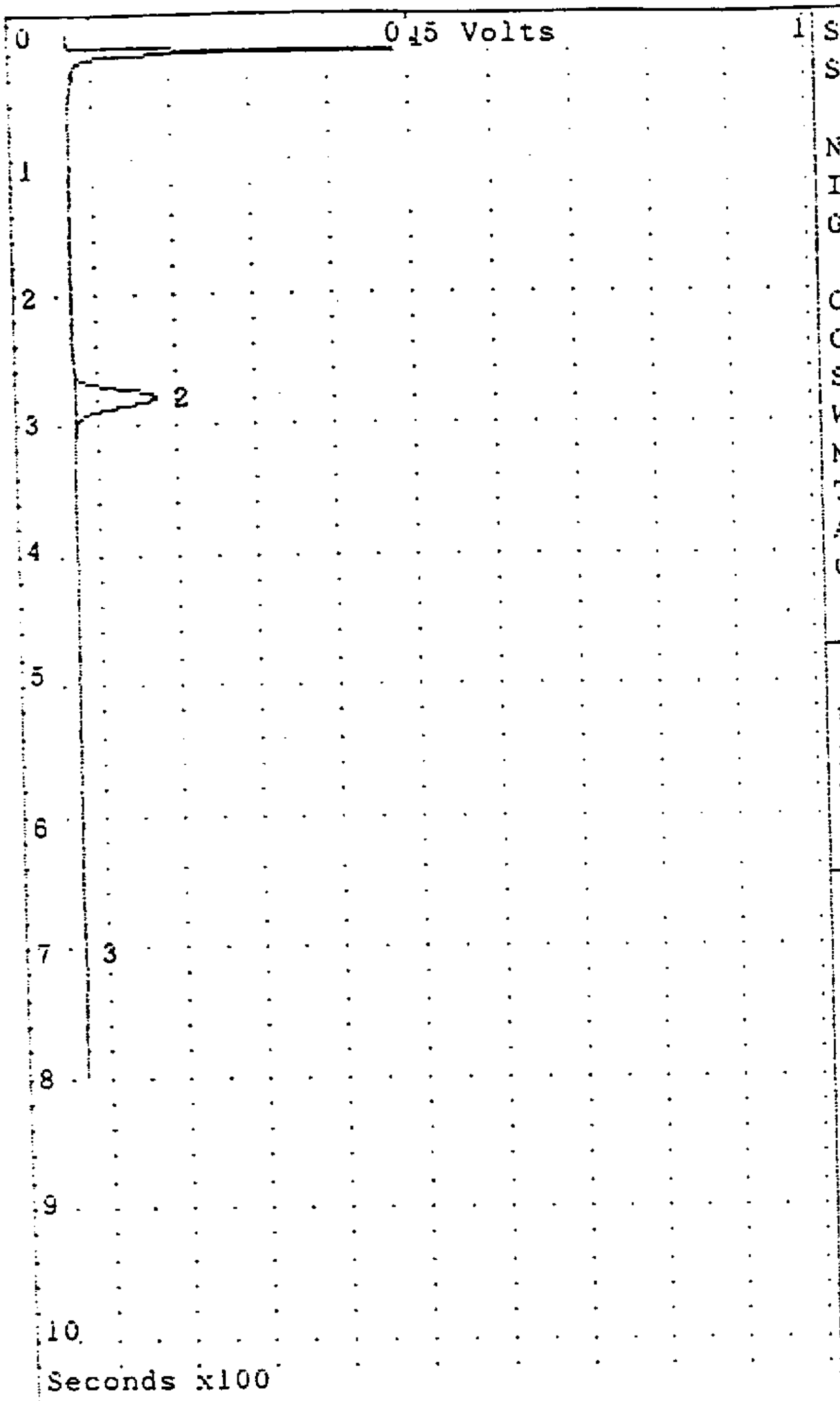
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #11
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1   MAR 3 1992   17:55
Stopped at 800.0 sec

Number	21	Livermore3/3/92
Internal Temp	18	MW11 2 well vols
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.5	1.5 VS
PCE	2	284.3	4.28 PPM*
UNKNOWN	3	722.5	37.8 mVS

* exceeds alarm level

GRUBB & ELLIS

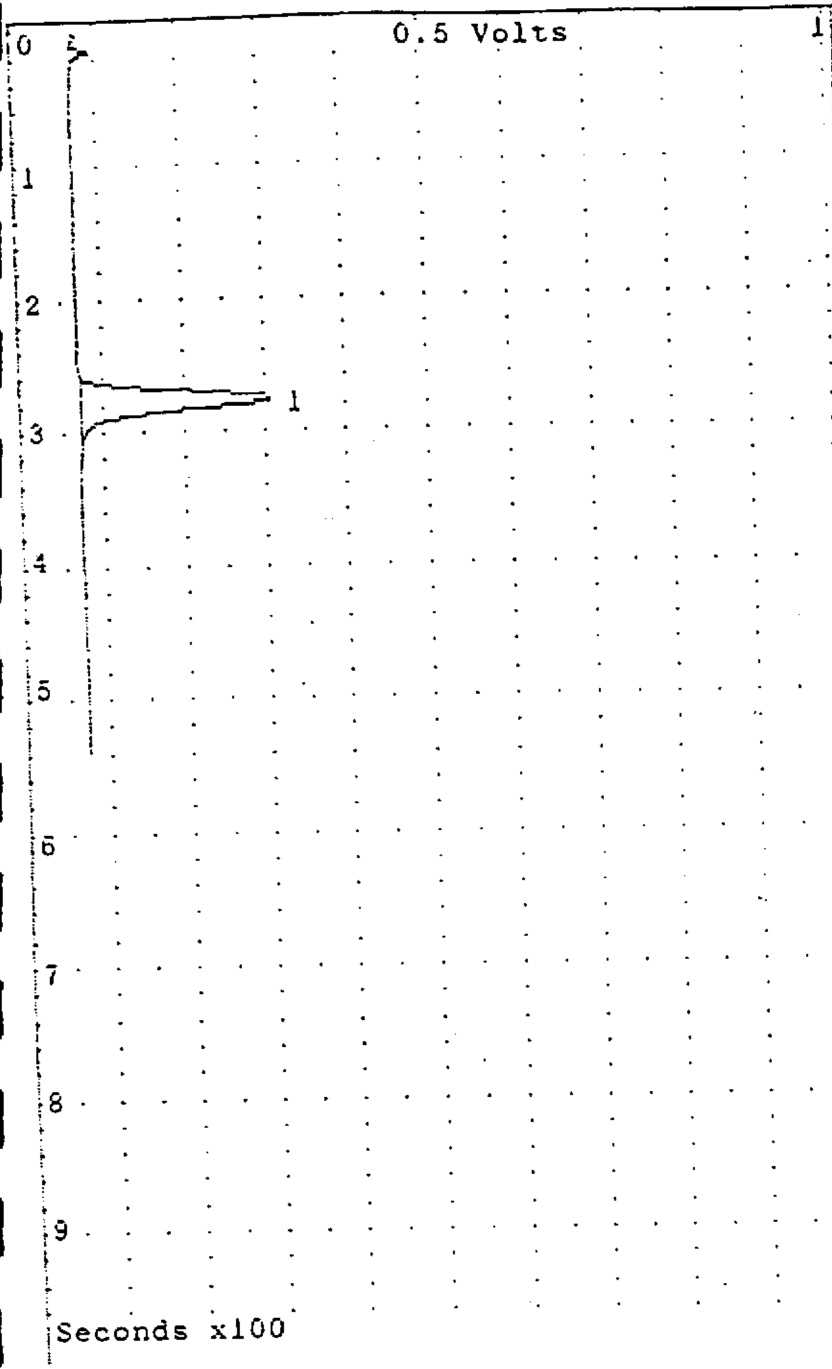
LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #11
EVACUATION: TWO WELL VOLUMES

TD = 55.5'
screen = 25' - 55'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 18: 6
Stopped at 541.5 sec

Number	22	Livermore3/3/92
Internal Temp	18	PCE calib check
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
PCE	1	281.9	10.4 PPM

* exceeds alarm level

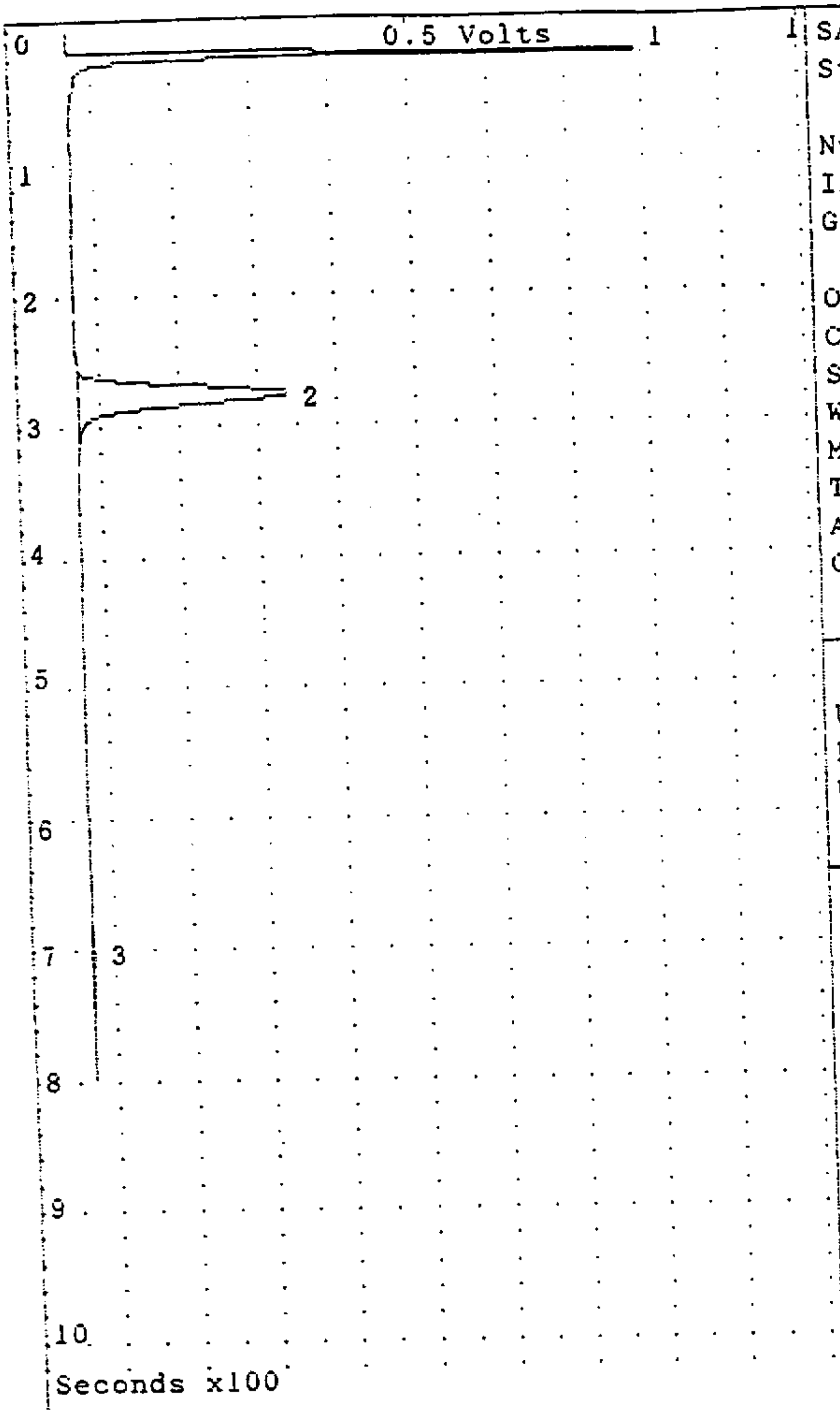
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 18:2(
Stopped at 800.0 sec

Number	23	Livermore3/3/92
Internal Temp	18	MW6 1 well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.2	3.1 VS
PCE	2	281.1	11.6 PPM
UNKNOWN	3	715.1	102 mVS

* exceeds alarm level

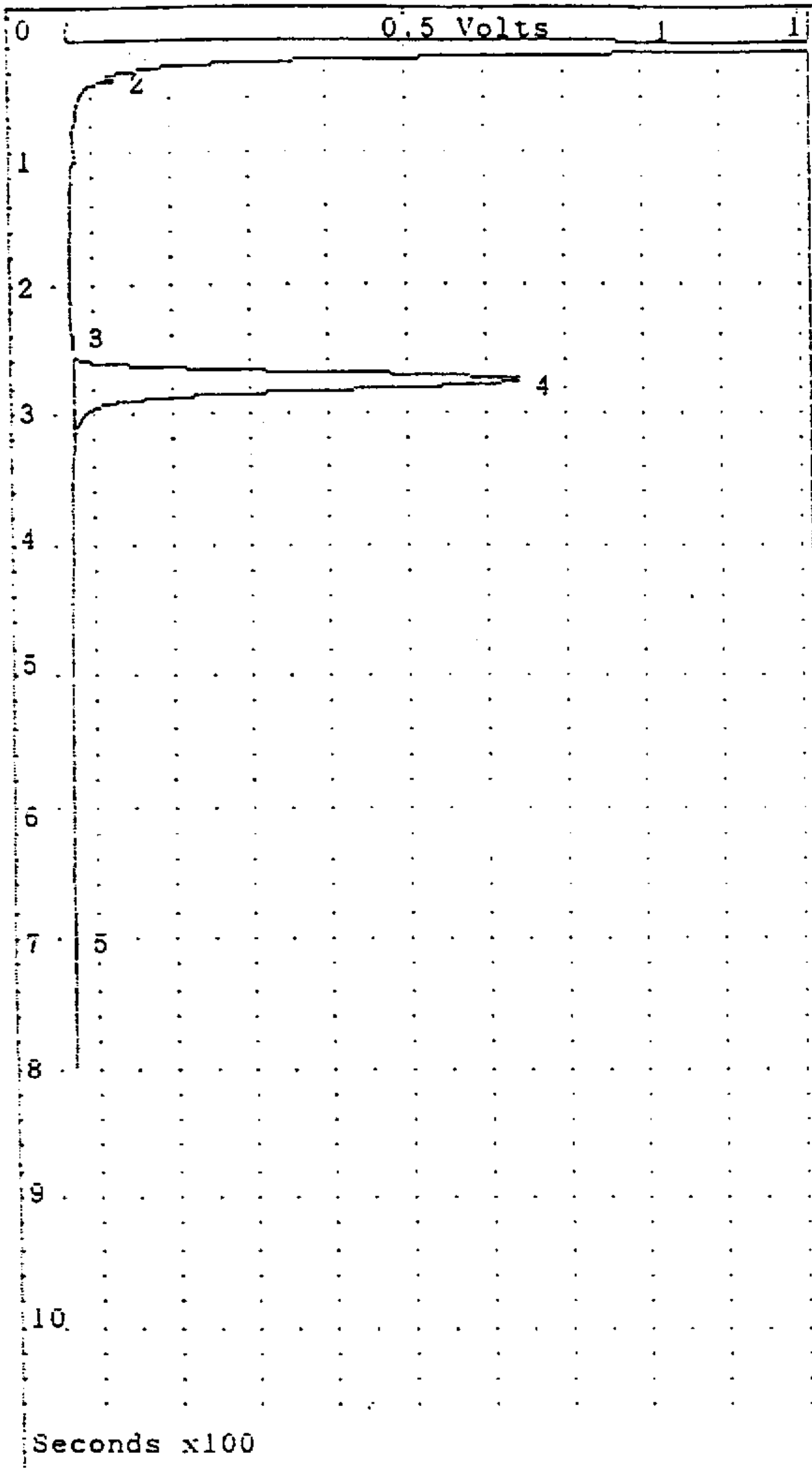
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #6
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 18:41

Stopped at 800.0 sec

Number	24	Livermore3/3/92
Internal Temp	17	MW6 2 well vols
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	22.9	28 VS
UNKNOWN	2	48.5	26.8 mVS
UNKNOWN	3	251.4	15 mVS
PCE	4	280.3	25.3 PPM
UNKNOWN	5	715.1	121 mVS

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

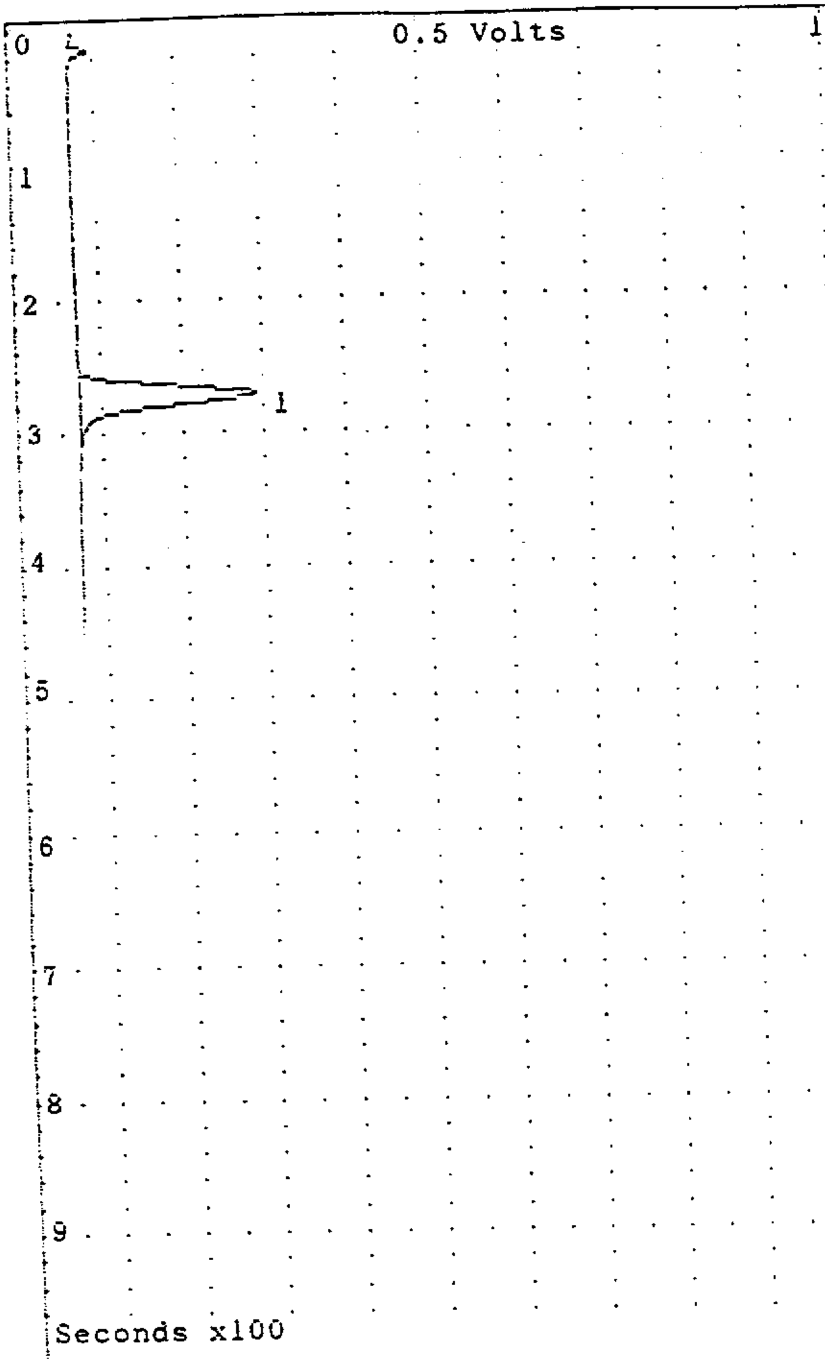
MARCH 3, 1992

MONITORING WELL #6
EVACUATION: TWO WELL VOLUMES

TD = 50'

Screen: 30'-50'

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 19:13
Stopped at 451.7 sec

Number	26	Livermore3/3/92
Internal Temp	16	PCE cal check
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
PCE	1	276.6	9.66 PPM

* exceeds alarm level

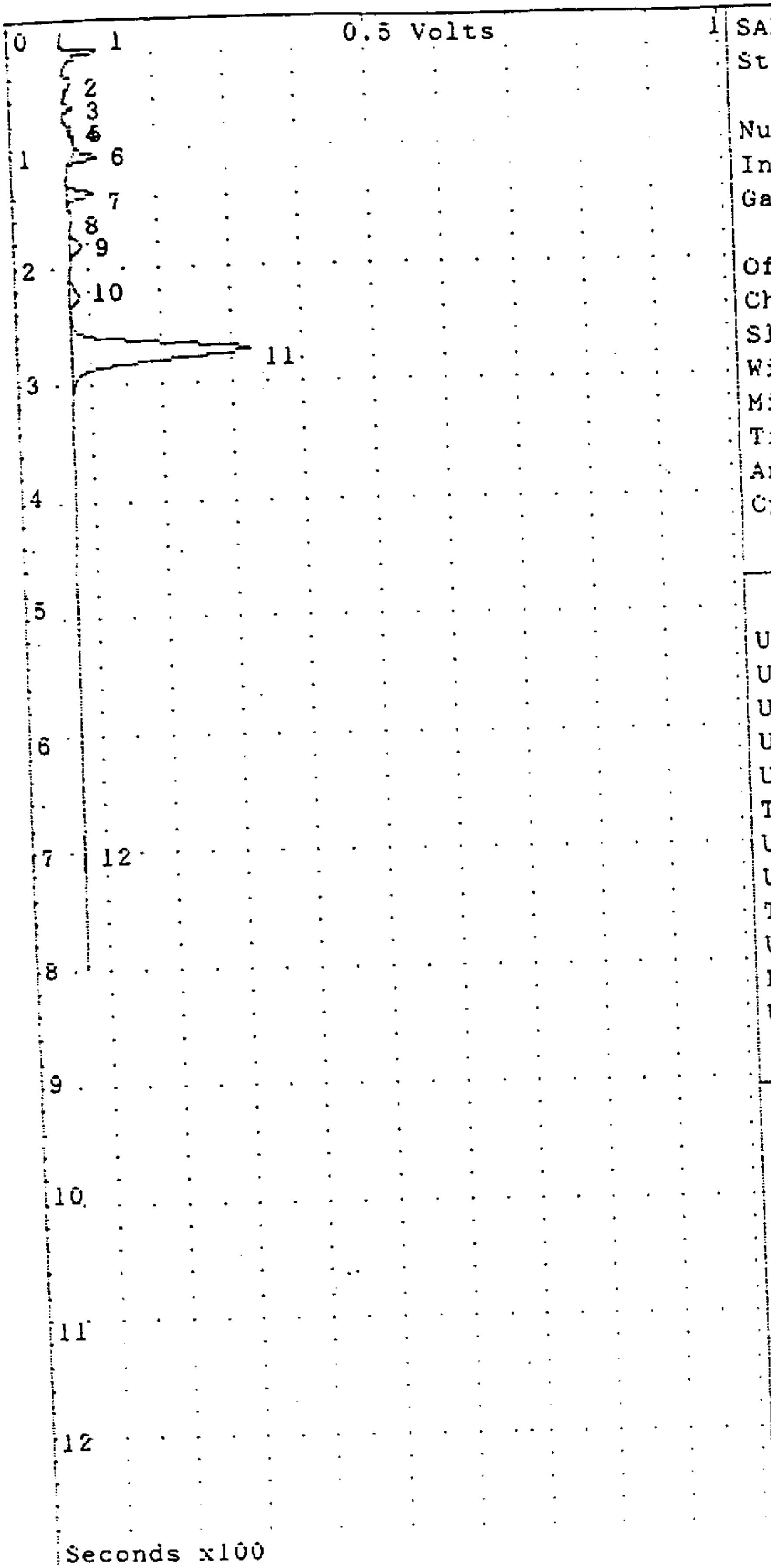
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

PCE CALIBRATION CHECK

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 19:27
Stopped at 800.0 sec

Number	27	Livermore3/3/92
Internal Temp	17	MW17 1 well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.0	120 mVS
UNKNOWN	2	44.9	18.8 mVS
UNKNOWN	3	67.1	20.3 mVS
UNKNOWN	4	85.6	22.7 mVS
UNKNOWN	5	93.4	21.6 mVS
TCE	6	108.7	455 PPE
UNKNOWN	7	140.8	289 mVS
UNKNOWN	8	160.7	14.1 mVS
TOLUENE	9	185.2	316 PPI
UNKNOWN	10	229.2	161 mVS
PCE	11	277.3	11.1 PPI
UNKNOWN	12	707.9	27.8 mV

* exceeds alarm level

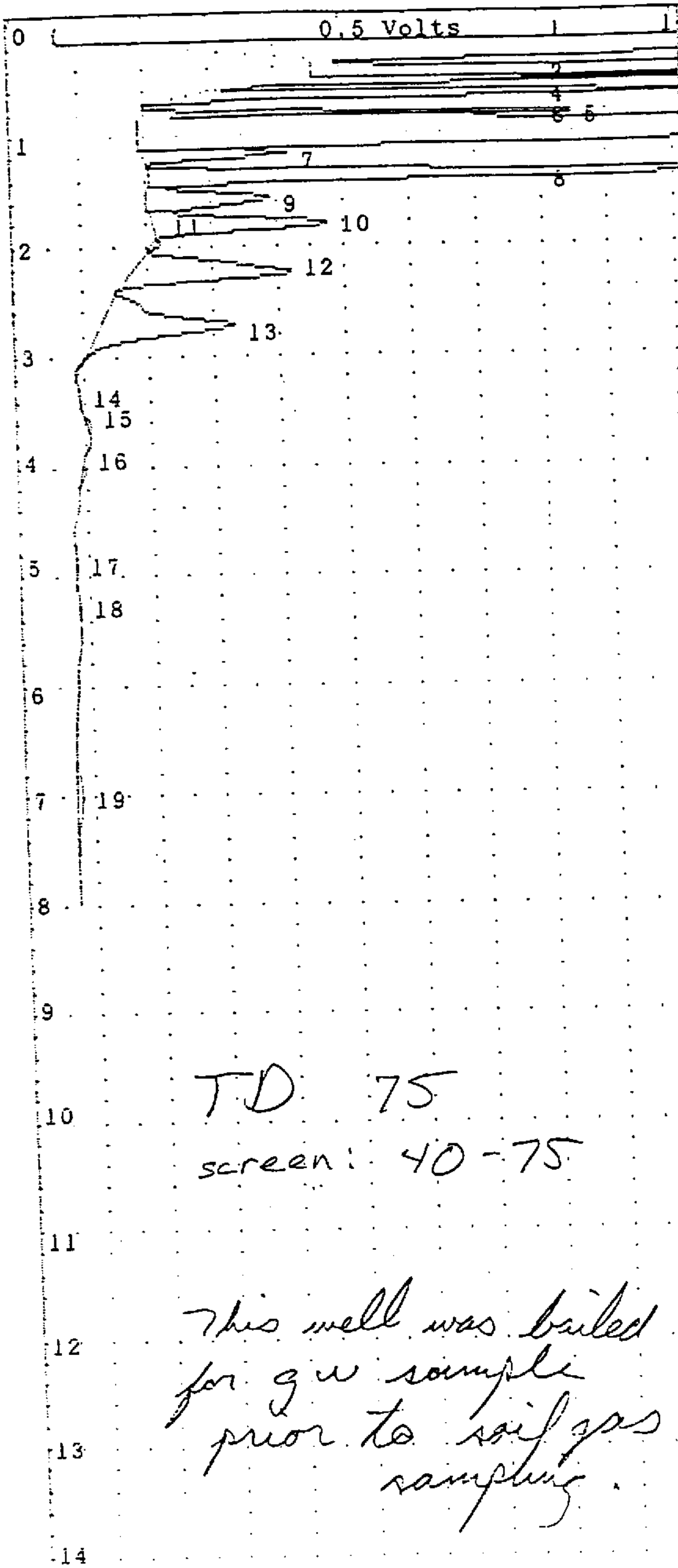
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #17
EVACUATION: ONE WELL VOLUME

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 19:4
Stopped at 800.0 sec

Number	28	Livermore3/3/92
Internal Temp	16	MW17 2 well vol
Gain	5	OV 30 10 ML MIN
Offset	0.0 mV	
Chart speed	0.5 cm/min	
Slope sens.	18 14 6 mV/Sec	
Window +/-	5 Percent	
Minimum area	5 mVsec	
Timer delay	10.0 sec	
Analysis time	800.0 sec	
Cycle time	0 min	

Name	#	R.T.	Area/PPM	
UNKNOWN	1	25.6	66	VS
UNKNOWN	2	46.6	13.6	VS
UNKNOWN	3	54.9	2.9	VS
UNKNOWN	4	66.5	5.7	VS
UNKNOWN	5	85.6	3.8	VS
UNKNOWN	6	100.4	72.4	VS
UNKNOWN	7	121.2	1.4	VS
UNKNOWN	8	139.0	13.3	VS
UNKNOWN	9	160.7	2.4	VS
TOLUENE	10	185.2	5.57	PP
TOLUENE	11	202.8	24.2	PP
UNKNOWN	12	229.2	4.1	V
PCE	13	277.3	10.8	PP
UNKNOWN	14	341.2	29.1	mV
UNKNOWN	15	369.2	97.4	mV
UNKNOWN	16	410.2	15.6	mV
p,m xylene	17	496.6	52.7	PP
UNKNOWN	18	541.1	79.4	mV
UNKNOWN	19	711.5	328	mV

* exceeds alarm level

TD 75
screen: 40-75

This well was bailed for g.w. sample prior to soil gas sampling.

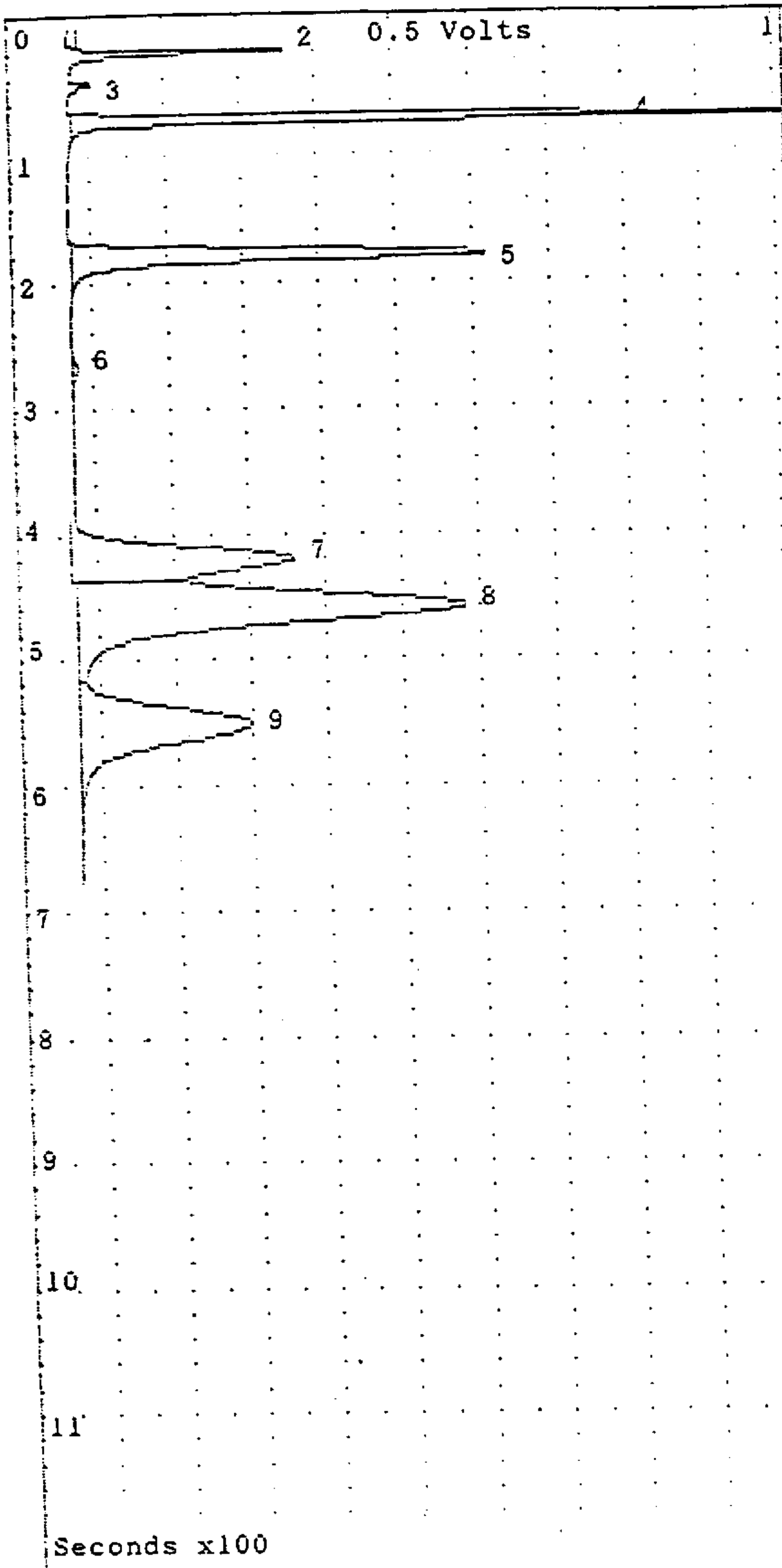
GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

MONITORING WELL #17
EVACUATION: TWO WELL VOLUMES

Analysis Report - Photovac 10S70 Gas Chromatograph



SAMPLE LIBRARY 1 MAR 3 1992 20: 2
Stopped at 684.0 sec

Number	29	Livermore3/3/92
Internal Temp	16	BTEX cal check
Gain	5	OV 30 10 ML MIN

Offset	0.0 mV
Chart speed	0.5 cm/min
Slope sens.	18 14 6 mV/Sec
Window +/-	5 Percent
Minimum area	5 mVsec
Timer delay	10.0 sec
Analysis time	800.0 sec
Cycle time	0 min

Name	#	R.T.	Area/PPM
UNKNOWN	1	20.4	23.9 mVS
UNKNOWN	2	26.9	921 mVS
UNKNOWN	3	51.5	58.2 mVS
benzene	4	78.8	11.1 PPM
TOLUENE	5	188.7	9.99 PPM
PCE	6	277.3	254 PPB
ethylbenzene	7	432.2	9.11 PPM
p,m xylene	8	471.2	18.6 PPM
o xylene	9	565.3	9.78 PPM

* exceeds alarm level

GRUBB & ELLIS

LIVERMORE ARCADE
LIVERMORE, CALIFORNIA

MARCH 3, 1992

BTEX CALIBRATION CHECK

92 ... 32

REMEDIAL INVESTIGATION

LIVERMORE ARCADE SHOPPING CENTER
Livermore, California

April 1992

APPENDICES 4 & 5

APPENDIX 4

BASELINE HEALTH RISK ASSESSMENT

BASELINE HEALTH RISK ASSESSMENT
LIVERMORE ARCADE SHOPPING CENTER
FIRST STREET AND SOUTH P STREET
LIVERMORE, CALIFORNIA

Prepared for:

H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Prepared by:

Environmental Risk Sciences, Inc.
381 Bush Street, Suite 600
San Francisco, California 94104

April 10, 1992

BASELINE HEALTH RISK ASSESSMENT
LIVERMORE ARCADE SHOPPING CENTER
FIRST STREET AND SOUTH P STREET
LIVERMORE, CALIFORNIA

Prepared for:

H+GCL
2200 Powell Street, Suite 880
Emeryville, California 94608

Prepared by:

Scott Wolff
Scott K. Wolff
Principal

Environmental Risk Sciences, Inc.
381 Bush Street, Suite 600
San Francisco, California 94104

April 10, 1992

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EXECUTIVE SUMMARY

A baseline health risk assessment (HRA) has been prepared at the request of H+GCL for the Livermore Arcade Shopping Center property, located near the center of the City of Livermore, California. Soil, soil gas and ground water investigations conducted at the Livermore Arcade Shopping Center by H+GCL since March 1990 have detected the presence of organic compounds in these media. The objective of the baseline HRA is to estimate the potential health risks posed by these compounds to potential human receptors who may come in contact with the soil, soil gas and ground water located at the shopping center. The HRA is considered a baseline analysis because the potential human health risks are estimated for the existing site conditions in the absence of site remediation activities.

Sixteen organic compounds have been detected at the Livermore Arcade Shopping Center. These include volatile organic compounds (VOCs) and acid/base neutral organic chemicals. These chemicals, with the current U.S. Environmental Protection Agency (U.S. EPA) designation of their carcinogenic (C) and/or noncarcinogenic (NC) potential in humans, are listed below:

SOIL:

- 1,2-dichloroethene, cis- (NC)
- methylene chloride (C/NC)
- tetrachloroethene (C/NC)
- 1,1,1-trichloroethane (NC)

SOIL GAS:

- tetrachloroethene (C/NC)
- toluene (NC)
- trichloroethene (C)
- xylenes (p- and m- isomers) (NC)

GROUND WATER:

•	benzene	(C)
•	bis(2-ethylhexyl)phthalate	(C/NC)
•	bromodichloromethane	(C/NC)
•	bromoform	(C/NC)
•	chloroform	(C/NC)
•	dibromochloromethane	(C/NC)
•	1,2-dichloroethene, cis-	(NC)
•	ethylbenzene	(NC)
•	Freon 12	(NC)
•	phenol	(NC)
•	tetrachloroethene	(C/NC)
•	toluene	(NC)
•	trichloroethene	(C)
•	xylenes, total	(NC)

Additionally, total hydrocarbons were analyzed for and detected in soil and ground water. Ground water and soil were also analyzed for the presence of Title 26 metals. A number of these were detected, but at concentrations well within the range of regional background levels. Tetrachloroethene (PCE) is the most frequently detected chemical in soil, soil gas and ground water. Based on the H+GCL investigations, the primary source of PCE is a dry cleaning facility located in the Livermore Arcade Shopping Center which under previous ownership discharged PCE into a floor drain connected to a broken sewer line (Hygienetics, 1990).

The estimation of human health risk follows a health conservative methodology recommended by the U.S. EPA and the California EPA Department of Toxic Substances Control (DTSC). The baseline HRA uses conservative exposure assumptions, and therefore tends to overestimate the actual human health risks posed by the organic compounds at the Livermore Arcade Shopping Center.

As recommended in U.S. EPA guidance, the baseline HRA considers both present and future case land use scenarios. The Livermore Arcade Shopping Center is presently covered with concrete sidewalks, concrete building foundations, asphalt parking areas and ornamental vegetation. No natural vegetation exists at the site.

Exposure to underlying soils is therefore considered highly unlikely given the current land use conditions. Additionally, ground water beneath the site is not currently accessible. No ground water wells in the upper aquifer zone located within one-half mile downgradient of the shopping center have been identified as being currently used for drinking water purposes. Therefore, the only exposure pathway assumed to potentially impact human receptors in the present case scenario is the inhalation of soil gas volatilizing upward through the concrete/asphalt covering into ambient air where it may be inhaled.

At this time, there is no plan to use the property for any purpose other than commercial development. However, in keeping with a health conservative approach, the baseline HRA assumes that the property may be the future location of a residential housing development. Given this scenario, both children and adults may eventually reside at the property. Two potential resident receptors are therefore assumed for the future land use scenario: an individual residing at the property who is an adult for the full duration of exposure (30 years), and an individual who is a child for six years of the exposure period (from ages 1 through 6) and an adult for the remaining exposure duration (ages 7 through 30). These potential receptors are respectively called the future onsite adult resident, and the future onsite child/adult resident. The future onsite adult and child/adult residents are conservatively assumed to come in contact with the organic compounds in soil, soil gas and ground water 24 hours/day, 365 days/year for 30 years.

The future onsite residents are assumed to be exposed to the detected organic compounds via soil ingestion, dermal absorption of soil, and the inhalation of soil gas. Additionally, it is conservatively assumed that ground water wells used for drinking water purposes may be constructed on the site. Future onsite residents may then be exposed to ground water via ingestion, dermal absorption, or inhalation of the organic compounds volatilizing during residential water usage. Although two of the monitoring wells (MW-13 and MW-14) sampled by H+GCL are located in a residential area to the north of the Livermore Arcade Shopping Center property, the potential human health risks attributable to the use of ground water from these wells are included in the future onsite residential population scenario.

This analysis assumes that ground water at the Livermore Arcade Shopping Center property is confined to two aquifers. The upper aquifer is encountered approximately 60 feet below grade. This aquifer has a thickness ranging from approximately 13-32 feet based on aquifer tests conducted in different years. Beneath the upper aquifer is a series of clay and clay sand layers that extend for approximately 40 feet. These layers serve as an aquitard. The second aquifer at the site, called the deeper aquifer in this analysis, is encountered at approximately 120 feet below grade, and is assumed to have a thickness ranging from 35-40 feet.

Analysis of exposure and risk from ground water are conducted under two different conditions. The first estimates the chemical exposures and subsequent health risks directly from the chemical concentrations detected in ground water samples collected by H+GCL from the monitoring wells. Exposures and risks are calculated separately for each ground water well, rather than combining data across all wells.

The second condition involves a contaminant fate and transport model that allows the chemicals detected in soil to migrate downward through the unsaturated zone until they reach the upper aquifer. It is additionally assumed that the organic compounds that reach the upper aquifer also are able to impact the deeper aquifer existing beneath the site.

Estimation of health risk begins with the determination of representative concentrations (RCs) and exposure point concentrations (EPCs) for each chemical in each environmental medium. These are calculated in accordance with health conservative methodology recommended by the U.S. EPA and the DTSC. RCs and EPCs for soil and ground water are estimated directly from the chemical concentrations detected in the site characterization studies. A second set of EPCs for ground water are estimated via the contaminant fate and transport model described in the previous paragraph. EPCs for the soil gas inhalation pathway are derived using a conservative chemical transport model that estimates the soil gas concentrations in ambient air where they may be inhaled by the future onsite residents. EPCs are used in conjunction with conservative exposure assumptions regarding human physiology and behavior to estimate chronic daily intake (CDI) of each chemical in each environmental medium by the potential human receptors.

The HRA uses the health criteria published by the U.S. EPA in either the Integrated Risk Information System (IRIS), or the Health Effects Assessment Summary Tables (HEAST). Health criteria are quantitative estimates reflecting the inherent toxicity of a chemical in terms of its ability to induce carcinogenic and/or noncarcinogenic adverse health effects. The health criteria provided in IRIS and HEAST are either U.S. EPA approved, or interim criteria currently undergoing U.S. EPA review. The carcinogenic and/or noncarcinogenic tendency of each of the sixteen chemicals detected at the Livermore Arcade Shopping Center was previously stated. Benzene, detected in ground water, is a known human carcinogen. The other carcinogens, which are known to cause cancer in test animals, are considered probable human carcinogens. In the final step of the HRA, the health criteria are mathematically combined with the exposure estimates (CDIs) to calculate estimates of health risk.

Following a health conservative methodology, the lifetime upper-bound cancer risk to the future onsite adult and child/adult resident is calculated via the soil ingestion, dermal absorption of soil, and soil gas inhalation pathways. These lifetime cancer risk estimates range from 1E-08 to 2E-07. The highest risks are estimated for the soil dermal absorption and soil gas inhalation pathways (child/adult scenario) as 2E-07 (two cases of cancer per ten million exposed individuals). These lifetime cancer risks are negligible as the DTSC considers 1E-06, or one-in-a million cases of cancer as a potential benchmark of regulatory concern.

Hazard Index (HI) estimates were calculated reflecting the potential for adverse health effects to occur in the future onsite residents from exposures to noncarcinogens. The HI estimates for the soil ingestion, dermal absorption and soil gas inhalation exposure pathways range from 6E-05 to 2E-02. Because the HI estimates are less than unity (one), the regulatory level of concern, no adverse health effects attributable to exposure to noncarcinogens via the soil ingestion, dermal absorption, and soil gas inhalation pathways are expected to occur in the future onsite adult or child/adult residential populations.

Since health risks to the future onsite residents are estimated as negligible via the soil gas inhalation exposure pathway, it is reasonable to conclude that health risks to potential present case receptors via soil gas inhalation is even more negligible. The asphalt and concrete currently covering the shopping center would decrease the ability of the soil gas VOCs to volatilize upward into the breathing zone, such that CDI estimates for receptors in the present case scenario would be significantly less than CDIs estimated for the future case receptors. Therefore, resulting health risks to receptors in the present case scenario, conservatively assuming daily exposure, 24 hours/day for 30 years, would be less than the health risks estimated for the future onsite residents.

The results from the estimation of cancer risk and noncarcinogenic adverse health effects to the future onsite adult and child/adult residents from exposure to ground water, however, suggest that the organic compounds in ground water may pose a health risk to these receptors. As described above, carcinogenic lifetime cancer risk and noncarcinogenic HIs are estimated for each ground water well separately. The highest cancer risk estimates for the future onsite adult resident are 1E-02 at MW-1, arising primarily from benzene, and 4E-03 at B1-U, contributed by PCE. Fifteen of 19 wells pose potential risks greater than the 1E-06 benchmark. The cancer risk estimate is 1E-06 or greater from all 19 ground water wells for the future onsite child/adult resident. The highest calculated risks were 1E-02 at MW-1 (benzene), and 5E-03 at B1-U (PCE).

HIs for nine of the 19 wells are equal to or exceed the 1E+00 benchmark for both the future onsite adult and child/adult residents. MW-1 and B1-U are also the locations generating the highest HIs. The HI for the future onsite adult is 1E+01 at MW-1 and 4E+01 at B1-U. The HI for the future onsite child/adult is 2E+01 at MW-1 and 4E+01 at B1-U. Toluene and total xylenes drive the HI for MW-1, while the high HI at B1-U arises from PCE.

The baseline HRA also provides health risk estimates for ground water use based on the results of the environmental fate and transport modeling for two cases. The modeling is conducted to estimate the extent of migration for the organic chemicals detected in soil and their potential impacts on ground water. Case #1 provides estimated ground water concentrations and health risk estimates assuming that precipitation at the site can infiltrate through the soils and impact ground water. Case #2 models VOCs migration assuming that the water table of the upper aquifer will rise in the future and will desorb the VOCs detected in the lower soils thereby increasing VOC concentrations in ground water. Both of these cases assume that the upper and lower aquifers are connected.

The results of both of these cases indicate that the lifetime cancer risks and hazard indices for ground water use are higher in the upper aquifer compared to the lower aquifer. For Case #1, the lifetime cancer risks for the future onsite adult resident range from 5E-06 to 1E-05 in the upper aquifer and 3E-06 to 4E-06 in the lower aquifer. The range of lifetime cancer risks from exposures to VOCs in the upper and lower aquifers for the child/adult resident are 7E-06 to 1E-05, and 4E-06 to 5E-06, respectively. The risk estimates are presented as a range because the thickness of the water bearing zone in the upper aquifer is dynamic and it is certain that the thickness will vary in the future. HI estimates for the future onsite residents are negligible. The maximum HIs are associated with the upper aquifer and range from 6E-02 to 2E-01, and 1E-01 to 2E-01 for the future onsite adult and child/adult, respectively. The estimated health risks for Case #2 are higher than the risks estimated for Case #1. The lifetime cancer risk for the future onsite adult resident are estimated as 5E-04 for the upper aquifer and 2E-04 for the lower aquifer. The lifetime cancer risk estimates for the child/adult resident are derived as 7E-04 and 4E-04 for the upper and lower aquifers. All of the estimated hazard indices are greater than unity indicating the potential for adverse noncarcinogenic health impacts in the future populations. The HIs for the future onsite adult resident are estimated as 6E+00 for the upper aquifer and 3E+00 for the lower aquifer. The HI estimates for the child/adult resident are 7E+00 and 3E+00 for the upper and lower aquifers, respectively.

Since health conservative assumptions have been used throughout the HRA, the risk estimates should be viewed as upper-bound estimates of the potential risk arising from the organic compounds detected at the Livermore Arcade Shopping Center. Using this methodology, it is likely that the actual risks posed by these chemicals are considerably less than the risk estimates derived in the baseline HRA.

1.0 INTRODUCTION

Environmental Risk Sciences, Inc. (ERS) has been retained by H+GCL to prepare a baseline health risk assessment (HRA) for the Livermore Arcade Shopping Center property located in Livermore, California. The HRA evaluates the potential incremental risks to human health attributable to the chemicals detected during various environmental investigations conducted at the property. Soil, soil gas and ground water have been sampled at the property. The analysis is called a baseline risk assessment because the potential human health risks are estimated assuming that no remedial activities will be conducted at the property. This assumption maximizes the potential human health risks in the event that no remedial action is taken.

The HRA follows the most recent U.S. Environmental Protection Agency (U.S. EPA) and Cal-EPA Department of Toxic Substances Control (DTSC) guidelines for conducting baseline health risk assessments (U.S. EPA, 1991b, 1989a, 1989b; DHS, 1990). It should be noted that until July 1991, the DTSC was an office within the Department of Health Services (DHS). The most recent risk assessment guidelines for facilities in the State of California were prepared by the DHS in August 1990. At the present, this document is available only in draft form. The DTSC has not stated when the final document will be available.

1.1 OVERVIEW

The primary objective of the HRA is to calculate health conservative estimates of the potential risks to human health posed by the chemicals detected at the Livermore Arcade Shopping Center. The general environmental condition at the facility is the presence of organic compounds in soil, soil gas and ground water. These compounds have been detected during several environmental investigations and include tetrachloroethene (PCE), benzene, and trichloroethene (TCE). Based on the conclusions of a subsurface investigation prepared by Hygienetics, now called H+GCL, the primary source of PCE is a dry cleaning facility whose prior owners discharged PCE into a floor drain that was connected to a sewer line that was cracked (Hygienetics, 1990). The site investigations conducted since the publication of this report have focused on defining the vertical and horizontal extent of contamination in soil, soil gas and ground water.

1.2 SITE DESCRIPTION

The Livermore Arcade Shopping Center is located near the center of the City of Livermore (see Figures 1 and 2). Built in 1972, the center consists of 15 businesses. The property is approximately 11.5 acres in area. The entire property is covered by either concrete sidewalks, concrete building foundations, asphalt parking areas or ornamental vegetation. No natural vegetation exists at the site.

1.3 CHEMICALS DETECTED AT THE SITE

Four volatile organic compounds (VOCs) have been detected in soil samples collected at the site, as follows:

- 1,2-dichloroethene, cis- (cis-1,2-DCE)
- methylene chloride
- tetrachloroethene (PCE)
- 1,1,1-trichloroethane (1,1,1-TCA)

Four VOCs have been detected in the ten soil gas samples collected by H+GCL at depths ranging from 25 to 75 feet. These VOCs are:

- PCE
- toluene
- trichloroethene (TCE)
- xylenes, p- and m- isomers

The site investigation activities have collected 24 ground water samples from monitoring wells located throughout the property. In these samples, 14 compounds have been detected during sampling activities conducted in 1990 and 1992. These chemicals are:

- AROMATIC VOLATILES
  - benzene
  - ethylbenzene
  - toluene
  - xylenes, total

- HALOGENATED VOLATILES
  - bromodichloromethane
  - bromoform
  - chloroform
  - dibromochloromethane
  - 1,2-DCE, cis-
  - Freon 12
  - PCE
  - TCE

- ACID/BASE NEUTRAL COMPOUNDS
  - bis(2-ethylhexyl)phthalate
  - phenol

1.4 HEALTH RISK ASSESSMENT METHODOLOGY

The chemical exposure and human health risk estimates presented in this report are based on health conservative methods recommended in several DTSC and U.S. EPA guideline documents following the Reasonable Maximum Exposure (RME) methodology recommended by both agencies (DHS, 1990; U.S. EPA, 1989a). The exposure and risk estimates will be evaluated based on the present and potential future uses of the site. Present case exposures are evaluated via the potential inhalation of chemicals detected in soil gas volatilizing upward through the shopping center's asphalt/concrete cover into ambient air where they may be inhaled. Exposure to soil and ground water is not evaluated for the present case scenario because these media are not currently accessible to potential human receptors. The current exposures can be regarded as a present onsite worker scenario.

In order to present a health conservative analysis, it is assumed that the property could be developed for residential housing and that the future residents would have contact with the soil and ground water beneath the property, and would inhale the soil gas that could impact the lower atmosphere. Since this is a baseline HRA, the current environmental conditions at the property are assumed to remain constant throughout the 30 year exposure period recommended by the DTSC and the U.S. EPA for residential exposure scenarios.

The following documents and databases have been used to prepare the baseline HRA:

Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency. March 1992.

Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, D.C. March 1991. OSWER Directive 9285.6-03.

Health Effects Assessment Summary Tables (HEAST). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. January 1991. OERR 9200.6-303 (91-1).

Scientific and Technical Standards for Hazardous Waste Sites. Draft (Dated August 1990). California Department of Health Services, Toxic Substances Control Program. Sacramento, CA.

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

Exposure Factors Handbook. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Washington, D.C. July 1989. EPA/600/8-89/043.

Superfund Exposure Assessment Manual. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. Washington, D.C. April 1988. EPA/540/1-88/001.

1.5 ORGANIZATION OF THE HEALTH RISK ASSESSMENT

The risk assessment report is organized according to DTSC and U.S. EPA recommendations. The HRA is presented in 7 chapters. Following this introduction, Chapter 2 presents the analytical data collected at the shopping center. The chemicals of potential concern detected in soil, soil gas, and ground water are identified.

Chapter 3 presents the exposure assessment section. The first task in this chapter characterizes the physical setting and identifies the potentially exposed populations. The next task identifies the exposure pathways, consisting of a chemical source area, fate and transport mechanisms, exposure point locations, and the exposure routes of concern. The analysis focuses on the potential exposures to the property under future land use conditions. Chemical concentrations at the exposure points, called exposure point concentrations (EPCs), are estimated for each compound of concern and for each pathway evaluated in the analysis. The exposure assessment chapter concludes by providing Chronic Daily Intake (CDI) estimates of each compound for the individuals located at the defined exposure points.

The toxicity assessment section is presented in Chapter 4. The objective of this chapter is to describe the health criteria for the chemicals included in the baseline HRA. Health criteria are quantitative estimates of potential human carcinogenic or noncarcinogenic toxicity of the chemicals. Health criteria are estimated for both the ingestion and inhalation exposure routes. Toxicity information published in the U.S. EPA databases, the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Tables (HEAST) is used in this analysis (U.S. EPA, 1992; U.S. EPA, 1991a).

Chapter 5 is the risk characterization chapter that presents the results of the baseline HRA. The quantitative toxicity estimates presented in Chapter 4 are mathematically combined with the CDI estimates from Chapter 3 to produce quantitative estimates of the carcinogenic and noncarcinogenic impacts on human health. The risk characterization chapter concludes with a discussion of the uncertainties inherent in the baseline HRA.

The limitations of the baseline HRA are presented in Chapter 6.

The literature references used to prepare the baseline HRA are listed in Chapter 7.

Appendices A, B, and C include summary tables of the laboratory data used to estimate representative concentrations for chemicals detected in soil, soil gas and ground water. The laboratory data sheets for these analyses are included in the Remedial Investigation (RI) report prepared by H+GCL.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section of the baseline HRA presents the analytical data collected at the Livermore Arcade Shopping Center. The site investigation activities conducted by H+GCL have obtained analytical data for the soil, soil gas and ground water media. These characterization studies have focused on identifying the source and extent of the organic chemicals in these environmental media.

The objective of this chapter is to identify the chemicals that will be evaluated in the baseline HRA. The analytical data are presented and evaluated according to U.S. EPA and DTSC methodologies to derive a subset of relevant data for estimating potential human health risks. The chapter concludes by deriving estimates of the representative concentration (RC) for each chemical of concern included in the baseline HRA.

2.1 SUMMARY OF PREVIOUS INVESTIGATIONS

Site characterization studies of soil, soil gas, and ground water have been conducted by H+GCL at the Livermore Arcade Shopping Center since 1990. The analytical data from these studies provide the database for the baseline HRA. The reader is referred to these H+GCL site investigation studies for more detailed discussions of the site characterization activities.

2.2 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

This section summarizes the analytical results of the data collected at the Livermore Arcade Shopping Center for soil, soil gas and ground water. The chemicals detected in each medium are identified in terms of their frequency of detection, minimum and maximum detected concentrations, mean concentrations, and 95% upper confidence limit of the mean concentrations (95% UCL). The data are then reviewed to determine which of the detected chemicals will be included in the remainder of the HRA. These are identified as the chemicals of potential concern. The chapter concludes by deriving a representative concentration (RC) for each chemical of potential concern. The RC is the assumed concentration of the chemicals in soil, soil gas or ground water that will be used as the basis for calculating human exposures and resulting health risks in the remaining chapters of the HRA.

2.2.1 Chemicals of Potential Concern in Soil

As shown in Table A-1 (Appendix A), thirty-four soil samples were collected by H+GCL from May 1990 through January 1992, and analyzed by BC Analytical (BCA) and Curtis & Tompkins, Ltd. (CT). The locations of these soil samples are shown in Figure 3. The depths of the samples ranged from 4 to 81 feet below the ground surface, with an average sample depth of approximately 41 feet. The samples were analyzed for VOCs, Title 26 metals, base/neutral and acid extractables, and hydrocarbons by a number of U.S. EPA approved laboratory methods. A complete listing of the laboratory methods used to analyze the soil, soil gas and ground water samples is presented in Table 2-1.

Four VOCs were detected in the soil samples, as shown in Table A-1. These chemicals are:

- 1,2-dichloroethene, cis- (cis-1,2-DCE)
- methylene chloride
- tetrachloroethene (PCE)
- 1,1,1-trichloroethane (1,1,1-TCA)

PCE was detected most frequently in the soil samples (in 20 of 34 samples), at concentrations ranging from 3.5E-03 mg/kg to 2.3 mg/kg. PCE was detected in samples ranging from 4 to 65 feet deep. A maximum PCE concentration of 2.3 mg/kg was detected at a 44 foot depth. 1,1,1-TCA was detected in 7 of 34 samples at depths from

16 to 61 feet. The maximum detected concentration is reported as 3.5 mg/kg at 26 feet. Cis-1,2-DCE and methylene chloride were detected at relatively lower concentrations in 2 of 34 and 4 of 34 samples, respectively.

All four detected VOCs will be included as chemicals of potential concern in the HRA. Summary data for these chemicals including frequency of detection, minimum/maximum concentrations, mean concentrations and the 95% UCL of the mean concentrations are listed in Table 2-2. It is important to note that laboratory results indicating a chemical was not detected in a certain sample do not prove conclusively that it is not present in that sample. The chemical could be present at a concentration less than the sample detection limit. As a health conservative measure, and in following U.S. EPA and DTSC risk assessment guidance documents, a chemical detected at least once in an environmental medium is included in the HRA (U.S. EPA, 1989a; DTSC, 1990). Furthermore, it is assumed that the concentration for each sample in which the chemical was not detected is one-half the detection limit for that sample. The mean concentration and 95% UCL are therefore calculated based not only on the detected concentrations of each chemical, but also assuming one-half the sample detection limits for the non-detects.

Two soil samples, taken from MW-17 and MW-18, were analyzed for Title 26 metals. The results of these analyses are shown in Table 2-3. Since the arithmetic mean concentration of each metal at the site is within the range of the regional background concentrations of each metal in the western United States, the detected metals are not considered chemicals of potential concern for the remainder of the HRA (USGS, 1984; 1975).

Hydrocarbons were also analyzed for and detected in some of the soil samples. The method for analyzing hydrocarbons was semi-quantitative: a comparison was made between the total ion count of the compound with that of the nearest internal standard. The highest concentration of hydrocarbons was for C6-C13 hydrocarbons at 60 mg/kg at MW-7. Hydrocarbons are not included as a chemical of potential concern in the HRA because their chemical constituents cannot be clearly defined, and the toxicological information necessary for risk assessment is not available from either the U.S. EPA or the DTSC.

2.2.2 Chemicals of Potential Concern in Soil Gas

Ten soil gas samples were collected from ground water monitoring well locations and analyzed by H+GCL using a photovac 10S70 gas chromatograph in March 1992. Figure 4 presents the locations of these onsite soil gas samples. Screen depths ranged from 25 to 75 feet. Four VOCs were detected out of a total of 7 organics that were analyzed:

- PCE
- toluene
- trichloroethene (TCE)
- xylenes, p- and m- isomers

Table B-1 (Appendix B) presents the complete analytical data for each detected chemical for all 10 soil gas samples. Table 2-4 summarizes the analytical data. PCE was detected in all 10 samples, at minimum and maximum concentrations of 5.7E-01 ppm and 7.7E+02 ppm, respectively. Toluene, TCE and xylenes (p- and m-isomers) were detected less frequently and in lower concentrations than PCE. Arithmetic mean concentrations and the 95% UCL of the mean concentrations are calculated, again assuming that each chemical is present in non-detects at one-half the sample detection limit. All four chemicals detected in soil gas are considered chemicals of potential concern in the HRA.

2.2.3 Chemicals of Potential Concern Detected in Ground Water Monitoring Wells

Twenty-four ground water samples were collected in the upper aquifer from 19 locations (17 monitoring wells and 2 soil boring ground water grab sample locations (B1-U and B2-U)) at the Livermore Arcade Shopping Center property. Seventeen of these sampling locations are on the Livermore Arcade Shopping Center property. Two wells, MW-13 and MW-14, are located downgradient of the shopping center. These samples were collected from March 1990 through March 1992, and analyzed by BC Analytical, with the exception of one set of samples from MW-17, which was analyzed by Curtis and Tompkins, Ltd. The locations of the monitoring wells are indicted in Figure 5. Twenty-one samples were analyzed for the volatile organic priority pollutants using U.S. EPA method 624/8240. Other analyses were conducted for the VOCs (U.S. EPA 8010 and 8020), base/neutral and acid compounds (U.S. EPA 625), metals and hydrocarbons. Table 2-1 summarizes the laboratory methods used for ground water sample analyses.

As shown in Table C-1 (Appendix C), four volatile aromatics, eight halogenated volatiles, and two base neutral and acid compounds have been detected in the ground water monitoring wells. These compounds are:

- AROMATIC VOLATILES
  - benzene
  - ethylbenzene
  - toluene
  - xylenes, total
- HALOGENATED VOLATILES
  - bromodichloromethane
  - bromoform
  - chloroform
  - dibromochloromethane
  - 1,2-DCE, cis-
  - Freon 12
  - PCE
  - TCE

- BASE NEUTRAL/ACID COMPOUNDS
  bis(2-ethylhexyl)phthalate
  phenol

Note that four of the halogenated volatiles are trihalomethanes (bromodichloromethane, bromoform, chloroform, and dibromochloromethane). These chemicals are excluded from the baseline HRA because it is believed that the soil at the Livermore Arcade Shopping Center (and notably Mike's Cleaners) is not the source of these chemicals. The onsite sampling did not detect the trihalomethanes in soil.

The remaining 10 organics are considered chemicals of potential concern in the HRA. Table 2-5 provides summary information regarding the frequency of detection and minimum/maximum concentrations for each chemical of potential concern. All chemicals were analyzed for in all 24 ground water samples collected, with the exception of Freon 12, bis(2-ethylhexyl) phthalate, and phenol, which were analyzed for only twice (wells MW-17 and MW-18). PCE was detected most frequently (17 of 24 samples), with a maximum concentration of 5.8 mg/L. Other chemicals detected at similar or higher maximum concentrations include the aromatic volatiles: benzene (14 mg/L); ethylbenzene (3.5 mg/L), toluene (25 mg/L) and total xylenes (20 mg/L).

Two samples, from wells MW-17 and MW-18, were also analyzed for the presence of metals. Arsenic, barium and zinc were detected at concentrations ranging from .004 mg/L to .19 mg/L. These analytical data are presented in Table C-2 (Appendix C). These three metals detected in ground water beneath the Livermore Arcade Shopping Center are not considered chemicals of potential concern in the HRA because the detected levels in soil are within the U.S. Western region range of background concentrations.

Hydrocarbons were analyzed for in some of the ground water samples using a semi-quantitative methodology identical to that used for the analysis of hydrocarbons in soil. The maximum detect was at well MW-1 at 20 mg/L. TPH volatile hydrocarbons (gasoline) were analyzed for using a qualitative method based on a visual comparison of sample chromatograms with those from authentic standards. The maximum detected concentration was 84 mg/L also at well MW-1. Hydrocarbons detected in ground water are not chemicals of potential concern in the HRA, for the reasons explained earlier regarding hydrocarbons in soil.

2.2.4 Chemicals of Potential Concern Detected in California Water Service Ground Water Wells

Six additional ground water samples have been collected from existing California Water Service Wells downgradient of the Livermore Arcade Shopping Center. These data are presented in Table C-3 (Appendix C). Bromochloromethane, bromodichloromethane and dibromochloromethane were detected once in the 6 samples, while chloroform was detected three times at a maximum concentration of 7E-04 mg/L. The data collected from these wells will not be included in the baseline HRA because it is assumed that the soil at the Livermore Arcade Shopping Center is not the source of these VOCs.

2.3 DERIVATION OF REPRESENTATIVE CONCENTRATIONS (RCs)

The representative concentration (RC) of each chemical of concern identified in soil, soil gas and ground water is required in order to calculate chemical intake and the resulting human health risk. A RC, as suggested in U.S. EPA and DTSC guidance, is the lesser of either the 95% UCL of the arithmetic mean or the maximum detected concentration for each chemical (U.S. EPA, 1989a; DHS, 1990). RCs for each chemical detected in soil and soil gas are presented in Tables 2-6 and 2-7, respectively by comparing the 95% UCL of the arithmetic mean and the maximum detected concentration for each chemical.

The methodology is somewhat different for the derivation of RCs in ground water. Risks arising from exposures to ground water at Livermore Arcade Shopping Center will be estimated separately for each ground water well, instead of for all ground water data combined. Therefore, a RC must be calculated for each chemical at each and every well. Three general cases arose for deriving RCs. RCs were derived for each chemical at each well as described below:

Case 1) More than one sample was collected from a particular monitoring well, and a particular chemical was detected at least once in the samples. In this case, similar to soil or soil gas, the RC is the lesser of the 95% UCL of the arithmetic mean or the maximum detected concentration. The 95% UCL is calculated assuming the concentrations of non-detects as one-half the sample detection limit.

Case 2) A chemical is detected in ground water at Livermore Arcade Shopping Center but not detected in the sample or samples collected from a particular monitoring well. In this case, the RC is one-half the detection limit of the sample collected at the well, or the average of one-half the detection limits of the samples collected at this well.

Case 3) One sample is collected from a particular well, and a particular chemical is detected. In this case, the RC for that particular chemical is the detected concentration.

Table 2-8 presents the RCs for each chemical at each well.

2.4 SUMMARY OF CHEMICALS OF POTENTIAL CONCERN

Table 2-9 summarizes the chemicals of potential concern for soil, soil gas and ground water. The current evidence regarding the potential toxicity for each chemical is also presented. Several physical/chemical properties of each chemical are listed in Table 2-10 to be used to estimating chemical exposures in Chapter 3.

3.0 EXPOSURE ASSESSMENT

The exposure assessment is the chapter that provides estimates of chemical exposure to the receptor populations who may come in contact with the organic compounds detected at the Livermore Arcade Shopping Center. The U.S. EPA identifies four tasks for the exposure assessment. The first task is to identify the potentially exposed human populations. This requires knowing which groups of individuals may have access to the facility property both presently and in the future.

The next task is to select the exposure pathways that are relevant in the analysis. These are the pathways by which the potentially exposed populations may come in contact with the organic chemicals originating in soil, soil gas and ground water at the site.

The third task estimates Exposure Point Concentrations (EPCs) at the potential points of human contact for the organic compounds of concern. EPCs are estimated separately for each environmental medium. EPCs for the organics detected in soil and ground water are derived directly from the concentrations detected in the sampling program. EPCs in ambient air are estimated for the VOCs detected in the soil gas. EPCs for chemicals detected in soil leaching into the ground water upper and lower aquifers are estimated using a chemical fate and transport model.

The fourth task provides estimates of the Chronic Daily Intakes (CDIs) of chemicals for all of the exposure routes included in the baseline HRA. The CDIs are derived using the EPCs and health conservative exposure assumptions regarding such variables as exposure duration, absorption factors, and human activity.

This chapter is organized to follow the U.S. EPA risk assessment guidelines (U.S. EPA, 1989a). EPC and CDI estimates are provided for the organics detected in soil, soil gas and ground water in

Section 3.4. Section 3.5 presents the contaminant fate and transport model that describes the upper-bound estimates of EPC and CDI levels for the VOCs detected in soil that may migrate downward through the soil column to eventually impact the upper and lower ground water aquifers beneath the property.

3.1 CHARACTERIZE THE EXPOSURE SETTING

This section summarizes the physical setting of the Livermore Arcade Shopping Center property and how it may relate to potential human exposures to the detected organic compounds. Both potential current and future exposed populations are identified.

3.1.1 Physical Setting

3.1.1.1 Climate

The City of Livermore has a mediterranean type climate characterized by warm, dry summers and cooler, wet winters. Rain occurs primarily in the winter months with an approximate average of 14.5 inches/yr (NWS, 1992). Livermore's monthly average high and low temperatures vary from an average high of 88.6 °F in August to an average low of 36.3 °F in January. Winds are generally from the W and SW directions with an average wind speed of 4.4 mph (2.0 m/s) measured at the California Air Resources Board's Livermore meteorological station (CARB, 1984).

3.1.1.2 Vegetation

The Livermore Arcade Shopping Center consists of several buildings which occupy a high percentage of the total surface area. The other areas of the property are currently covered by asphalt and/or concrete. The only vegetation present at the property are ornamental trees and plants.

3.1.2 Potentially Exposed Populations

This section identifies the human populations that are assumed to be potentially impacted by the organic compounds detected in soil, soil gas and ground water at the property. Current and future land use conditions are considered.

3.1.2.1 Current Land Use

The Livermore Arcade Shopping Center is a property consisting of 15 businesses. Ground water monitoring wells have been installed at various locations throughout the property. In addition, two monitoring wells that have been sampled by H+GCL (MW-13 and MW-14) are located to the north and downgradient of the shopping center (see Figure 5). All monitoring wells are installed in the upper aquifer. At the present, ground water in the upper aquifer located directly beneath the contaminated soils at the site is not known to be used for any purpose. Ground water located downgradient of the shopping center in the deeper aquifer is used for drinking water purposes by the California Water Service (CWS).

Because asphalt and concrete currently cover the shopping center and ground water in the upper aquifer is not used for drinking water purposes, the highest potential exposures to the detected organic chemicals would result from a population having the potential to inhale air containing soil gas that has migrated through the asphalt/concrete cover.

3.1.2.2 Future Land Use

Currently there are no plans to convert the Livermore Arcade Shopping Center to uses other than a commercial use facility. Regardless, U.S. EPA and DTSC risk assessment guidance documents suggest that a baseline analysis assume that in the future the property could be used for residential purposes. Assuming a future residential use represents a health conservative approach for estimating potential human health risks. This assumption is consistent with the Reasonable Maximum Exposure (RME) methodology recommended by the U.S. EPA and the DTSC (U.S. EPA, 1989a; DHS, 1990).

3.2 IDENTIFY POTENTIAL EXPOSURE PATHWAYS

The U.S. EPA identifies an exposure pathway as consisting of four necessary elements (U.S. EPA, 1989a):

"1) a chemical source and mechanism of chemical release,

2) a retention or transport medium (or media in cases involving media transfer),

3) a point of potential human contact with the contaminated medium (referred to as an exposure point), and

4) an exposure route (e.g., ingestion) at the exposure point."

3.2.1 Sources and Receiving Media

The potential chemical source area for the chlorinated VOCs has been identified as a broken sewer pipe beneath Mike's Cleaners (Hygienetics, 1990). The analytical evidence from soil indicates PCE was discharged through a floor drain that connects with the broken sewer pipe. Other VOCs detected at the facility are believed to have been discharged along with PCE or are PCE degradation products.

The aromatic VOCs derived from gasoline products detected in ground water at the facility (benzene, ethylbenzene, toluene and xylene) are believed to be the result of a source located to the southeast of the property. These aromatic VOCs detected in ground water are included in the baseline HRA for completeness. These chemicals have not been detected in soil at the property.

The analytical results obtained from the soil and ground water samples indicate that the organic chemicals have adsorbed onto soil particles beneath Mike's Cleaners. These chemicals have migrated to the upper aquifer ground water zone beneath the facility. Therefore, the soils can be viewed as both a retention and transport medium. In addition, several organics have been detected in soil gas beneath the shopping center.

3.2.2 Exposure Points and Exposure Routes

Exposure points are the assumed onsite locations where the potentially exposed populations may come in contact with the detected chemicals. Exposure routes are defined as the physical mechanisms by which chemicals may enter the human body, i.e. ingestion, dermal absorption and inhalation. The baseline HRA follows U.S. EPA and DTSC risk assessment guidance by identifying exposure points and the potential exposure routes for both the present and future land use conditions.

3.2.2.1 Present Land Use Conditions

Since the ground water in the upper aquifer beneath the property is not used as a current drinking water source, the present land use conditions at the Livermore Arcade Shopping Center property suggest that the inhalation of soil gas is the only complete exposure pathway that currently exists at the property. In addition, the potential inhalation exposures would be reduced due to the presence of asphalt and/or cement foundations that currently exist at the shopping center. Potential health risks for present land use receptor populations will be evaluated qualitatively in Chapter 5, the risk characterization section of the HRA.

are summarized in Table 3-1. These assumptions are used to estimate exposures to the future onsite residents. The assumptions have been compiled from the U.S. EPA reference sources noted in the table.

Following agency guidance, the baseline HRA assumes that the detected organics will remain at the same concentrations throughout the 30 year exposure duration used in this analysis (U.S. EPA, 1989a. Therefore, naturally occurring remedial actions that result in lower chemical concentrations over time such as biodegradation, chemical degradation and other mechanisms are assumed not to occur in this baseline HRA.

3.4 QUANTIFICATION OF EXPOSURE

This section presents the two steps required to quantify potential human exposures to the detected chemicals included in this analysis: 1) the estimation of Exposure Point Concentrations (EPCs) of detected chemicals in soil, soil gas and ground water, and 2) the estimation of chronic daily intakes (CDIs) for the detected chemicals of concern. Note that the fate and transport modeling for the VOCs detected in soil that may migrate into ground water is presented in Section 3.5.

3.4.1 Estimate Exposure Point Concentrations (EPCs)

The U.S. EPA defines EPCs as the chemical concentrations in environmental media at the points of potential human contact (U.S. EPA, 1989a). The methodology employed in the baseline HRA provides health conservative estimates of EPCs that tend to overestimate the chemical concentrations at the points of potential human contact. The future onsite resident exposure scenario includes EPCs for soil, air, and ground water based on the environmental sampling conducted at the property to date.

3.4.1.1 Soil EPCs

The analytical results of the onsite soil samples are presented in Appendix A. Table 2-1 provides statistics for these soil data as the maximum and minimum detected concentration, estimates of the average concentration and the 95% UCL of the arithmetic mean. Following U.S. EPA and DTSC guidance, the lesser of either the maximum detected concentration or the 95% UCL for each individual chemical was selected as its representative concentration (RC) (see Table 2-6). Because exposure to chemicals detected in soil involves direct contact (soil ingestion, dermal absorption), the soil RCs in Table 2-6 are identical to the EPCs presented in Table 3-2. The EPCs are used to estimate soil ingestion and dermal absorption exposures for the future onsite resident scenario.

3.4.1.2 Soil Gas EPCs

VOCs detected in soil gas vapors have the potential to volatilize upward through the interconnected air-filled pores of the unsaturated zone and impact the breathing zone of individuals standing on top of the soil at the property. Four VOCs have been detected in the onsite soil gas samples collected by H+GCL. The soil gas summary statistics are presented in Table 2-4 and the representative concentrations (RCs) in Table 2-7. The analytical data for the 10 soil gas samples are presented in Appendix B.

The soil gas EPCs in air are estimated using the methodology that follows. Diffusion dependent vapor movement is modeled using Fick's Law of Diffusion to approximate the rate that detected soil gas VOCs may be emitted from the soil surface and cross the soil/lower atmosphere interface. Fick's Law can be represented by several equations. The method developed by Farmer provides an equation that uses analytical soil data and has been recommended by the U.S. EPA in the Exposure Assessment Manual as Farmer's model reevaluated by Shen (U.S. EPA, 1988). Farmer's model was developed specifically for estimating VOC emissions from a landfill without internal gas generation. This equation has been validated specifically for predicting hexachlorobenzene emissions under these conditions (Farmer, 1978). Emission rates for the VOCs detected in soil gas samples can be approximated using this VOC air transport equation:

$$Q = D_i \ (p_A^{10/3} \ / \ p_T^2) \ (C_i \ / \ L) \ (1 \ g/1{,}000{,}000 \ ug)(1 \ L/1{,}000 \ cm^3)$$

where:

Q = soil gas emission rate (g/cm^2-sec);

D_i = diffusion coefficient of chemical i in air (cm^2/sec);

P_A = air-filled soil porosity (dimensionless);

P_T = total soil porosity (dimensionless);

C_i = concentration of chemical i (ug/l) in the soil vapor at depth L (Representative Concentrations (RCs)); and

L = average depth of the onsite soil gas samples (cm).

The diffusion coefficients in air for the detected onsite soil gas VOCs have been derived based on physical/chemical property estimation methods (Shen, 1981; U.S. EPA, 1990). These values are presented in Table 2-10.

The air filled soil porosity (P_A) of the soils at the Livermore Arcade Shopping Center has not been measured. For purposes of the HRA, an air filled soil porosity estimate of 0.3 is assumed based on the measurement of soils under dry conditions (Shen, 1981). Using the value derived for dry soil conditions maximizes the potential soil gas emission rates into the lower atmosphere.

Total soil porosity (P_T) for the onsite soils has not been estimated. This HRA uses a conservative estimate of 0.55 based on the range of 0.35 - 0.55 published in the California Site Mitigation Decision Tree Manual (DHS, 1986). Using the 0.55 value is recommended for dry, non-compacted soils.

The soil gas RCs for the detected onsite chemical compounds in units of ug/L are presented in Table 2-7.

The depth of the soil cover (L) is modeled as the average depth of the soil gas samples obtained throughout the property (30.6 feet or 932.7 cm).

The estimated soil gas emission rates into the lower atmosphere are given in Table 3-3.

Concentrations of the chemicals of concern in ambient air are derived based on the estimated soil gas emission rates into the lower atmosphere. Generally, the estimation of ambient air concentrations resulting from the emission of VOCs into the lower atmosphere is calculated using air dispersion models (e.g. Gaussian plume model). These atmospheric dispersion models are most appropriate when the source of the emitted chemicals is located some minimum distance from the receptors of concern, typically regarded as approximately 100 meters. However, this baseline HRA assumes that VOC soil gas compounds may be emitted directly underneath an exposed individual. This assumption maximizes the potential VOC emission rates.

The California Air Resources Board recommends using the "box model" methodology for onsite ambient air exposure estimates (DaMassa, 1992). This simplified atmospheric dispersion model has been used in several applications for developing air concentration estimates for area source emissions (Hanna et al., 1982). The box model methodology estimates ambient air concentrations and the potential inhalation exposures by placing a hypothetical box over the exposed individual that extends on four sides from the ground to nose height. The VOCs in soil gas that enter the lower atmosphere via volatilization through soil are diluted by the volume of the hypothetical box and by wind movement through the box. To estimate exposures using the box model, several assumptions are required: 1) the soil gas volatilization rates are assumed to remain constant over the entire exposure duration, although the soil gas concentrations may actually decrease over time, 2) the VOC compounds are uniformly mixed inside the box, and 3) the wind speed is uniform within the box. The box model equation used to estimate ambient air concentrations of the detected soil gas compounds is given as (Hanna et al., 1982):

$$C = (\text{delta } x)(Q)(1{,}000{,}000 \text{ ug/g})\ (1{,}000{,}000 \text{ cm}^3/\text{m}^3)\ /\ ((z)(u))$$

where:

C = soil gas ambient concentration within box (ug/m^3);
delta x = length of the box along the direction of wind flow (m);
Q = soil gas emission rate, from Table 3-3 (g/cm^2-sec);
z = mixing depth (cm); and
u = wind speed along the x direction (m/sec).

A box volume of 10 meters wide by 10 m long by 1.5 m high (average nose height) is used as the volume of air that flows over a person standing on-site. The length of the box along the direction of wind flow is 10 meters.

The average nose level height of the potentially exposed individuals is assumed to be 150 cm, or slightly under 5 feet (Hanna et al., 1982).

A wind speed of 2.0 m/sec is used in the box model equation based on the average annual wind speed of 4.4 mph recorded at the California Air Resources Board's meteorological field station in

Livermore (CARB, 1984).

Table 3-3 presents the ambient air EPCs estimated using the above equation regarding the migration of VOCs in soil gas into the lower atmosphere and into the breathing zone. These concentrations are used to estimate intake of VOCs for the inhalation exposure route and are assumed to remain constant over the entire exposure duration for the future onsite resident exposure scenario.

3.4.1.3 Ground Water EPCs

The baseline HRA evaluates ground water beneath the Livermore Arcade Shopping Center assuming the presence of two aquifers. These two aquifers are called the upper and the lower aquifers. The uppermost zone of the upper aquifer is located approximately 60 feet below grade. The water bearing portion of the upper aquifer has a thickness that ranges from approximately 13-32 feet. All of the monitoring wells sampled by H+GCL in this analysis have been installed in the upper aquifer.

An aquitard consisting of approximately 40 feet of a series of clay and clay sand layers separates the two aquifers. The deeper aquifer is located approximately 120 feet below the ground surface and has a thickness ranging from 35-40 feet. An average depth of 37.5 feet is assumed in this analysis. The offsite CWS wells sampled by H+GCL are installed in the deeper aquifer. The deeper aquifer is used in the baseline HRA to estimate the upper-bound ground water concentrations that may result if the organics detected in the upper aquifer would have the potential to impact the lower aquifer. This analysis is conducted in Section 3.5.

The potential exposure points via the ground water pathways are identified as the individual monitoring wells that have been sampled by H+GCL. This baseline HRA assumes that the potential future onsite residents will use ground water from directly beneath the site for both drinking water and domestic water purposes at the locations of the monitoring wells.

The data for the ground water monitoring wells are given in Appendix C, Table C-1. Table 2-5 presents a summary of the ground water data. RCs for the organic compounds detected in ground water are listed in Table 2-8. The EPCs in ground water are equivalent to the RCs in ground water because the direct contact pathways are involved. Note that this is similar to the use of RCs and EPCs in soil. The EPCs are used to estimate the potential chemical exposures resulting from the use of ground water for the future onsite resident scenario.

3.4.2 Estimation of Chemical Intakes

This section presents the necessary equations and assumptions used to estimate chemical intakes for the potentially exposed future onsite resident population. These individuals would be exposed to the detected organic chemicals via soil ingestion, dermal absorption of soil-bound chemicals, inhalation of soil gas, and the ingestion and dermal absorption/inhalation of organics in drinking water. Using U.S. EPA and DTSC guidance, chemical exposures via a onsite residential scenario are assumed to last for a 30 year exposure duration (U.S. EPA, 1989a; DHS, 1990).

A 30 year exposure duration could begin while an individual is a child or an adult. Based on these possibilities, potential exposures are estimated for two cases: 1) an individual moves to an onsite residence as an adult and is exposed for 30 years, and 2) an individual spends his childhood and part of adulthood at the site so that 6 years are spent as a child and 24 years as an adult. Both of these potential exposure scenarios are designed to follow U.S. EPA and DTSC methodology (U.S. EPA, 1989a; DHS, 1990).

This section derives quantitative estimates of chemical intake, called chronic daily intakes (CDIs). CDIs are provided in units of milligram of chemical intake per kilogram of human body weight per day (mg/kg-day). CDI estimates are presented in several tables. CDIs for the future onsite resident who spends his entire 30 exposure duration on the site as an adult are presented in Tables 3-4 and 3-5 for the carcinogens and Tables 3-6 and 3-7 for the noncarcinogens. CDI estimates for carcinogens and noncarcinogens are different because the Averaging Time (AT) is different, as recommended by the U.S. EPA (U.S. EPA, 1989a). The varying averaging times imply that exposures to carcinogens are estimated as lifetime average CDIs (assumed as 70 years in health risk assessment), while the exposures to noncarcinogens are estimated only during the time duration that an individual is being exposed to the chemicals. Thus, for carcinogens the Exposure Duration (ED) is 30 years, while the Averaging Time (AT) is 70 years. For the noncarcinogens, both the ED and the AT are assumed as 30 years.

For the individual who spends time at the property both as a child and as an adult, the CDIs for the carcinogens and noncarcinogens are presented in Tables 3-8 through 3-11. Reviewing all of the CDI tables indicates that the onsite resident who spends his exposure duration as a child/adult has higher CDI estimates than the onsite resident exposed as an adult only. The relatively smaller body size of the child as compared to the rate of chemical intake results in higher child/adult CDI estimates.

3.4.2.1 Exposures via Soil Ingestion

Potential exposures to the soil-bound VOCs via soil ingestion may occur when individuals come in contact with soil and exhibit hand-to-mouth activities. This activity has been studied by many investigators and several soil ingestion rate estimates have been published in the literature. Based on these published soil ingestion estimates, the U.S. EPA has estimated their own soil ingestion rate values. U.S. EPA guidance suggests that for the residential exposure scenario, the soil ingestion rates of 200 mg/day for children ages 1-6 years, and 100 mg/day for older age groups should be used in the absence of site-specific data (U.S. EPA, 1989a).

CDIs via soil ingestion are estimated in this baseline HRA for the future onsite resident using the following equation (U.S. EPA, 1989a):

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where:

CS = Chemical concentrations (EPCs) in soil, are presented in Table 3-2 (mg/kg);

IR = Soil ingestion rate of 200 mg/day for children ages 1-6 in a residential setting and 100 mg/day for adults in a residential setting (U.S. EPA, 1989a);

CF = Conversion Factor (1.0E-06 kg/mg);

FI = Fraction of chemicals absorbed into GI tract, assumed as 100% for all chemicals;

EF = Exposure frequency, assumed as 365 days/year for the onsite residents;

ED = Exposure duration, assumed as 30 years for the onsite residents;

BW = Lifetime average body weight of 70 kg for an adult and 16 kg for a child (U.S. EPA, 1989a); and

AT = Averaging time (period over which exposure is averaged, in days) assumed as 25,550 days (365 days/year x 70 years) for carcinogens and 10,950 days (365 days/year x 30 years) for noncarcinogens.

The soil ingestion CDI estimates for the future onsite residents (adult and child/adult) are presented in the tables identified above.

3.4.2.2 Exposures via Dermal Absorption

Dermal absorption exposures occur when soil particles containing adsorbed chemical compounds deposit on the skin surface. When this occurs, the organics can migrate through the semipermeable skin layer and enter the human body. Several variables are required to estimate the magnitude of exposure via the dermal absorption of VOCs. These factors include the area of skin exposed, the amount of soil depositing onto the skin, and the fraction of the total amount of the chemical that can cross the skin layer.

The surface area of the exposed skin is an important factor in estimating exposures via dermal contact with soil. Exposed skin surface areas have been estimated from surface area estimates for various parts of the body and exposure assumptions developed by the U.S. EPA. The absorption of chemicals through the skin has been studied using solvent vehicles such as acetone. Data regarding the dermal absorption of chemicals from soil are scant. Although several studies have been conducted regarding the possibility of physical/chemical properties that can be used to predict transdermal movement, the results have, thus far, been inconclusive. A dermal absorption efficiency factor of 10% is adopted for use in this baseline HRA, based on guidance published by the South Coast Air Quality Management District (SCAQMD, 1988).

Based on U.S. EPA and DTSC guidance, the following equation is used in the baseline risk assessment to estimate VOC exposures via dermal absorption (U.S. EPA, 1989a):

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

CS = Chemical concentrations (EPCs) in soil, presented in Table 3-2 (mg/kg);

CF = Conversion Factor (1.0E-06 kg/mg);

SA = Skin surface area available for contact (cm^2/event), 6,990 cm^2/day for an adult via residential exposure and 2,570 cm^2/day for a child via residential exposure;

AF = Soil to skin adherence factor, assumed as 2.77 mg/cm^2 (U.S. EPA, 1989a);

ABS = Absorption factor for soil-bound VOCs assumed as 10% for organics (SCAQMD, 1988);

EF = Exposure frequency, assumed as 365 days/year for the onsite residents;

ED = Exposure duration, assumed as 30 years for the onsite residents;

BW = Lifetime average body weight of 70 kg for an adult and 16 kg for a child (U.S. EPA, 1989a); and

AT = Averaging time (period over which exposure is averaged, in days) assumed as 25,550 days (365 days/year x 70 years) for carcinogens and 10,950 days (365 days/year x 30 years) for noncarcinogens.

The dermal absorption CDI estimates for the future onsite residents (adult and child/adult) are presented in the tables identified above.

3.4.2.3 Exposures via Inhalation of Soil Gas

Soil gas that migrates from soil beneath the future onsite residents can enter the lower atmosphere and impact the breathing zone. These chemicals would be inhaled along with air. The following equation is recommended by the U.S EPA and the DTSC for estimating exposures via the inhalation of chemicals (U.S. EPA, 1989a; DHS, 1990):

$$\text{Chronic Daily Intake (CDI) (mg/kg-day)} = \frac{CA \times CF \times IR \times EF \times ED}{BW \times AT}$$

where:

CA = Chemical concentration in air, EPCs in air (ug/m^3), as derived using the box model methodology (see Table 3-3);

CF = Conversion Factor (1.0E-03 mg/ug);

IR = Inhalation rate, assumed as 30 m^3/day for an adult onsite resident and 22.5 m^3/day for a child resident (see Table 3-1);

EF = Exposure frequency, assumed as 365 days/year for the onsite residents;

ED = Exposure duration, assumed as 30 years for the onsite residents;

BW = Lifetime average body weight of 70 kg for an adult and 16 kg for a child (U.S. EPA, 1989a); and

AT = Averaging time (period over which exposure is averaged, in days) assumed as 25,550 days (365 days/year x 70 years) for carcinogens and 10,950 days (365 days/year x 30 years) for noncarcinogens.

The CDI estimates from the inhalation of soil gas for the future onsite resident scenario (adult and child/adult) are presented in the tables identified above.

3.4.2.4 Exposures via Ground Water

CDI exposure estimates for ground water are derived below for the following pathways: ground water ingestion, inhalation of water-borne vapors, and dermal absorption of the detected chemicals through bathing and cleaning. CDI estimates are derived separately for each ground water well, based on the representative concentrations of chemicals in ground water, as estimated from the ground water sampling analyses.

3.4.2.4.1 Ingestion of Ground Water

The quantity of tap water an individual consumes daily varies according to climate, the level of physical activity, and individual habits and requirements. At the present, the U.S. EPA and the DTSC recommend using a daily average water consumption rate of 2 liters (L) for adults. Water consumption rate studies conducted by the National Cancer Institute (NCI) indicate that an average value is approximately 1.4 L/day (U.S. EPA, 1989b). Use of the 2 L/day estimate suggested by the regulatory agencies is likely to be a 90th percentile, or "reasonable worst case" estimate of drinking water ingestion under normal circumstances (U.S. EPA, 1989b). This baseline risk assessment uses the upper-bound value of 2 L/day for adults. A ground water ingestion rate of 1.5 L/day is used for children following U.S. EPA recommendations (U.S. EPA, 1989b).

The potential intake of organic compounds in drinking water is estimated using the following equation (U.S. EPA, 1989a):

$$\text{Chronic Daily Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

where:

CW = Chemical concentration in water (mg/L) based on the analytical data collected from the monitoring wells (see Table 2-8);

IR = Ingestion rate, assumed as 2 L/day for an adult and 1.5 L/day for a child (U.S. EPA, 1989a; U.S. EPA, 1989b);

EF = Exposure frequency assumed as 365 days/year for the onsite residents;

ED = Exposure duration, assumed as 30 years for the onsite residents;

BW = Lifetime average body weight of 70 kg for an adult and 16 kg for a child (U.S. EPA, 1989a); and

AT = Averaging time (period over which exposure is averaged, in days) assumed as 25,550 days (365 days/year x 70 years) for carcinogens and 10,950 days (365 days/year x 30 years) for noncarcinogens.

The ground water ingestion CDI estimates for the future onsite residents (adult and child/adult) are presented in the tables identified above.

3.4.2.4.2 Ground Water Inhalation and Dermal CDIs

The transfer of organic compounds from water to air may occur during the residential use of ground water as a result of vapor diffusion from appliances such as showers, baths, toilets, dishwashers and washing machines, and from other activities such as cooking and cleaning. The potential inhalation of these compounds can occur within the household to a significant extent, thereby adding to exposures from water ingestion alone.

In addition, exposures via the absorption of organics in water may occur as they pass through the semi-permeable skin layer during bathing and cleaning. The transdermal movement of organic chemicals is not well understood, although it is known that some physical/chemical properties, such as the octanol/water partition coefficient, may be an important influence. The temperature of the tap water may also be important in estimating dermal uptake of organics from tap water.

Studies regarding the indoor inhalation/dermal absorption of waterborne VOCs, such as TCE, indicate that exposures via this pathway may exceed the exposures from direct ingestion, assuming an ingestion rate of 2 L/day (McKone, 1987). U.S. EPA Region IX guidelines suggest a method of accounting for exposures via this pathway, which is to multiply the exposure estimates derived for ground water ingestion by two (U.S. EPA, 1989c). This approach is adopted in this baseline HRA to estimate the CDIs via the inhalation/dermal absorption of waterborne organic chemicals. Therefore, the ground water CDI tables indicate that the CDIs for inhalation/dermal absorption are identical to the ingestion CDIs for ground water.

3.5 FATE AND TRANSPORT MODELING

This section of the baseline HRA discusses the chemical fate and transport modeling that estimates the impact that the VOCs detected in the onsite soils may have on ground water. The onsite soil sampling conducted by H+GCL detected four VOCs in soil at varying depths. These VOCs are cis-1,2-dichloroethene, methylene chloride, PCE and 1,1,1-trichloroethane. Two fate and transport modeling scenarios are presented in this section, which are designated as case #1 and case #2.

Case #1 evaluates the fate and transport modeling involving the potential for precipitation to infiltrate through the soil at the site and impact ground water. The amount of precipitation is called net infiltration which is the amount of rainwater, minus the potential for evaporation, that may infiltrate through the onsite soil to form leachate that will impact ground water. Case #2 of the fate and transport modeling evaluates the ground water concentrations that would result from the upper aquifer ground water table rising to its documented historical levels. The rising ground water table would impact the VOCs adsorbed to the deeper soils that were once part of the upper ground water aquifer before the drought. Ground water EPCs and CDIs are presented for these two fate and transport modeling cases.

For both cases, the concentrations of the VOCs in ground water directly beneath the contaminated soil source area are estimated in order to provide an upper-bound estimate of the aqueous concentrations that may exist. The chemical fate and transport modeling is designed to provide health-conservative estimates of ground water concentrations directly beneath the detected soil contamination. In order to estimate the potential ground water exposures to the individuals who may be living at the property in the future, it is assumed that a drinking water well may be constructed in the upper and lower aquifer zones directly beneath the detected VOCs in soil.

3.5.1 Case #1

Case #1 evaluates the VOC concentrations in ground water that would result from the infiltration of precipitation through the contaminated soils at the Livermore Arcade Shopping Center property. Since the entire soil column will be infiltrated by the rainwater passing through soil, the representative concentrations presented for the onsite VOCs in Table 3-2 serve as the database for this analysis.

3.5.1.1 Estimate Leachate Concentrations

An estimate of the upper-bound VOC concentrations in leachate is required to model the impact that these chemicals may have on ground water. A simplified vadose zone model is used to derive upper-bound estimates of the organic compounds in leachate that may be formed as precipitation infiltrates the soil and percolates downward through the unsaturated zone. This analysis should be regarded as a health conservative approach because it is assumed that precipitation is able to infiltrate the onsite soils without the asphalt cap limiting the movement of rainwater. This assumption is health conservative compared to the H+GCL model in the Remedial Investigation that suggests the movement of VOCs in soil is driven primarily by gravity.

The methodology selected to estimate upper-bound leachate concentrations is based on the physical/chemical properties of VOCs and the concentrations of these chemicals detected in the onsite soils. It is assumed that the VOCs achieve equilibrium with the infiltrating rain water while moving through the unsaturated zone. The selected vadose zone screening model uses only the soil-organic carbon partition coefficient (K_{oc}) for the individual chemicals detected in soil. The U.S. EPA has used similar approaches for estimating leachate concentrations in applications such as the Liner Location Model.

The upper-bound leachate concentrations for the detected VOCs are estimated using the following equation:

$$C_L = C_s/(K_{oc} \times f_{oc})$$

where:

C_L = upper-bound average leachate concentrations for the detected VOCs in soil, in units of mg/L;

C_s = RCs in soil (Table 3-2), in units of mg/kg;

K_{oc} = soil-organic carbon partition coefficient for the individual VOCs (see Table 2-10); and

f_{oc} = fraction of organic carbon in soil, assumed as 0.001 for nonagricultural soils.

The upper-bound leachate concentrations for the detected VOCs are presented in Table 3-12.

3.5.1.2 Estimates of Net Precipitation Infiltration

Leachate will be formed as precipitation infiltrates through the VOCs detected in soil and passes through the soil column. The water balance model developed by Thornthwaite and Mather is used to derive estimates of net infiltration that would be expected at the shopping center property (Thornthwaite and Mather, 1957; 1955). The Thornthwaite and Mather water balance model has been used by several U.S. EPA program offices for estimating the net infiltration of rain water at hazardous waste sites. The algorithm for the Thornthwaite and Mather water balance model is presented below:

$$\text{Average Net Infiltration} = \text{Precipitation} - \text{Evaporation} - \text{Surface Runoff} - \text{Soil Storage}$$

The Thornthwaite and Mather model defines average net infiltration as a function of the precipitation level minus the factors that prevent rain from infiltrating through soil, such as evaporation, surface runoff and soil storage. This algorithm defines "average net infiltration" as the amount of precipitation that is available to form leachate. Evaporation is more appropriately defined as "potential evapotranspiration" and is regarded as the reverse of precipitation since it represents the transport of water from the earth back to the atmosphere. Surface runoff is defined as water that flows directly off the soil surface due to differences in surface grade height. Soil storage is an estimate of the soil moisture storage capacity and is defined as the quantity of water that can be held in place around soil particles and is therefore not free to move downward in the unsaturated zone.

The parameters on the right hand side of the above equation have been estimated using site-specific meteorological information from the Livermore area. Climatological data collected at the meteorological station in Livermore was obtained from the National Weather Service office in Redwood City, California. The NWS database has average monthly precipitation and temperature data collected over a 30 year period in Livermore. The NWS data indicates that the City of Livermore received an annual average rainfall of 14.6 inches per year during this time period.

Three health conservative assumptions have been used to predict the upper-bound quantity of leachate that could potentially be produced at the Livermore Arcade Shopping Center:

1. The property is assumed to have no vegetation or asphalt covers that would prevent the movement of precipitation downward through the soil column.

2. The property is assumed to be perfectly flat, so that a runoff coefficient is not used.

3. The soil storage moisture value is assumed to be zero.

Using the Livermore precipitation data and the above assumptions, an upper-bound net precipitation infiltration rate of 6.3 inches/year has been estimated using the Thornthwaite and Mather water balance model. This health conservative net infiltration value is used to estimate the upper-bound concentrations of VOC leachate in ground water.

3.5.1.3 Estimate Ground Water Exposure Point Concentrations

The leachate concentrations and net infiltration estimates derived above are used to estimate the upper-bound ground water concentrations directly beneath the VOCs detected in soil. This analysis assumes that ground water wells used for drinking water purposes may be constructed onsite in the future and that no remedial activities will be conducted at the property.

The VOCs in leachate will enter the upper aquifer at a constant mass loading rate that is dependent only on the volume of leachate and the chemical concentrations. Based on a volume for volume ratio, the organic compounds will be diluted in aqueous concentration by the volume of the ground water in the uppermost aquifer. No downgradient transport or degradation of the VOCs is assumed in this analysis.

To estimate the upper-bound ground water concentrations of the organic compounds, it is assumed that all of the leachate produced in the contaminated soil at the property will enter the upper aquifer. H+GCL has estimated that the soil-bound VOCs occupy a surface area of approximately 40 feet on a side (total surface area of 1,600 ft^2). The thickness of the water bearing zone in the upper aquifer has been measured several times. While the historical data indicate that this aquifer has an average thickness of 32 feet, more recent measurements indicate that at the present time the aquifer has an approximate thickness of 13 feet. Both values are used in the baseline HRA. The thickness of the lower aquifer has been estimated to range from approximately 35-40 feet.

The volumetric flow rate of leachate (Q_p) is estimated based on the surface area of the contaminated soil (1,600 ft^2) and the net infiltration of precipitation (6.3 inches/year). The volumetric flow rate of leachate produced annually is estimated as:

$$Q_p = (1{,}600\ ft^2)(6.3\ inches/year)(1\ foot/12\ inches)$$
$$= 840\ ft^3/year$$

The leachate generated at the property will be diluted by the volume of ground water in the upper aquifer. Because it is assumed that leachate will migrate directly downward, the surface area of the aquifer impacted by leachate will be equal to the surface area of the property estimated as containing the detected VOCs. The volumetric flow of ground water (Q_{gw}) is estimated using the following equation:

$$Q_{gw} = GWFR \times d \times 1$$

where:

GWFR = ground water flow rate for the upper aquifer, estimated as 0.274 ft/day, or 100 ft/year, (units in ft/year);

d = aquifer thickness, estimated as either 13 feet or 32 feet (units in feet); and

l = length of the contaminated soil perpendicular to ground water flow, estimated as 40 feet (units in feet).

Ground water volumetric flow rate values of 52,000 ft^3/year and 128,000 ft^3/year are estimated using the above equation. The dilution of leachate by the aquifer (ratio of the volumetric leachate flow to the ground water flow) is represented by the following equation:

$$Q_p \;/\; (Q_p + Q_{gw})$$

Solving this equation for the two upper aquifer thicknesses results in leachate dilution factors of 0.0159 and 0.0065 for the uppermost aquifer. Multiplying these factors by the leachate concentrations estimated above results in estimating ground water concentrations in the upper aquifer. These values are the upper aquifer EPCs given in Table 3-12.

The VOCs included in the fate and transport modeling for the upper aquifer are assumed to have the potential to reach the lower aquifer at the site. The fate and transport modeling for the VOCs impacting the lower aquifer is conducted by applying a dilution factor to the upper aquifer concentrations. The depth of the lower aquifer has been estimated as ranging from 35-40 feet. An average of 37.5 feet is used. These dilution factors are estimated using the thicknesses of each aquifer in the following equations:

$$\text{Dilution Factor (13')} = 13 \text{ feet} \;/\; (13 \text{ feet} + 37.5 \text{ feet}) = 0.26$$

$$\text{Dilution Factor (32')} = 32 \text{ feet} \;/\; (32 \text{ feet} + 37.5 \text{ feet}) = 0.46$$

These dilution factors are multiplied by the upper aquifer EPCs to estimate the EPCs for the lower aquifer. The estimated VOC ground water concentrations in the lower aquifer resulting from the detected VOCs in the onsite soils are presented in the fourth and fifth columns in Table 3-12.

CDI estimates for exposure to ground water based on the EPCs estimated using the above fate and transport modeling for Case #1 are presented in Tables 3-13 through 3-16.

3.5.2 Case #2

Case #2 in the fate and transport modeling section is concerned with estimating ground water concentrations in the upper and lower aquifers that would result from the water table in the upper aquifer rising to the point that it would impact the VOCs detected in the deeper soils at the Livermore Arcade Shopping Center property. Water level measurements at the site indicate that the water table has dropped during the drought. More recent measurements indicate that the water table is rising and may keep rising until the upper aquifer reaches the higher documented water elevations. The following analysis evaluates the resulting VOC ground water concentrations via this fate and transport pathway.

3.5.2.1 Estimate Soil Zone Ground Water Concentrations

The first step in the Case #2 analysis is to estimate the upper-bound VOC concentrations as ground water in the upper aquifer rises and impacts the VOCs detected in the deeper soils at the site. The VOC concentrations in this portion of the upper aquifer that has risen to impact the deeper soils at the site are called the "soil zone ground water concentrations." This analysis assumes that the deeper soil VOCs would reach equilibrium with the ground water in the uppermost portion of the upper aquifer. The soil-bound VOCs desorbed by the rising ground water would then be diluted by the entire volume of ground water in the upper aquifer.

detected VOCs in the deeper soils at the Livermore Arcade Shopping Center property are presented in Table 3-17.

3.5.2.2 Estimate Ground Water Exposure Point Concentrations

The above analysis provides estimates of the aqueous VOC concentrations in the uppermost portion of the upper aquifer that would impact the deeper soils at the site. The concentration of the aqueous VOCs would be diluted by the ground water in the entire upper aquifer assuming a volume for volume ratio. The average depth of the 20 deeper soil samples is estimated as approximately 57 feet and the deeper soils are defined as the samples greater that 41 feet. Knowing that the greatest measured thickness of the upper aquifer is 32 feet, the volume for volume dilution represented by the entire upper aquifer is estimated as:

$$\text{Dilution Factor} = (57 \text{ feet} - 41 \text{ feet})/32 \text{ feet}) = 0.5$$

The ground water VOCs in the soil zone will be diluted by a factor of 0.5 when mixed with the entire volume of ground water in the upper aquifer. The upper-bound VOC exposure point concentrations (EPCs) in the upper aquifer resulting from the rising water table are presented in Table 3-17.

The VOCs in the upper aquifer are assumed to have the potential to reach the lower aquifer by migrating downward vertically. The fate and transport modeling for the VOCs impacting the lower aquifer is conducted by applying a dilution factor based on a volume to volume ratio with the upper aquifer VOC concentrations. The depth of the lower aquifer has been estimated as ranging from 35-40 feet. An average thickness of 37.5 feet is used. Given a maximum thickness of 32 feet for the upper aquifer and the lower aquifer's thickness of 37.5 feet, the volume to volume dilution factor for the lower aquifer is estimated as:

Dilution Factor = 32 feet / (32 feet + 37.5 feet)
= 0.46

The ground water VOCs in the upper aquifer would be diluted by a factor of 0.46 if mixed with the volume of ground water in the lower aquifer. The upper-bound VOC exposure point concentrations (EPCs) in the lower aquifer in the Case #2 fate and transport scenario are presented in last column in Table 3-17.

CDI estimates for exposure to ground water based on the EPCs estimated using the fate and transport modeling for Case #2 are presented in Tables 3-18 through 3-21.

3.6 SUMMARY OF EXPOSURES

In this chapter, CDIs for the organic chemicals detected in soil, soil gas, and ground water at the Livermore Arcade Shopping Center have been estimated. In Chapter 5, the CDIs are combined with the health criteria presented in Chapter 4 to derive estimates of lifetime cancer risk and hazard indices for the potentially exposed future onsite residential population.

4.0 TOXICITY ASSESSMENT

This chapter summarizes the toxicological properties of the chemicals detected at the Livermore Arcade Shopping Center that are included in the baseline HRA. For both the carcinogens and noncarcinogens, quantitative estimates are presented which reflect the chemical's potential to either induce carcinogenesis or adverse noncarcinogenic health effects. These quantitative estimates are called health criteria. In accordance with the U.S. EPA risk assessment guidelines, the baseline HRA uses the health criteria approved by or currently under review by the U.S. EPA (U.S. EPA, 1989a). The U.S. EPA publishes these criteria in several documents. HRA guidelines suggest that the preferred source of information is the Integrated Risk Information System (IRIS), an on-line database containing the most current toxicity information. The health criteria published in IRIS have undergone an approval process by various offices within the U.S. EPA (U.S. EPA, 1992). If IRIS does not contain health criteria for a certain chemical, the next suggested reference is the Health Effects Assessment Summary Tables (HEAST). This document, published annually, lists the approved U.S. EPA health criteria and also reports any interim health criteria which may be under agency review (U.S. EPA, 1991a).

Health criteria are derived separately for both the ingestion and inhalation exposure routes. Neither IRIS nor HEAST contain health criteria for the dermal absorption exposure pathway, which is a pathway of concern in this HRA. U.S. EPA guidelines suggest that ingestion health criteria should be used to assess potential carcinogenic health risks and noncarcinogenic health impacts via dermal absorption (U.S. EPA, 1989a). This methodology is used in the HRA to estimate health risk via dermal absorption from the chemicals detected in soil.

Health criteria quantitatively link the dosage of a chemical (ingested or inhaled) with the occurrence of a resulting adverse health impact, or response. The dosage of a chemical is considered as either the amount administered to the organism, or the amount absorbed into the organism's system after exposure, in units of milligrams of the chemical per kilogram of body weight, per day of exposure (mg/kg-day).

In current health risk assessment practice, adverse health effects are divided into two broad categories: carcinogenic or noncarcinogenic. These effects are treated differently because the mechanisms by which cancer and noncarcinogenic health impacts develop are thought to differ. Noncarcinogenic effects are believed to occur only after a certain chemical dose, called a threshold dose, has been exceeded. Adverse health effects are not thought to arise from dosages below the threshold level. Noncarcinogenic health impacts are usually associated with a certain organ or organs, and may occur after acute or chronic exposures. Conversely, carcinogenic responses are not thought to be linked to a threshold dose. Instead, any exposure to a carcinogen is believed to increase the probability of cancer development no matter how low the dose. An individual chemical may be either a carcinogen or a noncarcinogen or both.

The following sections of this chapter describe the noncarcinogenic and carcinogenic health criteria for each chemical included in the baseline HRA.

4.1 NONCARCINOGENIC HEALTH CRITERIA

As previously stated, noncarcinogenic adverse health effects are believed to occur only after a threshold dose level has been exceeded. Noncarcinogenic effects include all adverse health effects except tumor development, and may include developmental and reproductive effects.

Following U.S. EPA and DTSC guidelines, the health criteria for noncarcinogens are called reference doses (RfDs). A RfD, in units of mg/kg-day, represents the maximum dose, either inhaled or ingested, from which no adverse health effects would be expected to occur in an exposed individual. Therefore, an RfD can also be considered as the maximum "safe" dose level. It is apparent that a chemical with a higher RfD ("safe" dose level) is less toxic than a chemical with a lower RfD.

For certain chemicals, the U.S. EPA reports inhalation health criteria as reference concentrations instead of reference doses. An inhalation reference concentration (RfC) designates the maximum "safe" concentration of a chemical in air instead of the maximum "safe" dose of a chemical. RfCs for the inhalation pathway are expressed in units of milligrams of a chemical in one cubic meter of air (mg/m^3). It is possible to convert an RfC for a chemical to a corresponding RfD. This step is conducted in the following equation by assuming that an exposed individual breathes 20 m^3 of air daily, and has an average body weight of 70 kg (U.S. EPA, 1989a):

$$\text{RfD (mg/kg-day)} = \frac{\text{RfC (mg/m}^3\text{) x 20 m}^3\text{/day}}{\text{70 kg}}$$

This equation has been used to derive RfDs from the U.S. EPA published inhalation RfCs for ethylbenzene, methylene chloride, toluene and total xylenes.

The ingestion and inhalation health criteria published in either IRIS or HEAST for each noncarcinogen included in the baseline HRA are discussed in the following sections. Following U.S. EPA guidance, the oral RfDs will be used to assess potential health impacts from the dermal absorption of chemicals detected in soil at the site (U.S. EPA, 1989a). The noncarcinogenic health criteria for ingestion and inhalation are summarized in Tables 4-1 and 4-2, respectively.

4.1.1 Bis(2-ethylhexyl)phthalate

The RfD for bis(2-ethylhexyl)phthalate via ingestion is published in IRIS as 2E-02 mg/kg-day (U.S. EPA, 1992). The basis for this determination is a study involving guinea pigs in which the weight of the liver increased in the chemical treated animals versus the controls. An inhalation RfD has not been derived by the U.S. EPA to date (U.S. EPA, 1992; 1991a). Assuming 100% absorption via both the ingestion and inhalation routes, the oral RfD of 2E-02 mg/kg-day is used to estimate adverse health impacts via inhalation. This assumption is made in accordance with U.S. EPA guidance documents (U.S. EPA, 1989a).

4.1.2 1,2-Dichloroethene, cis- (cis-1,2-DCE)

A U.S. EPA verified oral RfD for cis-1,2-DCE of 1E-02 mg/kg-day is published in HEAST and pending input into the IRIS database (U.S. EPA, 1991a). Since no inhalation RfD is currently reported in either IRIS or HEAST, the oral RfD of 1E-02 mg/kg-day is used in the HRA for the inhalation health criterion (U.S. EPA, 1992; 1991a).

4.1.3 Ethylbenzene

Rats ingesting ethylbenzene via gavage were found to exhibit liver and kidney toxicity. Based on this study, the U.S. EPA has established an oral RfD for ethylbenzene of 1E-01 mg/kg-day in the IRIS database (U.S. EPA, 1992). A workgroup verified RfC of 1E+00 mg/m^3 for the inhalation exposure route is published in HEAST, based on the occurrence of developmental effects in rats and rabbits following exposure (U.S. EPA, 1991a). As described previously, the RfC is converted to an RfD of 3E-01 mg/kg-day assuming a human body weight of 70 kg and an inhalation rate of 20 m^3/day.

4.1.4 Freon 12

The ingestion RfD derived by the U.S. EPA and published in the IRIS database for Freon 12 is 2E-01 mg/kg-day (U.S. EPA, 1992). An inhalation RfD of 5E-02 mg/kg-day has been published in HEAST based on lung and liver lesions in guinea pigs (U.S. EPA, 1991a).

4.1.5 Methylene Chloride

The U.S. EPA has published a chronic ingestion RfD for methylene chloride of 6E-02 mg/kg-day in the IRIS database (U.S. EPA, 1992). This health criterion is determined from a rat study in which liver toxicity was exhibited after exposure to methylene chloride in drinking water. The U.S. EPA has also published an inhalation RfC of 3E+00 mg/m^3 in HEAST, which is pending input into IRIS (U.S. EPA, 1991a). An inhalation RfD of 9E-01 mg/kg-day is calculated from the inhalation RfC following the conversion method described above.

4.1.6 Phenol

The U.S. EPA has derived an oral RfD of 6E-01 mg/kg-day for phenol based on a study in which rats were given phenol via gavage during organogenesis that resulted in a reduction of fetal body weight in the exposed offspring (U.S. EPA, 1992). A RfD for the inhalation route is currently not available (U.S. EPA, 1992; 1991a). The inhalation RfD, for the purposes of this HRA, is assumed to be equivalent to the oral RfD of 6E-01 mg/kg-day, assuming 100% absorption via both exposure routes.

4.1.7 Tetrachloroethene (PCE)

PCE has been assigned an oral RfD of 1E-02 mg/kg-day by the U.S. EPA in IRIS. This determination is based on hepatotoxicity demonstrated in mice following exposure (U.S. EPA, 1992). Since an inhalation RfD has not been published by the U.S. EPA, the oral RfD of 1E-02 mg/kg-day is used to estimate health impacts from the inhalation of PCE, assuming 100% absorption via both exposure routes (U.S. EPA 1992; 1991a).

4.1.8 Toluene

A RfD for the ingestion of toluene is derived in IRIS as 2E-01 mg/kg-day, based on a rat study in which liver and kidney weight changes were observed (U.S. EPA, 1992). HEAST provides an inhalation RfC of 2E+00 mg/m^3 for toluene (U.S. EPA, 1991a). This health criterion is U.S. EPA Workgroup verified and pending input into IRIS (U.S. EPA, 1991a). The inhalation RfC is derived from evidence in which exposure to toluene in air resulted in adverse effects to the central nervous system and eye and nose irritation (U.S. EPA, 1991a). An inhalation RfD of 6E-01 mg/kg-day is derived from the RfC.

4.1.9 1,1,1-Trichloroethane (1,1,1-TCA)

The ingestion RfD of 9E-02 mg/kg-day for 1,1,1-TCA, published in IRIS, was extrapolated from the inhalation route RfD of 3E-01 mg/kg-day, published in HEAST (U.S. EPA, 1992; 1991a). Both health criteria are presently under Workgroup review, however. A study resulting in hepatotoxicity in guinea pigs provides the basis for the inhalation RfD.

4.1.10 Xylenes, total

Based on the incidence of hyperactivity, decreased body weight and increased mortality observed in rats, IRIS lists a chronic oral RfD of 2E+00 mg/kg-day for mixed xylene isomers (U.S. EPA, 1992). HEAST has published a U.S. EPA Workgroup verified inhalation RfC of 3E-01 mg/m^3. This criterion is pending IRIS input, and results from central nervous system effects and nose and throat irritation demonstrated in humans exposed to xylenes in air (U.S. EPA, 1991a). An inhalation RfD of 9E-02 mg/kg-day is calculated from the inhalation RfC.

4.2 CARCINOGENIC HEALTH CRITERIA

The U.S. EPA and the International Agency for Research on Cancer (IARC) have developed a classification system for carcinogens. Carcinogens are categorized in five groups, Group A through Group E, based on the type and strength of epidemiological or experimental animal evidence regarding carcinogenicity. Group A carcinogens are those chemicals known to cause cancer in humans, based on sufficient epidemiological evidence. Groups B through E represent decreasing degrees of potential human carcinogenicity from epidemiological and/or animal studies. These categories are described in Table 4-3.

The U.S. EPA publishes health criteria for carcinogens in the form of slope factors (SFs), expressed in reciprocal units of daily chemical intake, or $(mg/kg\text{-}day)^{-1}$. A SF is "a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime" (U.S. EPA, 1989a). A SF is usually derived from a critical animal study in which dosage and tumor formation are linked. Laboratory animals are exposed to high dosages of the potential carcinogen that are not typical of the human environment. Dose-response models such as the linearized multistage model must be utilized to extrapolate the dose-response relationship from the higher experimental doses applied in animal studies down to the lower doses more typical of human exposures. The multistage model assumes a linear relationship between dose and carcinogenic response at low chemical doses. The SF is derived following health protective techniques, and is represented as the 95% upper confidence limit (UCL) of the slope of the dose-response curve.

The inhalation health criteria for carcinogens can also be expressed in terms of a concentration in air rather than chemical intake units. Health criteria for carcinogens expressed in air concentrations are called unit risk factors (URF), and are expressed in reciprocal units of micrograms of a chemical per cubic meter of air, or $(ug/m^3)^{-1}$. An inhalation SF can be derived from a URF using the following equation, which assumes a daily human air intake of 20 m^3/day and an average body weight of 70 kg (U.S. EPA, 1989a):

$$SF\ (mg/kg\text{-}day)^{-1} = \frac{URF\ (ug/m^3)^{-1} \times 70\ kg \times 1{,}000\ ug/mg}{20\ m^3/day}$$

The ingestion and inhalation health criteria for each carcinogen included in the HRA are presented below. URFs are converted into SFs for methylene chloride and tetrachloroethene. Again, the oral SFs are used to evaluate carcinogenic risk via dermal absorption for the chemicals detected in soil. The carcinogenic health criteria are summarized in Tables 4-4 (ingestion) and 4-5 (inhalation).

4.2.1 Benzene

Benzene is a known human carcinogen (Group A) (U.S. EPA, 1992). The U.S. EPA has published an oral SF of 2.9E-02 $(mg/kg\text{-}day)^{-1}$ in the IRIS database (U.S. EPA, 1992). This oral SF is extrapolated from the inhalation SF of 2.9E-02 $(mg/kg\text{-}day)^{-1}$, also reported in IRIS (U.S. EPA, 1992). Occupational exposure to humans resulting in the development of leukemia is the basis for the inhalation SF.

4.2.2 Bis(2-ethylhexyl)phthalate

Bis(2-ethylhexyl)phthalate is classified by the U.S. EPA as a Group B2, or probable human carcinogen. The U.S. EPA has derived an oral SF of 1.4E-02 $(mg/kg\text{-}day)^{-1}$ that is published in the IRIS database

(U.S. EPA, 1992). The SF is derived from a study involving mice in which liver tumors were observed following oral exposure. An inhalation SF has not been determined at this time (U.S. EPA, 1992; 1991a). The oral SF of 1.4E-02 $(mg/kg\text{-}day)^{-1}$ is used in the HRA to represent the carcinogenicity of bis(2-ethylhexyl)phthalate via the inhalation exposure route.

4.2.3 Methylene Chloride

Both oral and inhalation health criteria are available for methylene chloride, which is categorized as a Group B2, probable human carcinogen (U.S. EPA, 1992). The oral SF is published in IRIS as 7.5E-03 $(mg/kg\text{-}day)^{-1}$ and is extrapolated from a study in which mice were exposed via the oral and inhalation exposure routes and developed liver cancer. IRIS also reports a URF of 4.7E-07 $(ug/m^3)^{-1}$ for the inhalation exposure route, based on the development of lung and liver cancer in mice (U.S. EPA, 1992). The URF is converted to an inhalation SF of 1.6E-03 $(mg/kg\text{-}day)^{-1}$ assuming a human inhalation rate of 20 m^3/day and an average human body weight of 70 kg.

4.2.4 Tetrachloroethene (PCE)

The U.S. EPA classifies PCE as a Group B2, or probable human carcinogen (U.S. EPA, 1991a). The U.S. EPA has derived health criteria for both the oral and inhalation routes in the HEAST database (U.S. EPA, 1991a). These criteria are verified and are pending input into IRIS. Based on the development of tumors in the liver of mice, an oral SF of 5.1E-02 $(mg/kg\text{-}day)^{-1}$ has been established. A SF of 1.8E-03 $(mg/kg\text{-}day)^{-1}$ can be derived from the published URF of 5.2E-07 $(ug/m^3)^{-1}$. The inhalation URF arises from the development of leukemia and liver tumors in rat and mouse test animals exposed to PCE in air.

4.2.5 Trichloroethene (TCE)

TCE is classified as a Group B2 classification (probable human carcinogen) by the U.S. EPA (U.S. EPA, 1991a). HEAST has reported health criteria for TCE as follows: an oral SF of 1.1E-02 (mg/kg-day)$^{-1}$, based on two gavage studies involving liver tumors in mice, and an inhalation SF of 1.7E-02 (mg/kg-day)$^{-1}$ extrapolated from two inhalation studies in which mice exhibited lung tumors (U.S. EPA, 1991a). The inhalation SF is based on a metabolized dose, assumed to be 100% for the baseline HRA. Both the oral and inhalation health criteria are U.S. EPA Workgroup verified, and pending input into the IRIS database.

4.3 SUMMARY OF TOXICITY INFORMATION

The health criteria discussed in this chapter have been derived by the U.S. EPA, and are developed in a health conservative manner. Ingestion and inhalation RfDs and SFs for the chemicals included in the HRA are summarized in Tables 4-1, 4-2, 4-4 and 4-5. The oral RfDs or oral SFs for the individual chemicals are used to estimate the potential health risk from exposure to soil via the dermal exposure pathway.

5.0 RISK CHARACTERIZATION

In this final chapter of the baseline HRA, the chronic daily intake (CDI) estimates from Chapter 3 for each chemical and exposure pathway are mathematically combined with the pathway and chemical-specific health criteria provided in Chapter 4 to produce quantitative estimates of potential human health risk. Carcinogenic and noncarcinogenic health impacts are discussed for three scenarios: the future onsite adult resident, the future onsite child/adult resident, and present case conditions.

Due to the conservative nature of the health risk assessment methodology recommended by the U.S. EPA and DTSC, the risk estimates derived in the baseline HRA are upper-bound, health protective estimates. Assumptions made throughout the baseline HRA such as the manner in which representative concentrations are derived in Chapter 2, the assumptions regarding human behavior in Chapter 3, and the uncertainty factors applied to SFs and RfDs in Chapter 4 lead to the probable overestimates of risk presented in this chapter. It is unlikely that the actual risks to health posed by the organic compounds in soil, soil gas and ground water at the Livermore Arcade Shopping Center exceed the upper-bound risk estimates derived in this baseline HRA. The DTSC has stated, in fact, that the actual incidence of cancer in a potentially exposed population is likely to be considerably lower than the estimates derived using this methodology, and "may even be as low as zero" (DHS, 1990).

In the sections that follow, the lifetime carcinogenic risks and estimates of noncarcinogenic adverse health impacts, termed hazard indices, are discussed for each exposure scenario. The algorithms used to derive risk estimates are summarized. The algorithms are obtained from U.S. EPA guidance documents (U.S. EPA, 1989a).

The chapter concludes with a discussion of the uncertainties inherent in the baseline HRA process and their impact on the risk estimates. The discussion of uncertainties is an integral part of the HRA and should be considered carefully when interpreting the results of this analysis.

5.1 METHODOLOGY OF RISK CHARACTERIZATION

The methodologies used to derive quantitative estimates of potential carcinogenic risk and noncarcinogenic impacts posed by the chemicals of concern at the Livermore Arcade Shopping Center are discussed below.

5.1.1 Carcinogenic Risk Characterization

Estimates of carcinogenic risk reflect, in the form of a probability, the likelihood of cancer development following exposure to carcinogens. Exposure estimates in the form of chronic daily intake (CDIs) are provided in Chapter 3 for the soil ingestion, dermal absorption of soil, soil gas inhalation, ground water ingestion and ground water inhalation/dermal absorption pathways. In Chapter 4, health criteria are provided from either IRIS or HEAST for the potential carcinogens as Slope Factors (SFs) for both the ingestion and inhalation exposure pathways. SFs are upper-bound quantitative estimates reflecting the inherent carcinogenic potential of each chemical.

In risk characterization, lifetime cancer risk estimates for each potential human carcinogen via all relevant pathways are derived. The CDI estimates for each chemical are derived in units of mg/kg-day. The SFs presented in Chapter 4 are expressed in reciprocal units of exposure, $(mg/kg\text{-}day)^{-1}$. CDI estimates and SFs can be combined to estimate of the probability of developing cancer by multiplying each CDI estimate by its chemical and pathway-specific SF as follows (U.S. EPA, 1989a):

$$\text{Cancer Risk}_i = CDI_i \times SF_i$$

where:

Cancer Risk_i = Lifetime risk of tumor formation from potential human carcinogen, i (unitless);

CDI_i = Chronic Daily Intake of chemical i (mg/kg-day);

SF_i = Slope Factor of chemical i $(mg/kg\text{-}day)^{-1}$.

The chemical-specific cancer risks are then summed to provide a total lifetime cancer risk for all potential carcinogens via each exposure pathway. This step assumes that cancer risk is additive for all chemicals such that risk estimates may be combined regardless of which organ tumor formation occurs. (U.S. EPA, 1989a).

5.1.2 Noncarcinogenic Risk Characterization

Health criteria in the form of reference doses (RfDs) are obtained for the noncarcinogens from IRIS or HEAST in Chapter 4. Reference doses are pathway specific (ingestion and inhalation), and represent the highest human dosage from which adverse health effects are not expected to occur. RfDs are expressed in units identical to the units used to express chronic daily intake (mg/kg-day). Chronic daily intake for each chemical via each exposure pathway is derived in Chapter 3. Noncarcinogenic risk characterization compares the CDI estimate for each chemical with the chemical and pathway-specific RfD to ascertain whether the estimated chronic daily intake of that chemical exceeds its RfD (U.S. EPA, 1989a):

$$HI_i = CDI_i \div RfD_i$$

where:

HI_i = Hazard Index for chemical i (unitless);

CDI_i = Chronic Daily Intake of chemical i (mg/kg-day); and

RfD_i = Reference Dose of chemical i (mg/kg-day).

A hazard index (HI) greater than unity (one) indicates that intake has exceed the RfD, or the maximum "safe" dosage level. Therefore, for HIs greater than one, the potential exists for noncarcinogenic adverse health effects to occur from exposure to that chemical via that pathway. Conversely, if the HI is less than one, adverse health effects are not expected to occur in the potentially exposed population.

HI estimates, unlike cancer risk estimates, are not thought to be strictly additive (U.S. EPA, 1989a). Since the critical adverse health effects associated with exposure to various noncarcinogens vary greatly, it is believed to be more appropriate to sum HIs for only those chemicals exhibiting similar adverse health effects. However, due to the health conservative approach of this baseline HRA, all HIs for all chemicals in each exposure pathway will be summed. A pathway total HI greater than unity indicates adverse health effects may occur from exposure via that pathway. A pathway total HI less than unity suggests that it is unlikely that adverse health effects will occur.

5.2 RISK CHARACTERIZATION RESULTS

The equations provided in Section 5.1 are used to calculate carcinogenic risk and noncarcinogenic health impacts from the chemicals of concern at the Livermore Arcade Shopping Center. Risk estimates are discussed separately for each exposure scenario.

5.2.1 Future Onsite Adult Resident Scenario

Tables 5-1 and 5-2 present the estimated lifetime cancer risk and noncarcinogenic HIs, respectively, for the soil ingestion, dermal absorption of soil, and soil gas inhalation pathways. The lifetime cancer risk estimates in Table 5-1 all fall below the 1E-06 (one-in-a million) lifetime cancer risk level. The highest cancer risk is from dermal absorption of soil, at 2E-07. The highest total HI calculated is 1E-02 for the soil gas inhalation pathway, which is well below unity. Carcinogenic and noncarcinogenic health effects are therefore not expected to occur in the future onsite adult resident after daily exposure to soil and soil gas for 30 years.

Tables 5-3 and 5-4 provide lifetime cancer risk and HI estimates for the ground water ingestion and dermal absorption/inhalation exposure pathways for the individual ground water wells. These values are the estimates based directly on the analytical results of the sampling data from the wells monitored by H+GCL. Fifteen of the 19 wells analyzed pose potential lifetime cancer risks greater than 1E-06. The highest risks were calculated for wells MW-1 (1E-02) and B1-U (4E-03). The chemicals primarily contributing to the risk estimates for these wells are benzene and PCE, respectively.

Table 5-4 indicates that the highest HIs were calculated for the same wells, that is, MW-1 (1E+01) and B1-U (4E+01). Toluene and total xylenes drive the noncarcinogenic health hazard for MW-1, while PCE drives the HI estimate for B1-U. The HIs equal or exceed unity at 9 of the 19 ground water wells.

5.2.2 Future Onsite Child/Adult Resident Scenario

The lifetime cancer risk and HI estimates calculated for the future onsite child/adult resident from exposure to soil and soil gas imply that the chemicals in these media do not pose an adverse risk to human health. The risk and HI estimates are presented in Tables 5-5 and 5-6. The highest cancer risk estimate is 2E-07 for both the dermal absorption of soil and soil gas inhalation pathways. The HI most closely approaching unity is 2E-02, derived for the inhalation of soil gas. These estimates indicate that the VOCs detected in soil and soil gas at the Livermore Arcade Shopping Center do not present a health risk to the future onsite child/adult resident, assuming daily exposure for 30 years.

Similar to the future onsite adult resident, however, exposures to the chemical concentrations directly sampled in the ground water monitoring wells may pose a potential adverse health risk to the future onsite child/adult receptor. Notably, the cancer risk estimates derived for all 19 wells equal or exceed the 1E-06 lifetime cancer risk level. These risk estimates are presented for each well in Table 5-7. The highest risks were again associated with wells MW-1 (1E-02, from benzene) and B1-U (5E-03, from PCE).

The same 9 of 19 wells have HI estimates of 1E+00 or greater as in the future onsite adult resident scenario. The highest HIs are 2E+01 at MW-1 (toluene and total xylenes), and 4E+01 at B1-U (PCE). The HI estimates for the future onsite child/adult resident are listed in Table 5-8.

5.2.3 Present Case Conditions

Given present case conditions at the Livermore Arcade Shopping Center, the potential for carcinogenic and noncarcinogenic health risks to occur as a result of inhaling soil gas that has migrated upward through the unsaturated zone is judged to be negligible. Quantitative estimates have not been derived due to the negligible health risks calculated via the soil gas inhalation pathway for the future onsite adult and child/adult residents. It will be recalled that the Livermore Arcade Shopping Center is almost completely covered by asphalt parking lots, building foundations, and concrete walkways. Present case conditions indicate that individuals, if exposed to soil gas at all, would be exposed to chemicals that would have to volatilize upward through the asphalt/concrete covering into ambient air. An asphalt/concrete cap significantly reduces the ability of the chemicals to volatilize upward. Therefore, the concentrations of the organic compounds in the breathing zone during present case conditions would be significantly less than the concentrations inhaled by the future onsite adult or child/adult resident. Since the risk and HI estimates were negligible for the latter receptors via soil gas inhalation, it logically follows that the risk and HI estimates would be even more negligible under present case conditions.

5.2.4 Fate and Transport Modeling

A separate analysis was conducted to estimate health risk from exposure to chemicals originally detected in soil migrating downward into the upper and lower ground water aquifers flowing beneath the Livermore Arcade Shopping Center. The analysis was conducted in two case using chemical fate and transport models to estimate VOC concentrations within each aquifer (upper and lower). Lifetime cancer risk and HI estimates are derived for Case #1 for the ground water ingestion and inhalation/dermal absorption exposure pathways for the future onsite adult resident scenario, and are presented in Tables 5-9 and 5-10. Total lifetime cancer risk associated with the combination of methylene chloride and PCE leaching from soil is greater than 1E-06 for both the upper and lower aquifers. The lifetime cancer risk is highest in the upper aquifer assuming a thickness of 13 feet as 1E-05. Assuming a thickness of 32' in the upper aquifer, total cancer risk from the combination of these two chemicals was estimated as 5E-06. It is therefore possible that the future onsite adult resident could be at risk for cancer development if exposed to ground water in either the upper or lower aquifers. HI estimates calculated for the upper and lower aquifers are all less than unity by over an order of magnitude, as shown in Table 5-10.

Tables 5-11 and 5-12 summarize the cancer risk and HI estimates for exposures to chemicals leaching from soil into the upper and lower ground water aquifers for the future onsite child/adult resident. As with the adult receptor, the lifetime cancer risk estimates to the future onsite child/adult resident are greater than 1E-06 for both aquifers. Assuming an aquifer thickness of 13 feet, the lifetime cancer risk is estimated as 1E-05, while for a 32' thickness, risk is estimated as 7E-06. Lifetime cancer risk estimates from exposure to the lower aquifers are estimated as 4E-06 (13' - 37.5' thickness), and 3E-06 (32' - 37.5' thickness). HI estimates calculated for both aquifers, as indicated in Table 5-12, are approximately an order of magnitude less than unity. These estimates indicate that noncarcinogenic health effects are not expected to occur in the future onsite child/adult resident after daily exposure to leachate in ground water for a 30 year exposure duration.

Case #2 of the fate and transport modeling section evaluates the potential chemical concentrations and health risk from exposure to chemicals detected in the deeper soils that would be reintroduced into ground water as a result of the rising water table at the site. Lifetime cancer risk and HI estimates are derived for Case #1 for the ground water ingestion and inhalation/dermal absorption exposure pathways for the future onsite adult resident scenario in Tables 5-13 and 5-14. Table 5-14 indicates that the total lifetime cancer risk due to the potential exposures to methylene chloride and PCE is greater than 1E-06 for both the upper and lower aquifers. The lifetime cancer risk is highest in the upper aquifer as 5E-04. A lifetime cancer risk of 2E-04 is estimated in the lower aquifer. Based on these results, the future onsite adult resident may be subject to an increased risk of cancer if exposed to ground water in either the upper or lower aquifers. HI estimates calculated for the upper and lower aquifers are greater both greater than unity, as 6E+00 and 3E+00. These HI estimates indicate that the future onsite adult residents would be subjected to possible noncancer health impacts if ground water beneath the site if ingested as a primary drinking water source.

Tables 5-15 and 5-16 present the lifetime cancer risk and HI estimates for exposures to VOCs via the rising water table in the upper aquifer that may impact both aquifers for the future onsite child/adult resident. As with the adult receptor, the lifetime cancer risk estimates to the future onsite child/adult resident are greater than 1E-06 for both aquifers as indicated in Table 5-15. The upper aquifer presents a lifetime cancer risk of 7E-04, while a value of 4E-04 is estimated for the lower aquifer. Table 5-16 presents the HI estimates for both aquifers. Both HI estimate are greater than unity, 7E+00 and 3E+00. These estimates indicate that noncarcinogenic health effects are likely to occur in the future onsite child/adult resident after daily exposure to the VOCs in ground water resulting from the rising water table.

5.3 UNCERTAINTIES IN THE RISK ESTIMATES

Table 5-17 summarizes the uncertainties in this baseline HRA believed to most significantly impact the calculated health risk estimates. Most assumptions are judged to potentially affect the risk estimates by less than an order of magnitude (i.e., a low potential for impact). In addition, most of the assumptions, including those that have a medium or high potential for impact on the risk estimates, are believed to overestimate the actual risks associated with the chemicals of concern detected at the Livermore Arcade Shopping Center. The tendency to overestimate risk in the baseline risk assessment is the result of the health conservative methodology recommended by the U.S. EPA for risk assessments. As noted earlier, risk conservative assumptions are included throughout most steps of the HRA process. For example, in Chapter

2, one-half the detection limit is used for every chemical detected at least once at the site, but not detected in a specific sample. In Chapter 3, the very health protective assumption is made that the receptors are exposed to the media for 24 hours/day, 365 days/year for 30 years. The compounding of these health conservative assumptions provides health risk estimates that are overestimates of the actual risks posed to human health.

5.4 CONCLUSION

The results of the baseline HRA indicate that given the present case conditions, the potential for adverse impacts resulting from the inhalation of soil gas volatilizing upward through the concrete and asphalt cover at the Livermore Arcade Shopping Center is negligible. Should the Livermore Arcade Shopping Center property be developed sometime in the future for residential purposes, a future onsite adult and child/adult resident, exposed for 30 years, would not be expected to develop cancer or other adverse health effects from exposures to the uncovered soil or soil gas emanating from the soil.

The potential exists for the future onsite adult and child/adult residents to develop cancer or other adverse health effects after exposure to ground water beneath the property either via ingestion, dermal contact with ground water, or inhalation of organic compounds in ground water. This conclusion is based on the use of chemical concentrations detected during site sampling activities. In addition, the fate and transport modeling indicates that the adverse lifetime cancer risk estimated for individuals having contact with ground water containing estimated concentrations of VOCs in the upper and lower aquifers are greater than the levels of regulatory concern.

At the present, the State of California, Office of Drinking Water has developed a Maximum Contaminant Level (MCL) of 0.005 mg/l for

PCE in drinking water. MCLs are established based on criteria that include health effects information and technological feasibility. The current site conditions at the Livermore Arcade Shopping Center suggest that ground water in the upper aquifer flowing beneath the property is not used for drinking water purposes. Although a remediation program has not been prepared, the MCL of 0.005 mg/l represents a conservative clean-up level for PCE in the upper aquifer especially since this aquifer only poses an adverse risk to human health if the ground water is ingested. Currently, this water is not used for any residential or commercial uses, but, may be used in the future.

6.0 LIMITATIONS

This baseline HRA was prepared in accordance with risk assessment methodologies recommended at the present time by regulatory agencies having jurisdiction in Northern California. It should be recognized that the assessment of human health risks associated with exposures to chemicals in the environment is a difficult and inexact science. Professional judgments leading to conclusions and recommendations are often made with an incomplete knowledge of the surface and subsurface conditions. Additional studies may help reduce the uncertainties regarding the estimation of potential human health risks. No other warranty, expressed or implied, is made.

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Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-1

Livermore Arcade Shopping Center
Livermore, California

Laboratory Methods Used in Analyses
of Environmental Samples

Environmental Medium	Analyte	Analytical Method
SOIL	Title 26 Metals	EPA 6010,7060,7420 7471,7740,7841
	Volatile Halocarbons	EPA 8010
	Volatile Aromatic Hydrocarbons	EPA 8020
	Volatile Priority Pollutants	EPA 8240
	Hydrocarbons (semi-quantified) (1)	EPA 8240
	Base/Neutral and Acid Extractables	EPA 8270
SOIL GAS	Photovac 10S70 Gas Chromatograph	-- (2)
GROUND WATER/AQUEOUS SAMPLES (WELLS OTHER THAN CWS WELLS)	14 CA Metals by ICAP	EPA 6010,7060,7420 7471,7740,7841
	Purgeable Halocarbons	EPA 8010
	Volatile Aromatic Compounds	EPA 8020
	Pesticides/PCBs	EPA 8080
	Volatile Priority Pollutants	EPA 624/8240
	TPH Volatile Hydrocarbons (qualitative) (3)	EPA 624
	Hydrocarbons (semi-quantified) (1)	EPA 624,625
	Base/Neutral and Acid Extractables	EPA 625
GROUND WATER/AQUEOUS SAMPLES (CWS WELLS ONLY)	Drinking Water Standards	EPA 524.2
	Purgeable Halocarbons	EPA 601
	Volatile Aromatic Compounds	EPA 602

(1) Quantification based upon comparison of total ion count of compound with that of the nearest internal standard.
(2) No EPA method available.
(3) Qualitative identification based upon a visual comparison of sample chromatograms with those from verified standards.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-2

Livermore Arcade Shopping Center
Livermore, California

Summary of Analytical Results for
Organic Chemicals Detected in Soil

(All units in mg/kg)

Chemical	Frequency of Detection (1)	Concentrations			95% Upper Confidence Limit of Arithmetic Mean
		Minimum Detect	Maximum Detect	Arithmetic Mean (2)	
1,2-Dichloroethene, cis-	2/34	2.9E-03	1.5E-02	5.8E-02	7.5E-02
Methylene Chloride	4/34	8.3E-03	1.1E-02	1.2E-01	1.8E-01
Tetrachloroethene	20/34	3.5E-03	2.3E+00	2.2E-01	3.6E-01
1,1,1-Trichloroethane	7/34	3.0E-01	3.5E+00	3.3E-01	5.8E-01

(1) Number of samples in which the chemical was detected over the number of samples analyzed for the chemical.
(2) Both arithmetic mean and 95% UCL calculated assuming concentrations for nondetects as one-half the sample detection limit.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: TV QC: SKW

TABLE 2-3

Livermore Arcade Shopping Center
Livermore, California

Concentrations of Inorganic Chemicals Detected
in Soil Compared to Background Levels

(All units in mg/kg)

Laboratory	CT	CT		
Location	MW-17	MW-18		
Sample ID No.	9201191015	40		Range of
Laboratory No.	106406-1	106403-2		Regional
Sample Depth (ft.)	42	40	Arithmetic	Background
Date Sampled	01-19-92	01-27-92	Mean (1)	Concentrations (2)
Barium	117	115	116	70 - 5,000
Beryllium	0.25	0.26	0.255	<1 - 15
Chromium (total)	50.1	51.2	50.65	3 - 2,000
Cobalt	17.9	15.5	16.7	<3 - 50
Copper	23.1	28.6	25.85	2 - 300
Lead	ND-3.0	3	2.25	<10 - 700
Mercury	0.29	ND-0.10	0.17	<0.01 - 4.6
Nickel	145	129	137	<5 - 700
Vanadium	22.1	20.7	21.4	7 - 500
Zinc	40.3	40	40.15	10 - 2,100

(1) Arithmetic mean calculated assuming concentrations for nondetects as one-half the sample detection limit.

(2) Surficial soils, western U.S.A. (USGS, 1984; 1975).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-4

Livermore Arcade Shopping Center
Livermore, California

Summary of Analytical Results for
Chemicals Detected in Soil Gas

(All units in ppm)

Chemical	Frequency of Detection (1)	Concentrations Minimum Detect	Maximum Detect	Arithmetic Mean (2)	95% Upper Confidence Limit of Arithmetic Mean
Tetrachloroethene	10/10	5.7E-01	7.7E+02	1.1E+02	2.9E+02
Toluene	3/10	8.6E-02	5.6E+00	6.7E-01	1.9E+00
Trichloroethene	2/10	2.6E-01	3.1E+00	3.5E-01	1.0E+00
Xylenes, p- and m-	1/10	5.3E-02	5.3E-02	2.8E-02	3.4E-02

(1) Number of samples in which the chemical was detected over the number of samples analyzed for the chemical.

(2) Both arithmetic mean and 95% UCL calculated assuming concentrations for nondetects as one-half the sample detection limit.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-5

Livermore Arcade Shopping Center
Livermore, California

Summary of Analytical Results for Organic
Chemicals of Concern Detected in Ground Water

(Units in mg/L)

Chemical	Frequency of Detection (1)	Concentrations Minimum Detect	Concentrations Maximum Detect
AROMATIC VOLATILES:			
Benzene	6/24	1.0E-03	1.4E+01
Ethylbenzene	4/24	3.0E-03	3.5E+00
Toluene	5/24	1.4E-03	2.5E+01
Xylenes, total	4/24	4.5E-02	2.0E+01
HALOGENATED VOLATILES:			
1,2-Dichloroethene, cis-	6/24	5.0E-03	1.9E-01
Freon 12	1/2	7.0E-03	7.0E-03
Tetrachloroethene	17/24	2.0E-03	5.8E+00
Trichloroethene	8/24	1.0E-03	1.4E-01
BASE/NEUTRAL/ACID COMPOUNDS:			
Bis(2-ethylhexyl)phthalate	1/2	2.0E-02	2.0E-02
Phenol	1/2	5.0E-03	5.0E-03

(1) Number of samples in which the chemical was detected over the number of samples analyzed for the chemical.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-6

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs) of
Organic Chemicals Detected in Soil

(All units in mg/kg)

Chemical	Concentrations		
	95% UCL of Arithmetic Mean	Maximum Detect	RC (1)
1,2-Dichloroethene, cis-	7.5E-02	1.5E-02	1.5E-02
Methylene Chloride	1.8E-01	1.1E-02	1.1E-02
Tetrachloroethene	3.6E-01	2.3E+00	3.6E-01
1,1,1-Trichloroethane	5.8E-01	3.5E+00	5.8E-01

(1) The lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration for each chemical.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-7

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs)
of Chemicals Detected in Soil Gas

Chemical	Concentrations (ppm) 95% UCL of Arithmetic Mean	Maximum Detect	RC (1)	RC (2) (ug/L)
Tetrachloroethene	2.9E+02	7.7E+02	2.9E+02	2.0E+03
Toluene	1.9E+00	5.6E+00	1.9E+00	7.2E+00
Trichloroethene	1.0E+00	3.1E+00	1.0E+00	5.6E+00
Xylenes, p- and m-	3.4E-02	5.3E-02	3.4E-02	1.5E-01

(1) The lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration for each chemical.

(2) RCs in units of ppm converted to units of ug/L for use in transport modeling in Chapter 3.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 4

TABLE 2-8

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs) of
Chemicals of Concern Detected in Ground Water

(All units in mg/L)

Chemical	WELL MW-1		WELL MW-2		WELL MW-3		WELL MW-4		WELL MW-5		WELL MW-6	
AROMATIC VOLATILES:												
Benzene	1.4E+01	MDC	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	4.0E-01	C	5.0E-04	ND
Ethylbenzene	3.5E+00	MDC	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	3.1E-02	C	5.0E-04	ND
Toluene	2.5E+01	MDC	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	2.2E-02	C	5.0E-04	ND
Xylenes, total	2.0E+01	MDC	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	4.5E-02	C	5.0E-04	ND
HALOGENATED VOLATILES:												
1,2-Dichloroethene, cis-	5.0E-02	ND	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND
Freon 12	--		--		--		--		--		--	
Tetrachloroethene	5.0E-02	ND	3.5E-01	MDC	5.0E-04	ND	5.0E-04	ND	2.0E-03	C	3.5E-02	C
Trichloroethene	5.0E-02	ND	1.5E-03	ND	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND
BASE/NEUTRAL/ACID COMPOUNDS:												
Bis(2-ethylhexyl)phthalate	--		--		--		--		--		--	
Phenol	--		--		--		--		--		--	

NOTES:

MDC: This chemical was detected at least once in the samples collected at this monitoring well. The RC is the lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration. In this case, the RC is the maximum detected concentration (MDC).

ND: This chemical was not detected in any sample(s) collected at this well. The RC is the average of one-half of the detection limit(s) for this chemical.

C: This chemical was detected in the one sample collected at this well. The RC is assumed as the the detected concentration.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 2 of 4

TABLE 2-8

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs) of
Chemicals of Concern Detected in Ground Water

(All units in mg/L)

Chemical	WELL MW-7		WELL MW-8		WELL MW-9		WELL MW-10		WELL MW-11		WELL MW-12	
AROMATIC VOLATILES:												
Benzene	6.3E-02	C	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	2.5E-03	ND	2.5E-04	ND
Ethylbenzene	5.0E-03	ND	5.0E-04	ND	3.0E-03	C	5.0E-04	ND	2.5E-03	ND	2.5E-04	ND
Toluene	1.1E-02	C	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	2.5E-03	ND	1.4E-03	C
Xylenes, total	8.4E-01	C	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	2.5E-03	ND	2.5E-04	ND
HALOGENATED VOLATILES:												
1,2-Dichloroethene, cis-	1.4E-01	C	6.0E-03	C	5.0E-04	ND	5.0E-04	ND	2.5E-03	ND	2.5E-04	ND
Freon 12	--		--		--		--		--		--	
Tetrachloroethene	9.0E-01	C	5.8E-01	C	5.0E-04	ND	3.5E-02	C	1.0E-01	C	1.7E-01	C
Trichloroethene	2.6E-02	C	1.7E-02	C	5.0E-04	ND	5.0E-04	ND	2.5E-03	ND	1.1E-03	C
BASE/NEUTRAL/ACID COMPOUNDS												
Bis(2-ethylhexyl)phthalate	--		--		--		--		--		--	
Phenol	--		--		--		--		--		--	

NOTES:

MDC: This chemical was detected at least once in the samples collected at this monitoring well. The RC is the lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration. In this case, the RC is the maximum detected concentration (MDC).

ND: This chemical was not detected in any sample(s) collected at this well. The RC is the average of one-half of the detection limit(s) for this chemical.

C: This chemical was detected in the one sample collected at this well. The RC is assumed as the the detected concentration.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 4

TABLE 2-8

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs) of
Chemicals of Concern Detected in Ground Water

(All units in mg/L)

Chemical	WELL MW-13		WELL MW-14		WELL MW-15		WELL MW-17		WELL MW-18		WELL B1-U	
AROMATIC VOLATILES:												
Benzene	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	5.9E-02	MDC	5.0E-04	ND	2.5E-02	ND
Ethylbenzene	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	1.5E-03	ND	5.0E-04	ND	2.5E-02	ND
Toluene	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	1.5E-03	ND	5.0E-04	ND	2.5E-02	ND
Xylenes, total	5.0E-04	ND	5.0E-04	ND	5.0E-04	ND	1.5E-03	ND	5.0E-04	ND	2.5E-02	ND
HALOGENATED VOLATILES:												
1,2-Dichloroethene, cis-	5.0E-04	ND	5.0E-03	C	5.0E-04	ND	1.9E-01	MDC	5.0E-04	ND	7.9E-02	C
Freon 12	--		--		--		2.5E-03	ND	7.0E-03	C	--	
Tetrachloroethene	3.6E-02	MDC	5.0E-03	C	5.0E-04	ND	5.4E-01	MDC	2.0E-01	C	5.8E+00	C
Trichloroethene	5.0E-04	ND	1.0E-03	C	5.0E-04	ND	7.0E-02	MDC	2.0E-03	C	1.4E-01	C
BASE/NEUTRAL/ACID COMPOUNDS												
Bis(2-ethylhexyl)phthalate	--		--		--		2.0E-02	C	2.0E-03	ND	--	
Phenol	--		--		--		5.0E-03	C	2.5E-03	ND	--	

NOTES:

MDC: This chemical was detected at least once in the samples collected at this monitoring well. The RC is the lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration. In this case, the RC is the maximum detected concentration (MDC).

ND: This chemical was not detected in any sample(s) collected at this well. The RC is the average of one-half of the detection limit(s) for this chemical.

C: This chemical was detected in the one sample collected at this well. The RC is assumed as the the detected concentration.

TABLE 2-8

Livermore Arcade Shopping Center
Livermore, California

Representative Concentrations (RCs) of
Chemicals of Concern Detected in Ground Water

(All units in mg/L)

Chemical	WELL B2-U	
AROMATIC VOLATILES:		
Benzene	2.5E-03	ND
Ethylbenzene	2.5E-03	ND
Toluene	2.5E-03	ND
Xylenes, total	2.5E-03	ND
HALOGENATED VOLATILES:		
1,2-Dichloroethene, cis-	2.5E-03	ND
Freon 12	--	
Tetrachloroethene	8.2E-01	C
Trichloroethene	2.5E-03	ND
BASE/NEUTRAL/ACID COMPOUNDS		
Bis(2-ethylhexyl)phthalate	--	
Phenol	--	

NOTES:

MDC: This chemical was detected at least once in the samples collected at this monitoring well. The RC is the lesser of either the maximum detected concentration or the 95% UCL of the arithmetic mean concentration. In this case, the RC is the maximum detected concentration (MDC).

ND: This chemical was not detected in any sample(s) collected at this well. The RC is the average of one-half of the detection limit(s) for this chemical.

C: This chemical was detected in the one sample collected at this well. The RC is assumed as the the detected concentration.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-9

Livermore Arcade Shopping Center
Livermore, California

Summary of Organic Chemicals of Potential Concern
Detected in Environmental Media

Chemical	Toxicity Class (1)	Soil (2)	Soil Gas (2)	Ground Water (2)
Benzene	C			x
Bis(2-ethylhexyl)phthalate	C/NC			x (3)
1,2-Dichloroethene, cis-	NC	x		x
Ethylbenzene	NC			x
Freon 12	NC			x (3)
Methylene Chloride	C/NC	x		
Phenol	NC			x (3)
Tetrachloroethene	C/NC	x	x	x
Toluene	NC		x	x
1,1,1-Trichloroethane	NC	x		
Trichloroethene	C		x	x
Xylenes, p- and m-	NC		x (3)	
Xylenes, total	NC			x

(1) C = Chemical demonstrates potential carcinogenic health effects.
NC= Chemical demonstrates potential noncarcinogenic health effects.
(2) x = Chemical has been detected at least once in the environmental medium.
(3) Chemical detected only once in this environmental medium.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 2-10

Livermore Arcade Shopping Center
Livermore, California

Physical/Chemical Properties for Organic
Chemicals of Potential Concern

Chemical	Molecular Weight (1)	Henry's Law Constant (1) (atm-m3/mol)	Diffusivity in Air (2) (cm2/sec)	Log Kow (3)	Koc (3)
Benzene	78.12	5.50E-03	9.2E-02	2.12	83
Bis(2-ethylhexyl)phthalate	391.07	3.00E-07	3.5E-02 (1)	4.66 (4)	7,900 (4)
1,2-Dichloroethene, cis-	96.95	3.19E-02	8.4E-02	0.70	49
Ethylbenzene	106.20	6.44E-03	7.1E-02	3.15	1,100
Freon 12	120.92	4.01E-01	9.3E-02 (5)	2.16	58
Methylene chloride	85.00	3.19E-03	1.1E-01	1.30	8.8
Phenol	94.10	4.54E-07	8.9E-02	1.46	14.2
Tetrachloroethene	165.83	2.90E-02	7.7E-02	2.6	364
Toluene	92.40	6.68E-03	8.3E-02	2.73	300
1,1,1-Trichloroethane	133.40	1.72E-02	8.5E-02	2.5	152
Trichloroethene	131.40	9.10E-03	8.6E-02	2.38	126
Xylenes, total	106.20	5.27E-03	7.6E-02	3.26	240

(1) U.S. EPA, 1990.
(2) Shen, 1981, unless otherwise stated.
(3) U.S. EPA, 1986, unless otherwise stated.
(4) U.S. EPA, 1987.
(5) Estimated using Lyman et al., 1982.

TABLE 3-1

Livermore Arcade Shopping Center
Livermore, California

Summary of Exposure Assumptions (1)

Assumption	Exposure Scenario	Value Used	Reference
SOIL INGESTION RATE	Onsite Resident (adult)	100 mg/day	U.S. EPA, 1989a
	Onsite Resident (child)	200 mg/day	U.S. EPA, 1989a
FRACTION OF EXPOSURE	Onsite Resident (adult)	100%	U.S. EPA, 1989a
FROM CONTAMINATED SOURCE	Onsite Resident (child)	100%	U.S. EPA, 1989a
SKIN SURFACE AREA	Onsite Resident (adult)	6,990 cm2/day (2)	Estimated using
EXPOSED TO SOIL	Onsite Resident (child)	2,570 cm2/day (2)	U.S. EPA guidance
SOIL TO SKIN	Onsite Resident (adult)	2.77 mg/cm2	U.S. EPA, 1989a
ADHERENCE FACTOR	Onsite Resident (child)	2.77 mg/cm2	U.S. EPA, 1989a
INHALATION RATE	Onsite Resident (adult)	30 m3/day	U.S. EPA, 1989a
	Onsite Resident (child)	22.5 m3/day (3)	U.S. EPA, 1989b
WATER INGESTION RATE	Onsite Resident (adult)	2 Litres/day	U.S. EPA, 1989a
	Onsite Resident (child)	1.5 Litres/day (4)	U.S. EPA, 1989b
EXPOSURE TIME	Onsite Resident (adult)	24 hours/day	U.S. EPA, 1989a
	Onsite Resident (child)	24 hours/day	U.S. EPA, 1989a
EXPOSURE FREQUENCY	Onsite Resident (adult)	365 days/year	U.S. EPA, 1989a
	Onsite Resident (child)	365 days/year	U.S. EPA, 1989a
EXPOSURE DURATION	Onsite Resident (adult)	24 years or 30 years (5)	U.S. EPA, 1989a
	Onsite Resident (child)	6 years (5)	U.S. EPA, 1989a
AVERAGING TIME	Onsite Resident (adult)	30 years/70 years (6)	U.S. EPA, 1989a
	Onsite Resident (child)	30 years/70 years (6)	U.S. EPA, 1989a
BODY WEIGHT	Onsite Resident (adult)	70 kg	U.S. EPA, 1989a
	Onsite Resident (child)	16 kg	U.S. EPA, 1989a

(1) All values selected to provide estimates of Reasonable Maximum Exposure (RME).

(2) See text, Section 3.4.2.2.

(3) Age-specific data indicate that inhalation rate of 6 year old at various activity levels is approximately 75% that of an adult.

(4) Age-specific data indicate that water ingestion rate of 6 year old is approximately 75% of the adult value.

(5) The total exposure duration for an individual residing onsite is 30 years. Two scenarios are assumed:
 Exposure for 30 years as an adult
 Exposure for 6 years as a child and the remaining 24 years as an adult

(6) CDIs for noncarcinogens calculated assuming first value. CDIs for carcinogens calculated assuming second value.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-2

Livermore Arcade Shopping Center
Livermore, California

Estimated Exposure Point Concentrations (EPCs)
of Organic Chemicals Detected in Soil

Chemical	EPC (1) (mg/kg)
1,2-Dichloroethene, cis-	1.5E-02
Methylene Chloride	1.1E-02
Tetrachloroethene	3.6E-01
1,1,1-Trichloroethane	5.8E-01

(1) The EPC for each chemical in soil is identical to its representative concentration (RC) in soil, which was provided in Table 2-6.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-3

Livermore Arcade Shopping Center
Livermore, California

Estimated Emission Rates and
Exposure Point Concentrations (EPCs)
in Air of Chemicals Detected in Soil Gas

Chemical	Emission Rate (g/cm2-sec)	EPC in Air (1) (ug/m3)
Tetrachloroethene	9.9E-12	3.3E-01
Toluene	3.8E-14	1.3E-03
Trichloroethene	3.1E-14	1.0E-03
Xylenes, p- and m-	7.3E-16	2.4E-05

(1) Estimated using "box model" methodology and an annual average wind speed of 2.0 meters/second, based on the annual average wind speed measured by the California Air Resources Board at its Livermore meteorological field station (CARB, 1984).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: TV QC: SKW

TABLE 3-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS
CARCINOGENS (1)

(All units in mg/kg-day)

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
Methylene Chloride	6.7E-09	1.3E-07	--
Tetrachloroethene	2.2E-07	4.3E-06	6.0E-05
Trichloroethene	--	--	1.9E-07

-- = Chemical not detected in this specific medium.

(1) Exposure duration assumed as 30 years (U.S. EPA, 1989a). Averaging time assumed as 70 years (U.S. EPA, 1989a).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-1		WELL MW-2		WELL MW-3		WELL MW-4	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	1.7E-01	1.7E-01	1.8E-05	1.8E-05	6.1E-06	6.1E-06	6.1E-06	6.1E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	6.1E-04	6.1E-04	4.3E-03	4.3E-03	6.1E-06	6.1E-06	6.1E-06	6.1E-06
Trichloroethene	6.1E-04	6.1E-04	1.8E-05	1.8E-05	6.1E-06	6.1E-06	6.1E-06	6.1E-06
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-5 Ingestion CDI	WELL MW-5 Inhalation/ Dermal CDI	WELL MW-6 Ingestion CDI	WELL MW-6 Inhalation/ Dermal CDI	WELL MW-7 Ingestion CDI	WELL MW-7 Inhalation/ Dermal CDI	WELL MW-8 Ingestion CDI	WELL MW-8 Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	4.9E-03	4.9E-03	6.1E-06	6.1E-06	7.7E-04	7.7E-04	6.1E-06	6.1E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	2.4E-05	2.4E-05	4.3E-04	4.3E-04	1.1E-02	1.1E-02	7.1E-03	7.1E-03
Trichloroethene	6.1E-06	6.1E-06	6.1E-06	6.1E-06	3.2E-04	3.2E-04	2.1E-04	2.1E-04
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 5

TABLE 3-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-9		WELL MW-10		WELL MW-11		WELL MW-12	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	6.1E-06	6.1E-06	6.1E-06	6.1E-06	3.1E-05	3.1E-05	3.1E-06	3.1E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	6.1E-06	6.1E-06	4.3E-04	4.3E-04	1.2E-03	1.2E-03	2.1E-03	2.1E-03
Trichloroethene	6.1E-06	6.1E-06	6.1E-06	6.1E-06	3.1E-05	3.1E-05	1.3E-05	1.3E-05
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-13		WELL MW-14		WELL MW-15		WELL MW-17	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	6.1E-06	7.2E-04	7.2E-04
HALOGENATED VOLATILES:								
Tetrachloroethene	4.4E-04	4.4E-04	6.1E-05	6.1E-05	6.1E-06	6.1E-06	6.6E-03	6.6E-03
Trichloroethene	6.1E-06	6.1E-06	1.2E-05	1.2E-05	6.1E-06	6.1E-06	8.6E-04	8.6E-04
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	2.4E-04	2.4E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-18		WELL B1-U		WELL B2-U	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:						
Benzene	6.1E-06	6.1E-06	3.1E-04	3.1E-04	3.1E-05	3.1E-05
HALOGENATED VOLATILES:						
Tetrachloroethene	2.4E-03	2.4E-03	7.1E-02	7.1E-02	1.0E-02	1.0E-02
Trichloroethene	2.4E-05	2.4E-05	1.7E-03	1.7E-03	3.1E-05	3.1E-05
BASE/NEUTRAL/ACID COMPOUNDS:						
Bis(2-ethylhexyl)phthalate	2.4E-05	2.4E-05	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-6

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS
NONCARCINOGENS (1)

(All units in mg/kg-day)

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
1,2-Dichloroethene, cis-	2.1E-08	4.1E-07	--
Methylene Chloride	1.6E-08	3.0E-07	--
Tetrachloroethene	5.1E-07	1.0E-05	1.4E-04
Toluene	--	--	5.5E-07
1,1,1-Trichloroethane	8.3E-07	1.6E-05	--
Xylenes, p- and m-	--	--	1.0E-08

-- = Chemical not detected in this specific medium.

(1) Exposure duration assumed as 30 years (U.S. EPA, 1989a). Averaging time assumed as 30 years (U.S. EPA, 1989a).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-1 Ingestion CDI	WELL MW-1 Inhalation/ Dermal CDI	WELL MW-2 Ingestion CDI	WELL MW-2 Inhalation/ Dermal CDI	WELL MW-3 Ingestion CDI	WELL MW-3 Inhalation/ Dermal CDI	WELL MW-4 Ingestion CDI	WELL MW-4 Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	1.0E-01	1.0E-01	4.3E-05	4.3E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05
Toluene	7.1E-01	7.1E-01	4.3E-05	4.3E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05
Xylenes, total	5.7E-01	5.7E-01	4.3E-05	4.3E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	1.4E-03	1.4E-03	4.3E-05	4.3E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	1.4E-03	1.4E-03	1.0E-02	1.0E-02	1.4E-05	1.4E-05	1.4E-05	1.4E-05
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/1/92 Analyst: JV QC: SKW Page: 2 of 5

TABLE 3-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-5 Ingestion CDI	WELL MW-5 Inhalation/ Dermal CDI	WELL MW-6 Ingestion CDI	WELL MW-6 Inhalation/ Dermal CDI	WELL MW-7 Ingestion CDI	WELL MW-7 Inhalation/ Dermal CDI	WELL MW-8 Ingestion CDI	WELL MW-8 Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	8.9E-04	8.9E-04	1.4E-05	1.4E-05	1.4E-04	1.4E-04	1.4E-05	1.4E-05
Toluene	6.3E-04	6.3E-04	1.4E-05	1.4E-05	3.1E-04	3.1E-04	1.4E-05	1.4E-05
Xylenes, total	1.3E-03	1.3E-03	1.4E-05	1.4E-05	2.4E-02	2.4E-02	1.4E-05	1.4E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	1.4E-05	1.4E-05	1.4E-05	1.4E-05	4.0E-03	4.0E-03	1.7E-04	1.7E-04
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	5.7E-05	5.7E-05	1.0E-03	1.0E-03	2.6E-02	2.6E-02	1.7E-02	1.7E-02
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-9		WELL MW-10		WELL MW-11		WELL MW-12	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	8.6E-05	8.6E-05	1.4E-05	1.4E-05	7.1E-05	7.1E-05	7.1E-06	7.1E-06
Toluene	1.4E-05	1.4E-05	1.4E-05	1.4E-05	7.1E-05	7.1E-05	4.0E-05	4.0E-05
Xylenes, total	1.4E-05	1.4E-05	1.4E-05	1.4E-05	7.1E-05	7.1E-05	7.1E-06	7.1E-06
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	1.4E-05	1.4E-05	1.4E-05	1.4E-05	7.1E-05	7.1E-05	7.1E-06	7.1E-06
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	1.4E-05	1.4E-05	1.0E-03	1.0E-03	2.9E-03	2.9E-03	4.9E-03	4.9E-03
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-13		WELL MW-14		WELL MW-15		WELL MW-17	
	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	4.3E-05	4.3E-05
Toluene	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	4.3E-05	4.3E-05
Xylenes, total	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	1.4E-05	4.3E-05	4.3E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	1.4E-05	1.4E-05	1.4E-04	1.4E-04	1.4E-05	1.4E-05	5.4E-03	5.4E-03
Freon 12	--	--	--	--	--	--	7.1E-05	7.1E-05
Tetrachloroethene	1.0E-03	1.0E-03	1.4E-04	1.4E-04	1.4E-05	1.4E-05	1.5E-02	1.5E-02
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	5.7E-04	5.7E-04
Phenol	--	--	--	--	--	--	1.4E-04	1.4E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 5 of 5

TABLE 3-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-18		WELL B1-U		WELL B2-U	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:						
Ethylbenzene	1.4E-05	1.4E-05	7.1E-04	7.1E-04	7.1E-05	7.1E-05
Toluene	1.4E-05	1.4E-05	7.1E-04	7.1E-04	7.1E-05	7.1E-05
Xylenes, total	1.4E-05	1.4E-05	7.1E-04	7.1E-04	7.1E-05	7.1E-05
HALOGENATED VOLATILES:						
1,2-Dichloroethene, cis-	1.4E-05	1.4E-05	2.3E-03	2.3E-03	7.1E-05	7.1E-05
Freon 12	2.0E-04	2.0E-04	--	--	--	--
Tetrachloroethene	5.7E-03	5.7E-03	1.7E-01	1.7E-01	2.3E-02	2.3E-02
BASE/NEUTRAL/ACID COMPOUNDS:						
Bis(2-ethylhexyl)phthalate	5.7E-05	5.7E-05	--	--	--	--
Phenol	7.1E-05	7.1E-05	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS
CARCINOGENS (1)

(All units in mg/kg-day)

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
Methylene Chloride	1.7E-08	1.5E-07	--
Tetrachloroethene	5.6E-07	4.8E-06	8.8E-05
Trichloroethene	--	--	2.8E-07

-- = Chemical not detected in this specific medium.

(1) Exposure duration assumed as 30 years total, in which 6 years are spent as a child, and the remaining 24 years are spent as an adult. CDIs for the child are calculated using the child-specific exposure factors indicated in Table 3-1, and an exposure duration of 6 years. A separate calculation is made for the adult years of the child/adult individual, using the adult-specific exposure factors listed in Table 3-1, and assuming an exposure duration of 24 years. The two CDIs are summed to estimate chemical intake over 30 years total. The averaging time used for calculating CDIs for carcinogens is 70 years (U.S. EPA, 1989a).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 5

TABLE 3-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-1		WELL MW-2		WELL MW-3		WELL MW-4	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	2.5E-01	2.5E-01	2.7E-05	2.7E-05	8.9E-06	8.9E-06	8.9E-06	8.9E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	8.9E-04	8.9E-04	6.2E-03	6.2E-03	8.9E-06	8.9E-06	8.9E-06	8.9E-06
Trichloroethene	8.9E-04	8.9E-04	2.7E-05	2.7E-05	8.9E-06	8.9E-06	8.9E-06	8.9E-06
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-5		WELL MW-6		WELL MW-7		WELL MW-8	
	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	7.1E-03	7.1E-03	8.9E-06	8.9E-06	1.1E-03	1.1E-03	8.9E-06	8.9E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	3.6E-05	3.6E-05	6.2E-04	6.2E-04	1.6E-02	1.6E-02	1.0E-02	1.0E-02
Trichloroethene	8.9E-06	8.9E-06	8.9E-06	8.9E-06	4.6E-04	4.6E-04	3.0E-04	3.0E-04
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 5

TABLE 3-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-9		WELL MW-10		WELL MW-11		WELL MW-12	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	8.9E-06	8.9E-06	8.9E-06	8.9E-06	4.5E-05	4.5E-05	4.5E-06	4.5E-06
HALOGENATED VOLATILES:								
Tetrachloroethene	8.9E-06	8.9E-06	6.2E-04	6.2E-04	1.8E-03	1.8E-03	3.0E-03	3.0E-03
Trichloroethene	8.9E-06	8.9E-06	8.9E-06	8.9E-06	4.5E-05	4.5E-05	2.0E-05	2.0E-05
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 4 of 5

TABLE 3-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-13		WELL MW-14		WELL MW-15		WELL MW-17	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Benzene	8.9E-06	8.9E-06	8.9E-06	8.9E-06	8.9E-06	8.9E-06	1.1E-03	1.1E-03
HALOGENATED VOLATILES:								
Tetrachloroethene	6.4E-04	6.4E-04	8.9E-05	8.9E-05	8.9E-06	8.9E-06	9.6E-03	9.6E-03
Trichloroethene	8.9E-06	8.9E-06	1.8E-05	1.8E-05	8.9E-06	8.9E-06	1.2E-03	1.2E-03
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	3.6E-04	3.6E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 5 of 5

TABLE 3-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
CARCINOGENS

(All units in mg/kg-day)

	WELL MW-18		WELL B1-U		WELL B2-U	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:						
Benzene	8.9E-06	8.9E-06	4.5E-04	4.5E-04	4.5E-05	4.5E-05
HALOGENATED VOLATILES:						
Tetrachloroethene	3.6E-03	3.6E-03	1.0E-01	1.0E-01	1.5E-02	1.5E-02
Trichloroethene	3.6E-05	3.6E-05	2.5E-03	2.5E-03	4.5E-05	4.5E-05
BASE/NEUTRAL/ACID COMPOUNDS:						
Bis(2-ethylhexyl)phthalate	3.6E-05	3.6E-05	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-10

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS
NONCARCINOGENS (1)

(All units in mg/kg-day)

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
1,2-Dichloroethene, cis-	5.5E-08	4.7E-07	--
Methylene Chloride	4.0E-08	3.4E-07	--
Tetrachloroethene	1.3E-06	1.1E-05	2.1E-04
Toluene	--	--	8.0E-07
1,1,1-Trichloroethane	2.1E-06	1.8E-05	--
Xylenes, p- and m-	--	--	1.5E-08

-- = Chemical not detected in this specific medium.

(1) Exposure duration assumed as 30 years total, in which 6 years are spent as a child, and the remaining 24 years are spent as an adult. CDIs for the child are calculated using the child-specific exposure factors indicated in Table 3-1, and an exposure duration of 6 years. A separate calculation is made for the adult years of the child/adult individual, using the adult-specific exposure factors listed in Table 3-1, and assuming an exposure duration of 24 years. The two CDIs are summed to estimate chemical intake over 30 years total. The averaging time used for calculating CDIs for noncarcinogens is equal to the exposure duration, which is 30 years (U.S. EPA, 1989a).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 5

TABLE 3-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-1		WELL MW-2		WELL MW-3		WELL MW-4	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	1.5E-01	1.5E-01	6.2E-05	6.2E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05
Toluene	1.0E+00	1.0E+00	6.2E-05	6.2E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05
Xylenes, total	8.3E-01	8.3E-01	6.2E-05	6.2E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	2.1E-03	2.1E-03	6.2E-05	6.2E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	2.1E-03	2.1E-03	1.5E-02	1.5E-02	2.1E-05	2.1E-05	2.1E-05	2.1E-05
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

Chemical	WELL MW-5		WELL MW-6		WELL MW-7		WELL MW-8	
	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	1.3E-03	1.3E-03	2.1E-05	2.1E-05	2.1E-04	2.1E-04	2.1E-05	2.1E-05
Toluene	9.2E-04	9.2E-04	2.1E-05	2.1E-05	4.6E-04	4.6E-04	2.1E-05	2.1E-05
Xylenes, total	1.9E-03	1.9E-03	2.1E-05	2.1E-05	3.5E-02	3.5E-02	2.1E-05	2.1E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	2.1E-05	2.1E-05	2.1E-05	2.1E-05	5.8E-03	5.8E-03	2.5E-04	2.5E-04
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	8.3E-05	8.3E-05	1.5E-03	1.5E-03	3.7E-02	3.7E-02	2.4E-02	2.4E-02
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-9		WELL MW-10		WELL MW-11		WELL MW-12	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	1.2E-04	1.2E-04	2.1E-05	2.1E-05	1.0E-04	1.0E-04	1.0E-05	1.0E-05
Toluene	2.1E-05	2.1E-05	2.1E-05	2.1E-05	1.0E-04	1.0E-04	5.8E-05	5.8E-05
Xylenes, total	2.1E-05	2.1E-05	2.1E-05	2.1E-05	1.0E-04	1.0E-04	1.0E-05	1.0E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	2.1E-05	2.1E-05	2.1E-05	2.1E-05	1.0E-04	1.0E-04	1.0E-05	1.0E-05
Freon 12	--	--	--	--	--	--	--	--
Tetrachloroethene	2.1E-05	2.1E-05	1.5E-03	1.5E-03	4.2E-03	4.2E-03	7.1E-03	7.1E-03
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--

-- = Not Analyzed
(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 4 of 5

TABLE 3-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-13		WELL MW-14		WELL MW-15		WELL MW-17	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:								
Ethylbenzene	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	6.2E-05	6.2E-05
Toluene	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	6.2E-05	6.2E-05
Xylenes, total	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	2.1E-05	6.2E-05	6.2E-05
HALOGENATED VOLATILES:								
1,2-Dichloroethene, cis-	2.1E-05	2.1E-05	2.1E-04	2.1E-04	2.1E-05	2.1E-05	7.9E-03	7.9E-03
Freon 12	--	--	--	--	--	--	1.0E-04	1.0E-04
Tetrachloroethene	1.5E-03	1.5E-03	2.1E-04	2.1E-04	2.1E-05	2.1E-05	2.2E-02	2.2E-02
BASE/NEUTRAL/ACID COMPOUNDS:								
Bis(2-ethylhexyl)phthalate	--	--	--	--	--	--	8.3E-04	8.3E-04
Phenol	--	--	--	--	--	--	2.1E-04	2.1E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)
NONCARCINOGENS

(All units in mg/kg-day)

	WELL MW-18		WELL B1-U		WELL B2-U	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
AROMATIC VOLATILES:						
Ethylbenzene	2.1E-05	2.1E-05	1.0E-03	1.0E-03	1.0E-04	1.0E-04
Toluene	2.1E-05	2.1E-05	1.0E-03	1.0E-03	1.0E-04	1.0E-04
Xylenes, total	2.1E-05	2.1E-05	1.0E-03	1.0E-03	1.0E-04	1.0E-04
HALOGENATED VOLATILES:						
1,2-Dichloroethene, cis-	2.1E-05	2.1E-05	3.3E-03	3.3E-03	1.0E-04	1.0E-04
Freon 12	2.9E-04	2.9E-04	--	--	--	--
Tetrachloroethene	8.3E-03	8.3E-03	2.4E-01	2.4E-01	3.4E-02	3.4E-02
BASE/NEUTRAL/ACID COMPOUNDS:						
Bis(2-ethylhexyl)phthalate	8.3E-05	8.3E-05	--	--	--	--
Phenol	1.0E-04	1.0E-04	--	--	--	--

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-12

Livermore Arcade Shopping Center
Livermore, California

Estimates of Upper-Bound Leachate Concentrations
and Exposure Point Concentrations (EPCs) of
Leachate Diluted in Ground Water

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

Chemical	RC (mg/kg)	Leachate Concentration (mg/L)	UPPER AQUIFER EPCs (mg/L) 13' Thickness	UPPER AQUIFER EPCs (mg/L) 32' Thickness	LOWER AQUIFER EPCs (mg/L) 13' - 37.5' Thickness	LOWER AQUIFER EPCs (mg/L) 32' - 37.5' Thickness
1,2-Dichloroethene, cis-	1.5E-02	3.1E-01	4.9E-03	2.0E-03	1.3E-03	9.2E-04
Methylene Chloride	1.1E-02	1.3E+00	2.1E-02	8.5E-03	5.5E-03	3.9E-03
Tetrachloroethene	3.6E-01	9.9E-01	1.6E-02	6.5E-03	4.2E-03	3.0E-03
1,1,1-Trichloroethane	5.8E-01	3.8E+00	6.0E-02	2.5E-02	1.6E-02	1.2E-02

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-13

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
CARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

(All units in mg/kg-day)

	UPPER AQUIFER 13' Thickness		UPPER AQUIFER 32' Thickness		LOWER AQUIFER 13' - 37.5' Thickness		LOWER AQUIFER 32' - 37.5' Thickness	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
Methylene Chloride	2.6E-04	2.6E-04	1.0E-04	1.0E-04	6.7E-05	6.7E-05	4.8E-05	4.8E-05
Tetrachloroethene	2.0E-04	2.0E-04	8.0E-05	8.0E-05	5.1E-05	5.1E-05	3.7E-05	3.7E-05

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-14

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
NONCARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

(All units in mg/kg-day)

Chemical	UPPER AQUIFER 13' Thickness		UPPER AQUIFER 32' Thickness		LOWER AQUIFER 13' - 37.5' Thickness		LOWER AQUIFER 32' - 37.5' Thickness	
	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
1,2-Dichloroethene, cis-	1.4E-04	1.4E-04	5.7E-05	5.7E-05	3.7E-05	3.7E-05	2.6E-05	2.6E-05
Methylene Chloride	6.0E-04	6.0E-04	2.4E-04	2.4E-04	1.6E-04	1.6E-04	1.1E-04	1.1E-04
Tetrachloroethene	4.6E-04	4.6E-04	1.9E-04	1.9E-04	1.2E-04	1.2E-04	8.6E-05	8.6E-05
1,1,1-Trichloroethane	1.7E-03	1.7E-03	7.1E-04	7.1E-04	4.6E-04	4.6E-04	3.4E-04	3.4E-04

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-15

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
CARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

(All units in mg/kg-day)

	UPPER AQUIFER 13' Thickness		UPPER AQUIFER 32' Thickness		LOWER AQUIFER 13' - 37.5' Thickness		LOWER AQUIFER 32' - 37.5' Thickness	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
Methylene Chloride	3.7E-04	3.7E-04	1.5E-04	1.5E-04	9.8E-05	9.8E-05	7.0E-05	7.0E-05
Tetrachloroethene	2.9E-04	2.9E-04	1.2E-04	1.2E-04	7.5E-05	7.5E-05	5.3E-05	5.3E-05

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-16

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
NONCARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

(All units in mg/kg-day)

	UPPER AQUIFER 13' Thickness		UPPER AQUIFER 32' Thickness		LOWER AQUIFER 13' - 37.5' Thickness		LOWER AQUIFER 32' - 37.5' Thickness	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
1,2-Dichloroethene, cis-	2.0E-04	2.0E-04	8.3E-05	8.3E-05	5.4E-05	5.4E-05	3.8E-05	3.8E-05
Methylene Chloride	8.7E-04	8.7E-04	3.5E-04	3.5E-04	2.3E-04	2.3E-04	1.6E-04	1.6E-04
Tetrachloroethene	6.7E-04	6.7E-04	2.7E-04	2.7E-04	1.7E-04	1.7E-04	1.2E-04	1.2E-04
1,1,1-Trichloroethane	2.5E-03	2.5E-03	1.0E-03	1.0E-03	6.7E-04	6.7E-04	5.0E-04	5.0E-04

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SVW

TABLE 3-17

Livermore Arcade Shopping Center
Livermore, California

Estimates of Upper-Bound Soil Zone Ground Water
Concentrations and Exposure Point Concentrations (EPCs)
of VOCs in Upper and Lower Aquifers

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

Chemical	RC (mg/kg)	Soil Zone Ground Water Concentration (mg/L)	Upper Aquifer EPCs (mg/L)	Lower Aquifer EPCs (mg/L)
1,2-Dichloroethene, cis-	1.5E-02	3.1E-01	1.6E-01	7.4E-02
Methylene Chloride	1.1E-02	1.3E+00	6.5E-01	3.0E-01
Tetrachloroethene	4.4E-01	1.2E+00	6.0E-01	2.8E-01
1,1,1-Trichloroethane	5.2E-01	3.4E+00	1.7E+00	7.8E-01

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-18

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
CARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

(All units in mg/kg-day)

	UPPER AQUIFER		LOWER AQUIFER	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
Methylene Chloride	8.0E-03	8.0E-03	3.7E-03	3.7E-03
Tetrachloroethene	7.3E-03	7.3E-03	3.4E-03	3.4E-03

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-19

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
NONCARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

(All units in mg/kg-day)

	UPPER AQUIFER		LOWER AQUIFER	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
1,2-Dichloroethene, cis-	4.6E-03	4.6E-03	2.1E-03	2.1E-03
Methylene Chloride	1.9E-02	1.9E-02	8.6E-03	8.6E-03
Tetrachloroethene	1.7E-02	1.7E-02	8.0E-03	8.0E-03
1,1,1-Trichloroethane	4.9E-02	4.9E-02	2.2E-02	2.2E-02

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-20

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
CARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

(All units in mg/kg-day)

	UPPER AQUIFER		LOWER AQUIFER	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
Methylene Chloride	1.2E-02	1.2E-02	5.3E-03	5.3E-03
Tetrachloroethene	1.1E-02	1.1E-02	5.0E-03	5.0E-03

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 3-21

Livermore Arcade Shopping Center
Livermore, California

Estimates of Chronic Daily Intake (CDI)

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER
NONCARCINOGENS

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

(All units in mg/kg-day)

	UPPER AQUIFER		LOWER AQUIFER	
Chemical	Ingestion CDI	Inhalation/ Dermal CDI	Ingestion CDI	Inhalation/ Dermal CDI
1,2-Dichloroethene, cis-	6.7E-03	6.7E-03	3.1E-03	3.1E-03
Methylene Chloride	2.7E-02	2.7E-02	1.2E-02	1.2E-02
Tetrachloroethene	2.5E-02	2.5E-02	1.2E-02	1.2E-02
1,1,1-Trichloroethane	7.1E-02	7.1E-02	3.2E-02	3.2E-02

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 4-1

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Ingestion Exposure Route

POTENTIAL NONCARCINOGENIC EFFECTS

Chemical	Chronic RfD (mg/kg-day)	Effects of Concern	RfD Basis/ Source	Uncertainty/ Modifying Factors
Bis(2-ethylhexyl)phthalate	2E-02	Increased relative liver weight	Diet/IRIS (1)	1,000/1
1,2-Dichloroethene, cis-	1E-02 (2)	Decreased hematocrit and hemoglobin	Gavage/HEAST (3)	1,000/3
Ethylbenzene	1E-01	Hepatotoxicity and nephrotoxicity	Gavage/IRIS	1,000/1
Freon 12	2E-01	Depressed body weight gain	Food/IRIS	100/1
Methylene Chloride	6E-02	Liver toxicity	Water/IRIS	100/1
Phenol	6E-01 (4)	Reduced fetal body weight	Gavage/IRIS	100/1
Tetrachloroethene	1E-02	Hepatotoxicity	Gavage/IRIS	1,000/1
Toluene	2E-01	Liver and kidney weight changes	Gavage/IRIS	1,000/1
1,1,1-Trichloroethane	9E-02 (5)(6)	Hepatotoxicity	Air/IRIS	1,000/1
Xylenes, total	2E+00	Hyperactivity, decreased body weight	Gavage/IRIS	100/1

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 2 of 2

TABLE 4-1

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Ingestion Exposure Route

POTENTIAL NONCARCINOGENIC EFFECTS

Chemical	Chronic RfD (mg/kg-day)	Effects of Concern	RfD Basis/ Source	Uncertainty/ Modifying Factors

(1) Health criteria derived by U.S. EPA and published in the Integrated Risk Information System (IRIS) (U.S. EPA, 1992).

(2) RfD verified, IRIS input pending.

(3) Health criteria derived by U.S. EPA and published in the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1991a).

(4) Developmental effects used as basis for calculation.

(5) Toxicity value under review by RfD/RfC Workgroup.

(6) Based on route-to-route extrapolation.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 2

TABLE 4-2

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Inhalation Exposure Route

POTENTIAL NONCARCINOGENIC EFFECTS

Chemical	Chronic RfD (mg/kg-day)	Effects of Concern	RfD Basis/ Source	Uncertainty/ Modifying Factors
Bis(2-ethylhexyl)phthalate	2E-02 (1)	Increased relative liver weight	Diet/IRIS (2)	NA
1,2-Dichloroethene, cis-	1E-02 (1)	Decreased hematocrit and hemoglobin	Gavage/HEAST (3)	NA
Ethylbenzene	3E-01 (4)(5)	Developmental toxicity	Air/HEAST	100/3
Freon 12	5E-02	Lung and liver lesions	Air/HEAST	10,000/1
Methylene Chloride	9E-01 (4)	NA	Air/HEAST	100/1
Phenol	6E-01 (1)	Reduced fetal body weight	Gavage/IRIS	NA
Tetrachloroethene	1E-02 (1)	Hepatotoxicity	Gavage/IRIS	NA
Toluene	6E-01 (4)	CNS effects, eyes and nose irritation	Air/HEAST	100/1
1,1,1-Trichloroethane	3E-01 (6)	Hepatotoxicity	Air/HEAST	1,000/1
Xylenes, total	9E-02 (4)	CNS effects, nose/throat irritation	Air/HEAST	100/1

NA = Not Available

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 2 of 2

TABLE 4-2

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Inhalation Exposure Route

POTENTIAL NONCARCINOGENIC EFFECTS

Chemical	Chronic RfD (mg/kg-day)	Effects of Concern	RfD Basis/ Source	Uncertainty/ Modifying Factors

(1) Reference Dose (RfD) not available for the inhalation exposure route. Value chosen is RfD for oral route, assuming 100% absorption.
(2) Health criteria derived by U.S. EPA and published in the Integrated Risk Information System (IRIS) (U.S. EPA, 1992).
(3) Health criteria derived by U.S. EPA and published in the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1991a).
(4) RfC verified, IRIS input pending. RfD derived from RfC in air assuming a human inhalation rate of 20m^3/day and a body weight of 70 kg.
(5) Developmental effects used as basis of calculation.
(6) Toxicity value under review by RfD/RfC Workgroup.

TABLE 4-3

Livermore Arcade Shopping Center
Livermore, California

U.S. EPA Categorization of Carcinogens Based on
Human and Animal Evidence

	Animal Evidence				
Human Evidence	Sufficient	Limited	Inadequate	No Data	No Evidence
Sufficient	A	A	A	A	A
Limited	B1	B1	B1	B1	B1
Inadequate	B2	C	D	D	D
No Data	B2	C	D	D	E
No Evidence	B2	C	D	D	E

(1) Categorization as follows:

Group A - Human carcinogen (sufficient evidence from epidemiological studies).

Group B1 - Probable human carcinogen (limited evidence of carcinogenicity in humans, from epidemiological studies).

Group B2 - Probable human carcinogen (combination of sufficient evidence in animals and adequate evidence in humans).

Group C - Possible human carcinogen (limited evidence of carcinogenicity in animals).

Group D - Not classified (inadequate animal and human data).

Group E - No evidence for carcinogenicity (no evidence for carcinogenicity in at least two adequate animal tests in different species or in both epidemiological and animal studies).

Source: U.S. EPA, 1986

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 4-4

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Ingestion Exposure Route

POTENTIAL CARCINOGENIC EFFECTS

Chemical	Slope Factor (mg/kg-day)^-1	U.S. EPA Weight of Evidence Classification	Type of Cancer (1)	SF Basis/Source
Benzene	2.9E-02 (2)	A	Leukemia	Occupational/IRIS (3)
Bis(2-ethylhexyl)phthalate	1.4E-02	B2	--	Diet/IRIS
Methylene Chloride	7.5E-03	B2	--	Air and Water/IRIS
Tetrachloroethene	5.1E-02 (4)	B2	--	Gavage/HEAST (5)
Trichloroethene	1.1E-02 (4)	B2	--	Gavage/HEAST

(1) Class A carcinogens only.
(2) Based on route-to-route extrapolation.
(3) Health criteria derived by U.S. EPA and published in the Integrated Risk Information System (IRIS) (U.S. EPA, 1992).
(4) Slope factor verified; IRIS input pending.
(5) Health criteria derived by U.S. EPA and published in the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1991a).

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 4-5

Livermore Arcade Shopping Center
Livermore, California

Critical Toxicity Values for the
Inhalation Exposure Route

POTENTIAL CARCINOGENIC EFFECTS

Chemical	Slope Factor (mg/kg-day)^-1	U.S. EPA Weight of Evidence Classification	Type of Cancer (1)	SF Basis/Source
Benzene	2.9E-02	A	Leukemia	Occupational/IRIS (2)
Bis(2-ethylhexyl)phthalate	1.4E-02 (3)	B2	--	Diet/IRIS
Methylene Chloride	1.6E-03 (4)	B2	--	Air/IRIS
Tetrachloroethene	1.8E-03 (4)(5)	B2	--	Air/HEAST (6)
Trichloroethene	1.7E-02 (7)	B2	--	Air/HEAST

(1) Class A carcinogens only.
(2) Health criteria derived by U.S. EPA and published in the Integrated Risk Information System (IRIS) (U.S. EPA, 1992).
(3) Slope factor (SF) not available for the inhalation exposure route. Value chosen is SF for oral route, assuming 100% absorption.
(4) SF derived from U.S. EPA verified Unit Risk Factor by assuming a human inhalation rate of 20 m^3/day and a body weight of 70 kg.
(5) Unit Risk Factor verified; IRIS input pending.
(6) Health criteria derived by U.S. EPA and published in the Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1991a).
(7) Slope factor verified; IRIS input pending. Based on metabolized dose.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SYW

TABLE 5-1

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
Methylene Chloride	5E-11	1E-09	--
Tetrachloroethene	1E-08	2E-07	1E-07
Trichloroethene	--	--	3E-09
TOTAL CANCER RISK	1E-08	2E-07	1E-07

-- = Chemical not detected in this specific medium.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-2

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs)
for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
1,2-Dichlorethene, cis-	2E-06	4E-05	--
Methylene Chloride	3E-07	5E-06	--
Tetrachloroethene	5E-05	1E-03	1E-02
Toluene	--	--	9E-07
1,1,1-Trichloroethane	9E-06	2E-04	--
Xylenes, p- and m-	--	--	1E-07
TOTAL HI	6E-05	1E-03	1E-02

-- = Chemical not detected in this specific medium.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-1			WELL MW-2			WELL MW-3		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	5E-03	5E-03	1E-02	5E-07	5E-07	1E-06	2E-07	2E-07	4E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	3E-05	1E-06	3E-05	2E-04	8E-06	2E-04	3E-07	1E-08	3E-07
Trichloroethene	7E-06	1E-05	2E-05	2E-07	3E-07	5E-07	7E-08	1E-07	2E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			1E-02			2E-04			9E-07

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-4			WELL MW-5			WELL MW-6		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	2E-07	2E-07	4E-07	1E-04	1E-04	2E-04	2E-07	2E-07	4E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	3E-07	1E-08	3E-07	1E-06	4E-08	1E-06	2E-05	8E-07	2E-05
Trichloroethene	7E-08	1E-07	2E-07	7E-08	1E-07	2E-07	7E-08	1E-07	2E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			9E-07			2E-04			2E-05

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 7

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-7			WELL MW-8			WELL MW-9		
	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	2E-05	2E-05	4E-05	2E-07	2E-07	4E-07	2E-07	2E-07	4E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	6E-04	2E-05	6E-04	4E-04	1E-05	4E-04	3E-07	1E-08	3E-07
Trichloroethene	4E-06	5E-06	9E-06	2E-06	4E-06	6E-06	7E-08	1E-07	2E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			6E-04			4E-04			9E-07

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 4 of 7

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-10 Ingestion Risk	WELL MW-10 Inhal/ Dermal Risk	WELL MW-10 TOTAL RISK	WELL MW-11 Ingestion Risk	WELL MW-11 Inhal/ Dermal Risk	WELL MW-11 TOTAL RISK	WELL MW-12 Ingestion Risk	WELL MW-12 Inhal/ Dermal Risk	WELL MW-12 TOTAL RISK
AROMATIC VOLATILES:									
Benzene	2E-07	2E-07	4E-07	9E-07	9E-07	2E-06	9E-08	9E-08	2E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	2E-05	8E-07	2E-05	6E-05	2E-06	6E-05	1E-04	4E-06	1E-04
Trichloroethene	7E-08	1E-07	2E-07	3E-07	5E-07	8E-07	1E-07	2E-07	3E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			2E-05			6E-05			1E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 5 of 7

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-13			WELL MW-14			WELL MW-15		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	2E-07	2E-07	4E-07	2E-07	2E-07	4E-07	2E-07	2E-07	4E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	2E-05	8E-07	2E-05	3E-06	1E-07	3E-06	3E-07	1E-08	3E-07
Trichloroethene	7E-08	1E-07	2E-07	1E-07	2E-07	3E-07	7E-08	1E-07	2E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			2E-05			4E-06			9E-07

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 6 of 7

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-17			WELL MW-18			WELL B1-U		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	2E-05	2E-05	4E-05	2E-07	2E-07	4E-07	9E-06	9E-06	2E-05
HALOGENATED VOLATILES:									
Tetrachloroethene	3E-04	1E-05	3E-04	1E-04	4E-06	1E-04	4E-03	1E-04	4E-03
Trichloroethene	9E-06	1E-05	2E-05	3E-07	4E-07	7E-07	2E-05	3E-05	5E-05
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	3E-06	3E-06	6E-06	3E-07	3E-07	6E-07	--	--	0E+00
TOTAL RISK BY WELL			4E-04			1E-04			4E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-3

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL B2-U		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:			
Benzene	9E-07	9E-07	2E-06
HALOGENATED VOLATILES:			
Tetrachloroethene	5E-04	2E-05	5E-04
Trichloroethene	3E-07	5E-07	8E-07
BASE/NEUTRAL/ACID COMPOUNDS:			
Bis(2-ethylhexyl)phthalate	--	--	0E+00
TOTAL RISK BY WELL			5E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 7

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-1 Ingestion HI	WELL MW-1 Inhal/Dermal HI	WELL MW-1 TOTAL HI	WELL MW-2 Ingestion HI	WELL MW-2 Inhal/Dermal HI	WELL MW-2 TOTAL HI	WELL MW-3 Ingestion HI	WELL MW-3 Inhal/Dermal HI	WELL MW-3 TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	1E+00	3E-01	1E+00	4E-04	1E-04	5E-04	1E-04	5E-05	2E-04
Toluene	4E+00	1E+00	5E+00	2E-04	7E-05	3E-04	7E-05	2E-05	9E-05
Xylenes, total	3E-01	6E+00	6E+00	2E-05	5E-04	5E-04	7E-06	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	1E-01	1E-01	2E-01	4E-03	4E-03	8E-03	1E-03	1E-03	2E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	1E-01	1E-01	2E-01	1E+00	1E+00	2E+00	1E-03	1E-03	2E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			1E+01			2E+00			4E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 7

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-7			WELL MW-8			WELL MW-9		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	1E-03	5E-04	2E-03	1E-04	5E-05	2E-04	9E-04	3E-04	1E-03
Toluene	2E-03	5E-04	3E-03	7E-05	2E-05	9E-05	7E-05	2E-05	9E-05
Xylenes, total	1E-02	3E-01	3E-01	7E-06	2E-04	2E-04	7E-06	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	4E-01	4E-01	8E-01	2E-02	2E-02	4E-02	1E-03	1E-03	2E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	3E+00	3E+00	6E+00	2E+00	2E+00	4E+00	1E-03	1E-03	2E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			7E+00			4E+00			5E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 4 of 7

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-10			WELL MW-11			WELL MW-12		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	1E-04	5E-05	2E-04	7E-04	2E-04	9E-04	7E-05	2E-05	9E-05
Toluene	7E-05	2E-05	9E-05	4E-04	1E-04	5E-04	2E-04	7E-05	3E-04
Xylenes, total	7E-06	2E-04	2E-04	4E-05	8E-04	8E-04	4E-06	8E-05	8E-05
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	1E-03	1E-03	2E-03	7E-03	7E-03	1E-02	7E-04	7E-04	1E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	1E-01	1E-01	2E-01	3E-01	3E-01	6E-01	5E-01	5E-01	1E+00
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			2E-01			6E-01			1E+00

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 5 of 7

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-13			WELL MW-14			WELL MW-15		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	1E-04	5E-05	2E-04	1E-04	5E-05	2E-04	1E-04	5E-05	2E-04
Toluene	7E-05	2E-05	9E-05	7E-05	2E-05	9E-05	7E-05	2E-05	9E-05
Xylenes, total	7E-06	2E-04	2E-04	7E-06	2E-04	2E-04	7E-06	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	1E-03	1E-03	2E-03	1E-02	1E-02	2E-02	1E-03	1E-03	2E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	1E-01	1E-01	2E-01	1E-02	1E-02	2E-02	1E-03	1E-03	2E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			2E-01			4E-02			4E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 6 of 7

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-17 Ingestion HI	WELL MW-17 Inhal/ Dermal HI	WELL MW-17 TOTAL HI	WELL MW-18 Ingestion HI	WELL MW-18 Inhal/ Dermal HI	WELL MW-18 TOTAL HI	WELL B1-U Ingestion HI	WELL B1-U Inhal/ Dermal HI	WELL B1-U TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	4E-04	1E-04	5E-04	1E-04	5E-05	2E-04	7E-03	2E-03	9E-03
Toluene	2E-04	7E-05	3E-04	7E-05	2E-05	9E-05	4E-03	1E-03	5E-03
Xylenes, total	2E-05	5E-04	5E-04	7E-06	2E-04	2E-04	4E-04	8E-03	8E-03
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	5E-01	5E-01	1E+00	1E-03	1E-03	2E-03	2E-01	2E-01	4E-01
Freon 12	4E-04	1E-03	1E-03	1E-03	4E-03	5E-03	--	--	0E+00
Tetrachloroethene	1E+00	1E+00	2E+00	6E-01	6E-01	1E+00	2E+01	2E+01	4E+01
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	3E-02	3E-02	6E-02	3E-03	3E-03	6E-03	--	--	0E+00
Phenol	2E-04	2E-04	4E-04	1E-04	1E-04	2E-04	--	--	0E+00
TOTAL HI BY WELL			3E+00			1E+00			4E+01

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 1

TABLE 5-4

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL B2-U Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:			
Ethylbenzene	7E-04	2E-04	9E-04
Toluene	4E-04	1E-04	5E-04
Xylenes, total	4E-05	8E-04	8E-04
HALOGENATED VOLATILES:			
1,2-Dichloroethene, cis-	7E-03	7E-03	1E-02
Freon 12	--	--	0E+00
Tetrachloroethene	2E+00	2E+00	4E+00
BASE/NEUTRAL/ACID COMPOUNDS:			
Bis(2-ethylhexyl)phthalate	--	--	0E+00
Phenol	--	--	0E+00
TOTAL HI BY WELL			4E+00

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SYW

TABLE 5-5

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
Methylene Chloride	1E-10	1E-09	--
Tetrachloroethene	3E-08	2E-07	2E-07
Trichloroethene	--	--	5E-09
TOTAL CANCER RISK	3E-08	2E-07	2E-07

-- = Chemical not detected in this specific medium.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-6

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs)
for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO SOIL AND SOIL GAS

Chemical	Soil Ingestion	Dermal Absorption from Soil	Soil Gas Inhalation
1,2-Dichlorethene, cis-	5E-06	5E-05	--
Methylene Chloride	7E-07	6E-06	--
Tetrachloroethene	1E-04	1E-03	2E-02
Toluene	--	--	1E-06
1,1,1-Trichloroethane	2E-05	2E-04	--
Xylenes, p- and m-	--	--	2E-07
TOTAL HI	1E-04	1E-03	2E-02

-- = Chemical not detected in this specific medium.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 1 of 7

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-1			WELL MW-2			WELL MW-3		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	7E-03	7E-03	1E-02	8E-07	8E-07	2E-06	3E-07	3E-07	6E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	5E-05	2E-06	5E-05	3E-04	1E-05	3E-04	5E-07	2E-08	5E-07
Trichloroethene	1E-05	2E-05	3E-05	3E-07	5E-07	8E-07	1E-07	2E-07	3E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			1E-02			3E-04			1E-06

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 2 of 7

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-4 Ingestion Risk	WELL MW-4 Inhal/Dermal Risk	WELL MW-4 TOTAL RISK	WELL MW-5 Ingestion Risk	WELL MW-5 Inhal/Dermal Risk	WELL MW-5 TOTAL RISK	WELL MW-6 Ingestion Risk	WELL MW-6 Inhal/Dermal Risk	WELL MW-6 TOTAL RISK
AROMATIC VOLATILES:									
Benzene	3E-07	3E-07	6E-07	2E-04	2E-04	4E-04	3E-07	3E-07	6E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	5E-07	2E-08	5E-07	2E-06	6E-08	2E-06	3E-05	1E-06	3E-05
Trichloroethene	1E-07	2E-07	3E-07	1E-07	2E-07	3E-07	1E-07	2E-07	3E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			1E-06			4E-04			3E-05

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 7

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-7 Ingestion Risk	WELL MW-7 Inhal/ Dermal Risk	WELL MW-7 TOTAL RISK	WELL MW-8 Ingestion Risk	WELL MW-8 Inhal/ Dermal Risk	WELL MW-8 TOTAL RISK	WELL MW-9 Ingestion Risk	WELL MW-9 Inhal/ Dermal Risk	WELL MW-9 TOTAL RISK
AROMATIC VOLATILES:									
Benzene	3E-05	3E-05	6E-05	3E-07	3E-07	6E-07	3E-07	3E-07	6E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	8E-04	3E-05	8E-04	5E-04	2E-05	5E-04	5E-07	2E-08	5E-07
Trichloroethene	5E-06	8E-06	1E-05	3E-06	5E-06	8E-06	1E-07	2E-07	3E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			9E-04			5E-04			1E-06

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 4 of 7

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-10			WELL MW-11			WELL MW-12		
	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	3E-07	3E-07	6E-07	1E-06	1E-06	2E-06	1E-07	1E-07	2E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	3E-05	1E-06	3E-05	9E-05	3E-06	9E-05	2E-04	5E-06	2E-04
Trichloroethene	1E-07	2E-07	3E-07	5E-07	8E-07	1E-06	2E-07	3E-07	5E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			3E-05			9E-05			2E-04

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 5 of 7

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-13			WELL MW-14			WELL MW-15		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	3E-07	3E-07	6E-07	3E-07	3E-07	6E-07	3E-07	3E-07	6E-07
HALOGENATED VOLATILES:									
Tetrachloroethene	3E-05	1E-06	3E-05	5E-06	2E-07	5E-06	5E-07	2E-08	5E-07
Trichloroethene	1E-07	2E-07	3E-07	2E-07	3E-07	5E-07	1E-07	2E-07	3E-07
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL RISK BY WELL			3E-05			6E-06			1E-06

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-17			WELL MW-18			WELL B1-U		
	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:									
Benzene	3E-05	3E-05	6E-05	3E-07	3E-07	6E-07	1E-05	1E-05	2E-05
HALOGENATED VOLATILES:									
Tetrachloroethene	5E-04	2E-05	5E-04	2E-04	6E-06	2E-04	5E-03	2E-04	5E-03
Trichloroethene	1E-05	2E-05	3E-05	4E-07	6E-07	1E-06	3E-05	4E-05	7E-05
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	5E-06	5E-06	1E-05	5E-07	5E-07	1E-06	--	--	0E+00
TOTAL RISK BY WELL			6E-04			2E-04			5E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

TABLE 5-7

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL B2-U		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
AROMATIC VOLATILES:			
Benzene	1E-06	1E-06	2E-06
HALOGENATED VOLATILES:			
Tetrachloroethene	8E-04	3E-05	8E-04
Trichloroethene	5E-07	8E-07	1E-06
BASE/NEUTRAL/ACID COMPOUNDS:			
Bis(2-ethylhexyl)phthalate	--	--	0E+00
TOTAL RISK BY WELL			8E-04

-- = Not Analyzed
(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-1			WELL MW-2			WELL MW-3		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	1E+00	5E-01	1E+00	6E-04	2E-04	8E-04	2E-04	7E-05	3E-04
Toluene	5E+00	2E+00	7E+00	3E-04	1E-04	4E-04	1E-04	3E-05	1E-04
Xylenes, total	4E-01	9E+00	9E+00	3E-05	7E-04	7E-04	1E-05	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	2E-01	2E-01	4E-01	6E-03	6E-03	1E-02	2E-03	2E-03	4E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	2E-01	2E-01	4E-01	1E+00	1E+00	2E+00	2E-03	2E-03	4E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			2E+01			2E+00			9E-03

-- = Not Analyzed
(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 2 of 7

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-4			WELL MW-5			WELL MW-6		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	2E-04	7E-05	3E-04	1E-02	4E-03	1E-02	2E-04	7E-05	3E-04
Toluene	1E-04	3E-05	1E-04	5E-03	2E-03	7E-03	1E-04	3E-05	1E-04
Xylenes, total	1E-05	2E-04	2E-04	9E-04	2E-02	2E-02	1E-05	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	2E-03	2E-03	4E-03	2E-03	2E-03	4E-03	2E-03	2E-03	4E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	2E-03	2E-03	4E-03	8E-03	8E-03	2E-02	1E-01	1E-01	2E-01
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			9E-03			6E-02			2E-01

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW Page: 3 of 7

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-7			WELL MW-8			WELL MW-9		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	2E-03	7E-04	3E-03	2E-04	7E-05	3E-04	1E-03	4E-04	1E-03
Toluene	2E-03	8E-04	3E-03	1E-04	3E-05	1E-04	1E-04	3E-05	1E-04
Xylenes, total	2E-02	4E-01	4E-01	1E-05	2E-04	2E-04	1E-05	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	6E-01	6E-01	1E+00	3E-02	3E-02	6E-02	2E-03	2E-03	4E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	4E+00	4E+00	8E+00	2E+00	2E+00	4E+00	2E-03	2E-03	4E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			9E+00			4E+00			9E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-10 Ingestion HI	WELL MW-10 Inhal/Dermal HI	WELL MW-10 TOTAL HI	WELL MW-11 Ingestion HI	WELL MW-11 Inhal/Dermal HI	WELL MW-11 TOTAL HI	WELL MW-12 Ingestion HI	WELL MW-12 Inhal/Dermal HI	WELL MW-12 TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	2E-04	7E-05	3E-04	1E-03	3E-04	1E-03	1E-04	3E-05	1E-04
Toluene	1E-04	3E-05	1E-04	5E-04	2E-04	7E-04	3E-04	1E-04	4E-04
Xylenes, total	1E-05	2E-04	2E-04	5E-05	1E-03	1E-03	5E-06	1E-04	1E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	2E-03	2E-03	4E-03	1E-02	1E-02	2E-02	1E-03	1E-03	2E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	1E-01	1E-01	2E-01	4E-01	4E-01	8E-01	7E-01	7E-01	1E+00
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			2E-01			8E-01			1E+00

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL MW-13			WELL MW-14			WELL MW-15		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	2E-04	7E-05	3E-04	2E-04	7E-05	3E-04	2E-04	7E-05	3E-04
Toluene	1E-04	3E-05	1E-04	1E-04	3E-05	1E-04	1E-04	3E-05	1E-04
Xylenes, total	1E-05	2E-04	2E-04	1E-05	2E-04	2E-04	1E-05	2E-04	2E-04
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	2E-03	2E-03	4E-03	2E-02	2E-02	4E-02	2E-03	2E-03	4E-03
Freon 12	--	--	0E+00	--	--	0E+00	--	--	0E+00
Tetrachloroethene	1E-01	1E-01	2E-01	2E-02	2E-02	4E-02	2E-03	2E-03	4E-03
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	--	--	0E+00	--	--	0E+00	--	--	0E+00
Phenol	--	--	0E+00	--	--	0E+00	--	--	0E+00
TOTAL HI BY WELL			2E-01			8E-02			9E-03

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

Chemical	WELL MW-17			WELL MW-18			WELL B1-U		
	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:									
Ethylbenzene	6E-04	2E-04	8E-04	2E-04	7E-05	3E-04	1E-02	3E-03	1E-02
Toluene	3E-04	1E-04	4E-04	1E-04	3E-05	1E-04	5E-03	2E-03	7E-03
Xylenes, total	3E-05	7E-04	7E-04	1E-05	2E-04	2E-04	5E-04	1E-02	1E-02
HALOGENATED VOLATILES:									
1,2-Dichloroethene, cis-	8E-01	8E-01	2E+00	2E-03	2E-03	4E-03	3E-01	3E-01	6E-01
Freon 12	5E-04	2E-03	3E-03	1E-03	6E-03	7E-03	--	--	0E+00
Tetrachloroethene	2E+00	2E+00	4E+00	8E-01	8E-01	2E+00	2E+01	2E+01	4E+01
BASE/NEUTRAL/ACID COMPOUNDS:									
Bis(2-ethylhexyl)phthalate	4E-02	4E-02	8E-02	4E-03	4E-03	8E-03	--	--	0E+00
Phenol	4E-04	4E-04	8E-04	2E-04	2E-04	4E-04	--	--	0E+00
TOTAL HI BY WELL			6E+00			2E+00			4E+01

-- = Not Analyzed

(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-8

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER (1)

	WELL B2-U		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
AROMATIC VOLATILES:			
Ethylbenzene	1E-03	3E-04	1E-03
Toluene	5E-04	2E-04	7E-04
Xylenes, total	5E-05	1E-03	1E-03
HALOGENATED VOLATILES:			
1,2-Dichloroethene, cis-	1E-02	1E-02	2E-02
Freon 12	--	--	0E+00
Tetrachloroethene	3E+00	3E+00	6E+00
BASE/NEUTRAL/ACID COMPOUNDS:			
Bis(2-ethylhexyl)phthalate	--	--	0E+00
Phenol	--	--	0E+00
TOTAL HI BY WELL			6E+00

-- = Not Analyzed
(1) All monitoring wells are located onsite except for MW-13 and MW-14, which are located downgradient of the Livermore Arcade Shopping Center.

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-9

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

	UPPER AQUIFER 13' Thickness			UPPER AQUIFER 32' Thickness			LOWER AQUIFER 13' - 37.5' Thickness			LOWER AQUIFER 32' - 37.5' Thickness		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
Methylene Chloride	2E-06	4E-07	2E-06	8E-07	2E-07	1E-06	5E-07	1E-07	6E-07	4E-07	8E-08	5E-07
Tetrachloroethene	1E-05	4E-07	1E-05	4E-06	1E-07	4E-06	3E-06	9E-08	3E-06	2E-06	7E-08	2E-06
TOTAL RISK			1E-05			5E-06			4E-06			3E-06

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-10

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

	UPPER AQUIFER 13' Thickness			UPPER AQUIFER 32' Thickness			LOWER AQUIFER 13' - 37.5' Thickness			LOWER AQUIFER 32' - 37.5' Thickness		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
1,2-Dichloroethene, cis-	1E-02	1E-02	2E-02	6E-03	6E-03	1E-02	4E-03	4E-03	8E-03	3E-03	3E-03	6E-03
Methylene Chloride	1E-02	7E-04	1E-02	4E-03	3E-04	4E-03	3E-03	2E-04	3E-03	2E-03	1E-04	2E-03
Tetrachloroethene	5E-02	5E-02	1E-01	2E-02	2E-02	4E-02	1E-02	1E-02	2E-02	9E-03	9E-03	2E-02
1,1,1-Trichloroethane	2E-02	6E-03	3E-02	8E-03	2E-03	1E-02	5E-03	2E-03	7E-03	4E-03	1E-03	5E-03
TOTAL HI			2E-01			6E-02			4E-02			3E-02

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-11

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

	UPPER AQUIFER 13' Thickness			UPPER AQUIFER 32' Thickness			LOWER AQUIFER 13' - 37.5' Thickness			LOWER AQUIFER 32' - 37.5' Thickness		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
Methylene Chloride	3E-06	6E-07	4E-06	1E-06	2E-07	1E-06	7E-07	2E-07	9E-07	5E-07	1E-07	6E-07
Tetrachloroethene	1E-05	5E-07	1E-05	6E-06	2E-07	6E-06	4E-06	1E-07	4E-06	3E-06	1E-07	3E-06
TOTAL RISK			1E-05			7E-06			5E-06			4E-06

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: IV QC: SKW

TABLE 5-12

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #1

	UPPER AQUIFER 13' Thickness			UPPER AQUIFER 32' Thickness			LOWER AQUIFER 13' - 37.5' Thickness			LOWER AQUIFER 32' - 37.5' Thickness		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
1,2-Dichloroethene, cis-	2E-02	2E-02	4E-02	8E-03	8E-03	2E-02	5E-03	5E-03	1E-02	4E-03	4E-03	8E-03
Methylene Chloride	1E-02	1E-03	1E-02	6E-03	4E-04	6E-03	4E-03	3E-04	4E-03	3E-03	2E-04	3E-03
Tetrachloroethene	7E-02	7E-02	1E-01	3E-02	3E-02	6E-02	2E-02	2E-02	4E-02	1E-02	1E-02	2E-02
1,1,1-Trichloroethane	3E-02	8E-03	4E-02	1E-02	3E-03	1E-02	7E-03	2E-03	9E-03	6E-03	2E-03	8E-03
TOTAL HI			2E-01			1E-01			6E-02			4E-02

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-13

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

	UPPER AQUIFER			LOWER AQUIFER		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
Methylene Chloride	6E-05	1E-05	7E-05	3E-05	6E-06	4E-05
Tetrachloroethene	4E-04	1E-05	4E-04	2E-04	6E-06	2E-04
TOTAL RISK			5E-04			2E-04

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: TV QC: SKW

TABLE 5-14

Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

	UPPER AQUIFER			LOWER AQUIFER		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
1,2-Dichloroethene, cis-	5E-01	5E-01	1E+00	2E-01	2E-01	4E-01
Methylene Chloride	3E-01	2E-02	3E-01	1E-01	1E-02	1E-01
Tetrachloroethene	2E+00	2E+00	4E+00	8E-01	8E-01	2E+00
1,1,1-Trichloroethane	5E-01	2E-01	7E-01	2E-01	7E-02	3E-01
TOTAL HI			6E+00			3E+00

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-15

Livermore Arcade Shopping Center
Livermore, California

Estimates of Lifetime Cancer Risk

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

	UPPER AQUIFER			LOWER AQUIFER		
Chemical	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK	Ingestion Risk	Inhal/ Dermal Risk	TOTAL RISK
Methylene Chloride	9E-05	2E-05	1E-04	4E-05	8E-06	5E-05
Tetrachloroethene	6E-04	2E-05	6E-04	3E-04	9E-06	3E-04
TOTAL RISK			7E-04			4E-04

Name of Site: Livermore Arcade Shopping Center Date: 4/10/92 Analyst: JV QC: SKW

TABLE 5-16

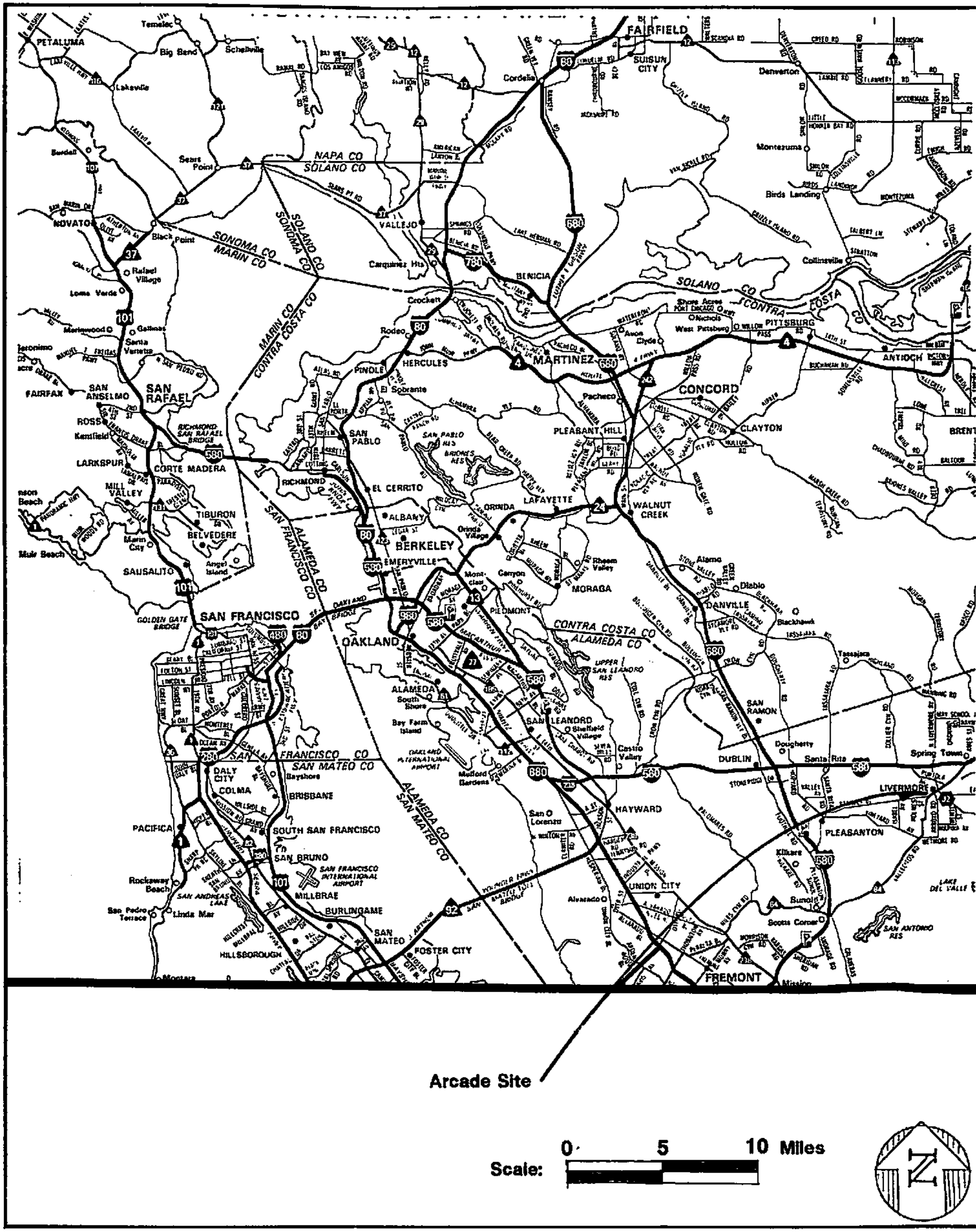
Livermore Arcade Shopping Center
Livermore, California

Estimates of Hazard Indices (HIs) for Noncarcinogenic Health Effects

FUTURE ONSITE CHILD/ADULT RESIDENT SCENARIO
EXPOSURES TO GROUND WATER

CHEMICAL FATE AND TRANSPORT MODEL - CASE #2

	UPPER AQUIFER			LOWER AQUIFER		
Chemical	Ingestion HI	Inhal/ Dermal HI	TOTAL HI	Ingestion HI	Inhal/ Dermal HI	TOTAL HI
1,2-Dichloroethene, cis-	7E-01	7E-01	1E+00	3E-01	3E-01	6E-01
Methylene Chloride	5E-01	3E-02	5E-01	2E-01	1E-02	2E-01
Tetrachloroethene	2E+00	2E+00	4E+00	1E+00	1E+00	2E+00
1,1,1-Trichloroethane	8E-01	2E-01	1E+00	4E-01	1E-01	5E-01
TOTAL HI			7E+00			3E+00

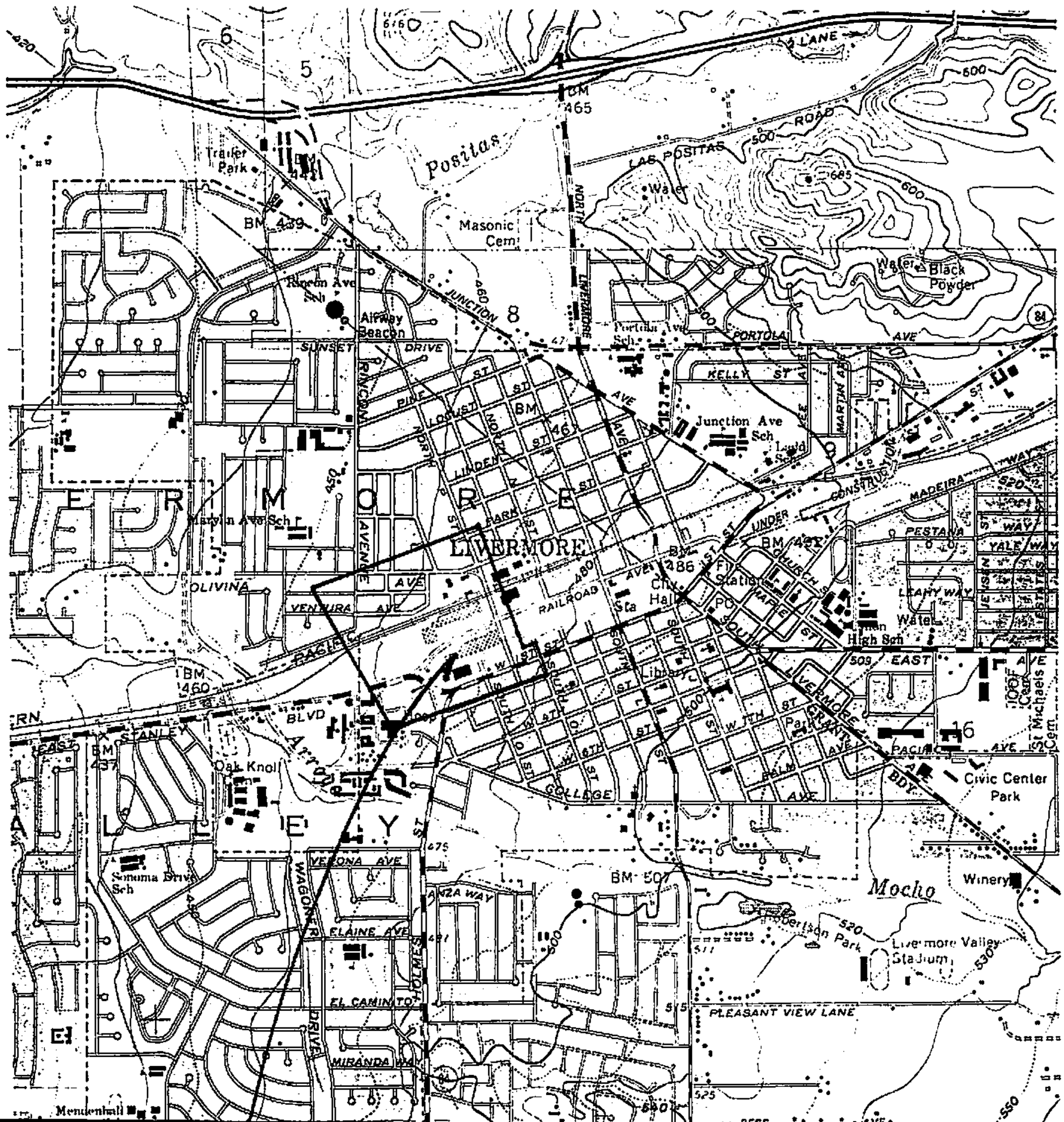


ARCADE SHOPPING CENTER Livermore, Ca.	GCL Environmental Scientists and Engineers	PROJECT NO 48016.08 DRN BY dlo REV. DATE DESCRIPTION	Location Map

DATE
March 1992
F1

166933

MAKEPEACE



Area of Site investigation

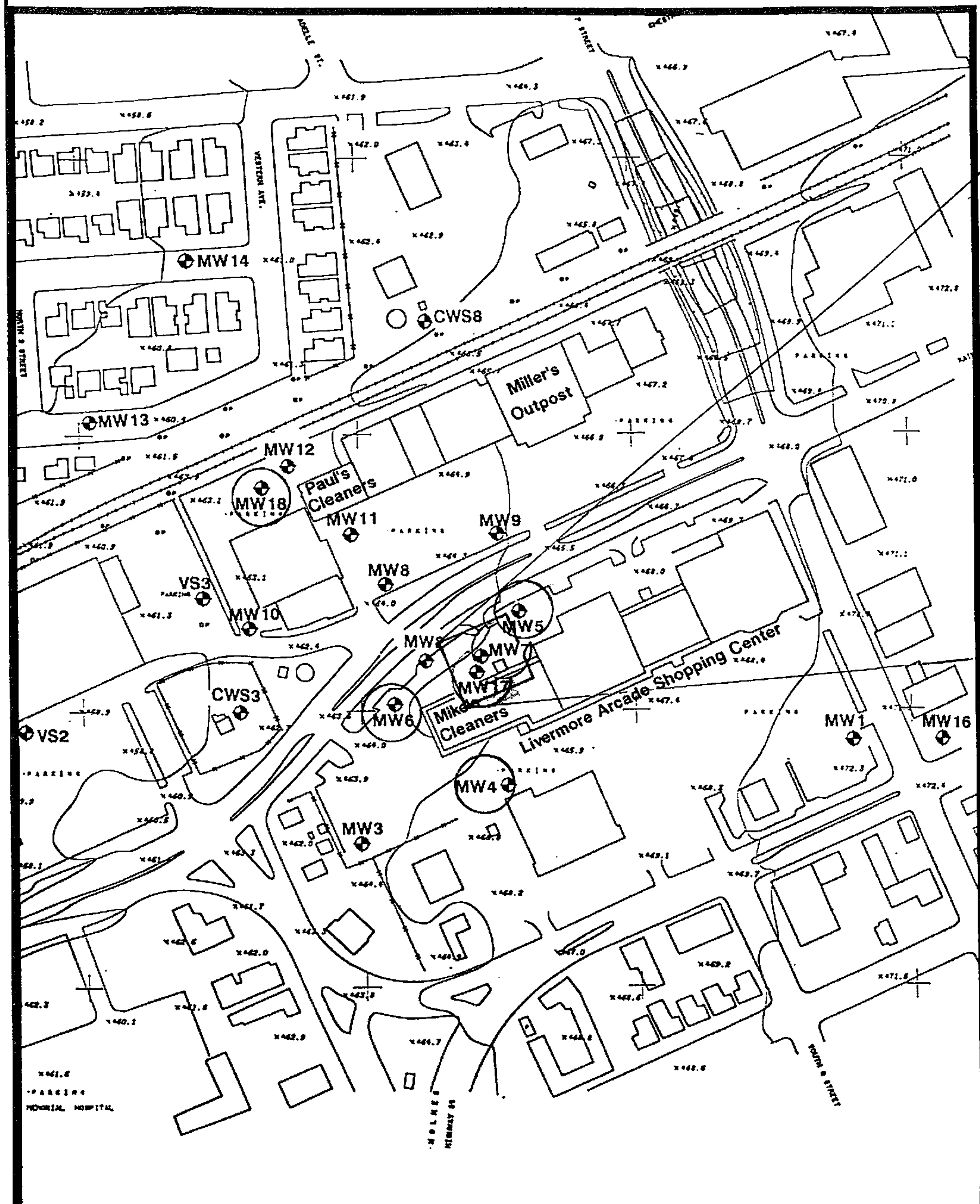
Scale: 0 24,000 48,000

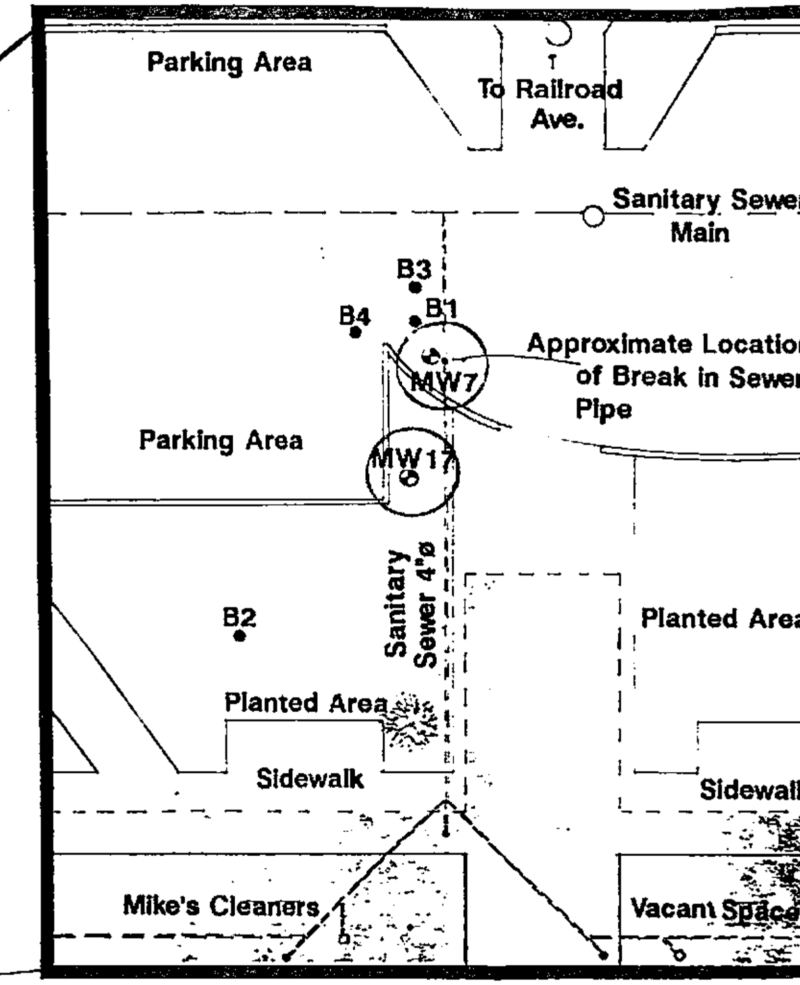
USGS Livermore Quad. 1961 / Photo Revised 1980

ARCADE SHOPPING CENTER **Livermore, Ca.**	H+GCL *Environmental Scientists and Engineers*	PROJECT NO **48016.08** DRN BY **dlo**	**Site Map**	DATE **March 1992** **F2**
		REV DATE DESCRIPTION		

166933

MAKEPEACE





Scale: 0 10' 20'

LEGEND

B1 Soil Boring Location

MW4 Monitoring Well Location

MW4 Soil Samples at Monitoring Well Location

Scale: 0 100' 200'

ARCADE SHOPPING CENTER
Livermore, Ca.

HGCL Environmental Scientists and Engineers

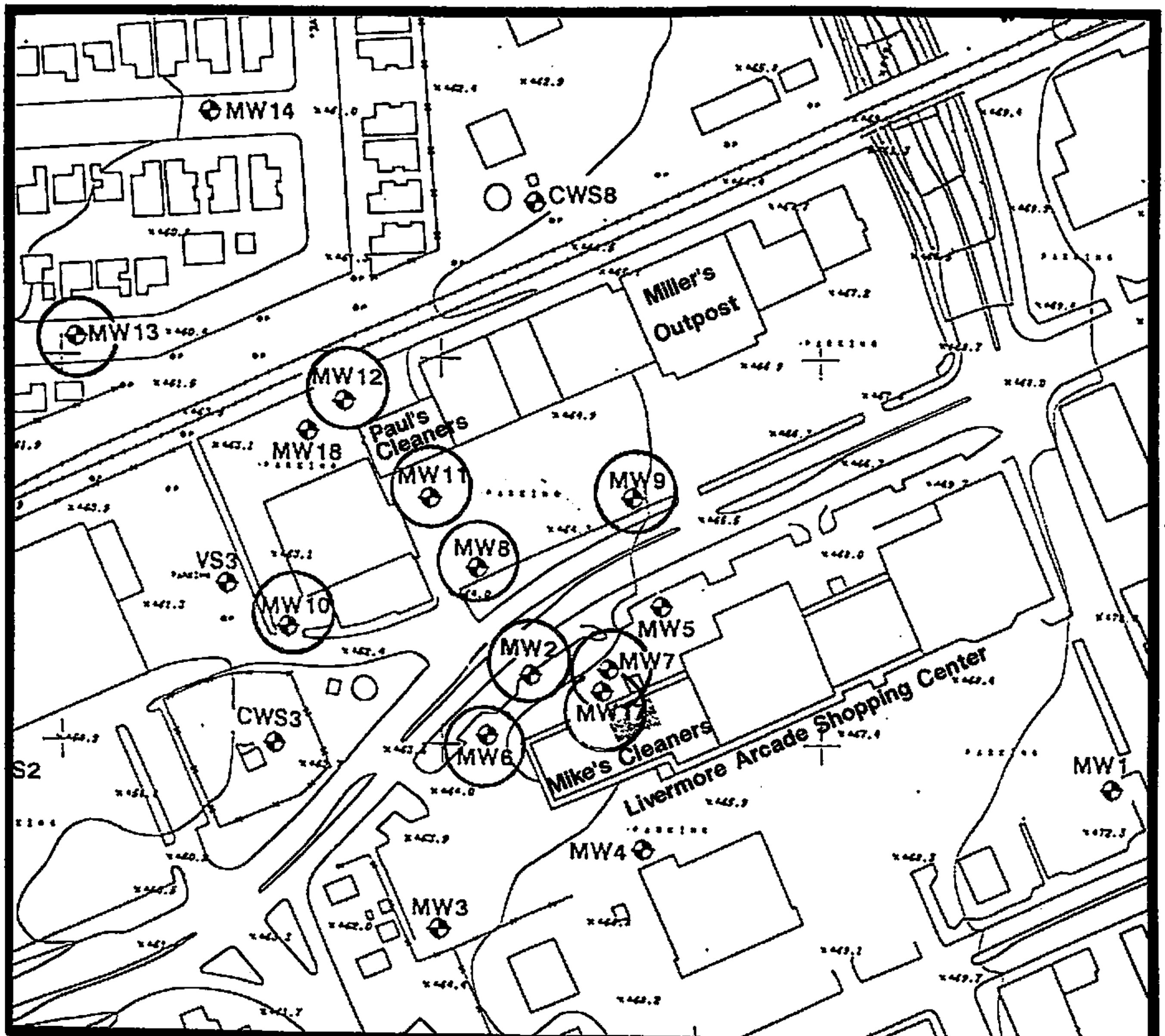
PROJECT NO 48016.08

Soil Sample Locations

DATE April 1992

F3

SHEET OF



Legend

MW10 H+GCL Monitoring Well

VS-1 Versar Monitoring Well

CWS-3 California Water Service Well

MW17 Monitor Well Vapor Sample Location

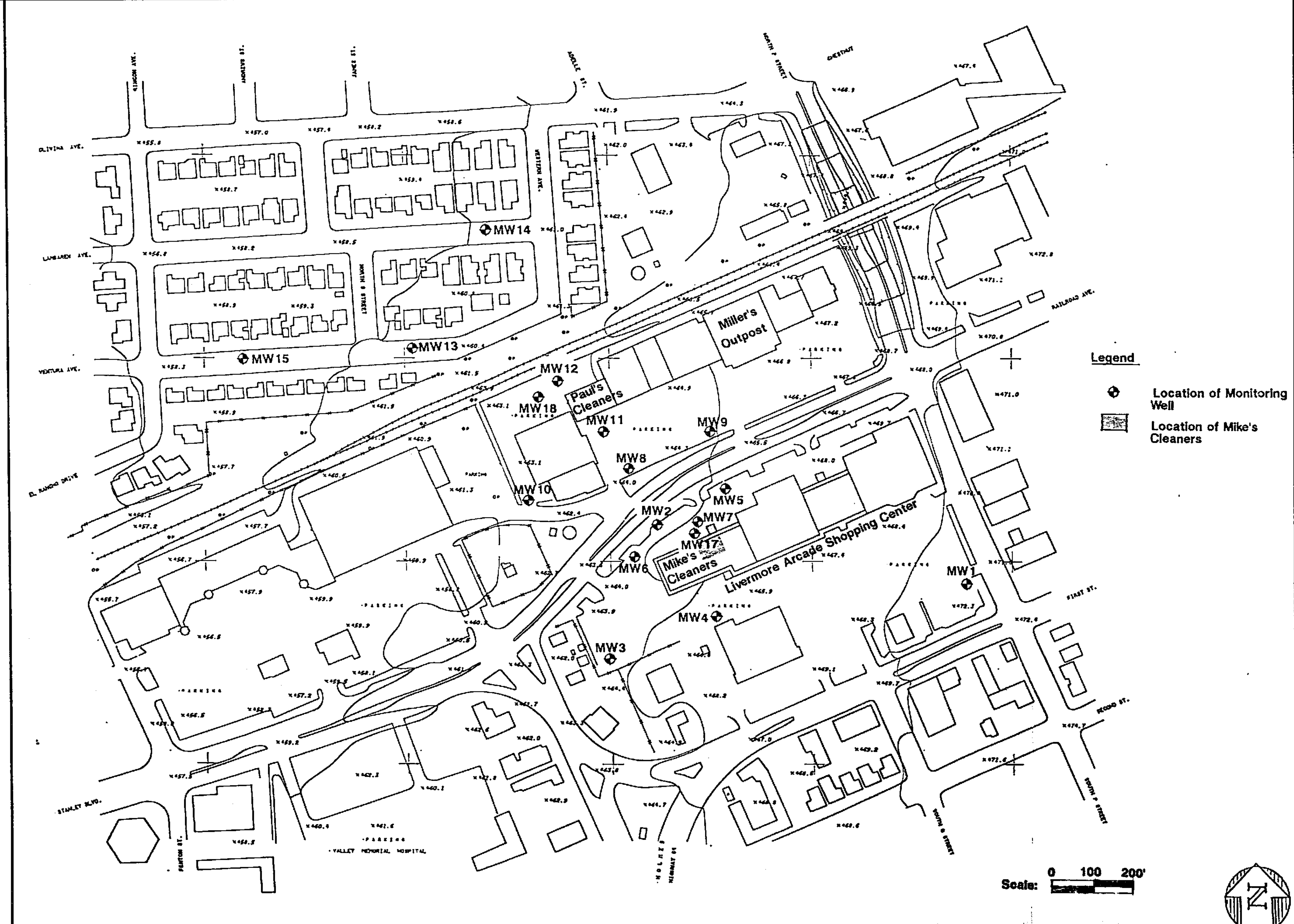
Scale: 0 100' 200'

N

ARCADE SHOPPING CENTER Livermore, Ca.	H+GCL Environmental Scientists and Engineers	PROJECT NO 48016.08 DRN BY dlo	Vapor Sample Locations
		REV DATE DESCRIPTION	DATE March 1992 F4

186933

MAKEPEACE



ARCADE SHOPPING CENTER
Livermore, Ca.

GCL Environmental Scientists and Engineers

Ground Water Monitoring Well Locations

PROJECT NO. 48016.08

F5

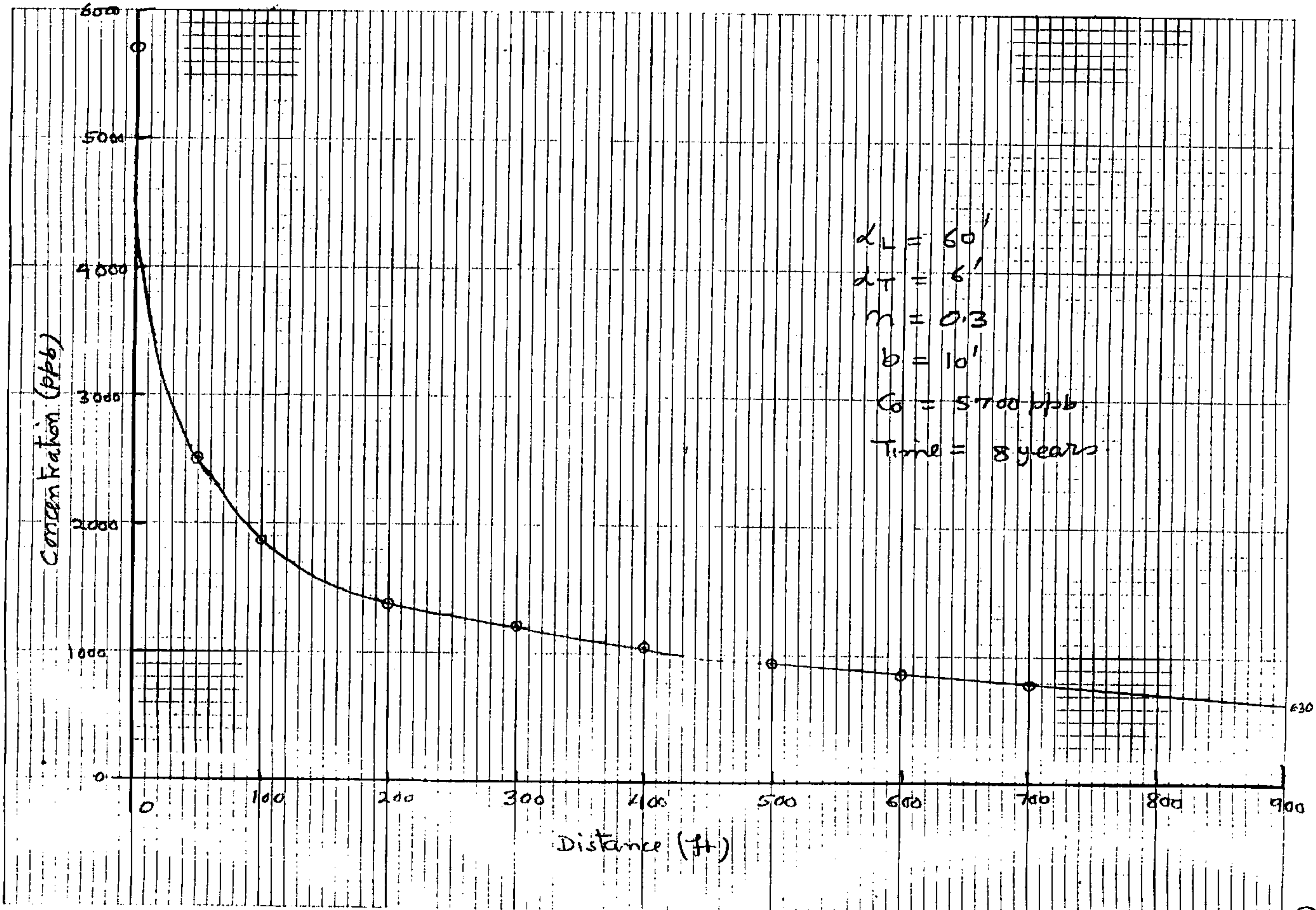
APPENDIX 5
AQUIFER TEST RESULTS

JA TON - B19

AQ IFER DISPERSIVITY-L (FT)= 60
AQ IFER DISPERSIVITY-T (FT)= 6
D RCY VELOCITY (FT/DAY)= 9.000001E-02
AQUIFER EFFECTIVE POROSITY (DIM)= .3
AQUIFER THICKNESS (FT)= 10
NO OF COLUMNS= 30
NO OF ROWS= 3
GRID SPACING (FT)= 50
NO. OF PT SOURCES= 1
X FT)= 50
Y FT)= 100
IN ECTED SOLUTE CONC. (MG/L)= 5.7
INJECTION RATE (GPD)= 215
TIME (DAY)= 2920
CO CENTRATIONS AT OB WELLS(MG/L):

0.413	0.570	0.684	0.744	0.831	0.832	0.822	0.805	0.786	0.767
0.747	0.728	0.710	0.692	0.676					
0	50	100		200		300		400	
5.701	2.492	1.876	1.567	1.368	1.326	1.210	1.121	1.048	0.988
0.938	0.894	0.856	0.822	0.792					
500		600		700					
0.413	0.570	0.684	0.744	0.831	0.832	0.822	0.805	0.786	0.767
0.747	0.728	0.710	0.692	0.676					

750									
0.660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000					
775									
0.765	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000					
0.660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000	0.000					


6000
5000
4000
3000
2000
1000
0
Concentration (ppb)
0
100
200
300
400
500
600
700
800
900
Distance (ft)
630
$\alpha_L = 60'$
$\alpha_T = 6'$
$n = 0.3$
$b = 10'$
$C_0 = 5700$ ppb
Time = 8 years

KPG

ON - 88

FER TRANSMISSIVITY (GPD/FT)= 1000
FER STORATIVITY (DIM)= .1
. OF COLUMNS= 8
. OF ROWS= 7
SPACING (FT)= 50
OF WELLS= 1
L (FT)= 350
ELL (FT)= 200
LL DISCHARGE (GPM)= .7
(DAY)= 60
DOWNS AT OB WELLS (FT):

MW-13

MW-12

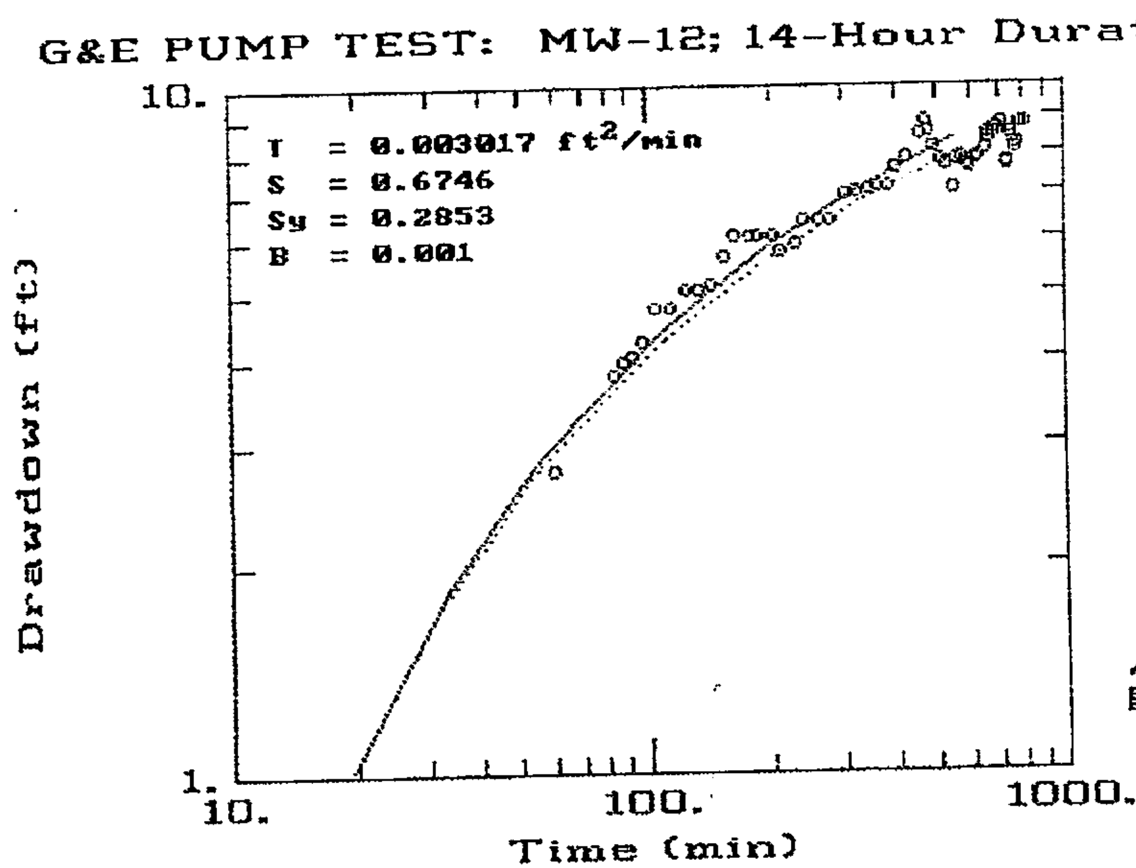
.06	0.08	0.10	0.12	0.15	0.16	0.17	0.16
0.07	0.09	0.11	0.15	0.18	0.22	0.23	0.22
.08	0.10	0.13	0.16	0.22	0.29	0.34	0.29
.08	0.10	0.13	0.17	0.23	0.34	0.97	0.34
0.08	0.10	0.13	0.16	0.22	0.29	0.34	0.29
.07	0.09	0.11	0.15	0.18	0.22	0.23	0.22
.06	0.08	0.10	0.12	0.15	0.16	0.17	0.16

8

A[illegible]TON - 88

Q[illegible]IFER TRANSMISSIVITY (GPD/FT)= 100
Q[illegible]IFER STORATIVITY (DIM)= .1
O. OF COLUMNS= 8
O. OF ROWS= 7
R[illegible]D SPACING (FT)= 50
O[illegible] OF WELLS= 1
W[illegible]LL (FT)= 350
WELL (FT)= 200
ELL DISCHARGE (GPM)= .7
I[illegible]E(DAY)= 60
R[illegible]WDOWNS AT OB WELLS (FT):

0.01	0.02	0.04	0.09	0.17	0.26	0.30	0.26	
0.01	0.03	0.07	0.17	0.35	0.58	0.70	0.58	MW-13
0.01	0.04	0.10	0.26	0.58	1.15	1.65	1.15	
0.01	0.04	0.12	0.30	0.70	1.65	7.86	1.65	MW-12
0.01	0.04	0.10	0.26	0.58	1.15	1.65	1.15	
0.01	0.03	0.07	0.17	0.35	0.58	0.70	0.58	
0.01	0.02	0.04	0.09	0.17	0.26	0.30	0.26	



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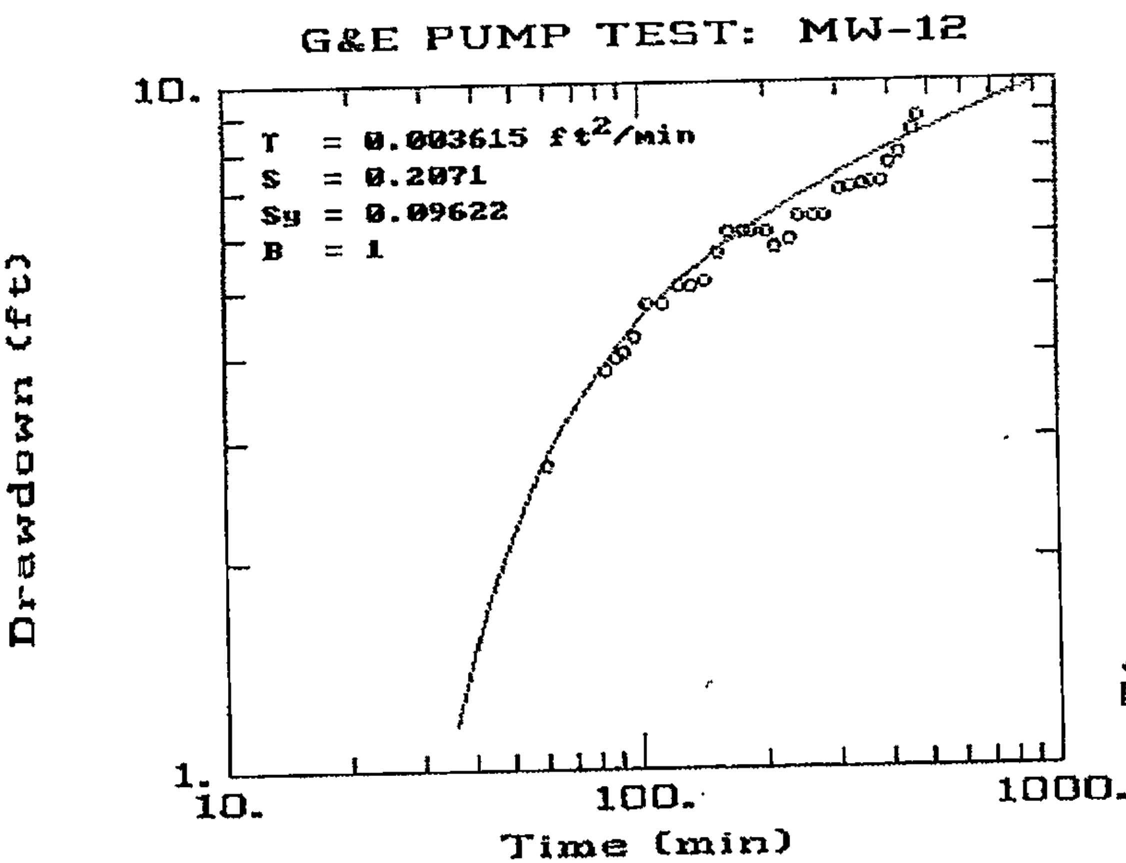

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Figure 3.4 Rapid Assessment Nomograph - - - Enlarged Scale, C/C_o < U.V.

Sheet 1 of 2
Calculated by VIT Date 3/18/92
Checked by ______ Date ______

Table 3.2

WORKSHEET FOR RAPID ASSESSMENT NOMOGRAPH

ZONE: UNSATURATED ______
SATURATED X

Site: Grubb & Ellis - Livermore Arcade Date of Incident: 1982
Location: Livermore, CA
On Site Coordinator: ______ Agency: ______
Scientific Support Coordinator: ______ Agency: ______
Compound Name: PCE
Compound Characteristics: solvent, DNAPL, vol., sol., sorbtion*

REQUIRED PARAMETERS:	DATA SOURCES / COMMENTS
C_o = 5.7 mg/l (5700 ppb)	reported peak concentration in g.w.
V = 3.706 ft/day	effective seepage velocity
D = 80 cm²/day	based on velocity & dispersivity
k = 0.004 day^{-1}	Tabulated value - PCE
$R = 1 + \frac{B}{\theta} K_d$ = 13.54	Tabulated value - PCE
K_d = 2.51 ml/g	Tabulated value - PCE
B = 1.65 g/cc	Estimated - literature
θ = 0.19	η = Sy (pump test average)

PRELIMINARY CALCULATIONS:

1. $V^* = V/R$ = 0.274
2. $D^* = D/R$ = 5.908
3. $k^* = k/R$ = 2.95×10^{-4}
4. $\sqrt{V^{*2} + 4D^*k^*}$ = 0.321

5	6	7	8	9				10		11	12
				See Footnote # 2				From Nomograph[3]			C
x	t	$x/2D^*$	$\sqrt{4D^*t}$	A_1	A_2	B_1	B_2	M_1	M_2	C/C_o	(ppb)
50	2920	4.23	263	-0.20	-3.37	2.52	178	1.59	Ø	0.80	4560
100	↓	8.46	↓	-0.40	-3.18	5.03	356	1.34	↓	0.67	3819
150	↓	12.69	↓	-0.60	-3.00	7.55	535	1.12	↓	0.56	3192
200	↓	16.92	↓	-0.80	-2.80	10.1	713	0.84	↓	0.42	2394

* = primary control

Table 3.2

Sheet 2 of 2
Calculated by VIT Date 3/18/92
Checked by ______ Date ______

ZONE: UNSATURATED ______
SATURATED X

NOMOGRAPH WORKSHEET (con't.)

5	6	7	8	9				10		11	12
				See Footnote # 2				From Nomograph[3]			C
x	t	$x/2D^*$	$\sqrt{4D^*t}$	A_1	A_2	B_1	B_2	M_1	M_2	C/Co	
250	2920	21.16	21.3	-0.99	-2.61	>10	>100	0.64	0	0.32	1824
300		25.4		-1.19	-2.42			0.50		0.25	1425
400		33.9		-1.59	-2.04			0.30		0.15	855
500		42.3		-1.99	-1.66			0.20		0.10	570
600		50.8		-2.39	-1.28			0.17		0.085	485
700		59.2		-2.78	-0.90			0.12		0.06	342
800		67.7		-3.18	-0.52			0.07		0.035	200
1000		84.6		-3.98	0.24			0.02		0.01	57
1250		105.8		-4.98	1.19			0.007		0.001	5.7
1500		126.9		-5.96	2.14			NA		ND	ND

Footnotes: 1. Refer to Table 3.1 for definitions and units, and to Chapter 4 for estimation guidelines.

2. $A_1 = \text{Col.7 X (Item 1 - Item 4)} = \frac{x}{2D^*}\left(V^* - \sqrt{V^{*2} + 4D^*k^*}\right)$

$A_2 = \left[\text{Col.5 - Col.6 X Item 4}\right] / \text{Col.8} = \frac{x - t\sqrt{V^{*2} + 4D^*k^*}}{\sqrt{4D^*t}}$

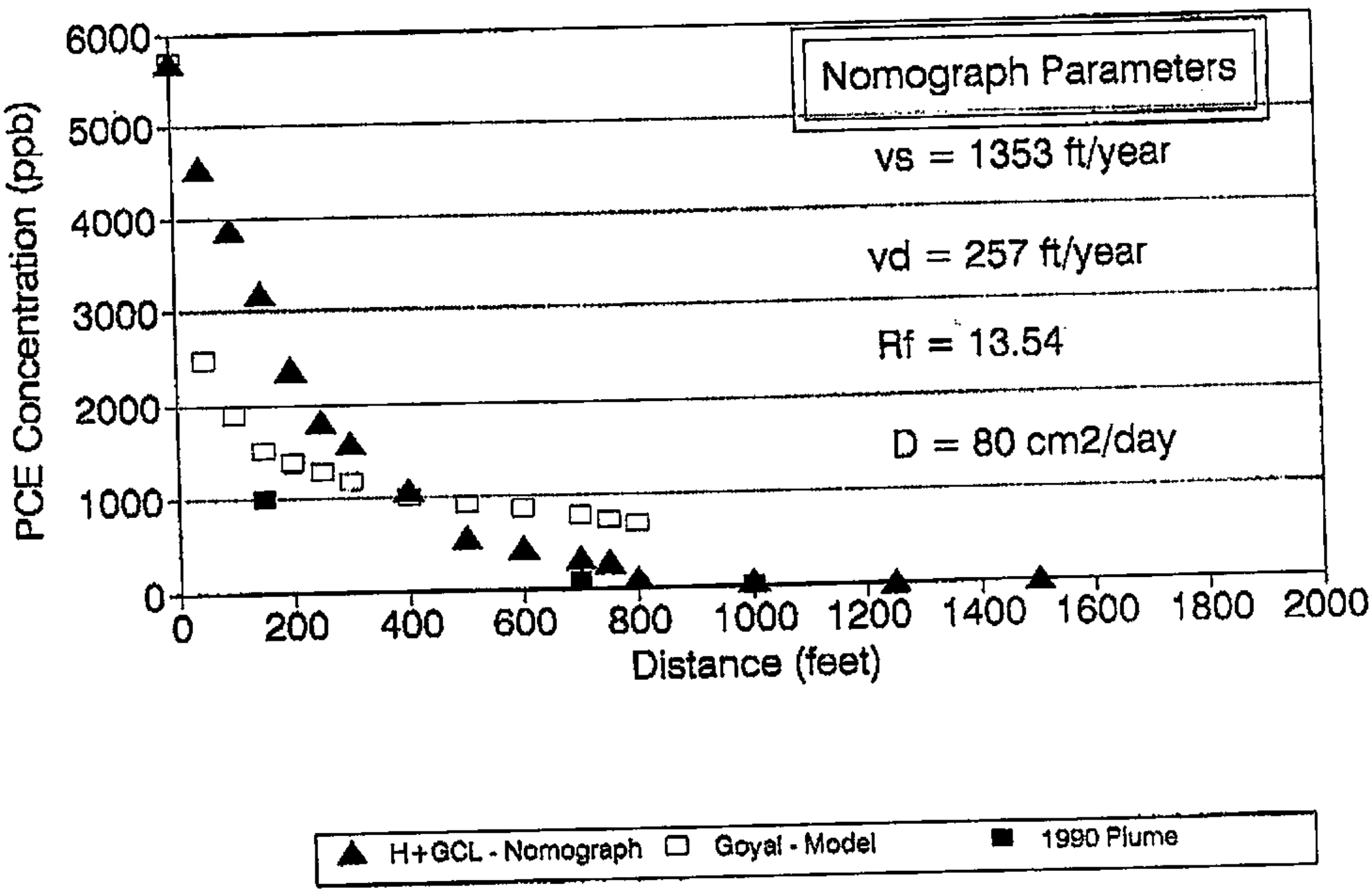
$B_1 = \text{Col.7 X (Item 1 + Item 4)} = \frac{x}{2D^*}\left(V^* + \sqrt{V^{*2} + 4D^*k^*}\right)$

$B_2 = \left[\text{Col.5 + (Col.6 X Item 4)}\right] / \text{Col.8} = \frac{x + t\sqrt{V^{*2} + 4D^*k^*}}{\sqrt{4D^*t}}$

3. Figure 3.3 or Figure 3.4 (See Figure 3.3 for use of nomograph).

Step 2:
Step 3:
Step 4:
Step 5:
Worksheet Proc
As mentioned
contaminant i
continuous in
requires sub
supplementary
Step-by-step
Step 1:
Step 2:
Step 3:
Step 4:
Step 5:
Step 6:
Step 7:

Concentration vs. Distance
Livermore Arcade



Sheet 1 of 2
Calculated by VIT Date 3/19/92
Checked by ______ Date ____

Table 3.2

WORKSHEET FOR RAPID ASSESSMENT NOMOGRAPH

ZONE: UNSATURATED ______
SATURATED X

Site: Grubb & Ellis - Livermore Arcade Date of Incident: ________
Location: Livermore, CA
On Site Coordinator: ________ Agency: ________
Scientific Support Coordinator: ________ Agency: ________
Compound Name: PCE
Compound Characteristics: solvent, DNAPL, vol., sol., sorption*

REQUIRED PARAMETERS: / **DATA SOURCES / COMMENTS**

Parameter	Value	Data sources / comments
C_o =	5.7 mg/l (5700 ppb)	reported peak concentration in g.w.
V =	3.706 ft/day	effective seepage velocity
D =	80 cm²/day	based on velocity & dispersivity
k =	0.004 day⁻¹	Tabulated value - PCE
$R = 1 + \frac{B}{\theta} K_d$ =	15.54	" " "
K_d =	2.51 ml/g	" " "
B =	1.65 g/cc	Estimated - literature
θ =	0.19	θ = Sy (pump test average)

PRELIMINARY CALCULATIONS:

1. $V^* = V/R$ = 0.274
2. $D^* = D/R$ = 5.908
3. $k^* = k/R$ = 2.95×10^{-4}
4. $\sqrt{V^{*2} + 4D^*k^*}$ = 0.321

t yrs	5	6	7	8	9				10		11	12
					See Footnote # 2				From Nomograph[3]			
	x	t	$x/2D^*$	$\sqrt{4D^*t}$	A_1	A_2	B_1	B_2	M_1	M_2	C/C_o	C (ppb)
1	900	365	76.2	92.9	-3.6	8.43	45.3	10.9	0	0	0	0
2	↓	730	↓	131	↓	5.08	↓	8.66	0	↓	0	0
3	↓	1095	↓	161	↓	3.44	↓	7.77	0	↓	0	0
4	↓	1460	↓	186	↓	2.32	↓	7.36	0.002	↓	0.001	5.7

* primary control

Figure 3.4 Rapid Assessment Nomograph — Enlarged Scale C/Co

Table 3.2

Sheet 2 of 2
Calculated by VIT Date 3/19/92
Checked by ______ Date ____

ZONE: UNSATURATED ______
SATURATED X

NOMOGRAPH WORKSHEET (con't.)

t	5	6	7	8	9				10		11	12
Yrs.	x	t	$x/2D^*$	$\sqrt{4D^*t}$	See Footnote # 2				From Nomograph[3]			C
					A_1	A_2	B_1	B_2	M_1	M_2	C/C_o	
5	900	1825	76.2	~~92.4~~ 208	-3.6	1.51	45.3	7.14	0.03	0	0.015	85.5
6		2190		227		0.87		7.06	0.04		0.02	114
7		2555		246		0.32		6.99	0.05		0.025	143
8		2920		263		-0.14		6.99	0.06		0.03	171
9		3285		279		-0.55		7.00	0.07		0.035	200
10		3650		294		-0.92		7.05	0.07		0.035	
11		4015		308		-1.26		7.11	0.07		0.035	
12		4380		322		-1.57		7.16	0.07			
13		4745		335		-1.86		7.23				
14		5110		348		-2.13		7.30				
15		5475		360		-2.38		7.38				
16		5840		371		-2.63		7.48				

Footnotes: 1. Refer to Table 3.1 for definitions and units, and to Chapter 4 for estimation guidelines.

2. A_1 = Col.7 X (Item 1 - Item 4) = $\frac{x}{2D^*}\left(V^* - \sqrt{V^{*2} + 4D^*k^*}\right)$

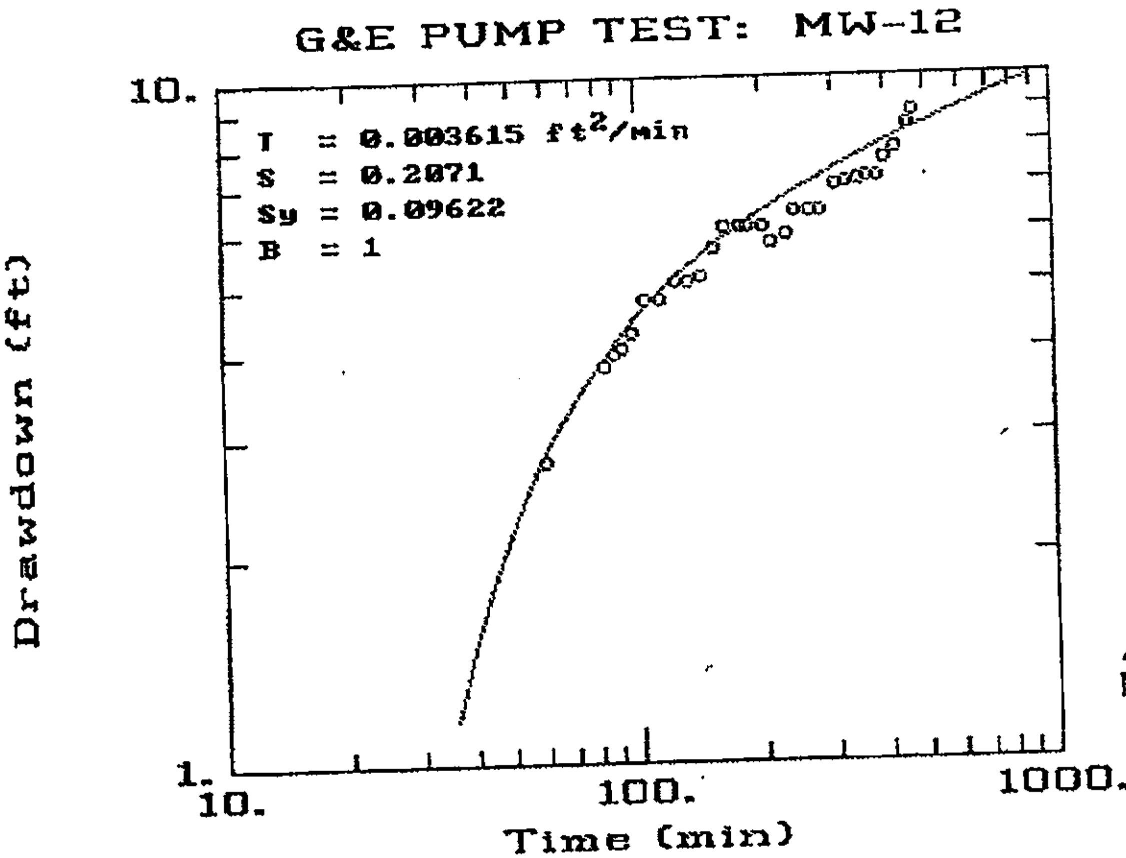
A_2 = [Col.5 - Col.6 X Item 4] / Col.8 = $\frac{x - t\sqrt{V^{*2} + 4D^*k^*}}{\sqrt{4D^*t}}$

B_1 = Col.7 X (Item 1 + Item 4) = $\frac{x}{2D^*}\left(V^* + \sqrt{V^{*2} + 4D^*k^*}\right)$

B_2 = [Col.5 + (Col.6 X Item 4)] / Col.8 = $\frac{x + t\sqrt{V^{*2} + 4D^*k^*}}{\sqrt{4D^*t}}$

3. Figure 3.3 or Figure 3.4 (See Figure 3.3 for use of nomograph).

~ 9 years to achieve steady-state concentration of ~ 200 ppb at x = 900 ft.



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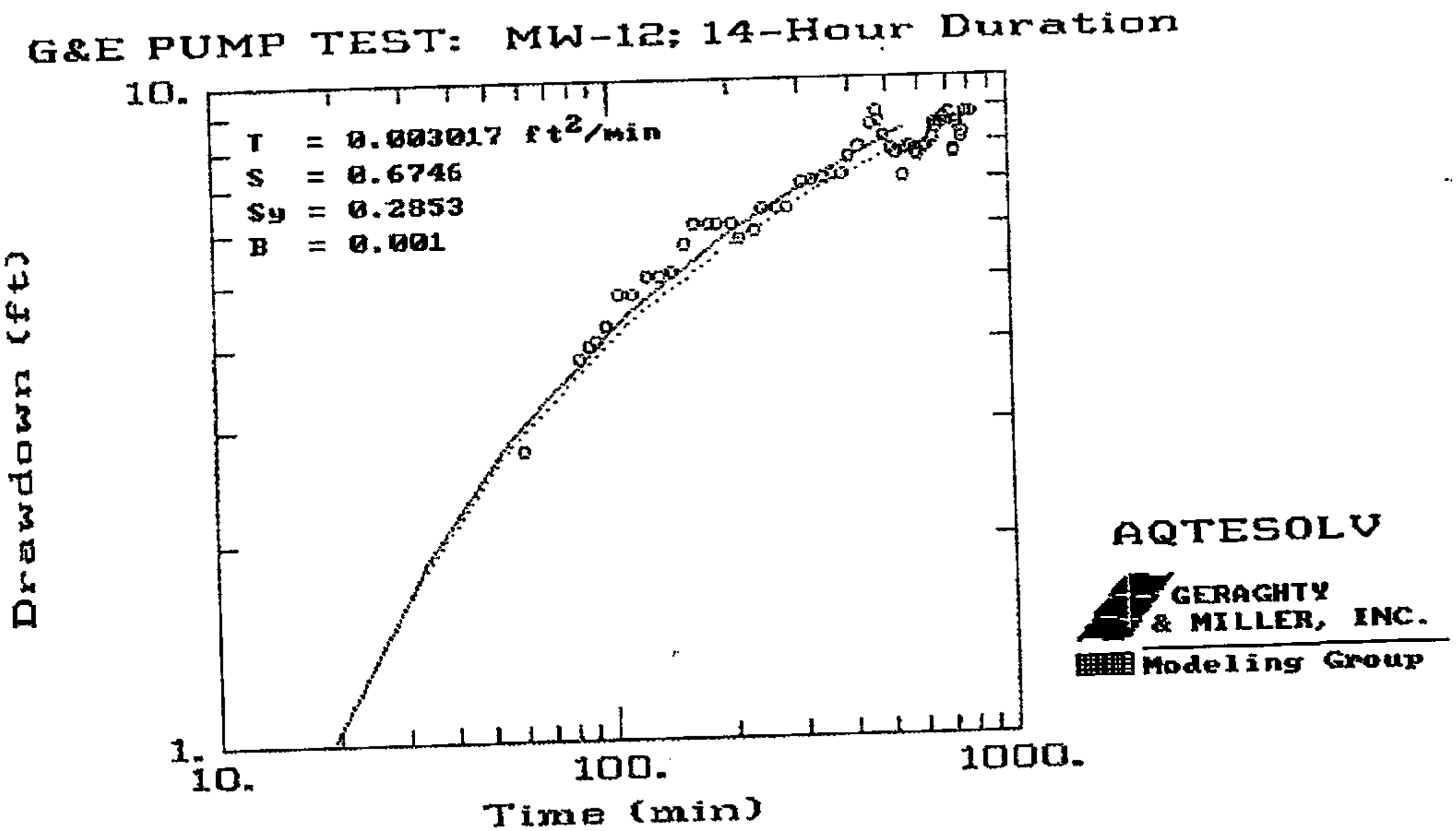
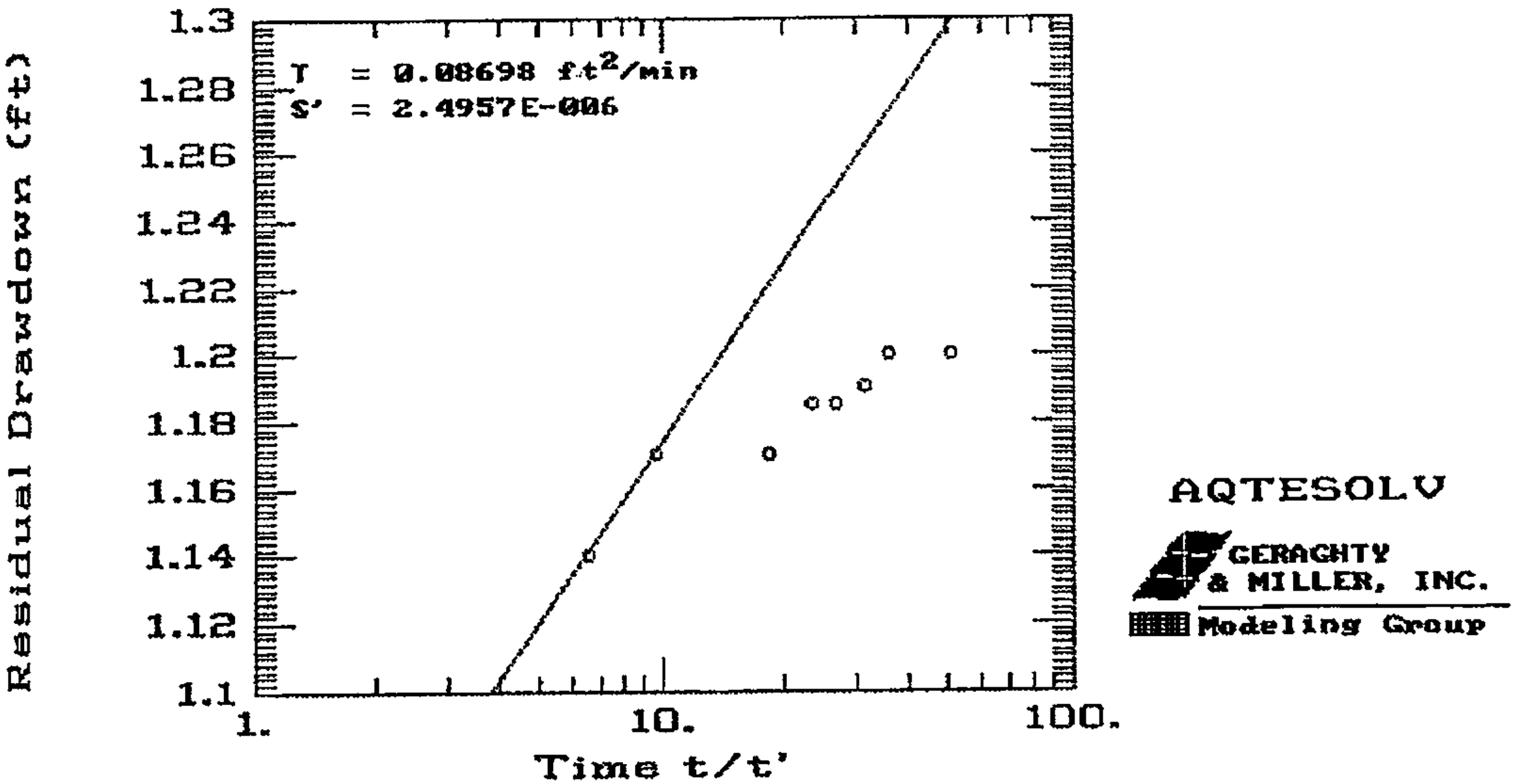
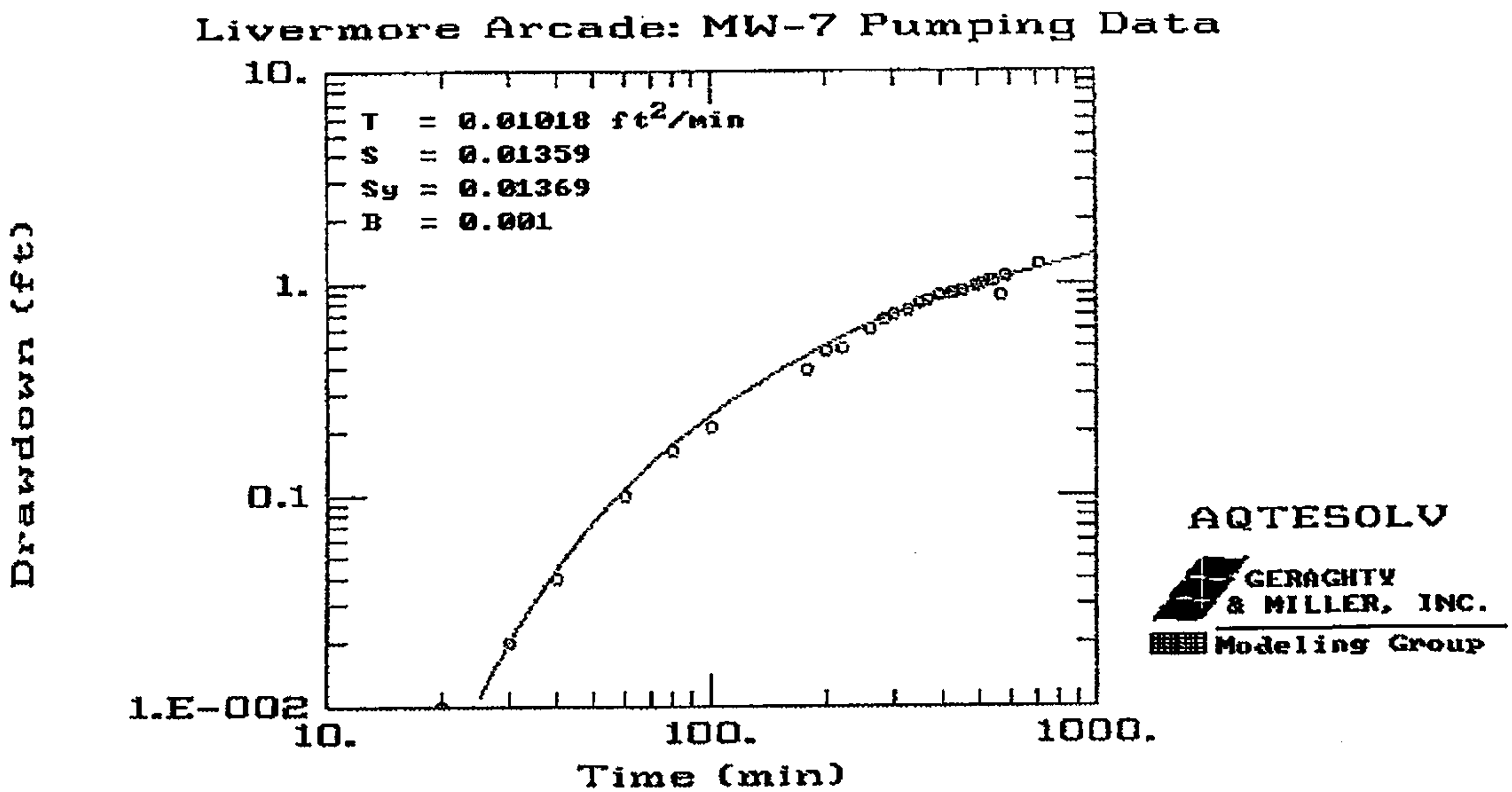

G&E PUMP TEST: MW-12; 14-Hour Duration
T = 0.003017 ft²/min
S = 0.6746
Sy = 0.2853
B = 0.001
Drawdown (ft)
10.
1.
10.
100.
1000.
Time (min)
AQTESOLV
GERAGHTY & MILLER, INC.
Modeling Group

Livermore Arcade: MW-7 Recovery

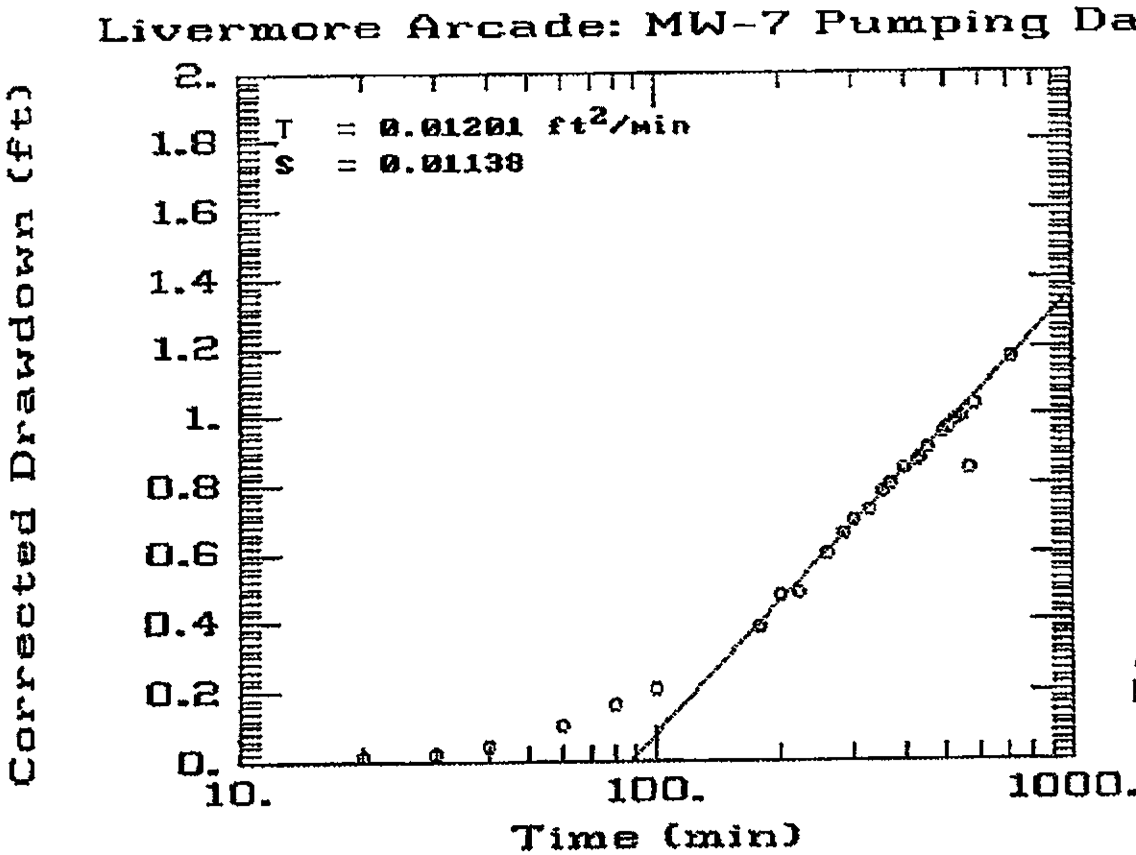


Recovery only
6% complete



Neuman

(Unconfined)

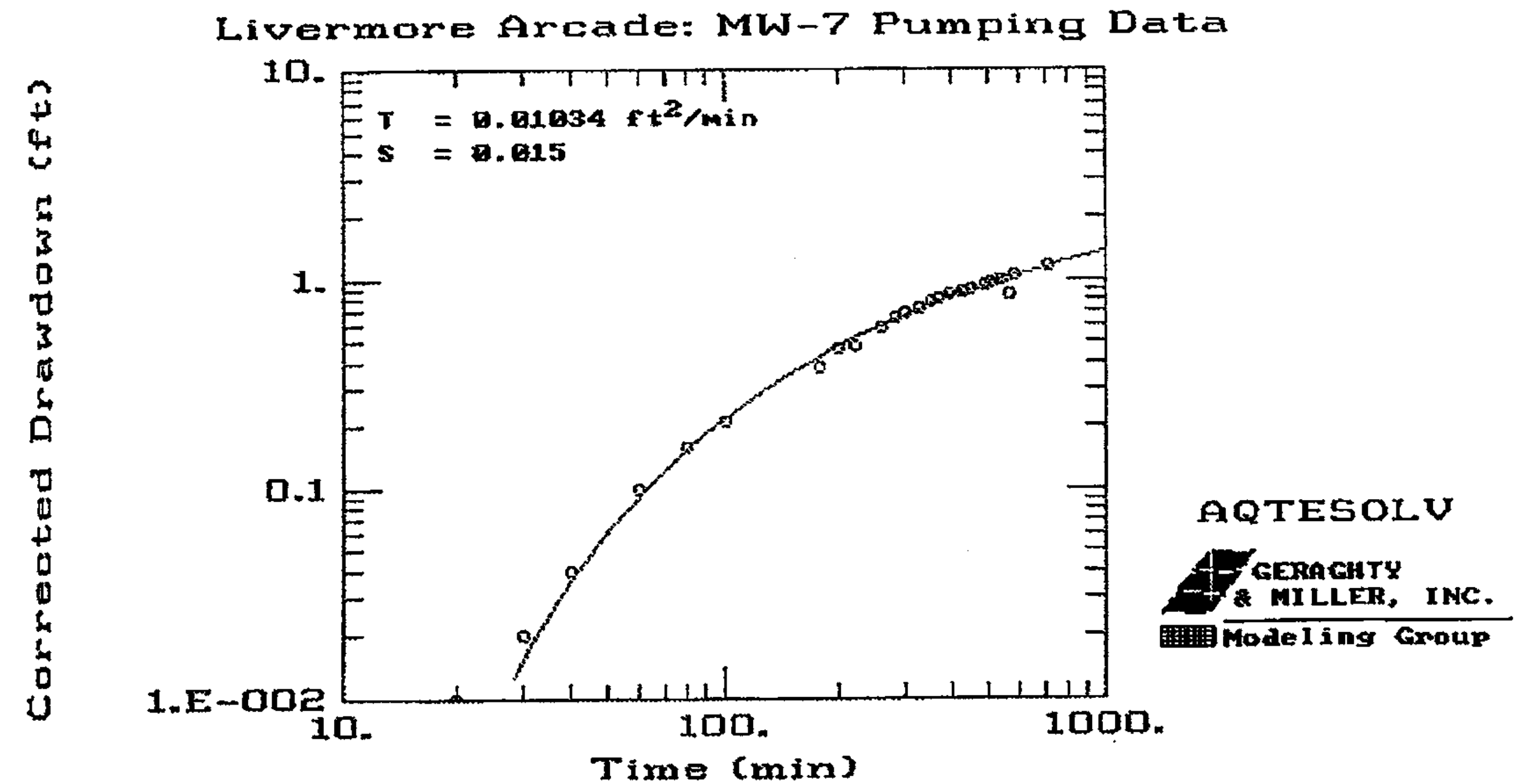


AQTESOLV

GERAGHTY & MILLER, INC.
Modeling Group

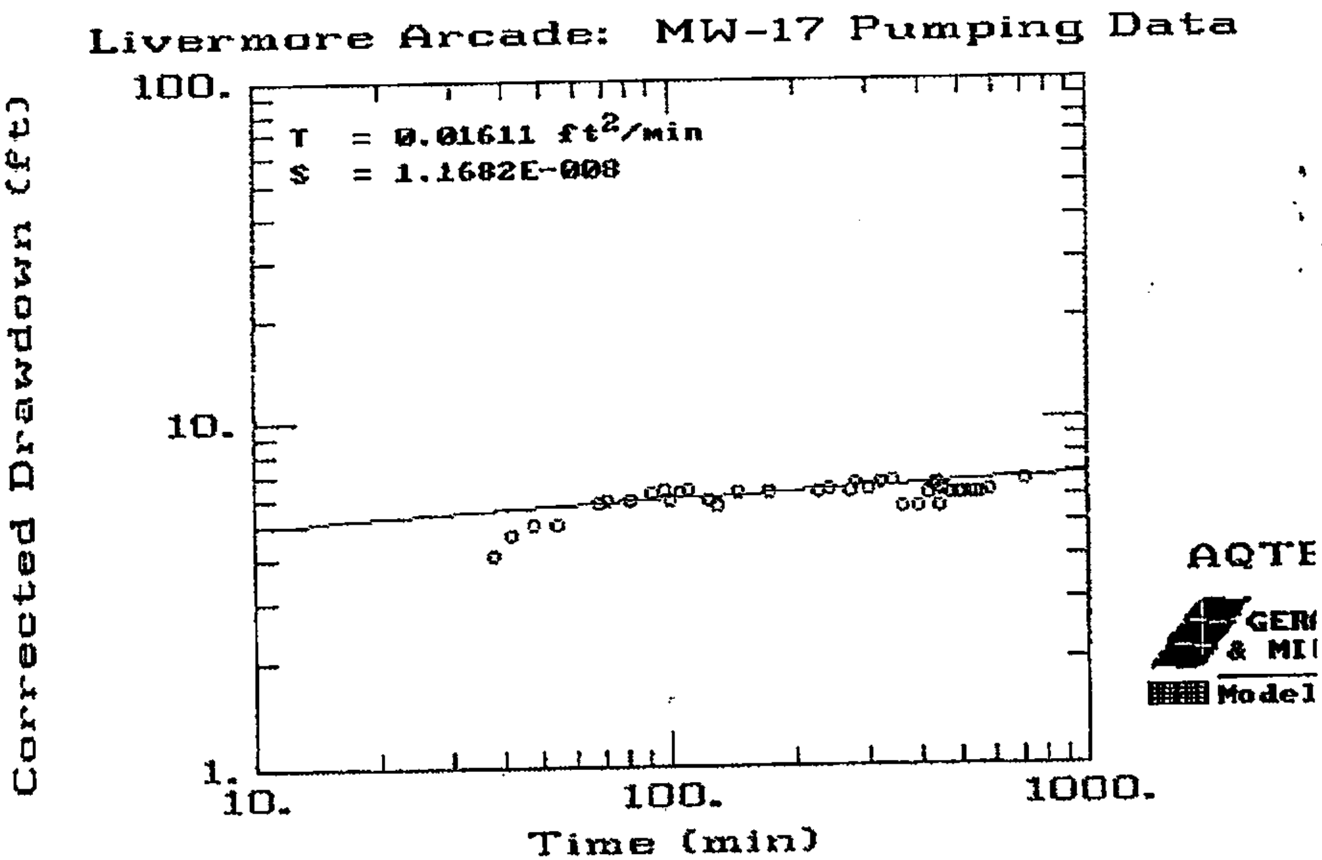
Cooper-Jacob

(Unconfined)

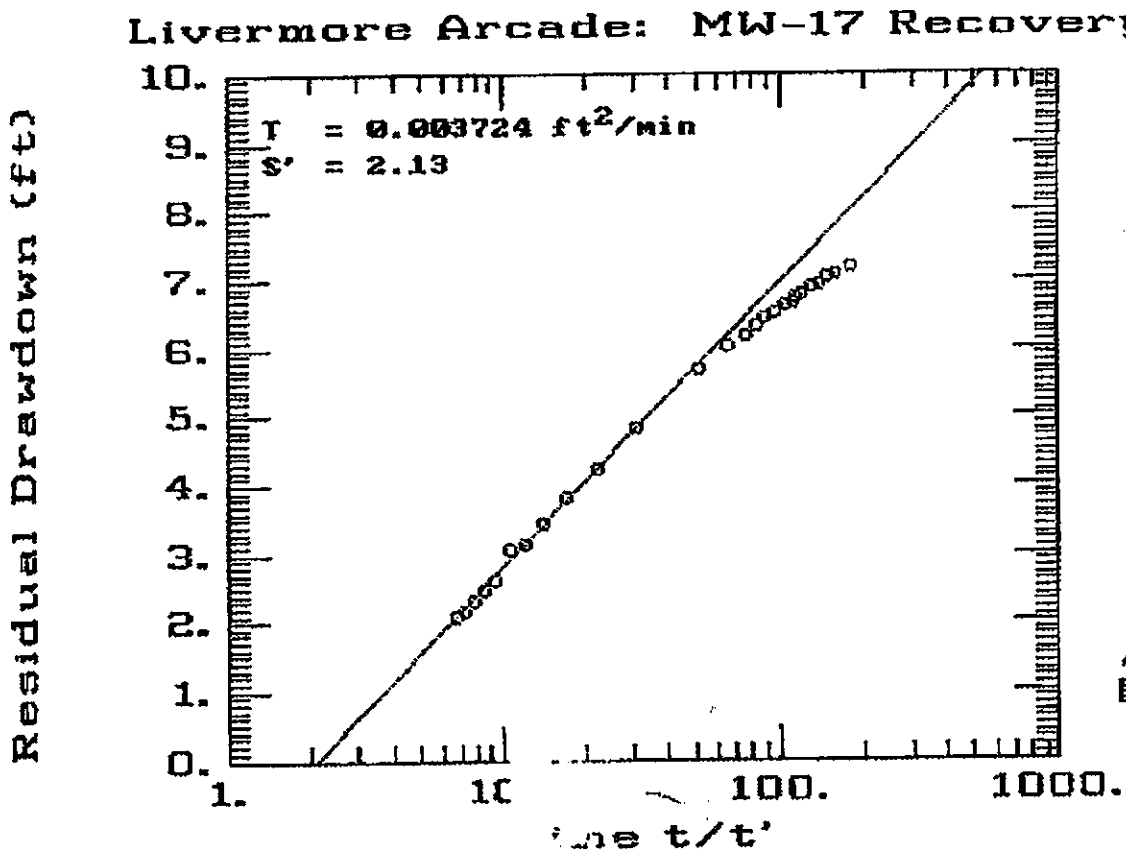


Theis

(Unconfined)



Livermore Arcade: MW-17 Pumping Data
T = 0.01611 ft²/min
S = 1.1682E-008
100.
10.
1.
10.
100.
1000.
Time (min)
Corrected Drawdown (ft)
AQTE
GER
& MI
Model



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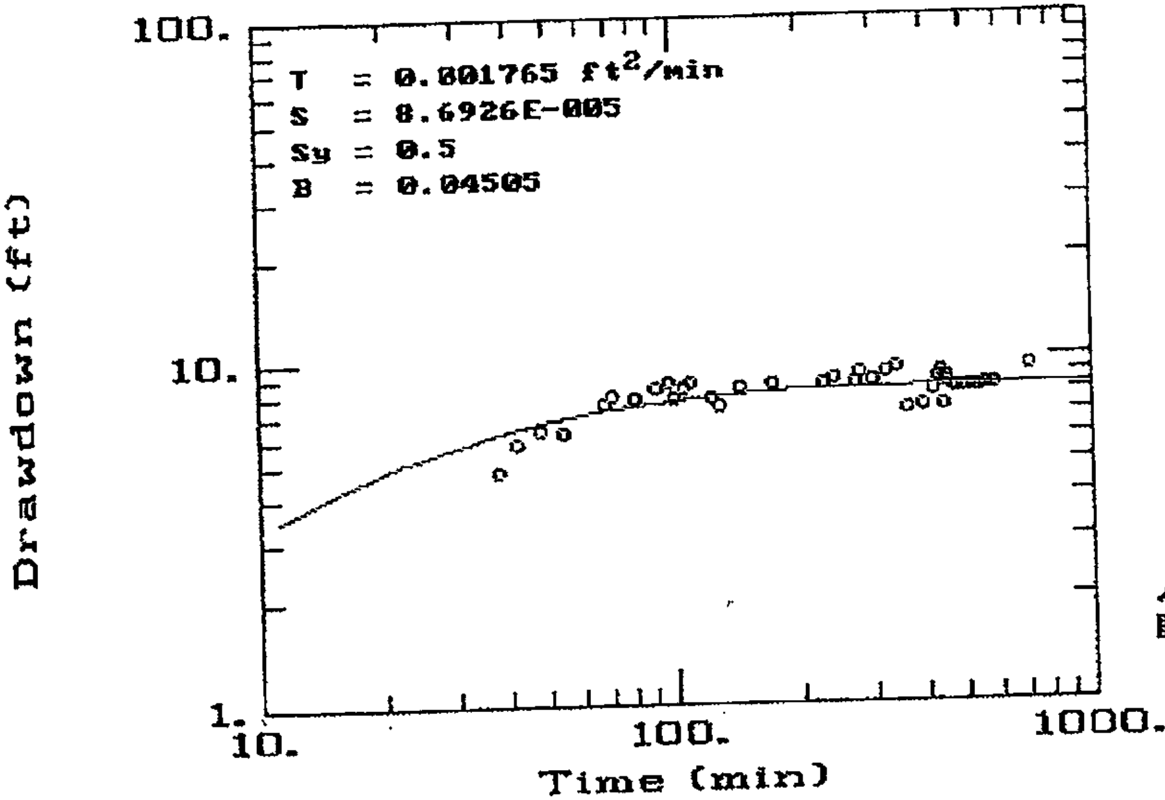
Recovery on
78 ?
cr

Livermore Arcade: MW-17 Pumping Data



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Neuman

(Unconfined)