ESE Environmental
Science &
Engineering, Inc.

A CILCORP Company

January 31, 1996

Mr. Dale Klettke, CHMM
Alameda County Health Care Services Agency
Department of Environmental Health
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

SUBJECT: CASE NO. 1008 - GROUND WATER DATA EVALUATION
JAMES RIVER CORPORATION
2101 WILLIAMS STREET
SAN LEANDRO, CALIFORNIA
ESE PROJECT NO. 65-95-226

Dear Mr. Klettke:

On behalf of James River Corporation (James River), Environmental Science & Engineering Inc. (ESE) has prepared this ground water data evaluation report to further characterize the chlorinated solvent and non-chlorinated organic compounds in ground water at the James River site. This report includes a discussion of the fate and history of chlorinated solvents and organic solvents which have been detected in the site monitoring wells. The method of analysis presented herein is in the form of tables listing chemical concentrations detected in monitoring wells during periodic sampling events and in the form of graphs which illustrate trends of the logarithmic concentration of the analyte (chemical analyzed) with time. The linear trends are compared to published findings regarding decay rates following first-order degradation kinetics.

Chemical degradation across the site is indicated by decreasing analyte concentrations and changes in the proportions of analyte concentrations. Migration of a significant chlorinated solvent plume from an upgradient offsite source shows little decrease in the concentration of chlorinated solvents migrating onto the James River site although the relative proportions of analytes change with distance from the source. Chemicals of concern originating at the James River site have decayed to levels that do not have an adverse effect to human health and the environment.

ESE recommends that the quarterly monitoring schedule related to James River case 1008 be discontinued and that the case be closed.

INTRODUCTION

Recent publications regarding site evaluations with respect to risk-based corrective action (RBCA) at petroleum release sites (ASTM, 1994) and reviews of biological degradation at leaking underground fuel tanks (LLNL, 1995) have prompted an increased emphasis on passive site remediation and the effects of natural chemical decay by microbial degradation. The ground water beneath the James River site contains both organic and chlorinated solvents and this report presents information on analyte concentrations and decay trends.

Many laboratory and field research publications have documented the chemistry of chlorinated solvent degradation by reductive dehalogenation and the relationship of degradation products with time and distance from a source. A chemical is considered to be reduced when a chemical reaction leads to the increase of the hydrogen content or the decrease in the oxygen content. The biological degradation of the chlorinated solvents tetrachloroethylene (PCE), trichlorethylene (TCE), 1,2-dichlorethylene (1,2-DCE), and vinyl chloride (VC) have been described by Vogel and McCarty (1985) and Dragun (1988). The time and distance relationships of the concentration of TCE and daughter products 1,2-DCE and VC have been demonstrated by Tucker and Zavala (1991).

Organic compounds such as acetone, methyl-isobutyl-ketone (MIBK) and fuel constituent aromatic hydrocarbons, and diesel oil also undergo biodegradation by first-order kinetics to some extent and half-lifes of specific compounds have been reported elsewhere (ASTM, 1994; Barker and others, 1987; Howard, 1991; Kemblowski, 1987).

Site Location

The James River site is located in a industrial area in the City of San Leandro on the flatland deposits adjacent to San Francisco Bay (see Figure 1- Site Location). The site topographic elevation is 25 feet above mean sea level (MSL) with surface drainage to the southwest (USGS, 1980). Flatland deposits in this area are composed of fine sands, silts, and clays (Helley, 1976). San Francisco Bay is located approximately one mile to the southwest. Shallow ground water flows southwesterly towards the bay. The edge of a major plume of dissolved chlorinated solvents (TCE 520,000 ug/L) originating from upgradient sources (1964 Williams Street and Caterpillar Tractor at the intersection of San Leandro Blvd. and Davis Streets) is slowly making its way across the James River site in the direction of San Francisco Bay (Klettke, 1995).

Ground water monitoring at the site presently involves ten monitoring wells to test the subsurface conditions around the former underground storage tanks (W-1, W-4, B-1, W-3, and W-10), to monitor the upgradient conditions (W-5 and W-6) and to monitor the down-

gradient conditions (W-7, W-8, and W-9). Monitoring and sampling of the ground water since 1990 has detected a persistent chlorinated solvent plume in all wells, acetone and MIBK in W-10, and diesel oil and motor oil in W-7 and W-8. The chemical findings for the last six years from March 1990 to October 1995 are further described below.

TABLES

For the purpose of this evaluation, the analytes were selected for study based on the following criteria: 1) their persistence in the ground water at the site; and 2) the observation of decreasing concentrations with time; and 3) published maximum contaminant levels (MCLs) or action levels (ALs) in potable ground water or tap water.

For each monitoring well, a table is presented that lists the historical concentrations of the selected analyte in micrograms per liter (ug/L). The time of the sampling event, the concentration measured, and the State or Federal maximum contaminant level (MCL) for a drinking water aquifer is listed (DWR, 1995). Acetone and MIBK do not have an MCL, and a Federal Environmental Protection Agency preliminary remediation goal (PRG) in tap water is presented (Smucker, 1993).

Chlorinated Solvents

A significant chlorinated solvent plume in San Leandro originates at very high concentrations at the Caterpillar Tractor Company and migrates southwesterly with decreasing concentrations in the ground water down-gradient direction through 1964 Williams Street and the James River site. James River has been monitoring for chlorinated solvents since 1990. Chlorinated solvent concentrations on the James River site are at least two orders of magnitude lower than the chlorinated solvent concentrations on the nearest upgradient source at 1964 Williams Street.

The historical concentrations of the selected chlorinated solvents in ground water from monitoring wells at the James River site are presented on Table 1 through Table 6. The upgradient wells W-5 and W-6 tend to have relatively higher PCE, TCE, 1,2-DCE and VC concentrations than the down-gradient wells W-8 and W-9. Variability of each chlorinated solvent concentration with time and between wells can be attributed to fluctuation in the source concentrations over time, periodic regional accelerated decay rates and well-specific decay rates. The concentration of PCE in W-5 has ranged from 5,600 ug/L in March 1990 to 130 ug/L in December 1990. Recently, in October 1995, the PCE concentration in W-5 was reported to be 3,700 ug/L. The highest concentration of TCE (970 ug/L in W-5) and 1,2-DCE (5,500 ug/L in W-5) were measured in February of 1992. In October 1995, the TCE and 1,2-DCE concentrations measured in W-5 have decreased to 450 ug/L and 350 ug/L, respectively. The highest concentration of VC (300 ug/L in W-5) was measured in

June of 1990, and was recently measured at the detection limit of 0.5 ug/L in W-5. Lower concentrations of PCE, TCE, 1,2-DCE and VC onsite at the James River site are detected in wells W-7, W-8, and W-9 which are located further from the offsite source and about 500 feet down-gradient from well W-5.

Organic Compounds

The historical concentrations of the selected non-chlorinated organic compounds are listed on Table 7. Acetone and MIBK persist in the area near the former USTs although at reduced concentrations from those measured in 1993. The aromatic hydrocarbons benzene, toluene, ethylbenzene and xylenes (BTEX) are masked by the relatively high acetone and MIBK concentrations. Due to relatively high method detection levels only reportable concentrations are used in this evaluation. Measurements of BTEX were reportable above the minimum detection limits during the time period of December 1990 to May 1992. Measurements of MIBK and acetone are reported in February 1993 through October 1995.

GRAPHICAL ANALYSIS

The graphical analysis for each selected analyte has been plotted as the logarithm of the analyte concentration with time. This allows the presentation of data with differing magnitudes of concentration on the same graph. It also helps to identify trends in the data which may be following apparent linear first-order decay.

Chlorinated Solvents

Graphs of the trends of the chlorinated analytes located in the site upgradient area (wells W-3, W-5, and W-6) can be characterized with proportions of PCE > TCE and the analyte concentrations tending to be higher than the down-gradient analyte concentrations. The analyte 1,2-DCE is more variable than PCE and TCE. A temporary change in relative degradation may have caused lower TCE concentrations and increased 1,2-DCE concentrations in February 1992 and again in December of 1994. VC concentrations tend to remain proportionately lower in the up-gradient area. This correlation is consistent with the work of Dragun (1995) who described the degradation relationship of PCE and TCE, and the work of Tucker and Zavala (1991) who described the relationship of TCE, DCE and VC with distance from a source area (see Figure 3 - TCE, DCE and VC Concentration With Distance From a Spill Source).

In the down-gradient area of wells W-7, W-8, and W-9, a distinct change in the relationship of proportions of PCE and TCE is observed where TCE > PCE. This relationship appears to have been present before March 1990 in wells W-8 and W-9. In well W-7, the TCE > PCE relationship is observed between the March 1994 and June 1994 sampling events. The

distinct relationship of 1,2-DCE > TCE is observed in well W-8 where the concentrations of 1,2-DCE and VC are in the highest proportions with VC periodically occurring highest. The variability of these proportions is an indication of the geometry and variability of decay within the solvent plume.

Organic Compounds

Over a three-year time period (1993 to 1995) of measurable concentrations, acetone, MIBK and toluene demonstrate linear degradation with time. These three organic compounds have decreased in concentration by about one order of magnitude where acetone has decreased from 420,000 ug/L to 39,000 ug/L, MIBK has decreased from 18,000 ug/L to 830 ug/L, and toluene has decreased from 31,000 ug/L to 1,300 ug/L. Over a shorter nine-month time period (August 1991 to May 1992) of measurable concentrations, xylenes and ethylbenzene demonstrate linear degradation and decrease in concentration by half.

FATE AND TRANSPORT

The purpose of this fate and transport section is to estimate the fate of the selected chemicals at the James River site by calculating the ground water flow direction and velocity, calculating the migration time across the site, and estimating the degradation time to reach MCL levels for the chlorinated solvents and organic compounds. The fate and transport of chemicals in the subsurface is complexly related to the properties of the specific chemical as it moves as a pure liquid, dissolved in water, or as a gas through the unsaturated soils (Tucker and Zavala, 1991). When the chemical is dissolved in ground water, transport is mainly by advection in the ground water down-gradient flow direction with lateral dispersion. The degradation time is calculated from an apparent decay rate that is estimated from the linear trend of data points observed on the graphs.

Ground Water Flow Direction and Velocity

The ground water flow direction at the James River site is based on measurements of the ground water elevations recorded in onsite wells. Table 8 lists ground water elevations measured in onsite wells. The trends of historical water levels are shown on Graph 8. Although site ground water levels were highest in February 1993, the effects of chemical dilution appear to have been minimal. During 1995 the ground water flow direction was in a west to southwesterly direction at a magnitude that varied from 0.003 foot per foot (ft/ft) to 0.006 ft/ft. In the source area located up-gradient of the James River site, the ground water flow direction is to the southwest and the gradient is reported to be shallower at 0.001 ft/ft (Klettke, 1995).

The ground water flow velocity at the James River site can be calculated based on a modification of the Darcy Equation where:

$$Vx = K(h/l)/n \ 7.5$$

where Vx is the horizontal flow velocity in feet per day
  K is the hydraulic conductivity in gallons/ft/day
  h/l is the ground water gradient
  n is porosity and 7.5 is a conversion from gallons to cubic feet

Using an estimated hydraulic conductivity of 500 gallons/day/ft for fine sands and clayey silts (Freeze and Cherry, 1979), an average site gradient of 0.004 ft/ft and a porosity of 0.28, a horizontal velocity of 0.95 ft/day is calculated. Given the variables of the calculation, the flow velocity is estimated to range from 0.5 ft/day to 5 ft/day.

Migration Time Across the Site

The time for ground water to flow across the site is calculated by dividing the distance across the site by the flow velocity. Using the distance of 500 feet between the upgradient and the down-gradient wells, a time of 526 days (500ft/0.95 ft/day) is calculated. Therefore, when ground water containing a contaminant enters the site from the upgradient direction, approximately 526 days or 1.4 years is required before the ground water containing the degraded contaminant leaves the site. Therefore, it is important to know how quickly the contaminants are naturally degrading in order to estimate the concentrations, if any, as the ground water departs the site.

Degradation of Chlorinated Solvents

In the case of chlorinated solvents which are entering the site from the upgradient direction, the concentrations are going to be a function of the upgradient plume geometry and the variability of the dissolved contaminants in the plume. Tucker and Zavala (1991) have studied this effect from a continuous source and plot the relationship of TCE, DCE and VC concentrations with distance from a source. This relationship is shown on Figure 3- TCE biodegradation. The findings for the James River site illustrated on the graphs, are consistent with the findings of Tucker and Zavala (1991) for TCE degradation. They have reported reasonable biodegradation field rate constants for TCE to be 0.05 year^{-1}, for DCE to be 0.01 year^{-1}, and for VC to be 0.02 year^{-1}. These values correspond to half-lifes that range from 14 years to 69 years. This information suggests that little degradation of the chlorinated solvents will take place as the dissolved plume moves across the James River site.

Only when the offsite source of the chlorinated solvents is removed and the ground water plume is remediated will there be a noticeable decrease in the present levels of PCE, TCE and the daughter products 1,2-DCE and VC which are migrating onto the James River site.

Degradation of Organic Compounds

The equation of linear first-order decay can be used to make estimates of the time for chemical concentrations to decay to a specified concentration, such as the MCL, when the decay rate is known. The equation of linear first-order kinetics is an expression of the difference in a chemical's concentration, the decay rate and time:

(1) $\text{Log} (Xo/X) = kt/2.30$

where,   Xo is the concentration of the analyte at time zero
X is the concentration at time t
k is the rate constant, and
t is time
2.30 is the correction from natural log (base e) to log (base $_{10}$)

and the half-life of the chemical is given as;

(2) $t_{1/2} = 0.693/k$

The formula of the half-life readily allows direct measurements from the graphs of chemical concentration and time during which the chemical concentration has decreased by half. A steep slope with time infers that the apparent chemical decay rate is faster than a shallow slope with time. By measuring the time from the graph where the analyte has decreased by half and solving for k in equation (2) gives the apparent k which can be further used in equation (1). The site-specific apparent half-lifes and resultant k values determined for the selected organic compounds and published reports are given below:

Chemical	Half-life (days)	k days^{-1}
Acetone	270	0.0026
MIBK	300	0.0023
Xylenes	240	0.0029

Chemical	Half-life (days)	k days^{-1}
Toluene	210	0.0033
Ethylbenzene	180	0.0039
Benzene	NA	0.007 (Barker and others, 1987)
TCE	NA	0.0002 (Tucker and Zavala, 1991)
DCE	NA	0.00004 (Tucker and Zavala, 1991)
VC	NA	0.00008 (Tucker and Zavala, 1991)

TIME TO REACH MCLs

Using the equation for linear first-order decay, the time to reach the MCL from a reported chemical concentration can be estimated. The estimated time for the decay of individual BTEX compounds is necessary because the relatively high acetone and MIBK concentrations result in relatively high laboratory minimum detection limits for BTEX above the MCL. Since the ethylbenzene concentration has always been below its MCL of 700 ug/L, it is not calculated. Using the site specific k values, the expected target date to decay to the MCL from the given concentration is calculated below:

Chemical	Date	Xo (ppb)	X (ppb)	k days^{-1}	Days	Target Date
Acetone	10/95	39,000	770 *610*	0.0026	1508	11/99
MIBK	11/93	6,000	1800 *29p00*	0.0023	523	3/95
Xylenes	8/91	2200	1750	0.0029	79	11/91
Toluene	2/93	3400	150	0.0033	945	9/95
Benzene	8/91	100	1	0.007	657	6/93
TCE	10/95	450	5	0.0002	22,474	year 2057
DCE	10/95	350	6	0.00004	101,540	year 2273
VC	10/95	290	0.5	0.00008	79,449	year 2214

where   Xo is the concentration reported for the given date;
        X is the MCL; and
        k is the apparent decay rate

The above calculations indicate that the natural persistence of the organic compounds is significantly shorter than the persistent chlorinated compounds. Chlorinated compounds have a persistence that is measured in centuries, whereas the organic compounds have a persistence that is measured in decades. The chemicals of concern originating at the James River site have already reached levels that are below the regulatory levels of concern when compared to the chlorinated solvents.

Taking into account that the conservative value of acetone in tap water was used in this evaluation, this analyte (localized in the area of W-10) has also likely reached a reasonable cleanup level in the commercial/industrial area of the James River site.

RECOMMENDED ACTIONS

ESE recommends that because a significant offsite chlorinated solvent plume continues to migrate onto the James River property, the James River Corp. should be notified of schedules regarding cleanup of this significant solvent plume. Estimates of the natural degradation time for selected chlorinated solvents indicate that the chlorinated solvent plume will have a persistence for 60 to 280 years. It is recommended that the responsible parties for the offsite source of chlorinated solvents undertake the appropriate action to control the migration of the chlorinated solvent plume.

With regard to the non-chlorinated organic compound analytes originating at the James River site, this evaluation suggests that the concentrations of acetone, MIBK and the aromatic hydrocarbons have already reached levels that are below levels that are adverse to human health and the environment.

ESE recommends that no further action is warranted regarding case 1008 and that James River should be granted closure of case 1008.
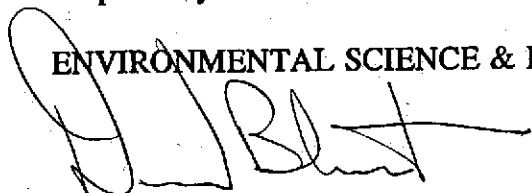
CLOSURE

On behalf of James River Corporation, ESE has prepared this ground water data evaluation report to further characterize the chlorinated solvent and non-chlorinated organic compounds in ground water at the James River site. The findings and conclusions documented in this report have been prepared for specific application to this project and have been developed in a manner consistent with that level of care and skill normally exercised by members of the environmental science and engineering profession currently practicing under similar conditions in this area. All conclusions, expectations, and recommendations are ESE's professional opinions based on ESE's interpretation of information currently available.

Should you have any questions, please call me at (510) 685-4053.
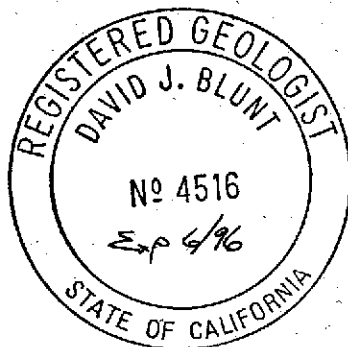
Respectfully submitted,

ENVIRONMENTAL SCIENCE & ENGINEERING INC.

David Blunt RG 4516
Senior Geologist

Attachments: Figures 1 to 3
Tables 1 to 8
Graphs 1 to 8

REFERENCES

ASTM- see American Society For Testing And Materials

American Society For Testing And Materials, 1994, *Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, ES 38 - 94, Philadelphia, PA, July 1994.

Barker, J.F., Patrick, G.C., and Major, D., *Natural Attenuation of Aromatic Hydrocarbons in a Shallow Sand Aquifer*, Ground Water Monitoring Review, Vol 7, 1987, pp. 64-71.

Dragun, J., 1988, *The Soil Chemistry of Hazardous Materials*, Hazardous Materials Control Research Institute, Silver Springs, MD, 1988.

Department of Water Resources, 1995, *Compilation of Federal and State Drinking Water Standards and Criteria*, State of California, July 1995.

DWR- see Department of Water Resources

Freeze, R.A. and Cherry, J.A., 1979, *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, NJ, 604 p.

Helley, E.J. and others, 1979, *Flatland Deposits-Their Geology and Engineering Properties and Their Importance to Comprehensive Planning;* United States Geological Survey Professional Paper 943.

Howard, P., and others, 1991, *Handbook of Environmental Degradation Rates*, Lewis Publishers Inc., Chelsea, MI, 1991.

Kemblowski, M. W., Salanitro, J.P., Deely, G.M., and Stanley, C.C., 1987, *Fate and Transport of Residual Hydrocarbons in Groundwater:* A Case Study, in Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water Conference, National Well Water Association and American Petroleum Institute, Houston, TX, 1987, pp. 207-231. 1987

Klettke, D., 1995, Personal Communication Letter from D. Klettke, Alameda County Health Care Services to Ms. Regina Colbert, James River Corporation Re: Groundwater Monitoring Schedule, James River Corporation, December 21, 1995.

Lawrence Livermore National Laboratory, 1995, *Recommendations To Improve the Cleanup Process for California's Leaking Underground Fuel Tanks*, Lawrence Livermore National Laboratory, University of California, UCRL-AR-121762, October 16, 1995.

LLNL- see Lawrence Livermore National Laboratory

Smucker, S.J., 1993, *Region IX Preliminary Remediation Goals (PRGs) Second Quarter 1993*, United States Environmental Protection Agency, Draft April 2, 1993.

Tucker, W.A., and Zavala, P.J., 1991, *Fate of Chlorinated Aliphatics in Groundwater: Implications for Risk Assessment*, in Proceedings of April 1991 HMCRI Conference, Houston, Texas, pp. 44-48.

USGS- see U. S. Geological Survey

U.S. Geological Survey, 1980, USGS San Leandro CA 7.5 Minute Topographic Quadrangle Map 1959, Photorevised 1980.

Vogel, T.M. and McCarty, L., 1985, *Biotransformation of Tetrachloroethylene to Trichloroethylene, Dichloroethylene, Vinyl Chloride, and Carbon Dioxide under Methanogenic Conditions*, Applied and Environmental Microbiology, 49, pp. 1080-1083, 1985.
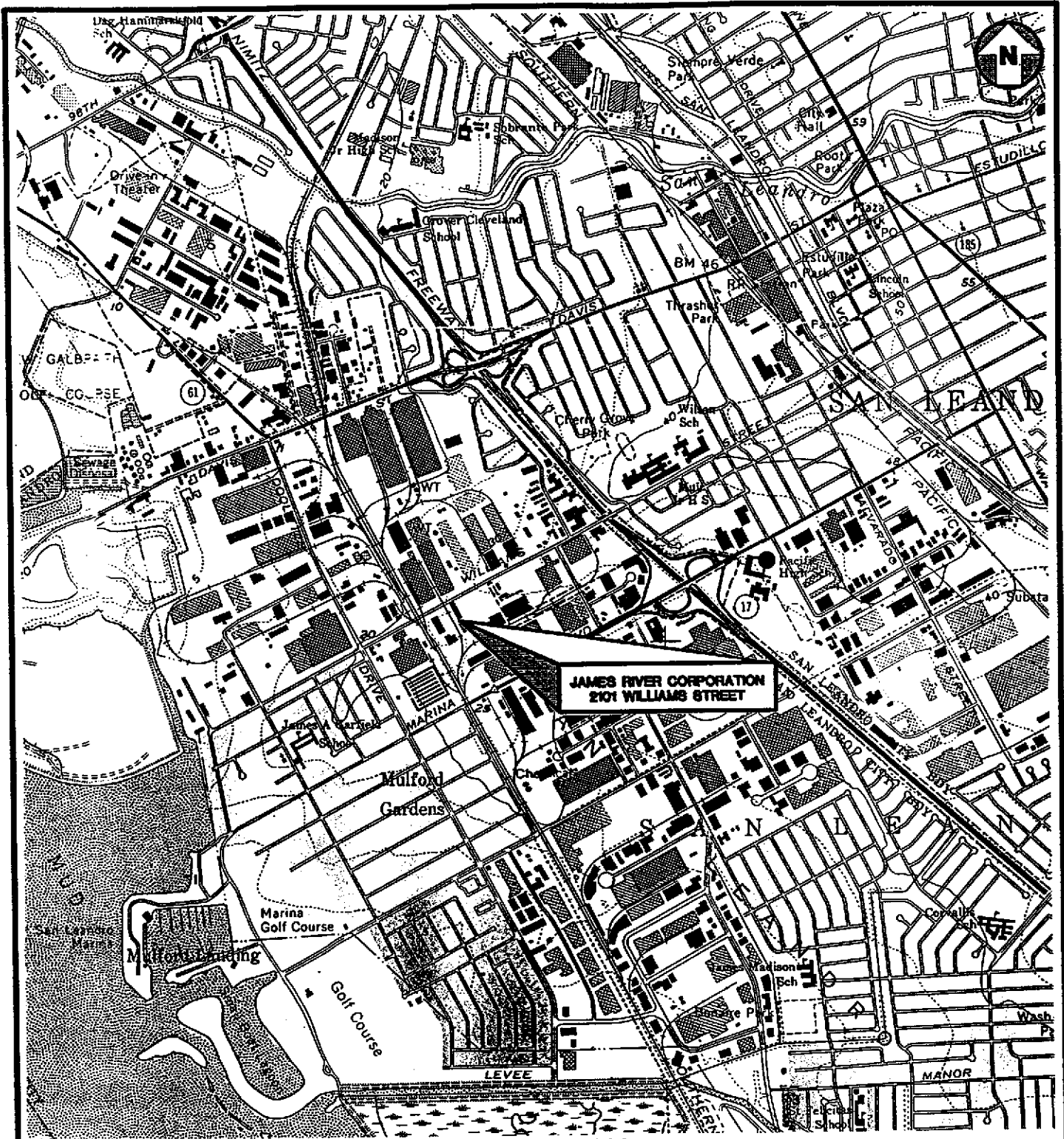
JAMES RIVER CORPORATION 2101 WILLIAMS STREET

SCALE 1:24,000

1000   0   1000   2000   3000   4000   5000   6000   7000 FEET

1   .5   0   1 KILOMETER
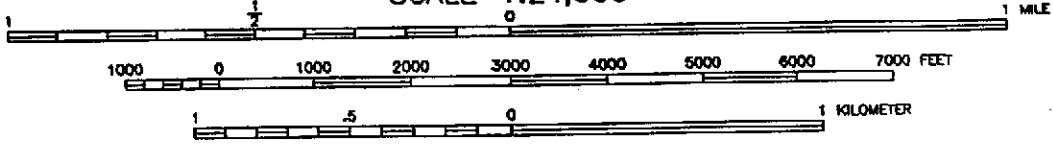
ADAPTED FROM U.S.G.S. SAN LEANDRO, CA. 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP 1959, PHOTOREVISED 1980.

ESE Environmental Science & Engineering, Inc.	DATE 3/10/95	LOCATION MAP	FIGURE NO. 1
	REVISED		
4090 NELSON AVENUE, SUITE J CONCORD, CA 94520	CAD FILE 50220003	JAMES RIVER CORPORATION 2101 WILLIAMS STREET SAN LEANDRO, CALIFORNIA	PROJ. NO. 6595022

SOUTHERN PACIFIC RAILROAD R/W

W-5
8.70

W-6
8.58

W-1
8.71

ABOVE GROUND
STORAGE TANKS

FORMER LOCATION OF
UNDERGROUND STORAGE
TANKS, REMOVED
JUNE 1989

W-4
8.66

B-1
8.61

W-3
8.58

RAMP

W-10
7.68

WILLIAMS STREET

JAMES RIVER FLEXIBLE
PACKAGING PLANT

W-8
8.69

AAAAA
RENT-A-SPACE

8.60

NEW INK ROOM

8.40

8.20

W-9
8.26

W-7
8.02

LEGEND

W-9
8.71 �◇   GROUND WATER MONITORING WELL WITH ELEVATION

— — — —   PROPERTY LINE

—8.60—   GROUND WATER POTENTIOMETRIC CONTOUR WITH ELEVATION

——▶   APPROXIMATE GROUND WATER FLOW DIRECTION

SCALE

0   60 FEET

ESE Environmental Science & Engineering, Inc.	DATE 3/9/95	GROUND WATER LEVEL CONTOUR MAP OCTOBER 13, 1995	FIGURE NO. 2
A OLDORF Company	REVISED 11/7/95	JAMES RIVER CORPORATION 2101 WILLIAMS STREET SAN LEANDRO, CALIFORNIA	
4090 NELSON AVENUE, SUITE J CONCORD, CA 94520	CAD FILE 65502202		PROJ. NO. 65-95-022

INCREASING CONCENTRATION ————►

(DCE)

(TCE)

(VC)

INCREASING DISTANCE ————►

	DATE 1/10/96	TCE, DCE AND VC CONCENTRATION WITH DISTANCE FROM SPILL SOURCE (TUCKER AND ZAVALA, 1991)	FIGURE NO.
ESE Environmental Science & Engineering, Inc. A ELCORP Company	REVISED		**3**
4090 NELSON AVENUE, SUITE J CONCORD, CA 94520	CAD FILE 65522603	JAMES RIVER CORPORATION 2101 WILLIAMS STREET SAN LEANDRO, CALIFORNIA	PROJ. NO. 65-95-226

TABLE 1. ANALYTES FROM WELL W-3.
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	29	130	4	24
Jun-90	340	200	1.9	1.9
Sep-90	190	140	0.9	14
Dec-90	88	69	0.9	11
Aug-91	75	48	39	14
Nov-91	0.5	46	73	1.9
Feb-92	340	290	76	20
May-92	250	210	28	12
Feb-93	250	190	24	19
Nov-93	4	4	14	26
Mar-94	4	4	25	9
Jun-94	4	4	8	9
Sep-94	19	14	8	9
Dec-94	4	4	61	9
Feb-95	0.5	0.5	11	0.5
May-95	270	160	23	28
Jul-95	320	150	19	20
Oct-95	220	150	24	25
MCL ug/L	5	5	6	0.5

TABLE 2. ANALYTES FROM WELL W-5.
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	5600	460	19	190
Jun-90	2100	340	49	300
Sep-90	670	170	19	220
Dec-90	130	63	480	99
Aug-91	1800	440	3600	80
Nov-91	2600	670	4400	90
Feb-92	3500	970	5500	80
May-92	3000	740	2700	120
Feb-93	3600	740	2500	190
Nov-93	2100	500	1000	160
Mar-94	2600	460	1200	99
Jun-94	3400	530	1700	160
Sep-94	2500	530	1300	140
Dec-94	1800	350	1600	99
Feb-95	1900	290	2100	0.5
May-95	3600	360	540	0.5
Jul-95	3400	350	320	28
Oct-95	3700	450	350	0.5
MCL ug/L	5	5	6	0.5

TABLE 3. ANALYTES FROM WELL W-6.
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	1700	280	19	19
Jun-90	940	230	4	4
Sep-90	980	280	7	4
Dec-90	540	210	6	4
Aug-91	320	220	2	1.9
Nov-91	430	310	4	4
Feb-92	430	360	1.9	1.9
May-92	520	390	1.9	1.9
Feb-93	520	340	4	4
Nov-93	280	170	9	9
Mar-94	220	160	56	9
Jun-94	450	310	100	9
Sep-94	310	230	380	9
Dec-94	120	78	280	9
Feb-95	320	250	24	0.5
May-95	440	230	16	0.5
Jul-95	470	250	0.5	0.5
Oct-95	430	250	0.5	0.5
MCL ug/L	5	5	6	0.5

TABLE 4. ANALYTES FROM WELL W-7.
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	740	240	72	4
Jun-90	590	210	81	4
Sep-90	680	270	65	4
Dec-90	480	170	32	4
Aug-91	390	190	39	1
Nov-91	430	220	50	1
Feb-92	410	240	110	29
May-92	380	210	44	30
Feb-93	270	200	66	51
Nov-93	190	160	15	19
Mar-94	220	230	21	9
Jun-94	240	240	26	9
Sep-94	86	120	230	9
Dec-94	8	9	120	37
Feb-95	170	180	17	0.5
May-95	0.5	100	110	59
Jul-95	140	140	49	48
Oct-95	170	190	39	28
MCL ug/L	5	5	6	0.5

TABLE 5. ANALYTES FROM WELL W-8.
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	1	3	31	5
Jun-90	1	3	31	5
Sep-90	1	3	31	5
Dec-90	1.5	3.5	28	9
Aug-91	1.9	4	24	13
Nov-91	0.5	0.6	14	11
Feb-92	1.2	1.5	72	54
May-92	0.4	3	53	62
Feb-93	1.9	7.6	200	170
Nov-93	4	3	150	130
Mar-94	4	4	250	180
Jun-94	4	4	290	280
Sep-94	4	4	59	43
Dec-94	4	4	15	9
Feb-95	0.5	0.5	79	82
May-95	0.5	0.5	160	260
Jul-95	0.5	0.5	230	200
Oct-95	0.5	0.5	280	290
MCL ug/L	5	5	6	0.5

TABLE 6. ANALYTES FROM WELL W-9
James River Corp., San Leandro, CA

DATE	PCE	TCE	1,2-DCE	VC
Mar-90	13	21	0.9	0.9
Jun-90	23	28	0.9	0.9
Sep-90	20	26	0.9	0.9
Dec-90	19	26	1.9	1.9
Aug-91	22	39	0.8	0.5
Nov-91	23	43	1.1	0.5
Feb-92	27	61	3	0.5
May-92	19	59	1.3	0.5
Feb-93	22	99	1.8	0.04
Nov-93	11	92	4	4
Mar-94	13	110	4	9
Jun-94	12	110	4	9
Sep-94	7	80	30	9
Dec-94	4	4	110	9
Feb-95	0.5	3	63	0.5
May-95	7.2	72	0.5	0.5
Jul-95	9	89	0.5	0.5
Oct-95	9.9	110	0.5	0.5
MCL ug/L	5	5	6	0.5

TABLE 7. ANALYTES FROM WELL W-10
James River Corp., San Leandro, CA

DATE	Benzene	Toluene	Ethyl-benzene	Xylenes	MIBK	Acetone
Dec-90	<5000	31000	440	<5000	NA	NA
Aug-91	100	18000	500	2200	NA	NA
Nov-91	<100	20000	400	1800	NA	NA
Feb-92	<100	12000	400	1400	NA	NA
May-92	<50	8700	220	1100	NA	NA
Feb-93	<300	3400	<300	<300	18000	420000
Nov-93	<5000	<5000	<5000	<5000	6000	210000
Mar-94	<1300	<1300	<1300	<1300	3600	99000
Jun-94	<2000	<2000	<2000	<2000	4800	150000
Sep-94	<2500	<2500	<2500	<2500	<5000	74000
Dec-94	<500	<500	<500	<500	1600	18000
Feb-95	<1300	<1300	<1300	<1300	1300	47000
May-95	<1000	<1000	<1000	<1000	<2000	21000
Jul-95	<5	140	15	80	<500	19000
Oct-95	<500	<500	<500	<500	830	39000
MCL ug/L	1	150	700	1750	1800	770

NOTE: NA- blanks represent time periods of no sampling; analytes with high
method detection limits greater than the MCL are not used on graphs.

TABLE 8. HISTORICAL WATER LEVELS
James River Corp., San Leandro, CA

	WELLS					
DATE	W-3	W-5	W-6	W-7	W-8	W-9
Sep-90	7.43	7.42	7.52	6.94	7.52	7.16
Dec-90	7.91	8.02	8.01	7.33	7.92	7.6
Aug-91	7.8	7.61	7.71	7.09	7.72	7.32
Nov-91	7.55	7.6	7.68	7.07	7.69	7.32
Feb-92	9.96	8.96	10.17	9.13	9.9	9.38
May-92	8.58	8.66	8.75	8.05	8.7	8.26
Feb-93	11.5	11.72	11.79	10.43	11.38	10.78
Nov-93	8.33	8.34	8.41	7.79	8.43	8.05
Mar-94	9.83	9.89	9.91	9.21	9.87	9.45
Jun-94	8.98	9	9.08	8.39	9.02	8.64
Sep-94	8.32	8.35	8.43	7.78	8.42	8.16
Dec-94	9.6	9.64	9.7	8.97	9.65	9.24
Feb-95	10.28	10.32	10.42	9.57	10.31	9.86
May-95	10.42	10.28	10.75	10.11	9.95	9.78
Jul-95	9.3	8.8	7.3	8.71	9.36	8.95
Oct-95	8.58	8.7	8.58	8.02	8.69	8.26

GRAPH 1. W-3 ANALYTES
James River Corp., San Leandro, CA
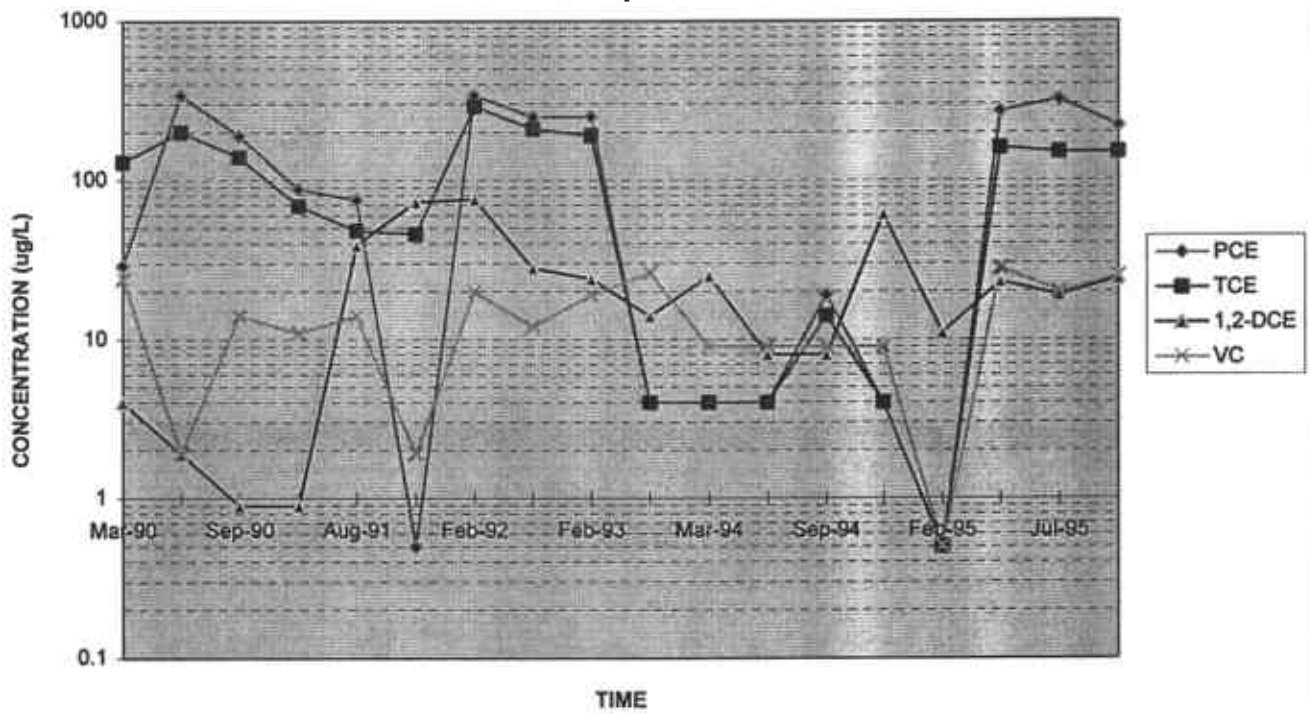
GRAPH 2. W-5 ANALYTES
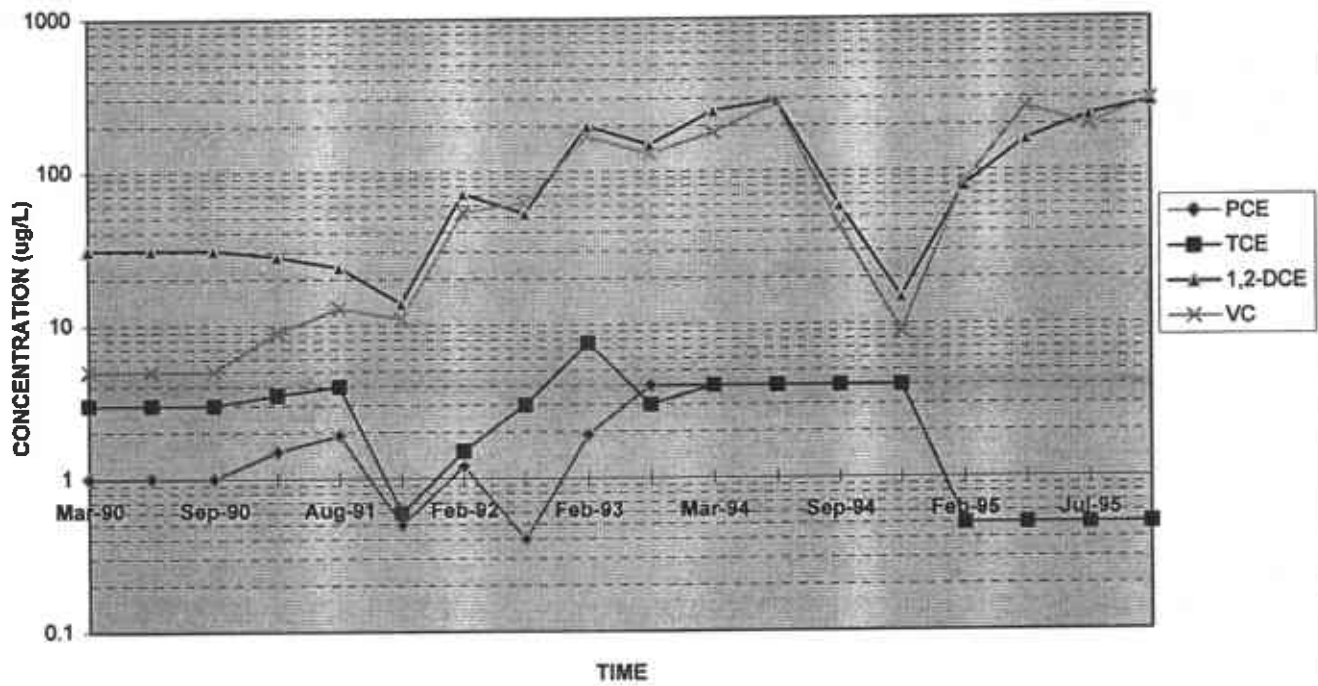**James River Corp., San Leandro, CA**

Legend: PCE, TCE, 1,2-DCE, VC

Y-axis: CONCENTRATION (ug/L)
X-axis: TIME
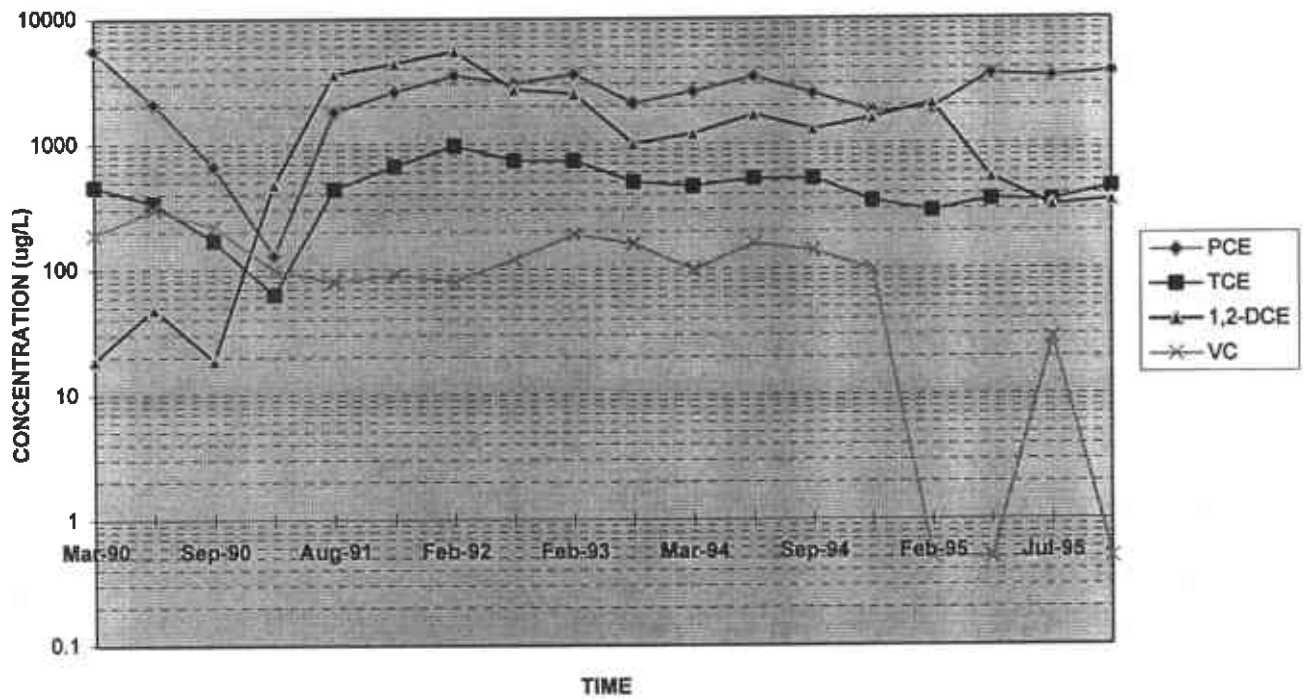
GRAPH 3. W-6 ANALYTES
James River Corp., San Leandro, CA
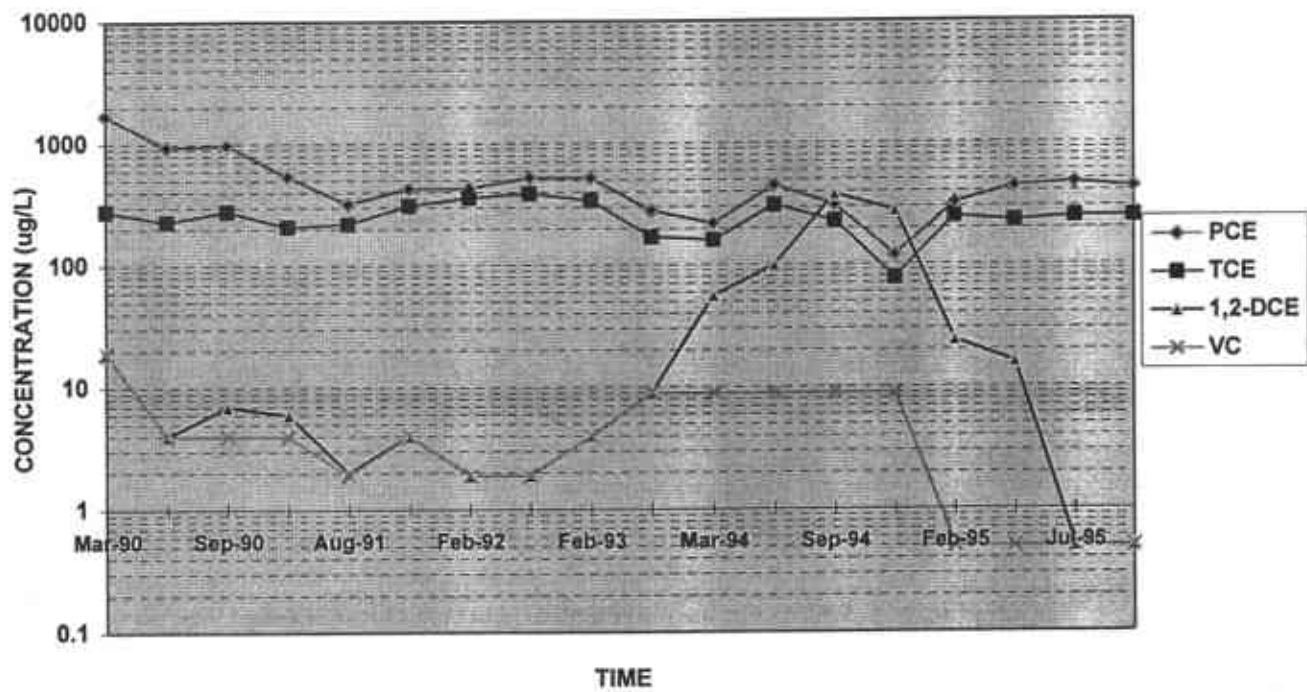
GRAPH 4. W-7 ANALYTES
James River Corp., San Leandro, CA

Legend: PCE, TCE, 1,2-DCE, VC
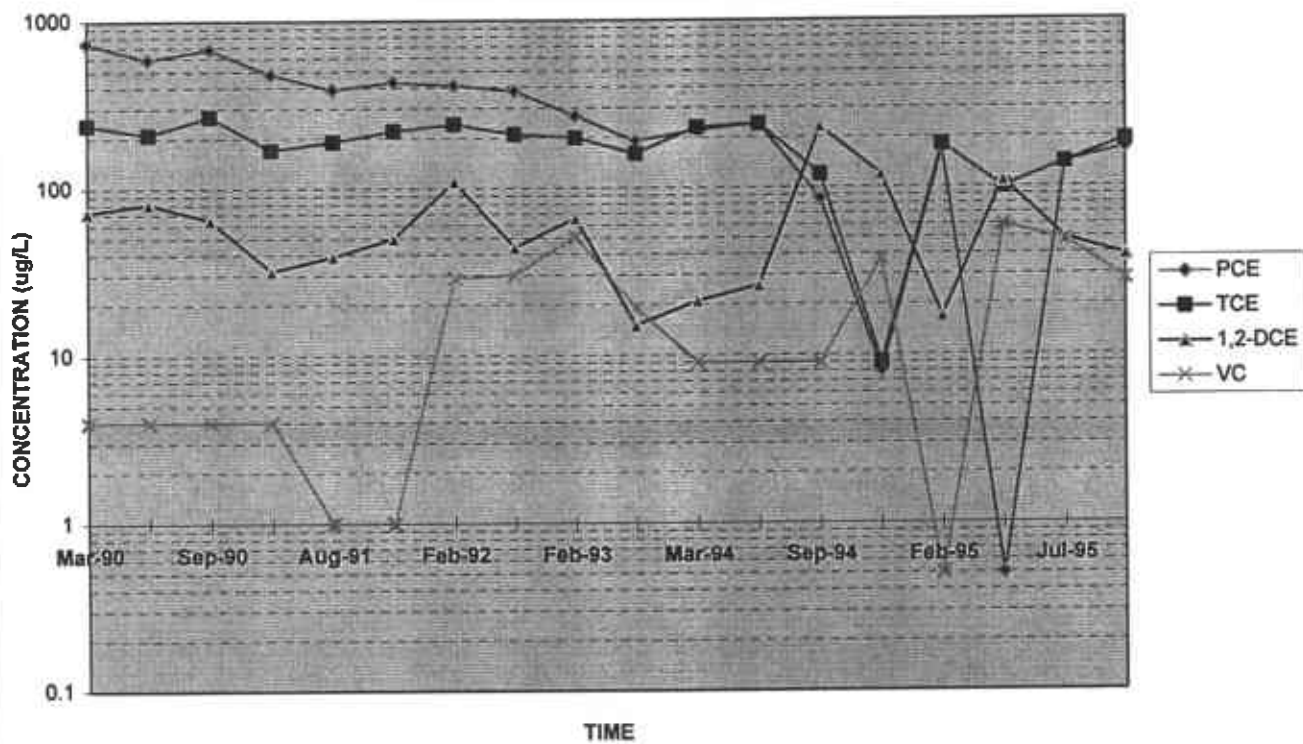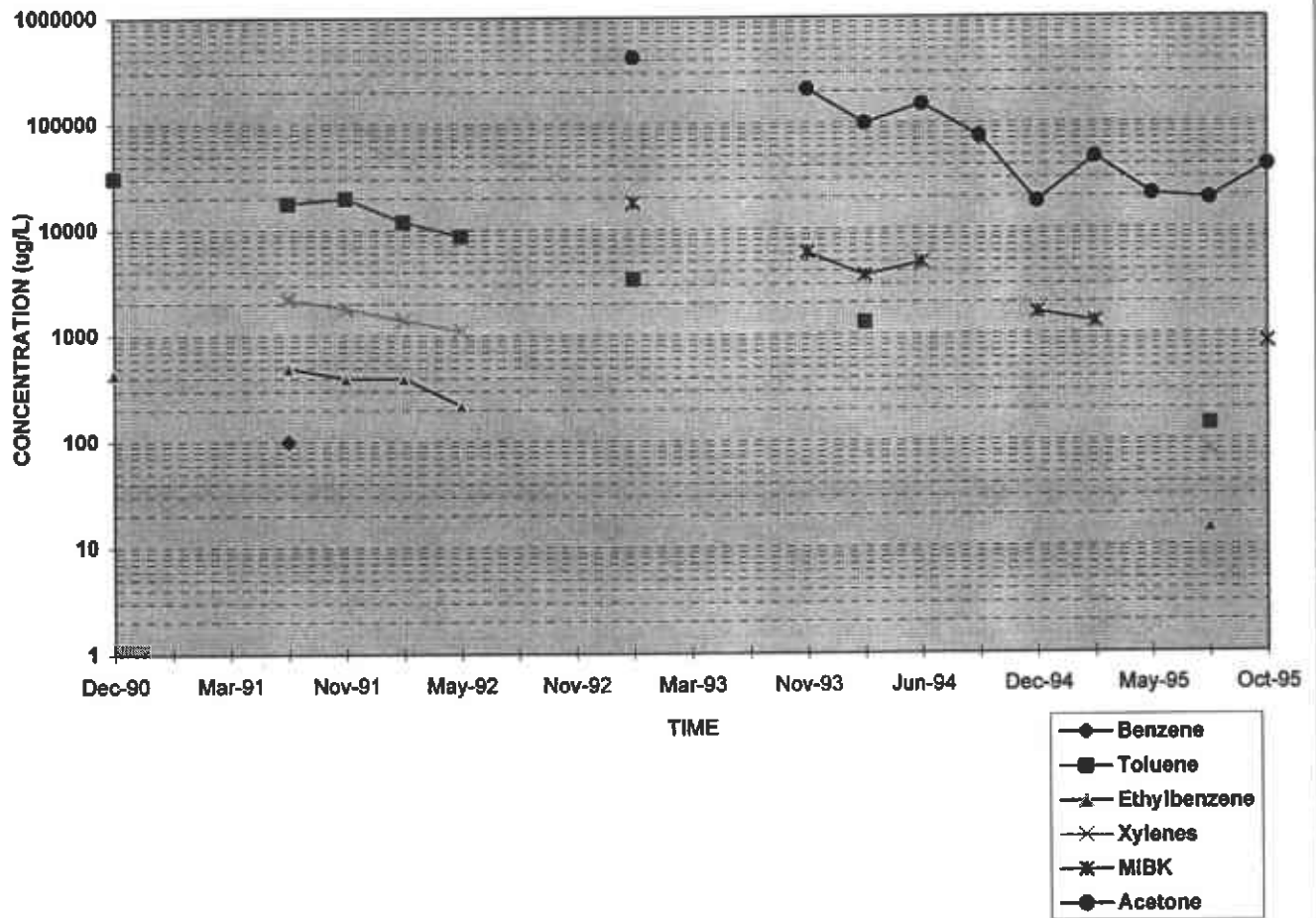
GRAPH 5. W-8 ANALYTES
James River Corp., San Leandro, CA

GRAPH 6. W-9 ANALYTES
James River Corp., San Leandro, CA
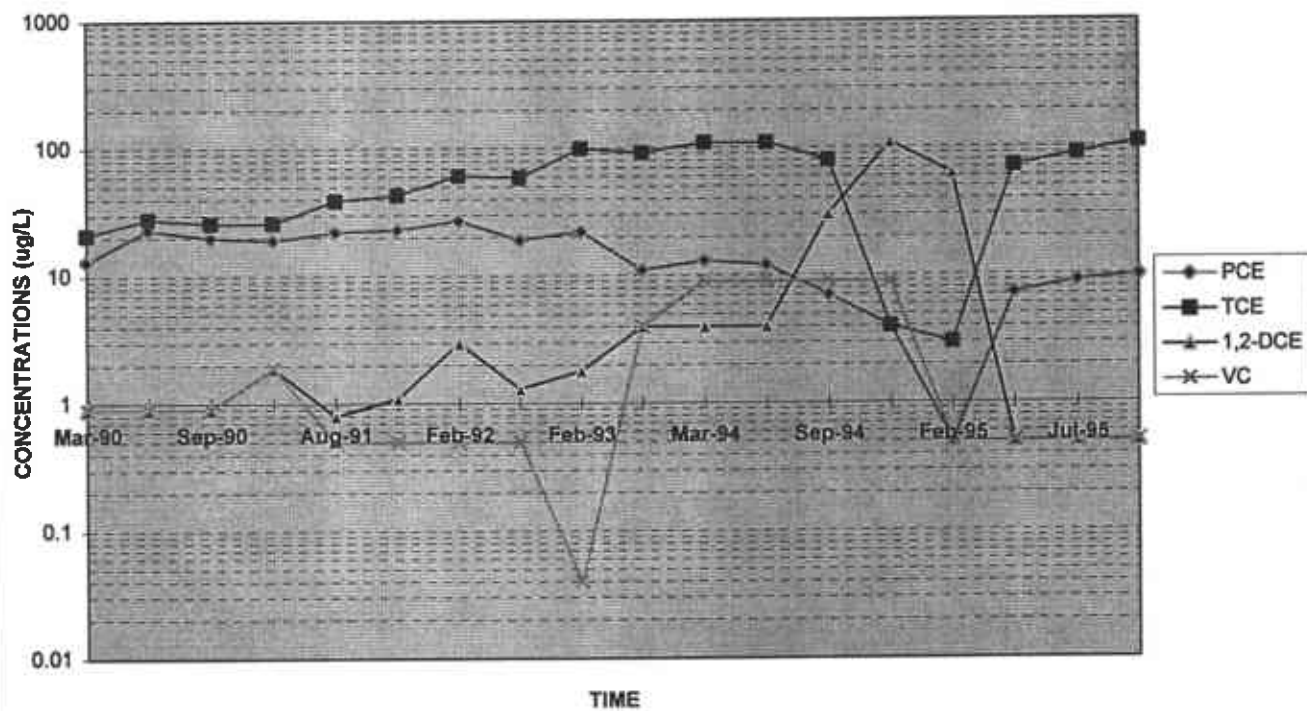
GRAPH 7. W-10 NON-CHLORINATED ANALYTES
James River Corp., San Leandro, CA

GRAPH 8. HISTORICAL WATER LEVELS
James River Corp., San Leandro, CA