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October 17, 1997

97 OCT 27 AM 11:40

Mr. Scott Seery, CHMM
Alameda County Environmental Health Department
Environmental Protection Division
1131 Harbor Bay Parkway, Suite 250
Alameda, California 94502

Dear Mr. Seery:

RE: INGERSOLL-RAND EQUIPMENT SALES, SAN LEANDRO

On behalf of Ingersoll-Rand Equipment Sales (IRES), Capsule Environmental Engineering and Braun Intertec, our project partner, are submitting the enclosed report, Low Risk Ground Water Determination, for the former leaking underground fuel tank site the IRES facility at 1944 Marina Boulevard, San Leandro.

As we have discussed and previously proposed, the report provides the technical data, information, analyses and conclusions to support two recommendations.

1) Classification of the IRES site as a low risk case.
2) The IRES leak site be closed.

We will await Alameda County's response to our recommendations. If you have any questions or comments regarding this matter, please contact me at (800) 328-8246.

Sincerely,

Don Huff

John J. McDermott
Hydrogeologist
Capsule Environmental Engineering, Inc.

Donald R. Huff, PhD
Environmental Scientist
Braun Intertec Corporation

JJM:jat
Enclosure
cc: R. Heindl/Ingersoll-Rand Equipment Sales, Bethlehem, PA
T. Tinsley/Ingersoll Rand Equipment Sales, San Leandro, CA
K. Graves/ Regional Water Quality Control Board, Oakland, CA
M. Bakaldin/San Leandro Fire Department, San Leandro, CA
J. Stuth/Braun Intertec
J. Henner/Azure Environmental

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LOW RISK GROUND WATER DETERMINATION

Prepared For:

Ingersoll-Rand Equipment Sales
San Leandro, California

October 16, 1997

LOW RISK GROUND WATER DETERMINATION

Prepared For:

Ingersoll-Rand Equipment Sales
1944 Marina Boulevard
San Leandro, California 94577

October 16, 1997

Prepared By:

CAPSULE
ENVIRONMENTAL ENGINEERING INC.
1970 Oakcrest Avenue, Suite 215
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1.0 INTRODUCTION

On the basis of previous discussions with Alameda County and guidance issued by the State Water Resources Control Board, Capsule Environmental Engineering and Braun Intertec have prepared this technical submittal. The letter presents data, analyses and conclusions to support two recommendations.

Recommendation 1. The remediated leaking underground fuel tank site at the Ingersoll-Rand Equipment Sales facility, 1944 Marina Boulevard, San Leandro, California, meets the Regional Water Quality Control Board's definition of a "low risk ground water case."

Recommendation 2. Consistent with the low risk definition, the site be closed.

1.1 BACKGROUND

Since 1987, Ingersoll-Rand Equipment Sales facility (Facility) has been investigating and remediating media impacted with gasoline constituents from a leaking underground gasoline storage tank (Site). See Figures 1 and 2 for Facility and Site maps. The tank was removed in 1989. A soil vapor extraction system has been operated to remove gasoline constituents from the Site soils. A chronology of corrective action events related to the leak is presented in Section C5.0, Appendix C. Individual project activities and milestones have been discussed in previous submittals to Alameda County.

The Facility received the December 8, 1995, letter from the State Water Resources Board regarding the Lawrence Livermore National Laboratory report and interim guidance on "low risk" soil and ground water cases. A copy of the interim guidance can be found as Appendix A.

In early 1996, the Facility received from the California Regional Water Quality Control Board, San Francisco Bay Region, The Supplemental Instructions to the State Water Board December 8, 1995, Interim Guidance on Required Cleanup of Low Risk Fuel Sites, (Supplemental Instructions) dated January 5, 1996. A copy of the Supplemental Instructions can be found as Appendix A. The Supplemental Instructions provide definitions of low risk soils and ground water sites.

2.0 LOW RISK GROUND WATER RATIONALE

The following six sections address each of the criteria in the Supplemental Instructions for a low risk ground water determination.

2.1 LEAK CONTAINMENT AND REMEDIATION

Supplemental Instructions Criterion 1. The leak has been stopped and ongoing sources, including free product, have been removed or remediated. FP?

The leak source was a 5,000-gallon underground gasoline storage tank. There are no product accounting records to determine the quantity of gasoline released. Using soil boring samples, it is estimated that 250 gallons were released. The tank was removed in 1989. At that time, gasoline remained in the soil. Gasoline constituents were also found in the shallow ground water downgradient of the leak.

A soil vapor extraction system (SVE system) was installed in 1992 and operated for several months before being shut down due to a high water table. In late 1994, additional vent wells were added. In early 1995, the system was redesigned and became operational in October 1995. The system has been operated during the normal work week since October 1995.

Through mid-June 1997, an estimated 296 gallons of gasoline hydrocarbons have been removed by the SVE system. (Braun estimates removal of 153 gallons and IT reported removal of 143 gallons.) On September 3, 1997, a recommendation for SVE system closure was submitted to Alameda County. The SVE closure recommendation was based upon the completion of remediation of the unsaturated soils. Source area levels have declined so that continued extraction would not significantly reduce the remaining gasoline concentrations in the soil.

Initial TPH as gasoline vapor concentrations in the soil were 880,000 μg\m^3 during the October 1995 system. By June 1997, the concentration was 4,200 μg\m^3. Recognizing that there are several physical and chemical factors that can cause decreased vapor concentrations, the most likely cause is a declining soil source.

Figure 3 shows the monitoring and vent wells. Monitoring well MW-3 is immediately downgradient of the leak area. Over the past three years of monitoring, ground water concentrations of gasoline constituents have significantly declined. Figure 4 shows benzene, ethylbenzene, toluene and xylene concentration time series charts for MW-3. The MW-3 and other monitoring point analytical data are presented in Appendix B.

In summary, the leak source has been removed and remediated. The underground storage tank was removed in 1989. The SVE system has removed gasoline in the unsaturated soils in the leak area. Monitoring well MW-3, immediately downgradient of the former tank area, shows declining BETX concentrations. These facts support the conclusion of a removed and remediated source.

2.2 SITE CHARACTERIZATION

Supplemental Instructions Criterion 2. The site has been adequately characterized.

Subsurface soil and ground water site conditions, both on and off the facility, have been characterized using auger borings from investigation phases, vent well installation and hydraulically pushed samples. Four monitoring wells have been installed and ground water conditions have been assessed both spatially and temporally. Findings have been reported in investigation submittals and quarterly reports to Alameda County.

The following table provides a summary of the major investigation activities that have been performed in response to the Site leak.

Characterization Activity	Date Performed
Soil sampling during tank removal	May 1989
MW-1 thru 3 monitoring well installation	June 1989
Continuous borehole sampling at 12 sites	October 1990
MW-4 monitoring well installation and aquifer testing	October/November 1990
Vapor extraction well installation	October 1994
Additional groundwater investigation both on and off facility	June 1995
Quarterly ground water	Quarterly

total BTEX ?

The June 1995 ground water investigation included the collecton of ground water samples approximately 500 feet downgradient of the former tank site. Figure 7 shows the hydraulic push sample locations, sampling results and TPH as gasoline contours. No TPH as gasoline was detected at 500 feet. From four sampling points at 500 feet, there was a single benzene detection 0.4 μg/l, ethylbenzene detection of 0.4 μg/l, and p,m-xylenes at 0.5 μg/l. As presented and discussed in the October 1995 Quarterly Report, ground water flow data and sampling results suggest a gasoline constituent plume moving from a northeast upgradient offsite source onto the Facility. ?

The drilling, sampling and analytical investigation activities have been used to assess the areal and vertical extent of the gasoline impacts to the subsurface. The findings provided a basis for the construction of the SVE system. Downgradient ground water conditions were assessed in 1995. No TPH as gasoline impacts were detected at a distance of approximately 500 feet from the former source downgradient. A single sampled point out of four points at 500 feet showed a sum of BETX compounds of 1.3 μg/l. Ground water conditions have been assessed quarterly for more than three years. Given these facts, the site is considered to have been adequately characterized.

2.3 NON-MIGRATING GROUND WATER PLUME

Supplemental Instructions Criterion 3. The dissolved plume is not migrating.

All concentrations found in the monitoring wells are below their respective solubility limits for the individual gasoline constituents, so the plume is a dissolved plume. There was a single 1989 observation of 3 mm of free product in MW-3. Since 1989, there has been no additional observation of free product in site monitoring wells. However, FP noted in GeoProbe holes GP-5 and GP-10.

The Supplemental Instructions indicate that chemical concentrations of hydrocarbons in ground water that decresase or do not change with time is the best indicator of a stable plume. Figures 3 and 4 have been prepared to show the period of record time series for individual BETX compounds at MW-3, immediately downgradient of the former source, and MW-4, approximately 200 feet downgradient of the former source and within the dissolved gasoline plume. The MW-3 and MW-4 constituent time series show declining concentrations with time.

As discussed in the Supplemental Instructions and the two Lawrence Livermore National Laboratory (LLNL) 1995 reports, gasoline plumes tend to stabilize once the source is removed. The IRES source has been removed.

As a general information point, the hydrogeologic setting of the San Leandro site is typical of the "average" LUFT site, investigated in the LLNL's LUFT Historical Case Studies Analysis. The following table compares several of the average hydrogeologic characteristics from Table 4 of the LUFT Historical Case Studies and Site specific characteristics, developed during investigations.

Hydrogeologic Parameter	LLNL Study 50% Quantile	IRES Site
hydraulic conductivity (cm/s)	0.00082	0.003
groundwater depth (ft), (B)	15.2	14.8
groundwater depth range (ft), (B)	3.5	3.9
groundwater gradient (ft/ft), (C)	0.0076	0.006
flow velocity (ft/yr), (A), (D)	7.8	60.

0.00082 < 0.003

78 < 60 ft/yr

Note: (A) LLNL ground water flow velocity is assumed to be through sand and gravel with an assumed hydraulic conductivity of 0.001 cm/s.

(B) IRES Site to ground water depth and depth range is average of MW-1, MW-2, MW-3 and MW-4 period of record.

(C) IRES Site gradient midpoint of seasonal extremes of 0.004 and 0.0075.

(D) IRES Site velocity is midpoint of seasonal extremes of 44 and 82 ft/yr.

A finding of the LUFT Historical Case Studies is that fuel hydrocarbon plumes behave in predictable ways. Following source removal, a plume's mass decreases rapidly and the remaining, or residual, source removal occurs due to passive bioremediation. Plumes tend to "exhaust" themselves and benzene plumes, of 10 ppb or more, tend to be less than 250 feet in length.

The Site source has been removed. Site analytical data from Facility wells show declining dissolved concentrations in the ground water, both near the former source and downgradient from the former source. During the 1995 ground water investigation (reported in the October 1995 Quarterly Report) conducted downgradient both on and off the Facility, there was a single BETX detection of 1.3 ug/l (see Section 2.2) at a distance of approximately 500 feet from the Site. No TPH as gasoline was detected during this ground water investigation at 500 feet downgradient from the Site. These trends show that the plume has stabilized.

plume moving
away from
site?

Additionally, the Site has hydrogeologic characteristics that are similar to the approximately 1,000 LUFT sites investigated by the LLNL. The LLNL investigators found that plumes tend to stabilize with distance from the source and rarely extend beyond 250 feet from the source. After source removal, plume masses tend to decrease more rapidly.

Given the Site source removal, the Site-specific water quality data that show declining trends, no significant downgradient BETX detections, and more general LLNL observations, it is concluded that the plume is stable, and as defined in the Supplemental Instructions, *is* not migrating.

2.4 LIKELIHOOD OF IMPACTED RECEPTORS

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

The Supplemental Instructions provide a general list of sensitive receptors. Sensitive receptors include: 1) water wells, 2) deeper drinking water aquifers, 3) surface water bodies, 4) sensitive habitats, including wetlands, marshes, mudflats, 5) human beings, 6) aquatic plants and animals, and 7) other wildlife.

No drinking water wells are likely to be impacted. As part of a comprehensive look at ground water conditions within the San Leandro Area, Woodward-Clyde (1993a) performed a compilation of all registered wells. No drinking water wells completed in the shallow subsurface were identified within 1,500 feet of the Site.

Given the very local nature of the release, the declining residual source mass and the general tendency of ground water flow to move horizontally, it is unlikely that deeper ground water would be impacted. The Woodward-Clyde (1993a) report provides a detailed assessment of the available hydrogeologic information in the San Leandro area. The report identifies a regional aquitard, 50 to 150 feet thick, composed of clay and silt, that helps prevent the migration of chemical-impacted water to deeper ground water units.

The nearest downgradient surface water is San Francisco Bay, which is approximately 1.25 miles west from the site. See Figure 1. Given the limited downgradient extent of Site plume, the declining BETX concentrations detected in Site groundwater, the remediated source, and the distance to surface water, it is unlikely that surface water would be impacted.

The Water Quality Control Plan, prepared by the San Francisco Bay Region, California Regional Water Quality Control Board, identifies mudflats and fresh, brackish and salt water marshes as important regional habitats. The closest such habitats are near San Francisco Bay, nearly 1.25 miles from the Site. Given the distance from the Site to these habitats, they are not likely to be impacted.

The likelihood of impacts to human beings is discussed in Section 2.5.

Given the information on limited potential receptors, the distance to potential receptors, and the hydrogeologic conditions, it is concluded that no water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.

2.5 SIGNIFICANT RISK TO HUMAN HEALTH

Supplemental Instructions Criterion 5. The site presents no significant risk to human health.

To address the *no significant risk to human health* criterion, the American Society for Testing and Materials (ASTM) Standard Guide for Risk Based Corrective Action, ASTM E-1739-95, (RBCA Standard Guide) has been used to determine potential human exposures and pathways and calculate potential risk levels. Specifically, the RBCA Tier 2 Toolkit, which is software developed by Groundwater Services, Inc. (GSI, 1996), was used to implement the RBCA Standard Guide. The complete evaluation can be found in Appendix C.

In summary, the following conclusions result from the RBCA process:

1) Negligible excess lifetime cancer risks, ranging from 10^{-4} to 10^{-6}, are found in California and federal regulations and guidance documents. A risk level of 10^{-6} is considered the general target for this Site evaluation.

2) The only complete pathway from the residual source to receptors is inhalation of gasoline constituent vapors, primarily benzene, that could migrate from the residual source and ground water through the subsurface soil into the breathing zone.

3) With the exposure models used, the inhalation of vapors in enclosed spaces becomes the critical pathway.

4) The following pathway risk levels result from the model:

Compound	Pathway	Excess Lifetime Cancer Risk	Hazard Risk	
	Target Level	*1.0×10^{-6}*	*1.0×10^{0}*	
benzene	outdoor air	1.5×10^{-8}	9.5×10^{-4}	?
benzene	indoor air	4.5×10^{-6}	2.8×10^{-1}	

5) The indoor-enclosed space volatilization model used is a mass balance approach. The model is conservative and does not account for barriers, such as pavement. The model is also independent of depth to the source. The remaining source is more than 12 feet below the surface. Attenuation within the soil is likely. Additionally, the Facility's enclosed space is a large building with large, bayed doors that are generally open during business hours. The building is also not overlying the residual source, but offset.

6) The indoor exposure risk level for benzene is within the range of excess upper bound lifetime cancer risks, 10^{-4} to 10^{-6}, found in the federal NCP and risk guidance. The Site level slightly exceeds the 10^{-6} target level in the Preliminary Endangerment Assessment guidance.

7) The calculated benzene indoor air concentration of 0.002 mg/m^3 is substantially lower than the California Occupational Health and Safety Administration permissible exposure limit of 1 ppm (3.2 mg/m^3) and the action level of 0.5 ppm (1.6 mg/m^3).

2.6 SIGNIFICANT RISK TO THE ENVIRONMENT

Supplemental Instructions Criterion 6. The site presents no significant risk to the environment.

The Site is within a heavily industrialized area. There are no nearby identified environmental receptors for either the impacted ground water or vapor emitted from the residual source or ground water. A review of Figure 2-1 of the Bay Region Water Quality Plan does not identify any nearby Areas of Special Biological Significance. (See reproduction of Figure 6.)

Given the industrial setting, the absence of identified environmental receptors, and the limited potential for appreciable exposure to gasoline constituents from the residual source, it is concluded that the Site does not pose a significant risk to the environment.

3.0 RECOMMENDATIONS

1. The Ingersoll Rand Equipment Sales former leaking underground storage tank site should be categorized as a "low risk ground water case." The information and analysis presented in this letter are sufficient to meet the Supplemental Instructions definition criteria for a "low risk groundwater case."

2. Quarterly monitoring has shown that ground water conditions are stable and no further active corrective action or monitoring is necessary for the Site. It is recommended that the Site be closed.

4.0 REFERENCES

American Society for Testing and Materials, 1996, Standard Guide for Risk Based Corrective Action Applied to Petroleum Release Sites, E 1739-95, West Conshohocken, PA.

California Regional Water Quality Control Board, San Francisco Bay Region, 1995, Water Quality Control Plan, Oakland, CA.

Department of Toxic Substances Control, 1991, Well Testing Information Fact Sheet, San Leandro, California, California Environmental Protection Agency.

Department of Toxic Substances Control, 1994, Preliminary Endangerment Assessment (Guidance Manual), California Environmental Protection Agency.

Groundwater Services, Inc., 1996, Tier II RBCA Tool Kit, version 1.0.1.

Hickenbottom, K. and Muir, M., 1988, Geohydrology and Groundwater Quality Overview, East Bay Plain Area, Alameda County, California, 205(J) Report, Alameda County Flood Control and Water Conservation District, Oakland, CA.

International Technology Corporation, 1989, Problem Assessment Report, Ingersoll-Rand Incorporated, 1944 Marina Boulevard, San Leandro, California, prepared by IT Environmental Services, Martinez, CA .

Lawrence Livermore National Laboratory, 1995a, Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks, UCRL-AR-121762, University of California, Livermore, CA.

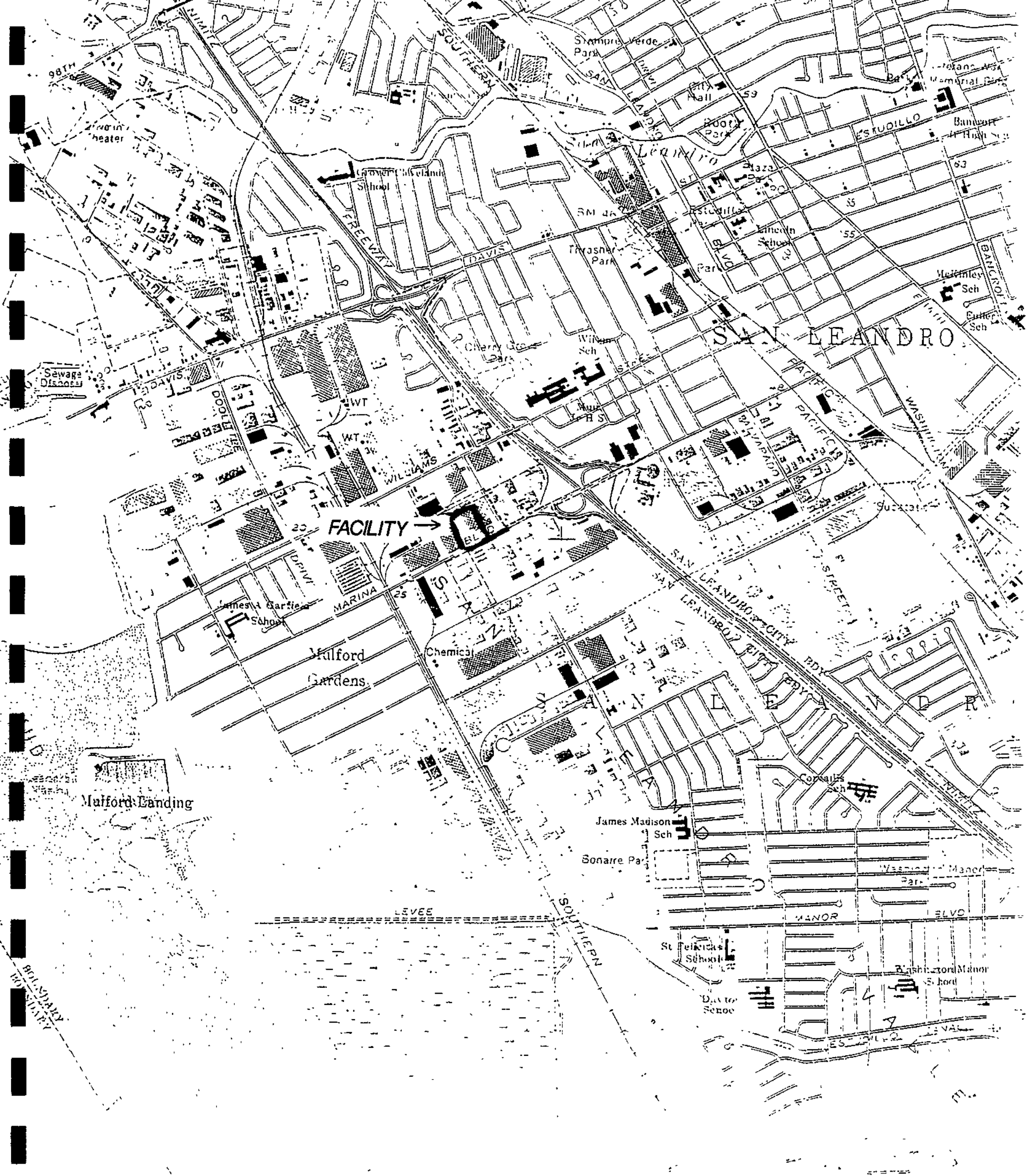
Lawrence Livermore National Laboratory, 1995b, California Leaking Underground Fuel Tank (LUFT) Historical Case Analyses, UCRL-AR-122207, University of California, Livermore, CA

U.S. Environmental Protection Agency, 1989, Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Washington D.C.

U.S. Environmental Protection Agency, 1995, How to Evaluate Alternative Cleanup Technologies for Underground Storage Tank Sites, EPA 510-B-95-007, Washington D.C. p II-1 to II-32.

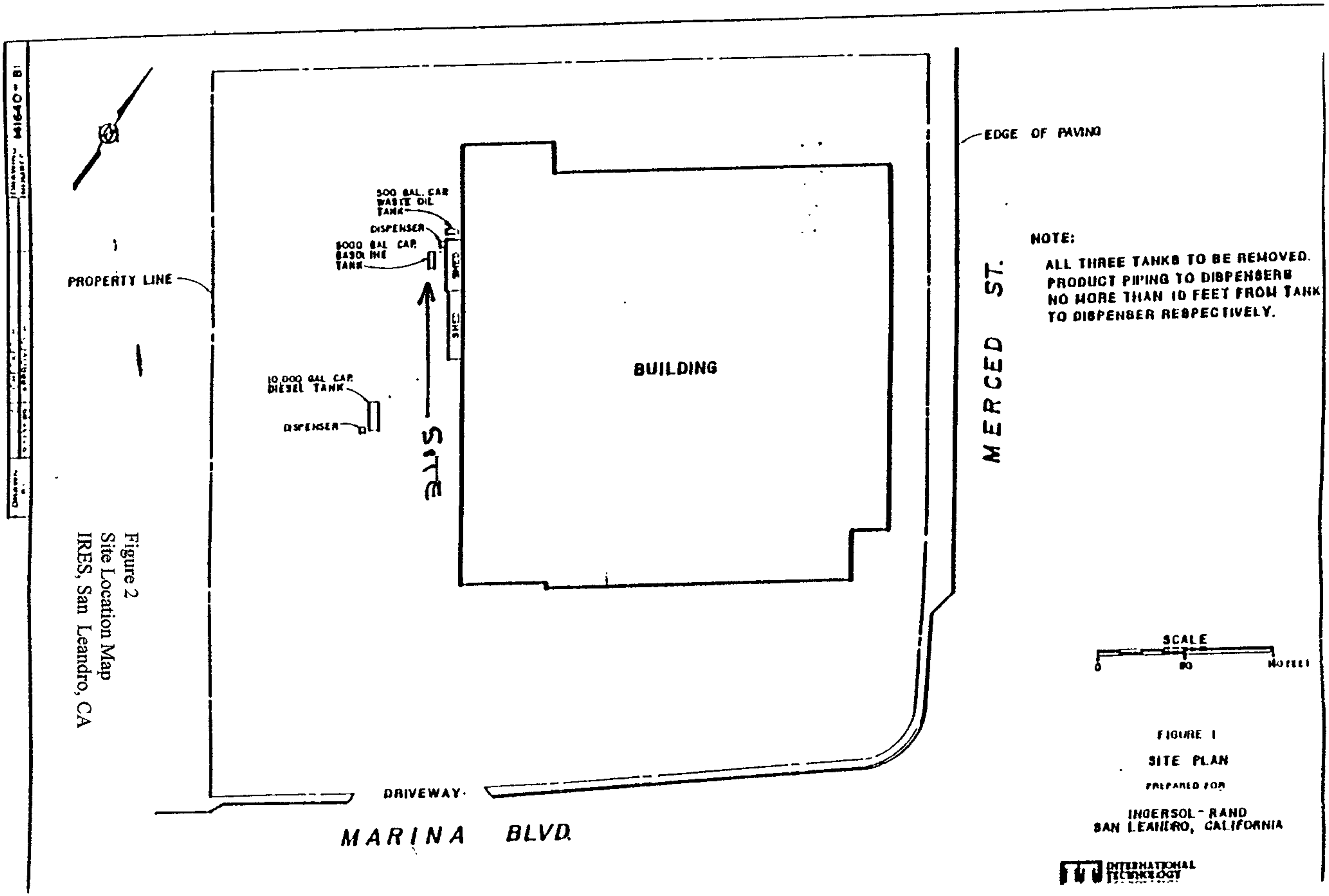
Woodward-Clyde Consultants, 1993a, Interim Groundwater Contamination Report for Central San Leandro, prepared for the California Environmental Protection Agency, Oakland, CA.

Woodward-Clyde Consultants, 1993b, Hydrogeology of Central San Leandro and Remedial Investigation of Regional Groundwater Contamination, San Leandro Plume, San Leandro, California, prepared for the California Environmental Protection Agency, Oakland, CA.



Source: San Leandro, California
7 ½ minute Quadrangle
U.S. Geological Survey
Photo revised 1980

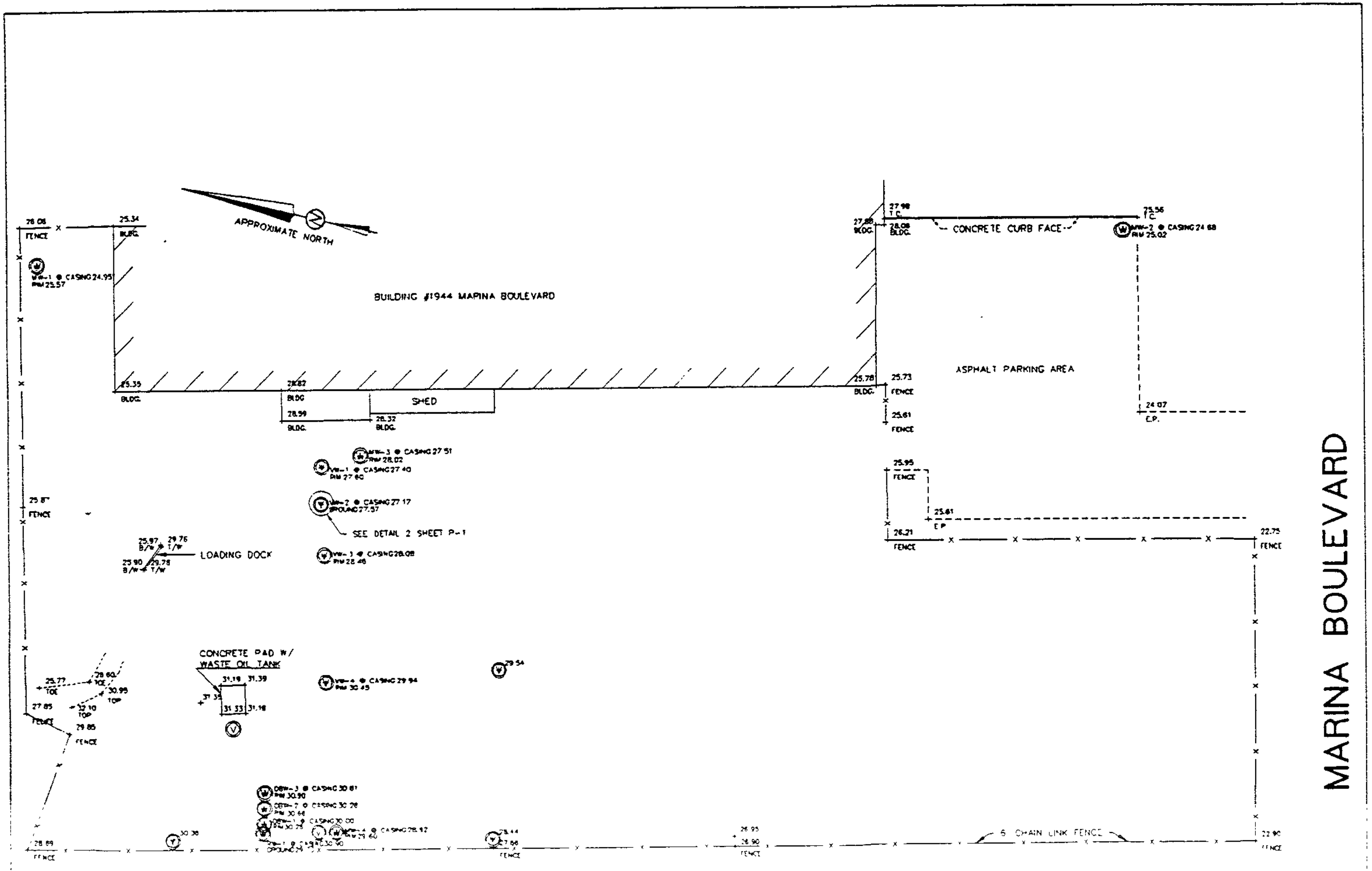
Figure 1
Facility Location Map
IRES, San Leandro, CA



NOTE:

ALL THREE TANKS TO BE REMOVED. PRODUCT PIPING TO DISPENSERS NO MORE THAN 10 FEET FROM TANK TO DISPENSER RESPECTIVELY.

Figure 2
Site Location Map
IRES, San Leandro, CA



LEGEND	
T.C.	TOP OF CURB
⟋⟋	BUILDING LINE
T/W	TOP OF WALL
B/W	BASE OF WALL
-x-	FENCE LINE
Ⓦ	WELL EXISTING
Ⓥ	SOIL VAPOR VENT
E.P.	EDGE OF PAVEMENT
TOP	TOP OF BANK
TOE	TOE OF SLOPE

BASIS OF ELEVATIONS: CITY OF SAN LEANDRO BENCHMARK. CINCH NAIL ON TOP OF CURB AT STORM WATER INLET SOUTHEAST CORNER OF THE INTERSECTION OF MARINA BOULEVARD AND MERCED STREET, ELEVATION = 22.98'

ALL CASING ELEVATIONS WERE TAKEN AT THE SOUTHWEST EDGE OF PVC PIPING

ALL RIM ELEVATIONS WERE TAKEN AT THE SOUTHWEST EDGE OF STEEL RIM UNLESS OTHERWISE NOTED.

* DENOTES APPROXIMATE LOCATION OF VW - 5 THRU 9

Figure 3
Monitoring and Vent Well Locations
IRES, San Leandro, CA

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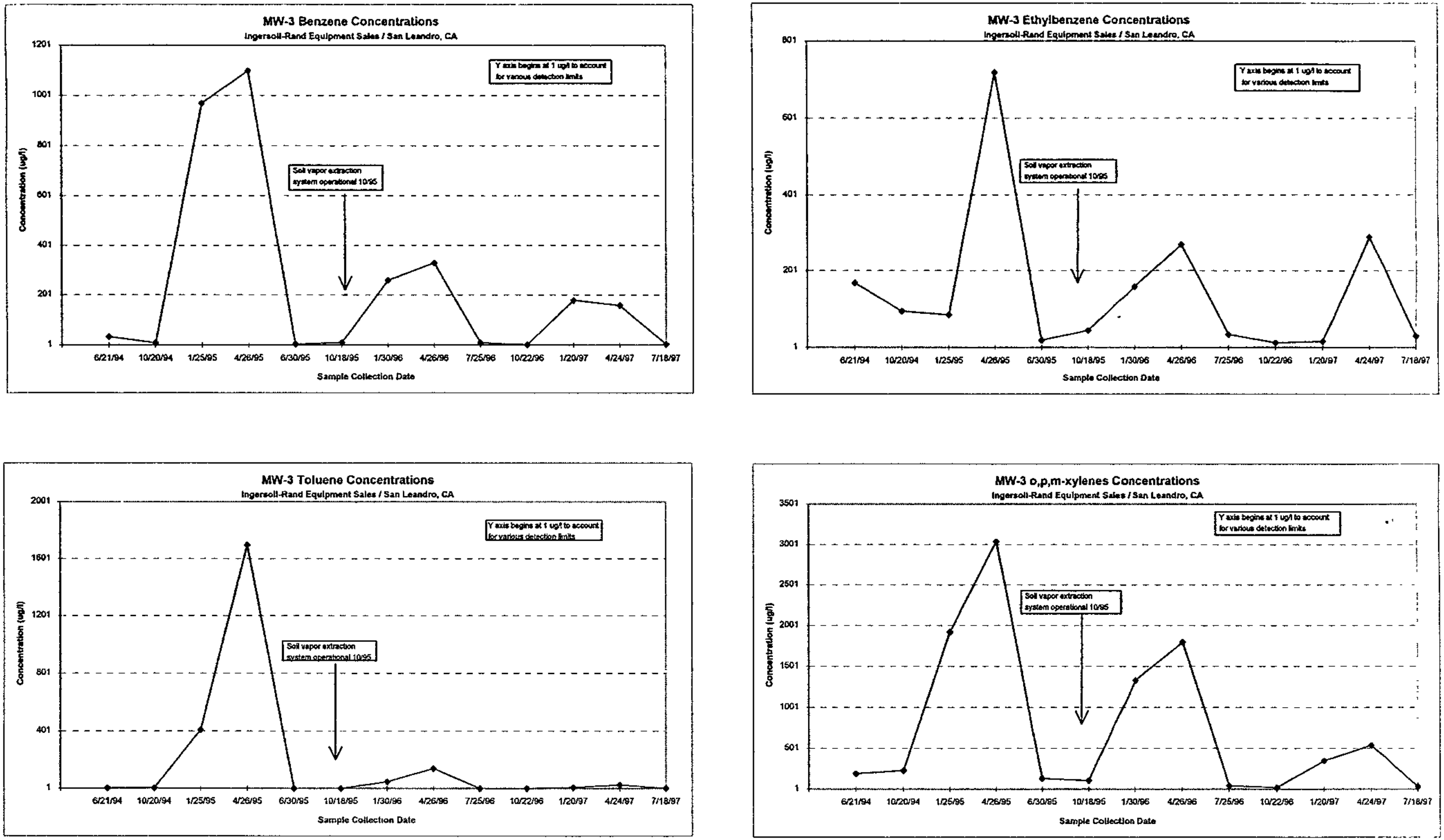
1970 OAKCREST AVE. SUITE 215
ST PAUL, MINNESOTA 55113
(612) 636-2644

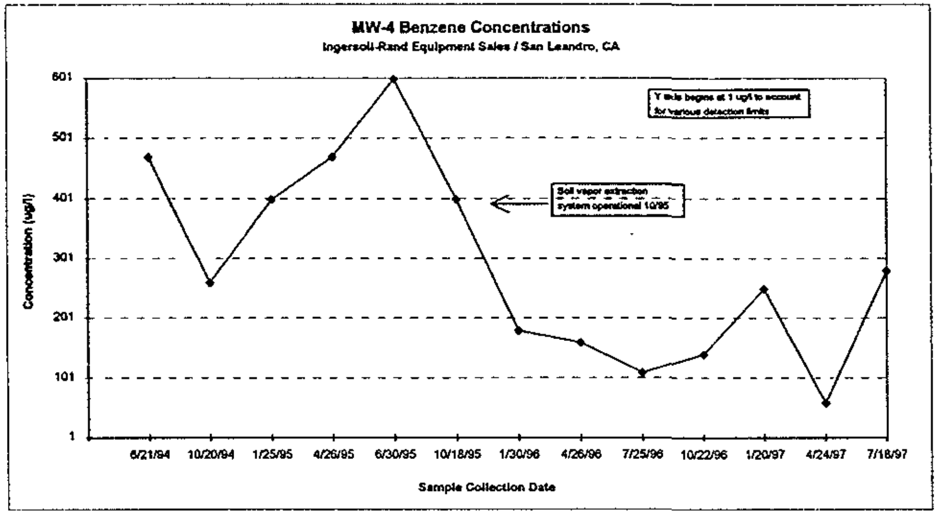
TITLE SITE MAP

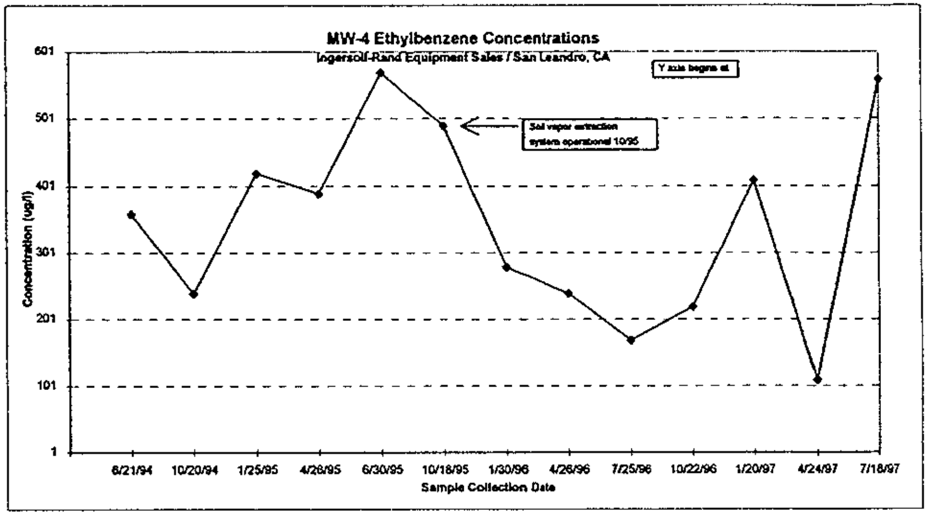
INGERSOLL-RAND CORPORATION
SAN LEANDRO, CALIFORNIA

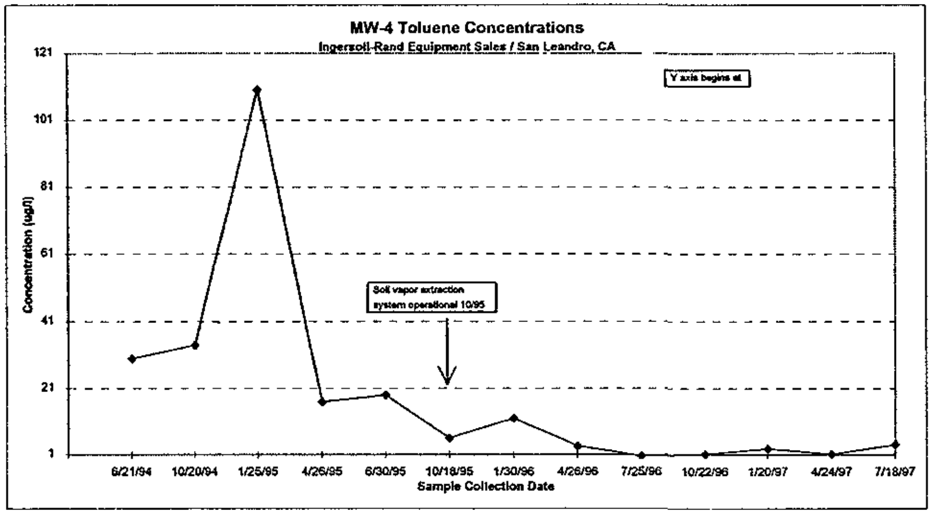


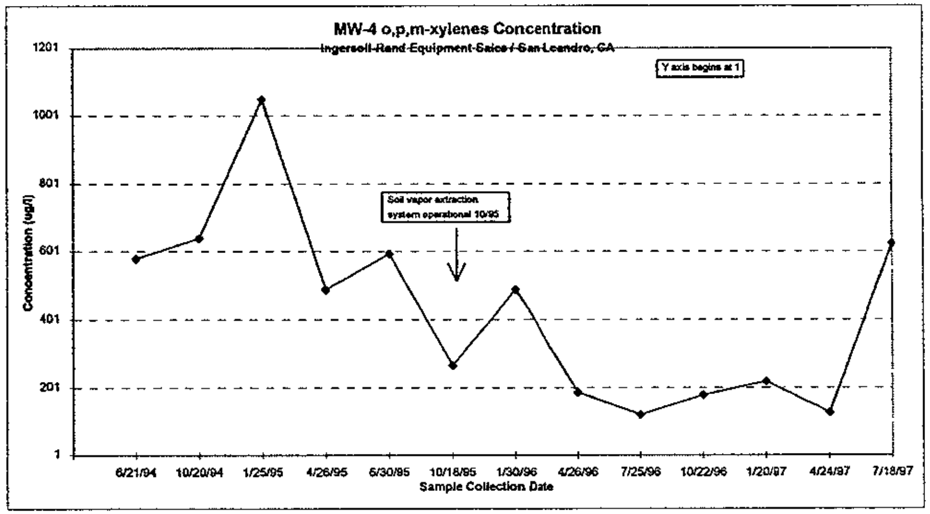
9/26/97

Figure 4









9/26/97

Figure 5

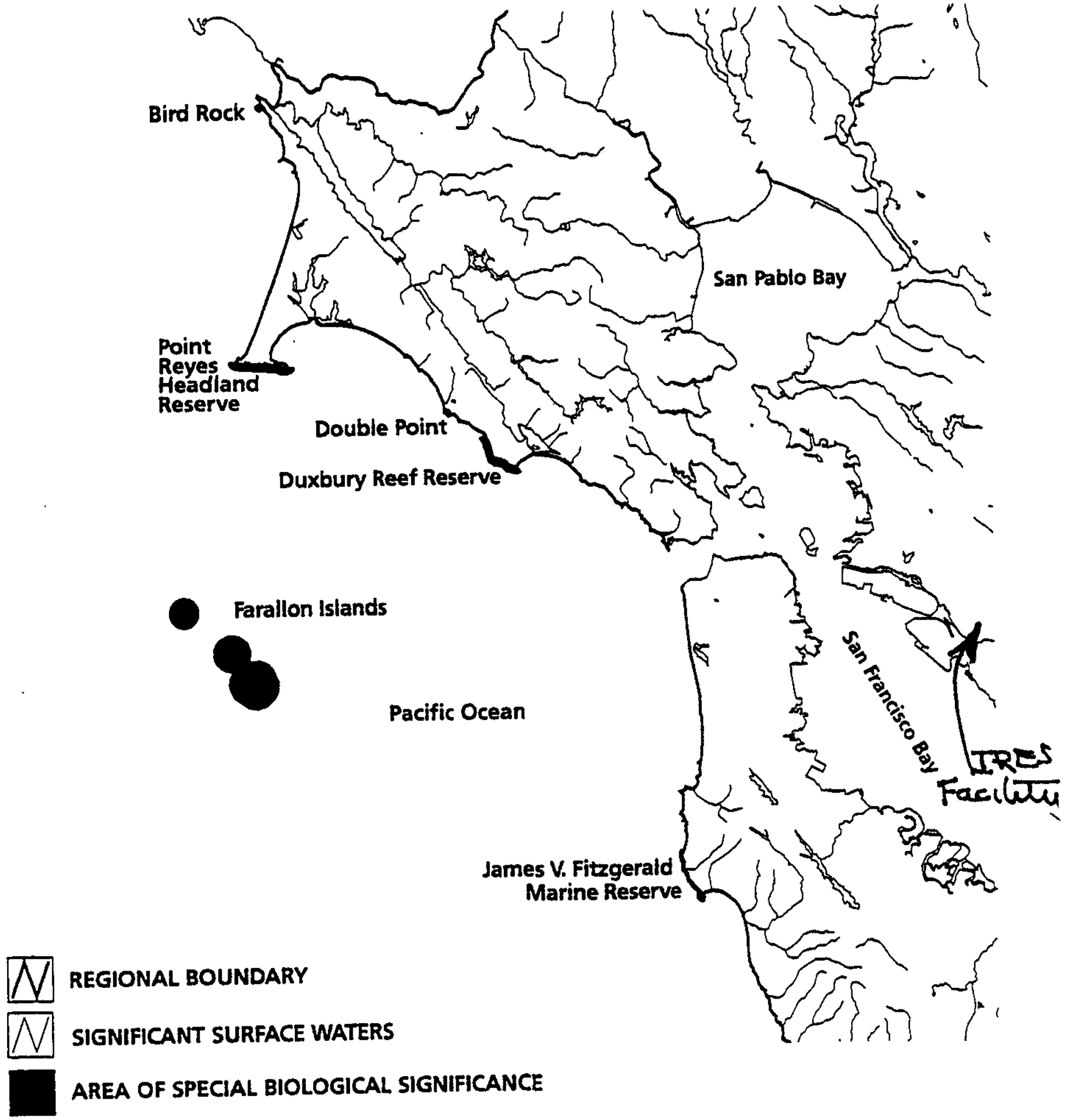


Figure 2-1
Areas of Special Biological Significance

SCALE: 1:600,000

Figure 6
Areas of Special Biological Significance
from: San Francisco Bay Region
Water Quality Control Plan
IRES, San Leandro, CA

from: Water Quality Control Plan 1995
San Francisco Bay Region, CRWQCB

FIGURE 7
Sum of BETX Compounds and Contours

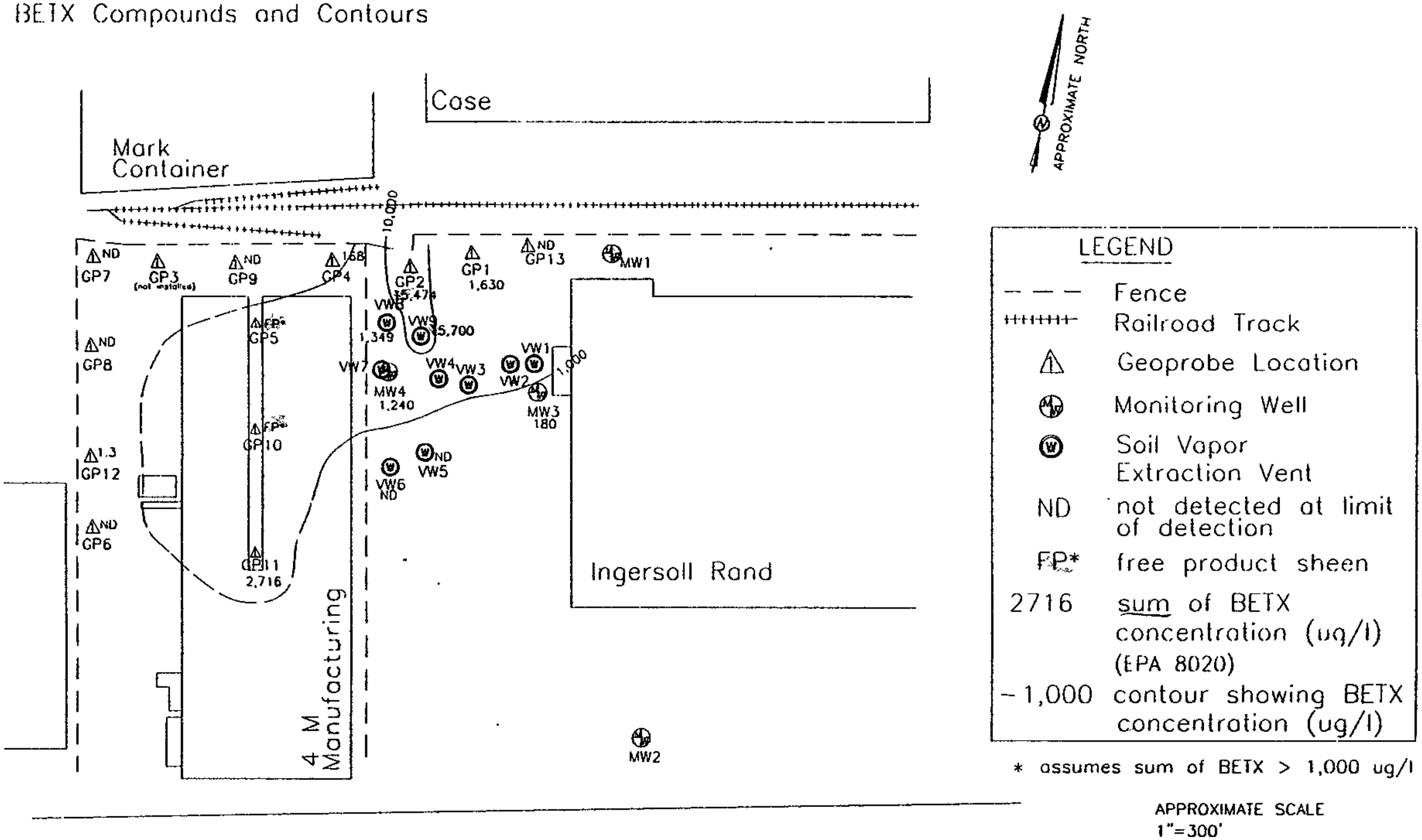


Figure 7
Extent of BETX Compounds
from 1995 Geoprobe Investigation
IRES, San Leandro, CA

CAPSULE
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1970 OAKCREST AVE., SUITE 215
ST. PAUL, MINNESOTA 55113
(612) 636-2644

TITLE
SAN LEANDRO, CA
Sum of BETX Compounds
and Contours

SCALE	DRAWN BY	CHECKED BY	DATE	PROJECT NO	DRAWING NO	SHEET

STATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
PETE WILSON, *Governor*

STATE WATER RESOURCES CONTROL BOARD
PAUL R. BONDERSON BUILDING
901 P STREET
P O BOX 100
SACRAMENTO, CALIFORNIA 95812-0100

(916) 657-0941
(916) 657-0932 (FAX)

DEC - 3 1995

All Regional Water Board Chairpersons
Al Regional Water Board Executive Officers
All LOP Agency Directors

LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL) REPORT ON LEAKING UNDERGROUND STORAGE TANK (UST) CLEANUP

In October 1995, the LLNL presented to the State Water Resources Control Board (SWRCB) its final report, Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks. The LLNL team found that the impacts to the environment from leaking USTs were not as severe as we once thought. The report also presents a convincing argument that passive bioremediation should be considered as the primary remediation tool in most cases once the fuel leak source has been removed.

The LLNL report has also been presented to the SWRCB's SB 1764 Advisory Committee which will, in turn, provide recommendations to the SWRCB by the end of January 1996. The SWRCB may choose to implement recommendations from the LLNL report and the SB 1764 Advisory Committee through revisions to SWRCB Resolution 92-49 in early 1996.

In the interim and in light of the findings and recommendations in the LLNL report, we believe cleanup oversight agencies should proceed aggressively to close low risk soil only cases. For cases affecting low risk groundwater (for instance, shallow groundwater with maximum depth to water less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak) we recommend that active remediation be replaced with monitoring to determine if the fuel leak plume is stable. Obviously good judgment is required in all of these decisions. However, that judgment should now include knowledge provided by the LLNL report.

What I propose to you is not in any way inconsistent with existing policies or regulations. However, it does represent a major departure from how we have viewed the threat from leaking USTs. This guidance is consistent with the results of a discussion of this subject among the State Board Chair and Regional Board Chairs on December 5, 1995. If you have any questions on this matter please call Mr. James Giannopoulos, our manager of the underground storage tank program, at (916) 227-4320.

Sincerely,

Walt Pettit

Walt Pettit
Executive Director

cc: All Regional Water Board/LOP UST Program Managers

STATE OF CALIFORNIA -- CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY PETE WILSON, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
2101 WEBSTER STREET, Suite 500
OAKLAND, CA 94612
Tel: (510) 286-1255
FAX: (510) 286-1380
BBS: (510) 286-0404

January 12, 1996

To: **San Francisco Bay Area Responsible Parties With**
Leaking Underground Fuel Tank Cleanups
Regulated by the San Francisco Bay Regional Water Quality Control Board

Subject: **Supplemental Instructions to State Water Board December 8, 1995,**
Interim Guidance on Required Cleanup at Low Risk Fuel Leak Sites

This letter is being sent to you:

- as the person(s) identified to cleanup a leak from an underground fuel tank (LUFT), and
- that you are under the regulation of the Regional Water Quality Control Board, and
- that new interim guidance on cleanups may affect the cleanup at your site, and
- to provide supplemental instructions from the Regional Board on the implementation of the new interim fuel cleanup guidance in the San Francisco Bay Area.

The Lawrence Livermore National Laboratory (LLNL) recently prepared and issued a report at the request and direction of the State Water Resources Control Board (SWRCB) entitled, "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks" (October 16, 1995). The LLNL report proposes significant changes in the requirements to cleanup LUFTs in California. In response to this report, SWRCB's Executive Director Walt Pettit issued an interim guidance letter (attached) dated December 8, 1995, which discussed the regulatory implications of the conclusions and recommendations of the LLNL report, especially as it affects "low-risk" sites. This new SWRCB interim guidance on low-risk sites was issued in expectation of similar final guidance later this year to be adopted under Senate Bill 1764 (SB 1764). This San Francisco Bay Regional Water Quality Control Board letter to you is intended to further amplify and implement the guidance contained in the SWRCB letter for fuel cleanup sites within the San Francisco Bay Region.

In general, we concur with the findings and conclusions of the LLNL study. The LLNL study is consistent with policy approved by this Regional Board for groundwater cleanups. For both the LLNL study and the Regional Board's policy, it is recommended that fuel sites be treated differently and less stringently than solvent sites. In this region we believe that most fuel sites fall into the low-risk category, for which source removal and passive remediation are adequate. At the same time, we believe that great care should be used to see that sites which are ***not*** low-risk receive more aggressive treatment. These judgements will always have to be made on a site-by-site basis.

Note that these instructions, like that provided in the SWRCB's December 8th letter, are only interim. The final recommendations of the SB 1764 Scientific Advisory Committee are due this month, and these will presumably be reflected in the pending changes the SWRCB is considering in its update to its cleanup policy.

Several documents are attached for your information. One we call "Supplemental Instructions", which will be used by Regional Board staff in determining and regulating required cleanup at low-risk LUFT sites as described in the SWRCB letter. Another document attached is a Fact Sheet in question and answer format intended to further amplify the interim guidance for you on what we believe are the most common questions about this guidance change.

Additionally, we have attached several other documents for you that are important to consider during LUFT cleanups. The SWRCB letter dated September 25, 1995, from James Cornelius provides information on the implementation of SB 2061 and your ability to request the appropriate regulating agency for your site. The Regional Board letters of July 16, 1995, and January 12, 1996, request that you include methyl tertiary butyl ether (MTBE) in any future monitoring and analysis at your cleanup site.

You should review this letter, the supplemental instructions, and other attachments with your cleanup consultant to determine if it may affect the cleanup requirements at your site. If you wish further information from or have questions for the Regional Board staff, you should call one of the following:

County	Staff Person	Telephone Number
Alameda	Kevin Graves	510-286-0435
Contra Costa	Jolanta Uchman	510-286-1332
Solano, Napa, Sonoma	Brad Job	510-286-1382
Marin	John Jang	510-286-0554
San Francisco	Vic Pal	510-286-0687
San Mateo	Diane Mims	510-286-0618
Santa Clara	John West	510-286-1247

For further information of a general nature you should call Wil Bruhns, 510-286-0838

Sincerely,

Lawrence P. Kolb
for
Loretta K. Barsamian
Executive Officer

Attachments

cc: all w/o attachments

Walt Pettit, SWRCB
James Giannopoulos, SWRCB-CWP

Alameda County Environmental Health Services
ATTN: Tom Peacock, Local Oversight Program Manager

Alameda County Water District
ATTN: Steven Inn, Manager, Groundwater Resources

City of Berkeley Toxics Management Division
ATTN: Steve Belcher, Manager - Emergency and Toxics/
Nabil Al-Hadithy, Hazardous Materials Supervisor

Hayward Fire Department
ATTN: Hugh J. Murphy - Environmental Specialist

Alameda County Fire Department
ATTN: Michael Bakaldin, Hazardous Materials Coordinator

Contra Costa County Department of Health Services
ATTN: Lew Pascalli, Deputy Director,
Environmental Health/Hazardous Materials;
Bruce Benike, Underground Storage Tank Manager

Marin County Office of Waste Management
ATTN: Dee Johnson, Deputy County Administrator,
Tim Underwood, UST Program

San Rafael Fire Department
ATTN: Forrest Craig, Deputy Fire Marshall,
Hazardous Materials Coordinator

County of Napa
Department of Environmental Health Management
Hazardous Materials Division
ATTN: Jill Pahl, Environmental Health Manager
Jackie Bertaina, Senior Env. Health Specialist

City and County of San Francisco
Department of Public Health
ATTN: Cherie D'Andrea
Albert Lee Project Director, LOP Program

San Mateo County Department of Health Services
Office of Environmental Health
ATTN: Dean Peterson, Program Manager, CROP
Gail Lee, Program Specialist CROP

Santa Clara Valley Water District
ATTN: James Crowley, LOP Program Director

Solano County Department of Environmental Health
ATTN: David L. Eubanks, Supervisor,
Environmental Health Services Division

Sonoma County Department of Environmental Health
Hazardous Materials Division
ATTN: Jeff Lewin, Supervisor,
Hazardous Material Section, LOP

State of California -- California Environmental Protection Agency Pete Wilson, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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January 5, 1996

MEMORANDUM

To: **San Francisco Bay Area Agencies Overseeing UST Cleanup and Other Interested Parties**

Subject: **Regional Board Supplemental Instructions to State Water Board December 8, 1995, Interim Guidance on Required Cleanup at Low-Risk Fuel Sites**

These supplemental instructions are intended for the regulatory and technical audience[1] to expand on the interim guidance provided in the December 8, 1995, letter from Walt Pettit, Executive Director of the State Water Resources Control Board regarding the findings of the report entitled "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks (LUFTs)" issued by the Lawrence Livermore National Laboratory (LLNL). Mr. Pettit's letter urges cleanup agencies to proceed aggressively to close low risk soil only cases and not to require active remediation of low risk groundwater cases.

The LLNL report indicates that bioremediation of petroleum is an important factor in stabilizing plumes and may be the only remedial activity necessary in the absence of free product. After a review of existing literature, white papers submitted to the SB1764 committee, and an extensive study of leak cases statewide, the LLNL report found that petroleum plumes tend to stabilize close to the source, generally occur in shallow groundwater and rarely impact drinking water wells in the state.

It is in light of these findings and the "lessons learned" over the past ten years in San Francisco Bay Region that these supplemental instructions are written. Strategies are presented for closing low risk soil only cases and managing low risk groundwater impact cases utilizing natural bioremediation as the preferred remedial alternative.

These two classes of sites, low risk soils and low risk groundwater, are not intended to include the whole universe of petroleum leaks. There are higher risk sites that may require immediate action and remediation to protect human health and the environment. The responsibility still lies with the discharger for investigation of the subsurface to gather the data necessary to make these decisions. It is the responsibility of the regulator to only request that information which is required to make the necessary regulatory decisions regarding the site.

It is the responsibility of everyone in the process, particularly consultants and regulators, to keep up with current research on site investigation, fate and transport of contaminants, analytical methods, and other topics that affect the decision making process. Training and education should be a high priority for all parties participating in the site cleanup process. The State and Regional Boards will be providing training to the local agencies and others affected. In addition, consulting by the Regional Board's toxicologist, Dr. Ravi Arulanantham, is available on a limited basis to local agencies.

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[1] Additional supplemental information is also provided from the Regional Board in the form of a Fact Sheet in a "Question and Answer" format.

LOW RISK SOILS CASE

Definition:

1) **The leak has been stopped and ongoing sources, including free product, removed or remediated.**

The tank or appurtenant structure that leaked must be repaired or permanently closed per Chapter 7, Section 2672 of the UST regulations. Free product shall be removed to the extent practicable per Chapter 5, Section 2655 of the UST regulations.

Free product or soil which contains sufficient mobile constituents (leachate, vapors, or gravity flow) to degrade groundwater quality above water quality objectives or result in a significant threat to human health or the environment should be considered a source.

For old releases, the absence of current groundwater impact is often a good indication that residual concentrations present in the soil are not a source of pollution. In general, if impacted soil is not in contact, or expected to come in contact, with or very close to the groundwater, it is unlikely that it is a significant source of pollution.

2) **The site has been adequately characterized.**
The extent of the subsurface impact should be defined to the degree that is necessary to determine if the site poses a threat to human health, the environment, or other sensitive nearby receptors. The level of detail required at a given site will depend upon the presence or absence of potential receptors and exposure pathways. Delineating plumes to non-detect levels is not required at all sites.

It is assumed that subsurface conditions are highly variable and that there is always some uncertainty associated with evaluating data at a site. However, the cost of obtaining additional data must be weighed against the benefit of obtaining that data and the effect the data may have on the certainty of decisions to be made at the site.

3) **Little or no groundwater impact currently exists and no contaminants are found at levels above established MCLs or other applicable water quality objectives.**

By definition, soils only cases do not have significant groundwater impacts.

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

5) **The site presents no significant risk to human health.**

The American Society of Testing and Materials' (ASTM) standard for Risked Based Corrective Action (RBCA), ASTM E-1739-95, details a framework and provides a methodology to perform a tiered risk analysis at petroleum release sites. This methodology incorporates EPA risk assessment practices to determine non-site specific (tier 1 look up table which provides generic risk based screening levels) and site specific (tier 2 and tier 3) clean up levels that are protective of public health and environmental resources.

In addition to the various methods of contaminant transport described in the ASTM standard. other methods may also be acceptable in determining health and environmental protective levels.

When using the ASTM lookup table risk based screening levels (RBSLs) one has to multiply the RBSL value for benzene by a factor of 0.29 to obtain the corrected value for California (CAL EPA has a higher toxicity value of 0.1 as compared to the USEPA value of 0.029 for benzene). All other values in the table remain the same.

6) **The site presents no significant risk to the environment.**
RBCA has no specific guidance for evaluating environmental risk although the basic framework is appropriate if site specific exposure pathways and ecological receptors are included. If the site has a potential to significantly impact surface water, wetlands, other sensitive receptors, it should not be considered low risk.

Management Strategy

Low risk soils cases should be closed when it is determined that site conditions conform to the above criteria. Further remediation or monitoring is not required. If the highest permitted use (e.g., residential) is not protected by the chosen cleanup levels, then land use restrictions or notifications for the site may be appropriate.

LOW RISK GROUNDWATER CASE

Definition

1) **The leak has been stopped and ongoing sources, including free product, have been removed or remediated** (see Low Risk Soils Case Definition #1).

2) **The site has been adequately characterized** (see Low Risk Soils Case Definition #2).

   The presence or absence of horizontal and vertical conduits which could act as preferential pathways for the dissolved plume should be evaluated as a part of the site characterization process.

3) **The dissolved hydrocarbon plume is not migrating.**
   The LLNL report found that petroleum plumes in the subsurface tend to stabilize once the source is removed. Natural biodegradation of hydrocarbons is the main reason why this stability occurs.

   Chemical concentrations of hydrocarbons in groundwater that decrease or do not change with time are the best indicators of a stable plume. Comparison of background and hydrocarbon plume concentrations of inorganic ions such as oxygen, iron, nitrate, sulfate, and others, can provide evidence of biodegradation at a given site. These data may not be required to determine plume stability but can supplement other lines of evidence.

   Stable or decreasing plumes often display short term variability in groundwater concentrations. These effects are due to changes in groundwater flow, degradation rates, sampling procedures, and other factors which are inherently variable. This behavior should not necessarily be construed as evidence of an unstable plume but may be the natural variations of a stable plume in the environment.

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

5) **The site presents no significant risk to human health.**

   For this analysis, the groundwater ingestion pathway need not be considered if the groundwater is not currently used as a source of drinking water or projected to be used within the life of the plume. (See Low Risk Soils Case Definition #5)

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

   RBCA has no specific guidance for evaluating environmental risk although the basic framework is appropriate if site specific exposure pathways and ecological receptors are included. If the site has a potential to significantly impact surface water, wetlands, other sensitive receptors, it should not be considered low risk. (See Low Risk Soils Case Definition #6)

Management Strategy

1) **Passive bioremediation should be the preferred remedial alternative unless there is a compelling reason to do otherwise.**

A partial list of reasons that may justify active remediation are listed below:

- Groundwater within the plume is likely to be used before natural biodegradation is projected to complete the cleanup.
- Sensitive receptors have been identified and are projected to be adversely impacted.
- The plume is migrating significantly.
- Another remedial alternative is shown to be more cost effective.

Generally, if any of these conditions or others deemed to be compelling are met, a more aggressive remedial approach may be appropriate.

2) **Monitor the site to determine plume stability and the effectiveness of the remedial strategy.**

Monitoring is necessary to determine if site conditions will remain stable or improve over time. One hydrologic cycle (four quarters) of monitoring data is usually considered to be the minimum necessary to determine site conditions. This assumes depth to groundwater has significant seasonal variation and that no longer term variation occurs. If little seasonal fluctuation is expected, then one year of monitoring may not be required. Conversely, if depth to groundwater is expected to change significantly from year to year due to droughts, adjacent pumping, or other factors, then one year of monitoring may not be adequate.

Data from adjacent or nearby sites may be useful in determining groundwater fluctuations and other regional aquifer characteristics. Frequency of monitoring and the number of monitoring points may be adjusted after site characterization is completed. At many existing sites, these data may already have been collected.

Coordinated &
Prepared by: Kevin L. Graves, P.E.
Associate Water Resources Control Engineer
January 5, 1996

Stephen I Morse

Concur: Stephen I. Morse, P.E.
Chief, Toxics Cleanup Division
January 5, 1996

STATE OF CALIFORNIA -- CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY PETE WILSON, Governor

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Fact Sheet
Questions and Answers
on the
"Interim Guidance on Low-Risk Petroleum Hydrocarbon Cleanups"

Lawrence Livermore National Laboratory (LLNL) issued its "Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks" (October 16, 1995). In response to this report, State Water Resources Control Board Executive Director Walt Pettit issued an interim guidance letter dated December 8, 1995, which discussed the regulatory implications of the conclusions and recommendations of the LLNL report.

From the December 8, 1995, letter:

"In the interim and in light of the findings and recommendations in the LLNL report, we believe cleanup oversight agencies should proceed aggressively to close low risk soil only cases. For cases affecting low risk groundwater (for instance, shallow groundwater with maximum depth to water less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak) we recommend that active remediation be replaced with monitoring to determine if the fuel leak plume is stable. Obviously good judgment is required in all of these decisions. However, that judgment should now include knowledge provided by the LLNL report."

This Fact Sheet is intended to further amplify the guidance contained in the State Board letter for fuel cleanup sites within the San Francisco Bay Region through the form of "Answers" to frequently asked questions regarding implementation of the new petroleum cleanup interim guidance.

Q **What is considered a "source" when completing source removal?**

A Leaking tanks and appurtenant structures must be removed or repaired. Free product or soil which contains sufficient mobile constituents (leachate, vapors, or gravity flow) to degrade groundwater quality above water quality objectives or provide a significant threat to human health or the environment should be considered a source.

Gasoline or diesel free product fits this definition at virtually all sites. Oil and grease, degraded crude oil, and degraded diesel may not be soluble enough to be considered a significant source and often do not degrade water quality or present a significant risk to human health or the environment.

Many factors need to be considered when determining if a given petroleum release constitutes a source.

- Depth of the affected soil below ground surface
- Depth to groundwater below ground surface
- Soil type and physical properties
- Presence of preferential pathways (ie. old wells, utility trenches, etc.)
- Type of petroleum released
- Infiltration rate
- Spatial distribution of petroleum concentrations
- Total mass of petroleum released
- Trends in monitoring data
- Chemical and physical properties of any residual hydrocarbons

Good judgment must be used when weighing these and other factors. For old releases, the absence of current groundwater degradation often is a good indication that residual concentrations present in the soil are not a source of pollution. In general, if impacted soil is not in contact or expected to come in contact with the groundwater, it is unlikely that it is a significant source of pollution.

Q **What is meant by "low risk groundwater sites"?**

A An example of a low risk groundwater site is described in the State Board letter as a site with maximum depth to groundwater less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak. In addition, there should be no surface water or other sensitive habitat that may be adversely impacted by the release.

These criteria are not hard and fast rules. They are meant to recognize that shallow groundwater is rarely used as a drinking water source, that biodegradation in most cases will stabilize a plume within 250 feet of the leak, and that the plume will likely remediate itself due to natural biodegradation. However, if the plume is not stable, preferential pathways exist at the site, or sensitive receptors are near the end of the plume, then the site should not be considered low risk.

Q **How do we determine if there is a significant risk to human health at a site?**

A The American Society of Testing and Materials (ASTM) standard for Risk Based Corrective Action, ASTM E-1739-95, (RBCA) provides look up tables for various exposure pathways that contains conservative screening levels (when modified for California's benzene standard) for comparison with values existing at the site. The standard also contains a methodology for determining site specific levels that are protective of public health and the environment. The SWRCB/RWQCB is now offering two day classes for all interested parties in risk-based decision making at soil and groundwater impacted sites. Please contact the UC

Riverside Extension at 909-787-4105 to obtain further information on upcoming classes.

Q **What is a sensitive receptor?**

A Water wells, deeper drinking water aquifers, surface water bodies, sensitive habitats such as wetlands, marshes, or mudflats, human beings, aquatic plants and animals, and other wildlife are all sensitive receptors. Property lines and other political or administrative boundaries are not considered to be sensitive receptors for the purposes of this guidance.

Q **How do we determine if there is significant ecological risk at the site?**

A There is not currently a standard method for determining potential threats to the environment or aquatic receptors. When appropriate, ASTM RBCA would identify this as a potential exposure pathway that is not included in the current "look up tables" and will therefore require a higher tier analysis. This analysis may require additional evaluation of migration pathways such as storm drains and other manmade conduits. Currently, evaluation protocols are being developed, and look up tables for ecological receptors may be added to ASTM RBCA in the future. The lack of a standard protocol or look up table does not eliminate the requirement to evaluate this pathway, especially in nearshore or Bay front locations.

Q **The State Board letter states that active remediation should be replaced with monitoring at low risk sites. What technologies are considered "active remediation"?**

A Active remediation refers to remediation of dissolved groundwater plumes. Mechanical systems that inject or remove material from the dissolved phase plume are considered active remediation. Examples of active remediation include groundwater extraction systems, air sparging systems, and hydrogen peroxide injection systems. Vapor extraction, bioslurping and other source removal systems are not considered active remediation if they are removing a source of pollution as defined in Question 1 above.

Q **What technologies for free product removal are currently considered practicable?**

A Appropriate excavation of the impacted material surrounding the leak is one of the best source removal technologies available. Manual bailing, passive skimming, and pumping of groundwater are only marginally effective at removing free product. Vacuum enhanced free product recovery (ie. vapor extraction, bioslurping, etc.) has been shown to be a highly effective method for removing mobile free product. Each site needs a determination of the cost-effectiveness of the various techniques taking into account the soil type, amount of free product present, potential for the free product to act as a source, preferential pathways, and other factors that affect hydrocarbon movement at the site.

Q **What 'reasonable justification' would be compelling enough to use active remediation on the dissolved hydrocarbon plume?**

A A partial list of reasons that may be compelling are listed below:

- Groundwater within the plume is likely to be used before natural biodegradation is projected to complete the cleanup.
- Sensitive receptors have been identified and are projected to be adversely impacted.
- The plume is migrating significantly.
- Another remedial alternative is shown to be more cost effective.

Generally, if any of these conditions or others deemed to be reasonable justification are met, a more aggressive remedial approach may be appropriate.

Q **What criteria are used to determine plume stability?**

A The LLNL report found that petroleum plumes in the subsurface tend to stabilize once the source is removed. Natural biodegradation of hydrocarbons is the main reason this stability occurs.

Many factors influence plume stability including hydrogeology and those listed in Question 1. However, chemical concentrations of hydrocarbons in groundwater that decrease or do not change with time are the best indicator of a stable plume. Comparison of background and hydrocarbon plume concentrations of inorganic ions such as oxygen, iron, nitrate, sulfate, and others, can provide evidence of biodegradation at a given site. These data may not be required to determine plume stability, but can supplement other lines of evidence.

Stable or decreasing plumes often display short term variability in groundwater concentrations. These effects are due to changes in groundwater flow, degradation rates, sampling procedures, and other factors which are inherently variable. This behavior should not necessarily be construed as evidence of an unstable plume but may be the natural variability of a stable plume in the environment.

Q **What should the monitoring frequency be?**

A The frequency of monitoring should be commensurate with the need for data to make required decisions at the site. Quarterly monitoring may be appropriate in the early stages of investigation when extent of contamination, seasonal groundwater fluctuations, and other site specific factors are being evaluated. After these have been determined, monitoring frequency may be reduced to perhaps annually and number of monitoring points reduced to selected wells only. Long-term monitoring should be limited to collecting only the minimum data needed to verify that site conditions are stable or improving. Much of this information has already been collected at many existing sites.

Q **Can existing active remediation systems at low risk sites be turned off even though established remedial goals have not been reached?**

A Yes. If the site is evaluated using the new guidance and active remediation is not indicated, then active treatment at the site should be terminated. If the extraction system is necessary to provide hydraulic control of the plume which prevents contaminants from reaching a sensitive receptor, then continued pumping may be warranted.

Q **When can adjacent site data be used in lieu of site specific data?**

A Local hydrogeologic data can often be inferred from data collected at adjacent sites. Depth to groundwater, depth to regional aquifer, groundwater gradient, soil types that may be present, and chemical concentrations may all be of value in directing an investigation. A conceptual model of the site may be formed using local or adjacent site data. Data collected during a site investigation should clarify the conceptual model and help to guide any further work at the site.

Q **If a site is only monitoring and no active remediation is anticipated, can the site be closed?**

A Regulatory agencies have broad discretion to determine whether or not regulatory action is necessary and appropriate at a given site. Under current policies, the monitoring period could be many years depending upon the magnitude of the release, remedial actions taken, and biodegradation rates at the site. Closure of low risk UST sites would be appropriate as soon as enough data supported the conclusion that the source had been removed, the plume had stabilized, and bioremediation was expected to achieve water quality objectives (e.g. MCLs) in a reasonable time.

The State Board has indicated that policies regarding petroleum cleanup standards will be reviewed in 1996 pursuant to SB1764 requirements. Changes in closure policy regarding low risk groundwater cases may be a result of that review.

Q **What action should be taken if a responsible party refuses to take any action at a site and cites this guidance as the reason for inaction?**

A Responsible parties are required to comply with all regulatory requirements. If they disagree with a directive or think it is in violation of current regulatory practice, they have the opportunity to appeal that directive through the proper channels. Responsible parties may face enforcement actions if they disregard regulatory requirements and do not appeal using the appropriate procedures.

Q **If a responsible party wants to pursue a more aggressive remedial strategy than stated in the State Board letter, will the Cleanup Fund pay for the additional remediation?**

A The Cleanup Fund manager has indicated that the Fund will only reimburse costs for those activities that are required by regulatory agencies. For low risk cases, regulatory agencies should not approve work plans for active remediation unless adequate justification is provided. Article 11, section 2727f of the Underground Storage Tank Regulations requires that responsible parties propose the most cost-effective corrective action. This will be monitoring, without active remediation, in many cases.

Q **What public notification is required when implementing this guidance?**

A The implementation of the LLNL recommendations suggested by the State Board letter does not change the public notification requirements already stated in the UST regulations in Chapter 11, Section 2728. That section requires that the public must be informed of the proposed activities contained in a site's corrective action plan. If a site's corrective action plan is modified to the extent that it is essentially a new corrective action plan, then it may be appropriate for the public to be notified of the new plan.

Q **Will future use of an impacted property be restricted by implementation of State Boards' recommendations?**

A No change in current practice is expected. Generally, sites are remediated to either residential or commercial/industrial requirements based on current and projected future land uses. If a site is cleaned up to commercial/industrial standards and the land use changes to residential, then further risk assessment and possibly mitigation or remediation may be required.

The current UST "no further action" letter requires that the implementing agency be notified if a change in land use occurs.

Q **How does this guidance fit with existing and future policy?**

A From the December 8, 1995 letter, "What I propose to you is not in any way inconsistent with existing policies or regulations. However, it does represent a major departure from how we have viewed the threat from leak USTs." Under the requirements of SB 1764 the legislature expects the State Water Resources Control Board to propose and make further permanent changes to the interim guidance, perhaps as early this spring. Meanwhile, the Regional Board and the local regulating agencies will be implementing the interim guidance.

For further information or questions, please contact the Regional Board. Initial contact should be Wil Bruhns, the Regional Board's Ombudsman at 510-286-0838. He can give you further general information and direct your questions to the appropriate staff persons. It should be noted that most fuel cleanup sites in the Bay Area are regulated by local agencies.

E OF CALIFORNIA · CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY PETE WILSON Governor

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SEP 25 1995

TO: Interested Responsible Parties

OPTION TO REQUEST DESIGNATION OF AN AGENCY TO OVERSEE UNDERGROUND STORAGE TANK (UST) LEAK CLEANUP

Responsible parties who are required to take corrective action at UST leak sites have the option to request designation of a single administering agency to implement and issue a final site certification covering all applicable cleanup laws. In so doing, responsible parties have the option of dealing with one agency, rather than multiple state and local agencies. The site designation process was established by Assembly Bill 2061 (Chapter 6.65 of the Health and Safety Code).

Chapter 6.65 allows responsible parties to request that a single state or local agency be assigned to oversee corrective action at sites including UST leak sites. Requests must be submitted as applications to the Site Designation Committee. This committee is made up of the Secretary of California Environmental Protection Agency, the Director of Department of Toxic Substances Control, the Chair of State Water Resources Control Board, the Director of the Department of Fish and Game, the Chair of the Air Resources Board, and the Director of the Office of Environmental Health Hazard Assessment, or their representative.

Applications must identify the agency proposed to oversee site investigation and cleanup. Based on factors contained in Chapter 6.65, the committee will decide whether the requested agency is qualified to oversee cleanup of the site under consideration.

Before filing applications, responsible parties should consult with the agency currently overseeing corrective action. Their staff will be able to provide information that will help you decide whether to take this option. If the agency that you have requested as the administering agency is not currently overseeing the corrective action, you should discuss your application with that agency.

If you have concerns about this letter or would like to obtain a copy of the site designation information package, which includes the application, please call Ms. Lisa Maddaus of the Division of Clean Water Programs at (916) 227-4520. In addition, this information is being made available through personal computer modem access on the SWRCB Bulletin Board (916-657-9722; Internet at http://www.swrcb.ca.gov) and Cal/EPA Access (916-322-5041; Internet at http://www.cahwnet.gov/epa).

Sincerely,

James Cornelius

James Cornelius, Chief
Program Support Branch

STATE OF CALIFORNIA - CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
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DEC - 8 1995

All Regional Water Board Chairpersons
All Regional Water Board Executive Officers
All LOP Agency Directors

LAWRENCE LIVERMORE NATIONAL LABORATORY (LLNL) REPORT ON LEAKING UNDERGROUND STORAGE TANK (UST) CLEANUP

In October 1995, the LLNL presented to the State Water Resources Control Board (SWRCB) its final report, Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks. The LLNL team found that the impacts to the environment from leaking USTs were not as severe as we once thought. The report also presents a convincing argument that passive bioremediation should be considered as the primary remediation tool in most cases once the fuel leak source has been removed.

The LLNL report has also been presented to the SWRCB's SB 1764 Advisory Committee which will, in turn, provide recommendations to the SWRCB by the end of January 1996. The SWRCB may choose to implement recommendations from the LLNL report and the SB 1764 Advisory Committee through revisions to SWRCB Resolution 92-49 in early 1996.

In the interim and in light of the findings and recommendations in the LLNL report, we believe cleanup oversight agencies should proceed aggressively to close low risk soil only cases. For cases affecting low risk groundwater (for instance, shallow groundwater with maximum depth to water less than 50 feet and no drinking water wells screened in the shallow groundwater zone within 250 feet of the leak) we recommend that active remediation be replaced with monitoring to determine if the fuel leak plume is stable. Obviously good judgment is required in all of these decisions. However, that judgment should now include knowledge provided by the LLNL report.

What I propose to you is not in any way inconsistent with existing policies or regulations. However, it does represent a major departure from how we have viewed the threat from leaking USTs. This guidance is consistent with the results of a discussion of this subject among the State Board Chair and Regional Board Chairs on December 5, 1995. If you have any questions on this matter please call Mr. James Giannopoulos, our manager of the underground storage tank program, at (916) 227-4320

Sincerely,

Walt Pettit

Walt Pettit
Executive Director

cc: All Regional Water Board/LOP UST Program Managers

STATE OF CALIFORNIA PETE WILSON, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
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January 12, 1996
File No. 2198.17(KLG)

Responsible Parties
LOP Program Managers

Subject: MTBE reporting requirements.

Dear Sir/Madam:

The increasing use of Methyl Tertiary Butyl Ether (MTBE) as a component of reformulated gasoline in the Bay Area has potential groundwater quality ramifications. In light of recent studies of the environmental impacts of MTBE, This office has decided to require quantification for MTBE as an additional analyte for EPA method 8020. The letter formalizes the previously informal request made in a letter dated May 2, 1995.

When we made our initial request for information, we stated that it was not anticipated that additional costs would be incurred by the addition of MTBE to the list of analytes on a standard EPA 8020 analysis. We now know that this is not correct in all cases. There are several circumstances in which the cost of the analysis will increase. However, we still believe our request is appropriate and will not present an unwarranted financial burden.

The Water Code specifies in section 13267 that Regional Boards may require technical reports regarding the water quality in its region. This section also states that the cost of these reports must bear a reasonable relationship to the need for the report and the benefits to be obtained from the report. In light of the increase in usage of MTBE in our region, the evidence of persistence of MTBE in the environment, and its possible impacts, we feel that the *increased cost of EPA method 8020 analysis for MTBE is merited when compared with the benefits to be obtained* by reporting of the analytical results. This data will allow us to profile and baseline MTBE in our region and be prepared to implement regulatory programs in a rational, cost effective manner should they become necessary.

Please submit results quantified in parts per billion (ppb) for each analysis performed. A detection limit of 5 ppb is recommended. This request, made pursuant to section 13267 of the Water Code, need not be submitted in a separate report, but may be submitted along with other required monitoring or investigation reports.

If you have any questions regarding this matter, please contact Kevin Graves of my staff at (510) 286-0435.

Sincerely,

Loretta K. Barsamian
Executive Officer

Stephen Morse
Stephen I. Morse
Chief, Toxics Division

cc:: James Giannopoulos, SWRCB

Attachment

STATE OF CALIFORNIA
PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
2101 WEBSTER STREET, Suite 500
OAKLAND, CA 94612
Tel: (510) 286-1255
FAX: (510) 286-1380

May 2, 1995
File No. 2188.14 (JRW)

To: All LOP/LIA Agencies in San Francisco Bay Region

Stephen I Morse

From: Stephen I. Morse

Subject: Human Health Threat Concerns and MTBE Reporting

Methyl Tertiary Butyl Ether (MTBE) is a colorless, relatively volatile liquid that has found widespread use since the early 80's as a gasoline additive. The Environmental Protection Agency's (EPA) Interagency Testing Committee identified MTBE for priority testing consideration based on large production volume, potential widespread exposure, and limited data on chronic health effects. Results of this study and subsequent studies suggest that MTBE may pose more of a threat to human health and the environment than previously suspected.

In order to fully evaluate this when analyzing for Total Petroleum Hydrocarbons as gasoline, it is now appropriate that MTBE be quantified using EPA method 8020 in addition to BTEX compounds. The objective of additional testing for MTBE is to better assess the magnitude and threat of MTBE for human health and ecological exposure in leaking underground fuel leak sites.

We do not intend or anticipate significant financial burdens on the regulated community because of this additional reporting, as MTBE can be easily and inexpensively quantified while using the existing EPA method 8020 protocol for BTEX, simply by reporting its peak which is already present on the Gas Chromatogram for this method. Several laboratories surveyed have indicated that, if regulatory agencies require MTBE reporting with EPA method 8020 for BTEX, no additional costs will be charged to the customer.

Please require reporting for MTBE at all sites with gasoline releases occurring after 1983 where an EPA 8020 analysis is performed. Should you have any questions related to this matter, please contact John West (510) 286-1247 or Kevin Graves (510) 286-0435 of my staff.

cc: Laboratories Affiliated with the Association of California Testing Laboratories
Dave Rice, Lawrence Livermore Labs
James Giannopoulos, SWRCB
Matt Small, EPA

STATE OF CALIFORNIA PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
2101 WEBSTER STREET, Suite 500
OAKLAND, CA 94612
Tel: (510) 286-1255
FAX: (510) 286-1380

July 18, 1995
File No. 2188.14 (JRW)

TO: ALL LOP/LIA AGENCIES, ACT LABORATORIES
AND CONSULTANTS IN THE SAN FRANCISCO BAY REGION

SUBJECT: RECOMMENDED GUIDELINES FOR METHYL TERTIARY BUTYL ETHER (MTBE)
REPORTING AT FUEL LEAK SITES

In response to several recent questions and comments that we have received related to our May 2, 1995, letter (see attachment), we have prepared this letter as additional recommended guidelines on MTBE reporting. Listed below are Regional Board staff responses to several of the major questions and/or comments that have come to our attention.

What is MTBE and why is it used?
MTBE is an ether. It is a volatile, flammable, colorless liquid at room temperature that smells like turpentine. According to a major oil company representative, MTBE has found widespread use as a fuel additive since the early 1980's. The Clean Air Act Amendments of 1990 mandate that compounds that add oxygen (oxygenates) be added either seasonally or year round to gasoline where ozone concentrations in the summer or carbon monoxide in the winter exceed established air quality standards. Oxygenates are added to increase the octane of gasoline and to improve air quality. Oxygenates are added to more than 30 percent of the gasoline produced in the United States, and by the end of this decade, the Oxygenated Fuels Association has estimated that oxygenates will be added to 70 percent of the gasoline produced. MTBE is a commonly used oxygenate because of its low cost, ease of production, and favorable transfer and blending characteristics. Gasoline can contain up to 15 percent MTBE by volume.

What should the laboratory reporting detection limit be for MTBE?
Several laboratories that service the San Francisco Bay Region have indicated that using a detection limit of 5 parts per billion (ppb) for MTBE in water samples would not burden normal laboratory protocol for EPA method 8020/602 reporting, and no additional costs would be charged to the customer. However, it was also mentioned that lowering MTBE detection limits below 5 ppb might increase reporting costs. As it is not our intention to place additional financial burdens on responsible parties of leaking underground fuel and/or surface spill sites, and because we feel that detection limits below 5 ppb are probably not necessary, we recommend for MTBE water samples using the 5 ppb reporting detection limit with EPA method 8020/602. One of the major oil companies has indicated that contract laboratory rates for large volume clients may cause a slight cost increase for the MTBE quantification because of their already discounted rate. However, we do not consider these increases to be significant enough to merit exemption from MTBE reporting.

What information suggests that MTBE may pose a human health threat?
The primary role of the State and Regional Boards is to protect and enhance the beneficial uses of the waters of the State as codified within the State's Porter Cologne Water Quality Act. Among such uses are those of drinking water. The presence of a compound within a drinking water source that could compromise the water's use as a healthful drinking water source or affect other beneficial uses is a concern. The U.S. Environmental Protection Agency classifies MTBE as a possible human

carcinogen and has identified the compound for priority testing consideration based on it's large production volume, it's widespread usage, and the limited data on it's chronic health effects. The EPA draft drinking water lifetime health advisory for MTBE falls within the range of 20-200 ppb. Contaminant concentrations below the health advisory are not expected to cause adverse effects over a lifetime of exposure. MTBE is also on the EPA's Drinking Water Priority List which means it is a possible candidate for future regulation.

What is the objective of reporting MTBE

MTBE reporting provides additional site information which may aid the characterization and dating of a fuel release. Moreover, given its relatively high solubility, mobility and resistance to biological decay, MTBE may in some instances behave as a conservative tracer, thereby providing valuable additional biodegradation and hydrogeological/fate and transport information. For example, preferential pathways and probable migration of fuels may be estimated using MTBE as a leading indicator in the head of the plume (MTBE has a much higher solubility and mobility than benzene.)

The amount of MTBE released from leaking underground fuel tanks and surface spills that have reached groundwater is unknown. Recently, a report from the USGS's National Water Quality Assessment Program indicated that MTBE is showing up in shallow groundwater at a surprising rate in urban areas, with 27 percent of shallow urban wells in eight cities nationwide having detectable MTBE concentrations. Although public water supplies generally only draw drinking water from deeper aquifers (over 100 feet below ground surface), of which there is little data indicating any MTBE presence, we feel that the large volume usage and widespread exposure of this compound merits attention, especially if there is little or no cost burden on the regulated community.

In summary, the objective of MTBE reporting is to compile data that provides valuable additional biodegradation and fate and transport information, and, to better assess the magnitude and threat of this compound for human health and ecological exposure. It is good public policy to compile data on issues before small problems become big ones. Should stronger regulations be necessary in the future, historical information on the scope of the problem will facilitate appropriate decision making. We would like to strongly emphasize that because of insufficient E.PA. health information, our agency is not presently treating MTBE as a human health threat and we have no intention of requiring remediation specifically for MTBE, nor as a factor in site closure consideration at this time.

Should you have any questions or comments related to this matter, please contact John West of my staff at (510) 286-1247.

Sincerely,

Steven R. Ritchie
Executive Officer

Attachment: Previous MTBE Letter

cc: James Giannopoulos, SWRCB
Glen Dembroff, Ultramar, Inc.
UST Project Managers, All Regional Boards
David Rice, Lawrence Livermore Labs
Matt Small, EPA

San Leandro Groundwater Analytical Data Summary
IRES, San Leandro, CA

Well	Date Collected	Sample collection by	Lab	EPA Method	acetone (ug/l)	benzene (ug/l)	bromo-benzene (ug/l)	bromo-chloro methane (ug/l)	bromo dichloro-methane (ug/l)	bromo-form (ug/l)	bromo-methane (ug/l)	2-buta-none (ug/l)	n-butyl-benzene (ug/l)	carbon disulfide (ug/l)	carbon tetra-chloride (ug/l)	chloro-benzene (ug/l)	chloro-ethane (ug/l)	chloro-form (ug/l)	chloro-methane (ug/l)	2-chloro-toluene (ug/l)	4-chloro-toluene (ug/l)	dibromo-chloro-methane (ug/l)	,2-dibromo-3-chloro-propane (ug/l)	1,2 di-bromo-ethane (ug/l)	dibromo-methane (ug/l)
MW-1	17-Nov-89	IT	PAL	8010/8020		ND																			
	21-Jun-94	CEC	ARC	8260		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020		<0.4																			
	25-Jan-95	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020		<0.4																			
MW-2	17-Nov-89	IT	PAL	8010/8020		ND																			
	21-Jun-94	CEC	ARC	8260		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020		<0.4																			
	25-Jan-95	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020		<0.4																			
MW-3	17-Nov-89	IT	PAL																						
	21-Jun-94	CEC	ARC	8260		27	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0		<1.0	17	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<20	34	<5	<5	<5	<5	<5	<20	7	<5	<5	19	<5	<5	<5	<5	<5	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	50	9	<5	<5	<5	<5	<5	<20	13	<5	<5	19	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020		8.9																			
	25-Jan-95	CEC	CEC	8260	<100	970	<30	<30	<30	<30	<30	<100	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
	25-Jan-95	CEC	CEC	8015/8020		950																			
	26-Apr-95	CEC	CEC	8260	<20	1100	<5	<5	<5	<5	<5	<20	<5	<5	<5	15	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-95	CEC	CEC	8015/8020		1200																			
	30-Jun-95	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020		16																			
	18-Oct-95	CEC	CEC	8260	<20	11	<5	<5	<5	<5	<5	<20	<5	<5	<5	15	<5	<5	<5	<5	<5	<5	<5	<5	<5
	18-Oct-95	CEC	CEC	8015/8020		12																			
	30-Jan-96	CEC	CEC	8260	<20	260	<5	<5	<5	<5	<5	<20	20	<5	<5	14	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jan-96	CEC	CEC	8015/8020		290																			
	26-Apr-96	CEC	CEC	8260	<20	330	<5	<5	<5	<5	<5	<20	22	<5	<5	13	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-96	CEC	CEC	8015/8020		210																			
	25-Jul-96	CEC	CEC	8260	<20	10	<5	<5	<5	<5	<5	<20	13	<5	<5	11	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jul-96	CEC	CEC	8015/8020		9																			
	22-Oct-96	CEC	CEC	8260	<200	<50	<50	<50	<50	<50	<50	<200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	22-Oct-96	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	10	<5	<5	12	<5	<5	<5	<5	<5	<5	<5	<5	<5
	22-Oct-96	CEC	CEC	8015/8020		3.1*																			
	20-Jan-97	CEC	CEC	8260	<20	180	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Jan-97	CEC	CEC	8015/8020		160																			
	24-Apr-97	CEC	CEC	8260A	<20	160	<5	<5	<5	<5	<5	<20	23	<5	<5	16	<5	<5	<5	<5	<5	<5	<5	<5	<5
	24-Apr-97	CEC	CEC	8015/8020		170																			
	18-Jul-97	CEC	CEC	8206A	<100	<30	<30	<30	<30	<30	<30	<100	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
	18-Jul-97	CEC	CEC	8015/8020		5																			
MW-4	16-Nov-90	IT	MCL	5030		1500																			
	21-Jun-94	CEC	ARC	8260		370	<1.0	<1.0	<1.0	<1.0	<1.0		19		<1.0	1.0 & <5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<100	470	<30	<30	<30	<30	<30	<100	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	160	260	<5	<5	<5	<5	<5	<20	17	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015 8020		360																			
	25-Jan-95	CEC	CEC	8260	<100	400	<30	<30	<30	<30	<30	<100	<30	<30	30	<30	<30	<30	<30	<30	<30	30	<30	<30	<30
	25-Jan-95	CEC	CEC	8015 8020		470																			
	26-Apr-95	CEC	CEC	8260	<20	470	<5	5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-95	CEC	CEC	8015/8020		500																			
	30-Jun-95	CEC	CEC	8260	<20	600	<5	5	<5	<5	<5	<20	13	<5	<5	5	<5	<5	<5	<5	<5	<5	5	<5	<5
	30-Jun-95	CEC	CEC	8015 8020		390																			

San Leandro Groundwater Analytical Data Summary
IRES, San Leandro, CA

Well	Date Collected	Sample collection by	Lab	EPA Method	1,2-dichlorobenzene (ug/l)	1,3-dichlorobenzene (ug/l)	1,4-dichlorobenzene (ug/l)	dichlorodifluoromethane (ug/l)	1,1-dichloroethane (ug/l)	1,2-dichloroethane (ug/l)	1,1-dichloroethene (ug/l)	cis-1,2-dichloroethene (ug/l)	trans-1,2-dichloroethene (ug/l)	1,2-dichloropropane (ug/l)	1,3-dichloropropane (ug/l)	2,2-dichloropropane (ug/l)	1,1-dichloropropene (ug/l)	cis-1-3-dichloropropene (ug/l)	trans-1,3-dichloropropene (ug/l)	ethylbenzene (ug/l)	freon 113 (ug/l)	hexachlorobutadiene (ug/l)	2-hexanone (ug/l)	isopropylbenzene (ug/l)	p-isopropyltoluene (ug/l)
MW-1	17-Nov-89	IT	PAL	8010/8020																ND					
	21-Jun-94	CEC	ARC	8260	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0		<1.0		<1.0	<1.0
	21-Jun-94	CEC	ARC	8015				<1.0									<1.0								
	21-Jun-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	20-Oct-94	CEC	CEC	8015/8020																<0.3					
	25-Jan-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	25-Jan-95	CEC	CEC	8015/8020																<0.3					
MW-2	17-Nov-89	IT	PAL	8010/8020																ND					
	21-Jun-94	CEC	ARC	8260	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0		<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	20-Oct-94	CEC	CEC	8015/8020																<0.3					
	25-Jan-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	25-Jan-95	CEC	CEC	8015/8020																<0.3					
MW-3	17-Nov-89	IT	PAL																						
	21-Jun-94	CEC	ARC	8260	42	6.6	13	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	120		<1.0		13	1.0 & <5.
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	45	7	14	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	170	<5	<5	<20	17	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	64	9	18	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	90	<5	<5	<20	20	<5
	20-Oct-94	CEC	CEC	8015/8020																96					
	25-Jan-95	CEC	CEC	8260	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	80	<30	<30	<100	<30	<30
	25-Jan-95	CEC	CEC	8015/8020																86					
	26-Apr-95	CEC	CEC	8260	43	6	11	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	640	<5	<5	<20	29	<5
	26-Apr-95	CEC	CEC	8015/8020																720					
	30-Jun-95	CEC	CEC	8260	58	9	17	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	30-Jun-95	CEC	CEC	8015/8020																20					
	18-Oct-95	CEC	CEC	8260	64	9	16	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	46	<5	<5	<20	9	<5
	18-Oct-95	CEC	CEC	8015/8020																46					
	30-Jan-96	CEC	CEC	8260	42	5	11	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	160	<5	<5	<20	17	<5
	30-Jan-96	CEC	CEC	8015/8020																150					
	26-Apr-96	CEC	CEC	8260	57	7	14	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	270	<5	<5	<20	19	<5
	26-Apr-96	CEC	CEC	8015/8020																170					
	25-Jul-96	CEC	CEC	8260	62	7	15	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	35	<5	<5	<20	7	<5
	25-Jul-96	CEC	CEC	8015/8020																27					
	22-Oct-96	CEC	CEC	8260	60	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<200	<50	<50
	22-Oct-96	CEC	CEC	8260	69	6	13	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	13	<5	<5	<20	<5	<5
	22-Oct-96	CEC	CEC	8015/8020																13					
	20-Jan-97	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	17	<5	<5	<5	<5	<5
	20-Jan-97	CEC	CEC	8015/8020																13					
	24-Apr-97	CEC	CEC	8260A	45	7	13	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	290	<5	<5	<5	24	<5
	24-Apr-97	CEC	CEC	8015/8020																240					
	18-Jul-97	CEC	CEC	8206A	50	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	30	<30	<30	<100	<30	<30
	18-Jul-97	CEC	CEC	8015/8020																30					
MW-4	16-Nov-90	IT	MCL	5030																720					
	21-Jun-94	CEC	ARC	8260	1.0 & <5	<1.0	<1.0	<1.0	<1.0	11	<1.0	1.0 & <5	16	<1.0	<1.0	1.0 & <5	<1.0	<1.0	<1.0	230		<1.0		43	1.0 & <5
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	360	<30	<30	<100	50	<30
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	7	<5	<5	<5	<5	<5	<5	<5	12	<5	<5	<5	<5	<5	<5	240	<5	<5	<5	56	<5
	20-Oct-94	CEC	CEC	8015/8020																270					
	25-Jan-95	CEC	CEC	8260	<30	<30	<30	<30	<30	30	<30	<30	<30	<30	<30	<30	<30	<30	<30	420	30	<30	<30	<100	40
	25-Jan-95	CEC	CEC	8015/8020																520					
	26-Apr-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	8	<5	<5	<5	<5	<5	<5	390	<5	<5	<20	51	<5
	26-Apr-95	CEC	CEC	8015/8020																250					
	30-Jun-95	CEC	CEC	8260	<5	<5	<5	<5	<5	11	5	<5	<5	<5	<5	<5	<5	<5	<5	570	<5	<5	<5	60	5
	30-Jun-95	CEC	CEC	8015/8020																380					

San Leandro Groundwater Analytical Data Summary
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Well	Date Collected	Sample collection by	Lab	EPA Method	methylene chloride (ug/l)	4-methyl-2-pentanone (ug/l)	MTBE (ug/l)	naphthalene (ug/l)	n-propylbenzene (ug/l)	sec-butylbenzene (ug/l)	styrene (ug/l)	tert-butylbenzene (ug/l)	tetrachloroethane (ug/l)	tetrachloroethane (ug/l)	tetrachloroethene (ug/l)	toluene (ug/l)	1,2,3-trichlorobenzene (ug/l)	1,2,4-trichlorobenzene (ug/l)	1,1,1-tnchloroethane (ug/l)	1,1,2 trichloroethane (ug/l)	trichloroethene (ug/l)	trichlorofluoromethane (ug/l)	1,2,3-trichloropropane (ug/l)	1,2,4-trimethylbenzene (ug/l)	1,3,5-trimethylbenzene (ug/l)
MW-1	17-Nov-89	IT	PAL	8010/8020												ND					29				
	21-Jun-94	CEC	ARC	8260	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1 0	<1.0	<1.0	<1.0	<1.0	18	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	20	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	11	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020												<0.3									
	25-Jan-95	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	16	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020												<0.3									
MW-2	17-Nov-89	IT	PAL	8010/8020												ND					10				
	21-Jun-94	CEC	ARC	8260	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020												<0.3									
	25-Jan-95	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020												<0.3									
MW-3	17-Nov-89	IT	PAL																						
	21-Jun-94	CEC	ARC	8260	<1.0			18	33	1.0 & <5.	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	63
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<5		<5	43	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	120	22
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<5		29	43	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	150	46
	20-Oct-94	CEC	CEC	8015/8020												4.4									
	25-Jan-95	CEC	CEC	8260	<30	<100		100	<30	<30	<30	<30	<30	<30	<30	410	<30	<30	<30	<30	<30	<30	<30	350	80
	25-Jan-95	CEC	CEC	8015/8020												340									
	26-Apr-95	CEC	CEC	8260	<5	<20		150	83	5	<5	62	<5	<5	<5	1600	<5	<5	<5	<5	<5	<5	<5	650	160
	26-Apr-95	CEC	CEC	8015/8020												1700									
	30-Jun-95	CEC	CEC	8260	<5	<5		14	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	54	40
	30-Jun-95	CEC	CEC	8015/8020												1.7									
	18-Oct-95	CEC	CEC	8260	<5	<5		14	23	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	110	28
	18-Oct-95	CEC	CEC	8015/8020												1.5									
	30-Jan-96	CEC	CEC	8260	<5	<20		85	57	5	<5	<5	<5	<5	<5	46	<5	<5	<5	<5	<5	<5	<5	390	110
	30-Jan-96	CEC	CEC	8015/8020												48									
	26-Apr-96	CEC	CEC	8260	<5	<20	<5	89	65	7	<5	<5	<5	<5	<5	140	<5	<5	<5	<5	<5	<5	<5	440	110
	26-Apr-96	CEC	CEC	8015/8020												100									
	25-Jul-96	CEC	CEC	8260	<5	<20	<5	10	26	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	140	35
	25-Jul-96	CEC	CEC	8015/8020												<0.3									
	22-Oct-96	CEC	CEC	8260	<50	<200		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	90	<50
	22-Oct-96	CEC	CEC	8260	<5	<20		6	18	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	95	23
	22-Oct-96	CEC	CEC	8015/8020												<0.3									
	20-Jan-97	CEC	CEC	8260	<5	<20	<5	28	<5	<5	<5	<5	<5	<5	<5	9	<5	<5	<5	<5	<5	<5	<5	68	10
	20-Jan-97	CEC	CEC	8015/8020												7.3									
	24-Apr-97	CEC	CEC	8260A	<5	<20	<5	64	80	8	<5	<5	<5	<5	<5	25	<5	<5	<5	<5	<5	<5	<5	680	97
	24-Apr-97	CEC	CEC	8015/8020												21									
	18-Jul-97	CEC	CEC	8206A	<30	<100	<30	<30	40	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	220	60
	18-Jul-97	CEC	CEC	8015/8020												<2									
MW-4	16-Nov-90	IT	MCL	5030												2000									
	21-Jun-94	CEC	ARC	8260	<1.0			46	54	1.0 & <5	<1.0	<1.0	<1.0	<1.0	<1.0	19	<1.0	<1.0	<1.0	<1.0	15	<1.0	<1.0	<1.0	110
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	30	<100		<30	60	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	530	110
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<20		96	78	8	<5	<5	<5	<5	<5	34	<5	<5	<5	<5	27	<5	<5	300	100
	20-Oct-94	CEC	CEC	8015/8020												33									
	25-Jan-95	CEC	CEC	8260	30	<30		120	100	<30	<30	<30	<30	<30	<30	90	<30	<30	<30	30	<30	<30	<30	600	120
	25-Jan-95	CEC	CEC	8015/8020												110									
	26-Apr-95	CEC	CEC	8260	<5	<20		54	61	6	<5	<5	<5	<5	<5	17	<5	<5	<5	<5	14	<5	<5	490	81
	26-Apr-95	CEC	CEC	8015/8020												11									
	30-Jun-95	CEC	CEC	8260	5	<20		38	110	10	<5	<5	<5	<5	<5	9	<5	<5	<5	5	3	<5	<5	690	130
	30-Jun-95	CEC	CEC	8015/8020												8									

San Leandro Groundwater Analytical Data Summary
IRES, San Leandro, CA

Well	Date Collected	Sample collection by	Lab	EPA Method	vinyl acetate (ug/l)	vinyl chloride (ug/l)	xylenes (ug/l)	o-xylene (ug/l)	p,m xylenes (ug/l)	TPH gasoline (ug/l)	TPH EPA 8015 gasoline (ug/l)	TPH diesel (ug/l)	Remarks	Data Source
MW-1	17-Nov-89	IT	PAL	8010/8020			ND			ND			TCE-only reported 8010 result	Problem Assessment Report, 1989
	21-Jun-94	CEC	ARC	8260		<1.0		<1.0	<1.0				EQL for PCE is 5.0 ug/l	quarterly monitoring
	21-Jun-94	CEC	ARC	8015							<50			
	21-Jun-94	CEC	CEC	8260	<10	<5		<5	<5					quarterly monitoring
	21-Jun-94	CEC	CEC	8015							<50			
	20-Oct-94	CEC	CEC	8260	<10	<5		<5	<5					
	20-Oct-94	CEC	CEC	8015/8020				<0.4	<0.4		<50			
	25-Jan-95	CEC	CEC	8260	<10	<5		<5	<5					
	25-Jan-95	CEC	CEC	8015/8020				<0.4	<0.4		<50			
MW-2	17-Nov-89	IT	PAL	8010/8020			ND			ND			TCE-only reported 8010 result	Problem Assessment Report, 1989
	21-Jun-94	CEC	ARC	8260		<1.0		<1.0	<1.0				EQL for 8260 VOCs is 5.0 ug/l	
	21-Jun-94	CEC	ARC	8015							<50			
	21-Jun-94	CEC	CEC	8260	<10	<5		<5	<5					
	21-Jun-94	CEC	CEC	8015							<50			
	20-Oct-94	CEC	CEC	8260	<10	<5		<5	<5					
	20-Oct-94	CEC	CEC	8015/8020				<0.4	<0.4		<50			
	25-Jan-95	CEC	CEC	8260	<10	<5		<5	<5					
	25-Jan-95	CEC	CEC	8015/8020				<0.4	<0.4		<50			
MW-3	17-Nov-89	IT	PAL										PAR cites "free product on well. No sample collected."	Problem Assessment Report, 1989
	21-Jun-94	CEC	ARC	8260		<1.0		31	100				m,p-xylene reported out of linear range	Aspen analytical report
	21-Jun-94	CEC	ARC	8015							2700			
	21-Jun-94	CEC	CEC	8260	<10	<5		40	150					
	21-Jun-94	CEC	CEC	8015							2900			
	20-Oct-94	CEC	CEC	8260	<10	<5		68	140				Reported acetone is lab error. See CEC letter, 12/22/94	
	20-Oct-94	CEC	CEC	8015/8020				69	160		2600			
	25-Jan-95	CEC	CEC	8260	<30	<30		820	1000					
	25-Jan-95	CEC	CEC	8015/8020				760	1100		7100			
	26-Apr-95	CEC	CEC	8260	<10	<5		900	2100					
	26-Apr-95	CEC	CEC	8015/8020				940	1500		14000			
	30-Jun-95	CEC	CEC	8260	<10	<5		26	41					
	30-Jun-95	CEC	CEC	8015/8020				33	99		1600			
	18-Oct-95	CEC	CEC	8260	<10	<5		23	77					
	18-Oct-95	CEC	CEC	8015/8020				24	83		2000			
	30-Jan-96	CEC	CEC	8260	<10	<5		570	630					
	30-Jan-96	CEC	CEC	8015/8020				590	740		6400			
	26-Apr-96	CEC	CEC	8260	<10	<5		600	1200				MTBE added to EPA 8260 analytes	
	26-Apr-96	CEC	CEC	8015/8020				320	640		5200			
	25-Jul-96	CEC	CEC	8260	<10	<5		7	36					
	25-Jul-96	CEC	CEC	8015/8020				7.8	30		2100			
	22-Oct-96	CEC	CEC	8260	<100	<50		<50	<50				Lab contamination. See lab narrative for higher detection limits.	
	22-Oct-96	CEC	CEC	8260		<5		<5	14				Rerun of EPA 8260. See case narrative.	
	22-Oct-96	CEC	CEC	8015/8020				4.0	16		1800			
	20-Jan-97	CEC	CEC	8260	<10	<5		250	99					
	20-Jan-97	CEC	CEC	8015/8020				240	82		1200			
	24-Apr-97	CEC	CEC	8260A	<20	<5		60	480					
	24-Apr-97	CEC	CEC	8015/8020				56	390		5100			
	18-Jul-97	CEC	CEC	8206A	<100	<30		<30	30					
	18-Jul-97	CEC	CEC	8015/8020				3	29		2100			
MW-4	16-Nov-90	IT	MCL	5030			27000			32000				Data Summary Report, 1990
	21-Jun-94	CEC	ARC	8260		>10 & <50		44	270					
	21-Jun-94	CEC	ARC	8015							3000			
	21-Jun-94	CEC	CEC	8260	<50	<30		50	530					
	21-Jun-94	CEC	CEC	8015							7600			
	20-Oct-94	CEC	CEC	8260	<10	<5		110	330				Reported acetone is lab error. See CEC letter, 12/22/94	
	20-Oct-94	CEC	CEC	8015/8020				120	520		7800			
	25-Jan-95	CEC	CEC	8260	<50	30		310	550					
	25-Jan-95	CEC	CEC	8015/8020				320	730		3700			
	26-Apr-95	CEC	CEC	8260	<10	<5		60	430					
	26-Apr-95	CEC	CEC	8015/8020				24	210		6100			
	30-Jun-95	CEC	CEC	8260	<10	<5		74	520					
	30-Jun-95	CEC	CEC	8015/8020				53	400		7800			

Well	Date Collected	Sample collection by	Lab	EPA Method	acetone (ug/l)	benzene (ug/l)	bromo-benzene (ug/l)	bromo-chloro methane (ug/l)	bromo dichloro-methane (ug/l)	bromo-form (ug/l)	bromo-methane (ug/l)	2-buta-none (ug/l)	n-butyl-benzene (ug/l)	carbon disulfide (ug/l)	carbon tetra-chlonde (ug/l)	chloro-benzene (ug/l)	chloro-ethane (ug/l)	chloro-form (ug/l)	chloro-methane (ug/l)	2-chloro-toluene (ug/l)	4-chloro-toluene (ug/l)	dibromo-chloro-methane (ug/l)	,2-dibromo-3-chloro-propane (ug/l)	1,2 di-bromo-ethane (ug/l)	dibromo-methane (ug/l)
MW-4	18-Oct-95	CEC	CEC	8260	<20	400	<5	<5	<5	<5	<5	<20	12	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
continued	18-Oct-95	CEC	CEC	8015/8020		280																			
	30-Jan-96	CEC	CEC	8260	<20	180	<5	<5	<5	<5	<5	<20	22	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jan-96	CEC	CEC	8015/8020		170																			
	26-Apr-96	CEC	CEC	8260	<20	160	<5	<5	<5	<5	<5	<20	13	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-96	CEC	CEC	8015/8020		190																			
	25-Jul-96	CEC	CEC	8260	<20	110	<5	<5	<5	<5	<5	<20	8	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jul-96	CEC	CEC	8015/8020		110																			
	22-Oct-96	CEC	CEC	8260	300	210	<50	<50	<50	<50	<50	<200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	22-Oct-96	CEC	CEC	8260	<20	130	<5	<5	<5	<5	<5	<20	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	22-Oct-96	CEC	CEC	8015/8020		140																			
	20-Jan-97	CEC	CEC	8260	<40	250	<10	<10	<10	<10	<10	<40	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	20-Jan-97	CEC	CEC	8015/8020		210																			
	24-Apr-97	CEC	CEC	8260A	<20	59	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	24-Apr-97	CEC	CEC	8015/8020		59																			
	18-Jul-97	CEC	CEC	8260A	<200	280	<50	<50	<50	<50	<50	<200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	18-Jul-97	CEC	CEC	8015/8020		240																			
OB-1	21-Jun-94	CEC	ARC	8260		83	<1.0	<1.0	<1.0	<1.0	<1.0		>1.0 & <5.0		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<20	130	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	120	48	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020		48																			
	25-Jan-95	CEC	CEC	8260	<20	180	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020		280																			
	26-Apr-95	CEC	CEC	8260	<20	190	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-95	CEC	CEC	8015/8020		200																			
	30-Jun-95	CEC	CEC	8260	<20	160	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020		140																			
VW-5	30-Jun-95	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020		<0.4																			
VW-6	30-Jun-95	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020		<0.4																			
VW-8	28-Jul-95	CEC	CEC	8260	<20	260	<5	<5	<5	<5	<5	<20	9	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	28-Jul-95	CEC	CEC	8015/8020		280																			
	18-Oct-95	CEC	CEC	8260	<20	290	<5	<5	<5	<5	<5	<20	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	18-Oct-95	CEC	CEC	8015/8020		15																			
	30-Jan-96	CEC	CEC	8260	<20	<5	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jan-96	CEC	CEC	8015/8020		18																			
	26-Apr-96	CEC	CEC	8260	<20	41	<5	<5	<5	<5	<5	<20	7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	26-Apr-96	CEC	CEC	8015/8020		34																			
	25-Jul-96	CEC	CEC	8260	<20	72	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	25-Jul-96	CEC	CEC	8015/8020		74																			
	22-Oct-96	CEC	CEC	8260	<200	170	<50	<50	<50	<50	<50	<200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	22-Oct-96	CEC	CEC	8260	<20	170	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	22-Oct-96	CEC	CEC	8015/8020		180																			
	20-Jan-97	CEC	CEC	8260	<20	14	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	20-Jan-97	CEC	CEC	8015/8020		16																			
	24-Apr-97	CEC	CEC	8260A	<20	50	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	24-Apr-97	CEC	CEC	8015/8020		41																			
	18-Jul-97	CEC	CEC	8260A	<20	59	<5	<5	<5	<5	<5	<20	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	18-Jul-97	CEC	CEC	8015/8020		75																			
VW-9	28-Jul-95	CEC	CEC	8260	<20	6600	<5	<5	<5	<5	<5	<20	13	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	28-Jul-95	CEC	CEC	8015/8020		7500																			

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Well	Date Collected	Sample collection by	Lab	EPA Method	1,2-dichlorobenzene (ug/l)	1,3-dichlorobenzene (ug/l)	1,4-dichlorobenzene (ug/l)	dichlorodifluoromethane (ug/l)	1,1-dichloroethane (ug/l)	1,2-dichloroethane (ug/l)	1,1-dichloroethene (ug/l)	cis-1,2-dichloroethene (ug/l)	trans-1,2-dichloroethene (ug/l)	1,2-dichloropropane (ug/l)	1,3-dichloropropane (ug/l)	2,2-dichloropropane (ug/l)	1,1-dichloropropene (ug/l)	cis-1-3-dichloropropene (ug/l)	trans-1,3-dichloropropene (ug/l)	ethylbenzene (ug/l)	freon 113 (ug/l)	hexachlorobutadiene (ug/l)	2-hexanone (ug/l)	isopropylbenzene (ug/l)	p-isopropyltoluene (ug/l)
MW-4	18-Oct-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	490	<5	<5	<5	53	<5
continued	18-Oct-95	CEC	CEC	8015/8020																330					
	30-Jan-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	280	<5	<5	<5	34	
	30-Jan-96	CEC	CEC	8015/8020																310					
	26-Apr-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	240	<5	<5	<5	56	<5
	26-Apr-96	CEC	CEC	8015/8020																230					
	25-Jul-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	5	11	<5	<5	<5	<5	<5	<5	170	<5	<5	<5	53	<5
	25-Jul-96	CEC	CEC	8015/8020																170					
	22-Oct-96	CEC	CEC	8260	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	240	<50	<50	<200	<50	<50
	22-Oct-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	5	10	<5	<5	<5	<5	<5	<5	200	<5	<5	<5	56	<5
	22-Oct-96	CEC	CEC	8015/8020																220					
	20-Jan-97	CEC	CEC	8260	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	410	<10		<40	50	<10
	20-Jan-97	CEC	CEC	8015/8020																340					
	24-Apr-97	CEC	CEC	8260A	<5	<5	<5	<5	<5	<5	<5	<5	7	<5	<5	<5	<5	<5	<5	110	<5	<5	<20	46	<5
	24-Apr-97	CEC	CEC	8015/8020																110					
	18-Jul-97	CEC	CEC	8260A	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	560	<50	<50	<200	60	<50
	18-Jul-97	CEC	CEC	8015/8020																450					
OB-1	21-Jun-94	CEC	ARC	8260	1.0 & < 5.	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	6.7	12	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10		<1.0		28	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	9	14	<5	<5	<5	<5	<5	<5	10	<5	<5	<20	39	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	9	10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	30	<5
	20-Oct-94	CEC	CEC	8015/8020																5.2					
	25-Jan-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	8	10	<5	<5	<5	<5	<5	<5	32	<5	<5	<20	30	44
	25-Jan-95	CEC	CEC	8015/8020																24					
	26-Apr-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	7	15	<5	<5	<5	<5	<5	<5	10	<5	<5	<20	38	<5
	26-Apr-95	CEC	CEC	8015/8020																7.4					
	30-Jun-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	12	15	<5	<5	<5	<5	<5	<5	17	<5	<5	<20	48	<5
	30-Jun-95	CEC	CEC	8015/8020																15					
VW-5	30-Jun-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	30-Jun-95	CEC	CEC	8015/8020																<0.3					
VW-6	30-Jun-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	30-Jun-95	CEC	CEC	8015/8020																<0.3					
VW-8	28-Jul-95	CEC	CEC	8260	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	210	<5	<5	<20	21	<5
	28-Jul-95	CEC	CEC	8015/8020																230					
	18-Oct-95	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	200	<5	<5	<20	17	<5
	18-Oct-95	CEC	CEC	8015/8020																0.6					
	30-Jan-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<20	<5	<5
	30-Jan-96	CEC	CEC	8015/8020																7.2					
	26-Apr-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	91	<5		<20	9	<5
	26-Apr-96	CEC	CEC	8015/8020																58					
	25-Jul-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	52	<5	<5	<20	<5	<5
	25-Jul-96	CEC	CEC	8015/8020																48					
	22-Oct-96	CEC	CEC	8260	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	160	<50	<50	<200	<50	<50
	22-Oct-96	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	190	<5	<5	<20	11	<5
	22-Oct-96	CEC	CEC	8015/8020																190					
	20-Jan-97	CEC	CEC	8260	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	29	<5	<5	<20	<5	<5
	20-Jan-97	CEC	CEC	8015/8020																30					
	24-Apr-97	CEC	CEC	8260A	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	86	<5	<5	<20	7	<5
	24-Apr-97	CEC	CEC	8015/8020																77					
	18-Jul-97	CEC	CEC	8260A	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	60	<5	<5	<20	<5	<5
	18-Jul-97	CEC	CEC	8015/8020																70					
VW-9	28-Jul-95	CEC	CEC	8260	<5	<5	<5	<5	<5	33	<5	6	<5	<5	<5	<5	<5	<5	<5	970	<5	<5	<20	48	<5
	28-Jul-95	CEC	CEC	8015/8020																1100					

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prepared by JJM 1/95 updated 6/97

Well	Date Collected	Sample collection by	Lab	EPA Method	methylene chloride (ug/l)	4-methyl-2-pentanone (ug/l)	MTBE (ug/l)	naphthalene (ug/l)	n-propylbenzene (ug/l)	sec-butylbenzene (ug/l)	styrene (ug/l)	tert-butylbenzene (ug/l)	tetrachloroethane (ug/l)	tetrachloroethane (ug/l)	tetrachloroethene (ug/l)	toluene (ug/l)	1,2,3-trichlorobenzene (ug/l)	1,2,4-trichlorobenzene (ug/l)	1,1,1-trichloroethane (ug/l)	1,1,2 trichloroethane (ug/l)	trichloroethene (ug/l)	trichlorofluoromethane (ug/l)	1,2,3-trichloropropane (ug/l)	1,2,4-trimethylbenzene (ug/l)	1,3,5-trimethylbenzene (ug/l)
MW-4	18-Oct-95	CEC	CEC	8260	<5	<20		65	110	13	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	530	91
continued	18-Oct-95	CEC	CEC	8015/8020												5.4									
	30-Jan-96	CEC	CEC	8260	<5	<20		85	89	10	<5	<5	<5	<5	<5	12	<5	<5	<5	<5	<5	<5	<5	500	120
	30-Jan-96	CEC	CEC	8015/8020												12									
	26-Apr-96	CEC	CEC	8260	<5	<20	<5	45	61	7	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	15	<5	<5	270	69
	26-Apr-96	CEC	CEC	8015/8020												3.6									
	25-Jul-96	CEC	CEC	8260	<5	<20	<5	32	39	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	22	<5	<5	180	44
	25-Jul-96	CEC	CEC	8015/8020												0.6									
	22-Oct-96	CEC	CEC	8260	<50	<200		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	240	50
	22-Oct-96	CEC	CEC	8260	<5	<20		36	38	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	22	<5	<5	220	47
	22-Oct-96	CEC	CEC	8015/8020												1.2									
	20-Jan-97	CEC	CEC	8260	<10	<40	<10	70	110	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	500	90
	20-Jan-97	CEC	CEC	8015/8020												2.8									
	24-Apr-97	CEC	CEC	8260A	<5	<20	<5	17	35	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	15	<5	<5	140	39
	24-Apr-97	CEC	CEC	8015/8020												1.2									
	18-Jul-97	CEC	CEC	8260A	<50	<200	<50	110	140	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	670	190
	18-Jul-97	CEC	CEC	8015/8020												4									
OB-1	21-Jun-94	CEC	ARC	8260	<1.0			>1.0 & <5.0	5.4	1.0 & >5.	<1.0	<1.0	<1.0	<1.0	<1.0	1.0 & <5.	<1.0	<1.0	<1.0	<1.0	31	<1.0	<1.0	1.0 & <5.	<1.0
	21-Jun-94	CEC	ARC	8015																					
	21-Jun-94	CEC	CEC	8260	<5	<20		<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	42	<5	<5	<5	<5
	21-Jun-94	CEC	CEC	8015																					
	20-Oct-94	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	66	<5	<5	<5	<5
	20-Oct-94	CEC	CEC	8015/8020												3.3									
	25-Jan-95	CEC	CEC	8260	<5	<20		<5	11	<5	<5	<5	<5	<5	<5	39	<5	23	<5	<5	27	<5	<5	<5	<5
	25-Jan-95	CEC	CEC	8015/8020												29									
	26-Apr-95	CEC	CEC	8260	<5	<20		<5	8	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	57	<5	<5	5	<5
	26-Apr-95	CEC	CEC	8015/8020												3.4									
	30-Jun-95	CEC	CEC	8260	<5	<20		<5	11	<5	<5	<5	<5	<5	<5	7	<5	<5	<5	<5	55	<5	<5	8	<5
	30-Jun-95	CEC	CEC	8015/8020												7									
VW-5	30-Jun-95	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020												<0.3									
VW-6	30-Jun-95	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jun-95	CEC	CEC	8015/8020												<0.3									
VW-8	28-Jul-95	CEC	CEC	8260	<5	<20		46	57	6	<5	<5	<5	<5	<5	44	<5	<5	<5	<5	<5	<5	<5	270	61
	28-Jul-95	CEC	CEC	8015/8020												570									
	18-Oct-95	CEC	CEC	8260	<5	<20		32	45	<5	<5	<5	<5	<5	<5	11	<5	<5	<5	<5	<5	<5	<5	170	21
	18-Oct-95	CEC	CEC	8015/8020												0.3									
	30-Jan-96	CEC	CEC	8260	<5	<20		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	30-Jan-96	CEC	CEC	8015/8020												1.5									
	26-Apr-96	CEC	CEC	8260	<5	<20	<30	18	25	<5	<5	<5	<5	<5	<5	41	<5	<5	<5	<5	<5	<5	<5	91	93
	26-Apr-96	CEC	CEC	8015/8020												31									
	25-Jul-96	CEC	CEC	8260	<5	<20	<5	<5	10	<5	<5	<5	<5	<5	<5	<5	<5	10	<5	<5	<5	<5	<5	<5	<5
	25-Jul-96	CEC	CEC	8015/8020												3									
	22-Oct-96	CEC	CEC	8260	<50	<200	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	22-Oct-96	CEC	CEC	8260	<5	<20		6	35	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	22-Oct-96	CEC	CEC	8015/8020												3.9									
	20-Jan-97	CEC	CEC	8260	<5	<20	<5	5	9	<5	<5	<5	<5	<5	<5	7	<5	<5	<5	<5	<5	<5	<5	29	9
	20-Jan-97	CEC	CEC	8015/8020												6.8									
	24-Apr-97	CEC	CEC	8260A	<5	<20	<5	15	17	<5	<5	<5	<5	<5	<5	16	<5	<5	<5	<5	<5	<5	<5	67	21
	24-Apr-97	CEC	CEC	8015/8020												12									
	18-Jul-97	CEC	CEC	8260A	<5	<20	<5	9	10	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	28	6
	18-Jul-97	CEC	CEC	8015 8020												2.1									
VW 9	28-Jul-95	CEC	CEC	8260	<5	<20		240	120	9	<5	<5	<5	<5	<5	2600	<5	<5	<5	<5	<5	<5	<5	650	190
	28-Jul-95	CEC	CEC	8015 8020												3500									

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Well	Date Collected	Sample collection by	Lab	EPA Method	vinyl acetate (ug/l)	vinyl chloride (ug/l)	xylenes (ug/l)	o-xylene (ug/l)	p,m xylenes (ug/l)	TPH gasoline (ug/l)	TPH EPA 8015 gasoline (ug/l)	TPH diesel (ug/l)	Remarks	Data Source
MW-4 *continued*	18-Oct-95	CEC	CEC	8260	<10	<5		17	250					
	18-Oct-95	CEC	CEC	8015/8020				10	190		5900			
	30-Jan-96	CEC	CEC	8260	<10	<5		110	330					
	30-Jan-96	CEC	CEC	8015/8020				110	380		5900			
	26-Apr-96	CEC	CEC	8260	<10	<5		15	160				MTBE added to EPA 8260 analytes	
	26-Apr-96	CEC	CEC	8015/8020				17	170		5400			
	25-Jul-96	CEC	CEC	8260	<10	<5		11	110					
	25-Jul-96	CEC	CEC	8015/8020				12	95		4300			
	22-Oct-96	CEC	CEC	8260	<100	<50		<50	170				Lab contamination. See lab narrative for higher detection limits.	
	22-Oct-96	CEC	CEC	8260	<5	<5		6	140				Rerun of EPA 8260. See case narrative.	
	22-Oct-96	CEC	CEC	8015/8020				9.3	170		4800			
	20-Jan-97	CEC	CEC	8260	<10	<10		10	180				Lab note. Dilution necessary for quantitation.	
	20-Jan-97	CEC	CEC	8015/8020				10	210		6400			
	24-Apr-97	CEC	CEC	8260A	<20	<5		8	99					
	24-Apr-97	CEC	CEC	8015/8020				8.5	120		4100			
	18-Jul-97	CEC	CEC	8260A	<200	<50		<50	580					
	18-Jul-97	CEC	CEC	8015/8020				45	480		6400			
OB-1	21-Jun-94	CEC	ARC	8260		<1.0		>1.0 & <5.	6.6					
	21-Jun-94	CEC	ARC	8015							2800			
	21-Jun-94	CEC	CEC	8260	<10	<5		<5	7					
	21-Jun-94	CEC	CEC	8015							1600			
	20-Oct-94	CEC	CEC	8260	<10	<5		<5	<5					
	20-Oct-94	CEC	CEC	8015/8020				0.9	5		2600			
	25-Jan-95	CEC	CEC	8260	<10	<5		21	45					
	25-Jan-95	CEC	CEC	8015/8020				15	35		3900			
	26-Apr-95	CEC	CEC	8260	<10	<5		<5	8					
	26-Apr-95	CEC	CEC	8015/8020				2	6.2		2400			
	30-Jun-95	CEC	CEC	8260	<10	<5			15					
	30-Jun-95	CEC	CEC	8015/8020				3.1	13		2600		Lab note-Purgeable hydroc. do not match typical gasoline pattern	
VW-5	30-Jun-95	CEC	CEC	8260	<10	<5		<5	<5					
	30-Jun-95	CEC	CEC	8015/8020				<0.4	<0.4		<50			
VW-6	30-Jun-95	CEC	CEC	8260	<10	<5		<5	<5					
	30-Jun-95	CEC	CEC	8015/8020				<0.4	<0.4		<50			
VW-8	28-Jul-95	CEC	CEC	8260	<10	<5		130	210					
	28-Jul-95	CEC	CEC	8015/8020				89	180		5300			
	18-Oct-95	CEC	CEC	8260	<10	<5		31	69					
	18-Oct-95	CEC	CEC	8015/8020				<0.4	<0.4		500		Laboratory suggested inhomegenity of vials (see Clayton report)	
	30-Jan-96	CEC	CEC	8260				<5	<5					
	30-Jan-96	CEC	CEC	8015/8020				2.6	2.9		50		Laboratory suggested heterogenous sample. (see Clayton report)	
	26-Apr-96	CEC	CEC	8260	<10	<5		49	120				MTBE added to EPA 8260 analytes	
	26-Apr-96	CEC	CEC	8015/8020				35	80		1400			
	25-Jul-96	CEC	CEC	8260	<10			<5	<5					
	25-Jul-96	CEC	CEC	8015/8020				0.9	3.6		800			
	22-Oct-96	CEC	CEC	8260	<100	<50		<50	<50				Lab contamination. See lab narrative for higher detection limits.	
	22-Oct-96	CEC	CEC	8260	<5	<5		<5	<5				Rerun of EPA 8260. See case narrative.	
	22-Oct-96	CEC	CEC	8015/8020				1.0	6.8		2300			
	20-Jan-97	CEC	CEC	8260	<5	<5		14	41					
	20-Jan-97	CEC	CEC	8015/8020				15	42		620			
	24-Apr-97	CEC	CEC	8260A	<20	<5		26	86					
	24-Apr-97	CEC	CEC	8015/8020				24	78		960			
	18-Jul-97	CEC	CEC	8260A	<20	<5		<5	27					
	18-Jul-97	CEC	CEC	8015/8020				2.1	29		680			
VW-9	28-Jul-95	CEC	CEC	8260	<10	<5		1100	1900					
	28-Jul-95	CEC	CEC	8015/8020				1200	2400		32000			

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APPENDIX C

C1.0 Executive Summary

The procedures of the Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, E 1739-95, (ASTM, 1995) have been performed for a release site at the Ingersoll-Rand Equipment Sales facility, (Facility) San Leandro, California. The Risk-Based Corrective Action (RBCA) is a guide for decision-making in response to petroleum releases.

This RBCA addresses the conditions related to a 1989 leak from a Facility underground gasoline storage tank (Site). The RBCA process identifies exposure and potential human health effects for people at and near the Site. The Facility is located in a heavily industrialized portion of San Leandro and the nearest residences are more than 1,500 feet to the west of the Site.

California Regulation 12711(b) cites that an excess cancer in an exposed population of 100,000 (10^{-5}) constitutes a no significant risk level. California Environmental Protection Agency guidance Preliminary Endangerment Assessment (PEA) states that a risk estimate greater than 10^{-6} may pose a significant threat to human health. The National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) states: "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6}." The RBCA Standard Guide indicates that there is compelling regulatory, risk estimate and actuarial information to support a de minimus risk level of 10^{-5}. To provide an initial conservative screening level for potential risks and for consistency with the PEA guidance, an excess lifetime cancer risk level of 10^{-6} was chosen as the target risk level.

The leaking underground storage tank was removed in 1989. Gasoline in the soil has been remediated with a soil vapor extraction system. It was estimated that approximately 250 gallons were released into the soil. In addition, an estimate of up to 296 gallons were removed with the soil vapor extraction system. Gasoline constituents remain in the subsurface soils at the Site. These remaining gasoline concentrations in the soil represent a residual source. For the purposes of the RBCA, residual gasoline constituents, including benzene, ethylbenzene, toluene and xylene, constitute the compounds of concern in the subsurface soils (>3 feet) and shallow ground water.

The conceptual model for the Site describes potential complete exposure pathways from the residual source to receptors. Primary potential receptors include individuals exposed both indoors and outdoors to vapors from the gasoline-containing soils and shallow ground water. There are no onsite or nearby ground water receptors, so this pathway is incomplete. There are also no identified surficial soils at the Site, so the soil pathway is also incomplete.
From a human health viewpoint, benzene was shown to be the primary constituent of concern. Using the Tier II models in the RBCA, the total excess lifetime cancer risk is calculated to be 4.5×10^{-6}. The major contributor to this risk is the potential for inhalation of vapors in an

enclosed area. The model used for inhalation estimates was very conservative. Additionally, the model assumes that the vapor source is immediately under the enclosed space. In the case of the Site, the former tank area is out of doors. See the maps in Section C11.0. For assessment purposes, it was assumed that the Site was directly beneath an enclosed space. All of the other calculated risks and hazard indices were all within acceptable risk ranges. However, given the conservative nature of risk calculation models, the position of the Site in relation to the adjacent building and the building's construction, the inhalation exposure and resulting calculated risks are probably overestimated.

C2.0 Site Description

Ingersoll Rand Equipment Sales operates a construction equipment sales and maintenance facility at 1944 Marina Boulevard, San Leandro, Alameda County, California. The eastern shore of San Francisco Bay is approximately 1.25 miles west of the Facility. The local topography around the Facility is fairly flat, sloping gently toward the bay. Facility land surface elevations range from 25 to 30 feet above sea level. See the maps in Section C11.0.

The Facility is situated in an area of industrial and commercial development. It is bounded on the north by Southern Pacific railroad tracks and on the south by Marina Boulevard. Immediately to the west of the Facility is a manufacturer of packaging materials. To the east is an office filing equipment manufacturer. The office equipment manufacturing facility closed during the first half of 1996. The Facility has perimeter fencing. The closest residences are more than 1,500 feet west of the Facility. See Facility and Site photographs in Section C12.0.

The property's building has two tenants. The closed office filing equipment manufacturer occupies the eastern portion of the building. I-R occupies the western portion of the building, which consists of an office and parts distribution area attached to a large bayed service area. To the north and west of the building is an outdoor equipment storage yard. The stored equipment includes both new and used construction machinery. Drilling rigs, compressors, compactors, and other construction equipment are commonly stored in this area while being readied for sale, repair, rental, and salvage. The IR portion of the building has 28,500 square feet of shop space and 3,500 of office area.

Adjacent to the Facility building is the Site, a former 5,000-gallon underground storage tank location. The Site is approximately 15 feet from the main building and adjoins a small attached shed to the main building. The Site is paved with concrete. To the west, the ground surface is unpaved.

C3.0 Site Ownership and Use

I-R has leased the property since 1969. During that time, the property has been used as a sales, service and repair center for large construction and drilling equipment.

C4.0 Past Releases

In 1955 (or 1969), two USTs were installed; a 5,000-gallon unleaded gasoline tank, and a 10,000-gallon diesel tank. In 1969(?), a 500-gallon used oil tank was installed. All tanks passed biennial tank testing in 1987; however, during the 1989 testing, the unleaded gasoline tank was found to be leaking. All of the tanks were subsequently removed in October 1989.

Soil samples collected from the overburden removed from all three tanks contained detectable levels of hydrocarbons. No petroleum hydrocarbons were detected in soil samples collected from beneath the waste oil and diesel tanks. Total petroleum hydrocarbon as gasoline (TPH-g) levels of 7,770 and 3,200 milligrams/kilogram (mg/kg) were found in samples obtained from beneath the gasoline tank.

In May 1989, an Unauthorized Underground Storage Tank Release Report was submitted to the San Leandro Fire Department. Site investigation activities commenced in 1989 under the direction of IT Corporation (IT).

In November 1989, three ground water monitoring wells, MW-1, MW-2, and MW-3, were installed on the site. Additionally, seven soil borings were installed in the immediate vicinity of the previously removed gasoline UST. The analytical results found hydrocarbons in an area around the location of the former gasoline UST. Approximately 3 millimeters of floating product was found during the installation of monitoring well MW-3. Free product has not been seen at the site since this 1989 occurrence.

C5.0 Summary of Current and Completed Site Activities

On December 20, 1989, a Problem Assessment Report (PAR) was submitted to Alameda County and the Regional Water Quality Board (ITES, 1989). The PAR summarized the tank removal, monitoring well installation, and soil boring findings. The PAR also proposed soil venting with carbon filtration of effluent air to remove gasoline constituents from the soil above the water table. This proposal was accepted by the Alameda County Department of Environmental Health on June 4, 1990.

During October 1990, 12 additional soil borings were installed. Four of the borings were completed as soil vapor extraction (SVE) wells. A fourth ground water monitoring well, MW-4, was installed near the west boundary of the property, approximately 200 feet west of the former UST to evaluate ground water conditions hydraulically downgradient from the UST. The analytical results from the soil borings and the monitoring well detected gasoline constituents in both soils around the former gasoline UST and in the ground water.

Aquifer and SVE tests were also conducted. The investigators reported a drought period for the area and indicated that low well yields in wells MW-3 and MW-4 may have been due, in part, to the low rainfall period. The SVE test indicated a radius of influence of over 100 feet. The work efforts were summarized in a Data Summary Report (IT, 1990).

In 1992, IT installed a SVE system using one vent well with a 100 standard cubic feet per minute (scfm) design flow rate to remove hydrocarbons from the unsaturated soils. An air permit was obtained for the system and removed vapors were treated through a two-stage carbon bed system. System operation was discontinued after several months when water levels rose and the system collected condensate. IT reported that 800 pounds of product were removed during the initial operation although there is no supporting information for this statement.

In April 1992, eight cone penetrometer tests were performed and temporary wells were installed in the test holes. Four of these wells were installed off site, on the Page Packaging site to the west of IRES. Soil vapor samples and ground water samples were collected from several of the wells. These samples indicated downgradient off-site total petroleum hydrocarbon (TPH) levels of 680 to 53,000 micrograms/liter (mg/l) as compared to levels of 2,600 mg/l in MW-3 near the former gasoline UST.

In September 1992, an 8-inch diameter ground water extraction well, RW-1, and three observation wells were installed in the low permeability saturated sediments near the western property border. A pump test indicated that the well yield was limited, but could be increased through the use of vacuum to approximately 1 gallon per minute (gpm).

In November 1994, five additional SVE vents were installed. These vents were installed to provide the SVE system with flexibility in vacuum configuration over a larger area, including the downgradient property boundary.

In March 1995, Alameda County directed I-R to conduct additional ground water assessment work as part of remedial activities to determine the extent of downgradient gasoline-impacted ground water. The additional assessment work was conducted in June and July 1995. The work included push probe-type borings and ground water sampling. The assessment findings were reported in the October 1995 Quarterly Report.

In May 1995, SVE testing was conducted on all vent wells except VW-2. The testing results were used as the basis for a redesign of the SVE system. Construction of the redesigned system began in mid-September and was completed in early October. The original regenerative vacuum blower, which is connected to four vent wells and three carbon vessels, describes the redesigned system.

The redesigned SVE system became operational during October 1995. The system generally operates during the normal work week when facility personnel are available to perform permit-required daily air monitoring.

The facility received a December 8, 1995, letter from the State Water Resources Control Board, regarding interim guidance, in light of the October 1995 Lawrence Livermore National Laboratory report on leaking USTs. Additional supplemental instructions, prepared by the San Francisco Bay Region, California Water Quality Control Board, to the December 8 letter were received by the facility on March 15, 1996. (See Appendix A.)

After June 1997 SVE system testing, a September 1997 recommendation for system closure and supporting documentation was submitted to Alameda County.

Quarterly ground water monitoring is also being performed. The analytical results are submitted in quarterly reports to Alameda County.

C6.0 Regional Hydrogeologic Setting

The facility lies within the East Bay Plain. Young, unconsolidated sediments of Pleistocene and Holocene age, make up the soil materials of the plain. These sediments are up to 1,000 feet thick and rest on Jurassic-aged bedrock. The regional geology is dominated by northwest trending faults of the San Andreas fault system.

The shallow, unconsolidated sediments are comprised of bedded clays, silts, and sands. These sediments have eroded from the hills to the east of the plain and deposited in alluvial cones, similar to deltas. These cones coalesce to form the gently sloping East Bay Plain.

The shallow hydrogeologic setting has also been influenced by the rise and fall of sea level over recent geologic time.

Several investigators have described the near surface hydrogeology of the San Leandro area. Hickenbottom and Muir (1988) describe the near surface deposits as relatively thin deposits of silt and clay, fine sand and silt, and occasional thin beds of coarse sand.

Beneath these younger alluvial deposits is older alluvium comprised of fine to medium grained sands with lenses of silt and clay, and layers of unconsolidated and consolidated clay, silt and sand. In some areas, a unit identified as the bay mud comprised of plastic clay and silt separate the younger and older alluvium.

The more recent Department of Toxic Substance Control (DTSC) investigation, conducted by Woodward-Clyde Corporation (WCC, 1993), of the central San Leandro hydrogeology provides considerable information and discussion on the nature of shallow geologic setting. The existing topography and the collected data suggested to the WCC investigators that very shallow, laterally discontinuous subsurface channels may exist across the San Leandro area. These channels of more permeable sediments may provide preferential pathways for shallow ground water movement. The same report also concludes that an aquitard exists at a depth of 50 to 150 feet below mean sea level.

Recharge to the shallow alluvium occurs primarily from the infiltration of precipitation. Stream flow losses may also contribute to the shallow recharge. Recharge to deeper geologic units appears to occur at higher elevations where these units are nearer the surface. Infiltration from overlying shallower units to lower units appears to be a secondary, minor recharge pathway because of the presence of clay units.

The mean annual precipitation for San Leandro ranges between 18 and 26 inches with the eastern upland areas recording the greater amounts. Hickenbottom and Muir report 22 to 24 inches per year for the project area.

C7.0 Facility Hydrogeologic Setting

During the remedial activities, the Facility's shallow subsurface has been investigated to a depth of 50 feet using both auger borings and cone penetrometer testing. The investigation work was conducted both on and off site.

The Facility's shallow hydrogeologic setting is similar to that described for the general San Leandro area. Subsurface geologic features are the result of sediment deposition in layers. The sediments are composed of silts, clays, and sands. The silts and clays are found in the upper 10 to 15 feet. A sand layer and gravel layer varying in thickness from 3 to 10 feet is found beneath the silt and clay layer. A dense, plastic clay, containing varying amounts of silt and sand, represents the deepest sediments evaluated.

The water table is approximately 12 to 17 feet below the land surface. The shallow ground water in the area of the facility responds directly to seasonal rainfall. Water levels rise in response to higher rainfall in the late winter and early spring, and decline through the lower rainfall periods of summer and fall. Water level elevations in individual monitoring wells respond fairly uniformly. This uniform fluctuation results in generally consistent hydraulic gradients and ground water flow direction over time.

The general ground water flow direction is to the southwest. Seasonally, a flexure appears in the ground water contours. The flexure is a trough-like feature in the contours, trending generally northeast to southwest. The flexure is likely due to the water level rising into an area of higher permeability. The flexure dissipates as water levels decline throughout the late spring and early summer. A ground water elevation map can be found in Section C13.0.

Using site hydraulic gradient and conductivity data, the ground water flow velocity is estimated to range from 40 to 80 feet per year. (See individual quarterly reports for calculations.)

C8.0 Risk Assessment Summary

For the Site, the methods and models from the Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites (ASTM, 1995) were used to characterize the fate and movement, and estimate potential risks of the gasoline constituents in the subsurface. Specifically, the software package, RBCA Tier 2 Toolkit, version 1.0.1, developed by Groundwater Services, Inc. (GSI) was used to perform the RBCA calculations. Additionally, information regarding the indoor risk pathway was provided by Alameda County. See Appendix CA. The Toolkit version 1.0.1 accounts for the concerns presented in the Appendix CA information.

As a note, most of the corrective action activities performed at the site were completed before the issuance of the ASTM Standard, published in November 1995.

C8.0.1 Exposure Pathway and Potential Receptor Identification

Worksheet 4.2 was completed to characterize baseline exposure conditions. Three transport mechanisms were identified: 1) leaching and groundwater transport, 2) volatilization and enclosed space accumulation, and 3) volatilization and atmospheric dispersion.

Volatilization from the residual soil source and shallow ground water is considered a completed pathway. Facility employees work above the residual source, so they could potentially be exposed to outdoor vapors. There is no building directly over the residual soil source or impacted ground water. The building near the source is more than 35 feet high with large overhead doors that are generally left open during work periods. For the purposes of this assessment, the building is considered a potential enclosed space.

Ground water is not considered a completed pathway. No downgradient users of the shallow ground water were identified. Additionally, the Department of Toxic Substance Control has issued an advisory indicating that the shallow ground water beneath San Leandro should not be used for domestic purposes unless tested due to the presence of volatile organic compounds, heavy metals, nitrate and hydrocarbons associated with past land use practices in the area (DTSC, 1991). See Appendix CB.

C8.0.2 Significant Risk Determination

California Regulation 12711(b) cites that excess cancer in an exposed population of 100,000 constitutes a *no significant risk* level. California guidance Preliminary Endangerment Assessment states that a risk estimation greater than 10^{-6} may pose a significant threat to health.

The National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR 300) states: "For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper-bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6}."
To provide an initial conservative screening of risks and for consistency with the PEA guidance, an excess lifetime cancer risk level of 10^{-6} was chosen as the general, target risk level. The general target risk level is 10^{-6}. While setting this target level, it is recognized that the models used in risk assessment are conservative. The combined effect of a 10^{-6} risk level and the inherent model conservatism may result in risk estimates that are overly conservative.

The California Occupational Health and Safety Adminstration permissible emission limits (PELs) for the BETX compounds are: benzene - 1 ppm (3.2 mg/m^3), ethylbenzene - 100 ppm (434 mg/m^3), toluene - 50 ppm (188 mg/m^3), and xylene - 100 ppm (434 mg/m^3).

C8.0.3 Residual Source Estimate

Two estimates on the amount of gasoline in the subsurface *soil* at the time of the 1989 leak were calculated using 1989 soil boring and analytical data. The first estimate uses the mean concentration of gasoline detected in the 1989 samples. The second estimate uses the maximum concentration detected in the samples. The following table presents the two estimates.

	TPH as Gasoline Concentration	**Estimated Gasoline in Subsurface *Soil***
	(µg/kg)	(gallons)
Mean	3093	101
Maximum	7700	252

As a note, there are gasoline consituents in the ground water below the residual subsurface soil source. Using the TPH as gasoline concentrations for MW-3 concentrations during the past year and an estimated volume of impacted water based on the distance from MW-3 to MW-4, an assigned width of 75 feet and a saturated interval of 10 feet, an estimate of gasoline in the ground water was calculated. For comparision purposes, two estimates were prepared. The first estimate was made using the maximum TPH as gasoline concentration of 5,100 µg/l. The estimated volume is 3.1 gallons. The second estimate was made using the mean (last four quarterly results) TPH as gasoline concentration of 2,500 µg/l. The estimated volume is 1.5 gallons.

Using seven percent of the original gasoline volume (.07 x 252 gallons) indicates that there would be 18 gallons of gasoline remaining in the soil. The estimated 1.5 to 3.1 gallons in the ground water does not significantly change the magnitude of the estimated volume of remaining gasoline.

Soil Vapor Extraction Removal Estimate

As part of the recently completed soil vapor extraction system (SVE) closure recommendation for the San Leandro facility (See September 2, 1997 letter to S. Seery, Alameda County), an estimate of the amount of gasoline removed by the SVE system was calculated. The estimated total removed from October 1995 to June 1997 was 153 gallons. Prior work by IT Corporation reported that 143 gallons were removed during the initial operation of the system. Using the two estimates, a total of up to 296 gallons of gasoline has been removed from the subsurface soils.

C8.0.4 Estimate of Residual Concentrations in Soil

The estimated amount of gasoline removed by the SVE system compares favorably with the maximum estimate of the gasoline mass in the subsurface. The estimated 296 gallons removed compares to the 252 gallons in the subsurface soils.

It is commonly accepted that residual gasoline concentrations remain in the soil after SVE extraction. These residual concentrations represent a potential source for human health exposure.

The following procedure was used to estimate the residual gasoline after completion of the SVE operation. (In fact, at the time of this RBCA, the SVE system was still operational.) Three air stream samples taken during SVE operation showed a reduction in vapor TPH concentration discharge from 880,000 μg/kg to 4,200 μg/kg from October 1995 to June 1997. Gasoline constituent concentrations from these three sampling events are listed in the following table. Also listed is the fraction remaining from the constituent's initial October 1995 concentration. (This fraction is referred to as ratio in the table.)

Constituent	**10/3/95 Sampling Result (ug/m^3)**	**10/16/96 Sampling Result (ug/m^3)**	**10/16/96 to 10/3/95 Ratio (A)**	**6/12/97 Sampling Result (ug/m^3)**	**6/12/97 to 10/3/95 Ratio (A)**
benzene	8,500	<840	0.099	<650	0.076
ethylbenzene	11,000	<830	0.075	<700	0.064
toluene	88,000	<1,000	0.011	<910	0.010
TPH as gas	880,000	15,000	0.017	4,200	0.005
xylenes	100,000	920	0.009	<650	0.007

Note:

(A) - Where a result is less than the detection limit, the ratio is formed using the detection limit. Example: benzene < 840, becomes (840/8500) = 0.099

For risk assessment purposes, the residual constituent source is estimated to be a fraction of the initial concentration of gasoline in the soil. The residual soil concentrations are estimated as 0.07 or 7% of the initial soil concentration, measured in 1989 as part of the initial site characterization.

The 7% of the initial soil concentration is a conservative estimate. As the above table indicates, the constituent fractions removed in the soil vapor ranged from .005 to .076. Choosing the largest remaining residual fraction results in a conservative estimate. Additionally, it should be noted that 0.07 represents a maximum amount remaining, since the actual concentration is below the detection limit.

Following are 1989 sample results and the 1989 concentrations multiplied by 0.07 used to characterize the residual soil source.

UST closure

1989 SAMPLE RESULTS

	Sample Number			
Constituent	**BH-1 (mg/kg)**	**BH-5 (mg/kg)**	**4557 (mg/kg)**	**4559 (mg/kg)**
benzene	13	5	39	16
ethylbenzene	13	13	83	35
toluene	53	28	240	110
TPH as gas	400	1,000	7,770	3,200
xylenes	75	75	470	200

MAX conc.

7% of 1989 SAMPLE RESULTS

Constituent	**Multiplier**	**BH-1 (mg/kg)**	**BH-5 (mg/kg)**	**4557 (mg/kg)**	**4559 (mg/kg)**
benzene	0.07	0.9	1.7	2.7	1.1
ethylbenzene	0.07	0.9	0.9	5.8	2.5
toluene	0.07	3.7	2.0	16.8	7.7
TPH as gas	0.07	28.0	70	544.0	224
xylenes	0.07	5.3	5.3	32.9	14

Sample Locations:

BH-1	beneath the building adjacent to the tank
BH-5	bordering the tank excavation
4557	12.5 feet below grade, at end of tank
4559	12.5 feet below grade, at end of tank

C9.0 Risk-based Corrective Action Methods

The methods, equations and models from the Standard Guide for Risk-Based Corrective Action at Petroleum Release Sites (ASTM, 1995) were used to estimate the risk, fate and movement of the gasoline constituents for the San Leandro site. Specifically, the software package, RBCA Tier 2 Toolkit, version 1.0.1, developed by Groundwater Services, Inc. (GSI), was used to perform the calculations. Additionally, information included in Appendix CA, provided by Alameda County, was considered during the work. RBCA Toolkit version 1.0.1 accounts for the concerns raised about the indoor pathway. The enclosed space inhalation is accounted for in version 1.0.1 of the Toolkit.

C9.1 Summary of Tier Evaluation

Site Classification

Following an initial compilation of the site information, the Site was initially classified using the ASTM Site Classification scheme. Because of the uncertainty over the long term threat of the residual soil source, the Site was classified as a "Long term (>2 years) threat to human health, safety or sensitive environmental receptors."

Worksheet 4.2 provides a characterization of the exposure conditions for the Site. Volatilization of volatile organic compounds from the residual soil source and ground water were identified as complete pathways.

A list of values used in the exposure and risk characterization models and equations are described in Appendix CD.

The use of ground water is not a complete pathway. There are no potential receptors.
i.e., ingestion

Tier I & II Evaluation

The I and II evaluations were performed using the GSI software.

The target risk level was set at 10^{-6}.

The GSI software used two different approaches to estimate the volatilization factors within an enclosed space. The two models are the Johnson and Ettinger model and a mass balance model. The smaller volatilization factor is then used to calculate a concentration. See Appendix CD.

For comparison purposes, two runs of the Tier I model were performed. One run of the Tier II model was performed. The spreadsheets for each model run can be found in Appendix CC. The following descriptions summarize the runs.

Tier I-Run 1

To develop Risk Based Screening Levels (RBSLs), the Tier I model was run the first time using the adjusted concentrations (see Section C8.0.4) and the ASTM default parameters for soil, building and ground water conditions. 7% Soil

Tier I-Run 2

For comparison purposes, the Tier I model was run a second time using the 1989 maximum concentrations and the ASTM default parameters for soil, building and ground water conditions. This run provided RBSLs to compare against the RBSLs from the adjusted concentrations in Run 1. Soil

Tier II

To develop Site-specific Target Levels (SSTLs) the Tier II model was run using the adjusted concentrations and available Site-specific values for soil, building and ground water parameters,

but not conc.

and the ASTM default values. Appendix CD lists all values used in the model calculations. Among the site specific parameters were:

- depth to ground water
- enclosed-space volume/infiltration area ratio (using the a 900 cm ceiling height as compared to the default 300 cm)
- depth to impacted soil, thickness of the affected soils,and capillary zone thickness

C9.2 Tier Model Findings

The use of Site-specific parameters in the Tier II run generally lessened the risk levels and raised the SSTLs. This is to be expected. The default parameters in the RBCA Tier I are generally very conservative and, as a result, risk estimates are generally maximized. Using site-specific parameters, the diversity of site types can be factored into the risk estimates. The following table presents a summary of the total pathway risks for the Tier II evaluation.

Tier and Run of Risk Model	**Pathway**	***Total Pathway Excess Lifetime Cancer Risk***	**Hazard Index**
Target Risk Level		*1.0E-6*	*1.0E+0*
Tier II	Outdoor Air	1.5E-8	9.4E-4
	Indoor Air	4.5E-6	2.8E-1
	Groundwater	IP	IP
	Soil	IP	IP

Note: IP-incomplete pathway

C10.0 Analytical Data Summary and RBSLs

The following table summarizes the adjusted (described in C8.0.4) soil data used in RBCA and the calculated RBSLs and SSTLs. While the risk calculations were performed on benzene, ethylbenzene, toluene, and xylene, only the gasoline constituents that exceeded a RBSL or SSTL are listed in this table. All constituents can be found on the worksheets in Appendix CC.

Consistent with the GSI suggested guidelines, the maximum detected soil concentration is used for source characterization and comparison with the target levels. The data can be found in Appendix B.

ground water data?

Tier and Run of Risk Model	Constituent of Concern	Source of Representative Concentration	Representative Concentration (mg/kg)	RBSL (mg/kg)	SSTL (mg/kg)
Subsurface Soil					
Tier I Run 1	benzene	adjusted data	2.7	.079	--
Tier I Run 2	benzene	1989 data	39	.079	--
Tier II	benzene	adjusted data	2.7	--	.62
Tier I Run 1	toluene	adjusted data	17	93	--
Tier I Run 2	toluene	1989 data	240	93	--
Groundwater			(mg/l)	(mg/l)	
Tier I Run 1	benzene	max. '96-'97	.18	1.4	--
Tier I Run 2	benzene	max. '96-'97	.18	.074	--
Tier II	benzene	max. '96-'97	.18	--	1.4

C11.0 Site Location Maps

Following are two figures. Figure C1 is an excerpt of the San Leandro U.S. Geological Survey quadrangle map showing the Facility and surrounding area. Figure C2 shows the Facility and the Site.

Source: San Leandro, California
7 ½ minute Quadrangle
U.S. Geological Survey
Photo revised 1980

Figure C1
Facility Location Map
IRES, San Leandro, CA

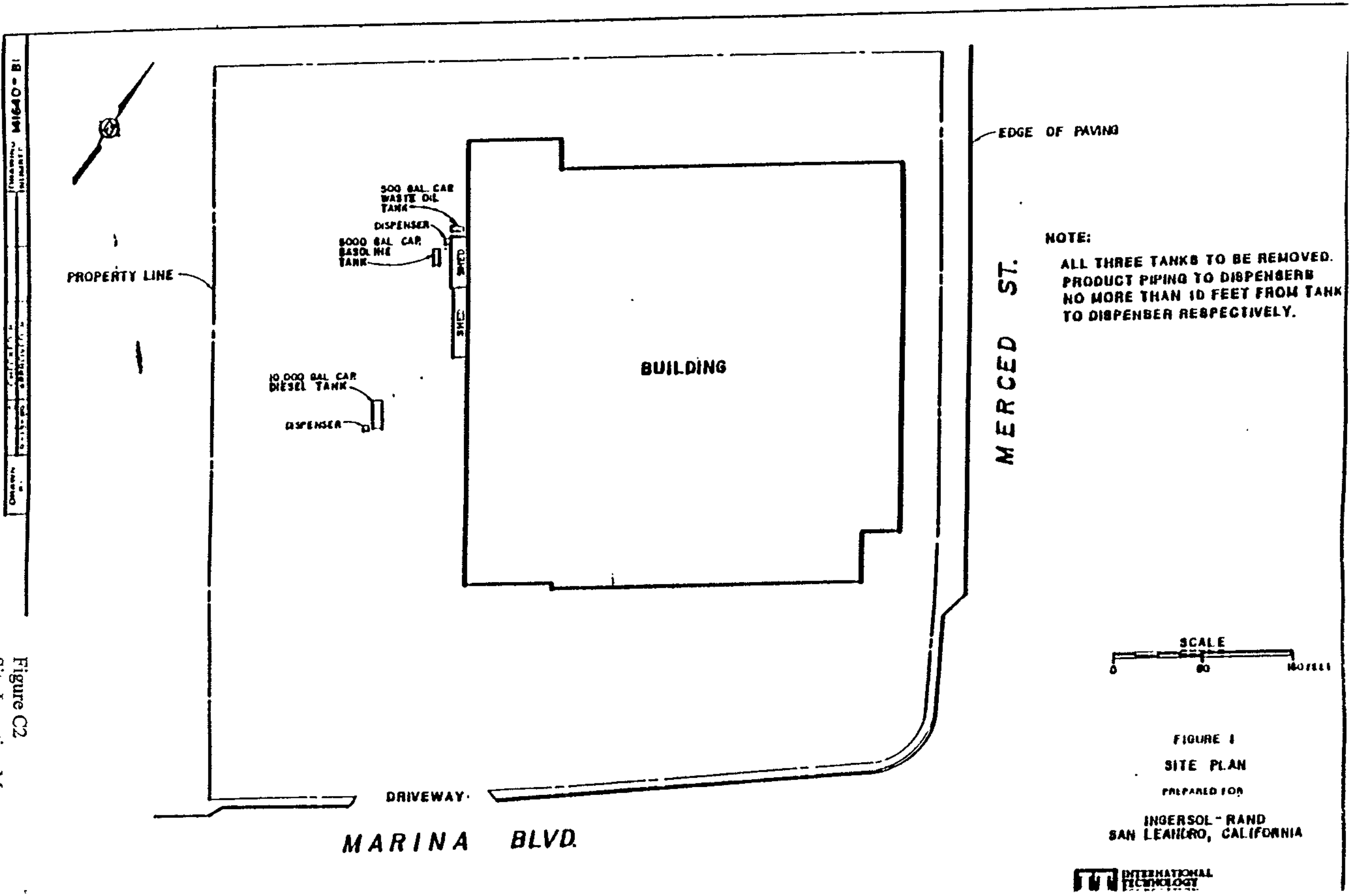


Figure C2
Site Location Map
IRES, San Leandro, CA

C.12.0 Site Photographs

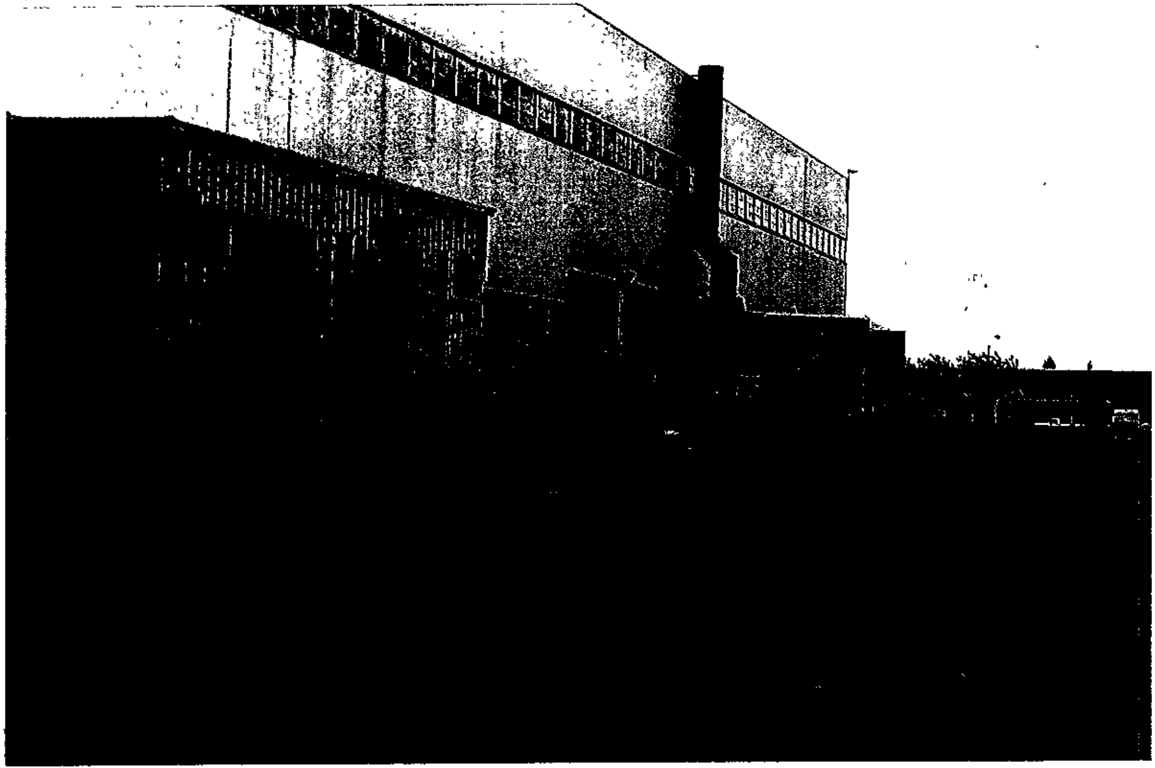
Following are four photographs of the Facility and Site.

Photograph 1 is taken looking southeast. It shows the shop area of the Facility and the Site. Near the center of the photograph, traffic cones mark the general area above the former UST location. The tan metal shed is adjacent to and east of the Site. The main facility building, which is the shop area, is the steel gray building.

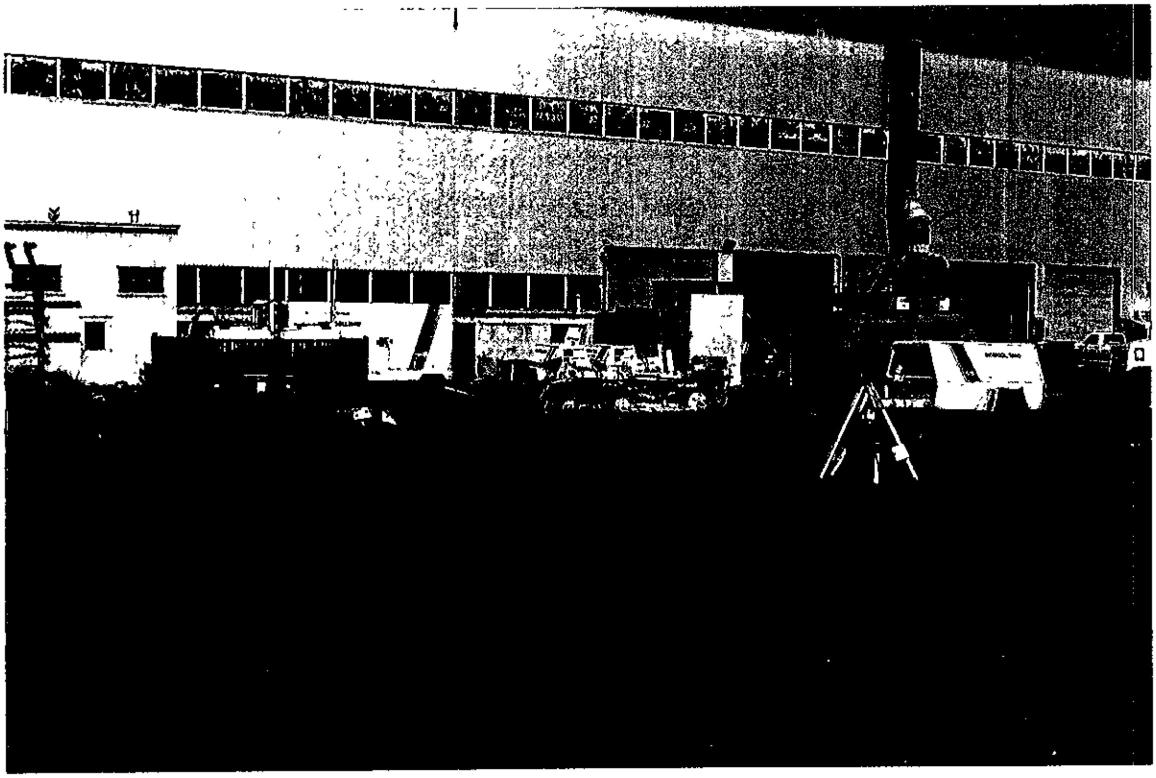
Photograph 2 is taken looking east, showing the shop building. The Site is at the left center of the photograph, in front of the tan shed.

Photograph 3 is taken looking west, showing the adjacent property to the west.

Photograph 4 is taken looking east. The north part of the Facility is to the right of the fence and Southern Pacific railroad tracks are to the left. The jog in the fence, shown in the lower half of the photograph, is a former spur line into the Facility.

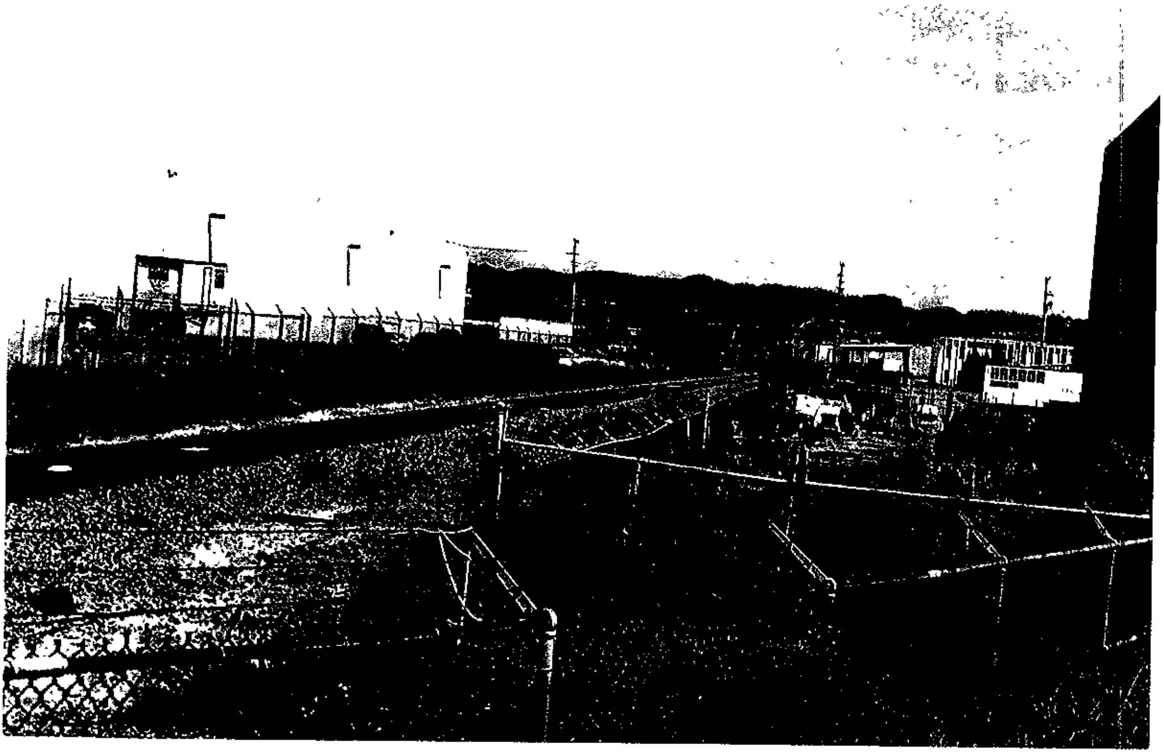


IRES (San Leandro) Photograph 1



IRES (San Leandro) Photograph 2

IRES (San Leandro) Photograph 3



IRES (San Leandro) Photograph 4

C13.0 Ground Water Elevation Map

While the ground water pathway is not complete, for consistency with the RBCA Standard Guide reporting format, Figures C3 and C4 are copies of representative ground water flow maps for the Facility. Figure C3 shows the seasonal flexure that develops during higher water table periods. Figure C4 shows the seasonal conditions during lower water table periods.

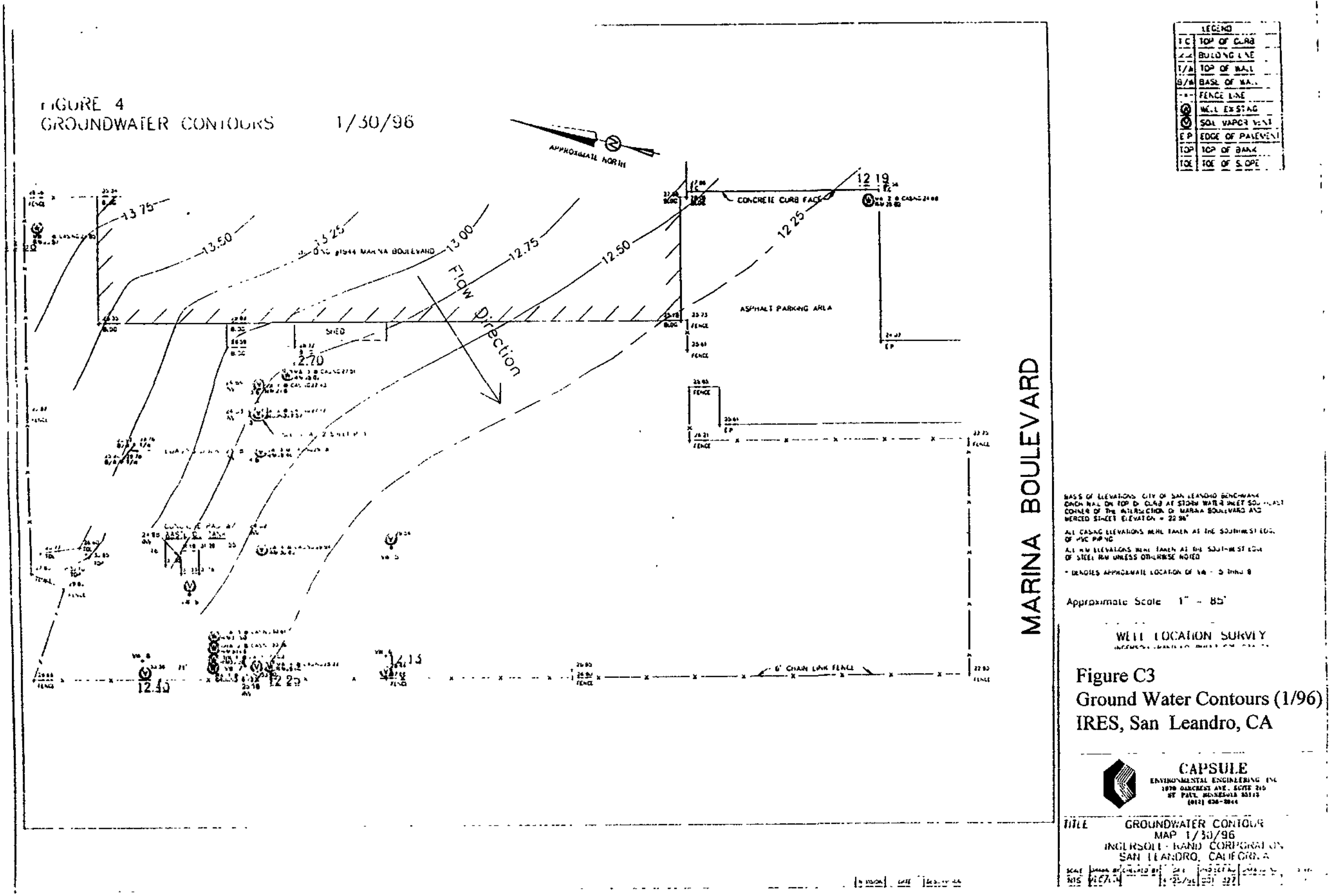
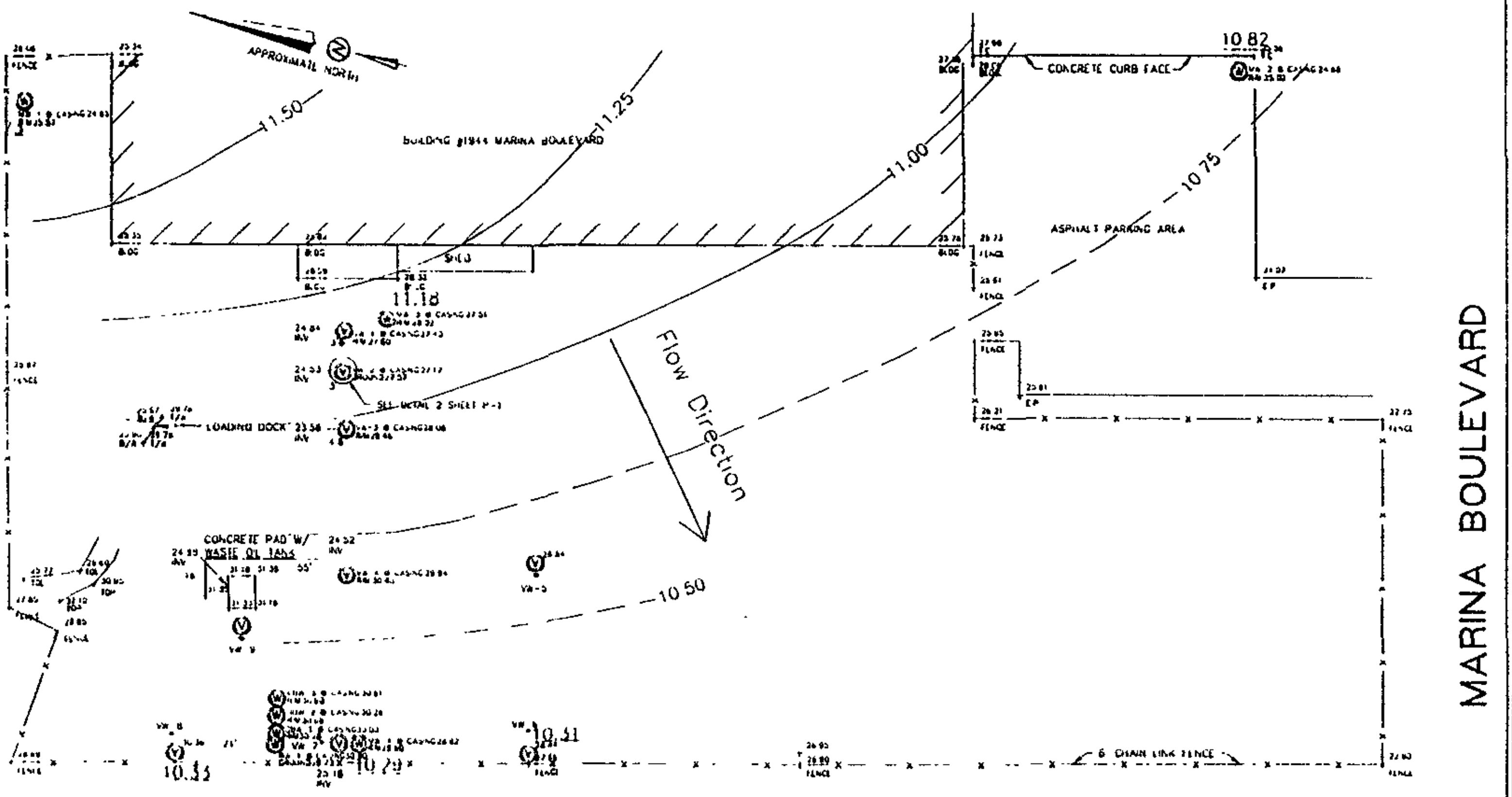


Figure C3
Ground Water Contours (1/96)
IRES, San Leandro, CA

FIGURE 4
GROUNDWATER CONTOURS 10/18/95



	LEGEND
TC	TOP OF CURB
⟋⟋	BUILDING LINE
T/W	TOP OF WALL
B/W	BASE OF WALL
-x-	FENCE LINE
Ⓦ	WELL EXISTING
Ⓥ	SOIL VAPOR VENT
EP	EDGE OF PAVEMENT
TOP	TOP OF BANK
TOE	TOE OF SLOPE

BASIS OF ELEVATIONS: CITY OF SAN LEANDRO BENCHMARK CINCH NAIL ON TOP OF CURB AT STORM WATER INLET SOUTH EAST CORNER OF THE INTERSECTION OF MARINA BOULEVARD AND MERCED STREET ELEVATION = 22.96'

Figure C4
Ground Water Contours (10/95)
IRES, San Leandro, CA

WELL LOCATION SURVEY
INGERSOLL RAND EQUIPMENT CORPORATION
LOCATED AT 1944 MARINA BOULEVARD
CITY OF SAN LEANDRO, COUNTY OF ALAMEDA CALIFORNIA
JUNE 1994

MORAN ENGINEERING
CIVIL ENGINEERS & LAND SURVEYORS
[illegible]
BERKELEY CALIFORNIA
[illegible]
[illegible]

CAPSULE
ENVIRONMENTAL ENGINEERING INC
1970 OAKCREST AVE SUITE 215
ST PAUL, MINNESOTA 55113
(612) 636-2644

TITLE GROUNDWATER CONTOUR MAP 10/18/95
INGERSOLL-RAND CORPORATION
SAN LEANDRO, CALIFORNIA

SCALE	DRAWN BY	CHECKED BY	DATE	PROJECT NO	DRAWING NO
NTS	[illegible]		2/7/96	[illegible] 377	

C14.0 Geologic Cross Sections

Figure C5 is a geologic cross section prepared by IT Corporation.

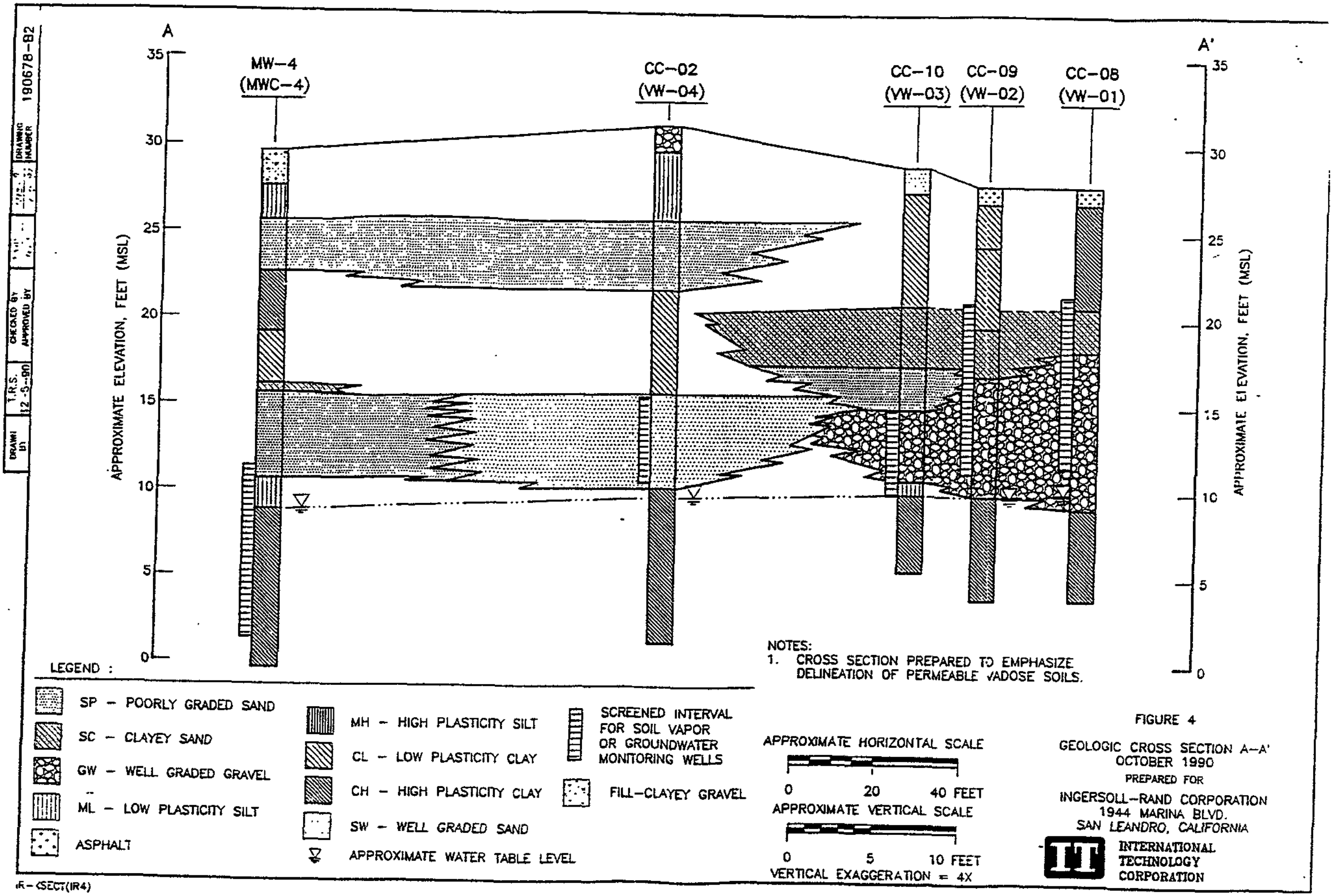


Figure C5
Geologic Cross Section
IRES, San Leandro, CA

C15.0 Findings

- Benzene is the primary constituent of concern. It was the only constituent to exceed either the Subsurface soil or Ground Water SSTL.
- Use of the RBCA method has identified vapor migration to enclosed space as the critical pathway.
- The subsurface soil representative concentration for benzene is 2.7 mg/kg and exceeds the SSTL of 0.62 mg/kg for a target risk level of 10^{-6}.
- The representative concentration for benzene is considered conservative. Adjusted concentrations were used in the model.
- The mass balance approach is the more reasonable of the two models to calculate volatile ratio factors. It assumes that subsurface source is depleted as volatilization occurs. The mass balance model is conservative.
- Although the area of concern is out of doors, for risk assessment purposes, it was assumed that the building overlaid the source.
- The benzene total indoor air pathway excess lifetime cancer risk is 4.5×10^{-6}. This risk level is within the general NCP acceptable risk range of 10^{-4} to 10^{-6}. It is also lower than the previously cited California regulatory level of 10^{-5}. It exceeds the PEA guidance level of 10^{-6}.
- The California OSHA permissible exposure limit for benzene is 1 ppm (3.2 mg/m^3). The recommended action level 0.5 ppm (1.5 mg/m^3). The calculated benzene exposure concentration in the enclosed space is 0.002 mg/m^3.

C15.1 Conclusions

- Soil vapor extraction action activities have removed an estimated 296 gallons of gasoline from the soil.
- A residual source remains in the subsurface soils beneath the former outdoor tank site.
- California regulation and guidance cites acceptable risks of 10^{-5} and 10^{-6}. Federal guidance on acceptable risk ranges from 10^{-4} to 10^{-6}. The RBCA method suggests a level of 10^{-5}.
- The calculated air exposure level is significantly less than the OSHA standard for benzene.
- The residual source does not underlie an enclosed structure.

- The building has several large overhead doors that are generally opened during work periods. Given the building height and doors, it is not a "tight" enclosed space as envisioned by either the enclosed space model or risk assessment guidance.

- Given the risk estimates, the cited acceptable risk ranges, and the conservative nature of the indoor air model, and the building itself, the residual soil source does not represent a significant risk to human health.

Chevron

Research and
Technology

7/8/96

MEMORANDUM

TO: Groundwater Services, Inc., Tier 2 RBCA Tool Kit Users

FROM: Michele Emerson
CTN 2-3365

RE: Misleading Information

This memo is for all persons using the Groundwater Services, Inc. Tier 2 RBCA Tool Kit. Last week it was brought to the attention of Curt Peck and myself that the baseline risk estimates presented in Worksheet 8.3 do not include risks for the inhalation of VOCs within enclosed space air. That is, the risk estimates provided for the "air exposure pathways" do not include those risks attributable to inhalation of VOCs from either subsurface soil or groundwater. However, if you select "volatiles and particulate inhalation" and "volatilization to outdoor air" as complete exposure pathways these risk estimates may be provided. If only volatilization from either subsurface soil or groundwater to enclosed space are selected, no risk estimates will be provided for air exposure pathways.

I called GSI last week and was informed that:

- An ASTM committee reviewed the GSI software system and they only "required" that the system include the means to estimate pathway-specific RBSLs and SSTLs.
- GSI added baseline risks to the software system as an "add on".
- GSI elected not to include the inhalation of VOCs within enclosed spaces due to the large degree of uncertainties associated with partitioning.
- The person I spoke with on July 3 (Tariq) said that you cannot alter the present EXCEL spreadsheets to incorporate the pathway, however you could set up your own EXCEL spreadsheet and link it to the system.
- He also recommended the following simple procedure to derive baseline risks for the indoor air pathways:

  SSTL / Target Risk = Source Concentration / Baseline Risk

  Given that pathway-specific SSTLs are available for inhalation of VOCs within indoor air, see Worksheet 9.2, you can essentially derive baseline risk estimates using the relationship above. For example, given an SSTL = 1.5 mg/kg corresponding to 10^{-4} excess cancer risk and a representative subsurface soil source concentration of 0.43 mg/kg, the resulting baseline risk for soil volatilization to indoor air is calculated as follows:

$1.5 \text{ mg/kg} / 10^{-4} = 0.43 \text{ mg/kg} / x$

$x = 2.9 \times 10^{-5}$

Similarly, given an SSTL of 1.1 mg/L corresponding to 10^{-4} excess cancer risk and a representative groundwater source concentration of 0.068 mg/L, the resulting baseline risk for groundwater volatilization to indoor air is calculated as follows:

$1.1 \text{ mg/kg} / 10^{-4} = 0.068 \text{ mg/kg} / y$

$y = 7.4 \times 10^{-6}$

Therefore, given a site with both soil and groundwater potential exposure sources the excess cancer risk due to inhalation VOCs in an enclosed space is equal to x + y, or $2.9 \times 10^{-5} + 7.4 \times 10^{-6} = 3\overset{6}{.}4 \times 10^{-5}$. This value must be manually added to the Tier 2 RBCA system on Worksheet 8.3 via the EXCEL Workbook. Note, if your estimates already show air exposure pathway risks, then these risks are attributable to particle inhalation and/or inhalation of outdoor air.

It is also noteworthy to mention that "Critical Exposure Pathway" risks are <u>not</u> total risk estimates. Your best bet is to sum the risk estimates for all exposure pathways, again using EXCEL Workbook, and then manually change the words "Critical Exposure Pathway" to "Multipathway".

Both Curt and myself verified that using this simple relationship approach results in the same risk estimates as using the volatilization factor equations, CM-4 and CM-6, on Page A-12 in the guidance manual. In other words, it appears that the appropriate equations were used to derive RBSLs and SSTLs, but were not used to estimate risks.

Please past along this information to other Chevron users of this software system.

WELL TESTING INFORMATION FACT SHEET

California Environmental Protection Agency
Department of Toxic Substances Control
Region 2

San Leandro, California

October 1991

This fact sheet was created by the State Department of Toxic Substances Control (DTSC), formerly the Department of Health Services (DHS), at the request of San Leandro well owners and well users. The purpose of this fact sheet is to provide information on well water testing to the San Leandro community.

BACKGROUND

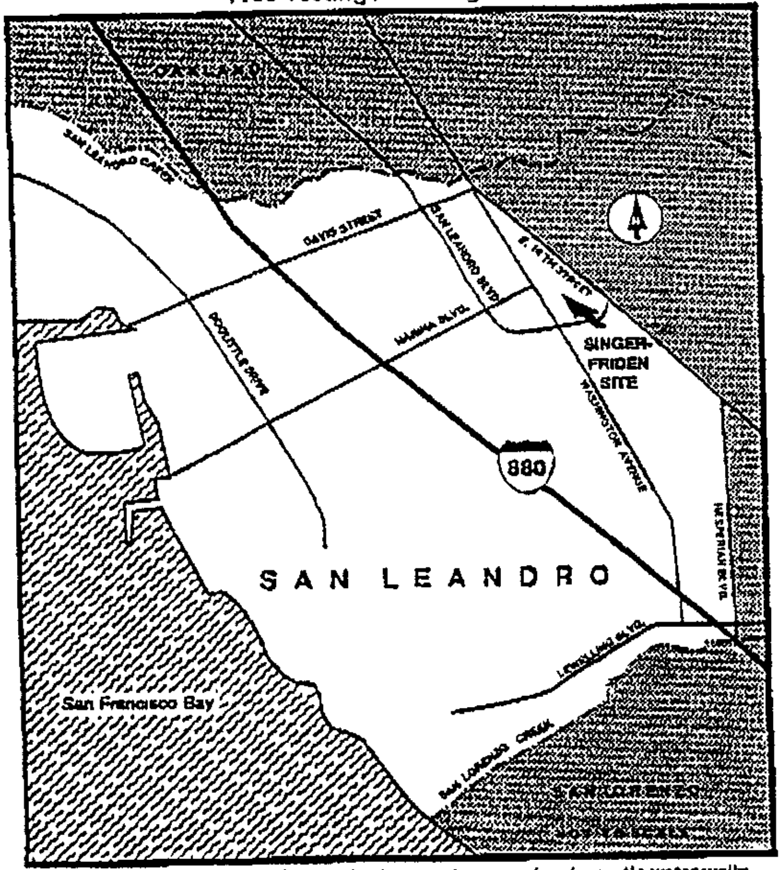
Investigations conducted by DTSC at several hazardous waste sites in San Leandro have confirmed that a regional shallow groundwater problem exists in central San Leandro. Chemicals have been found in shallow groundwater at several locations in San Leandro, at concentrations above State drinking water standards. These chemicals include volatile organic compounds, heavy metals, nitrate, and hydrocarbons. Exposure to these hazardous chemicals may cause cancer or contribute to other health problems. The purpose of the regional shallow groundwater investigation currently in progress is to further define the extent of contamination in San Leandro and to provide information necessary to designing cleanup plans.

Volatile organic compounds (VOCs) include industrial solvents and cleaners. VOCs readily change from liquid to gaseous form and are absorbed through the skin and inhaled during showering and bathing. Therefore, domestic well users whose wells are contaminated with VOCs may be getting a triple dose of VOC contamination (through drinking, inhaling, and skin absorption). Toxic heavy metals, such as lead, chromium and cyanide, are industrial by-products. Some metals can also occur naturally in soil and groundwater. Nitrate is a common component of fertilizer, including manure. Nitrate in San Leandro groundwater may be due to the overuse of fertilizers on home gardens and lawns and in landscaping. Young children, pregnant women and developing fetuses are especially sensitive to nitrate. Nitrate may interfere with the transfer of oxygen through blood, causing "methemoglobinemia," commonly called "blue-baby disease." Hydrocarbons include petroleum products, such as gasoline and diesel, and oil and grease.

Sites under investigation by DTSC in San Leandro include: Singer-Friden, Caterpillar, Factor Avenue, 139th Avenue, Hudson ICS and Staefa. For more information on these sites, refer to the Singer-Friden Site Briefing Package (February 1991), which may be found in the Singer-Friden Site information repository (see page 8, For More Information). Many additional sites with leaking underground storage tanks are under investigation by the Regional Water Quality Control Board and the Alameda County Department of Environmental Health. More sites may be discovered as investigations proceed.

CONTENTS

Free Testing Area - Figure 1



The white portion above indicates the free testing area for domestic water wells. Groundwater flows generally southwest, toward the Bay.

DOMESTIC WELLS

Domestic wells are household wells whose water is used inside the home for drinking, cooking, showering and bathing. DTSC will test, for free, domestic wells within the area noted on Figure 1, Free Testing Area (page 1). The free testing area extends south from San Leandro Creek, southwest of East 14th Street, west of Hesperian Boulevard, east of the Bay, and north of San Lorenzo Creek. Domestic wells outside the area shown on Figure 1 and all irrigation wells are not eligible for the free testing program. Industrial wells are also not eligible for the free testing program.

DTSC believes that a potential health risk may exist for San Leandro residents who use their private wells for domestic purposes. DTSC has issued a public health advisory to the users of private wells in the area. The advisory recommends that private wells not be used for domestic purposes unless the wells have been tested for common chemical contaminants (see Table 1, Suggested Tests). Bacteria tests alone are not sufficient.

If you have a domestic well within the free testing area, telephone Eileen Hughes at (510) 540-3848 to have your well sampled. If you are outside the free testing area and you choose to have your domestic well water tested, you will be responsible for the cost of the tests. For well testing information, please refer to "Phased Testing Approach" below.

IRRIGATION WELLS

Irrigation wells are used for landscape irrigation and for gardening. Irrigation wells are not eligible for the free testing program. If you choose to have your irrigation wells tested, you will be responsible for the cost of the tests. At this time, assuming that the water in your well has similar contaminants at similar concentrations to groundwater tested in San Leandro to date, DTSC does not believe there is a significantly increased health risk associated with using groundwater for irrigation. Please refer to "Phased Testing Approach" below for well testing information.

IF YOUR WELL IS CONTAMINATED

If your water is contaminated, you have three main options:

1 Connect to a public water system – this will provide the most reliable source of uncontaminated water. You will have to pay for the costs of pipe installation, which can cost several thousand dollars, depending upon the length of the pipe necessary. Plumbing and other permits may also be required for the installation and the hookup.

2 Treat your own water – this can be expensive, depending upon the contaminants and the concentrations of the contaminants. Initial costs for the treatment system can range from $30 to $3,000. Additional long-term maintenance costs should also be considered. These costs vary, depending on the type of treatment system.

3 Drill a new well – before considering this option, read "How Water Sources Become Contaminated" (page 6) and "Private Well Registration" (page 4).

PUBLIC HEALTH ADVISORY

Toxic chemical contamination has been found in some water wells in San Leandro. It is not possible to know whether any private well water is safe to drink until the water is tested. Please do not drink water from private wells unless the water has been tested for common chemical contaminants.

PHASED TESTING APPROACH

All tests required by State law for public water system drinking water are listed in Table 1, Suggested Tests (page 3). A range of costs for these tests is also listed in the table. If you want to ensure that your well water is safe, you should have your water tested for all the contaminants listed in this table. Because the cost for the complete analysis is quite high, DTSC suggests a phased testing approach to be completed in two steps:

Phase One

Perform the tests for contaminants that are known by the State to exist in central San Leandro groundwater. A description of the phase one tests is included in Table 1. Instruct the laboratory to do the tests one at a time in sequence (billing you one at a time), but to stop all testing when a positive result is found that is higher than the State drinking water standard. If you get a positive result which is higher than the State drinking water standard, DTSC recommends that you stop using your well water for domestic purposes.

Phase Two

If you complete step one with no positive results higher than State drinking water standards, you may perform the phase two tests listed in Table 1, in the same manner as in phase one. These tests are primarily for pesticides and herbicides (weed-killers), known to be used on vegetable crops, fruit trees and grains.

Table 1 • SUGGESTED TESTS

This table includes drinking water tests required by law for public drinking water systems, grouped according to the phased testing approach described on page 2. DTSC surveyed seven State-certified laboratories, within the counties of Alameda, Contra Costa, and San Mateo, to obtain their fees for performing Title 22 analyses on water samples. "Title 22" refers to Title 22 of the California Health and Safety Code. Chapter 3 of Title 22, entitled "Safe Drinking Water and Toxic Enforcement Act of 1986," lists chemicals known to the State to cause cancer or reproductive toxicity. *The cost estimates provided below are for analyzing one sample. (U.S. EPA stands for the United States Environmental Protection Agency.)*

Phase One Tests	**Cost for one sample analysis**		
Total coliform bacteria (Title 22): *These bacteria are common in animal and human feces. A positive test result may indicate a broken sewer line or septic tank waste migrating into your well water.*	Low - $18	Average - $28	High - $35
Inorganic chemicals (Title 22): *This test includes a test for nitrate (a common component of fertilizers) and a test for toxic metals. Ask the lab to test for nitrate only first; then for a few metals at a time, and to stop if a positive result is obtained that is higher than the drinking water standard.*	Low - $200	Average - $215	High - $240
Volatile organic by GC/MS (U.S. EPA Test Method 524.2): *This test is for VOCs, such as industrial solvents and cleaners. It also tests for the toxic compounds in gasoline and diesel.*	Low - $225	Average - $249	High - $290
Total cost for Phase One tests:	Low - $443	Average - $492	High - $565

Phase Two Tests	**Cost for one sample analysis**		
Organic compounds:			
EDB and DBCP (U.S. EPA Test Method 504):	Low - $100	Average - $124	High - $150
Chlorinated pesticides (U.S. EPA Test Method 505):	Low - $125	Average - $140	High - $155
Triazine pesticides (U.S. EPA Test Method 507):	Low - $120	Average - $180	High - $255
Chlorothalonil (U.S. EPA Test Method 508):	Low - $125	Average - $193	High - $300
Chlorinated herbicides/Bentazon (U.S. EPA Test Method 515.1):	Low - $165	Average - $182	High - $200
DEHP and bis (2-chloroethyl) ether (U.S. EPA Test Method 525):	Low - $230	Average - $342	High - $470
Carbofuran (U.S. EPA Test Method 531.1):	Low - $155	Average - $190	High - $240
Glyphosphate (U.S. EPA Test Method 547): $195 (Only one laboratory surveyed will perform this test by the U.S. EPA test method.)			
Other compounds:			
General mineral (Title 22): *This is a test for general water quality.*	Low - $200	Average - $256	High - $350
General physical (Title 22):	Low - $35	Average - $57	High - $100
Gross alpha radioactivity (Title 22):	Low - $49	Average - $55	High - $60
Total cost for Phase Two tests:	Low - $1,499	Average-$1,914	High - $2,475

Total cost for both Phase One and Phase Two tests:	*Low - $1,942*	*Average - $2,406*	*High - $3,040*

Helpful Hints for Water Testing

- Look in the Yellow Pages for "Laboratories-Analytical."
- *Shop around.* Call several laboratories and get price quotes for the tests listed in Table 1.
- Use only laboratories which are certified by the State or U.S. EPA.
- Ask the laboratory to use a phased testing approach, as described on page 2.
- Send the laboratory a copy of this fact sheet in order to inform them of the general issues.
- Discuss the sampling methods with the laboratory. Most laboratories prefer to have their own staff conduct the sampling. However, you may choose to do the sampling yourself, in order to save money. The laboratory may allow you to sample the water yourself, but will probably withdraw certain guarantees about the results. If you choose to do the sampling yourself, the laboratory will send you the containers to fill with water and detailed instructions about sample collection. Be sure to follow the instructions *very* carefully.
- The laboratory may suggest a different testing program which will accomplish the same result. Alternative tests should be U.S. EPA test methods only.
- It may take several weeks to get your results back from the laboratory.
- **DTSC will assist in interpreting your results.** Send a copy of your results to: California Environmental Protection Agency, Department of Toxic Substances Control, 700 Heinz Avenue, Suite 200, Berkeley, California 94710, Attention: Eileen Hughes.
- **Repeat sampling** will be necessary on a regular basis to ensure that contamination has not migrated through the groundwater to your well. The frequency of the repeat sampling may be determined by reviewing regional hydrogeological data (data on underground geological and water characteristics). If your well is near the edge of a migrating "plume" of contamination, greater frequency of repeat testing is recommended.

DRINKING WATER REGULATION

Your water comes from one of two sources: your local water district or a private well. Water which comes from local water districts is regulated by Federal and State law and is treated to remove bacteria and some other contaminants before distribution to consumers. State regulations require that public water systems (such as the East Bay Municipal Utility District, or EBMUD) meet certain water quality standards in order to protect public health. Water from public water systems is routinely tested to ensure that the water meets these standards.

Water from private wells or from very small water systems is not required to be tested by law. If your water comes from a private well or from a very small water system, your water may never have been tested. To find out what is in *your* well, you must have your water tested.

PRIVATE WELL REGISTRATION

In order to protect the groundwater resource, wells are regulated by the State. **Permits must be obtained for construction, altering or destroying a well.**

To be in compliance with the law, for any work that is to be done on a well, you should **hire a well driller with a C-57 Water Well Driller's License.** The well driller is required to file a *Water Well Drillers Report.* In San Leandro, the Alameda County Water Conservation and Flood Control District processes the well driller reports and well permits. Information on the well driller report provides important geological and hydrological data to local agencies and is crucial to ensuring a reliable and safe water supply.

Once the well drillers report is filed, the Alameda County Water Conservation and Flood Control District will issue a permit for well construction or alteration, or destruction of the well. **There are no fees for well inspection or for obtaining the permit, and the process is reportedly quick and easy to complete.**

Failure to file the required reports, to obtain a license prior to working on a well, and falsifying reports are misdemeanors. However, the law does allow a reasonable opportunity to comply with these requirements, except in the case of deliberate falsification.

The *Guide to Preparation of the Water Well Drillers Report* is a pamphlet which describes how to fill out the well drillers report. It is available for public review at the Singer-Friden Site Information Repository, located at the San Leandro Community Library Center (see page 8).

If you do not know whether your well is registered, you can find out by writing or calling:

Andreas Godfrey
Department of Public Works
399 Elmhurst Avenue
Hayward, California 94544
(510) 670-5575.

This agency will provide you with any records that exist regarding your well. If your well is not registered, Mr. Godfrey will send you forms to fill out. Please return these forms to the above address. Your cooperation will enable the agency to keep their well database up-to-date.

WELL CLOSURE

If your well is contaminated and if your well connects two or more water-bearing zones (aquifers), DTSC may order that your well be closed or altered. The closure of wells may be necessary to protect the groundwater resource. Cleanup of contaminated groundwater is very expensive. Cleanup of deeper contamination is much more expensive than cleanup of shallow contamination. It is necessary to order well closure when a possibility of spreading contamination to deeper aquifers exists. **If DTSC orders your well to be closed or altered, you will have to bear the cost of the closure or alteration.**

Figure 2 illustrates a well (well C) that serves as a conduit (a connecting pipe) between three aquifers. If a well, such as well C, is contaminated and connects two or more aquifers, but the owner does not properly close or alter the well, **the owner may be liable for the cleanup costs of the groundwater contamination.** These costs can be considerably large, much larger than the cost of well closure or alteration.

Shallow wells in central San Leandro (for example, less than approximately 40 feet deep) generally do not connect two or more aquifers, and will most likely not need to be closed. It will be necessary to examine each well closely, with regard to the well construction and the well location and depth, in order to determine whether a well should be closed. Wells serve as important resources for the community, especially in times of drought and disaster. DTSC will not order closure of any wells without careful consideration.

REGIONAL GROUNDWATER INVESTIGATION STATUS

DTSC is currently engaged in a regional hydrogeological study (a study looking at underground geology and water characteristics) to determine the extent of groundwater contamination in central San Leandro. In addition to site-specific activities being conducted at identified hazardous waste sites, DTSC plans to conduct more sampling off-site to determine whether contamination connections exist between sites. Once the regional investigation is complete, it will most likely take three to seven years to design and implement a Remedial Action Plan (RAP), which will identify the approach to take to clean up the contamination. Twenty or more years of oversight and maintenance may be necessary to ensure that the cleanup is effective.

CONSUMER'S GUIDE TO CALIFORNIA DRINKING WATER

Additional information concerning water quality and treatment systems is contained in the *Consumer's Guide to California Drinking Water*. This pamphlet is available for public review in the Singer-Friden Site Information Repository located at the San Leandro Community Library Center (see page 8). For your own copy, send $5.00 along with your request to: Local Government Commission, 909 12th Street, Suite 205, Sacramento, California 95814.

Quick Clues To Assess Your Water Quality

Use your own senses for a quick assessment of your water quality.

Water should not have an odor. If your water smells like a swimming pool, it may be contaminated with chlorine from a disinfection process. If your water has any other smell, such as solvents, gasoline, or sewage, it is probably contaminated.

Contaminated water may taste bad. A metallic or bitter taste could suggest the presence of pesticides or metals. If the water tastes salty, salt water could be seeping into your system from the ocean or the Bay, or from a broken water system. Rotten egg smells may indicate sulfur, which, although it may smell bad, it is not necessarily hazardous to your health. Water that contains no minerals at all tastes flat, even though it is good to drink.

Water should be absolutely clear in appearance. If you see any color or particles in your water, it is probably contaminated. If any colored sheen can be seen on the surface of the water, it is contaminated. If, after sitting for a while, the water is full of tiny bubbles, the water may be contaminated. Hard, white deposits that build up in a pot, tea kettle, or clothes iron are usually due to naturally-occurring minerals. Other minerals, which occur at too high a level, can make water turn orange, black or brown, causing it to stain your sinks, toilets and laundry.

Water should feel clean and smooth to the touch. It should not be slimy or gritty. Slimy water may contain microscopic plants. Oily or greasy water may contain gasoline, motor oil, or some other petroleum product. Water softeners may also make your water feel silky or slimy, but this does not mean that the water is contaminated with toxic chemicals.

Water should not kill or disfigure plants. If your water is destroying your garden, it is probably contaminated. Some contaminants may selectively harm only some plants.

Some chemicals are tasteless, odorless, and invisible at levels high enough to cause harm to human health. Unexplained stomach, intestinal, or other health problems may be caused by microorganisms or toxic contaminants in water. The safest and surest way to determine if your water is contaminated is to have it professionally tested.

Carefully note any changes in your water over time. Contamination may travel through porous soil or rock, into your well. An observable change in the characteristics of your water may indicate contamination.

Do you have a water well located in San Leandro?

If so, please fill out and submit the enclosed San Leandro Water Well Survey.

HOW WATER SOURCES BECOME CONTAMINATED

Refer to Figure 2 on page 7 when reading this section.

Groundwater is found under about 40% of California land, providing almost one-half of the State's drinking water. The quality of groundwater in the State can be detrimentally effected by improperly constructed, maintained, destroyed, or abandoned water wells. Contaminated water may flow down the well casing or down the inside of the well, thereby spreading contamination between different water-bearing zones called aquifers (see Figure 2). Both domestic and irrigation wells can spread groundwater contamination.

An aquifer is as an underground zone of porous soil or rock that has its pore spaces filled with water. Water can be pumped from aquifers, for a reasonable amount of money and expenditure of energy. Layers of sand make good aquifers because water flows easily through sand. Layers of clay do not serve as aquifers because water flows very slowly through clay, making it very expensive to extract the water.

Common sources of contamination include:

Household waste • including items such as drain cleaners, paint thinners, furniture strippers, automotive waste oil, pesticides and fertilizers, and discarded medicines. Wastes disposed directly onto the ground or discarded in garbage cans may eventually leak into groundwater.

Septic tank, cesspool and privy waste • bacteria from these sources may leak into groundwater.

Agricultural wastes • wastes from farming and gardening activities. Certain salts and minerals can dissolve out of soil into groundwater. Nitrate can leach out of feedlots or livestock enclosures. Fertilizers can also contribute to nitrate contamination. Overuse and improper storage of pesticides and herbicides (weed-killers) can result in contaminated groundwater.

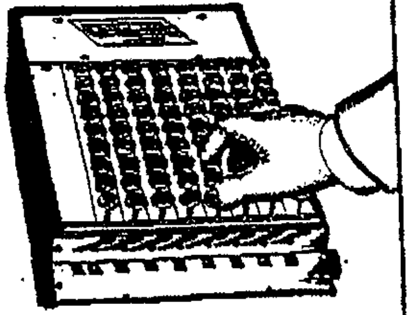
Underground storage tanks and pipelines • Tanks and pipelines of gas, diesel, oil and industrial chemicals frequently leak into groundwater.

Industrial wastes • including the following wastes from sample industries:

Plastics – hydrocarbons, solvents and formaldehydes.
Paints – heavy metals, cyanide wastes and organic compounds.
Dry cleaners – volatile organic compounds (solvents), such as trichloroethylene (TCE) and perchloroethylene (PCE).
Metal fabrication and production – PCBs, cyanide wastes, heavy metals and degreasing sludges.
Petroleum extraction and refining – PCBs, heavy metals, solvents, and sludges.
Electric and electronics equipment – heavy metals, plating sludges, PCBs and solvents.

DO YOU REMEMBER

The Former SINGER-FRIDEN MANUFACTURING PLANT in San Leandro?



Were you an employee, supervisor, or manager at the former plant? Did you have some other type of involvement with the former plant (construction, maintenance, repair work, well-drilling, and/or demolition)? If so, you may have knowledge that is critical to investigation and cleanup activities at the Singer-Friden Hazardous Waste Site in San Leandro, California.

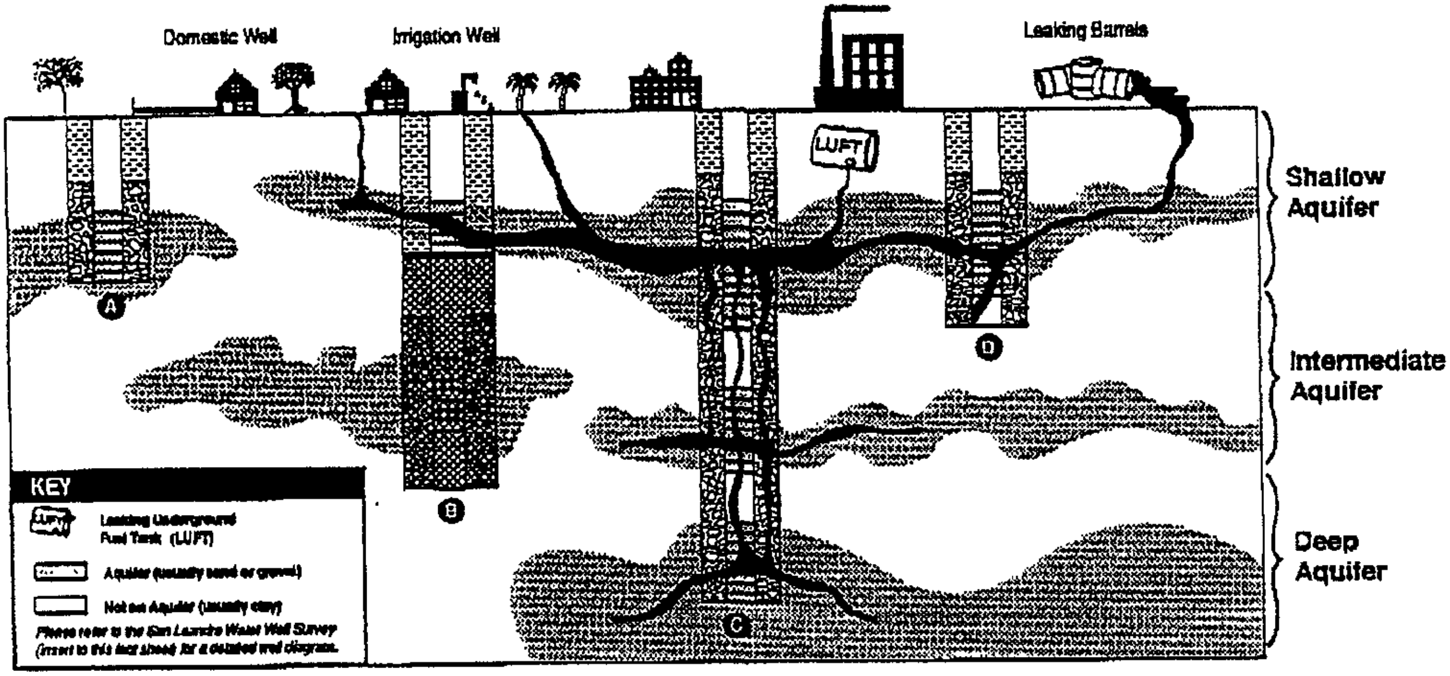
The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) needs information regarding operations at the former plant to help determine where contamination may exist at the Site and to identify parties who may have responsibility for or knowledge about the contamination. The former plant was located near the intersection of Washington Avenue and San Leandro Boulevard in San Leandro and operated from approximately 1936 to 1976.

PLEASE CALL ☎ 1-800-621-3386 WITH ANY INFORMATION
(TOLL-FREE)
YOUR CALL WILL BE KEPT STRICTLY CONFIDENTIAL

California Environmental Protection Agency
Department of Toxic Substances Control

Figure 2

WELLS, AQUIFERS, AND CROSS-CONTAMINATION



Ⓐ **Shallow well** with clean well water and a clean shallow aquifer.

Ⓑ **Intermediate well** with contaminated well water, a contaminated shallow aquifer and an un-contaminated intermediate aquifer. The lower part of the well has been plugged to ensure no cross-contamination from the shallow to the intermediate aquifer.

Ⓒ **Deep well** with contaminated well water and contaminated shallow, intermediate, and deep aquifers. This well has cross-contaminated all three aquifers by spreading contamination from the shallow aquifer to the intermediate and deep aquifers. The shallow aquifer has multiple sources of contamination (leaking barrels, LUFTs, and leaking agricultural and household wastes). The contamination has flowed along the inside and outside of the well pipe. Contamination can migrate both up and down a well, from shallow to deep and deep to shallow.

Ⓓ **Shallow well** with contaminated well water and a contaminated shallow aquifer.

KEEP ME INFORMED

YES, I would like to receive future information on the regional groundwater investigation in San Leandro.

Name ______________________________

Affiliation (if any) ______________________________

Address ______________________________

City/State/Zip ______________________________

Telephone Number (______) ______________ Comments ______________

Please return completed coupon to:

Shirley Buford, Public Participation Coordinator
California Environmental Protection Agency
Department of Toxic Substances Control
700 Heinz Avenue, Suite 200, Berkeley, California 94710

Tier I – Run 1
RBSL 7% DEFAULT

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 6.2**

Site Name: Ingersoll-Rand Equipment Sales | Completed By: John McDermott

Site Location. San Leandro, California | Date Completed. 9/8/1997

1 OF 1

SUBSURFACE SOIL RBSL VALUES
(> 3.3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

RBSL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			X Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential (on-site)	Commercial: (on-site)	Regulatory(MCL) (on-site)	Residential (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" if yes	Only if "yes" left
71-43-2	Benzene	2.7E+0	NA	NA	NA	NA	7.9E-2	NA	3.4E+1	7.9E-2	■	3.4E+01
100-41-4	Ethylbenzene	5.8E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1
108-88-3	Toluene	1.7E+1	NA	NA	NA	NA	9.3E+1	NA	>Res	9.3E+1	☐	<1
1330-20-7	Xylene (mixed isomers)	3.3E+1	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

Software: GSI RBCA Spreadsheet
Version: 1.0.1
Serial: G-457-IKX-532

RBCA SITE ASSESSMENT Tier 1 Worksheet 6.3

Site Name: Ingersoll-Rand Equipment Sales
Completed By: John McDermott
Site Location: San Leandro, California
Date Completed: 9/8/1997
1 OF 1

GROUNDWATER RBSL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1.0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

RBSL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	Groundwater Ingestion			X Groundwater Volatilization to Indoor Air		X Groundwater Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CRF
CAS No.	**Name**	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial (on-site)	(mg/L	"■" if yes	Only if "yes" left
71-43-2	Benzene	1.8E-1	NA	NA	NA	NA	7.4E-2	NA	1.8E+1	7.4E-2	■	2.0E+00
100-41-4	Ethylbenzene	2.9E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
108-88-3	Toluene	2.5E-2	NA	NA	NA	NA	8.5E+1	NA	>Sol	8.5E+1	☐	<1
1330-20-7	Xylene (mixed isomers)	5.4E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1

>Sol indicates risk-based target concentration greater than constituent solubility

Software: GSI RBCA Spreadsheet
Version: 1.0.1
Serial: G-457-IKX-532

Where were RBSLs derived?

Were Cal. Slope factors used? NO

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed: 9/8/1997   *4 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS:

VAPOR INTRUSION TO BUILDINGS

Exposure Concentration									
	1) Source Medium	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Indoor Air: POE Conc. (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
Constituents of Concern	Subsurface Soil Conc. (mg/kg)		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial
Benzene	2.7E+0		1.6E+2		1.7E-2		7.0E-2		1.2E-3
Ethylbenzene	5.8E+0		1.6E+2		3.6E-2		2.0E-1		7.1E-3
Toluene	1.7E+1		1.6E+2		1.1E-1		2.0E-1		2.1E-2
Xylene (mixed isomers)	3.3E+1		1.7E+2		1.9E-1		2.0E-1		3.8E-2

NOTE:

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version: 1.0.1
Serial: G-457-IKX-532

7% conc. of max

natural attention factor = NAF

Soil pathway Risk = 3.5E-5

RBCA SITE ASSESSMENT	**Tier 1 Worksheet 8.1**

Site Name. Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By. John McDermott   Date Completed. 9/8/1997   *5 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER:
VAPOR INTRUSION TO BUILDINGS

	Exposure Concentration											TOTAL PATHWAY INTAKE (mg/kg-day) *(Sum intake values from subsurface & groundwater routes.)*	
	1) Source Medium	2) NAF Value (m^3/L) Receptor		3) Exposure Medium Indoor Air: POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)					
Constituents of Concern	Groundwater Conc (mg/L)		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial				On-Site Commercial
Benzene *	1.8E-1		1.5E+2		1.2E-3		7.0E-2		8.4E-5				1.3E-3
Ethylbenzene	2.9E-1		1.4E+2		2.1E-3		2.0E-1		4.1E-4				7.5E-3
Toluene	2.5E-2		1.5E+2		1.7E-4		2.0E-1		3.4E-5				2.1E-2
Xylene (mixed isomers)	5.4E-1		1.6E+2		3.5E-3		2.0E-1		6.8E-4				3.8E-2

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software. GSI RBCA Spreadsheet
Version 1.0.1
Serial G-457-IKX-532

* represents highest benzene conc. Jan. 1997 in area of indoor on-site receptor – i.e., MW-3 data, next to I-R building

GW pathway Risk = 2.4E-6

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.2**

Site Name: Ingersoll-Rand Equipment Sales Site Location: San Leandro, California Completed By: John McDermott Date Completed. 9/8/1997

TIER 1 PATHWAY RISK CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)	On-Site Commercial	(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3)	On-Site Commercial	(5) Total Toxicant Intake Rate (mg/kg/day)	On-Site Commercial	(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6)	On-Site Commercial
Benzene	A		1.3E-3	2 9E-2		3 7E-5		3.5E-3	1.7E-3		2.1E+0
Ethylbenzene	D							7.5E-3	2.9E-1		2.6E-2
Toluene	D							2 1E-2	1.1E-1		1.8E-1
Xylene (mixed isomers)	D							3 8E-2	2.0E+0		1.9E-2

Total Pathway Carcinogenic Risk = 0.0E+0 | 3.7E-5

3.8E-5

Total Pathway Hazard Index = 0.0E+0 | 2.3E+0

Software: GSI RBCA Spreadsheet
Version 1 0 1

Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales Site Location: San Leandro, California Completed By: John McDermott Date Completed 9/8/1997 *1 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ☐ **(CHECKED IF PATHWAY IS ACTIVE)**

SURFACE SOILS: VAPOR AND DUST INHALATION

Constituents of Concern	Exposure Concentration 1) Source Medium Surface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Outdoor Air: POE Conc. (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
Benzene	0.0E+0								
Ethylbenzene	0.0E+0								
Toluene	0.0E+0								
Xylene (mixed isomers)	0.0E+0								

NOTE:

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version 1.0 1

Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | Tier 1 Worksheet 8.1

Site Name. Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By. John McDermott   Date Completed: 9/8/1997   2 OF 9

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS. VAPOR INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Subsurface Soil Conc. (mg/kg)	2) NAF Value (m^3/kg) Receptor On-Site Commercial		3) Exposure Medium Outdoor Air. POE Conc. (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial	
Benzene	2.7E+0	7.0E+4		3.9E-5		7.0E-2		2.7E-6	
Ethylbenzene	5.8E+0	7.0E+4		8.3E-5		2.0E-1		1.6E-5	
Toluene	1.7E+1	7.0E+4		2.4E-4		2.0E-1		4.7E-5	
Xylene (mixed isomers)	3.3E+1	7.0E+4		4.7E-4		2.0E-1		9.3E-5	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposue area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed: 9/8/1997   *3 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAY IS ACTIVE)**

GROUNDWATER: VAPOR INHALATION Constituents of Concern	Exposure Concentration 1) Source Medium Groundwater Conc (mg/L)	2) NAF Value (m^3/L) Receptor On-Site Commercial		3) Exposure Medium Outdoor Air POE Conc (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial		TOTAL PATHWAY INTAKE (mg/kg-day) *(Sum intake values from surface, subsurface & groundwater routes.)* On-Site Commercial	
Benzene	1.8E-1	3.7E+4		4.9E-6		7.0E-2		3.4E-7		3.1E-6	
Ethylbenzene	2.9E-1	3.6E+4		8.1E-6		2.0E-1		1.6E-6		1.8E-5	
Toluene	2.5E-2	3.7E+4		6.7E-7		2.0E-1		1.3E-7		4.7E-5	
Xylene (mixed isomers)	5.4E-1	4.0E+4		1.4E-5		2.0E-1		2.6E-6		9.5E-5	

NOTE:

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version 1.0.1

Serial G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.2**

Site Name. Ingersoll-Rand Equipment Sales   Site Location San Leandro, California   Completed By: John McDermott   Date Completed 9/8/1997   *1 OF 4*

TIER 1 PATHWAY RISK CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS			
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Commercial		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
Benzene	A	3.1E-6		2.9E-2	8.9E-8		8 6E-6		1.7E-3	5 0E-3	
Ethylbenzene	D						1.8E-5		2.9E-1	6 3E-5	
Toluene	D						4.7E-5		1.1E-1	4.1E-4	
Xylene (mixed isomers)	D						9.5E-5		2.0E+0	4.8E-5	

Total Pathway Carcinogenic Risk = 8.9E-8 | 0.0E+0

Total Pathway Hazard Index = 5.6E-3 | 0.0E+0

Tier I – Run 2
RBSL MAXIMUM DEFAULT

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 6.2**

Site Name: Ingersoll-Rand Equipment Sales
Completed By: John McDermott
Site Location: San Leandro, California
Date Completed. 9/8/1997

1 OF 1

SUBSURFACE SOIL RBSL VALUES (> 3.3 FT BGS)

Target Risk (Class A & B) 1 0E-6
Target Risk (Class C) 1 0E-5
Target Hazard Quotient 1 0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

RBSL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		**Representative Concentration**	Soil Leaching to Groundwater			X Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential (on-site)	Commercial (on-site)	Regulatory(MCL) (on-site)	Residential (on-site)	Commercial (on-site)	Residential (on-site)	Commercial (on-site)	(mg/kg)	"■" if yes	Only if "yes" left
71-43-2	Benzene *	3.9E+1	NA	NA	NA	NA	7.9E-2	NA	3.4E+1	7.9E-2	■	4.9E+02
100-41-4	Ethylbenzene	8 3E+1	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1
108-88-3	Toluene	2.4E+2	NA	NA	NA	NA	9.3E+1	NA	>Res	9.3E+1	■	3.0E+00
1330-20-7	Xylene (mixed isomers)	4.7E+2	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

Software: GSI RBCA Spreadsheet
Serial: G-457-IKX-532
Version: 1 0 1

* benzene soil conc. represents worse case - sample 4557, collected 11/89 during UST closure

RBSLs / HQ not reflective of Cal s.f. and other criteria

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 6.3**

Site Name Ingersoll-Rand Equipment Sales | Completed By: John McDermott

Site Location: San Leandro, California | Date Completed: 9/8/1997 | *1 OF 1*

GROUNDWATER RBSL VALUES

Target Risk (Class A & B) 1 0E-6
Target Risk (Class C) 1 0E-5
Target Hazard Quotient 1 0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

RBSL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		**Representative Concentration**	Groundwater Ingestion			X Groundwater Volatilization to Indoor Air		X Groundwater Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CRF
CAS No.	**Name**	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL) (on-site)	Residential (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)	(mg/L	"■" if yes	Only if "yes" left
71-43-2	Benzene	1.8E-1	NA	NA	NA	NA	7.4E-2	NA	1.8E+1	7.4E-2	■	2.0E+00
100-41-4	Ethylbenzene	2.9E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
108-88-3	Toluene	2.5E-2	NA	NA	NA	NA	8.5E+1	NA	>Sol	8.5E+1	☐	<1
1330-20-7	Xylene (mixed isomers)	5.4E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1

>Sol indicates risk-based target concentration greater than constituent solubility

Software: GSI RBCA Spreadsheet
Version. 1 0 1

Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name Ingersoll-Rand Equipment Sales Site Location. San Leandro, California Completed By John McDermott Date Completed: 9/8/1997 *1 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ☐ **(CHECKED IF PATHWAY IS ACTIVE)**

SURFACE SOILS: VAPOR AND DUST INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Surface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Outdoor Air POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
Benzene	0.0E+0								
Ethylbenzene	0.0E+0								
Toluene	0.0E+0								
Xylene (mixed isomers)	0.0E+0								

NOTE
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software GSI RBCA Spreadsheet
Version 1 0 1
Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed. 9/8/1997   *2 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS: VAPOR INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Subsurface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor On-Site Commercial		3) Exposure Medium Outdoor Air POE Conc (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial	
Benzene	3.9E+1	7.0E+4		5.6E-4		7.0E-2		3.9E-5	
Ethylbenzene	8.3E+1	7.0E+4		1.2E-3		2.0E-1		2.3E-4	
Toluene	2.4E+2	7.0E+4		3.5E-3		2.0E-1		6.8E-4	
Xylene (mixed isomers)	4.7E+2	7.0E+4		6.8E-3		2.0E-1		1.3E-3	

NOTE

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposue area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version 1.0.1
Serial: G-457-IKX-532

RBCA SITE ASSESSMENT	Tier 1 Worksheet 8.1

Site Name: Ingersoll-Rand Equipment Sales   Site Location San Leandro, California   Completed By: John McDermott   Date Completed 9/8/1997   *3 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAY IS ACTIVE)**

GROUNDWATER: VAPOR INHALATION	Exposure Concentration									TOTAL PATHWAY INTAKE (mg/kg-day) *(Sum intake values from surface, subsurface & groundwater routes)*	
	1) Source Medium	2) NAF Value (m^3/L) Receptor		3) Exposure Medium Outdoor Air: POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)			
Constituents of Concern	Groundwater Conc (mg/L)	On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial	
Benzene	1.8E-1	3.7E+4		4.9E-6		7.0E-2		3.4E-7		4.0E-5	
Ethylbenzene	2.9E-1	3.6E+4		8.1E-6		2.0E-1		1.6E-6		2.4E-4	
Toluene	2.5E-2	3.7E+4		6.7E-7		2.0E-1		1.3E-7		6.8E-4	
Xylene (mixed isomers)	5.4E-1	4.0E+4		1.4E-5		2.0E-1		2.6E-6		1.3E-3	

NOTE:

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.2**

Site Name. Ingersoll-Rand Equipment Sales Site Location: San Leandro, California Completed By: John McDermott Date Completed. 9/8/1997 *1 OF 4*

TIER 1 PATHWAY RISK CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Commercial		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
Benzene	A	4.0E-5		2.9E-2	1.1E-6		1.1E-4		1.7E-3	6.5E-2	
Ethylbenzene	D						2.4E-4		2.9E-1	8.2E-4	
Toluene	D						6.8E-4		1.1E-1	5.9E-3	
Xylene (mixed isomers)	D						1.3E-3		2.0E+0	6.6E-4	

Total Pathway Carcinogenic Risk = 1.1E-6 | 0.0E+0

Total Pathway Hazard Index = 7.2E-2 | 0.0E+0

noncarcinogens

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name Ingersoll-Rand Equipment Sales Site Location: San Leandro, California Completed By: John McDermott Date Completed 9/8/1997 *4 OF 9*

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAY IS ACTIVE)**

SUBSURFACE SOILS: **Exposure Concentration**

VAPOR INTRUSION TO BUILDINGS

Constituents of Concern	1) Source Medium Subsurface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Indoor Air POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
			On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial
Benzene	3.9E+1 *		1.6E+2		2.4E-1		7.0E-2		1.7E-2
Ethylbenzene	8.3E+1		1.6E+2		5.2E-1		2.0E-1		1.0E-1
Toluene	2.4E+2		1.6E+2		1.5E+0		2.0E-1		2.9E-1
Xylene (mixed isomers)	4.7E+2		1.7E+2		2.8E+0		2.0E-1		5.4E-1

NOTE:

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)
NAF=

Software: GSI RBCA Spreadsheet
Version 1.0.1

Serial: G-457-IKX-532

* represents max conc. ~~of~~ benzene identified during 11/89 UST closures

NAF ?

RBCA SITE ASSESSMENT | **Tier 1 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed: 9/8/1997   5 OF 9

TIER 1 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER:

VAPOR INTRUSION TO BUILDINGS

Exposure Concentration

Constituents of Concern	1) Source Medium Groundwater Conc. (mg/L)	2) NAF Value (m^3/L) Receptor		3) Exposure Medium Indoor Air: POE Conc. (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)		**TOTAL PATHWAY INTAKE (mg/kg-day)** *(Sum intake values from subsurface & groundwater routes.)*	
			On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial
Benzene	1.8E-1		1.5E+2		1.2E-3		7.0E-2		8.4E-5		1.7E-2
Ethylbenzene	2.9E-1		1.4E+2		2.1E-3		2.0E-1		4.1E-4		1.0E-1
Toluene	2 5E-2		1.5E+2		1.7E-4		2.0E-1		3.4E-5		2.9E-1
Xylene (mixed isomers)	5.4E-1		1.6E+2		3.5E-3		2 0E-1		6.8E-4		5.4E-1

NOTE
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version 1.0 1
Serial G-457-1KX-532

* represents max conc. of benzene from well MW-3 in Jan. 97 adjacent to on-site receptor location

NAF ?

RBCA SITE ASSESSMENT	Tier 1 Worksheet 8.2

Site Name: Ingersoll-Rand Equipment Sales Site Location. San Leandro, California Completed By. John McDermott Date Completed: 9/8/1997

TIER 1 PATHWAY RISK CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6)	
			On-Site Commercial			On-Site Commercial		On-Site Commercial			On-Site Commercial
Benzene	A		1.7E-2	2.9E-2		5.0E-4		4.8E-2	1.7E-3		2.8E+1
Ethylbenzene	D							1.0E-1	2.9E-1		3.6E-1
Toluene	D							2.9E-1	1.1E-1		2.6E+0
Xylene (mixed isomers)	D							5.4E-1	2.0E+0		2.7E-1

Total Pathway Carcinogenic Risk = 0.0E+0 | 5.0E-4

Total Pathway Hazard Index = 0.0E+0 | 3.1E+1

Software: GSI RBCA Spreadsheet
Version 1.0.1

Serial: G-457-IKX-532

Tier II
SSTL 7% SITE-SPECIFIC PARAMETERS

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 9.2**

Site Name. Ingersoll-Rand Equipment Sales
Site Location. San Leandro, California

Completed By John McDermott
Date Completed. 9/8/1997

1 OF 1

SUBSURFACE SOIL SSTL VALUES
(> 3 FT BGS)

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1.0E-5
Target Hazard Quotient 1 0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		**Representative Concentration**	☐ Soil Leaching to Groundwater			X Soil Volatilization to Indoor Air		X Soil Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	**Name**	(mg/kg)	Residential. (on-site)	Commercial: (on-site)	Regulatory(MCL) (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	"■" If yes	Only if "yes" left
71-43-2	Benzene	2.7E+0	NA	NA	NA	NA	6 2E-1	NA	1.8E+2	6.2E-1	■	4.0E+00
100-41-4	Ethylbenzene	5.8E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1
108-88-3	Toluene	1.7E+1	NA	NA	NA	NA	7.4E+2	NA	>Res	7.4E+2	☐	<1
1330-20-7	Xylene (mixed isomers)	3.3E+1	NA	NA	NA	NA	>Res	NA	>Res	>Res	☐	<1

>Res indicates risk-based target concentration greater than constituent residual saturation value

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Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | Tier 2 Worksheet 9.3

Site Name. Ingersoll-Rand Equipment Sales
Site Location. San Leandro, California

Completed By. John McDermott
Date Completed: 9/8/1997

1 OF 1

GROUNDWATER SSTL VALUES

Target Risk (Class A & B) 1.0E-6
Target Risk (Class C) 1 0E-5
Target Hazard Quotient 1 0E+0

☐ MCL exposure limit?
☐ PEL exposure limit?

Calculation Option 1

SSTL Results For Complete Exposure Pathways ("x" if Complete)

CONSTITUENTS OF CONCERN		Representative Concentration	Groundwater Ingestion			X Groundwater Volatilization to Indoor Air		X Groundwater Volatilization to Outdoor Air		Applicable SSTL	SSTL Exceeded ?	Required CRF
CAS No.	Name	(mg/L)	Residential (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial (on-site)	(mg/L	"■" if yes	Only if "yes" left
71-43-2	Benzene	1.8E-1	NA	NA	NA	NA	1.4E+0	NA	3.9E+2	1.4E+0	☐	<1
100-41-4	Ethylbenzene	2.9E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
108-88-3	Toluene	2.5E-2	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1
1330-20-7	Xylene (mixed isomers)	5.4E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	☐	<1

>Sol indicates risk-based target concentration greater than constituent solubility

Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial: G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By. John McDermott   Date Completed: 9/8/1997   *1 OF 9*

TIER 2   EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ☐ **(CHECKED IF PATHWAY IS ACTIVE)**

SURFACE SOILS: VAPOR AND DUST INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Surface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Outdoor Air POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
Benzene	0 0E+0								
Ethylbenzene	0 0E+0								
Toluene	0 0E+0								
Xylene (mixed isomers)	0 0E+0								

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

Software: GSI RBCA Spreadsheet
Version: 1 0 1
Serial G-457-IKX-532

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.1**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed: 9/8/1997   *2 OF 9*

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAY IS ACTIVE)**

SUBSURFACE SOILS: VAPOR INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Subsurface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor On-Site Commercial		3) Exposure Medium Outdoor Air POE Conc (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial	
Benzene	2.7E+0	3.7E+5		7.2E-6		7.0E-2		5.0E-7	
Ethylbenzene	5.8E+0	3.7E+5		1.5E-5		2.0E-1		3.0E-6	
Toluene	1.7E+1	3.7E+5		4.5E-5		2.0E-1		8.8E-6	
Xylene (mixed isomers)	3.3E+1	3.7E+5		8.8E-5		2.0E-1		1.7E-5	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposue area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.1**

Site Name. Ingersoll-Rand Equipment Sales   Site Location San Leandro, California   Completed By: John McDermott   Date Completed. 9/8/1997

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

GROUNDWATER: VAPOR INHALATION

Exposure Concentration

Constituents of Concern	1) Source Medium Groundwater Conc (mg/L)	2) NAF Value (m^3/L) Receptor On-Site Commercial		3) Exposure Medium Outdoor Air: POE Conc (mg/m^3) (1) / (2) On-Site Commercial		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day) On-Site Commercial		5) Average Daily Intake Rate (mg/kg-day) (3) X (4) On-Site Commercial		TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from surface, subsurface & groundwater routes.) On-Site Commercial	
Benzene	1.8E-1	8.0E+5		2.3E-7		7.0E-2		1.6E-8		5.2E-7	
Ethylbenzene	2.9E-1	8.0E+5		3.6E-7		2.0E-1		7.1E-8		3.1E-6	
Toluene	2.5E-2	8.2E+5		3.1E-8		2.0E-1		6.0E-9		8.8E-6	
Xylene (mixed isomers)	5.4E-1	8.8E+5		6.2E-7		2.0E-1		1.2E-7		1.7E-5	

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.2**

Site Name: Ingersoll-Rand Equipment Sales   Site Location. San Leandro, California   Completed By: John McDermott   Date Completed. 9/8/1997   *1 OF 4*

TIER 2 PATHWAY RISK CALCULATION

OUTDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day) On-Site Commercial		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3) On-Site Commercial		(5) Total Toxicant Intake Rate (mg/kg/day) On-Site Commercial		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6) On-Site Commercial	
Benzene	A	*5.2E-7*		*2.9E-2*	*1.5E-8*		*1.5E-6*		*1.7E-3*	*8.6E-4*	
Ethylbenzene	D						3.1E-6		2.9E-1	1.1E-5	
Toluene	D						8.8E-6		1.1E-1	7.7E-5	
Xylene (mixed isomers)	D						1.7E-5		2.0E+0	8.7E-6	

Total Pathway Carcinogenic Risk = **1.5E-8** | **0.0E+0**

Total Pathway Hazard Index = **9.5E-4** | **0.0E+0**

Software: GSI RBCA Spreadsheet
Version: 1.0.1

Serial G-457-IKX-532

Site Name. Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed 9/8/1997   *4 OF 9*

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ (CHECKED IF PATHWAY IS ACTIVE)

SUBSURFACE SOILS:

VAPOR INTRUSION TO BUILDINGS

Exposure Concentration

Constituents of Concern	1) Source Medium Subsurface Soil Conc (mg/kg)	2) NAF Value (m^3/kg) Receptor		3) Exposure Medium Indoor Air: POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)	
			On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial
Benzene	2.7E+0		1.3E+3		2.1E-3		7.0E-2		1.5E-4
Ethylbenzene	5.8E+0		1.3E+3		4.6E-3		2.0E-1		9.0E-4
Toluene	1.7E+1		1.3E+3		1.3E-2		2.0E-1		2.6E-3
Xylene (mixed isomers)	3.3E+1		1.3E+3		2.6E-2		2.0E-1		5.1E-3

NOTE.

ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.1**

Site Name Ingersoll-Rand Equipment Sales

Site Location: San Leandro, California

Completed By: John McDermott

Date Completed 9/8/1997

5 OF 9

TIER 2 EXPOSURE CONCENTRATION AND INTAKE CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ■ **(CHECKED IF PATHWAY IS ACTIVE)**

GROUNDWATER:

VAPOR INTRUSION TO BUILDINGS

Constituents of Concern	Exposure Concentration 1) Source Medium Groundwater Conc (mg/L)	2) NAF Value (m^3/L) Receptor		3) Exposure Medium Indoor Air POE Conc (mg/m^3) (1) / (2)		4) Exposure Multiplier (IRxEFxED)/(BWxAT) (m^3/kg-day)		5) Average Daily Intake Rate (mg/kg-day) (3) X (4)		TOTAL PATHWAY INTAKE (mg/kg-day) (Sum intake values from subsurface & groundwater routes)	
			On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial		On-Site Commercial
Benzene	1.8E-1		2.9E+3		6.2E-5		7.0E-2		4.4E-6		1.5E-4
Ethylbenzene	2.9E-1		2.8E+3		1.0E-4		2 0E-1		2 0E-5		9.2E-4
Toluene	2.5E-2		2.9E+3		8 6E-6		2.0E-1		1 7E-6		2 6E-3
Xylene (mixed isomers)	5.4E-1		3 1E+3		1.7E-4		2.0E-1		3 4E-5		5 1E-3

NOTE:
ABS = Dermal absorption factor (dim)
AF = Adherance factor (mg/cm^2)
AT = Averaging time (days)
BW = Body weight (kg)
CF = Units conversion factor
ED = Exposure duration (yrs)
EF = Exposure frequencey (days/yr)
ET = Exposure time (hrs/day)
IR = Inhalation rate (m^3/day)
POE = Point of exposure
SA = Skin exposure area (cm^2/day)

RBCA SITE ASSESSMENT | **Tier 2 Worksheet 8.2**

Site Name: Ingersoll-Rand Equipment Sales   Site Location: San Leandro, California   Completed By: John McDermott   Date Completed: 9/8/1997   *2 OF 4*

TIER 2 PATHWAY RISK CALCULATION

INDOOR AIR EXPOSURE PATHWAYS ☒ **(CHECKED IF PATHWAYS ARE ACTIVE)**

	CARCINOGENIC RISK						TOXIC EFFECTS				
Constituents of Concern	(1) EPA Carcinogenic Classification	(2) Total Carcinogenic Intake Rate (mg/kg/day)		(3) Inhalation Slope Factor (mg/kg-day)^-1	(4) Individual COC Risk (2) x (3)		(5) Total Toxicant Intake Rate (mg/kg/day)		(6) Inhalation Reference Dose (mg/kg-day)	(7) Individual COC Hazard Quotient (5) / (6)	
			On-Site Commercial			On-Site Commercial		On-Site Commercial			On-Site Commercial
Benzene	A		1.5E-4	2 9E-2		4 5E-6		4.3E-4	1.7E-3		2.5E-1
Ethylbenzene	D							9.2E-4	2.9E-1		3.2E-3
Toluene	D							2 6E-3	1.1E-1		2.3E-2
Xylene (mixed isomers)	D							5.1E-3	2.0E+0		2.6E-3

Total Pathway Carcinogenic Risk = **0.0E+0** | **4.5E-6**

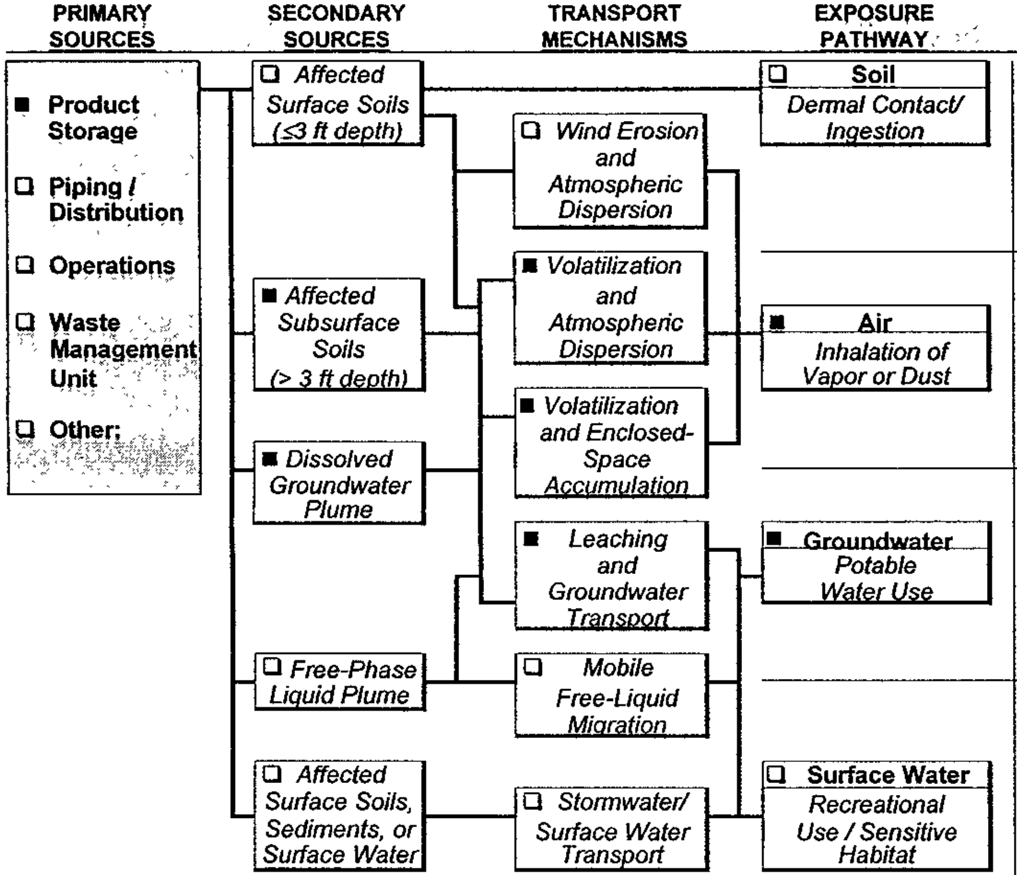
Total Pathway Hazard Index = **0.0E+0** | **2.8E-1**

Site Name: Ingersoll Rand Equipment Sales
Date Completed: September 11, 1997
Site Location: San Leandro, CA
Completed by: JJM

Page 1 of 1

BASELINE EXPOSURE FLOWCHART

Instructions: *To characterize baseline exposure conditions, check boxes to identify applicable primary sources, secondary sources (affected media), potential transport mechanisms, and current or potential exposure pathways and receptors (■ = applicable to site). Identify types(s) of both on-site and off-site receptors, if applicable. Provide detailed information on complete pathways, exposure factors, and risk goals on Worksheets 4.3 - 4.5.*



PRIMARY SOURCES
- ■ Product Storage
- ☐ Piping / Distribution
- ☐ Operations
- ☐ Waste Management Unit
- ☐ Other:

SECONDARY SOURCES
- ☐ *Affected Surface Soils (≤3 ft depth)*
- ■ *Affected Subsurface Soils (> 3 ft depth)*
- ■ *Dissolved Groundwater Plume*
- ☐ *Free-Phase Liquid Plume*
- ☐ *Affected Surface Soils, Sediments, or Surface Water*

TRANSPORT MECHANISMS
- ☐ *Wind Erosion and Atmospheric Dispersion*
- ■ *Volatilization and Atmospheric Dispersion*
- ■ *Volatilization and Enclosed-Space Accumulation*
- ■ *Leaching and Groundwater Transport*
- ☐ *Mobile Free-Liquid Migration*
- ☐ *Stormwater/ Surface Water Transport*

EXPOSURE PATHWAY
- ☐ **Soil** *Dermal Contact/ Ingestion*
- ■ **Air** *Inhalation of Vapor or Dust*
- ■ **Groundwater** *Potable Water Use*
- ☐ **Surface Water** *Recreational Use / Sensitive Habitat*

POTENTIAL RECEPTORS			COMPLETE PATHWAY?
Exposed Receptors	On-Site:	☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ *Current* ○ *Potential*
	Off-Site:	☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ *Current* ○ *Potential*
Exposed Persons	On-Site:	☐ Residential ■ Non-Resid. ☐ N/A	☐ No ■ Yes ● *Current* ○ *Potential*
	Off-Site:	☐ Residential ☐ Non-Resid. ■ N/A	■ No ☐ Yes ○ *Current* ○ *Potential*
Groundwater Users	On-Site:	☐ Residential ☐ Non-Resid. ■ N/A	■ No ☐ Yes ○ *Current* ○ *Potential*
	Off-Site:	☐ Residential ☐ Non-Resid. ■ N/A	■ No ☐ Yes ○ *Current* ○ *Potential*
Surface Water Users	On-Site:	☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ *Current* ○ *Potential*
	Off-Site:	☐ Residential ☐ Non-Resid. ■ N/A ☐ Sensitive Habitat ☐ Recreation	■ No ☐ Yes ○ *Current* ○ *Potential*

(■ OR ● TO SELECT)

APPENDIX CD

CD1.0 RBCA Models Used

The GSI software used for the RBCA for San Leandro incorporates the equations and models used to calculate baseline risk levels and site-specific target levels. The risk assessment procedures used in GSI software are consistent with the current U.S. EPA guidelines and incorporated within ASTM E-1739.

For the Ingersoll-Rand Equipment Sales (San Leandro) RBCA, the models of primary concern were associated with volatilization of gasoline constituent VOCs from soil and ground water into the outdoor and indoor air.

To estimate exposure point concentrations for inhalation of vapors in enclosed spaces, the GSI software and the RBCA Standard Guide use two models. The Johnson and Ettinger (1991) model and a mass balance model. Consistent with RBCA Standard Guide, the resulting two volatilization factors are compared and the smaller of the two is used for further calculation. The Johnson and Ettinger model tends to be very conservative. The model is based on an infinite source for volatilization. The mass balance model assumes that the source is depleted as chemical volatilization occurs. The mass balance model is independent of depth to the source and does not account for barriers, such as pavement. The mass balance model produces a conservative result.

There are no physical conditions at the Ingersoll-Rand Equipment Sales site that would invalidate the use of either of the volatilization models.

CD2.0 Assumptions

The RBCA Standard Guide contains default values for soil, water, air and building parameters used in the exposure models and calculations. The GSI software uses these default values to calculate the RBSLs. To calculate the Tier II SSTLs, site-specific parameters can be entered.

The following table presents the default and site-specific values used for the variables in the Tier II equations and calculations. The site-specific parameter values are underlined. The other listed values are the RBCA default values. The site-specific values were collected during site investigation and monitoring activities.

Ground Water Table Depth. The Site water table varies both areally and seasonally. Areally, the range is approximately 4 feet. Seasonally, water levels fluctuate 3.5 to 4 feet. The average depth to the water table in the MW-3, which is nearest to the residual source, is 15 feet.

The Thickness of the Affected Soils. The thickness is based on the depth to the water table minus the shallowest depth of encountered impacted soils, 15.0 - 12.5 feet, or 2.5 feet.

Capillary Zone Thickness. Given the geologic character of the shallow subsurface, silt to fine sand, a capillary rise of 61 cms was assigned. See U.S. Geological Survey Professional Paper 708, Ground Water Hydraulics.

Contaminated Soil Area. The dimensions of the contaminated soil area, 480 ft^2, (20 feet by 24 feet) were estimated from the spacing and results of the 1989 soil borings done in and around the former tank location.

Building Volume/Area Ratio. Given the configuration of the shop area, the building volume to area ratio is approximately equivalent to the building's height. The building is approximately 36 feet high. For conservative estimating purposes, it was assumed that the upper six feet of building were stagnant and 30 feet was used in the calculations.

RBCA TIER 1/TIER 2 EVALUATION

Output Table 1

CD3

Site Name: Ingersoll-Rand Equipment Sal Job Identification: 100061
Site Location: San Leandro, California Date Completed: 9/8/97
Completed By. John McDermott
Software: GSI RBCA Spreadsheet
Version: 1.0.1

NOTE: values which differ from Tier 1 default values are shown in bold italics and underlined.

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m^3/day)	15			20	
IRa out	Inhalation rate outdoor (m^3/day)	20			20	10
SA	Skin surface area (dermal) (cm^2)	5.8E+03		2.0E+03	5 8E+03	5.8E+03
SAadj	Adjusted dermal area (cm^2-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

Matrix of Exposed Persons to Complete Exposure Pathways		Residential	Commercial/Industrial	
			Chronic	Constrctn
Outdoor Air Pathways:				
SS.v	Volatiles and Particulates from Surface Soil	FALSE	FALSE	TRUE
S.v	Volatilization from Subsurface Soils	FALSE	TRUE	
GW.v	Volatilization from Groundwater	FALSE	TRUE	
Indoor Air Pathways:				
S.b	Vapors from Subsurface Soils	FALSE	TRUE	
GW.b	Vapors from Groundwater	FALSE	TRUE	
Soil Pathways:				
SS.d	Direct Ingestion and Dermal Contact	FALSE	TRUE	TRUE
Groundwater Pathways:				
GW.i	Groundwater Ingestion	FALSE	FALSE	
S.l	Leaching to Groundwater from all Soils	FALSE	FALSE	

Matrix of Receptor Distance and Location On- or Off-Site		Residential		Commercial/Industrial	
		Distance	~~On-Site~~	Distance	On-Site
GW	Groundwater receptor (cm)		~~TRUE~~		TRUE
S	Inhalation receptor (cm)		~~TRUE~~		TRUE

Matrix of Target Risks		Individual	Cumulative
TRab	Target Risk (class A&B carcinogens)	1.0E-06	
TRc	Target Risk (class C carcinogens)	1.0E-05	
THQ	Target Hazard Quotient	1.0E+00	
Opt	Calculation Option (1, 2, or 3)	1	
Tier	RBCA Tier	2	

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm^2)	***4.5E+05***	1.0E+06
W	Length of affect. soil parallel to wind (cm)	***7.3E+02***	1 0E+03
W gw	Length of affect. soil parallel to groundwater (c	***7.3E+02***	
Uair	Ambient air velocity in mixing zone (cm/s)	2 3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	***8.1E+01***	
Pe	Particulate areal emission rate (g/cm^2/s)	6.9E-14	

Groundwate	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	2.5E+03
Ugw.tr	Groundwater seepage velocity (cm/yr)	6 6E+03
Ks	Saturated hydraulic conductivity(cm/s)	
grad	Groundwater gradient (cm/cm)	
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3 8E-01
foc sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	FALSE
BC	Biodegradation Capacity (mg/L)	

Soil	Definition (Units)	Value		
hc	Capillary zone thickness (cm)	***6.1E+01***	~2'	
hv	Vadose zone thickness (cm)	***4.0E+02***		
rho	Soil density (g/cm^3)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	0.38		
Lgw	Depth to groundwater (cm)	***4.6E+02***	~15'	
Ls	Depth to top of affected subsurface soil (cm)	***3.8E+02***	~12.5'	
Lsubs	Thickness of affected subsurface soils (cm)	***7.6E+01***		
pH	Soil/groundwater pH	6 5		
		capillary	vadose	foundation
phi w	Volumetric water content	0 342	0.12	0 12
phi a	Volumetric air content	0.038	0 26	0 26

Building	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	***9.0E+02***
ER	Building air exchange rate (s^-1)	1 4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0 01	

Transport Parameters	Definition (Units)	Residential	Commercial
Groundwater			
ax	Longitudinal dispersivity (cm)		
ay	Transverse dispersivity (cm)		
az	Vertical dispersivity (cm)		
Vapor			
dcy	Transverse dispersion coefficient (cm)		
dcz	Vertical dispersion coefficient (cm)		