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PUBLIC HEALTH RISK ASSESSMENT

FOR THE
H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

PREPARED BY:
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MAY 1992

RISK ASSESSMENT
for

H. Kramer & Company Site
El Segundo, CA

MAY 1992

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

CONTENTS

Section		Page
	EXECUTIVE SUMMARY	
1.0	**INTRODUCTION**	1
	1.1 PURPOSE OF THE REPORT	1
	1.2 SITE BACKGROUND	1
	1.3 METHODOLOGY AND REPORT ORGANIZATION	1
2.0	**IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**	5
	2.1 SUMMARY OF PRIOR SITE CHARACTERIZATION RESULTS	5
	2.1.1 Sampling Activities	5
	2.1.2 Summary of Analytical Results	5
	2.2 SUMMARY OF CHEMICALS OF POTENTIAL CONCERN (COPC)	8
	2.2.1 Soil COPC	8
	2.2.2 Groundwater COPC	11
3.0	**EXPOSURE ASSESSMENT**	12
	3.1 CHARACTERIZATION OF EXPOSURE SETTING	12
	3.1.1 Physical Setting	12
	3.1.2 Potentially Exposed Populations	15
	3.2 IDENTIFICATION OF EXPOSURE PATHWAYS	15
	3.2.1 Current Use Exposure Pathways	15
	3.2.1.1 Exposure Pathways Selected for Quantitative Evaluation	16
	3.2.1.2 Exposure Pathways Not Selected for Quantitative Evaluation	16
	3.2.2 Future Use Exposure Pathways	19
	3.2.2.1 Exposure Pathways Selected for Quantitative Evaluation	19
	3.2.2.2 Exposure Pathways Not Selected for Quantitative Evaluation	19
	3.3 QUANTIFICATION OF EXPOSURES	20
	3.3.1 Exposure Point Concentrations	20
	3.3.1.1 Soil Direct Pathways	20
	3.3.1.2 Inhalation Pathways - COPC Resuspended in Site Soils	23
	3.3.2 Estimation of Chemical Intakes	23
	3.4 IDENTIFICATION OF UNCERTAINTIES	23
	3.4.1 Exposure Point Concentration (EPC) Determination	28
	3.4.2 Human Exposure Parameter Estimation	28

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

CONTENTS

Section		Page
4.0	**TOXICITY ASSESSMENT**	29
4.1	TOXICITY INFORMATION FOR NONCARCINOGENIC EFFECTS	29
4.2	TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS	29
4.2.1	Weight-of-Evidence Classifications	29
4.2.2	Slope Factors	34
4.3	CHEMICALS FOR WHICH NO TOXICITY VALUES ARE AVAILABLE	34
4.4	UNCERTAINTIES RELATED TO TOXICITY INFORMATION	37
5.0	**RISK CHARACTERIZATION**	38
5.1	RISK CALCULATION METHODOLOGY	38
5.1.1	Risk Calculations for Carcinogens	38
5.1.2	Risk Calculations for Noncarcinogens	38
5.2	RESULTS OF THE RISK ASSESSMENT	39
5.2.1	Current Use Adult Worker Scenarios	39
5.2.2	Current Use Trespasser Scenarios	41
5.2.3	Future Use Construction Workers Scenarios: Area 1 Receptor Locations	41
5.2.4	Future Use Construction Workers Scenarios: Area 2 Receptor Locations	44
5.3	IDENTIFICATION OF UNCERTAINTIES	44
6.0	**CONCLUSIONS OF THE HUMAN HEALTH RISK ASSESSMENT**	46
7.0	**REFERENCES**	48

APPENDICES

APPENDIX A - SITE CHARACTERIZATION ANALYTICAL RESULTS (ENSR, 1990)
APPENDIX B - SURROUNDING WELL LOCATION INFORMATION
APPENDIX C - SOIL AND GROUNDWATER SUMMARY STATISTICS
APPENDIX D - GUIDANCE FOR ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL (DTSC, 1992)
APPENDIX E - RISK ASSESSMENT CALCULATION DOCUMENTATION

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

FIGURES

Figure		Page
1	Site Location Map	2
2	Site and Sample Location Map	3
3	Generalized Regional Geographic Cross Section	13

TABLES

Table		Page
2-1	Summary of Subsurface Soil Analytical Results	6
2-2	Summary of Groundwater Analytical Results	9
2-3	Summary of Chemicals of Potential Concern (COPC)	10
3-1	Potential Pathways of Exposure to COPC	17
3-2	Summary of Exposure Point Concentrations (EPCs) for Soil Exposure Pathways	21
3-3	Summary of Exposure Point Concentrations (EPCs) for Air Exposure Pathways	22
3-4	Equations Used to Calculate Chronic Daily Intakes (CDIs) of COPC	24
3-5	Assumptions Used to Evaluate Exposures to Soil COPC: Current Use Scenarios	25
3-6	Assumptions Used to Evaluate Exposures to Soil COPC: Future Use Construction Worker Scenarios	27
4-1	Toxicity Values For Potential Noncarcinogenic Effects	30
4-2	Toxicity Values For Potential Carcinogenic Effects	35
5-1	Cancer and Noncancer Risks Determined For Current Use Adult Worker Scenarios	40
5-2	Cancer and Noncancer Risks Determined For Current Use Trespasser Scenarios	42
5-3	Cancer and Noncancer Risks Determined For Future Use Construction Worker Scenarios: Area 1 Receptor Locations	43
5-4	Cancer and Noncancer Risks Determined for Future Use Construction Worker Scenarios: Area 2 Receptor Locations	45
6-1	Summary of Risk Assessment Results	47

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
CA MCL	California Environmental Protection Agency Max
CAPCOA	California Air Pollution Control Officers Association (CAPCOA).
CDI	Chronic Daily Intake
CNS	Central Nervous System
COPC	Chemical(s) of Potential Concern
DTSC	California EPA Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency Maximum Contaminant Level
EPC	Exposure Point Concentration
HEAST	Health Effects Assessment Summary Tables (EPA, 1991b)
HI	Hazard Index
N	Sample Number
MCL	Maximum Contaminant Level (USEPA or California EPA)
mg/kg	milligrams/kilogram, equivalent to ppm
mg/l	milligrams/liter, roughly equivalent to ppm
NCP	National Contingency Plan
PCE	Tetrachloroethene
PID	Photo-ionization Detector
PM_{10}	particulate matter 10 um or less in size, considered the respirable fraction
ppb	parts per billion
ppm	parts per million
RfD	Risk Reference Dose (for noncarcinogens)
SF	Slope Factor (for carcinogens)
TCE	Trichloroethene
TTLC	Total Threshold Limits Concentration
UCL	Upper Confidence Limit (as in 95% UCL of mean)
ug/kg	micrograms/kilogram, equivalent to ppb
ug/l	micrograms/liter, roughly equivalent to ppb
VOCs	Volatile Organic Compounds
WET	Waste Extraction Test

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

The purpose of this report was to conservatively estimate public health risks associated with the H. Kramer & Company (H. Kramer) Site in El Segundo, California (Figure 1). This risk assessment followed USEPA guidance and was developed using data from a previous investigation and Site Characterization Report (ENSR, 1990). Results of that investigation indicated the presence of metals exceeding expected background concentrations in site soils and underlying groundwater. Volatile organic compounds (VOCs) were also detected in groundwater samples, but not in soil samples, at concentrations exceeding drinking water guidelines, although presence of such compounds has not been associated with prior operations at the site. Given this, and the fact that the affected groundwater is not used as a potable water supply, the quantitative risk assessment focuses on soil contaminants at H. Kramer.

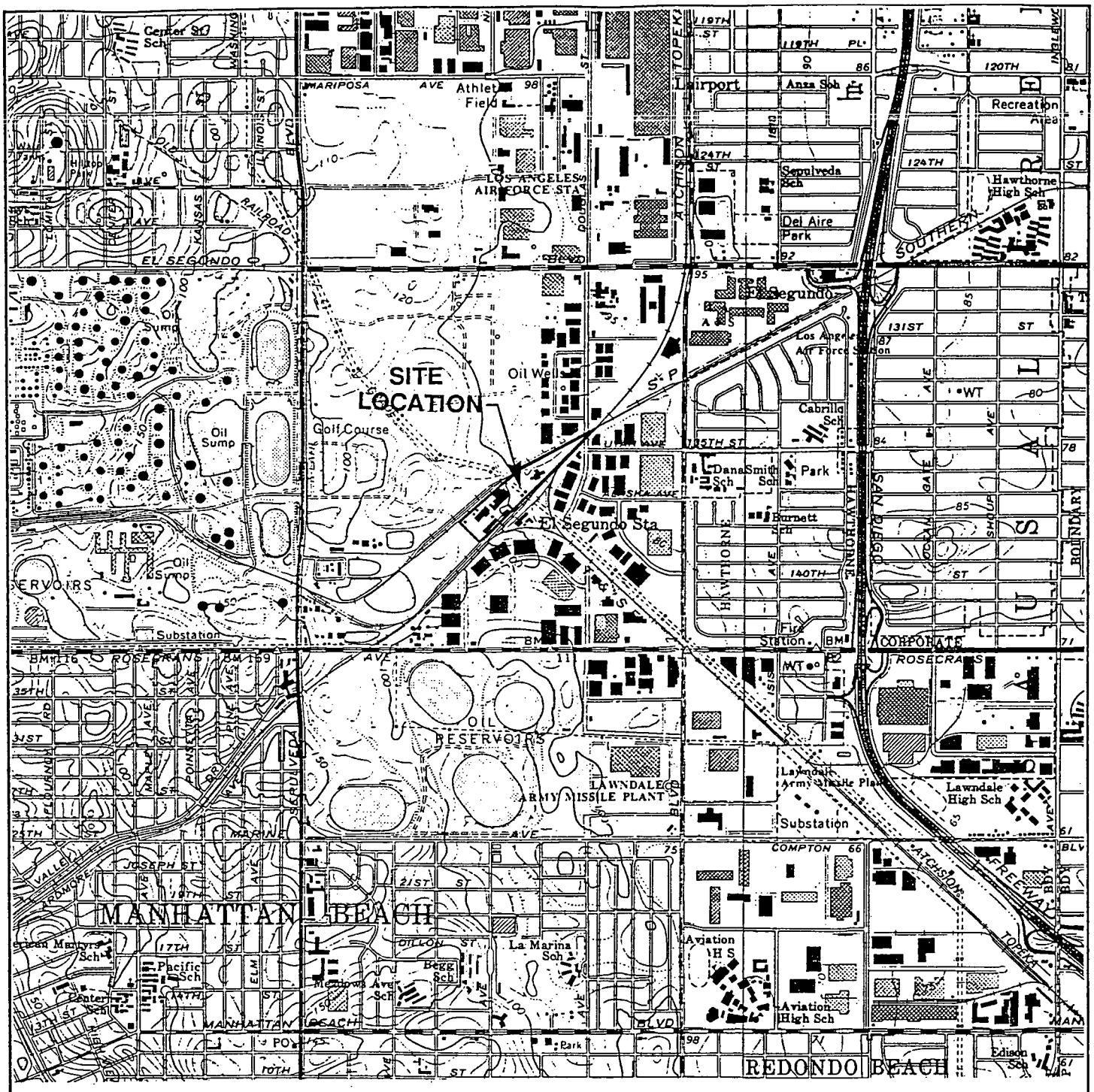
1.2 SITE BACKGROUND

H. Kramer operated a brass foundry at the subject site from 1951 through mid-1985. The layout of the site, showing present features, is shown in Figure 2. Of particular note to this report is the slag pile located in the northeast segment. This pile is roughly 50-acre feet in volume, with a maximum depth of approximately 20 feet (±10' above grade). The slag pile occupies a former surface lagoon which was used by the previous owner and occupant of the site (Harshaw Chemical Company) in its manufacture of ammunition casings. Use of the site by Harshaw apparently resulted in deposition of arsenical wastes (and perhaps other contaminants), on top of which slags containing heavy metals were deposited by H. Kramer.

The surface aquifer underlying this site, as well as the entire El Segundo area, is known to be unfit for use as potable water due to salinity intrusion and contamination from a variety of sources. The H. Kramer site has not been used since mid-1985, when the company ceased operations in California. Recently, however, construction of a high voltage transmission line and an extension of the LA light rail system across the northeast portion of the site have begun. Presence of these two features will further restrict opportunities for future site use.

1.3 METHODOLOGY AND REPORT ORGANIZATION

Using analytical results presented in the Site Characterization Report (ENSR, 1990), combined with pertinent environmental setting and land use information, this report evaluates potential human health risks posed by the H. Kramer site. All methods used in this evaluation were in accordance with



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SCALE IN MILES

FIGURE 1

SITE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

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Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981

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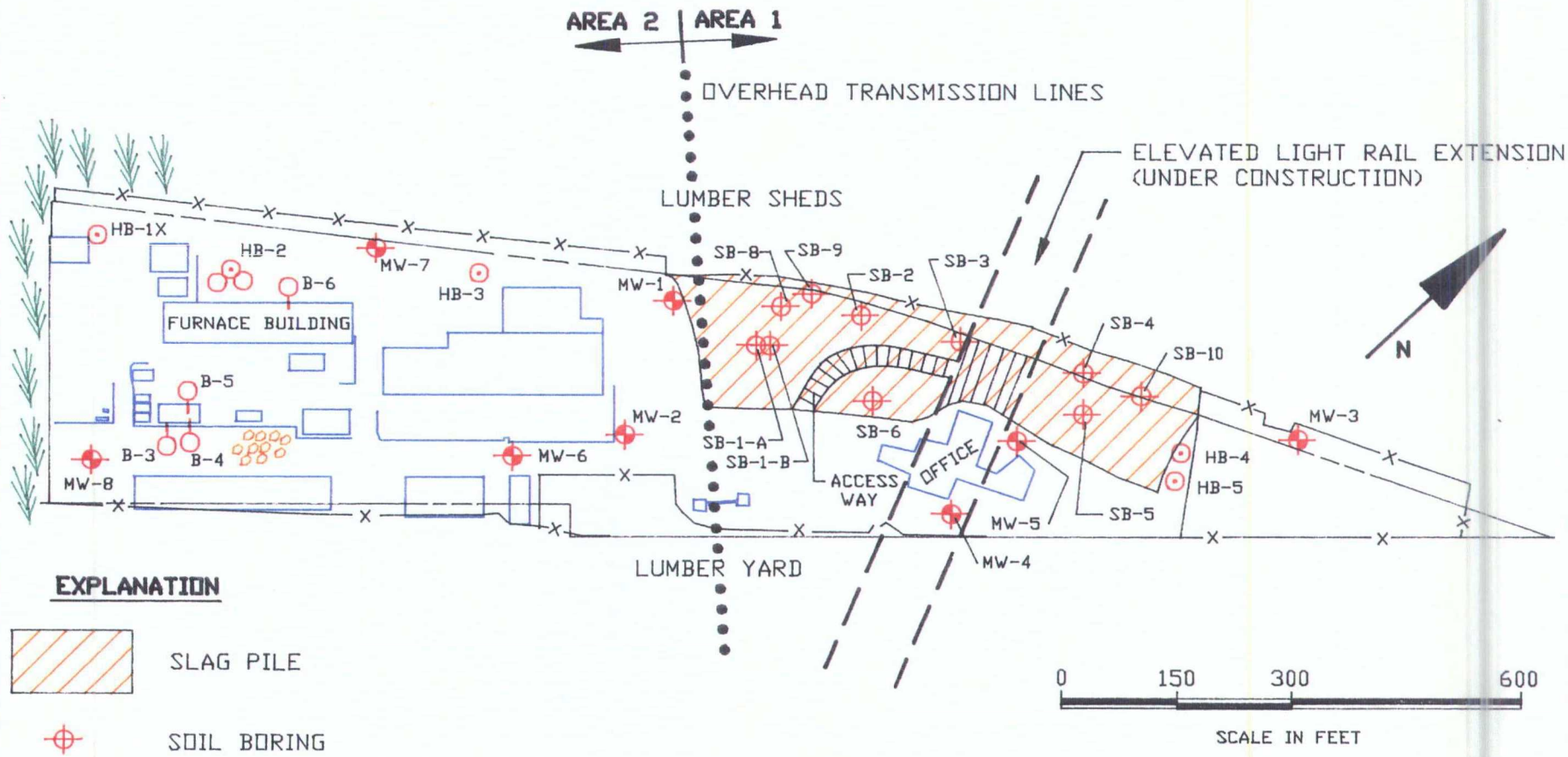

EXPLANATION

SLAG PILE

SOIL BORING

SOIL BORING/MONITORING WELL

SLANT BORING (SHOWING DIRECTION OF SLANT)

HAND BORING

PHRAGMITES (vegetation)

55 GALLON DRUMS

TARP AND PLANK COVERED ACCESS WAY
(UNDERLAIN WITH IMPORTED FILL)

LOCAL GROUNDWATER
GRADIENT: S/SE

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

PLSC: 1.4=300, CHEV-3

FIGURE 2

SITE AND SAMPLE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

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guidelines presented in the U.S. Environmental Protection Agency (EPA) document entitled *Risk Assessment Guidance for Superfund* (USEPA, 1989a).

Consistent with these guidelines, the baseline human health risk assessment was developed according to the following steps:

- Identification of Chemicals of Potential Concern (Section 2.0)
- Exposure Assessment (Section 3.0)
- Toxicity Assessment (Section 4.0)
- Risk Characterization (Section 5.0)

These steps are developed in the following sections.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC)

Chemicals of potential concern (COPC) are those chemicals to be evaluated in the risk assessment process. COPC were selected based on analytical results presented in the Site Characterization Report (ENSR, 1990) as summarized below.

2.1 SUMMARY OF PRIOR SITE CHARACTERIZATION RESULTS

2.1.1 Sampling Activities

ENSR's site characterization was performed for H. Kramer in 1989 according to an EPA-approved work plan. Soil boring and monitoring well sample locations are shown in Figure 2.

A total of 50-61 soil samples (the exact number depending on analyte) were collected from 23 locations (including 9 borings in and through the slag pile). Soil samples were collected at 5 foot intervals, starting at a depth of 3 to 5 feet and extending to depths of approximately 20-30 feet below the surface. [Note: Surveyed elevations of soil borings were not included in ENSR's Site Characterization Report. Consequently, all soil sample depths cited in this reported are measured relative to the ground or slag pile surface. The slag pile is approximately 8-10 ft above grade.] These samples were analyzed for total metals (the 17 CAM metals plus iron, aluminum, and manganese). Subsets of these samples were analyzed for volatile organic compounds (VOCs) and California Waste Extraction Test (WET) metals. ENSR utilized a decision tree, based on the Total Threshold Limits Concentration (TTLC) and the Soluble Threshold Limits Concentration (STLC), to select additional soil samples for analysis. VOCs were analyzed only for those soil samples with organic vapor readings exceeding 25 parts per million (ppm) using a Photo-ionization Detector (PID) organic vapor meter.

Groundwater samples from eight on-site monitoring wells were analyzed for VOCs and metals. The depths and wells screens of MW-1, MW-2 and MW-3 are not known. Wells MW-4 through MW-8 are 96 to 115 ft deep and have 30 ft zones of perforation beginning at 45 to 85 ft bgs.

2.1.2 Summary of Analytical Results

Soils

Table 2-1 presents ranges and means of metals detected in the subsurface soil/slag samples. In lieu of site-specific background data, metal concentrations were compared with background levels reported in literature (Kabata-Pendias and Pendias, 1984). These comparisons indicate that soil/slag concentrations of antimony, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium and zinc exceed national background levels. [Note: Site-specific background data were not available.] Sample locations in the slag pile, particularly SB-1A and SB-3, contained the highest concentrations of metals. In addition, the majority of the slag pile samples containing the maximum metal concentrations were collected five feet below the surface of the slag pile (this was the shallowest depth sampled). The only exception was the maximum concentration of arsenic, 2,800 mg/kg, detected in a slag pile sample

TABLE 2-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	SUBSURFACE SOIL SAMPLE RESULTS /1/ Frequency	Mean	Minimum	Maximum	Location of Maximum	BACKGROUND LEVELS /2/ CITED IN LITERATURE Reported Range	Mean
METALS (mg/kg)							
Aluminum	49/50	4,276	690	18,000	SB1A-5'	--	--
Antimony	20/54	87.9	2.8	1,780	MW5-5'	0.05 - 4.0	--
Arsenic	61/61	185.7	0.6	2,800	SB3-20'	0.1 - 30	5.1
Barium	50/50	53.7	6.1	501	SB3-5'	20 - 1,500	400
Beryllium	39/50	12.5	0.06	230	SB1A-5'	3 - 200	40
Cadmium	30/50	1.48	0.05	29.5	SB3-5'	0.07 - 1.1	0.5
Chromium	50/50	9.39	1.5	74.60	SB4-10'	3 - 200	40
Chromium (VI)	1/50	1.21	1.21	1.21	SB2-5'	--	--
Cobalt	49/50	4.14	0.5	28	SB1A-5'	0.4 - 20	3.5
Copper	50/50	1,826	2.6	53,800	SB6-5'	1 - 70	14
Iron	50/50	8,252	1,800	31,000	SB1A-5'	--	--
Lead	43/50	242.1	1	2,500	SB1A-5'	10 - 70	17
Manganese	50/50	1,188	16.2	41,000	SB1A-5'	7 - 2,000	345
Mercury	37/50	0.19	0.02	5.80	MW5-5'	0.01 - 0.54	0.08
Molybdenum	34/50	4.45	0.1	33	SB1A-5'	0.05 - 2.0	--
Nickel	46/50	29.1	2.0	310	SB1A-5'	5 - 70	13
Selenium	22/52	10.6	0.09	300	MW5-5'	0.05 - 4.0	--
Silver	15/50	1.35	0.1	3.7	SB8-10'	0.1 - 5.0	--
Vanadium	50/50	9.42	2.3	27	SB1A-5'	7 - 150	47
Zinc	50/50	7,757	5.2	76,000	SB3-5'	15 - 164	40
VOLATILE ORGANIC COMPOUNDS (ug/kg)							
Acetone	4/7	14.0	15.0	30.0	SB4-30'	--	--
Methylene chloride	2/7	3.21	5.0	5.0	B4, MW-8	--	--
Toluene	3/7	4.86	6.0	12.0	B4-X-10	--	--

: Indicates constituents selected as Chemicals of Potential Concern (COPC) based on criteria defined in Section 2.2.1.

*See NOTES on following page.

NOTES:

/1/ Means reported above were calculated by assuming non-detected results were equal to 1/2 the sample-specific detection limit value. Appendix C presents summary statistics for individual constituents, partitioning results according to location and depth.

/2/ National background levels for sandy soils reported by Kabata-Pendias and Pendias (1984).

collected at a depth of 20 feet, in soils at the slag/soil interface. [Appendix A contains detailed sample-specific results of ENSR's investigation.]

Based on results of the initial organic vapor screening, and using the sampling criteria described in Section 2.1.1, seven soil samples were analyzed for VOCs (three in the slag pile and four underlying pavement). As shown in Table 2-1, acetone was detected in 4/7 samples at concentrations ranging from 15 to 30 ug/kg (ppb). Methylene chloride was detected in 2/7 samples at the detection limit of 5 ug/kg. Results for acetone and methylene chloride are both considered suspect given possible cross-contamination reported by the laboratory. Toluene was detected in 3/7 samples at concentrations ranging from 6 ug/kg (in 30' and 70' samples) to 12 ug/kg (10' sample).

Groundwater

Table 2-2 summarizes groundwater sampling results using ENSR analytical data included in Appendix A. Metals detected in groundwater samples taken from 30-foot zones beginning between 45 and 85 feet below grade included: antimony (ND-0.84 mg/l); arsenic (ND-140 mg/l); barium (ND-0.49 mg/l); trivalent chromium (ND-0.21 mg/l); hexavalent chromium (ND-0.23 mg/l); manganese (ND-3.3 mg/l); nickel (ND-0.07 mg/l); selenium (ND-0.19 mg/l) and zinc (ND-0.11 mg/l).

VOCs detected in site groundwater samples included carbon tetrachloride (ND-43.0 ug/l); 1,1-dichloroethene (ND-19 ug/l); ethylbenzene (ND-39 ug/l); tetrachloroethene or PCE (ND-200 ug/l); toluene (ND-270 ug/l); 1,1,1-trichloroethane (ND-12 ug/l); trichloroethene or TCE (18-370 ug/L); trichlorofluoromethane (ND-73 ug/l); and xylenes (ND-300 ug/l). Results of metal and VOC groundwater analyses are discussed in greater detail in Section 2.2.2.

2.2 SUMMARY OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPC) are those chemicals selected for evaluation in the risk assessment. COPC for the H. Kramer site are summarized in Table 2-3 and were identified based on the analytical results of the field investigation discussed above (Tables 2-1 and 2-2). Factors considered in their selection are discussed below.

2.2.1 Soil COPC

Metals

Soil COPC were primarily selected on the basis of two factors: 1] frequency of detection (greater than five percent); and 2] carcinogenic or other toxic effects (as indicated by available toxicity criteria). Comparison to (national) background levels was considered in selecting soil COPC, but was not the sole factor used to exclude a chemical from evaluation. [Site-specific background data were not available.] Consequently, barium and trivalent chromium were retained as soil COPC despite their presence at concentrations below literature background values (Table 2-1; Kabata-Pendias and Pendias, 1984).

TABLE 2-2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	MONITORING WELL LOCATION MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	Range of Sample QLs	Drinking Water Guidelines Value	Source
Screen Depth (bgs):	--	--	--	(45-75')	(80-110')	(85-115')	(65-95')	(80-110')			
Screen Elevation (amsl):	--	--	--	(17.2 - 47.2')	(-17.2 - 12.8')	(-16.8 - 13.2')	(12.9 - 42.9')	(-7.6-22.4')			
METALS (mg/l)											
Antimony	<0.1	<0.1	0.84	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	----	
Arsenic	3.2	12	9.8	0.005	140	25	0.011	<0.005	0.005 - 50	0.05 mg/l	EPA/CA MCL
Barium	<0.02	<0.02	0.07	0.49	0.03	0.03	0.04	0.03	0.02	1.0 mg/l	CA MCL
Chromium III	<0.02	0.21	<0.02	0.1	<0.02	0.23	<0.02	0.02	0.02	0.05 mg/l	CA MCL
Chromium VI	<0.05	0.17	<0.05	0.09	<0.05	0.23	NA	<0.05	0.05 - 0.1	----	
Manganese	0.06	3.3	<0.02	<0.02	0.08	1.9	0.5	0.42	0.02	0.05 mg/l	CA MCL
Nickel	0.02	0.06	<0.02	<0.02	0.03	0.07	<0.02	0.06	0.02	----	
Selenium	0.02	0.24	0.19	<0.01	0.02	0.03	<0.01	0.01	0.01- 0.03	0.01 mg/l	CA MCL
Zinc	<0.05	0.04	0.03	<0.02	0.02	0.11	<0.02	0.04	0.02	5.0 mg/l	CA MCL
VOLATILE ORGANIC COMPOUNDS (ug/l)											
Carbon Tetrachloride	<5	<5	<5	<5	<5	43	NA	<5	5	0.5 ug/l	CA MCL
1,1-Dichloroethene	19	<5	<5	<5	<5	8	NA	5	5	6.0 ug/l	CA MCL
Ethylbenzene	<5	<5	<5	6	39	<5	NA	<5	5	680 ug/l	CA MCL
Tetrachloroethene (PCE)	200	16	160	<5	<5	<5	NA	25	5	5 ug/l	EPA/CA MCL
Toluene	<5	18	6	39	270	<5	NA	<5	5	100 ug/l	CA Action Level (AL)
1,1,1-Trichloroethane	12	<5	<5	<5	<5	10	NA	<5	5	200 ug/l	CA MCL
Trichloroethene (TCE)	370	40	120	190	18	110	NA	88	5	5 ug/l	EPA/CA MCL
Trichlorofluoromethane (Freon-11)	<5	<5	<5	<5	<5	73	NA	<5	5	150 ug/l	CA MCL
Xylenes	<5	<5	<5	40	300	<5	NA	<5	5	1750 ug/l	CA MCL

: Shaded chemicals were selected as Chemicals of Potential Concern (COPC). Shaded values indicate sample in which drinking water guidelines were exceeded for a given parameter. NOTE: Decisions to retain or exclude groundwater COPC in the RA were made independent of exposure likelihood. However, as discussed in Section 3.2, groundwater COPC were not quantitatively evaluated in the risk assessment because no exposure pathways were identified for current or potential future site uses.

NA: Not Analyzed
QL: Quantitation Limit
---: No data/criteria available.

TABLE 2-3
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN (COPC)
H. KRAMER & COMPANY SITE

MATRIX/ CHEMICAL	SUBSURFACE SOILS/1/	GROUNDWATER/1/
Metals		
Antimony	X	X
Arsenic	X	X
Barium	X	(below MCL; noncarcinogen)
Beryllium	X	(ND)
Cadmium	X	(ND)
Chromium III	X	X
Chromium VI		X
Copper	X	(ND)
Lead	X	(ND)
Manganese	X	X
Mercury	X	(ND)
Nickel	X	X
Selenium	X	X
Zinc	X	(below MCL; noncarcinogen)
Volatile Organic Compounds /2/		
Acetone	(laboratory blank contaminant)	(ND)
Carbon Tetrachloride	(ND)	X
1,1-Dichloroethene	(ND)	(ND)
Methylene chloride	(laboratory blank contaminant)	X
Tetrachloroethene (PCE)	(ND)	X
Toluene	(See Section 2.1.1 discussion.)	X
Trichloroethene (TCE)	(ND)	X

NOTE:

/1/ "X" indicates chemical chosen as COPC. See Tables 2-1 and 2-2 for ranges of COPC detected in subsurface soil and groundwater samples. Constituents not listed in this table were either not detected or excluded from further evaluation based on lack of toxicity criteria or, for noncarcinogenicconstituents in groundwater, comparisons to MCLs. As discussed in Section 3.2, groundwater COPC were not quantitatively evaluated in the risk assessment.

/2/ Using the sampling criteria defined in Section 2.1.1, seven soil samples were analyzed for VOCs. These results indicated the presence of only acetone, methylene chloride and toluene. These constituents were not quantitatively evaluated in the risk assessment for reasons described in Section 2.2.1.

ND - Not Detected

Using these selection criteria, the following soil COPC were selected for evaluation:

- antimony
- arsenic
- barium
- beryllium
- cadmium
- chromium (III)
- zinc
- copper
- lead
- mercury
- manganese
- nickel
- selenium

Hexavalent chromium was not selected due to low frequency of detection (1/50 samples). Cobalt, iron, molybdenum, silver and vanadium were not evaluated given the lack of toxicity criteria and/or presence well within the range of national background levels.

Volatile Organic Compounds (VOCs)

Using the sampling criteria defined in Section 2.1.1, ENSR selected seven soil samples for analysis of VOCs. As shown in Table 2-1, these results indicated the presence of only acetone, methylene chloride and toluene. Given that acetone and methylene chloride were reported as possible laboratory contaminants (ENSR, 1990), and also that methylene chloride was present at the detection limit, neither of these two compounds were selected as soil COPC.

Toluene qualified in theory as a COPC, but was not quantitatively evaluated in the risk assessment. This is because it was found at very low concentrations (6-12 ug/kg) and potential human exposures are only a remote possibility (found in three samples at 10, 30 and 70 feet).

2.2.2 Groundwater COPC

Based solely upon toxicity and drinking water MCLs (for noncarcinogenic constituents) of compounds identified in Table 2-2, groundwater COPC include:

- antimony
- arsenic
- trivalent chromium
- hexavalent chromium
- manganese
- nickel
- selenium
- carbon tetrachloride
- 1,1-dichloroethene
- tetrachloroethene (PCE)
- toluene
- trichloroethene (TCE)

Arsenic, trivalent chromium, manganese, selenium and all VOCs listed above were present above MCLs. Because MCLs are not available for antimony, hexavalent chromium and nickel, these constituents are identified as groundwater COPC based on potential toxicity. As discussed in the following section, however, none of these COPC were quantitatively evaluated because no groundwater exposure pathways were identified for current or expected future site uses. Additionally, it is well known and established that shallow groundwater in the entire El Segundo region is contaminated from a variety of other sources.

3.0 EXPOSURE ASSESSMENT

This section characterizes potential human exposure routes at the H. Kramer site for both current and potential alternate future site uses.

3.1 CHARACTERIZATION OF EXPOSURE SETTING

3.1.1 Physical Setting

Site Features and Surroundings

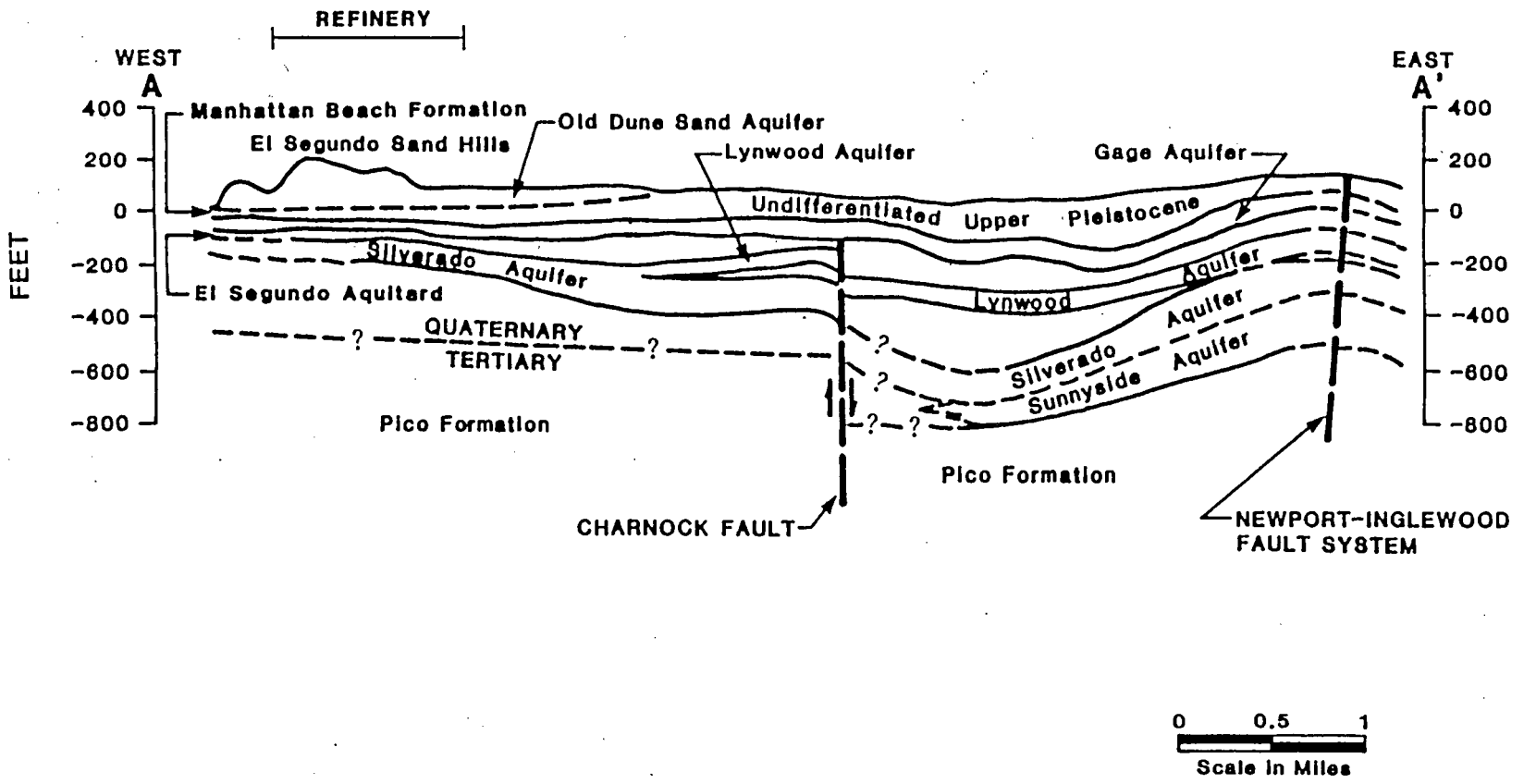
The northeast portion of the site, as shown in Figure 2, is occupied by the slag pile and an office building. A furnace building, blast furnace, bag house, silos, and former cooling basins occupy the central and southwest portions of the site. Principal boundary features include the Southern Pacific Railroad line (northern border); the Atchison, Topeka & Santa Fe rail line (southern border); and a lumber yard (northeast and southern boundaries). Surrounding land use includes a golf course 1/4 mile to the northwest; three schools within 3/4 miles to the east; and extensive industrial park development northeast and southeast of the slag pile. Large areas of vacant property exist west-northwest of the site.

The site is fenced and paved, except for the slag pile and several peripheral small areas (a dirt walkway behind the office building and a plank-covered access way). The surface of the slag pile is littered with debris, and the slag pile itself is not of a constituency which would suggest potential for significant resuspension. [Despite high winds during a recent site visit, the air above the slag pile was not dusty.] There is an office in the eastern portion of the site, but all other buildings are vacant and in disrepair. The general topographic slope of the area is to the east, with the elevation sloping approximately 20 feet approximately 400 feet east of the site.

Geology

The area stratigraphy, shown in Figure 3, was taken from a 1987 report by Radian Corporation. The H. Kramer site is located on the eastern fringe of the El Segundo Sand Hills. Based on drilling work performed at the site by ENSR, and by Radian at the nearby refinery, the stratigraphy includes the uppermost Old Dune Sand formation; the Manhattan Beach formation; the Gage aquifer; the El Segundo aquitard; and the Silverado aquifer.

The Old Dune Sand formation is unconsolidated and consists of brown to reddish brown sands. Based on ENSR's report, there does not appear to be a significant amount of groundwater in the Old Dune Sand formation. Immediately below the Old Dune Sand is the Manhattan Beach Formation. The Manhattan Beach formation in this area consists primarily of the Manhattan Beach aquitard. At the nearby Chevron refinery, the Manhattan Beach aquitard has been found across the site and has been shown to separate the Old Dune Sand from the Gage aquifer (Radian, 1987). At H. Kramer, presence of the Manhattan Beach aquitard has been identified in several of the soil borings which were converted to groundwater wells. Immediately below the Manhattan Beach aquitard is the Gage formation which



Source: Hydrogeological Assessment Report - Radian Corporation, 1987.

FIGURE 3
GENERALIZED REGIONAL GEOGRAPHIC CROSS SECTION

is also an aquifer. The extent of the Manhattan Beach aquitard varies in this general area such that where the Gage is overlain by fine sand, the Manhattan Beach aquitard may not be present.

The Gage aquifer consists mainly of a medium to coarse grained yellow-brown sand with minor silt and clay. Beneath the Gage is the El Segundo aquitard which separates the Gage from the Silverado aquifer. The El Segundo aquitard is comprised of a blue-grey to dark grey, dense, silty clay. At the refinery, shell fragments and traces of wood fragments are also present within this formation. The presence of the El Segundo aquitard under the H. Kramer site has not been defined at present, however nearby wells in the City of Hawthorne and the eastern portion of the refinery have shown it to be present thus bracketing the site.

The Silverado aquifer consists of fine-to coarse sand and gravel, with interbeds of pebbles. In some areas of the refinery, beds of silt and clay up to 10 feet thick occur in the Silverado. These fine-grained deposits are generally described as grey, silty (highly plastic) clay and as brown silt and/or grey silt. According to Radian (1986), the elevation of the Silverado aquifer ranges from 65 feet below mean sea level near the center of the refinery to 23 feet below mean sea-level to the north of the refinery. This large range in depth is probably due to local erosional influences and results. The depth of the Silverado aquifer increases substantially with distance inland.

Hydrology

Groundwater was encountered in on-site wells at depths of 70-90 feet bgs, or 16 to 22 feet above mean sea-level. This groundwater was found to contain contaminants identified in Section 2.1.2, which are common to the area. This may be the Gage aquifer, but it clearly does not represent the deeper Silverado aquifer.

The groundwater hydrology in the vicinity of the site is influenced by variations in the local geology and the presence of a series of groundwater injection wells near the site. Fresh water injection wells are operated by the County of Los Angeles along a saltwater intrusion barrier located one-half mile west of the site along Sepulveda Boulevard. Fresh water is injected from 110 to 347 feet bgs spanning two aquifers, an upper aquifer referred to as the 200-foot dune sand aquifer (which may be a combination of the Gage aquifer and Old Dune Formation), below which lies the Silverado aquifer.

While the available geological data are sufficiently complete to support a conclusion that the H. Kramer site is at least partially underlain by a confining layer of clay (El Segundo aquitard), the hydrogeological data (flow direction and rate) are confounded by effects of the intrusion barrier and therefore subject to greater uncertainty. Reports related to the refinery indicate that flow is to the west, whereas H. Kramer site results and the Radian report on the Section 18 property show an east-southeast flow direction (ENSR, 1990; Radian, 1986). This difference in flow may be a result of the intrusion barrier, but Radian has indicated that the barrier well leakage which could have caused this has been fixed, and the mounding diminished over time. Thus, as the flow direction returns to normal conditions, water flow in the Gage will be toward the ocean and away from the existing groundwater production wells east of the site.

3.1.2 Potentially Exposed Populations

Current Site Uses

The site has not been used for industrial purposes since foundry operations ceased in 1985. The only individual currently working at the site is a daytime security guard who occupies the front portion of the office building but spends some time outdoors. The site is surrounded by a fence, but certain portions of the fence are not intact, thus permitting site access. Evidence of trespassing has been noted during previous site visits. Given these factors, potentially exposed populations for current site uses include on-site workers and trespassers.

The groundwater present in the Old Dune Sand and Gage aquifers is not produced at this time. As a result, no populations are currently exposed to shallow groundwater contaminants in these aquifers since they are not used as potable water sources (see Sections 3.1.1 and 3.2.1.2 for further information).

Potential Alternate Future Site Uses

While no future use of the site has been defined, current zoning suggests that any future use of the site would likely be industrial in nature. Consequently, adult workers are considered potentially exposed populations for future use scenarios.

As described for the current use scenario, no potentially exposed populations were identified for future use groundwater pathways. Future use of groundwater in the Old Dune Sand and Gage aquifers beneath the site is not expected due to groundwater salinity; regional contamination; and production capacity (see Section 3.1.1).

3.2 IDENTIFICATION OF EXPOSURE PATHWAYS

According to EPA risk assessment guidance (USEPA, 1989a), an exposure pathway consists of the following elements:

- a source and mechanism of chemical release to the environment;
- an environmental transport medium;
- a point of human or biota contact with the medium (the exposure point); and
- an exposure route at the contact point (e.g., ingestion, dermal contact, inhalation).

Table 3-1 summarizes potential pathways of exposure to COPC at the H. Kramer site. These exposure pathways are discussed below for both current and potential future site uses. Rationales for exposure scenarios evaluated qualitatively, or not retained, are also presented.

3.2.1 Current Use Exposure Pathways

For assessment of current site uses, the following conditions were assumed:

- no change in worker activity patterns
- no subsurface excavation

- no groundwater use
- no seismic liquefaction

Using these assumptions, potential current use exposure pathways are summarized below.

3.2.1.1 Exposure Pathways Selected for Quantitative Evaluation

Current Use On-Site Worker and Trespasser Pathways

As shown in Table 2-1, subsurface soils at the site contain metals at concentrations exceeding expected background levels. The highest concentrations were detected in slag pile soils, which are exposed and potentially accessed by on-site workers and/or trespassers. Direct exposure to slag soils is likely to occur infrequently because the pile is isolated and in some areas barricaded. Nonetheless, potential direct contact and inhalation exposures to slag pile soils warrant evaluation.

The following current use exposure pathways were quantitatively evaluated:

Exposure Pathway(s)	Current Use Receptor	Receptor Location
•Ingestion, Dermal Contact and Inhalation	Child Trespassers	• Slag Pile Shallow Subsurface Soils ($\leq$ 5 ft)
•Ingestion, Dermal Contact and Inhalation	Adult Workers	• Slag Pile Shallow Subsurface Soils ($\leq$ 5 ft)

3.2.1.2 Exposure Pathways Not Selected for Quantitative Evaluation

Current Use Groundwater Pathways

Groundwater in the Old Dune Sand and Gage aquifers beneath the site contained concentrations of metals and volatile organic compounds exceeding drinking water guidelines (ENSR, 1990; Table 2-2). However, due to salinity and other recognized problems discussed in Section 3.1.1, groundwater from this formation in El Segundo is not used as a drinking water source or for irrigation purposes. As a result, groundwater exposure pathways were not quantitatively evaluated in the risk assessment.

The city of El Segundo is located primarily seaward of the County's saltwater intrusion barrier shown in Appendix B, Figure B-1 (personal communication, Larry Vivian, City of El Segundo, November 14, 1991). In addition, a wedge of saltwater trapped inland upon construction of the barrier has remained in the area just east of the barrier, which includes the H. Kramer site. As a result, groundwater in the Old Dune Sand and Gage aquifers seaward and inland of the barrier in El Segundo is highly saline and non-potable (Bookman-Edmonston Engineering, 1991).

The Silverado aquifer, which underlies the Gage aquifer (below 200 feet bgs), is the primary aquifer utilized for drinking water in the El Segundo area. The nearest drinking water wells to the H. Kramer

TABLE 3-1
POTENTIAL PATHWAYS OF EXPOSURE TO COPC
H. KRAMER & COMPANY SITE
page 1 of 2

EXPOSURE MEDIUM	RECEPTOR LOCATION	POTENTIAL RECEPTOR(S)	EXPOSURE ROUTE	PATHWAY EVALUATED	REASON FOR SELECTION OR EXCLUSION
Current Use Pathways					
Soils (≤5 ft)	Slag Pile	On-site Workers, Trespassers	Ingestion, Dermal Contact	YES	Slag pile soils are contaminated with metals (see Table 2-1). Soils are exposed and potentially accessed by on-site workers and/or trespassers. Access is likely to be infrequent, however, given that the slag pile is isolated, and, in some areas, surrounded by a 4-foot high vinyl net fence.
Air	On-site Areas	On-site Workers, Trespassers	Inhalation of soil containing COPC	YES	Resuspension of slag pile soils could result in emissions of fugitive dust containing COPC. Such exposures are likely to be limited given the apparent large grain size of slag pile soils. [Note: Despite high wind speeds during a recent site visit, resuspension of slag pile soils was not evident.]
Groundwater	On-site or local downgradient wells	Local workers or residents	Ingestion, dermal contact and inhalation of volatilized organic compounds (e.g., while showering)	NO	Shallow groundwater in the Old Dune Sand and Gage beneath the site is saline and not used as a potable water source or for irrigation purposes. There appears to be a high degree of hydrologic isolation between the site and any groundwater production wells completed (several miles from the site) in the Silverado aquifer.
Surface Water	On-site	Local workers or trespassers	Ingestion, dermal contact and/or biota ingestion	NO	The only water at the site is that contained in a former equalization basin located in the western portion of the site. Exposures to this water are not expected and thus were not quantitatively evaluated.
Potential Future Use Pathways					
Soils (≤25 ft); Air	Area 1 Area 2	Construction Workers	Ingestion, dermal contact and inhalation exposures to soil COPC during potential future excavation	YES	No construction has been planned for the H. Kramer site, nor is any planned in the future. However, a hypothetical construction scenario was included to evaluate potential effects associated with exposures to subsurface soils. This scenario assumes major construction and earth-moving activities to depths of 25 feet. Receptor locations are distinguished by two areas (1 and 2) given the differing distribution of contaminants at the site. As shown in Appendix C, metals concentrations were most elevated in areas within and surrounding the slag pile.

TABLE 3-1
POTENTIAL PATHWAYS OF EXPOSURE TO COPC
H. KRAMER & COMPANY SITE
page 2 of 2

EXPOSURE MEDIUM	RECEPTOR LOCATION	POTENTIAL RECEPTOR(S)	EXPOSURE ROUTE	PATHWAY EVALUATED	REASON FOR SELECTION OR EXCLUSION
Potential Future Use Pathways (Cont.)					
Slag Pile Soils; Air	On-site Areas	Future Industrial Workers	Direct contact and inhalation exposures to COPC in slag pile soils	NO	This scenario assumes: 1] future industrial use of the site; 2] no removal of contaminated soils; and 3] subsequent installation of a cap or vegetative cover (e.g., grass). Given that these factors would prevent exposures to subsurface contaminants, this future use pathway was not quantitatively evaluated.
Groundwater	On-site or local downgradient wells	Adult residents	Ingestion, dermal contact, and inhalation of volatilized organic compounds (e.g., while showering)	NO	Future use of shallow groundwater beneath the site is not expected due to salinity problems; regional contamination; and production capacity. Local saline groundwater appears to be hydrologically isolated from deeper groundwater production aquifers as a result of fine-grain silt and clay aquitards. Upper aquifer flow is also toward the ocean and away from any existing production wells. Consequently, future use groundwater exposure pathways were not quantitatively evaluated.

site are located in the cities of Hawthorne (four wells) and Redondo Beach (one well), approximately 1.5 miles northeast (upgradient) and southeast of the site, respectively (personal communication, Melinda Gleason, Water Replenishment District, November 20, 1991). These wells are shown in Appendix B, Figure B-2. Regular chemical monitoring of these five wells has not detected contamination (personal communication, Al Rivier, City of Hawthorne, November 25, 1991). The shallowest screening sections in these wells are located within the Silverado aquifer, or in even deeper aquifers (See Appendix B, Tables B-1 and B-2). As discussed in Section 3.1.1, the shallow groundwater beneath the H. Kramer site and the production wells in the Silverado are probably hydrologically isolated. Consequently, vertical (downward) migration of shallow groundwater contaminants to potable aquifers is not expected.

Surface Water Pathways

The only "surface water" at the H. Kramer site is some standing water which is contained in two small concrete basins located in the western portion of the former foundry. Exposures to this water are not expected and thus are not quantitatively evaluated in the risk assessment.

3.2.2 Future Use Exposure Pathways

3.2.2.1 Exposure Pathways Selected for Quantitative Evaluation

Future Use Construction Worker Pathway

Future use of the site is uncertain, and consequently no construction activities involving soil excavation are planned. However, a quantitative risk assessment to evaluate potential health effects associated with exposures to subsurface soils was performed using a hypothetical construction worker scenario as the most plausible yet conservative case. Ingestion, dermal contact and inhalation exposure pathways were quantitatively evaluated for adult construction worker receptors.

As noted in Table 3-1, receptor locations for this scenario were distinguished according to two areas: Area 1 and Area 2. "Area 1" includes the slag pile and surrounding area encompassing the eastern portion of the site. "Area 2" represents the western paved portion of the site and includes data from corresponding soil boring samples (See Figure 2 delineations). This distinction was made because metals concentrations in soils were most elevated in areas within and surrounding the slag pile. Both (Area 1 and 2) scenarios conservatively assume major construction and earth-moving activities to depths of 25 feet for a period of one year.

3.2.2.2 Exposure Pathways Not Selected for Quantitative Evaluation

Future Industrial Use Pathways

Potential future use of the site for alternate industrial uses is possible. However, this risk assessment assumes that development of the site would be preceded by some form of reduction in slag pile mass, profile and/or lack of cover. Given that these factors would prevent exposures to subsurface contaminants, this future use pathway was not quantitatively evaluated. Assuming no change in the

condition of the slag pile, the current use worker exposure scenario could also apply to future site uses if worker activity patterns remained similar.

Future Residential Use Pathways

Future residential use of the site is not expected given current and future anticipated industrial zoning and land use.

Future Groundwater Use Pathways

Future use groundwater exposure pathways were not quantitatively evaluated in the risk assessment, based on the fact that such use is not foreseeable in the reasonably near future.

3.3 QUANTIFICATION OF EXPOSURES

3.3.1 Exposure Point Concentrations

An exposure point concentration (EPC) is the chemical concentration to which an individual is assumed to be exposed. Tables 3-2 and 3-3 list exposure point concentrations (EPCs) for the soil exposure pathways defined above. Risks were calculated using median soil concentrations and, in accordance with EPA guidance (1989a), 95% upper confidence limits (UCLs) of the means of soil COPC. The purpose of this bounded analysis was to better reflect the distribution of, and the influence of outliers in, the underlying data.

Supporting EPC calculations and summary statistics are included in Appendix C.

3.3.1.1 Soil Direct Contact Pathways

Current Use Exposure Scenarios

EPCs for current use soil exposure pathways were calculated using analytical results of slag pile soil samples collected at 3-5 foot depths. Table 3-2 presents the median and 95% UCL concentrations used to calculate risks associated with these pathways.

The use of these data (vs. surface data, which were not available) is assumed to be representative yet conservative because, as shown in Table 2-1, maximum concentrations of most soil COPC were detected in slag pile samples collected at 5 foot depths. [Note: The lack of surface soil data may have been a function of the presence of debris and the large grain size of material on the surface of the slag pile. These factors could have hindered sample recovery and/or precluded collection of a representative surface sample.] Sample-specific analytical results are provided in Appendix A. Appendix C includes corresponding summary statistics and EPC calculations.

Future Use Construction Worker Scenarios

EPCs for future use soil exposure pathways were determined using analytical results of subsurface soil samples collected at depths ranging from 1 to 25 feet. Median and 95% UCL EPCs are shown in Table 3-2. Receptor locations are distinguished by areas (Areas 1 and 2), given the differing distribution of

TABLE 3-2
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR SOIL EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/ WORKER AND TRESPASSER RECEPTORS		FUTURE USE SCENARIOS /2/ AREA 1 SUBSURFACE SOILS		AREA 2 SUBSURFACE SOILS	
	Soil EPC (mg/kg) Median	95% UCL	Soil EPC (mg/kg) Median	95% UCL	Soil EPC (mg/kg) Median	95% UCL
Antimony	11.5	81.5	5.40	305.4	0.5	4.93
Arsenic	9.85	17.3	18.0	540.3	1.25	45.73
Barium	133.5	382.5	49.4	129.6	22	27.05
Beryllium	48.0	164.07	0.84	45.5	0.13	0.15
Cadmium	5.70	19.8	0.78	5.28	0.06	0.37
Chromium (trivalent)	15.15	28.7	7.90	20.01	5.15	6.35
Copper	3,745	34,413	196	8,084	7.1	12.38
Lead	1,150	2,308	77.7	782.07	1.4	10.10
Manganese	1,575	24,997	290	5602.18	11	168.20
Mercury	0.17	0.57	0.06	0.81	0.02	0.07
Nickel	116	272.3	9.60	87.8	3.85	6.59
Selenium	1.00	1.63	0.90	41.9	0.05	0.12
Zinc	39,800	67,134	847	24,606	14	24.00

NOTES:

/1/

Given the lack of surface data for slag pile soils, results from 3-5' sample depths were conservatively assumed for current-use pathway calculations. (samples SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5, and SB9-3). All 95% upper confidence limit (UCL) values were calculated assuming non-detects were equal to one-half the sample-specific detection limit value (see Appendix C summary statistics).

/2/

For hyphothetical future use scenarios, receptor locations were partitioned into two areas: Area 1 and Area 2 (see Figure 2). Area 1 represents the eastern portion of the site, including the slag pile and surrounding sample locations (all SB-, HB-4, HB-5, MW-4 and MW-5 results). Area 2 represents the western portion of the site, encompassing results from remaining soil samples collected below paved areas not within Area 1. These areas were distinguished because contaminant concentrations were most elevated in samples collected within and surrounding the slag pile (see Appendix C EPC calculations)

Sample results for Area 1 and Area 2 are for 1-25' sample depths; the one-foot sample depths correspond only to the five hand boring (HB) locations shown in Figure 2. All 95% upper confidence limit EPC values were calculated assuming non-detects were equal to 1/2 the sample-specific detection limit values.

TABLE 3-3
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR AIR EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/ WORKER AND TRESPASSER RECEPTORS		FUTURE USE SCENARIOS /2/ AREA 1 SUBSURFACE SOILS		AREA 2 SUBSURFACE SOILS	
	Air EPC (mg/m^3) Median	95% UCL	Air EPC (mg/m^3) Median	95% UCL	Air EPC (mg/m^3) Median	95% UCL
Antimony	4.72E-07	3.36E-06	5.40E-07	3.05E-05	5.00E-08	4.93E-07
Arsenic	4.06E-07	7.14E-07	1.80E-06	5.40E-05	1.25E-07	4.57E-06
Barium	5.50E-06	1.58E-05	4.94E-06	1.30E-05	2.20E-06	2.71E-06
Beryllium	1.98E-06	6.76E-06	8.40E-08	4.55E-06	1.30E-08	1.50E-08
Cadmium	2.35E-07	8.17E-07	7.80E-08	5.28E-07	6.00E-09	3.70E-08
Chromium (trivalent)	6.24E-07	1.18E-06	7.90E-07	2.00E-06	5.15E-07	6.35E-07
Copper	1.54E-04	1.42E-03	1.96E-05	8.08E-04	7.10E-07	1.24E-06
Lead	4.74E-05	9.51E-05	7.77E-06	7.82E-05	1.40E-07	1.01E-06
Manganese	6.49E-05	1.03E-03	2.90E-05	5.60E-04	1.10E-06	1.68E-05
Mercury	7.00E-09	2.35E-08	6.00E-09	8.10E-08	2.00E-09	7.00E-09
Nickel	4.78E-06	1.12E-05	9.60E-07	8.78E-06	3.85E-07	6.59E-07
Selenium	4.12E-08	6.72E-08	9.00E-08	4.19E-06	5.00E-09	1.20E-08
Zinc	1.64E-03	2.77E-03	8.47E-05	2.46E-03	1.40E-06	2.40E-06

NOTES:

/1/

Air EPCs were calculated by multiplying the corresponding soil EPC by the mean annual PM10 concentration reported for Hawthorne, 0.0412 mg/m^3 (see Table 3-2 for soil EPCs).

/2/

Air EPCs were calculated by multiplying the corresponding soil EPC by 0.1 mg/m^3. This value was measured at two construction sites where dust control measures were not employed (Ebasco, 1986). See Table 3-2 for assumptions related to soil EPC derivation.

metals in site soils (Section 3.2.2). Metals were most elevated in areas within and surrounding the slag pile (encompassing Area 1), where, as indicated in Appendix C, sample means were typically one to three orders of magnitude greater than those calculated for Area 2.

3.3.1.2 Inhalation Pathways - COPC Resuspended in Site Soils

As shown in Table 3-3, EPCs for air (inhalation) pathways were calculated by multiplying soil EPCs by the mean annual PM_{10} (respirable fraction) concentration of 0.0412 mg/m^3 reported for Hawthorne (personal communication, Mel Celdin, South Coast Air Quality Management District, November 18, 1991). [Note: Air quality data are not available for El Segundo.] Suspended particulates were conservatively assumed to have the same COPC concentrations as slag pile shallow subsurface (3-5 ft) soils. Subsurface volatilization pathways were not quantitatively evaluated given lack of soil VOC data and the relatively great depth to groundwater (80 ft).

3.3.2 Estimation of Chemical Intakes

To calculate chemical intakes (and corresponding risks), EPCs listed in Tables 3-2 and 3-3 were combined with human exposure assumptions to calculate the chronic daily intake, or CDI. The CDI is an estimated average daily dose received (e.g., via direct contact with soils and/or inhalation) expressed in mg of chemical per kg body weight per day. Key factors incorporated in the CDI equation, include:

- the constituent concentration in the medium to which an individual is exposed
- the amount of constituent taken up by the body (e.g., via dermal absorption)
- the frequency and duration of exposures.

Equations used to calculate CDIs for ingestion, dermal contact and inhalation pathways are summarized in Table 3-4. Values used as input to these equations are listed in Tables 3-5 and 3-6 for current and future use soil exposure pathways, respectively. These tables also list supporting references, assumptions and rationales. Resulting CDI values were then combined with toxicity factors (Section 4.0) to calculate risks (Section 5.0). CDI calculation documentation is provided in Appendix E.

3.4 IDENTIFICATION OF UNCERTAINTIES

The following describes uncertainties surrounding exposure point concentration (EPC) determination and human exposure parameter estimation. There are always a number of statistical uncertainties related to sample size and frequency distribution as well as those inherent to risk assessment paradigms in general. In the present case, any imprecision in the assessment which could be related to data gaps, were compensated for by using conservative assumptions relating to exposure type, frequency, and duration.

TABLE 3-4
EQUATIONS USED TO CALCULATE CHRONIC DAILY INTAKES (CDIs) OF COPC
H. KRAMER & COMPANY SITE

CARCINOGENS

Soil Ingestion

CDI = **Soil EPC** (mg/kg) x **10^{-6}** (kg/mg) x **SIR** (mg/day) x **1/BW** (kg) x (**# days/365 days**) x (**# years/70 years**)

Dermal Contact with Soils

CDI = **Soil EPC** (mg/kg) x **10^{-6}** (kg/mg) x **AF** (mg/cm^2) x **SA** (cm^2) x **ABS/BW** x (**# days/365 days**) x (**# years/70 years**)

Inhalation of Particulates

CDI = **EPC** (mg/kg) x **10^{-6}** (kg/mg) x **PM_{10}** (mg/m^3) x **IR** (m^3/hour) x **ET** (hrs) x **1/BW** x (**# dys/365 dys**) x (**# yrs/70 yrs**)

NONCARCINOGENS

Chronic Daily Intakes (CDIs) for noncarcinogens are calculated in the same manner as that used for carcinogens (above) with one exception: intakes are not averaged over a 70 year lifetime. That is, the last term in the equation (# years/70 years) is excluded in order to account for toxic (noncarcinogenic) effects associated with subchronic exposures to COPC.

DEFINITIONS

CDI = Chronic Daily Intake (mg/kg/day)
EPC = Exposure Point Concentration (mg/kg for soils; mg/m3 for air)
10^{-6} = Unit correction factor (kg/mg)
SIR = Soil Ingestion Rate (mg/day)
BW = Body Weight (kg)
AF = Soil Adherence Factor (mg/cm^2)
SA = Skin Surface Area Exposed (cm^2)
ABS = Dermal Absorption Rate (unitless)
PM_{10} = Mean annual concentration of respirable particulates (<10um in diameter)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)

NOTE:
EPCS used to calculate CDIs are listed in Tables 3-2 and 3-3. Tables 3-5 and 3-6 summarize human exposure parameters used as input to the above equations.

TABLE 3-5
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC: CURRENT USE SCENARIOS
H. KRAMER & COMPANY SITE
page 1 of 2

Parameter	CURRENT USE RECEPTOR On-site Worker	Trespasser	SOURCE/ASSUMPTIONS
GENERAL EXPOSURE PARAMETERS			
Age During Exposure	Adult	9-16 years	--
Average Body Weight	70 kg	46 kg	USEPA, 1991a.
Frequency	250 days/year	72 days/year	USEPA, 1991a; professional judgement. Trespassers are assumed to access the site 2 times/week, 9 months/year.
Duration			
Per day	4 hours (/8 hours)	2 hours	USEPA, 1991a; professional judgement. See Note 1.
Over lifetime	25 years	5 years	
SOIL INGESTION EXPOSURE PARAMETERS			
Soil Ingestion Rate	50 mg/day	100 mg/day	USEPA, 1991a; USEPA, 1989b; See Note 2.
DERMAL CONTACT EXPOSURE PARAMETERS			
Soil Adherence Rate	0.5 mg/cm^2	0.5 mg/cm^2	Schaum, 1984.
Surface Area Exposed	3700 cm^2	3000 cm^2	USEPA, 1989b. Assumes hands, forearms and head are exposed (see Note 3).
Dermal Absorption Rate (metals)	1%	1%	SCAQMD, 1988.
INHALATION EXPOSURE PARAMETERS			
Respiratory Volume	2.5 m^3/hour	0.7 m^3/hour	USEPA, 1991a. Assumes moderate activity for both receptor groups.
Total Suspended Respirable (PM_{10}) Dust Concentration	0.0412 mg/m^3	0.0412 mg/m^3	Arithmetic mean annual PM_{10} concentration reported for Hawthorne (personal communication, Mel Celdin, South Coast Air Quality Management District, November 18, 1991). See Note 4.

TABLE 3-5
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC: CURRENT SITE USES
H. KRAMER & COMPANY SITE
page 2 of 2

NOTES:

[1] Because the slag pile is isolated and is not usually accessed by current on-site workers, intakes for these receptors were calculated assuming that 4 hours of an 8-hour work day are spent outside in the vicinity of the slag pile. The trespasser scenario assumes the entire 2-hour duration is spent in contact with slag pile soils.

[2] The soil ingestion rate assumed for on-site workers, 50 mg/day, is the standard default value recommended by EPA for soil ingestion in the workplace (USEPA, 1991a). Average soil ingestion in the population of young children (under the age of 7) has been estimated at approximately 100 to 200 mg/day (USEPA, 1989b). Calabrese (1987) recommends a value of 100 mg/day for children/young adults aged 5 to 18 years, assuming a high tendency to ingest soil. Given the age of trespassers assumed in this study (9-16 years), 100 mg/day was considered a reasonable soil ingestion rate value. This ingestion rate is assumed to apply to an exposure "event" and thus (in contrast to the value assumed for on-site workers) does not represent a daily average rate.

[3] Soil contact rates are assumed equal to the skin surface area exposed (cm^2) multiplied by the amount of soil adhered to skin (mg/cm^2). For both receptor groups (workers and trespassers), the assumed exposed dermal surface includes the hands, forearms and head. These areas comprise approximately 19% of the total body surface area for adult males (1.94 m^2), resulting in an exposed surface area of 3700 cm^2. For trespassers (9-16 years), these areas represent approximately 21% of the total body surface area (1.42 m^2), resulting in an exposed surface area of approximately 3000 cm^2 (USEPA, 1985; USEPA, 1989b).

[4] COPC concentrations in dust particles are assumed to be the same as the soil EPC. All dust particles are assumed to be respirable (less than 10 microns in diameter).

TABLE 3-6
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC:
FUTURE USE CONSTRUCTION WORKER SCENARIOS
H. KRAMER & COMPANY SITE

Parameter	FUTURE USE RECEPTOR Construction Worker	SOURCE/ASSUMPTIONS
GENERAL EXPOSURE PARAMETERS		
Age During Exposure	Adult	--
Average Body Weight	70 kg	USEPA, 1991a.
Frequency	250 days/year	USEPA, 1991a. Assumes individuals work five days per week, 50 weeks per year.
Duration Per day Over lifetime	 8 hours 1 year	 USEPA, 1991a; professional judgement.
INGESTION EXPOSURE PARAMETERS		
Soil Ingestion Rate	480 mg/day	Estimated soil ingestion rate assuming construction activities in a commercial/industrial setting and an exposure duration generally less than one year (USEPA, 1991a).
DERMAL CONTACT EXPOSURE PARAMETERS		
Soil Adherence Rate	0.5 mg/cm^2	Schaum, 1984.
Surface Area Exposed	3700 cm^2	USEPA, 1989b. Assumes hands, forearms and head are exposed.
Dermal Absorption Rate (metals)	1%	SCAQMD, 1988.
INHALATION EXPOSURE PARAMETERS		
Respiratory Volume	4.5 m^3/hour	USEPA, 1989b. Assumes construction workers are engaged in heavy activity (e.g., vigorous exercise).
Total Suspended Respirable (PM_{10}) Dust Concentration	0.1 mg/m^3	Assumed dust concentration uses the value measured at two construction sites where dust control measures were not employed (PJP Landfill Site Monitoring Program, Ebasco, 1986).

3.4.1 Exposure Point Concentration (EPC) Determination

One source of uncertainty in the exposure point concentrations used in the risk assessment is the lack of surface data for slag pile soils. In lieu of these data, current use risks were calculated using the results of slag pile samples collected at 3 to 5 foot depths. As discussed in Section 3.3.1, this assumption is assumed to be conservative because maximum concentrations of most soil COPC were detected in slag pile samples collected at 5 foot depths. The sample size (N=6) supporting current use EPC calculations represents another source of uncertainty in that statistical estimators are less reliable. However, despite these uncertainties, the data are considered sufficient for the risk assessment given the apparent homogeneity of slag pile soils and, in particular, the conservative assumptions used to estimate exposures/risks. Typically, small sample sizes result in larger variance and positively-biased (i.e., conservative) point estimators (e.g., mean).

EPCs for soil inhalation pathways are also conservative, because these scenarios assume resuspension of slag pile soils at levels equivalent to the local PM_{10} concentration. However, the debris and large grain size of material comprising the surface of the slag pile would likely limit significant resuspension. This assumption was verified during a recent site visit when, despite high winds, dust from slag pile soils was not evident in the air.

3.4.2 Human Exposure Parameter Estimation

Numerous uncertainties surround the determination of exposure parameters because behavior patterns of individuals are not well known. For example, this risk assessment assumes that trespassers walk on and/or play near the slag pile. There is no direct evidence supporting the validity of this assumption, but it (trespassing) is possible. Assumptions regarding the activity patterns of on-site workers (the security guard and occasional metal scavenger) have similar limitations. Also, body weights, breathing rates, soil ingestion rates, and dermal contact rates are likely to vary depending on the actual characteristics of the population exposed. In this evaluation, reasonable maximum ingestion rates and breathing rates were assumed, in accordance with EPA guidance (USEPA, 1989a).

4.0 TOXICITY ASSESSMENT

For risk assessment purposes, COPCs are separated into two categories of chemical toxicity: carcinogenic and noncarcinogenic effects. This distinction assumes the biological mechanism of action for each category is different, as defined below. Tables 4-1 and 4-2 list toxicity values developed for noncarcinogenic and carcinogenic COPC, respectively. These values were combined with CDIs, defined in Section 5.2, to calculate risks (Section 5.4).

4.1 TOXICITY INFORMATION FOR NONCARCINOGENIC EFFECTS

For chemicals exhibiting noncarcinogenic effects, exposed organisms are assumed to have protective mechanisms which must be overcome before the toxic endpoint is manifested. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without appreciable risk of causing an adverse effect (USEPA, 1989a).

Health criteria for chemicals exhibiting noncarcinogenic effects are generally developed using risk reference doses (RfDs). The RfD, expressed in units of mg/kg/day, is an estimate of the daily exposure that a human population (including sensitive subpopulations) can sustain that is not likely to present an unacceptable risk of deleterious effects during a lifetime (USEPA, 1989a). RfDs are generally developed by the EPA RfD Work Group. Alternative sources include Health Effects Assessments (HEAs) and/or Office of Drinking Water criteria documents which support health-based drinking water standards. These values are usually derived from animal studies and, in some cases, from human studies involving occupational exposures. These experimental or epidemiological data are then adjusted using a range of uncertainty factors. The RfDs thereby provide a benchmark to which chemical intakes by other routes (e.g., via exposure to environmental media) may be compared.

RfDs developed for noncarcinogenic effects of COPC are listed in Table 4-1.

4.2 TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS

In assessing risks associated with potential carcinogens, EPA has adopted the position that a small number of molecular events can cause changes in a single cell or a small number of cells that can lead to tumor formation. This is described as a no-threshold mechanism because it is assumed that there is essentially no level of exposure (i.e., a threshold) to a carcinogen that will not result in some finite possibility of causing the disease. Evaluation of carcinogenic effects is a two-step process: weight-of-evidence determination and calculation of slope factors. These steps are described below.

4.2.1 Weight-of-Evidence Classifications

Weight-of-evidence classifications are assigned to account for the likelihood that an agent is a human carcinogen. Using this system, chemicals are classified as either Group A, Group B1, Group B2, Group C, Group D, or Group E. Group A chemicals (human carcinogens) are agents for which there

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
ORAL AND DERMAL EXPOSURE ROUTES							
Antimony	4.0E-04	Oral	2.0E-05	longevity, blood glucose and cholesterol	IRIS	Low	1000
Arsenic	3.0E-04	Oral	1.5E-05	hyperpigmentation, keratosis; possible vascular complications	IRIS	Medium	3
Barium	7.0E-02	Oral	3.5E-03	increased blood pressure	IRIS	Medium	3
Beryllium	5.0E-03	Oral	2.5E-04	none reported	IRIS	Low	100
Cadmium	5.0E-04	Oral (water)	2.5E-05	significant proteinuria	IRIS	High	10
Cadmium	1.0E-03	Oral (food)	2.5E-05	proteinuria	IRIS	High	10
Chromium III	1.0E+00[a], 1.0E+01[b]	Oral	5.0E-02[a], 5.0E-01[b]	none reported	IRIS	Low	100
Chromium VI	5.0E-03[a], 2.0E-02[b]	Oral	2.5E-04[a], 2.5E-03[b]	none reported	IRIS	Low	500
Copper /5/	3.7E-02	Oral	--	local gastrointestinal (GI) irritation	HEAST	--	--
Lead /6/	--	--	--	central nervous system (CNS) effects	See Note 6	--	--

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
Manganese	1.0E-01	Oral (total dietary intake)	5.0E-03	CNS effects	IRIS	Medium	1
Mercury	3.0E-04	Oral	1.5E-05	kidney effects	HEAST	--	1000
Nickel	2.0E-02	Oral (diet)	1.0E-03	decreased body and organ weights	IRIS	Medium	100
Selenium	5.0E-03	Oral	2.5E-04	clinical selenosis	IRIS	High	3
Zinc	2.0E-01	Oral	1.0E-02	anemia	HEAST	--	10
INHALATION EXPOSURE ROUTES /7/							
Antimony	ND	Inhalation	--	cancer, based on studies with antimony trioxide	--	--	--
Arsenic	ND	Inhalation	--	--	--	--	--
Barium	1.0E-04[a], 1.0E-03[b]	Inhalation	--	fetotoxicity	HEAST	--	1000
Beryllium	1.4E-06	Inhalation	--	--	CAPCOA	--	--
Cadmium	1.0E-03	Inhalation	--	cancer	CAPCOA	--	--
Chromium III	5.7E-07[a], 5.7E-06[b]	Inhalation	--	nasal mucosa atrophy	HEAST	--	300

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
Copper	1.0E-02	Inhalation	--	--	CAPCOA	--	--
Lead /6/		Inhalation	--	CNS effects	See Note 6	--	--
Manganese	1.1E-04	Inhalation	--	increased prevalence of respiratory symptoms and psychomotor disturbances	IRIS	Medium	300
Mercury	8.6E-05	Inhalation		neurotoxicity	HEAST	--	30
Nickel	6.9E-05	Inhalation	--	cancer	CAPCOA	--	--
Selenium	1.0E-03	Inhalation	--	--	CAPCOA	--	--
Zinc	1.0E-02	Inhalation	--	--	CAPCOA	--	--

NOTES:

/1/ Unless otherwise noted, Reference Doses (RfDs) listed above represent both chronic and subchronic RfDs. Where toxicity criteria differ according to the length of the exposure period, RfD values are flagged as follows: [a] for chronic exposures and [b] for subchronic exposures.

A chronic RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure periods, generally 7 years to a lifetime (EPA, 1989a). Alternatively, subchronic RfDs are estimates of daily exposure levels that are likely to be without an appreciable risk of deleterious effects during a portion of a lifetime, generally 2 weeks to 7 years. In this evaluation, chronic RfDs were used to evaluate the current use worker exposure scenario. Alternatively, subchronic RfDs were used to evaluate current-use trespasser and hypothetical future-use construction worker scenarios. Oral RfDs are expressed as an administered dose in drinking water with an assumed absorption of 1.0.

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

/2/ No RfDs are available for the dermal route of exposure. Where applicable, noncarcinogenic risks associated with dermal exposures were evaluated using an oral RfD adjusted for absorption. With the exception of cadmium and copper, RfDs for dermal exposures to metals were adjusted assuming 5% gastrointestinal absorption (per USEPA, 1986). Thus, oral RfDs (representing administered doses) were multiplied by 0.05 to derive a "surrogate" dermal RfD. The only exceptions are cadmium, for which the RfD for food assumes 2.5% absorption, and copper, for which extrapolation to dermal exposures is not appropriate given the localized nature of the toxic effect (gastrointestinal effects).

/3/ RfD sources include (in order of access) IRIS, HEAST and CAPCOA guidance. These sources are defined below.

IRIS = Integrated Risk Information System, accessed December 1991.
HEAST = Health Effects Summary Tables, FY-1991 Annual (EPA, 1991b)
CAPCOA = California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

/4/ Uncertainty values represent a statement of the confidence in the RfD value, the critical study and the supporting database. See HEAST (1991) for further information.

/5/ Because toxicity data for copper were considered inadequate to calculate an oral RfD (IRIS 1991), an RfD of 3.7 E-02 mg/kg/day was extrapolated from the 1.3 mg/l drinking water standard, assuming a 2 liter/day water ingestion rate and a body weight of 70 kg.

/6/ EPA has not developed an RfD value for lead. Therefore, health effects associated with potential exposures to lead were evaluated by estimating blood lead concentrations according to DTSC guidance (see Section 4.3; Appendix D). Based on this guidance, blood lead concentrations were calculated for ingestion, dermal contact and inhalation pathways. The total blood lead concentration was then compared to DTSC's blood lead concentration of concern, 10 ug/dl (DTSC, 1992, provided in Appendix D).

/7/ Inhalation RfDs were converted from corresponding reference concentrations (RfCs) by assuming a 70 kg individual breathes 20 m^3/day. When inhalation RfDs have not been developed for a COPC, noncancer inhalation risks were calculated using oral RfDs (e.g., for antimony and arsenic).

ND = Not Determined
--: Not available or not applicable.

is sufficient evidence to support the causal association between human exposures and cancer. Group B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from human studies, but for which there is sufficient evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and no human data. Group D chemicals, not classified as to human carcinogenicity, are agents for which data are inadequate to evaluate either animal or human carcinogenicity. Group E chemicals (evidence of non-carcinogenicity in humans) are agents for which there is no evidence in adequate human or animal studies of carcinogenicity. In this analysis, chemicals with weight of evidence classifications A, B and C are considered carcinogens. Chemicals with unknown carcinogenicity (Class D) are treated as noncarcinogens.

4.2.2 Slope Factors

Based on the weight-of-evidence determinations described above, a slope factor is calculated that quantitatively defines the relationship between dose and response. This factor is expressed in units of $(mg/kg/day)^{-1}$. Slope factors are derived from the results of human epidemiological studies or, in many cases, chronic animal bioassays. These animal studies are usually conducted using relatively high doses to detect possible adverse effects. Because humans are expected to be exposed to lower doses than those used in animal studies, animal data are adjusted by using mathematical models and applying an inter-species scaling factor to derive a comparable low-dose slope factor for humans. Therefore, the use of these slope factors typically results in an upper-bound estimate of the probability of an individual developing cancer (as a result of exposure to a given level of a potential carcinogen). Whereas the actual risks are not likely to be higher than estimated risks, they could be considerably lower.

Table 4-2 lists slope factors and related toxicity information developed for each carcinogenic COPC evaluated.

4.3 CHEMICALS FOR WHICH NO TOXICITY VALUES ARE AVAILABLE

Given the lack of toxicity factors for lead, which is still under review by EPA, risks associated with exposures to lead were evaluated using California EPA's Department of Toxic Substances Control (DTSC) guidance entitled Assessment of Health Risks from Inorganic Lead in Soil (DTSC, 1992). Using this guidance, included in Appendix D, estimated blood lead concentrations were calculated for ingestion, dermal contact and inhalation pathways. The total blood lead concentration was then compared to DTSC's blood lead concentration of concern, 10 ug/dl (DTSC, 1992; see Appendix D).

No RfDs are available for the dermal route of exposure. Where applicable, noncarcinogenic risks associated with dermal exposures were evaluated using an oral RfD adjusted for absorption. With the exception of cadmium and copper, RfDs for dermal exposures to metals were adjusted assuming 5% gastrointestinal absorption (per USEPA, 1986). Thus, oral RfDs (representing administered doses) were multiplied by 0.05 to derive a "surrogate" dermal RfD. The only exceptions are cadmium, for which the RfD for food assumes 2.5% absorption, and copper, for which extrapolation to dermal exposures is not appropriate given the localized nature of the toxic effect (gastrointestinal effects).

TABLE 4-2
TOXICITY VALUES FOR POTENTIAL CARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	Slope Factor/1/ $(mg/kg/day)^{-1}$	Slope Factor Adjusted for Dermal Absorption /2/	Weight of Evidence Classification /3/	Species	Type of Cancer (Tumor Site)	Slope Factor Source /4/
ORAL AND DERMAL EXPOSURE ROUTES						
Arsenic	1.5E+00	3.0E+01	A	human	skin	HEAST
Beryllium	4.3E+00	8.6E+01	B2	rat	gross tumors, all sites combined	IRIS
INHALATION EXPOSURE ROUTES /5/						
Arsenic	1.15E+01	--	A	human	lung	CAPCOA
Beryllium	8.40E+00	--	B2	human	lung	CAPCOA
Cadmium	1.47E+01	--	B1	human	lung, trachea, bronchus	CAPCOA

NOTES:

/1/ The slope factor is an upper bound estimate of the probability of a carcinogenic response per unit intake of a chemical over a 70-year lifetime.

/2/ No slope factors are available for the dermal route of exposure. Where applicable, (noncarcinogenic) risks associated with dermal exposures were evaluated using an oral slope factor adjusted for absorption. For metals, this adjustment conservatively assumed 5% gastrointestinal absorption of metal compounds. Thus, oral slope factors for metal COPC (representing administered doses) were divided by 0.05 to derive a "surrogate" dermal slope factor.

TABLE 4-2
TOXICITY VALUES FOR POTENTIAL CARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

/3/ The weight-of evidence classification characterizes the extent to which available data indicate that an agent is a human carcinogen. These classifications are defined as follows:

A - Human carcinogen
B - Probable human carcinogen, sufficient evidence in animals but inadequate evidence in humans
C - Possible human carcinogen

/4/ Slope factor sources include IRIS, HEAST and CAPCOA guidance, defined below.

IRIS = Integrated Risk Information System, accessed December 1991.
HEAST = Health Effects Summary Tables, FY-1991 Annual (EPA, 1991b)
CAPCOA = California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

/5/ Inhalation slope factors were converted from corresponding inhalation unit risks (in ug/m^3) by assuming a 70 kg individual breathes 20 m^3/day. Inhalation slope factors are not listed for volatile organic compounds (1,1-dichloroethene, PCE and TCE) because these constituents were not evaluated for inhalation exposures.

ND = Not Determined
--: Not available or not applicable.

4.4 UNCERTAINTIES RELATED TO TOXICITY INFORMATION

A number of uncertainties surround the use of slope factors, which serve as the basis for calculating estimated cancer risks. For example, the dose-response relationship is assumed to be the same for both test animal and humans. Additionally, these factors represent upper bound (95% upper confidence limit) estimates of potency. That is, if an individual's exposure to a constituent is equivalent to that level which defines the potency, there is only a 5% chance that the actual risk to that individual will exceed the calculated risk, where as there is a 95% chance that the risk is at or below the calculated level. Thus, the actual risks associated with exposures to a potential carcinogen are not likely to exceed the risk estimated using these upper bound slope factors, but may be lower.

5.0 RISK CHARACTERIZATION

This section describes the mathematical methods used to calculate pathway-specific cancer and noncancer risks (Section 5.1). Section 5.2 presents the results of the risk assessment; uncertainties inherent in the risk assessment process are discussed in Section 5.3.

5.1 RISK CALCULATION METHODOLOGY

5.1.1 Risk Calculations for Carcinogens

Excess cancer risks associated with exposures to known or potentially carcinogenic COPC are calculated by multiplying the slope factor (SF) by the estimated average lifetime dose, or CDI. "Excess" cancer risks are risks in excess of the normal cancer "burden" in a population and represent the upper bound probability that an individual exposed to a given level of contaminant over a lifetime will develop cancer as a result of those exposures. A 10^{-6} upper bound excess lifetime cancer risk, for example, is a one in a million increase in the probability that an exposed individual would develop cancer.

In equation form, risk is defined:

$$\textbf{Risk} = (\textbf{SF}) * (\textbf{CDI})$$

where: Risk=
a unitless probability of an individual developing cancer attributable to the assumed exposure scenario
SF = slope factor, expressed in $(mg/kg/day)^{-1}$
CDI = chronic daily intake averaged over 70 years (mg/kg/day)

However, the linear equation defined above is valid only at low risk levels (i.e., below estimated risks of 0.01). Because risks calculated for hypothetical groundwater ingestion exposures exceeded 10^{-2} (see Section 5.2.5; Table 5-5), an alternate calculation equation was used for these pathway calculations. This "one-hit" equation, which is consistent with the linear low-dose model given above, is defined as follows:

$$\textbf{Risk} = 1 - \exp(-\textbf{CDI} * \textbf{SF})$$

where "exp" is the exponential.

5.1.2 Risk Calculations for Noncarcinogens

Risks associated with chemicals exhibiting noncarcinogenic effects are generally developed using RfDs (and/or HEAs; Section 5.3). These criteria are estimates of the daily chemical exposures which present an acceptably low risk of adverse effects to an individual over a specified exposure duration. In the absence of any information on the specific chemical mixture in question, the mixture is assessed by means of a hazard index (**HI**).

The HI is defined as the sum of the ratios of the CDI to the RfD for each non-carcinogenic chemical where:

$$HI = CDI_1 / RfD_1 + CDI_2 / RfD_2 + \ldots CDI_i / RfD_i$$

CDI_i = Chronic daily intake for the ith chemical in mg/kg/day
RfD_i = Chronic reference dose for the ith chemical in mg/kg/day

Any single chemical with an exposure level greater than the reference level would cause the hazard index to exceed unity, indicating concern for potential health risks. For multiple chemical exposures, the hazard index can exceed the 1.0 target criterion even if no single chemical exceeds its corresponding reference dose (RfD). However, the assumption of additivity reflected in the hazard index equation is most properly applied to compounds that induce the same effect by the same mechanism. Consequently, applying this equation to a mixture of compounds that are not expected to induce the same type of effects could overestimate the potential for adverse health impacts. If the hazard index exceeds unity, compounds driving the noncarcinogenic risks are segregated according to their critical toxic effects.

5.2 RESULTS OF THE RISK ASSESSMENT

Tables 5-1 through 5-4 present results of the risk calculations performed for the risk assessment. Each table presents the results of the bounded analyses, using median and upper bound exposure point concentration (EPCs), and identifies the major chemical(s) accounting for calculated risks. Corresponding chemical-specific results and calculations are included in Appendix E.

The context within which to judge the relative risk from each of the pathways has been established by the EPA for the Federal Superfund Program (NCP, 1990). For carcinogens, the target risk range is a 10^{-6} to 10^{-4} incremental cancer risk. For noncarcinogens, where the sum of expected dose/RfD ratios exceeds unity (1.0, expressed in scientific notation as 1.0E+00), assumed exposures may present a health hazard and therefore warrant further evaluation.

5.2.1 Current Use Adult Worker Scenarios

Exposures to Carcinogens

Table 5-1 summarizes risks calculated for exposures to carcinogenic COPC for current use adult worker scenarios. Total risks calculated using median and upper bound (95% UCL) EPCs were 1.6×10^{-4} and 5.4×10^{-4}, respectively. Dermal contact exposures to beryllium accounted for the majority of these risks, both of which exceeded EPA's target risk range (10^{-6} to 10^{-4}). These results should be viewed in light of the conservative assumptions used to calculate these risks, discussed below.

In accordance with EPA guidance, the oral slope factor for beryllium (and other compounds) was adjusted (upward) for absorption to evaluate dermal exposures. A 1% dermal absorption rate was then assumed using the adjusted slope factor (see Table 4-2). However, there is major uncertainty surrounding the dermal toxicity (if any) of beryllium compounds because beryllium is considered to be very poorly absorbed. Also, the oral slope factor was derived from a study using beryllium sulfate which had only

TABLE 5-1
CANCER AND NONCANCER RISKS DETERMINED FOR
CURRENT USE ADULT WORKER SCENARIOS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	1.9E-05	Beryllium	6.4E-05	Beryllium
Dermal Contact	1.4E-04	Beryllium	4.7E-04	Beryllium
Inhalation	8.6E-07	Beryllium	2.7E-06	Beryllium
TOTAL CANCER RISKS, ALL PATHWAYS:	1.6E-04*	Beryllium (dermal contact)	5.4E-04*	Beryllium (dermal contact)

**Both risks exceed EPA's target risk range (10^{-6} to 10^{-4}).*

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	9.8E-02	Zinc, copper	4.5E-01	Copper
Dermal Contact	2.7E-02	Zinc	8.3E-02	Zinc, antimony, manganese
Inhalation	3.3E-01	Beryllium, chromium-III	1.7E+00	Manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	4.6E-01	Beryllium, chromium (inhalation)	2.2E+00*	Manganese (inhalation)

**The upper bound Hazard Index exceeds EPA's target criterion of 1.0.*

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets AD_ING1.WR1, AD_DC1.WR1 and AD_INH1.WR1).

/2/ Source Files: AD_ING2.WR1, AD_DC2.WR1 and AD_INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.51 ug/dl (using median EPC) and 1.01 ud/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

one non-zero dose group and did not indicate a significant increase in tumorigenic response (IRIS, 1991). Finally, the beryllium concentrations used to calculate risks (48.0 ppm and 164.1 ppm for median and upper bound, respectively) are both within the range of (national) soil background concentrations reported in the literature, 3-200 ppm (Kabata-Pendias and Pendias, 1984).

Exposures to Noncarcinogens

Table 5-1 also summarizes noncancer hazard indices (HIs) calculated for current use worker exposures to COPC. Hazard indices calculated using median and upper bound (95% UCL) EPCs were 0.46 and 2.2, respectively. The upper bound HI exceeds EPA's target criterion of 1.0. Inhalation exposures to manganese accounted for the most of the upper bound noncancer risk. [Note: The manganese concentration used to calculate this risk, 25,000 ppm, reflected an "outlier" value of 41,000 ppm; the remaining five soil samples ranged from 696-2200 ppm.]

5.2.2 Current Use Trespasser Scenarios

Exposures to Carcinogens

Table 5-2 summarizes risks calculated for exposures to carcinogenic COPC for current use trespasser scenarios. Total risks calculated using median and upper bound EPCs were 2.7×10^{-5} and 8.9×10^{-5}, respectively. Both risks are within EPA's target risk range (10^{-6} to 10^{-4}). As determined for the current use worker exposure pathways, exposures to beryllium accounted for the majority of calculated risks. The conservative assumptions applied in estimating beryllium exposures/toxicity, discussed above for the on-site worker exposure scenario, also apply here.

Exposures to Noncarcinogens

Hazard indices calculated for current use trespasser exposures were 0.2 and 0.94 using median and upper bound soil EPCs, respectively (Table 5-2). Both HIs are less than the EPA target HI criterion of 1.0. Exposures to copper and zinc via soil ingestion exposures accounted for most of the HI values.

5.2.3 Future Use Construction Worker Scenarios: Area 1 Receptor Locations

Exposures to Carcinogens

Table 5-3 summarizes risks calculated for construction worker exposures to soils in Area 1, the slag pile area. Risks calculated using median and upper bound soil EPCs were 3.8×10^{-6} and 1.2×10^{-4}, respectively. The upper bound risk exceeds EPA's target risk range (10^{-6} to 10^{-4}). For both (median and upper bound) scenarios, arsenic accounted for the majority of calculated risks.

Exposures to Noncarcinogens

Table 5-3 summarizes noncancer risks associated with Area 1 construction worker exposures. Hazard indices (HIs) calculated using median and upper bound soil EPC were 0.61 and 18.0, respectively. The upper bound HI exceeds the EPA's target HI criterion of 1.0. Arsenic accounted for most of the total HI values using both sets of exposure point concentrations.

TABLE 5-2
CANCER AND NONCANCER RISKS DETERMINED FOR
CURRENT USE TRESPASSER SCENARIOS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	6.8E-06	Beryllium	2.2E-05	Beryllium
Dermal Contact	2.0E-05	Beryllium	6.7E-05	Beryllium
Inhalation	1.1E-08	Beryllium	3.3E-08	Beryllium
TOTAL CANCER RISKS, ALL PATHWAYS:	2.7E-05	Beryllium (dermal contact)	8.9E-05	Beryllium (dermal contact)

Both risks are within EPA's target risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	1.7E-01	Zinc, copper	7.9E-01	Copper
Dermal Contact	1.9E-02	Zinc	5.9E-02	Zinc, antimony, manganese
Inhalation	1.4E-02	Beryllium, manganese	9.0E-02	Beryllium, manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	2.0E-01	Zinc, copper (soil ingestion)	9.4E-01	Copper (soil ingestion)

Both Hazard Indices are below EPA's target criterion of 1.0.

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets TRES_ING1.WR1, TRES_DC1.WR1 and TRES_INH1.WR1).

/2/ Source Files: TRES_ING2.WR1, TRES_DC2.WR1 and TRES_INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 1.71 ug/dl (using median EPC) and 3.27 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

TABLE 5-3
CANCER AND NONCANCER RISKS DETERMINED FOR FUTURE USE
CONSTRUCTION WORKER SCENARIOS: AREA 1 RECEPTOR LOCATIONS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	2.1E-06	Arsenic	6.8E-05	Arsenic
Dermal Contact	1.6E-06	Arsenic	5.2E-05	Arsenic
Inhalation	1.1E-07	Arsenic	3.4E-06	Arsenic
TOTAL CANCER RISKS, ALL PATHWAYS:	3.8E-06	Arsenic (soil ingestion)	1.2E-04*	Arsenic (soil ingestion)

**The upper bound risk exceeds EPA's target risk range (10^{-6} to 10^{-4}).*

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	4.2E-01	Arsenic	1.4E+01	Arsenic, antimony
Dermal Contact	1.5E-02	Arsenic	5.0E-01	Arsenic, antimony
Inhalation	1.8E-01	Manganese, chromium-III	3.3E+00	Manganese, beryllium
TOTAL HAZARD INDEX, ALL PATHWAYS:	6.1E-01	Arsenic (soil ingestion)	1.8E+01*	Arsenic, antimony (soil ingestion)

**The upper bound Hazard Index exceeds EPA's target criterion of 1.0.*

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets CWA1ING1.WR1, CWA1_DC1.WR1 and CWA1INH1.WR1).

/2/ Source Files: CWA1ING2.WR1, CWA1_DC2.WR1 and CWA1INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.48 ug/dl (using median EPC) and 4.86 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

5.2.4 Future Use Construction Worker Scenarios: Area 2 Receptor Locations

Exposures to Carcinogens

Table 5-4 summarizes risks calculated for future use construction worker exposures to carcinogenic COPC in Area 2 locations, the western portion of the site. Risks calculated using median and upper bound soil concentrations were 3.0×10^{-7} and 8.5×10^{-6}, respectively. Both risks are within EPA's target risk range (10^{-6} to 10^{-4}), and are more than an order of magnitude lower than risks calculated for Area 1 exposures (3.8×10^{-6} and 1.2×10^{-4}). Exposures to arsenic accounted for the majority of calculated risks.

Exposures to Noncarcinogens

Median and upper bound HIs calculated for Area 2 construction worker exposures were 0.073 and 0.93, respectively (Table 5-4). Both HIs are less than EPA's target HI criterion of 1.0 and significantly lower than the HIs calculated for Area 1 exposures (0.61 and 18.0). Exposures to trivalent chromium and manganese accounted for the majority of these HI values.

5.3 IDENTIFICATION OF UNCERTAINTIES

Risk assessment is an inexact but essential methodology used to characterize and evaluate potential exposures to chemicals. The lack of explicitly relevant toxicity and exposure data, the uncertainty in chemical measurements in both the environment and the laboratory, coupled with the need to extrapolate experimental end-points to assumed human exposures and potential responses make precise quantification of risk difficult. For example, the assumptions used to calculate exposure rates and quantify potential health risks, described in Tables 3-2 through 3-7, are by nature imprecise (given variations in human behavior and physical characteristics). Specific uncertainties relating to chemical concentration and human exposure estimates, discussed in previous sections, also apply to the risk characterization.

Other uncertainties which were evaluated were the future site use; potential use of groundwater from the upper aquifer; and the potential for deeper aquifer contamination. Any uncertainty about future use has been reduced by utility and infrastructure development over the site (i.e., rail and transmission lines), thus limiting use to manufacturing, parking, etc. As far as hydrogeology is concerned, there are uncertainties about groundwater flow rate and direction in the upper aquifer, and site-specific detail on stratigraphy; the volume of regionally contaminated waters contained in the uppermost water-bearing zones; and how much additional contaminant input could derive from Area I of the site during rainfall events.

TABLE 5-4
CANCER AND NONCANCER RISKS DETERMINED FOR
FUTURE USE CONSTRUCTION WORKER SCENARIOS: AREA 2 RECEPTOR LOCATIONS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	1.6E-07	Arsenic	4.6E-06	Arsenic
Dermal Contact	1.3E-07	Arsenic	3.6E-06	Arsenic
Inhalation	8.2E-09	Arsenic	2.7E-07	Arsenic
TOTAL CANCER RISKS, ALL PATHWAYS:	3.0E-07	Arsenic (soil ingestion)	8.5E-06	Arsenic (soil ingestion)

Risks are within or below EPA's target risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	3.0E-02	Arsenic	7.9E-01	Arsenic
Dermal Contact	1.1E-03	Arsenic	3.0E-02	Arsenic
Inhalation	4.2E-02	Chromium-III	1.1E-01	Chromium, manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	7.3E-02	Chromium-III (inhalation)	9.3E-01	Chromium, manganese (inhalation)

Both Hazard Indices are below EPA's target criterion of 1.0.

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets CWA2ING1.WR1, CWA2_DC1.WR1 and CWA2INH1.WR1).

/2/ Source Files: CWA2ING2.WR1, CWA2_DC2.WR1 and CWA2INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.008 ug/dl (using median EPC) and 0.063 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

6.0 CONCLUSIONS OF THE HUMAN HEALTH RISK ASSESSMENT

Results of the quantitative risk assessment developed for the H. Kramer site are summarized in Table 6-1. As shown in this table, two sets of exposure point concentrations were used to calculate risks for each pathway -- a median concentration (considered the most representative estimate) and the upper 95% confidence limit of the mean concentration (considered an upper bound value). Based on these quantitative results, and other findings discussed in this report, major conclusions of the human health risk assessment developed for the site are as follows:

- Total cancer risks calculated for current use worker exposures to slag pile soils exceeded EPA's target risk range (10^{-6} to 10^{-4}). Median and upper bound noncancer hazard indices were 0.46 and 2.2; the upper bound value exceeds EPA's target criterion of 1.0. These results should be viewed in light of the conservative assumptions employed and the uncertainty surrounding the toxicity of beryllium, which accounted for the majority of the cancer and noncancer risks calculated for this pathway. Nonetheless, prevention of exposures to slag pile soils would be a recommended course of action.

- Cancer and noncancer risks calculated for current use trespasser exposure scenarios were within or less than corresponding EPA target criteria.

- Cancer and noncancer risks calculated for hypothetical future construction worker exposures to soils located within or near the slag pile (Area 1) exceeded target risk criteria when upper bound soil concentrations were assumed. Risks calculated using median concentrations were within or below EPA target risk criteria.

- Cancer and noncancer risks calculated for future use construction worker exposures to soils in the western portion of the site (Area 2) were within or less than corresponding EPA target criteria. These Area 2 results indicate that the western paved portion of the site does not require remediation, given the assumed conditions of exposure.

- Groundwater under the site contains COPCs sufficiently in excess of MCLs that it was apparent that EPA drinking water risk ranges would be exceeded. Therefore, quantitative risk assessment was considered to be redundant. However, groundwater in the Old Dune Sand and Gage aquifers beneath the site is not used as a potable water source or for irrigation purposes due to salinity problems; regional contamination; and production capacity. These conditions are not expected to change in the future. Also, groundwater in these aquifers appears to be hydrologically isolated from deeper (potable) groundwater production aquifers (e.g., the Silverado) as a result of fine-grain silt and clay aquitards. As a practical matter then, quantitative risk analysis for groundwater pathway scenarios was not included herein.

These results of the cancer and non-cancer risk evaluation are considered conservative given use of conservative estimates of exposure scenarios and contaminant doses, especially where data relevant to some scenarios needed to be extrapolated from sources other than on-site characterization, and future uses are undefined.

TABLE 6-1
SUMMARY OF RISK ASSESSMENT RESULTS
H. KRAMER & COMPANY SITE

	TOTAL EXCESS CANCER RISKS[1]		
EXPOSURE PATHWAY	Calculated Using Median Exposure Point Concentration	Calculated Using Upper Bound (95% UCL) Concentration	CHEMICALS CONTRIBUTING MOST TO TOTAL CANCER RISK
Current Use Receptors			
On-site Worker Exposure to Soils	1.6×10^{-4}	5.4×10^{-4}	Beryllium (dermal contact)
Child Trespasser Exposure to Soils	2.7×10^{-5}	8.9×10^{-5}	Beryllium (dermal contact)
Future Use Receptors			
Construction Scenario: Area 1 Soils	3.8×10^{-6}	1.2×10^{-4}	Arsenic (soil ingestion)
Construction Scenario: Area 2 Soils	3.0×10^{-7}	8.5×10^{-6}	Arsenic (soil ingestion)
EPA CRITERION OF ACCEPTABLE RISK:	**10^{-6} to 10^{-4}** *(Shaded values exceed EPA's target risk range)*		--

	NONCANCER HAZARD INDICES (HIs)[1]		
EXPOSURE PATHWAY	Calculated Using Median Exposure Point Concentration	Calculated Using Upper Bound (95% UCL) Concentration	CHEMICALS CONTRIBUTING MOST TO HAZARD INDEX
Current Use Receptors			
On-site Worker Exposure to Soils	0.46	2.2	Beryllium, chromium (median); manganese (upper bound)
Child Trespasser Exposure to Soils	0.20	0.94	Zinc, copper (soil ingestion)
Future Use Receptors			
Construction Scenario: Area 1 Soils	0.61	18.0	Arsenic, antimony (soil ingestion)
Construction Scenario: Area 2 Soils	0.073	0.93	Chromium, manganese (inhalation)
EPA TARGET HI CRITERION:	**1.0** *(Shaded values exceed HI criterion)*		

[1]Total cancer and noncancer risks are sum of ingestion, dermal contact and inhalation pathways. Total blood lead levels calculated for all exposure scenarios were less than DTSC's level of concern, 10 ug/l.

7.0 REFERENCES

Bookman-Edmonston Engineering Inc., 1991. Annual Report on Results of Water Quality Monitoring Water Year 1989-1990. Prepared for Central and West Basin Water Replenishment District, April 1991.

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). 1992. Assessment of Health Risks from Inorganic Lead in Soil. IN: Draft Guidance for Site Characterization and Multimedia Risk Assessment for Hazardous Substances Release Sites (Volume 6, Chapter 5). DTSC Review Draft, January 1992.

California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

Ebasco Services Inc. (EBASCO). 1986. PJP Landfill Site Monitoring Program. Report to New Jersey Department of Environmental Protection (NJDEP).

ENSR Consulting and Engineering. 1991. Site Characterization Report for the H. Kramer & Company Facility, El Segundo, California.

Kabata-Pendias, A. and H. Pendias. 1984. Trace Elements in Soils and Plants. CRC Press, Boca Raton, Florida.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 1990. Final Rule. 300.430(e)[2](i)[A][2], March 1990.

Radian Corporation. 1986. Site Investigation for the Chevron U.S.A. Inc. Section 18 Property.

Radian Corporation. 1987. Hydrogeological Assessment Report for Surface Impoundments at the El Segundo Refinery of Chevron U.S.A., Inc. December 1987.

Schaum, J.L. 1984. Risk Analysis of TCDD Contaminated Soil. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency. EPA/600/8-84/031.

South Coast Air Quality Management District (SCAQMD). 1988. Multi-Pathway Health Risk Assessment Input Parameters Guidance Document. June, 1988.

U.S. Environmental Protection Agency (USEPA). 1985. Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments. Office of Health and Environmental Assessment, Washington, D.C.

USEPA. 1989a. Risk Assessment Guidance for Superfund. Volumes I and II. Interim Final. December, 1989.

USEPA. 1989b. Exposure Factors Handbook. Exposure Assessment Group, Office to Health and Environmental Assessment. Washington, D.C. May 1989. EPA/600/8-89/043.

USEPA. 1991a. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual, Supplemental Guidance, "Standard Default Exposure Factors," Interim Final.

USEPA. 1991a. Health Effects Summary Tables. FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response. Washington, D.C. January 1991.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 1990. Final Rule. 300.430(e)[2](i)[A][2], March 1990.

APPENDIX A

SITE CHARACTERIZATION ANALYTICAL RESULTS (ENSR, 1990)

TABLE 6.1

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB1A-5(Total)	ND<100.0	16	310	230	6	37	ND<1.0	28	12000	2500	0.18	33	310	ND<0.1	ND<5.0	ND<1.0	27	65000	18000	31000	41000
SB1A-5(WET)	4.4	0.53	8	6.1	0.4	1	ND<0.05	0.8	[illegible]	130	ND<0.005	1.1	4.3	0.03	ND<0.2	ND<0.3	0.6	3400	530	1400	140
SB1B-15(Total)	ND<1.0	2100	45	0.3	ND<0.05	5.5	ND<1.0	4.7	15	2.6	0.15	0.07	5.3	ND<0.1	ND<0.05	ND<1.0	13	24	7400	9700	380
SB1B-15(WET)		370																			
SB1B-20(Total)		65																			
SB1B-25(Total)		1.4																			
SB1B-30(Total)	ND<1.0	2.5	15	0.13	0.16	5	ND<1.0	1.5	6.1	1.1	0.08	0.18	4.9	0.5	ND<0.05	ND<1	8.8	13	2000	4900	52
SB2-5(Total)	ND<1.0	3.7	68	47	2.2	8.2	1.21	6.3	3300	700	0.16	11	280	1.1	0.72	ND<1.0	3.6	30000	9600	19000	1200
SB2-5(WET)	3.3	0.53	9	5.3	0.4	0.7	ND<0.05	0.6	16	[illegible]	ND<0.005	2.6	11	ND<0.01	ND<0.2	ND<0.3	ND<0.2	3100	810	1100	93
SB2-16(Total	5	200	21	18	0.78	13	ND<1.0	5	1700	420	0.04	6.3	39	1.4	0.25	ND<1.0	4.1	20000	4400	19000	400
SB2-16(WET)		130							ND<0.50	5.1								2500			
SB3-5(Total)	ND<5.0	3.1	501	106	29.5	19.3	ND<1.0	17	3000	2450	0.36	24.4	116	2	1.9	ND<1.0	17.5	76000	10600	22100	1430
SB3-5(WET)	0.76	ND<0.50	14.4	3.9	4.1	0.72	ND<0.05	0.57	101	250	ND<0.005	0.84	2.4	ND<1.0	ND<0.05	ND<10.0	0.26	6830	189	623	44.8
SB3-15(Total)	102	1000	74.3	0.22	ND<0.49	7.9	ND<1	10.6	22	5.2	0.03	ND<1.9	4.6	0.9	0.97	ND<1.0	13.8	61	2910	5630	1110
SB3-15(WET)	8.9	152	4	ND<0.01	ND<0.05	0.23	ND<0.05	0.61	0.099	ND<0.25	ND<0.005	ND<0.1	ND<0.2	ND<1.0	ND<0.05	ND<10.0	0.64	4.1	32.3	160	47.1
SB3-20(Total)	ND<4.9	2800	25.6	ND<0.2	ND<0.49	6.7	ND<1.0	2.8	36.2	5.5	ND<0.02	ND<2.0	6.5	ND<0.1	ND<0.98	ND<1.0	12.9	75.6	3420	6010	104
SB3-20(WET)		12																			
SB3-25(Total)		3.8																			
SB3-30(Total)	ND<5.0	14	23.1	ND<0.2	ND<0.5	4.7	ND<1.0	1.4	13.8	5.6	0.03	ND<2.0	4.6	0.1	ND<1.0	ND<1.0	6.3	56.8	2120	3380	78.7
SB3-30(WET)	0.9	ND<0.50	2.3	ND<0.010	ND<0.025	0.1	ND<0.05	0.09	0.73	0.63	ND<0.005	ND<0.10	ND<0.20	ND<1.0	ND<0.050	ND<10.0	0.15	9.2	10.2	14	5.2

TABLE 6.1 (continued page 2)

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB4-10(Total)	ND<10.7	5.1	155	53.6	6.5	74.6	ND<1.0	13.1	4860	1310	0.09	15.9	120	1.3	1.8	ND<1.0	15.2	39500	10300	19000	1480
SB4-10(WET)	1.3	ND<0.5	4.9	3.7.	0.72	1.7	ND<0.05	0.75	142.	53.8.	0.005	1.3	2.9	2.7	ND<0.05	ND<10	0.44	2740	315	903	98.2
SB4-15(Total)	196	11	36.7	ND<0.20	ND<0.49	4.8	ND<1.0	1.7	21.4	ND<4.9	0.04	ND<2.0	ND<3.9	17	ND<0.98	ND<1.0	7.1	36.9	2200	4260	93.6
SB4-15(WET)	41.													0.02							
SB4-30(Total)	180	61	23	0.16	0.09	5	ND<1.0	1.4	6.5	1.0	0.04	0.7	5.3	19	ND<0.05	ND<1.0	7.1	9.4	4500	5300	77
SB4-30(WET)	14.	5.1 .												0.13							
SB5-5(Total)	ND<11.8	2.8	129	49	5.4	19.5	ND<1.0	13.2	4190	1100	0.09	18.3	116	1	3.3	ND<1.0	13.5	38200	9260	16800	1720
SB5-5(WET)	3.3	ND<0.5	4	2.4	1.7.	1.1	ND<0.05	0.68	104.	37.4	ND<0.005	1.5	3.7	ND<1	ND<0.05	ND<10	0.42	4040 .	281	816	101
SB5-18(Total)	ND<4.9	1500	41.3	0.2	ND<0.49	12	ND<1.0	2.8	19.9	5	0.02	ND<2.0	6	ND<0.1	ND<0.98	ND<1.0	15.7	31.1	6560	9340	85.4
SB5-18(WET)		140.																			
SB6-5(Total)	17	16	138	21.2	8.6	10	ND<1.0	3.6	53800	713	0.80	4	80.5	1	3.1	ND<1.0	8.4	41400	6420	19400	696
SB6-5(WET)	7.4	0.91	6.1	1.5.	1.5 .	0.63	ND<0.05	0.57	178 .	494	ND<0.005	0.7	2.8	1.6	ND<0.05	ND<10	0.61	2460	272	1040	53.9
SB6-15(Total)	ND<4.9	220	49.4	0.32	ND<0.49	5.9	ND<1	4.0	13.5	ND<4.9	ND>0.02	ND<2	6.30	ND<0.1	ND<0.99	ND<1.0	13.2	23.7	4710	5310	283
SB6-15(WET)		[illegible]																			
SB6-20(Total)		0.6																			
SB6-25(Total)		13																			
SB6-30(Total)	ND<4.9	2.4	6.9	ND<0.2	ND<0.49	3.3	ND<1.0	ND<0.99	10.5	ND<4.9	ND<0.02	ND<2.0	ND<4.0	ND<1.0	ND<0.99	ND<1.0	5.3	15.7	1220	2270	16.2

TABLE 6.1 (continued page 3)

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB8-10(Total)	1000	1.1	63	30	1.3	16	ND<1.0	5.9	1800	440	0.06	5.1	43	2.3	3.7	ND<1.0	4.6	22000	8100	16000	1700
SB8-10(WET)	[illegible]	0.12	5.9	[illegible]	ND<0.2	0.6	ND<0.05	0.81	ND<0.5	[illegible]	ND<0.005	0.45	6.2	ND<0.01	ND<0.2	ND<0.3	ND<0.2	[illegible]	400	1100	200
SB9-3(Total)	120	17	100	44	2.3	11	ND<1.0	9.2	3200	1200	0.14	9.3	90	0.5	2.5	ND<1.0	6.2	25000	12000	23000	2200
SB9-3(WET)	[illegible]	0.04	6.6	[illegible]	ND<0.2	ND<0.2	ND<0.05	1.2	[illegible]	[illegible]	ND<0.005	1	5.2	0.05	ND<0.2	ND<0.3	ND<0.2	[illegible]	360	1100	150
SB10-10(Total)	ND<1.0	0.68	44	16	0.79	5.6	ND<1.0	5.3	1900	800	0.02	5.7	44	0.3	0.52	ND<1.0	3.4	24000	6000	9800	1500
SB10-10(WET)	ND<1.0	0.19	5.6	[illegible]	ND<0.2	0.94	ND<0.05	0.72	[illegible]	[illegible]	ND<0.005	1	5.1	0.06	ND<0.2	ND<0.3	0.22	[illegible]	380	1100	150
SB10-16(Total)	370	19	38	5.3	0.33	5.1	ND<1.0	2.7	300	110	ND<0.02	2.4	12	22	0.11	ND<1.0	6.4	4000	3400	5400	290
SB10-16(WET)	[illegible]	0.046							7.7	2.6				0.03				110			
SB10-30(Total)	240	180	31	0.17	0.08	4.8	ND<1.0	1.8	3.8	1.6	0.03	0.57	5.1	53	ND<0.05	ND<1.0	6.7	9.7	3400	5400	110
SB10-30(WET)	[illegible]	[illegible]												0.31							
SB10-35(Total)	92	82																			
SB10-40(Total)	40	100																			

TABLE 6.2

RESULTS OF LABORATORY ANALYSES

Sample Totals WET	Sb mg/kg mg/L	As mg/kg mg/L	Ba mg/kg mg/L	Be mg/kg mg/L	Cd mg/kg mg/L	Cr mg/kg mg/L	Cr HEX mg/kg mg/L	Co mg/kg mg/L	Cu mg/kg mg/L	Pb mg/kg mg/L	Mg mg/kg mg/L	Mo mg/kg mg/L	Ni mg/kg mg/L	Se mg/kg mg/L	Ag mg/kg mg/L	Tl mg/kg mg/L	V mg/kg mg/L	Zn mg/kg mg/L	Al mg/kg mg/L	Fe mg/kg mg/L	Mn mg/kg mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
MW4-5(Total)	5.2	2.3	33.7	ND<0.19	ND<0.49	7.5	ND<1.0	2.6	11.3	16.0	0.03	ND<1.9	8.8	ND<0.1	ND<0.97	ND<1.0	16.3	25	2510	5640	68.8
MW4-20(Total)	ND<4.8	430	25.1	ND<0.19	ND<0.48	5	ND<1.0	1.9	8.8	ND<4.8	0.02	ND<1.9	4.8	ND<0.1	ND<0.97	ND<1.0	8.2	13.1	2630	4310	95.6
MW4-20(WET)		34																			
MW4-20xx(Total)	19.5	350	30	ND<0.19	ND<0.48	5.3	ND<1.0	2.4	27.5	ND<4.8	0.22	ND<1.9	3.9	0.1	ND<0.97	ND<1.0	8.9	25.4	2780	4730	94.9
MW4-25(Total)		94																			
MW4-30(Total)		58																			
MW5-5(Total)	1780	1300	52.6	ND<0.2	0.78	7.3	ND<1.0	3.5	45.7	13.1	5.8	ND<2.0	9.6	300	1	ND<1.0	12.5	76.5	2980	7140	134
MW5-5(WET)	280	82																			
MW5-10(Total)	ND<1	2.5												ND<0.10							
MW5-15(Total)	ND<1	1.3												ND<0.10							
MW5-20(Total)	ND<5.0	45	11.1	ND<0.2	ND<0.5	4.3	ND<1.0	1.5	9.7	ND<5.0	ND<0.02	ND<2.0	ND<4.0	ND<0.1	ND<0.99	ND<1	7.1	14.1	1880	3200	44
		0.036																			
MW6-5(Total)	ND<1.0	1.3	29	0.21	0.1	5.47	ND<1.0	2.48	7.53	1.66	0.02	0.09	4.35	ND<0.1	ND<0.05	ND<1.0	11	16	8100	6100	150.00
MW6-20(Total)	ND<1.0	3.9	13	0.07	0.07	2.97	ND<1.0	0.83	5.41	1.11	0.03	0.11	2.94	ND<0.1	ND<0.05	ND<1.0	3.92	14	1700	3500	34
MW7-5(Total)	ND<1.0	1.3	14	0.13	ND<0.05	3.6	ND<1.0	1.4	4.6	1.4	0.02	0.05	3.3	ND<0.1	ND<0.05	ND<1.0	7.50	8.9	2300	4700	50
MW7-20(Total)	ND<1.0	0.95	6.1	ND<0.05	ND<0.05	1.5	ND<1.0	0.47	12	0.54	0.02	0.05	2.0	ND<0.1	ND<0.05	ND<1.0	2.3	15	690	1800	20
MW7-20A(Total)	ND<1.0	0.98	6.7	ND<0.05	ND<0.05	1.9	ND<1.0	0.53	7.6	0.59	0.02	0.05	2.1	ND<0.1	ND<0.05	ND<1.0	2.5	7.1	840	1900	22
MW8-5(Total)	ND<1.0	1.9	19	0.10	0.07	6.1	ND<1.0	2	3.6	1.1	ND>0.02	ND>0.05	3.2	ND<0.1	ND<0.05	ND<1.0	11	8.5	2700	8400	110
MW8-20(Total)	ND<1.0	1.3	9.8	0.06	ND<0.05	4.7	ND<1.0	0.87	7.5	1.8	ND>0.02	ND>0.05	2.9	ND<0.1	ND<0.05	ND<1.0	4.3	21	1100	2600	31

TABLE 6.3

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
B3-5(Total)	ND<1.0	0.96	28	0.14	0.08	6.1	ND<1.0	2.2	17	1.4	ND>0.02	0.11	4	ND<0.1	ND<0.05	ND<1.0	12	19	3400	9300	139
B3-20(Total)	ND<1.0	0.89	14	0.07	0.06	6.5	ND<1.0	1.3	13	0.86	ND>0.02	0.05	3.9	ND<0.1	ND<0.05	ND<1.0	6.8	9.8	2200	4000	55
B4-5(Total)	ND<1.0	0.92	27	0.13	0.08	5.8	ND<1.0	2.3	3.3	1.4	ND>0.02	0.08	3.8	ND<0.1	ND<0.05	ND<1.0	11	10	3200	7800	150
B4-20(Total)	ND<1.0	1.1	21	0.11	0.07	5.4	ND<1.0	1.8	6.7	1.4	0.02	0.1	3.6	ND<0.1	ND<0.05	ND<1.0	8.5	14	3100	5200	130
B5-5(Total)	ND<1.0	0.69	46	0.14	0.06	6.1	ND<1.0	2.5	4.4	1.4	ND<0.02	0.17	5.5	ND<0.1	ND<0.05	ND<1.0	10	11	3400	7500	150
B5-20(Total)	ND<1.0	1.2	30	0.19	0.07	9.3	ND<1.0	3.5	4.4	1.5	ND<0.02	0.16	5.9	ND<0.1	ND<0.05	ND<1.0	13	12	5000	8100	170
B5-20A(Total)	ND<1.0	1.4	33	0.21	0.08	10	ND<1.0	3.5	4.4	1.6	ND<0.02	0.14	5.9	ND<0.1	ND<0.05	ND<1.0	14	12	5200	8400	180
B6-5(Total)	ND<1.0	270	26	0.16	ND<0.05	4.7	ND<1.0	3.2	6.4	1.3	0.05	0.17	4.4	ND<0.1	ND<0.05	ND<1.0	9.7	14	3000	5900	150
B6-5(WET)		47																			
B6-20(Total)	ND<1.0	5.9	11	0.06	ND<0.05	3.1	ND<1.0	0.7	2.6	0.79	0.02	0.1	2.8	ND<0.1	ND<0.05	ND<1.0	3.8	5.2	1200	2500	24
B6-20A(Total)	ND<1.0	1.2	19	0.13	ND<0.05	5	ND<1.0	1.2	4.8	1.1	ND<0.02	0.17	4.1	ND<0.1	ND<0.05	ND<1.0	6.5	9	2700	3800	60

TABLE 6.4

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
MB1-1(Total)	2.8	1.5	32	0.23	0.06	5	ND<1.0	1.8	21	4	0.06	0.59	4.4	ND<0.1	0.14	ND<1.0	8.8	46	1800	4600	500
MB1-5(Total)	ND<1.0	0.99	36	0.14	ND<0.05	5.3	ND<1.0	2.2	9.9	2.6	ND<0.02	0.26	4	ND<0.1	ND>0.05	ND<1.0	7.9	16	2200	4300	110
MB2-1(Total)	25	6.3	28	0.16	2.1	12	ND<1.0	3.1	22	7.5	0.26	7.6	22	0.1	0.09	ND<1.0	9.7	67	2600	12000	180
MB2-5(Total)	9	47	21	0.12	0.14	4.8	ND<1.0	2.4	8.7	55	0.15	0.2	4	ND<0.1	0.15	ND<1.0	8	14	1900	4100	87
MB2-5(WET)		1.5								4											
MB3-1(Total)	ND<1.0	0.98	23	0.15	0.05	4.1	ND<1.0	1.8	2.8	1.5	ND<0.02	1.1	3.2	ND<0.1	ND<0.05	ND<1.0	9.9	8.2	3100	5300	110
MB3-5(Total)	ND<1.0	1.2	13	0.11	ND<0.05	3	ND<1.0	1.1	23	1.6	0.03	0.25	2.2	ND<0.1	ND<0.05	ND<1.0	6.4	16	1900	3600	39
MB4-1(Total)	17.1	24	63.1	1	0.8	10.6	ND<1.0	5.2	613	77.7	0.07	ND<2.0	20.4	1.6	ND<0.98	ND<1.0	15.6	847	ND<9.8	6320	263
MB4-1(WET)									6.6	3.2								90			
MB4-5(Total)	30.8	480	34.5	ND<0.2	ND<0.5	4.1	ND<1.0	2.1	10.7	ND<5.0	0.04	ND<2.0	ND<4	0.09	ND<0.99	ND<1.0	8.8	19	1780	3970	150
MB4-5(WET)		57																			
MB5-1(Total)	334	79	58.8	0.84	2.1	36	ND<1.0	3.6	196	118	0.07	3.1	7.5	5.6	ND<0.99	ND<1.0	10.8	1020	3020	5390	169
MB5-1(WET)	28	3.1																			
MB5-5(Total)	87.8	20	22.5	ND<0.19	ND<0.48	4.1	ND<1.0	2.3	9.9	ND<4.8	0.11	ND<1.9	3.9	120	ND<0.96	ND<1.0	6.3	46.6	1590	3340	55.6

TABLE 6.5.1

RESULTS OF LABORATORY ANALYSES

Sample	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Cd mg/L	Cr mg/L	Cr HEX mg/L	Co mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Tl mg/L	V mg/L	Zn mg/L	Al mg/L	Fe mg/L	Mn mg/L
MCL's		0.05	1		0.01	0.05				0.05	0.002			0.01	0.05						
MW1	ND<0.1	3.2	ND<0.02	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.02	0.02	ND<0.01	ND<0.3	ND<0.02	ND<0.02	0.17	ND<0.05	0.06
MW2	ND<0.1	12	ND<0.02	ND<0.01	ND<0.01	0.21	0.17	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.05	0.06	0.24	ND<0.01	ND<0.3	0.05	0.04	0.49	0.15	3.3
MW3	0.84	9.8	0.07	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	ND<0.02	0.19	ND<0.01	ND<0.3	0.04	0.03	0.51	0.05	ND<0.02
MW4	ND<0.1	0.005	0.49	ND<0.01	ND<0.01	0.1	0.09	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	ND<0.02	ND<0.01	ND<0.01	ND<0.3	ND<0.02	ND<0.02	1.1	ND<0.05	ND<0.02
MW5	ND<0.1	140	0.03	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.1	0.03	0.02	ND<0.01	ND<0.3	0.13	0.02	0.6	0.41	0.08
MW6	ND<0.1	25	0.03	ND<0.01	ND<0.01	0.23	0.23	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.05	0.07	0.03	ND<0.01	ND<0.3	0.04	0.11	1.9	1.8	1.9
MW7	ND<0.1	0.011	0.04	ND<0.02	ND<0.02	ND<0.02		ND<0.02	ND<0.02	ND<0.05		ND<0.02	ND<0.02	ND<0.02	ND<0.02		ND<0.02	ND<0.02	0.17	0.12	0.5
[illegible]	ND<0.1	ND<0.005	0.03	ND<0.01	ND<0.01	0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.06	0.01	ND<0.01	ND<0.3	ND<0.02	0.04	2.2	2.1	0.42
FIELD BLANK MW9	ND<0.1	ND<0.005	ND<0.02	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.03	ND<0.01	ND<0.01	ND<0.3	ND<0.02	ND<0.02	ND<0.1	ND<0.05	ND<0.02

Enseco

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Laboratory Report

ENSR CONSTRUCTORS
19782 MacArthur Blvd., Suite 365
Irvine, CA 92715
ATTN: Mr. Erik Nelson

Analysis No.: G-9004528-001
Date Sampled: 13-FEB-1990
Date Sample Rec'd: 13-FEB-1990
Date Analyzed: 20-FEB-1990
16-FEB-1990
Sample Type: LIQUID

Project: (9500-089) KRAMER - EL SEGUNDO
Sample ID: MW7

Parameter	Units	Result	Blank	Detection Limit
Aluminum (EPA 200.7)	mg/L	0.17	ND	0.10
Antimony (EPA 200.7)	mg/L	ND	ND	0.10
Barium (EPA 200.7)	mg/L	0.04	ND	0.02
Beryllium (EPA 200.7)	mg/L	ND	ND	0.02
Cadmium (EPA 200.7)	mg/L	ND	ND	0.02
Chromium (Total) (EPA 200.7)	mg/L	ND	ND	0.02
Cobalt (EPA 200.7)	mg/L	ND	ND	0.02
Copper (EPA 200.7)	mg/L	ND	ND	0.05
Iron (EPA 200.7)	mg/L	0.12	ND	0.05
Lead (EPA 200.7)	mg/L	ND	ND	0.05
Manganese (EPA 200.7)	mg/L	0.50	ND	0.02
Molybdenum (EPA 200.7)	mg/L	ND	ND	0.02
Nickel (EPA 200.7)	mg/L	ND	ND	0.02
Silver (EPA 200.7)	mg/L	ND	ND	0.02
Vanadium (EPA 200.7)	mg/L	ND	ND	0.02
Zinc (EPA 200.7)	mg/L	ND	ND	0.02
Arsenic (EPA 206.3)	mg/L	0.011	ND	0.005
Selenium (EPA 270.3)	mg/L	ND	ND	0.01

TABLE 6.5.2

RESULTS OF LABORATORY ANALYSES

Sample	PCE ug/L	TCE ug/L	TOLUENE ug/L	XYLENES ug/L	ETYHL-BENZENE ug/L	ACETONE ug/L	2-BUTANONE ug/L	11-DCE ug/L	111-TCA ug/L	TRICHLOROFLUORO-METHANE ug/L	CARBON-TETRACHLORIDE ug/L
MW1	200	370	ND<5	ND<5	ND<5	ND<10	ND<10	19	12	ND<5	ND<5
MW2	16	40	18	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW3	160	120	6	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW4	ND<5	190	39	40	6	74	12	ND<5	ND<5	ND<5	ND<5
MW5	ND<5	18	270	300	39	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW6	ND<5	110	ND<5	ND<5	ND<5	ND<10	ND<10	8	10	73	43
MW7											
MW8	25	88	ND<5	ND<5	ND<5	ND<10	ND<10	5	ND<5	ND<5	ND<5
FIELD BLANK MW9	ND<5	ND<5	ND<5	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5

TABLE 6.6

MONITORING WELLS REFERENCE ELEVATIONS, DEPTHS TO GROUNDWATER (12/15/89 and 1/9/90), AND GROUNDWATER ELEVATIONS

Well	Reference Elevation (feet above MSL)	Depth to Water(12/15/89) (feet)	Groundwater Elevation (feet above MSL)	Depth to Water(1/9/90) (feet)	Groundwater Elevation (feet above MSL)
W-1	102.06	82.70	19.36	82.72	19.34
W-2	98.79	81.82	16.97	81.80	16.99
W-3	94.17	71.83	22.34	71.52	22.65
MW-4	92.17	71.40	20.77	71.45	20.72
MW-5	92.75	76.94	15.81	77.03	15.72
MW-6	98.15	81.95	16.20	81.86	16.29
MW-7	107.90	89.70	18.20	89.72	18.18
MW-8	102.38	85.44	16.94	85.44	16.94

APPENDIX B

SURROUNDING WELL LOCATION INFORMATION

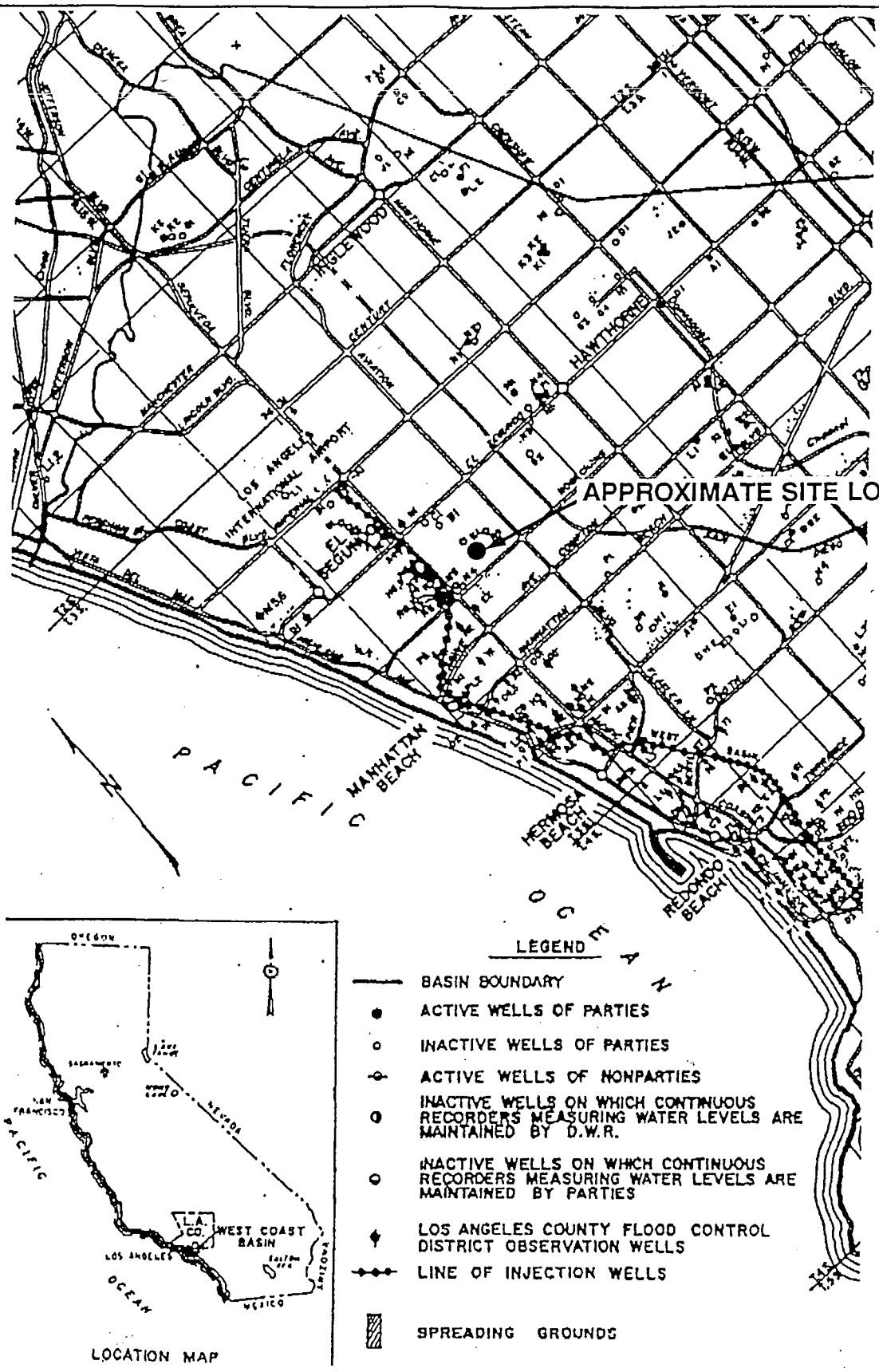
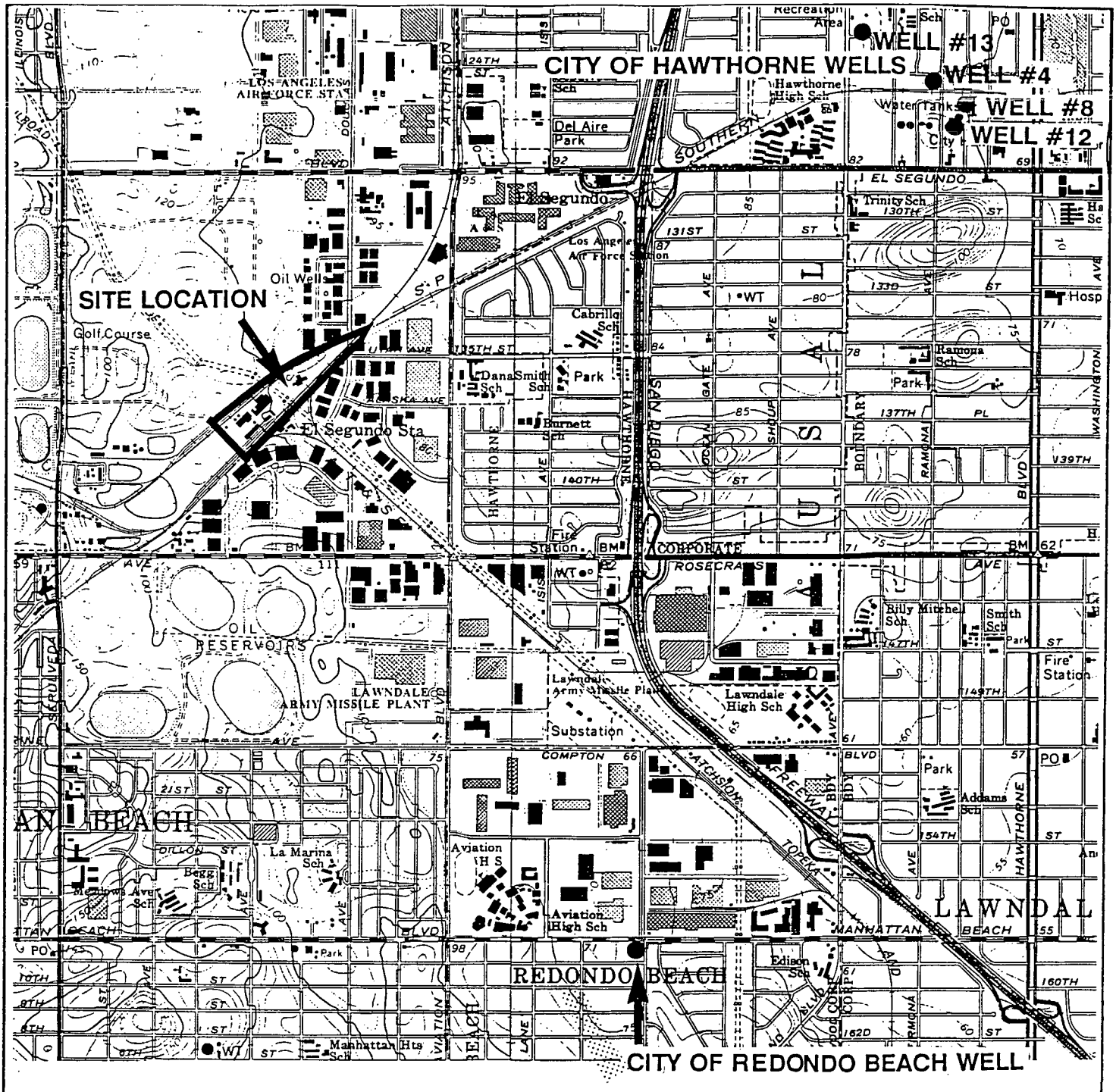


FIGURE B-1
LINE OF INJECTION WELLS
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

Source: West Coast Basin Watermaster Service - June 1991



0 1/2 1

SCALE IN MILES

FIGURE B-2

DRINKING WATER WELL LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981

Table B-1. Drinking Water Well Data for Wells Located Near the Chevron El Segundo Site

Owner/Well Number	Year Drilled	Well Depth (feet)	Highest Perforation Level (feet)
City of Hawthorne No. 4	1941	655	306
City of Hawthorne No.8	1948	518	318
City of Hawthorne No. 12	1968	554	300
City of Hawthorne No. 13	1970	480	282
City of Manhattan Beach Well		320	180

Sources: 1) Rivier, Al, City of Hawthorne, telephone conversation, November 19, 1991.
2) Rivier, J.A., City of Hawthorne, letter and enclosure, November 22, 1991.
3) Beaver, Duane, City of Manhattan Beach, telephone conversation, November 14, 1991.

Note:

1] Data regarding the City of Manhattan Beach well are approximate.

2] Well locations are indicated on Figure B-2.

Table B–2. Groundwater Use as Drinking Water in the Vicinity of the Chevron El Segundo Site

City/Water Purveyor	Number of Wells	Groundwater as a % of Total Drinking Water Supplied	Connections Served
City of Hawthorne	4	15 *	6,100
City of Manhattan Beach	1	40	12,800

Sources: 1) Rivier, Al, City of Hawthorne, telephone conversation, November 19, 1991.
2) Beaver, Duane, City of Manhattan Beach, telephone conversation, November 14, 1991.

Note:

1] City of El Segundo not included because groundwater not used for drinking water. All water supplied by the Metropolitan Water District. (Vivian, Larry, City of El Segundo, telephone conversation, November 14, 1991)

* During drought conditions, groundwater use ranges from 20 to 25% of total drinking water supplied.

APPENDIX C

SOIL AND GROUNDWATER SUMMARY STATISTICS

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ANTIMONY.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ANTIMONY.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	54	24	6	34	27	20
Minimum:	54.0	24.0	6.0	34.0	27.0	20.0
Maximum:	1780	1000	120	1780	1780	25
Mean:	87.89	101.67	32.65	138.26	153.46	2.27
Std. Dev. (/n):	278.08	209.66	42.49	340.51	377.91	5.55
Std Dev, s (/n-1):	280.69	214.17	46.55	345.63	385.11	5.69
CI input, ts/n^0.5:	76.78	90.50	48.86	120.92	151.94	2.66
Upper 95% CI of Mean:	164.67	192.17	81.51	259.18	305.40	4.93
Median:			11.45		5.4	0.5

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ARSENIC.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ARSENIC.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	61	29	6	41	34	20
Minimum:	61.0	29.0	6.0	41.0	34.0	20.0
Maximum:	2800	2800	17.0	2800	2800	270
Mean:	185.70	291.08	9.77	267.74	309.86	17.51
Std. Dev. (/n):	508.06	674.41	6.58	601.52	652.06	58.77
Std Dev, s (/n-1):	512.28	686.35	7.21	608.99	661.87	60.30
CI input, ts/n^0.5:	131.18	261.28	7.57	192.21	230.42	28.22
Upper 95% CI of Mean:	316.88	552.35	17.33	459.95	540.29	45.73
Median:			9.85	18	1.25	

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS BARIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

BARIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	501	501	501	501	501	46
Mean:	53.73	88.10	207.67	74.66	85.63	22.35
Std. Dev. (/n):	80.82	111.69	152.02	98.62	104.58	9.80
Std Dev, s (/n-1):	81.64	114.32	166.53	100.31	106.73	10.05
CI input, ts/n^0.5:	23.21	50.84	174.79	37.40	43.97	4.70
Upper 95% CI of Mean:	76.94	138.95	382.46	112.05	129.60	27.05
Median:			133.5		49.4	22

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS BERYLLIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

BERYLLIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	230	230	230	230	230	0.23
Mean:	12.54	28.27	82.87	20.81	24.95	0.13
Std. Dev. (/n):	36.78	51.31	70.63	45.65	48.97	0.05
Std Dev, s (/n-1):	37.16	52.52	77.37	46.43	49.98	0.05
CI input, ts/n^0.5:	10.56	23.36	81.21	17.31	20.59	0.02
Upper 95% CI of Mean:	23.10	51.63	164.07	38.12	45.54	0.15
Median:			48		0.84	0.13

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS CADMIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

CADMIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	29.5	29.5	29.5	29.5	29.5	2.1
Mean:	1.48	2.99	9.00	2.36	2.79	0.16
Std. Dev. (/n):	4.40	6.28	9.43	5.49	5.92	0.45
Std Dev, s (/n-1):	4.44	6.43	10.33	5.59	6.04	0.46
CI input, ts/n^0.5:	1.26	2.86	10.84	2.08	2.49	0.21
Upper 95% CI of Mean:	2.74	5.85	19.84	4.44	5.28	0.37
Median:			5.7		0.78	0.06

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS COPPER.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

COPPER.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	53800	53800	53800	53800	53800	23
Mean:	1826.19	4100.85	13248.33	3037.46	3643.32	9.29
Std. Dev. (/n):	7685.38	11179.54	18407.50	9735.18	10560.59	6.44
Std Dev, s (/n-1):	7763.40	11442.62	20164.40	9901.60	10778.35	6.61
CI input, ts/n^0.5:	2206.80	5088.95	21164.69	3691.48	4440.68	3.09
Upper 95% CI of Mean:	4032.99	9189.80	34413.02	6728.94	8084.01	12.38
Median:			3745		196	7.1

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS CR_III.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

CR_III.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	74.6	74.6	37	74.6	74.6	12
Mean:	9.39	12.95	17.50	12.13	13.64	5.28
Std. Dev. (/n):	11.62	15.39	9.77	14.24	15.15	2.24
Std Dev, s (/n-1):	11.74	15.76	10.70	14.49	15.47	2.29
CI input, ts/n^0.5:	3.34	7.01	11.23	5.40	6.37	1.07
Upper 95% CI of Mean:	12.72	19.96	28.73	17.53	20.01	6.35
Median:			15.15		7.9	5.15

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS LEAD.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

LEAD.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	2500	2500	2500	2500	2500	55
Mean:	242.05	535.36	1443.83	400.42	480.03	4.49
Std. Dev. (/n):	560.95	748.75	751.99	679.45	718.30	11.68
Std Dev, s (/n-1):	566.65	766.37	823.76	691.07	733.11	11.98
CI input, ts/n^0.5:	161.07	340.83	864.63	257.64	302.04	5.61
Upper 95% CI of Mean:	403.12	876.19	2308.46	658.06	782.07	10.10
Median:			1150		77.7	1.4

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS MANGA.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

MANGANESE
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	41000	41000	41000	41000	41000	500
Mean:	1187.50	2545.72	8041.00	1899.53	2266.08	119.45
Std. Dev. (/n):	5713.13	8418.80	14746.87	7288.72	7933.74	101.53
Std Dev, s (/n-1):	5771.13	8616.92	16154.39	7413.32	8097.34	104.17
CI input, ts/n^0.5:	1640.49	3832.26	16955.75	2763.81	3336.10	48.75
Upper 95% CI of Mean:	2827.98	6377.98	24996.75	4663.34	5602.18	168.20
Median:			1575		290	110

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS MERCURY.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

MERCURY.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	5.8	0.8	0.8	5.8	5.8	0.26
Mean:	0.19	0.11	0.29	0.29	0.33	0.04
Std. Dev. (/n):	0.81	0.17	0.24	1.03	1.13	0.06
Std Dev, s (/n-1):	0.82	0.17	0.27	1.05	1.15	0.06
CI input, ts/n^0.5:	0.23	0.08	0.28	0.39	0.47	0.03
Upper 95% CI of Mean:	0.42	0.19	0.57	0.68	0.81	0.07
Median:			0.17		0.06	0.02

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS NICKEL.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

NICKEL.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	310	310	310	310	310	22
Mean:	29.09	59.23	165.42	45.40	53.61	4.62
Std. Dev. (/n):	62.49	85.00	92.93	76.37	81.21	4.10
Std Dev, s (/n-1):	63.13	87.00	101.80	77.67	82.88	4.20
CI Input, ts/n^0.5:	17.94	38.69	106.85	28.96	34.15	1.97
Upper 95% CI of Mean:	47.03	97.92	272.27	74.36	87.75	6.59
Median:			116	9.6	3.85	

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS SELENIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

SELENIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	52	22	6	32	27	20
Minimum:	52.0	22.0	6.0	32.0	27.0	20.0
Maximum:	300	53	2	300	300	0.5
Mean:	10.64	5.64	0.94	17.24	17.73	0.07
Std. Dev. (/n):	44.40	12.17	0.60	55.59	59.86	0.10
Std Dev, s(/n-1):	44.83	12.46	0.65	56.48	61.00	0.10
CI input, ts/n^0.5:	12.50	5.54	0.69	20.39	24.18	0.05
Upper 95% CI of Mean:	23.13	11.18	1.63	37.63	41.91	0.12
Median:			1		0.9	0.05

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ZINC.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ZINC.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	76000	76000	76000	76000	76000	67
Mean:	7757.28	17520.77	45933.33	12917.27	15496.54	17.28
Std. Dev. (/n):	17163.03	22342.34	18438.97	20600.61	21664.4	14.00
Std Dev, s (/n-1):	17337.28	22868.12	20198.88	20952.78	22111.14	14.36
CI input, ts/n^0.5:	4928.24	10170.29	21200.87	7811.54	9109.79	6.72
Upper 95% CI of Mean:	12685.52	27691.06	67134.20	20728.82	24606.33	24.00
Median:			39,800.00	847.00	14.00	

CALCULATION SHEET
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR SOIL AND AIR EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/				FUTURE USE SCENARIOS /2/							
	WORKER AND TRESPASSER RECEPTORS				AREA 1 SUBSURFACE SOILS				AREA 2 SUBSURFACE SOILS			
	95% UCL		Median		95% UCL		Median		95% UCL		Median	
PARAMETER	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)
Antimony	81.51	3.36E-06	11.45	4.72E-07	305.40	3.05E-05	5.4	5.40E-07	4.93	4.93E-07	0.5	5.00E-08
Arsenic	17.33	7.14E-07	9.85	4.06E-07	540.29	5.40E-05	18	1.80E-06	45.73	4.57E-06	1.25	1.25E-07
Barium	382.46	1.58E-05	133.5	5.50E-06	129.60	1.30E-05	49.4	4.94E-06	27.05	2.71E-06	22	2.20E-06
Beryllium	164.07	6.76E-06	48	1.98E-06	45.54	4.55E-06	0.84	8.40E-08	0.15	1.50E-08	0.13	1.30E-08
Cadmium	19.84	8.17E-07	5.7	2.35E-07	5.28	5.28E-07	0.78	7.80E-08	0.37	3.70E-08	0.06	6.00E-09
Chromium (trivalent)	28.73	1.18E-06	15.15	6.24E-07	20.01	2.00E-06	7.9	7.90E-07	6.35	6.35E-07	5.15	5.15E-07
Copper	34,413	1.42E-03	3745	1.54E-04	8,084	8.08E-04	196	1.96E-05	12.38	1.24E-06	7.1	7.10E-07
Lead	2,308	9.51E-05	1150	4.74E-05	782.07	7.82E-05	77.7	7.77E-06	10.10	1.01E-06	1.4	1.40E-07
Manganese	24,997	1.03E-03	1575	6.49E-05	5602.18	5.60E-04	290	2.90E-05	168.20	1.68E-05	11	1.10E-06
Mercury	0.57	2.35E-08	0.17	7.00E-09	0.81	8.10E-08	0.06	6.00E-09	0.07	7.00E-09	0.02	2.00E-09
Nickel	272.27	1.12E-05	116	4.78E-06	87.75	8.78E-06	9.6	9.60E-07	6.59	6.59E-07	3.85	3.85E-07
Selenium	1.63	6.72E-08	1	4.12E-08	41.91	4.19E-06	0.9	9.00E-08	0.12	1.20E-08	0.05	5.00E-09
Zinc	67,134	2.77E-03	39,800	1.64E-03	24,606	2.46E-03	847	8.47E-05	24.00	2.40E-06	14	1.40E-06

CHEVRON H. KRAMER & CO. SITE 14-Feb-92
APPENDIX C SUMMARY STATS

GROUNDWATER EPC CALCULATIONS FOR INORGANIC COPC
GWINOEPC.WR1

1] All units in mg/l, roughly equivalent to ppm.
2] All non-detects are assumed equal to 1/2 the sample-specific detection limit value.

Source Data: ENSR (1990) Report, Table 6.5

Sample Location	Antimony	Arsenic	Trivalent Chromium	Hexavalent Chromium	Manganese	Nickel	Selenium
MW-1	0.05	3.2	0.01	0.025	0.06	0.02	0.02
MW-2	0.05	12	0.21	0.17	3.3	0.06	0.24
MW-3	0.84	9.8	0.01	0.025	0.01	0.01	0.19
MW-4	0.05	0.005	0.1	0.09	0.01	0.01	0.005
MW-5	0.05	140	0.01	0.025	0.08	0.03	0.02
MW-6	0.05	25	0.23	0.23	1.9	0.07	0.03
MW-7	0.05	0.011	0.01		0.5	0.01	0.005
MW-8	0.05	0.0025	0.02	0.025	0.42	0.06	0.01
Count:	8	8	8	7	8	8	8
Minimum:	0.050	0.003	0.010	0.025	0.010	0.010	0.005
Maximum:	0.84	140	0.23	0.23	3.3	0.07	0.24
Mean:	0.15	23.75	0.08	0.08	0.79	0.03	0.07
Std. Dev. (/n):	0.26	44.67	0.09	0.08	1.12	0.02	0.09
Std Dev, s (/n-1):	0.279	47.752	0.095	0.084	1.196	0.026	0.094
CI input, ts/n^0.5:	0.234	39.928	0.079	0.078	1.000	0.021	0.079
Upper 95% CI of Mean:	0.38	63.68	0.15	0.162	1.78	0.06	0.14
Median of detects:	0.84	9.8	0.155	0.17	1.2	0.06	0.025

CHEVRON H. KRAMER & CO. SITE 14-Feb-92
APPENDIX C EPC SUMMARY STATS

GROUNDWATER EPC CALCULATIONS FOR ORGANIC COPC
GWORGEPC.WR1

1] All units in mg/l, roughly equivalent to ppm.
2] All non-detects are assumed equal to 1/2 the sample-specific detection limit value.

Source Data: ENSR (1990) Report, Table 6.5

Sample Location	Carbon Tetrachloride	1,1-DCE	PCE	Toluene	TCE
MW-1	0.0025	0.019	0.2	0.0025	0.37
MW-2	0.0025	0.0025	0.016	0.018	0.04
MW-3	0.0025	0.0025	0.16	0.006	0.12
MW-4	0.0025	0.0025	0.0025	0.039	0.19
MW-5	0.0025	0.0025	0.0025	0.27	0.018
MW-6	0.043	0.008	0.0025	0.0025	0.11
MW-7					
MW-8	0.0025	0.005	0.025	0.0025	0.088
Count:	7	7	7	7	7
Minimum:	0.003	0.003	0.003	0.003	0.018
Maximum:	0.043	0.019	0.200	0.270	0.370
Mean:	0.008	0.006	0.058	0.049	0.134
Std. Dev. (/n):	0.014	0.006	0.078	0.091	0.110
Std Dev, s (/n-1):	0.015	0.006	0.084	0.099	0.118
CI input, ts/n^0.5:	0.014	0.006	0.078	0.091	0.109
Upper 95% CI of Mean:	0.022	0.012	0.136	0.140	0.243

APPENDIX D

GUIDANCE FOR ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL (DTSC, 1992)

VOLUME 6

CHAPTER 5

ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL

FOREWORD

The Department of Toxic Substances Control (DTSC), within the California Environmental Protection Agency, has the responsibility of managing the State's hazardous waste program to protect public health and the environment. The Toxicology and Risk Assessment Section (TRAS) within the Technical Services Branch provides scientific assistance in the areas of toxicology, risk and environmental assessment, training, and guidance to the regional offices within DTSC. Part of this assistance and guidance is the preparation of regulations, scientific standards, guidance documents, and recommended procedures for use by regional staff, local governmental agencies, or responsible parties and their contractors in the characterization and mitigation of hazardous waste substances release sites.

This chapter is just one part of the DTSC document, Guidance for Site Characterization and Multimedia Risk Assessment for Hazardous Substances Release Sites. The document has been prepared to provide guidelines for the investigation, monitoring, and remediation of hazardous substances release sites. Please note that within each chapter the more commonly used terms, hazardous waste site and toxic waste site, are used synonomously with the term hazardous substances release site.

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Review Draft

ABSTRACT

This guidance describes a mathematical model for estimating blood lead concentration resulting from contact with lead-contaminated environmental media. A lead concentration of concern of ten milligrams per deciliter of whole blood is established. A distributional approach is used, allowing estimation of various percentiles of blood lead concentration associated with a given set of inputs. The method can be adapted to a computer spreadsheet.

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

Review Draft

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

Review Draft

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

Review Draft

Assessment of Health Risks From Inorganic Lead in Soil

1 INTRODUCTION

1.1 PURPOSE

The purpose of this guidance is to provide a methodology for evaluating exposure and the potential for adverse health effects resulting from exposure to lead in the environment.

1.2 APPLICATION

Since most human health effects data are based on blood lead (Pb) concentration, this guidance presents a blood Pb concentration of concern for the protection of human health, and an alogrithm for estimating blood Pb concentrations in children and adults based on a multi-pathway analysis.

1.3 LIMITATIONS

It is anticipated that this guidance will be periodically revised to reflect the changing state of the science.

2 PRINCIPLE OR THEORY

2.1 BLOOD LEAD CONCENTRATION OF CONCERN

The Pb concentration of concern in children and adults is ten micrograms (ug) per deciliter (dl) of whole blood. The point of departure for risk management is a 0.01 risk of exceeding this value.

2.2 LEAD EXPOSURE PATHWAYS--BLOOD LEAD CALCULATION

This method can be used to estimate blood lead concentrations (Pb_b) resulting from exposure via the five pathways listed below. Each pathway is represented by an equation relating incremental blood lead increase to a concentration in a medium, using contact rates and empirically determined ratios. The contributions via the five pathways are added

to arrive at an estimate of median blood lead concentration resulting from the multipathway exposure. Ninety-fifth and ninety-ninth percentile concentrations are estimated from the median by assuming a log-normal distribution with a geometric standard deviation (GSD) of 1.42. The method can be adapted to a computer spreadsheet.

3 METHODS

Generalized equations describing uptake via the five exposure pathways are as follows:

Dietary Intake Equation

$$Pb_b = \text{dietary Pb} * \text{contact rate} * \text{dietary constant}$$

where:

dietary Pb (ug Pb/kg diet) = (9.45 + 0.025 mg Pb/kg soil) [1]
contact rate, adults = 2.2 kg diet/day[2]
contact rate, children = 1.3 kg diet/day[2]
dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Drinking Water Intake Equation

$$Pb_b = \text{water Pb} * \text{contact rate} * \text{water constant}$$

where:

drinking water Pb (ug Pb/l water) is a site-specific, measured value[5]
contact rate, adults = 1.4 l water/day[6]
contact rate, children = 0.4 l water/day[6]
dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Soil and Dust Ingestion Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

soil Pb (ug/g) is a site-specific, measured value
contact rate, children = 0.000055 kg/day[7]
contact rate, adults = 0.000025 kg/day[8]
soil constant, children = 0.07 (ug Pb/dl blood)/(ug ingested Pb/day)[9]
soil constant, adults = 0.018 (ug Pb/dl blood)/(ug ingested Pb/day)[9]

Inhalation Intake Equation

$$Pb_b = \text{atmospheric Pb} * \text{inhalation constant}$$

where:

atmospheric Pb = local or regional ambient Pb (ug/m^3) [10]
inhalation constant, children = 1.92 $(ug/dl)/(ug/m^3)$[11]
inhalation constant, adults = 1.64 $(ug/dl)/(ug/m^3)$[11]

Dermal Contact Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

soil Pb (ug Pb/gm soil) is a site-specific, measured value
contact rate, children = 1.4 gm soil/day [12]
contact rate, adults = 1.85 gm soil/day [13]
soil constant = 0.0001 (ug Pb/dl blood)/(ug dermal Pb/day)[14]

---

1 Derived as follows: (0.945 * 10 ug/kg) + (0.055 * 0.00045 * soil Pb in mg/kg * 1000 ug/mg). Assumes that 5.5% of the diet consists of home-grown produce with the other 94.5% supplied by a homogeneous source with a lead content of 10 ug/kg. If food production on the site can be ruled out, use 10 ug/kg for dietary lead (EPA, 1989b, Bolger, et.al., 1990). Home-grown produce is assumed to contain 0.045% of the lead level in the soil.

2 Based on a report by Pennington (1983). For this method, a one-year-old child shall represent all children, based on the assumption that protecting the one-year-old child will protect all children.

3 Based on a study by Ryu, et.al. (1983)

4 Based on a report by FDA (1990)

5 Pb concentrations in local water supplies as consumed. If site-specific data are unavailable, a value of 15 ug/l may be used.

6 EPA (1989b)

7 Based on Calabrese (1990). Deliberate soil ingestion (soil pica) is represented as 0.00079 kg soil/day average.

8 For residential exposures and most occupational exposures, based on Calabrese (1990). Occupations with a high potential for soil ingestion (such as construction) should be represented as 0.00005 kg soil/day average.

9 These values are 44% of that for lead ingested with food or water, based on a study in rats which compared the bioavailability of lead acetate mixed with the diet to that of soil-bound lead (Chaney et.al., 1990).

10 The ambient air Pb concentration data are available from the California Air Resources Board, Technical Support Division. Data for the most recent year for the nearest monitoring station should be used. If monitoring data collected within the same air basin are unavailable, a value of 0.18 ug/m^3 may be used, or consult with the DTSC project manager.

11 Based on EPA (1986)

12 Based on a soil adherence of 5 g/m^2 and 0.28 m^2 of exposed skin (EPA, 1989b).

13 Based on a soil adherence of 5 g/m^2 and 0.37 m^2 of exposed skin (EPA, 1989b).

14 This value is derived by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [11% (ATSDR, 1990)].

4 COMMENTS

4.1 BLOOD LEAD CONCENTRATION OF CONCERN

The traditional reference dose approach to toxic chemicals is not applied to Pb because most human health effects data are based on blood Pb concentrations rather than external dose. Blood Pb concentration is an integrated measure of internal dose, reflecting total exposure from site-related and background sources. A clear no-observed-effect concentration has not been established for such Pb-related endpoints as birth weight, gestation period, heme synthesis and neurobehavioral development in children and fetuses, and blood pressure in middle-aged men. Dose-response curves for these endpoints appear to extend down to 10 ug Pb/dl or less (ATSDR, 1990).

4.2 ESTIMATING BLOOD LEAD CONCENTRATIONS FROM ENVIRONMENTAL CONCENTRATIONS

Total Pb is generally used as the measure of Pb in various media, even though the disposition of Pb may differ according to its form. Insufficient data are available to justify differential treatment of different forms of inorganic Pb, and most of the published toxicity data and most site characterization data are in terms of total Pb. Organic Pb is more readily absorbed through the skin and other membranes than inorganic Pb, and it must therefore be treated separately. Since it is less stable in the environment, it is usually a minor source of exposure. In the absence of specific information for the population of interest, background exposures are estimated using norms developed from survey data.

4.3 DERIVATION OF MODEL PARAMETERS

Unless the potential for on-site gardening can be ruled out, it is assumed that 5.5% of the diet consists of home-grown produce, based on EPA guidance (USEPA, 1991). Pb concentration in home-grown produce is calculated as 0.045% of that in the soil, based on plant uptake studies (Chaney, et.al., 1982). Background dietary Pb concentration (10 ug/kg) is based on a 1990 report based on FDA data (Bolger, et.al., 1990). The default drinking water Pb concentration is based on the federal action concentration of 15 ug/l at the tap (USEPA, 1991b).

The distribution of blood Pb concentrations for a given set of environmental inputs is a critical factor in protecting sensitive members of the population. Based on a review of data from NHANES II and from several published studies of blood Pb concentrations in children living near point sources of lead, EPA concluded that blood Pb was generally log-normally distributed, that the geometric standard deviation (GSD) for children was between 1.3 and 1.53, and that 1.42 was a representative value for the

GSD (USEPA, 1989c). Adult GSDs ranged from 1.34 to 1.40, which we do not consider to be sufficiently different from the range for children to justify using a different value for adults. The model assumes a log-normal distribution with a GSD of 1.42 and uses this information to estimate the fiftieth, ninety-fifth, and ninety-ninth percentile blood Pb concentration for a set of inputs. Since this distribution reflects the physiologic and behavioral variables including soil consumption, using upper bound values for exposure inputs would distort the percentiles corresponding to blood Pb concentrations.

The availability of Pb ingested with soil is based on a study which compared the absorption of soil Pb and Pb acetate incorporated into the diet of rats (Chaney, et.al., 1990). While the authors found a direct relationship between the Pb concentration in the soil and Pb bioavailability, the data did not define the shape of the concentration/bioavailability curve sufficiently to allow extrapolation beyond the range studied. The highest observed bioavailability for soil lead concentrations less than 1000 ppm was 44% of that observed for Pb acetate, and this guideline adopts this value as a conservative estimate of bioavailability. To accurately assess the matrix effect, a variety of variables, including lead species, particle size, and soil type would have to be systematically examined at realistic Pb concentrations in soil.

The daily soil adherence to skin of 5 gm/m^2 is based on Driver et.al (1989). The dermal absorption factor of 0.0001 ug Pb/dl blood per ug dermal Pb/day was developed by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [(11% (ATSDR, 1990)]. Based on data in the Exposure Factors Handbook (USEPA, 1989b), the median skin area of arms, hands, feet, and legs of 1-year-old boys is estimated to be 0.28 m^2, and the median skin area of arms and hands of men is estimated to be 0.37 m^2.

The ratio of 0.16 ug/dl per ug/day ingested by children is a value derived from studies in infants by Ryu et.al. (1983). The ratio of 0.04 ug/dl per ug/day ingested by adults is an empirically-determined value recommended by EPA (1986) and FDA (1990). The default value for inadvertent soil/dust ingestion by children, 55 mg/day, is based on tracer studies reviewed by Calabrese, et.al. (1991). Adult soil consumption is 25 mg/day, based on EPA (1991a). DTSC uses soil consumption rates of 200 and 100 mg/day in calculating a reasonable maximum exposure for children and adults, respectively. However, reasonable maximum inputs are not recommended for use with the lead model because the model already considers the distribution of blood lead, which reflects variation in soil ingestion along with other variables. Soil consumption representing pica is 0.79 g/day, based on estimates by Calabrese et.al. (1991).

The slopes of 1.92 and 1.64 ug/dl of blood per ug/m^3 of continuously-breathed air at atmospheric Pb concentrations <5 ug/m^3 are based on results of experimental exposures and epidemiological studies which adjusted for airborne lead contributions to pathways other than inhalation. These studies found slopes ranging from 1.52 to 2.46 ug/dl per ug/m^3 in children and 1.25 to 2.14 in adults (USEPA, 1986). The default airborne lead concentration is the highest monthly mean 24-hour value recorded in California in 1990.

4.4 USING THIS GUIDANCE

This guidance may be implemented using a computer spreadsheet, which may be obtained from DTSC. The spreadsheet is based on DTSC Guidance, Volume 4, Chapter 1, which should be consulted for more general aspects of spreadsheet application. For this spreadsheet, soil concentration in mg/kg (ppm w/w) is entered in cell E6. The spreadsheet uses it in each calculation that is affected by soil Pb. Atmospheric Pb is entered in cell E5. Drinking-water Pb is entered in cell E7. If omission of the site-grown produce pathway can be justified, a "0" is entered in cell E8. The remainder of the cells are protected and should not be altered without approval of DTSC. Any such changes will require sufficient justification and must be documented.

4.5 OTHER STANDARDS AND GUIDANCE

USEPA (1991c) considers lead to be a class B-2 carcinogen, with sufficient evidence in animals and inadequate evidence in humans. A carcinogenic potency has not been assigned. The federal MCL is 15 ug/l maximum at the tap with a maximum of 5 ug/l as a system-wide average (USEPA, 1991b). The Centers for Disease Control recommends that blood Pb concentrations exceeding 25 ug/dl require follow-up and intervention (CDC, 1985). The EPA has set 1.5 ug/m^3 as the Pb concentration limit for ambient air (quarterly average) (USEPA, 1978). California's standard is also 1.5 ug/m^3, but is based on a monthly average. The threshold limit value is 50 ug/m^3 for workplace air (ACGIH, 1989).

FDA (1990) considers the Lowest Observable Adverse Effect Level (LOAEL) to be 10 ug/dl in children and fetuses, and 30 ug/dl in adults. They use empirically-derived ratios of 0.16 and 0.04 ug/dl per ug/day ingested to predict concentrations in young children and adults, respectively. Applying an uncertainty factor of ten results in provisional tolerable intake levels of 6 ug/day for children six or less, 15 ug/day for children over six, 25 ug/day for pregnant women, and 75 ug/day for men.

REFERENCES

ACGIH. 1989. American conference of Governmental Industrial Hygienists, Documentation of TLVs and BEIs.

ATSDR. 1990. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service; Toxicological Profile for Lead.

Bolger, P. M., S. G. Capar, and M. A. Adams. 1990. Reductions in Dietary Lead Exposure in the United States. Presented at the Symposium on the Bioavailability and Dietary Exposure of Lead, Sept 24-27, 1990.

Calabrese, E. J., E. S. Stanek, and C. E. Gilbert. 1991. A Preliminary Decision Framework for Deriving Soil Ingestion Rates. In: Hydrocarbon-Contaminated Soils and Groundwater, Volume 1, Kostecki and Calabrese, eds., Lewis, Chelsea, MI.

CDC. 1985. Centers for Disease Control, U.S. Public Health Service; Preventing Lead Poisoning in Young Children; Publ. #99-2230, pp 7-19.

Chaney, R. L., H. W. Mielke, and S. B. Sterrett. 1990. Speciation, Mobility, and Bioavailability of Soil Lead; Environ. Geochem. and Health.

Chaney, R. L., S. B. Sterrett, and H. W. Mielke. 1982. The Potential for Heavy Metal Exposure from Urban Gardens and Soils; In: Proceedings of a Symposium on Heavy Metals in Urban Gardens, Agricultural Experiment Station, University of the District of Columbia, James M. Preer, ed.

DTSC. 1990. Default Risk Assessment Formulas for Determination of Soil Remediation Levels, California Environmental Protection Agency. Department of Toxic Substances Control. Draft.

Driver, J. H., J. J. Konz, and G. K. Whitmyre. 1989. Soil adherence to human skin. Bull. Environ. Contam. Toxicol. 43: 814-820.

FDA. 1990. Contaminants Team, Division of Toxicological Review and Evaluation, Food and Drug Administration, Public Health Service, U.S. Department of Health and Human services; Memorandum to Elizabeth Campbell, Division of Regulatory Guidance.

Moore, M. R., P. A. Meridith, W. S. Watson, D. J. Summer, M. K. Taylor, and A. Goldberg. 1980. The percutaneous absorption of lead-203 in humans from cosmetic preparations containing lead acetate, as assessed by whole-body counting and other techniques. Food Cosmet. Toxicol. 18: 636.

Pennington, J. A. T. 1983. Revision of the total diet study food list and diets. J. Am. Dietetic Association, 82: 166.

Ryu, J. E., E. E. Ziegler, S. E. Nelson, and S. J. Fomon. 1983. Dietary intake of lead and blood lead concentration in early infancy. Am. J. Dis. Early Child. 137: 886.

USEPA. 1978. U.S. Environmental Protection Agency; National Primary and Secondary Ambient Air Quality Standards for Lead. Fed. Regist. 43(194): 46246-46261.

USEPA. 1986. Environmental Criteria And Assessment Office, U.S. Environmental Protection Agency. Air Quality Criteria for Lead, EPA 600/8-83-028, June 1986.

USEPA. 1989a. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund, Volume 1; EPA 540/1-89-002 December, 1989.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Exposure Factors Handbook. EPA/600/8-89/043

USEPA. 1989c. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Review of the National Ambient Air Quality Standards for Lead, EPA 450/2-89-011 June 1989.

USEPA. 1991a. Office of Solid Waste and Emergency Response U.S. Environmental Protection Agency. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors; OSWER Directive 9285.6-03.

USEPA. 1991b. U.S. Environmental Protection Agency. National Primary Drinking Water Quality Standards for Lead and Copper. Fed. Regist. 56(110): June 7, 1991, p. 26460.

USEPA. 1991c. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Health Effects Assessment Summary Tables, NTIS No. PB91-921199, January 1991.

APPENDIX E

RISK ASSESSMENT CALCULATION DOCUMENTATION

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF, AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	70	50	0.122	8.6E-07	1.5E+00	1.3E-06	0.07
Beryllium	48	1.0E-06	70	50	0.122	4.2E-06	4.3E+00	1.8E-05	0.93
							TOTAL EXCESS CANCER RISK:	1.9E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	11.45	1.0E-06	70	50	0.342	2.8E-06	4.0E-04	7.0E-03	0.07
Arsenic	9.85	1.0E-06	70	50	0.342	2.4E-06	3.0E-04	8.0E-03	0.08
Barium	133.5	1.0E-06	70	50	0.342	3.3E-05	7.0E-02	4.7E-04	0.00
Beryllium	48	1.0E-06	70	50	0.342	1.2E-05	5.0E-03	2.3E-03	0.02
Cadmium	5.7	1.0E-06	70	50	0.342	1.4E-06	1.0E-03	1.4E-03	0.01
Chromium (trivalent)	15.15	1.0E-06	70	50	0.342	3.7E-06	1.0E+00	3.7E-06	0.00
Copper	3745	1.0E-06	70	50	0.342	9.2E-04	3.7E-02	2.5E-02	0.25
Lead	1150	1.0E-06	70	50	0.342	2.8E-04	See Note Below	NA	NA
Manganese	1575	1.0E-06	70	50	0.342	3.9E-04	1.0E-01	3.9E-03	0.04
Mercury	0.17	1.0E-06	70	50	0.342	4.2E-08	3.0E-04	1.4E-04	0.00
Nickel	116	1.0E-06	70	50	0.342	2.8E-05	2.0E-02	1.4E-03	0.01
Selenium	1.0	1.0E-06	70	50	0.342	2.4E-07	5.0E-03	4.9E-05	0.00
Zinc	39800	1.0E-06	70	50	0.342	9.7E-03	2.0E-01	4.9E-02	0.50
							HAZARD INDEX:	9.81E-02	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.8E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.354 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	9.85	1.0E-06	70	0.50	3700	0.01	0.122	3.2E-07	3.0E+01	9.6E-06	0.07
Beryllium	48	1.0E-06	70	0.50	3700	0.01	0.122	1.6E-06	8.6E+01	1.3E-04	0.93
									TOTAL EXCESS CANCER RISK:	1.4E-04	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	11.45	1.0E-06	70	0.50	3700	0.01	0.342	1.0E-06	4.0E-04	2.6E-03	0.10
Arsenic	9.85	1.0E-06	70	0.50	3700	0.01	0.342	8.9E-07	3.0E-04	3.0E-03	0.11
Barium	133.5	1.0E-06	70	0.50	3700	0.01	0.342	1.2E-05	7.0E-02	1.7E-04	0.01
Beryllium	48	1.0E-06	70	0.50	3700	0.01	0.342	4.3E-06	5.0E-03	8.7E-04	0.03
Cadmium	5.70	1.0E-06	70	0.50	3700	0.01	0.342	5.2E-07	1.0E-03	5.2E-04	0.02
Chromium (trivalent)	15.15	1.0E-06	70	0.50	3700	0.01	0.342	1.4E-06	1.0E+00	1.4E-06	0.00
Copper	3745.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1150.00	1.0E-06	70	0.50	3700	See Below	0.342	1.0E-02	See Note Below	--	--
Manganese	1575.00	1.0E-06	70	0.50	3700	0.01	0.342	1.4E-04	1.0E-01	1.4E-03	0.05
Mercury	0.17	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-08	3.0E-04	5.1E-05	0.00
Nickel	116.00	1.0E-06	70	0.50	3700	0.01	0.342	1.0E-05	2.0E-02	5.2E-04	0.02
Selenium	1.00	1.0E-06	70	0.50	3700	0.01	0.342	9.1E-08	5.0E-03	1.8E-05	0.00
Zinc	39800.00	1.0E-06	70	0.50	3700	0.01	0.342	3.6E-03	2.0E-01	1.8E-02	0.66
									HAZARD INDEX:	2.72E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.0E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.073 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on median soil EPC and local PM10 concentrations

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	0.0412	4.06E-07	70	2.5	4.0	0.245	1.4E-08	1.15E+01	1.6E-07	0.19
Beryllium	48	1.0E-06	0.0412	1.98E-06	70	2.5	4.0	0.245	6.9E-08	8.40E+00	5.8E-07	0.67
Cadmium	5.7	1.0E-06	0.0412	2.35E-07	70	2.5	4.0	0.245	8.2E-09	1.47E+01	1.2E-07	0.14
										TOTAL EXCESS CANCER RISK:	8.6E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	11.45	1.0E-06	0.0412	4.72E-07	70	2.5	4.0	0.685	4.6E-08	4.0E-04	1.2E-04	0.00
Arsenic*	9.85	1.0E-06	0.0412	4.06E-07	70	2.5	4.0	0.685	4.0E-08	3.0E-04	1.3E-04	0.00
Barium	133.5	1.0E-06	0.0412	5.50E-06	70	2.5	4.0	0.685	5.4E-07	1.0E-04	5.4E-03	0.02
Beryllium	48	1.0E-06	0.0412	1.98E-06	70	2.5	4.0	0.685	1.9E-07	1.4E-06	1.4E-01	0.41
Cadmium	5.70	1.0E-06	0.0412	2.35E-07	70	2.5	4.0	0.685	2.3E-08	1.0E-03	2.3E-05	0.00
Chromium (trivalent)	15.15	1.0E-06	0.0412	6.24E-07	70	2.5	4.0	0.685	6.1E-08	5.7E-07	1.1E-01	0.32
Copper	3745	1.0E-06	0.0412	1.54E-04	70	2.5	4.0	0.685	1.5E-05	1.0E-02	1.5E-03	0.00
Lead	1150	1.0E-06	0.0412	4.74E-05	70	2.5	4.0	0.685	4.6E-06	See Note Below	NA	NA
Manganese	1575	1.0E-06	0.0412	6.49E-05	70	2.5	4.0	0.685	6.3E-06	1.1E-04	5.8E-02	0.17
Mercury	0.17	1.0E-06	0.0412	7.00E-09	70	2.5	4.0	0.685	6.9E-10	8.6E-05	8.0E-06	0.00
Nickel	116.00	1.0E-06	0.0412	4.78E-06	70	2.5	4.0	0.685	4.7E-07	6.9E-05	6.8E-03	0.02
Selenium	1.00	1.0E-06	0.0412	4.12E-08	70	2.5	4.0	0.685	4.0E-09	1.0E-03	4.0E-06	0.00
Zinc	39800	1.0E-06	0.0412	1.64E-03	70	2.5	4.0	0.685	1.6E-04	1.0E-02	1.6E-02	0.05
										HAZARD INDEX:	3.33E-01	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.74E-05 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.078 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRESING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	46	100	0.014	3.0E-07	1.5E+00	4.5E-07	0.07
Beryllium	48	1.0E-06	46	100	0.014	1.5E-06	4.3E+00	6.3E-06	0.93
							TOTAL EXCESS CANCER RISK:	6.8E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	11.45	1.0E-06	46	100	0.197	4.9E-06	4.0E-04	1.2E-02	0.07
Arsenic	9.85	1.0E-06	46	100	0.197	4.2E-06	3.0E-04	1.4E-02	0.08
Barium	133.5	1.0E-06	46	100	0.197	5.7E-05	7.0E-02	8.2E-04	0.00
Beryllium	48	1.0E-06	46	100	0.197	2.1E-05	5.0E-03	4.1E-03	0.02
Cadmium	5.70	1.0E-06	46	100	0.197	2.4E-06	1.0E-03	2.4E-03	0.01
Chromium (trivalent)	15.15	1.0E-06	46	100	0.197	6.5E-06	1.0E+01	6.5E-07	0.00
Copper	3745	1.0E-06	46	100	0.197	1.6E-03	3.7E-02	4.3E-02	0.25
Lead	1150	1.0E-06	46	100	0.197	4.9E-04	See Note Below	NA	NA
Manganese	1575	1.0E-06	46	100	0.197	6.8E-04	1.0E-01	6.8E-03	0.04
Mercury	0.17	1.0E-06	46	100	0.197	7.3E-08	3.0E-04	2.4E-04	0.00
Nickel	116.00	1.0E-06	46	100	0.197	5.0E-05	2.0E-02	2.5E-03	0.01
Selenium	1.00	1.0E-06	46	100	0.197	4.3E-07	5.0E-03	8.6E-05	0.00
Zinc	39800	1.0E-06	46	100	0.197	1.7E-02	2.0E-01	8.5E-02	0.50
							HAZARD INDEX:	1.72E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.9E-04 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.07 [Soil Pb constant: (ug Pb/dl blood)(ug ingested Pb/day)].
1.588 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRES_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	9.85	1.0E-06	46	0.50	3000	0.01	0.014	4.5E-08	3.0E+01	1.4E-06	0.07
Beryllium	48	1.0E-06	46	0.50	3000	0.01	0.014	2.2E-07	8.6E+01	1.9E-05	0.93
									TOTAL EXCESS CANCER RISK:	2.0E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	11.45	1.0E-06	46	0.50	3000	0.01	0.197	7.4E-07	4.0E-04	1.8E-03	0.10
Arsenic	9.85	1.0E-06	46	0.50	3000	0.01	0.197	6.3E-07	3.0E-04	2.1E-03	0.11
Barium	133.5	1.0E-06	46	0.50	3000	0.01	0.197	8.6E-06	7.0E-02	1.2E-04	0.01
Beryllium	48	1.0E-06	46	0.50	3000	0.01	0.197	3.1E-06	5.0E-03	6.2E-04	0.03
Cadmium	5.70	1.0E-06	46	0.50	3000	0.01	0.197	3.7E-07	1.0E-03	3.7E-04	0.02
Chromium (trivalent)	15.15	1.0E-06	46	0.50	3000	0.01	0.197	9.7E-07	1.0E+01	9.7E-08	0.00
Copper	3745.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1150.00	1.0E-06	46	0.50	3000	See Below	0.197	7.4E-03	See Note Below	--	--
Manganese	1575.00	1.0E-06	46	0.50	3000	0.01	0.197	1.0E-04	1.0E-01	1.0E-03	0.05
Mercury	0.17	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-08	3.0E-04	3.6E-05	0.00
Nickel	116.00	1.0E-06	46	0.50	3000	0.01	0.197	7.5E-06	2.0E-02	3.7E-04	0.02
Selenium	1.00	1.0E-06	46	0.50	3000	0.01	0.197	6.4E-08	5.0E-03	1.3E-05	0.00
Zinc	39800.00	1.0E-06	46	0.50	3000	0.01	0.197	2.6E-03	2.0E-01	1.3E-02	0.66
									HAZARD INDEX:	1.93E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.4E-03 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.034 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRESINH1.WR1
14-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers
AIR EPC: Estimated particulate concentration in air based on median soil EPC and PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	0.0412	4.06E-07	46	0.7	2.0	0.014	1.7E-10	1.15E+01	2.0E-09	0.19
Beryllium	48	1.0E-06	0.0412	1.98E-06	46	0.7	2.0	0.014	8.5E-10	8.40E+00	7.1E-09	0.67
Cadmium	5.7	1.0E-06	0.0412	2.35E-07	46	0.7	2.0	0.014	1.0E-10	1.47E+01	1.5E-09	0.14
										TOTAL EXCESS CANCER RISK:	1.1E-08	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	11.45	1.0E-06	0.0412	4.72E-07	46	0.7	2.0	0.197	2.8E-09	4.0E-04	7.1E-06	0.00
Arsenic*	9.85	1.0E-06	0.0412	4.06E-07	46	0.7	2.0	0.197	2.4E-09	3.0E-04	8.1E-06	0.00
Barium	133.5	1.0E-06	0.0412	5.50E-06	46	0.7	2.0	0.197	3.3E-08	1.0E-03	3.3E-05	0.00
Beryllium	48	1.0E-06	0.0412	1.98E-06	46	0.7	2.0	0.197	1.2E-08	1.4E-06	8.5E-03	0.60
Cadmium	5.70	1.0E-06	0.0412	2.35E-07	46	0.7	2.0	0.197	1.4E-09	1.0E-03	1.4E-06	0.00
Chromium (trivalent)	15.15	1.0E-06	0.0412	6.24E-07	46	0.7	2.0	0.197	3.7E-09	5.7E-06	6.6E-04	0.05
Copper	3745	1.0E-06	0.0412	1.54E-04	46	0.7	2.0	0.197	9.3E-07	1.0E-02	9.3E-05	0.01
Lead	1150	1.0E-06	0.0412	4.74E-05	46	0.7	2.0	0.197	2.8E-07	See Note Below	NA	NA
Manganese	1575	1.0E-06	0.0412	6.49E-05	46	0.7	2.0	0.197	3.9E-07	1.1E-04	3.5E-03	0.25
Mercury	0.17	1.0E-06	0.0412	7.00E-09	46	0.7	2.0	0.197	4.2E-11	8.6E-05	4.9E-07	0.00
Nickel	116.00	1.0E-06	0.0412	4.78E-06	46	0.7	2.0	0.197	2.9E-08	6.9E-05	4.2E-04	0.03
Selenium	1.00	1.0E-06	0.0412	4.12E-08	46	0.7	2.0	0.197	2.5E-10	1.0E-03	2.5E-07	0.00
Zinc	39800	1.0E-06	0.0412	1.64E-03	46	0.7	2.0	0.197	9.8E-06	1.0E-02	9.8E-04	0.07
										HAZARD INDEX:	1.42E-02	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.
Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.74E-05 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.92 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.091 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: SOIL INGESTION PATHWAY

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	18	1.0E-06	70	480	0.010	1.2E-06	1.5E+00	1.8E-06	0.88
Beryllium	0.84	1.0E-06	70	480	0.010	5.6E-08	4.3E+00	2.4E-07	0.12
							TOTAL EXCESS CANCER RISK:	2.1E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	5.4	1.0E-06	70	480	0.685	2.5E-05	4.0E-04	6.3E-02	0.15
Arsenic	18.0	1.0E-06	70	480	0.685	8.5E-05	3.0E-04	2.8E-01	0.68
Barium	49.4	1.0E-06	70	480	0.685	2.3E-04	7.0E-02	3.3E-03	0.01
Beryllium	0.84	1.0E-06	70	480	0.685	3.9E-06	5.0E-03	7.9E-04	0.00
Cadmium	0.78	1.0E-06	70	480	0.685	3.7E-06	1.0E-03	3.7E-03	0.01
Chromium (trivalent)	7.90	1.0E-06	70	480	0.685	3.7E-05	1.0E+01	3.7E-06	0.00
Copper	196	1.0E-06	70	480	0.685	9.2E-04	3.7E-02	2.5E-02	0.06
Lead	77.7	1.0E-06	70	480	0.685	3.6E-04	See Note Below	NA	NA
Manganese	290	1.0E-06	70	480	0.685	1.4E-03	1.0E-01	1.4E-02	0.03
Mercury	0.06	1.0E-06	70	480	0.685	2.8E-07	3.0E-04	9.4E-04	0.00
Nickel	9.60	1.0E-06	70	480	0.685	4.5E-05	2.0E-02	2.3E-03	0.01
Selenium	0.90	1.0E-06	70	480	0.685	4.2E-06	5.0E-03	8.5E-04	0.00
Zinc	847	1.0E-06	70	480	0.685	4.0E-03	2.0E-01	2.0E-02	0.05
							HAZARD INDEX:	4.15E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 3.6E-04 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.46 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	18	1.0E-06	70	0.50	3700	0.01	0.010	4.7E-08	3.0E+01	1.4E-06	0.88
Beryllium	0.84	1.0E-06	70	0.50	3700	0.01	0.010	2.2E-09	8.6E+01	1.9E-07	0.12
									TOTAL EXCESS CANCER RISK:	1.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	5.4	1.0E-06	70	0.50	3700	0.01	0.685	9.8E-07	4.0E-04	2.4E-03	0.16
Arsenic	18.0	1.0E-06	70	0.50	3700	0.01	0.685	3.3E-06	3.0E-04	1.1E-02	0.72
Barium	49.4	1.0E-06	70	0.50	3700	0.01	0.685	8.9E-06	7.0E-02	1.3E-04	0.01
Beryllium	0.84	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-07	5.0E-03	3.0E-05	0.00
Cadmium	0.78	1.0E-06	70	0.50	3700	0.01	0.685	1.4E-07	1.0E-03	1.4E-04	0.01
Chromium (trivalent)	7.90	1.0E-06	70	0.50	3700	0.01	0.685	1.4E-06	1.0E+01	1.4E-07	0.00
Copper	196	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	77.7	1.0E-06	70	0.50	3700	See Below	0.685	1.4E-03	See Note Below	--	--
Manganese	290	1.0E-06	70	0.50	3700	0.01	0.685	5.2E-05	1.0E-01	5.2E-04	0.03
Mercury	0.06	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-08	3.0E-04	3.6E-05	0.00
Nickel	9.60	1.0E-06	70	0.50	3700	0.01	0.685	1.7E-06	2.0E-02	8.7E-05	0.01
Selenium	0.90	1.0E-06	70	0.50	3700	0.01	0.685	1.6E-07	5.0E-03	3.3E-05	0.00
Zinc	847	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-04	2.0E-01	7.7E-04	0.05
									HAZARD INDEX:	1.51E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.4E-3 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.010 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1

AIR EPC: Estimated particulate concentration in air based on Area 1 median soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	18.0	1.0E-06	0.1	1.80E-06	70	4.5	8.0	0.010	9.1E-09	1.15E+01	1.0E-07	0.92
Beryllium	0.84	1.0E-06	0.1	8.40E-08	70	4.5	8.0	0.010	4.2E-10	8.40E+00	3.6E-09	0.03
Cadmium	0.78	1.0E-06	0.1	7.80E-08	70	4.5	8.0	0.010	3.9E-10	1.47E+01	5.8E-09	0.05
										TOTAL EXCESS CANCER RISK:	1.1E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	5.4	1.0E-06	0.1	5.40E-07	70	4.5	8.0	0.685	1.9E-07	4.0E-04	4.8E-04	0.00
Arsenic*	18.0	1.0E-06	0.1	1.80E-06	70	4.5	8.0	0.685	6.3E-07	3.0E-04	2.1E-03	0.01
Barium	49.4	1.0E-06	0.1	4.94E-06	70	4.5	8.0	0.685	1.7E-06	1.0E-03	1.7E-03	0.01
Beryllium	0.84	1.0E-06	0.1	8.40E-08	70	4.5	8.0	0.685	3.0E-08	1.4E-06	2.1E-02	0.12
Cadmium	0.78	1.0E-06	0.1	7.80E-08	70	4.5	8.0	0.685	2.7E-08	1.0E-03	2.7E-05	0.00
Chromium (trivalent)	7.90	1.0E-06	0.1	7.90E-07	70	4.5	8.0	0.685	2.8E-07	5.7E-06	4.9E-02	0.28
Copper	196	1.0E-06	0.1	1.96E-05	70	4.5	8.0	0.685	6.9E-06	1.0E-02	6.9E-04	0.00
Lead	77.7	1.0E-06	0.1	7.77E-06	70	4.5	8.0	0.685	2.7E-06	See Note Below	NA	NA
Manganese	290	1.0E-06	0.1	2.90E-05	70	4.5	8.0	0.685	1.0E-05	1.1E-04	9.3E-02	0.53
Mercury	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.685	2.1E-09	8.6E-05	2.5E-05	0.00
Nickel	9.60	1.0E-06	0.1	9.60E-07	70	4.5	8.0	0.685	3.4E-07	6.9E-05	4.9E-03	0.03
Selenium	0.90	1.0E-06	0.1	9.00E-08	70	4.5	8.0	0.685	3.2E-08	1.0E-03	3.2E-05	0.00
Zinc	847	1.0E-06	0.1	8.47E-05	70	4.5	8.0	0.685	3.0E-05	1.0E-02	3.0E-03	0.02
										HAZARD INDEX:	1.76E-01	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.77E-6 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.013 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: SOIL INGESTION PATHWAY

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 2 subsurface soils (3-25').

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	1.25	1.0E-06	70	480	0.010	8.4E-08	1.5E+00	1.3E-07	0.77
Beryllium	0.13	1.0E-06	70	480	0.010	8.7E-09	4.3E+00	3.8E-08	0.23
							TOTAL EXCESS CANCER RISK:	1.6E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	0.50	1.0E-06	70	480	0.685	2.3E-06	4.0E-04	5.9E-03	0.19
Arsenic	1.25	1.0E-06	70	480	0.685	5.9E-06	3.0E-04	2.0E-02	0.65
Barium	22.00	1.0E-06	70	480	0.685	1.0E-04	7.0E-02	1.5E-03	0.05
Beryllium	0.13	1.0E-06	70	480	0.685	6.1E-07	5.0E-03	1.2E-04	0.00
Cadmium	0.06	1.0E-06	70	480	0.685	2.8E-07	1.0E-03	2.8E-04	0.01
Chromium (trivalent)	5.15	1.0E-06	70	480	0.685	2.4E-05	1.0E+01	2.4E-06	0.00
Copper	7.10	1.0E-06	70	480	0.685	3.3E-05	3.7E-02	9.0E-04	0.03
Lead	1.40	1.0E-06	70	480	0.685	6.6E-06	See Note Below	NA	NA
Manganese	11.00	1.0E-06	70	480	0.685	5.2E-05	1.0E-01	5.2E-04	0.02
Mercury	0.02	1.0E-06	70	480	0.685	9.4E-08	3.0E-04	3.1E-04	0.01
Nickel	3.85	1.0E-06	70	480	0.685	1.8E-05	2.0E-02	9.0E-04	0.03
Selenium	0.05	1.0E-06	70	480	0.685	2.3E-07	5.0E-03	4.7E-05	0.00
Zinc	14.00	1.0E-06	70	480	0.685	6.6E-05	2.0E-01	3.3E-04	0.01
							HAZARD INDEX:	3.03E-02	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 6.6E-6 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.008 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 2 subsurface soils (3-25').

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	1.25	1.0E-06	70	0.50	3700	0.01	0.010	3.2E-09	3.0E+01	9.7E-08	0.77
Beryllium	0.13	1.0E-06	70	0.50	3700	0.01	0.010	3.4E-10	8.6E+01	2.9E-08	0.23
									TOTAL EXCESS CANCER RISK:	1.3E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	0.50	1.0E-06	70	0.50	3700	0.01	0.685	9.1E-08	4.0E-04	2.3E-04	0.20
Arsenic	1.25	1.0E-06	70	0.50	3700	0.01	0.685	2.3E-07	3.0E-04	7.5E-04	0.66
Barium	22.00	1.0E-06	70	0.50	3700	0.01	0.685	4.0E-06	7.0E-02	5.7E-05	0.05
Beryllium	0.13	1.0E-06	70	0.50	3700	0.01	0.685	2.4E-08	5.0E-03	4.7E-06	0.00
Cadmium	0.06	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-08	1.0E-03	1.1E-05	0.01
Chromium (trivalent)	5.15	1.0E-06	70	0.50	3700	0.01	0.685	9.3E-07	1.0E+01	9.3E-08	0.00
Copper	7.10	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1.40	1.0E-06	70	0.50	3700	See Below	0.685	2.5E-05	See Note Below	--	--
Manganese	11.00	1.0E-06	70	0.50	3700	0.01	0.685	2.0E-06	1.0E-01	2.0E-05	0.02
Mercury	0.02	1.0E-06	70	0.50	3700	0.01	0.685	3.6E-09	3.0E-04	1.2E-05	0.01
Nickel	3.85	1.0E-06	70	0.50	3700	0.01	0.685	7.0E-07	2.0E-02	3.5E-05	0.03
Selenium	0.05	1.0E-06	70	0.50	3700	0.01	0.685	9.1E-09	5.0E-03	1.8E-06	0.00
Zinc	14.00	1.0E-06	70	0.50	3700	0.01	0.685	2.5E-06	2.0E-01	1.3E-05	0.01
									HAZARD INDEX:	1.13E-03	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.5E-05 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.000 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2

AIR EPC: Estimated particulate concentration in air based on Area 2 median soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	1.25	1.0E-06	0.1	1.25E-07	70	4.5	8.0	0.010	6.3E-10	1.15E+01	7.2E-09	0.88
Beryllium	0.13	1.0E-06	0.1	1.30E-08	70	4.5	8.0	0.010	6.5E-11	8.40E+00	5.5E-10	0.07
Cadmium	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.010	3.0E-11	1.47E+01	4.4E-10	0.05
										TOTAL EXCESS CANCER RISK:	8.2E-09	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	0.50	1.0E-06	0.1	5.00E-08	70	4.5	8.0	0.685	1.8E-08	4.0E-04	4.4E-05	0.00
Arsenic*	1.25	1.0E-06	0.1	1.25E-07	70	4.5	8.0	0.685	4.4E-08	3.0E-04	1.5E-04	0.00
Barium	22.00	1.0E-06	0.1	2.20E-06	70	4.5	8.0	0.685	7.7E-07	1.0E-03	7.7E-04	0.02
Beryllium	0.13	1.0E-06	0.1	1.30E-08	70	4.5	8.0	0.685	4.6E-09	1.4E-06	3.3E-03	0.08
Cadmium	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.685	2.1E-09	1.0E-03	2.1E-06	0.00
Chromium (trivalent)	5.15	1.0E-06	0.1	5.15E-07	70	4.5	8.0	0.685	1.8E-07	5.7E-06	3.2E-02	0.76
Copper	7.10	1.0E-06	0.1	7.10E-07	70	4.5	8.0	0.685	2.5E-07	1.0E-02	2.5E-05	0.00
Lead	1.40	1.0E-06	0.1	1.40E-07	70	4.5	8.0	0.685	4.9E-08	See Note Below	NA	NA
Manganese	11.00	1.0E-06	0.1	1.10E-06	70	4.5	8.0	0.685	3.9E-07	1.1E-04	3.5E-03	0.08
Mercury	0.02	1.0E-06	0.1	2.00E-09	70	4.5	8.0	0.685	7.0E-10	8.6E-05	8.2E-06	0.00
Nickel	3.85	1.0E-06	0.1	3.85E-07	70	4.5	8.0	0.685	1.4E-07	6.9E-05	2.0E-03	0.05
Selenium	0.05	1.0E-06	0.1	5.00E-09	70	4.5	8.0	0.685	1.8E-09	1.0E-03	1.8E-06	0.00
Zinc	14.00	1.0E-06	0.1	1.40E-06	70	4.5	8.0	0.685	4.9E-07	1.0E-02	4.9E-05	0.00
										HAZARD INDEX:	4.16E-02	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.40E-7 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.000 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	70	50	0.122	1.5E-06	1.5E+00	2.3E-06	0.04
Beryllium	164.07	1.0E-06	70	50	0.122	1.4E-05	4.3E+00	6.2E-05	0.96
							TOTAL EXCESS CANCER RISK:	6.4E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	81.51	1.0E-06	70	50	0.342	2.0E-05	4.0E-04	5.0E-02	0.11
Arsenic	17.33	1.0E-06	70	50	0.342	4.2E-06	3.0E-04	1.4E-02	0.03
Barium	382.46	1.0E-06	70	50	0.342	9.4E-05	7.0E-02	1.3E-03	0.00
Beryllium	164.07	1.0E-06	70	50	0.342	4.0E-05	5.0E-03	8.0E-03	0.02
Cadmium	19.84	1.0E-06	70	50	0.342	4.9E-06	1.0E-03	4.9E-03	0.01
Chromium (trivalent)	28.73	1.0E-06	70	50	0.342	7.0E-06	1.0E+00	7.0E-06	0.00
Copper	34413	1.0E-06	70	50	0.342	8.4E-03	3.7E-02	2.3E-01	0.50
Lead	2308	1.0E-06	70	50	0.342	5.6E-04	See Note Below	NA	NA
Manganese	24997	1.0E-06	70	50	0.342	6.1E-03	1.0E-01	6.1E-02	0.14
Mercury	0.57	1.0E-06	70	50	0.342	1.4E-07	3.0E-04	4.6E-04	0.00
Nickel	272.27	1.0E-06	70	50	0.342	6.7E-05	2.0E-02	3.3E-03	0.01
Selenium	1.63	1.0E-06	70	50	0.342	4.0E-07	5.0E-03	8.0E-05	0.00
Zinc	67134	1.0E-06	70	50	0.342	1.6E-02	2.0E-01	8.2E-02	0.18
							HAZARD INDEX:	4.53E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 5.6E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.711 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	17.33	1.0E-06	70	0.50	3700	0.01	0.122	5.6E-07	3.0E+01	1.7E-05	0.04
Beryllium	164.07	1.0E-06	70	0.50	3700	0.01	0.122	5.3E-06	8.6E+01	4.6E-04	0.96
									TOTAL EXCESS CANCER RISK:	4.7E-04	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	81.51	1.0E-06	70	0.50	3700	0.01	0.342	7.4E-06	4.0E-04	1.8E-02	0.22
Arsenic	17.33	1.0E-06	70	0.50	3700	0.01	0.342	1.6E-06	3.0E-04	5.2E-03	0.06
Barium	382.46	1.0E-06	70	0.50	3700	0.01	0.342	3.5E-05	7.0E-02	4.9E-04	0.01
Beryllium	164.07	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-05	5.0E-03	3.0E-03	0.04
Cadmium	19.84	1.0E-06	70	0.50	3700	0.01	0.342	1.8E-06	1.0E-03	1.8E-03	0.02
Chromium (trivalent)	28.73	1.0E-06	70	0.50	3700	0.01	0.342	2.6E-06	1.0E+00	2.6E-06	0.00
Copper	34413.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	2308.00	1.0E-06	70	0.50	3700	See Below	0.342	2.1E-02	See Note Below	--	--
Manganese	24997.00	1.0E-06	70	0.50	3700	0.01	0.342	2.3E-03	1.0E-01	2.3E-02	0.27
Mercury	0.57	1.0E-06	70	0.50	3700	0.01	0.342	5.2E-08	3.0E-04	1.7E-04	0.00
Nickel	272.27	1.0E-06	70	0.50	3700	0.01	0.342	2.5E-05	2.0E-02	1.2E-03	0.01
Selenium	1.63	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-07	5.0E-03	3.0E-05	0.00
Zinc	67134.00	1.0E-06	70	0.50	3700	0.01	0.342	6.1E-03	2.0E-01	3.0E-02	0.36
									HAZARD INDEX:	8.34E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.1E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.146 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.14E-07	70	2.5	4.0	0.245	2.5E-08	1.15E+01	2.9E-07	0.11
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	70	2.5	4.0	0.245	2.4E-07	8.40E+00	2.0E-06	0.74
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	70	2.5	4.0	0.245	2.9E-08	1.47E+01	4.2E-07	0.16
										TOTAL EXCESS CANCER RISK:	2.7E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	81.51	1.0E-06	0.0412	3.36E-06	70	2.5	4.0	0.685	3.3E-07	4.0E-04	8.2E-04	0.00
Arsenic*	17.33	1.0E-06	0.0412	7.14E-07	70	2.5	4.0	0.685	7.0E-08	3.0E-04	2.3E-04	0.00
Barium	382.46	1.0E-06	0.0412	1.58E-05	70	2.5	4.0	0.685	1.5E-06	1.0E-04	1.5E-02	0.01
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	70	2.5	4.0	0.685	6.6E-07	1.4E-06	4.7E-01	0.28
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	70	2.5	4.0	0.685	8.0E-08	1.0E-03	8.0E-05	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.18E-06	70	2.5	4.0	0.685	1.2E-07	5.7E-07	2.0E-01	0.12
Copper	34413	1.0E-06	0.0412	1.42E-03	70	2.5	4.0	0.685	1.4E-04	1.0E-02	1.4E-02	0.01
Lead	2308	1.0E-06	0.0412	9.51E-05	70	2.5	4.0	0.685	9.3E-06	See Note Below	NA	NA
Manganese	24997	1.0E-06	0.0412	1.03E-03	70	2.5	4.0	0.685	1.0E-04	1.1E-04	9.2E-01	0.55
Mercury	0.57	1.0E-06	0.0412	2.35E-08	70	2.5	4.0	0.685	2.3E-09	8.6E-05	2.7E-05	0.00
Nickel	272.27	1.0E-06	0.0412	1.12E-05	70	2.5	4.0	0.685	1.1E-06	6.9E-05	1.6E-02	0.01
Selenium	1.63	1.0E-06	0.0412	6.72E-08	70	2.5	4.0	0.685	6.6E-09	1.0E-03	6.6E-06	0.00
Zinc	67134	1.0E-06	0.0412	2.77E-03	70	2.5	4.0	0.685	2.7E-04	1.0E-02	2.7E-02	0.02
										HAZARD INDEX:	1.67E+00	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.51E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.156 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRESING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	46	100	0.014	5.3E-07	1.5E+00	8.0E-07	0.04
Beryllium	164.07	1.0E-06	46	100	0.014	5.0E-06	4.3E+00	2.2E-05	0.96
							TOTAL EXCESS CANCER RISK:	2.2E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	81.51	1.0E-06	46	100	0.197	3.5E-05	4.0E-04	8.7E-02	0.11
Arsenic	17.33	1.0E-06	46	100	0.197	7.4E-06	3.0E-04	2.5E-02	0.03
Barium	382.46	1.0E-06	46	100	0.197	1.6E-04	7.0E-02	2.3E-03	0.00
Beryllium	164.07	1.0E-06	46	100	0.197	7.0E-05	5.0E-03	1.4E-02	0.02
Cadmium	19.84	1.0E-06	46	100	0.197	8.5E-06	1.0E-03	8.5E-03	0.01
Chromium (trivalent)	28.73	1.0E-06	46	100	0.197	1.2E-05	1.0E+01	1.2E-06	0.00
Copper	34413	1.0E-06	46	100	0.197	1.5E-02	3.7E-02	4.0E-01	0.50
Lead	2308	1.0E-06	46	100	0.197	9.9E-04	See Note Below	NA	NA
Manganese	24997	1.0E-06	46	100	0.197	1.1E-02	1.0E-01	1.1E-01	0.14
Mercury	0.57	1.0E-06	46	100	0.197	2.4E-07	3.0E-04	8.1E-04	0.00
Nickel	272.27	1.0E-06	46	100	0.197	1.2E-04	2.0E-02	5.8E-03	0.01
Selenium	1.63	1.0E-06	46	100	0.197	7.0E-07	5.0E-03	1.4E-04	0.00
Zinc	67134	1.0E-06	46	100	0.197	2.9E-02	2.0E-01	1.4E-01	0.18
							HAZARD INDEX:	7.94E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.9E-4 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.07 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
3.187 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRES_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	17.33	1.0E-06	46	0.50	3000	0.01	0.014	8.0E-08	3.0E+01	2.4E-06	0.04
Beryllium	164.07	1.0E-06	46	0.50	3000	0.01	0.014	7.5E-07	8.6E+01	6.5E-05	0.96
									TOTAL EXCESS CANCER RISK:	6.7E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	81.51	1.0E-06	46	0.50	3000	0.01	0.197	5.2E-06	4.0E-04	1.3E-02	0.22
Arsenic	17.33	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-06	3.0E-04	3.7E-03	0.06
Barium	382.46	1.0E-06	46	0.50	3000	0.01	0.197	2.5E-05	7.0E-02	3.5E-04	0.01
Beryllium	164.07	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-05	5.0E-03	2.1E-03	0.04
Cadmium	19.84	1.0E-06	46	0.50	3000	0.01	0.197	1.3E-06	1.0E-03	1.3E-03	0.02
Chromium (trivalent)	28.73	1.0E-06	46	0.50	3000	0.01	0.197	1.8E-06	1.0E+01	1.8E-07	0.00
Copper	34413.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	2308.00	1.0E-06	46	0.50	3000	See Below	0.197	1.5E-02	See Note Below	--	--
Manganese	24997.00	1.0E-06	46	0.50	3000	0.01	0.197	1.6E-03	1.0E-01	1.6E-02	0.27
Mercury	0.57	1.0E-06	46	0.50	3000	0.01	0.197	3.7E-08	3.0E-04	1.2E-04	0.00
Nickel	272.27	1.0E-06	46	0.50	3000	0.01	0.197	1.8E-05	2.0E-02	8.8E-04	0.01
Selenium	1.63	1.0E-06	46	0.50	3000	0.01	0.197	1.0E-07	5.0E-03	2.1E-05	0.00
Zinc	67134.00	1.0E-06	46	0.50	3000	0.01	0.197	4.3E-03	2.0E-01	2.2E-02	0.36
									HAZARD INDEX:	5.93E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.5E-2 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.068 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRESINH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers
AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.14E-07	46	0.7	2.0	0.014	3.1E-10	1.15E+01	3.5E-09	0.11
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	46	0.7	2.0	0.014	2.9E-09	8.40E+00	2.4E-08	0.74
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	46	0.7	2.0	0.014	3.5E-10	1.47E+01	5.2E-09	0.16
										TOTAL EXCESS CANCER RISK:	3.3E-08	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	81.51	1.0E-06	0.0412	3.36E-06	46	0.7	2.0	0.197	2.0E-08	4.0E-04	5.0E-05	0.00
Arsenic*	17.33	1.0E-06	0.0412	7.14E-07	46	0.7	2.0	0.197	4.3E-09	3.0E-04	1.4E-05	0.00
Barium	382.46	1.0E-06	0.0412	1.58E-05	46	0.7	2.0	0.197	9.5E-08	1.0E-03	9.5E-05	0.00
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	46	0.7	2.0	0.197	4.1E-08	1.4E-06	2.9E-02	0.32
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	46	0.7	2.0	0.197	4.9E-09	1.0E-03	4.9E-06	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.18E-06	46	0.7	2.0	0.197	7.1E-09	5.7E-06	1.2E-03	0.01
Copper	34413	1.0E-06	0.0412	1.42E-03	46	0.7	2.0	0.197	8.5E-06	1.0E-02	8.5E-04	0.01
Lead	2308	1.0E-06	0.0412	9.51E-05	46	0.7	2.0	0.197	5.7E-07	See Note Below	NA	NA
Manganese	24997	1.0E-06	0.0412	1.03E-03	46	0.7	2.0	0.197	6.2E-06	1.1E-04	5.6E-02	0.62
Mercury	0.57	1.0E-06	0.0412	2.35E-08	46	0.7	2.0	0.197	1.4E-10	8.6E-05	1.6E-06	0.00
Nickel	272.27	1.0E-06	0.0412	1.12E-05	46	0.7	2.0	0.197	6.7E-08	6.9E-05	9.8E-04	0.01
Selenium	1.63	1.0E-06	0.0412	6.72E-08	46	0.7	2.0	0.197	4.0E-10	1.0E-03	4.0E-07	0.00
Zinc	67134	1.0E-06	0.0412	2.77E-03	46	0.7	2.0	0.197	1.7E-05	1.0E-02	1.7E-03	0.02
										HAZARD INDEX:	9.01E-02	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.
Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.51E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.92 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.183 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	540.29	1.0E-06	70	480	0.010	3.6E-05	1.5E+00	5.4E-05	0.81
Beryllium	45.54	1.0E-06	70	480	0.010	3.1E-06	4.3E+00	1.3E-05	0.19
							TOTAL EXCESS CANCER RISK:	6.8E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	305.4	1.0E-06	70	480	0.685	1.4E-03	4.0E-04	3.6E+00	0.26
Arsenic	540.3	1.0E-06	70	480	0.685	2.5E-03	3.0E-04	8.5E+00	0.60
Barium	129.6	1.0E-06	70	480	0.685	6.1E-04	7.0E-02	8.7E-03	0.00
Beryllium	45.54	1.0E-06	70	480	0.685	2.1E-04	5.0E-03	4.3E-02	0.00
Cadmium	5.28	1.0E-06	70	480	0.685	2.5E-05	1.0E-03	2.5E-02	0.00
Chromium (trivalent)	20.01	1.0E-06	70	480	0.685	9.4E-05	1.0E+01	9.4E-06	0.00
Copper	8084	1.0E-06	70	480	0.685	3.8E-02	3.7E-02	1.0E+00	0.07
Lead	782.1	1.0E-06	70	480	0.685	3.7E-03	See Note Below	NA	NA
Manganese	5602	1.0E-06	70	480	0.685	2.6E-02	1.0E-01	2.6E-01	0.02
Mercury	0.81	1.0E-06	70	480	0.685	3.8E-06	3.0E-04	1.3E-02	0.00
Nickel	87.75	1.0E-06	70	480	0.685	4.1E-04	2.0E-02	2.1E-02	0.00
Selenium	41.91	1.0E-06	70	480	0.685	2.0E-04	5.0E-03	3.9E-02	0.00
Zinc	24606	1.0E-06	70	480	0.685	1.2E-01	2.0E-01	5.8E-01	0.04
							HAZARD INDEX:	1.41E+01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 3.7E-3 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
4.63 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	540.29	1.0E-06	70	0.50	3700	0.01	0.010	1.4E-06	3.0E+01	4.2E-05	0.81
Beryllium	45.54	1.0E-06	70	0.50	3700	0.01	0.010	1.2E-07	8.6E+01	1.0E-05	0.19
									TOTAL EXCESS CANCER RISK:	5.2E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	305.4	1.0E-06	70	0.50	3700	0.01	0.685	5.5E-05	4.0E-04	1.4E-01	0.28
Arsenic	540.3	1.0E-06	70	0.50	3700	0.01	0.685	9.8E-05	3.0E-04	3.3E-01	0.65
Barium	129.6	1.0E-06	70	0.50	3700	0.01	0.685	2.3E-05	7.0E-02	3.4E-04	0.00
Beryllium	45.54	1.0E-06	70	0.50	3700	0.01	0.685	8.2E-06	5.0E-03	1.6E-03	0.00
Cadmium	5.28	1.0E-06	70	0.50	3700	0.01	0.685	9.6E-07	1.0E-03	9.6E-04	0.00
Chromium (trivalent)	20.01	1.0E-06	70	0.50	3700	0.01	0.685	3.6E-06	1.0E+01	3.6E-07	0.00
Copper	8084	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	782.1	1.0E-06	70	0.50	3700	See Below	0.685	1.4E-02	See Note Below	--	--
Manganese	5602	1.0E-06	70	0.50	3700	0.01	0.685	1.0E-03	1.0E-01	1.0E-02	0.02
Mercury	0.81	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-07	3.0E-04	4.9E-04	0.00
Nickel	87.75	1.0E-06	70	0.50	3700	0.01	0.685	1.6E-05	2.0E-02	7.9E-04	0.00
Selenium	41.91	1.0E-06	70	0.50	3700	0.01	0.685	7.6E-06	5.0E-03	1.5E-03	0.00
Zinc	24606	1.0E-06	70	0.50	3700	0.01	0.685	4.5E-03	2.0E-01	2.2E-02	0.04
									HAZARD INDEX:	5.02E-01	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.4E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.099 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1

AIR EPC: Estimated particulate concentration in air based on Area 1 soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	540.3	1.0E-06	0.1	5.40E-05	70	4.5	8.0	0.010	2.7E-07	1.15E+01	3.1E-06	0.93
Beryllium	45.54	1.0E-06	0.1	4.55E-06	70	4.5	8.0	0.010	2.3E-08	8.40E+00	1.9E-07	0.06
Cadmium	5.28	1.0E-06	0.1	5.28E-07	70	4.5	8.0	0.010	2.7E-09	1.47E+01	3.9E-08	0.01
										TOTAL EXCESS CANCER RISK:	3.4E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	305.4	1.0E-06	0.1	3.05E-05	70	4.5	8.0	0.685	1.1E-05	4.0E-04	2.7E-02	0.01
Arsenic*	540.3	1.0E-06	0.1	5.40E-05	70	4.5	8.0	0.685	1.9E-05	3.0E-04	6.3E-02	0.02
Barium	129.6	1.0E-06	0.1	1.30E-05	70	4.5	8.0	0.685	4.6E-06	1.0E-03	4.6E-03	0.00
Beryllium	45.54	1.0E-06	0.1	4.55E-06	70	4.5	8.0	0.685	1.6E-06	1.4E-06	1.1E+00	0.35
Cadmium	5.28	1.0E-06	0.1	5.28E-07	70	4.5	8.0	0.685	1.9E-07	1.0E-03	1.9E-04	0.00
Chromium (trivalent)	20.01	1.0E-06	0.1	2.00E-06	70	4.5	8.0	0.685	7.0E-07	5.7E-06	1.2E-01	0.04
Copper	8084	1.0E-06	0.1	8.08E-04	70	4.5	8.0	0.685	2.8E-04	1.0E-02	2.8E-02	0.01
Lead	782.1	1.0E-06	0.1	7.82E-05	70	4.5	8.0	0.685	2.8E-05	See Note Below	NA	NA
Manganese	5602	1.0E-06	0.1	5.60E-04	70	4.5	8.0	0.685	2.0E-04	1.1E-04	1.8E+00	0.54
Mercury	0.81	1.0E-06	0.1	8.10E-08	70	4.5	8.0	0.685	2.9E-08	8.6E-05	3.3E-04	0.00
Nickel	87.75	1.0E-06	0.1	8.78E-06	70	4.5	8.0	0.685	3.1E-06	6.9E-05	4.5E-02	0.01
Selenium	41.91	1.0E-06	0.1	4.19E-06	70	4.5	8.0	0.685	1.5E-06	1.0E-03	1.5E-03	0.00
Zinc	24606	1.0E-06	0.1	2.46E-03	70	4.5	8.0	0.685	8.7E-04	1.0E-02	8.7E-02	0.03
										HAZARD INDEX:	3.32E+00	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.82E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.128 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: SOIL INGESTION PATHWAY

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 2 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	45.73	1.0E-06	70	480	0.010	3.1E-06	1.5E+00	4.6E-06	0.99
Beryllium	0.15	1.0E-06	70	480	0.010	1.0E-08	4.3E+00	4.3E-08	0.01
							TOTAL EXCESS CANCER RISK:	4.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	4.93	1.0E-06	70	480	0.685	2.3E-05	4.0E-04	5.8E-02	0.07
Arsenic	45.73	1.0E-06	70	480	0.685	2.1E-04	3.0E-04	7.2E-01	0.91
Barium	27.05	1.0E-06	70	480	0.685	1.3E-04	7.0E-02	1.8E-03	0.00
Beryllium	0.15	1.0E-06	70	480	0.685	7.0E-07	5.0E-03	1.4E-04	0.00
Cadmium	0.37	1.0E-06	70	480	0.685	1.7E-06	1.0E-03	1.7E-03	0.00
Chromium (trivalent)	6.35	1.0E-06	70	480	0.685	3.0E-05	1.0E+01	3.0E-06	0.00
Copper	12.38	1.0E-06	70	480	0.685	5.8E-05	3.7E-02	1.6E-03	0.00
Lead	10.10	1.0E-06	70	480	0.685	4.7E-05	See Note Below	NA	NA
Manganese	168.20	1.0E-06	70	480	0.685	7.9E-04	1.0E-01	7.9E-03	0.01
Mercury	0.07	1.0E-06	70	480	0.685	3.3E-07	3.0E-04	1.1E-03	0.00
Nickel	6.59	1.0E-06	70	480	0.685	3.1E-05	2.0E-02	1.5E-03	0.00
Selenium	0.12	1.0E-06	70	480	0.685	5.6E-07	5.0E-03	1.1E-04	0.00
Zinc	24.00	1.0E-06	70	480	0.685	1.1E-04	2.0E-01	5.6E-04	0.00
							HAZARD INDEX:	7.90E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.7E-5 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.060 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 2 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	45.73	1.0E-06	70	0.50	3700	0.01	0.010	1.2E-07	3.0E+01	3.5E-06	0.99
Beryllium	0.15	1.0E-06	70	0.50	3700	0.01	0.010	3.9E-10	8.6E+01	3.3E-08	0.01
									TOTAL EXCESS CANCER RISK:	3.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	4.93	1.0E-06	70	0.50	3700	0.01	0.685	8.9E-07	4.0E-04	2.2E-03	0.07
Arsenic	45.73	1.0E-06	70	0.50	3700	0.01	0.685	8.3E-06	3.0E-04	2.8E-02	0.91
Barium	27.05	1.0E-06	70	0.50	3700	0.01	0.685	4.9E-06	7.0E-02	7.0E-05	0.00
Beryllium	0.15	1.0E-06	70	0.50	3700	0.01	0.685	2.7E-08	5.0E-03	5.4E-06	0.00
Cadmium	0.37	1.0E-06	70	0.50	3700	0.01	0.685	6.7E-08	1.0E-03	6.7E-05	0.00
Chromium (trivalent)	6.35	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-06	1.0E+01	1.1E-07	0.00
Copper	12.38	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	10.10	1.0E-06	70	0.50	3700	See Below	0.685	1.8E-04	See Note Below	--	--
Manganese	168.20	1.0E-06	70	0.50	3700	0.01	0.685	3.0E-05	1.0E-01	3.0E-04	0.01
Mercury	0.07	1.0E-06	70	0.50	3700	0.01	0.685	1.3E-08	3.0E-04	4.2E-05	0.00
Nickel	6.59	1.0E-06	70	0.50	3700	0.01	0.685	1.2E-06	2.0E-02	6.0E-05	0.00
Selenium	0.12	1.0E-06	70	0.50	3700	0.01	0.685	2.2E-08	5.0E-03	4.3E-06	0.00
Zinc	24.00	1.0E-06	70	0.50	3700	0.01	0.685	4.3E-06	2.0E-01	2.2E-05	0.00
									HAZARD INDEX:	3.04E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.8E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.001 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2

AIR EPC: Estimated particulate concentration in air based on Area 2 soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	45.73	1.0E-06	0.1	4.57E-06	70	4.5	8.0	0.010	2.3E-08	1.15E+01	2.6E-07	0.99
Beryllium	0.15	1.0E-06	0.1	1.50E-08	70	4.5	8.0	0.010	7.5E-11	8.40E+00	6.3E-10	0.00
Cadmium	0.37	1.0E-06	0.1	3.70E-08	70	4.5	8.0	0.010	1.9E-10	1.47E+01	2.7E-09	0.01
										TOTAL EXCESS CANCER RISK:	2.7E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	4.93	1.0E-06	0.1	4.93E-07	70	4.5	8.0	0.685	1.7E-07	4.0E-04	4.3E-04	0.00
Arsenic*	45.73	1.0E-06	0.1	4.57E-06	70	4.5	8.0	0.685	1.6E-06	3.0E-04	5.4E-03	0.05
Barium	27.05	1.0E-06	0.1	2.71E-06	70	4.5	8.0	0.685	9.5E-07	1.0E-03	9.5E-04	0.01
Beryllium	0.15	1.0E-06	0.1	1.50E-08	70	4.5	8.0	0.685	5.3E-09	1.4E-06	3.8E-03	0.04
Cadmium	0.37	1.0E-06	0.1	3.70E-08	70	4.5	8.0	0.685	1.3E-08	1.0E-03	1.3E-05	0.00
Chromium (trivalent)	6.35	1.0E-06	0.1	6.35E-07	70	4.5	8.0	0.685	2.2E-07	5.7E-06	3.9E-02	0.37
Copper	12.38	1.0E-06	0.1	1.24E-06	70	4.5	8.0	0.685	4.4E-07	1.0E-02	4.4E-05	0.00
Lead	10.10	1.0E-06	0.1	1.01E-06	70	4.5	8.0	0.685	3.6E-07	See Note Below	NA	NA
Manganese	168.20	1.0E-06	0.1	1.68E-05	70	4.5	8.0	0.685	5.9E-06	1.1E-04	5.4E-02	0.50
Mercury	0.07	1.0E-06	0.1	7.00E-09	70	4.5	8.0	0.685	2.5E-09	8.6E-05	2.9E-05	0.00
Nickel	6.59	1.0E-06	0.1	6.59E-07	70	4.5	8.0	0.685	2.3E-07	6.9E-05	3.4E-03	0.03
Selenium	0.12	1.0E-06	0.1	1.20E-08	70	4.5	8.0	0.685	4.2E-09	1.0E-03	4.2E-06	0.00
Zinc	24.00	1.0E-06	0.1	2.40E-06	70	4.5	8.0	0.685	8.5E-07	1.0E-02	8.5E-05	0.00
										HAZARD INDEX:	1.07E-01	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.0E-06 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.002 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

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EBASCO
ENVIRONMENTAL

PUBLIC HEALTH RISK ASSESSMENT

FOR THE
H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

FEBRUARY 1993

A Division of Ebasco Services Incorporated
120 MONTGOMERY STREET ∘ SUITE 715
SAN FRANCISCO, CA ∘ 94104-4310
(415) 249-0831 ∘ (415) 249-0931 FAX

EBASCO

February 1, 1993

Mr. James E. Ross, Unit Chief
Site Cleanup Unit
California Regional Water Quality Control Board
Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

RE: H. KRAMER & COMPANY SITE, EL SEGUNDO, CALIFORNIA
FINAL HEALTH RISK ASSESSMENT

Dear Mr. Ross:

Please find enclosed Ebasco's final risk assessment for the subject site. In this document, we have made every possible effort to address all OEHHA comments received up through January 28.

In particular, I wish to point out that Ebasco undertook a major effort, subsequent to January 27, to model inhalation and ingestion (including via garden vegetables) risks to the maximally exposed resident. This, as we understand, was the major concern of OEHHA. We also provide new worst-case calculations regarding silver (Ag); we believe that the future residential risk is the same or comparable to that predicted for the current residential population; and we believe that the future-use child trespasser risks would be less than those calculated for the construction worker (considered to represent the maximally exposed individual for future-use scenarios) and comparable to those estimated for the current-use child trespasser. In addition, I am compelled to note again the commitment my client has made to preventing such trespassing.

Finally, although we were unable to consolidate all blood lead data in one table due to effort required in fulfilling the residential risk calculations, all such data are included in Attachment #2 to Addendum #5 (pathway-specific). Also, we have acknowledged understanding of reproductive effects of certain metals in Addendum #5, Attachment #1, Table A-3.

We wish to emphasize that in addition to providing the information cited above, Ebasco and its client are committed to continued cooperation with the Board as regards other aspects of the Cleanup and Abatement Order.

Yours truly,

Glenn Piehler
Manager, San Francisco Operations

cc: W. Potter
L. Sutton
J. Rabovski

GP:slk 01feb01

EBASCO ENVIRONMENTAL *A Division of Ebasco Services Incorporated*
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PUBLIC HEALTH RISK ASSESSMENT

FOR THE
H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

PREPARED BY:
EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
120 MONTGOMERY STREET, SUITE 715
SAN FRANCISCO, CALIFORNIA 94104

FEBRUARY 1993

PUBLIC HEALTH RISK ASSESSMENT
for the
H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

EXECUTIVE SUMMARY

Ebasco Environmental performed a risk assessment for the H. Kramer & Co. property in El Segundo, California. The objectives of this study were: (1) to identify and quantitatively evaluate baseline public health risks using existing site characterization data collected by ENSR Corporation in 1989; and (2), as a consequence of that risk assessment, identify remedial action alternatives which could be used to mitigate potential future-use risks attendant to the site.

Kramer operated a brass foundry at the property between 1951 and 1985. The secondary and tertiary smelting processes used by Kramer resulted in the production during that period of a large volume of slag, which was accumulated in a pile currently occupying approximately two acres near the eastern end of the property. This slag pile occupies a former surface lagoon which Harshaw Chemical Company, the previous owner and operator, used to deposit arsenic and other metals yielded in the course of smelting antimony.

The slag at the property consists of residual metals (not able to be extracted during the secondary and tertiary smelting phases) encased in silica, which is drawn from sand introduced as a flux at the beginning of the secondary smelting process. ENSR's investigation confirmed the presence of heavy metals in the slag. It also identified the presence of certain metals (most significantly arsenic) and a few volatile organic compounds in shallow groundwater beneath the site (85-115 bgs) at levels exceeding drinking water guidelines. The volatile organic compounds do not appear to be associated with any prior operation at the site. In addition to the data collected by ENSR, this risk assessment also takes account of information and data available from a variety of other sources pertaining to nearby locations and regional conditions.

This assessment included identification of chemicals of potential concern, exposure pathway definition, estimation of chemical intakes (using median and upper bound soil concentrations), toxicity assessment (for carcinogens and non-carcinogens), and characterization of potential health risks. Both current and potential future use pathways were identified, focusing on worker and/or trespasser exposures to on-site soils, including, in particular, the slag. Risks of exposure to members of the public located off-site were also quantified in a sequel to the original risk assessment (Addendum #6), although no evidence exists which would suggest that such exposure could even approach the conservative conditions used to quantify on-site risks.

Since the quantitative assessment of health risks is inherently uncertain (because it entails an effort to predict potential future health impacts on the basis of limited data concerning receptor behavior and the toxicological effects of chemicals), very conservative assumptions about contaminant exposures, doses and health risks were developed for each exposure scenario that was identified and evaluated.

The results demonstrate:

- Cancer and non-cancer risks calculated in accordance with EPA RAGs for current use worker exposures to the slag exceeded EPA target risk ranges and criteria (10^{-6} to 10^{-4} for carcinogens and a hazard index of 1.0 for non-carcinogens).

- Risks calculated in accordance with EPA RAGs for current use trespasser exposure scenarios were within or less than corresponding EPA target criteria. Risks to child trespassers during any future construction would be lower than those calculated for the future-use construction worker, and comparable to those estimated for the current-use trespasser scenario. [This is because the shorter, 1-year, exposure duration (consistent with a construction scenario) would offset any increase in risks stemming from the use of higher soil exposure point concentrations.] Consequently, such risks were not quantitatively evaluated in the risk assessment. In point of fact, however, future-use trespasser risks would be obviated through the use of fencing and appropriate site security measures enforced during construction. Such measures would consist of constant surveillance by construction management staff during working hours and provision of site security during non-working hours.

- Risks calculated in accordance with EPA RAGs for hypothetical future use construction worker exposures (not related to remedial action per se) to soils located within or near the slag pile (on the eastern portion of the site) exceeded target risk criteria only when upper bound soil concentrations were assumed. These risks can be eliminated and/or acceptably managed by the installation of a cap and restrictions on the future excavation activities. Risks calculated for worker exposures to soils in the western portion of the site were within or less than corresponding EPA target criteria (for both median and upper bound soil concentrations).

These results were subjected to extensive review by the Los Angeles Regional Water Quality Control Board and the California Office of Environmental Health Hazard Assessment; comments, correspondence and responses pertaining thereto are given in Addenda Numbers 1 through 5. As presented in Addendum #5, the majority of the original analyses were recalculated using alternative concentration estimates, toxicity, intake and/or exposure factors. As a result, the numerical results changed, but the conclusions of this report remain unaltered. Similarly, the opinion of this report remains that the assumptions and most of the risk factors used in the original report still represent the most realistic and (therefore) appropriate basis to evaluate overall public health risks attendant to the site. This includes risks due to any off-site (residential) deposition of particles from the slag pile which might be hypothesized, as also quantified in the final addendum.

Groundwater pathways were not quantitatively evaluated in the risk assessment. The decision to forego a quantitative analysis was based on the judgment that the risk of any actual exposure is extremely remote. This judgment was based on the fact that shallow groundwater in the Old Dune Sand and Gage aquifers beneath the site and in the surrounding area is not currently used as a source of either potable or industrial water due to salinity problems, regional contamination and lack of production capacity. These conditions are not expected to change in the foreseeable future.

The results of the original and amended risk assessment and the underlying analyses (including the absence of present or anticipated future exposures to the contaminated groundwater) demonstrate that a cap, in conjunction with certain restrictions on the future use of the property, will eliminate hypothetically problematic present and future exposures and eliminate any associated public health risks. In light of the location and other characteristics of the property, its future uses can be limited to those of an industrial or commercial character. Moreover, the combination of the aerial light rail system that traverses the property above the slag pile and the location of the slag pile relative to the configuration of the property as a whole would allow a restriction preventing any significant excavation (beyond any associated with installing the cap) in the area immediately surrounding the slag pile, while still enabling construction on the larger, remaining portion of the property. A prohibition against the extraction of any groundwater from underneath the property would also be appropriate and would, among other things, avoid the risk of inadvertently creating any conduits for the migration of contamination into deeper aquifers. Further study of groundwater beneath the site is ongoing.

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

TABLE OF CONTENTS

EXECUTIVE SUMMARY

PART I: MAY 1992 RISK ASSESSMENT

SECTION: *PAGE*

1.0 INTRODUCTION 1

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC) . . . 5

3.0 EXPOSURE ASSESSMENT 12

4.0 TOXICITY ASSESSMENT 29

5.0 RISK CHARACTERIZATION 38

6.0 CONCLUSIONS OF THE HUMAN HEALTH RISK ASSESSMENT 46

7.0 REFERENCES 48

APPENDICES

APPENDIX A - SITE CHARACTERIZATION ANALYTICAL RESULTS (ENSR, 1990)
APPENDIX B - SURROUNDING WELL LOCATION INFORMATION
APPENDIX C - SOIL AND GROUNDWATER SUMMARY STATISTICS
APPENDIX D - GUIDANCE FOR ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL (DTSC, 1992)
APPENDIX E - RISK ASSESSMENT CALCULATION DOCUMENTATION

FIGURES

TABLES

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

TABLE OF CONTENTS

PART II: FEBRUARY 1993 RISK ASSESSMENT ADDENDA

SECTION:

ADDENDUM #1: 14 AUGUST 1992 OEHHA COMMENTS ON MAY 1992 RISK ASSESSMENT

ADDENDUM #2: 14 OCTOBER 1992 RESPONSES TO OEHHA COMMENTS OF 14 AUGUST 1992

ADDENDUM #3: 16 NOVEMBER 1992 OEHHA COMMENTS

ADDENDUM #4: 18 DECEMBER 1992 DIRECTIVE FROM LARWQCB

ADDENDUM #5: RESPONSES TO 16 NOVEMBER OEHHA COMMENTS AS DISCUSSED WITH LARWQCB AND OEHHA ON 4 DECEMBER 1992. Addendum #5 includes the following five Attachments:

Attachment #1 -- Revised HRA Results Based on OEHHA-Recommended Intake and Exposure Parameters

Attachment #2 -- Risk Assessment Calculation Documentation for February 1993 HRA Addenda

Attachment #3 -- Latest DTSC Blood Lead Guidance (July 1992)

Attachment #4 -- Toxicity Profiles for Aluminum, Cobalt, Molybdenum, Silver and Vanadium (Source: Klaasen, C.D., M.O. Amdurer and J. Doull. 1986. Casarett and Doull's Toxicology)

ADDENDUM #6: CURRENT RESIDENTIAL USE SCENARIO: REASONABLE MAXIMUM EXPOSURE (RME) RISKS AT THE LOCATION OF THE MAXIMALLY EXPOSED INDIVIDUAL (MEI). This evaluation, which used very conservative assumptions, includes dispersion modeling and exposure and risk estimation for the following RME exposure pathways: soil ingestion; dermal contact; inhalation; and ingestion of garden vegetables.

PART I

RISK ASSESSMENT
for

H. Kramer & Company Site
El Segundo, CA

MAY 1992

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

CONTENTS

Section		Page
	EXECUTIVE SUMMARY	
1.0	**INTRODUCTION**	1
1.1	PURPOSE OF THE REPORT	1
1.2	SITE BACKGROUND	1
1.3	METHODOLOGY AND REPORT ORGANIZATION	1
2.0	**IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC)**	5
2.1	SUMMARY OF PRIOR SITE CHARACTERIZATION RESULTS	5
2.1.1	Sampling Activities	5
2.1.2	Summary of Analytical Results	5
2.2	SUMMARY OF CHEMICALS OF POTENTIAL CONCERN (COPC)	8
2.2.1	Soil COPC	8
2.2.2	Groundwater COPC	11
3.0	**EXPOSURE ASSESSMENT**	12
3.1	CHARACTERIZATION OF EXPOSURE SETTING	12
3.1.1	Physical Setting	12
3.1.2	Potentially Exposed Populations	15
3.2	IDENTIFICATION OF EXPOSURE PATHWAYS	15
3.2.1	Current Use Exposure Pathways	15
3.2.1.1	Exposure Pathways Selected for Quantitative Evaluation	16
3.2.1.2	Exposure Pathways Not Selected for Quantitative Evaluation	16
3.2.2	Future Use Exposure Pathways	19
3.2.2.1	Exposure Pathways Selected for Quantitative Evaluation	19
3.2.2.2	Exposure Pathways Not Selected for Quantitative Evaluation	19
3.3	QUANTIFICATION OF EXPOSURES	20
3.3.1	Exposure Point Concentrations	20
3.3.1.1	Soil Direct Pathways	20
3.3.1.2	Inhalation Pathways - COPC Resuspended in Site Soils	23
3.3.2	Estimation of Chemical Intakes	23
3.4	IDENTIFICATION OF UNCERTAINTIES	23
3.4.1	Exposure Point Concentration (EPC) Determination	28
3.4.2	Human Exposure Parameter Estimation	28

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

CONTENTS

Section	Page
4.0 **TOXICITY ASSESSMENT**	29
4.1 TOXICITY INFORMATION FOR NONCARCINOGENIC EFFECTS	29
4.2 TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS	29
4.2.1 Weight-of-Evidence Classifications	29
4.2.2 Slope Factors	34
4.3 CHEMICALS FOR WHICH NO TOXICITY VALUES ARE AVAILABLE	34
4.4 UNCERTAINTIES RELATED TO TOXICITY INFORMATION	37
5.0 **RISK CHARACTERIZATION**	38
5.1 RISK CALCULATION METHODOLOGY	38
5.1.1 Risk Calculations for Carcinogens	38
5.1.2 Risk Calculations for Noncarcinogens	38
5.2 RESULTS OF THE RISK ASSESSMENT	39
5.2.1 Current Use Adult Worker Scenarios	39
5.2.2 Current Use Trespasser Scenarios	41
5.2.3 Future Use Construction Workers Scenarios: Area 1 Receptor Locations	41
5.2.4 Future Use Construction Workers Scenarios: Area 2 Receptor Locations	44
5.3 IDENTIFICATION OF UNCERTAINTIES	44
6.0 **CONCLUSIONS OF THE HUMAN HEALTH RISK ASSESSMENT**	46
7.0 **REFERENCES**	48

APPENDICES
APPENDIX A - SITE CHARACTERIZATION ANALYTICAL RESULTS (ENSR, 1990)
APPENDIX B - SURROUNDING WELL LOCATION INFORMATION
APPENDIX C - SOIL AND GROUNDWATER SUMMARY STATISTICS
APPENDIX D - GUIDANCE FOR ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL (DTSC, 1992)
APPENDIX E - RISK ASSESSMENT CALCULATION DOCUMENTATION

FIGURES

Figure		Page
1	Site Location Map	2
2	Site and Sample Location Map	3
3	Generalized Regional Geographic Cross Section	13

TABLES

Table		Page
2-1	Summary of Subsurface Soil Analytical Results	6
2-2	Summary of Groundwater Analytical Results	9
2-3	Summary of Chemicals of Potential Concern (COPC)	10
3-1	Potential Pathways of Exposure to COPC	17
3-2	Summary of Exposure Point Concentrations (EPCs) for Soil Exposure Pathways	21
3-3	Summary of Exposure Point Concentrations (EPCs) for Air Exposure Pathways	22
3-4	Equations Used to Calculate Chronic Daily Intakes (CDIs) of COPC	24
3-5	Assumptions Used to Evaluate Exposures to Soil COPC: Current Use Scenarios	25
3-6	Assumptions Used to Evaluate Exposures to Soil COPC: Future Use Construction Worker Scenarios	27
4-1	Toxicity Values For Potential Noncarcinogenic Effects	30
4-2	Toxicity Values For Potential Carcinogenic Effects	35
5-1	Cancer and Noncancer Risks Determined For Current Use Adult Worker Scenarios	40
5-2	Cancer and Noncancer Risks Determined For Current Use Trespasser Scenarios	42
5-3	Cancer and Noncancer Risks Determined For Future Use Construction Worker Scenarios: Area 1 Receptor Locations	43
5-4	Cancer and Noncancer Risks Determined for Future Use Construction Worker Scenarios: Area 2 Receptor Locations	45
6-1	Summary of Risk Assessment Results	47

ABBREVIATIONS AND ACRONYMS

bgs	below ground surface
CA MCL	California Environmental Protection Agency Max
CAPCOA	California Air Pollution Control Officers Association (CAPCOA).
CDI	Chronic Daily Intake
CNS	Central Nervous System
COPC	Chemical(s) of Potential Concern
DTSC	California EPA Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency Maximum Contaminant Level
EPC	Exposure Point Concentration
HEAST	Health Effects Assessment Summary Tables (EPA, 1991b)
HI	Hazard Index
N	Sample Number
MCL	Maximum Contaminant Level (USEPA or California EPA)
mg/kg	milligrams/kilogram, equivalent to ppm
mg/l	milligrams/liter, roughly equivalent to ppm
NCP	National Contingency Plan
PCE	Tetrachloroethene
PID	Photo-ionization Detector
PM_{10}	particulate matter 10 um or less in size, considered the respirable fraction
ppb	parts per billion
ppm	parts per million
RfD	Risk Reference Dose (for noncarcinogens)
SF	Slope Factor (for carcinogens)
TCE	Trichloroethene
TTLC	Total Threshold Limits Concentration
UCL	Upper Confidence Limit (as in 95% UCL of mean)
ug/kg	micrograms/kilogram, equivalent to ppb
ug/l	micrograms/liter, roughly equivalent to ppb
VOCs	Volatile Organic Compounds
WET	Waste Extraction Test

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

The purpose of this report was to conservatively estimate public health risks associated with the H. Kramer & Company (H. Kramer) Site in El Segundo, California (Figure 1). This risk assessment followed USEPA guidance and was developed using data from a previous investigation and Site Characterization Report (ENSR, 1990). Results of that investigation indicated the presence of metals exceeding expected background concentrations in site soils and underlying groundwater. Volatile organic compounds (VOCs) were also detected in groundwater samples, but not in soil samples, at concentrations exceeding drinking water guidelines, although presence of such compounds has not been associated with prior operations at the site. Given this, and the fact that the affected groundwater is not used as a potable water supply, the quantitative risk assessment focuses on soil contaminants at H. Kramer.

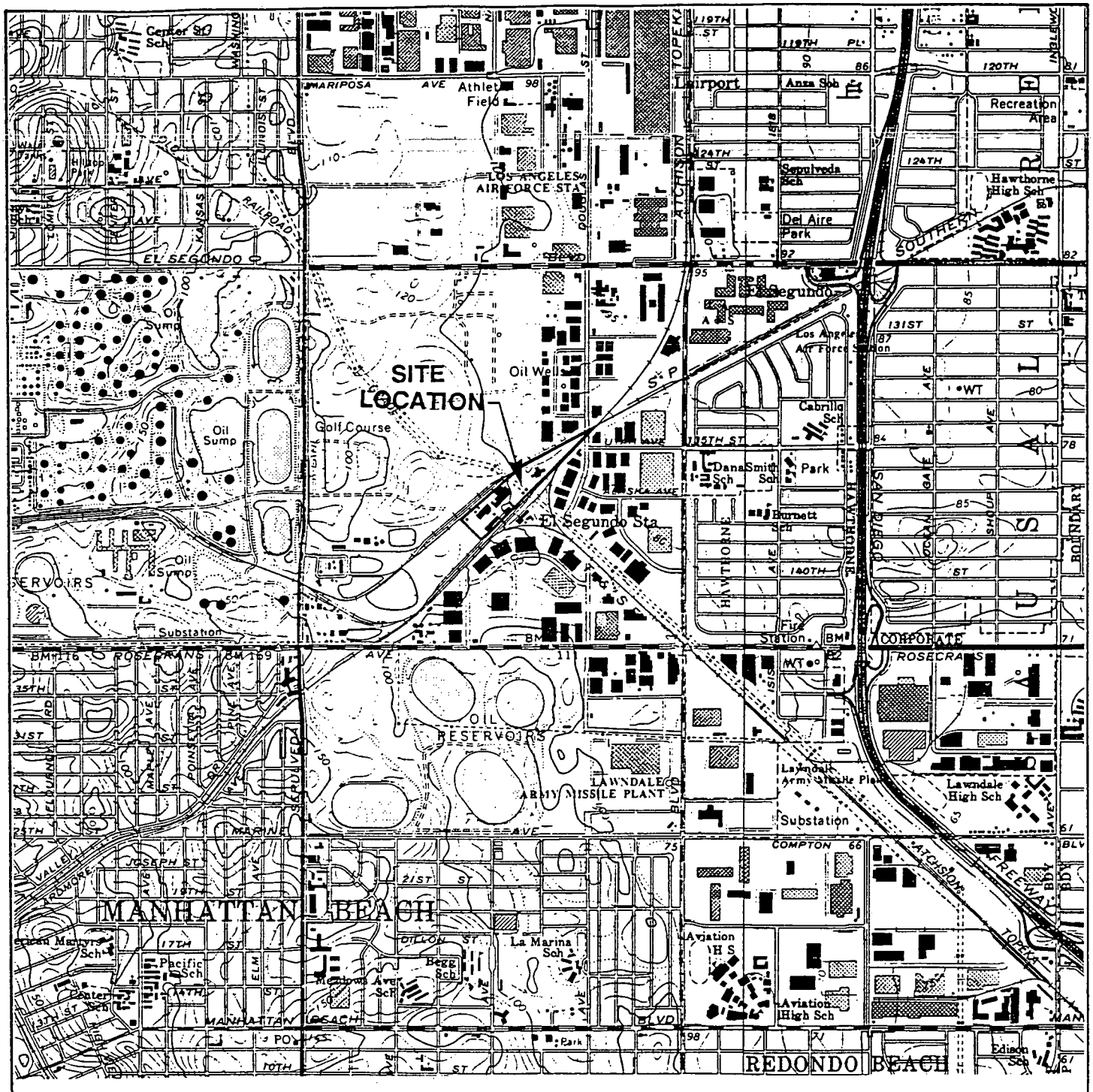
1.2 SITE BACKGROUND

H. Kramer operated a brass foundry at the subject site from 1951 through mid-1985. The layout of the site, showing present features, is shown in Figure 2. Of particular note to this report is the slag pile located in the northeast segment. This pile is roughly 50-acre feet in volume, with a maximum depth of approximately 20 feet ($\pm$10' above grade). The slag pile occupies a former surface lagoon which was used by the previous owner and occupant of the site (Harshaw Chemical Company) in its manufacture of ammunition casings. Use of the site by Harshaw apparently resulted in deposition of arsenical wastes (and perhaps other contaminants), on top of which slags containing heavy metals were deposited by H. Kramer.

The surface aquifer underlying this site, as well as the entire El Segundo area, is known to be unfit for use as potable water due to salinity intrusion and contamination from a variety of sources. The H. Kramer site has not been used since mid-1985, when the company ceased operations in California. Recently, however, construction of a high voltage transmission line and an extension of the LA light rail system across the northeast portion of the site have begun. Presence of these two features will further restrict opportunities for future site use.

1.3 METHODOLOGY AND REPORT ORGANIZATION

Using analytical results presented in the Site Characterization Report (ENSR, 1990), combined with pertinent environmental setting and land use information, this report evaluates potential human health risks posed by the H. Kramer site. All methods used in this evaluation were in accordance with



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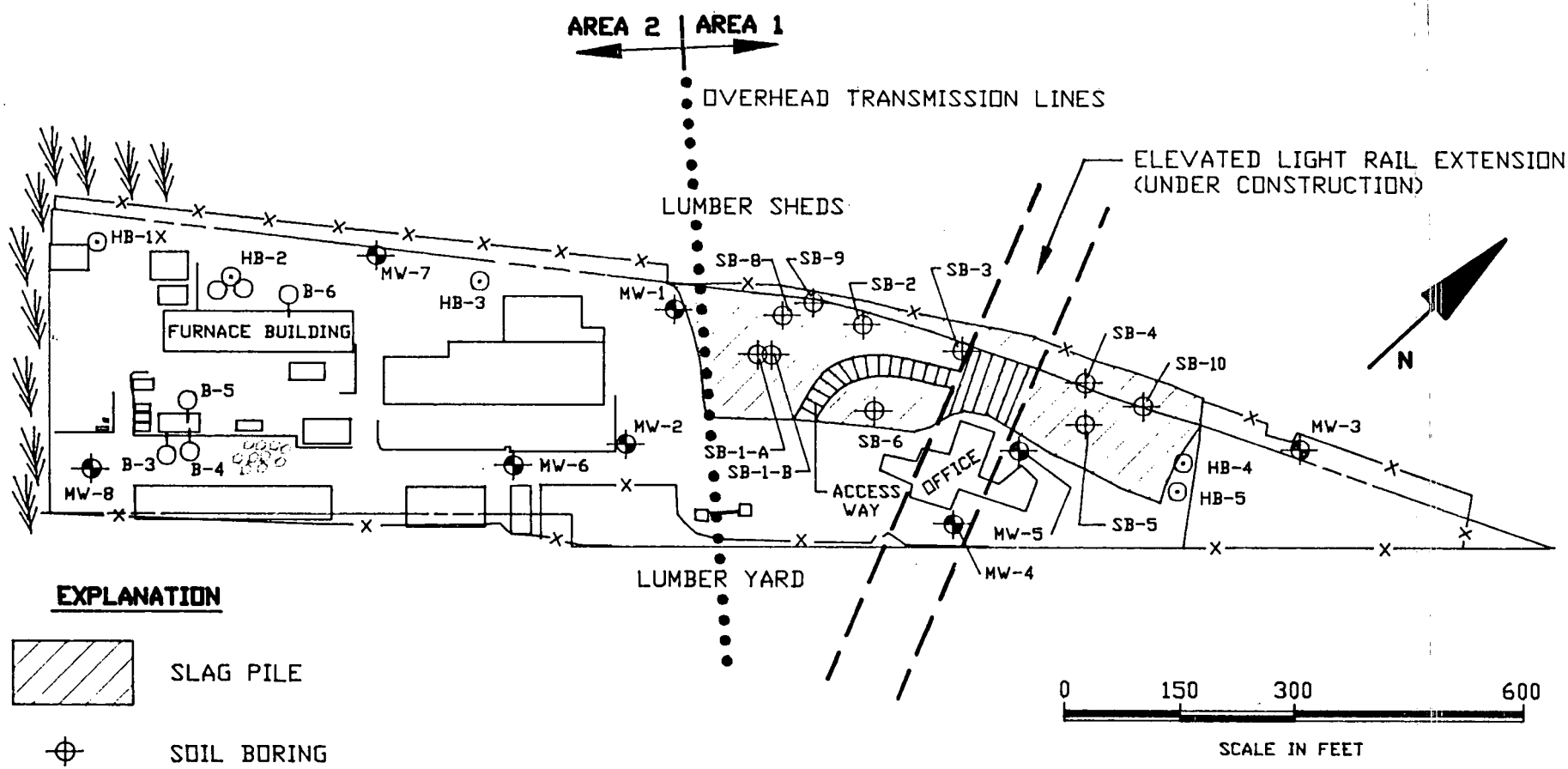
SCALE IN MILES

FIGURE 1

SITE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981



EXPLANATION

SLAG PILE

SOIL BORING

SOIL BORING/MONITORING WELL

SLANT BORING (SHOWING DIRECTION OF SLANT)

HAND BORING

PHRAGMITES (vegetation)

55 GALLON DRUMS

TARP AND PLANK COVERED ACCESS WAY
(UNDERLAIN WITH IMPORTED FILL)

LOCAL GROUNDWATER
GRADIENT: S/SE

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

FIGURE 2

SITE AND SAMPLE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK, 4-30-92

PLSC: 1.4=300, CHEV-3

EBASCO ENVIRONMENTAL

guidelines presented in the U.S. Environmental Protection Agency (EPA) document entitled *Risk Assessment Guidance for Superfund* (USEPA, 1989a).

Consistent with these guidelines, the baseline human health risk assessment was developed according to the following steps:

- Identification of Chemicals of Potential Concern (Section 2.0)
- Exposure Assessment (Section 3.0)
- Toxicity Assessment (Section 4.0)
- Risk Characterization (Section 5.0)

These steps are developed in the following sections.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPC)

Chemicals of potential concern (COPC) are those chemicals to be evaluated in the risk assessment process. COPC were selected based on analytical results presented in the Site Characterization Report (ENSR, 1990) as summarized below.

2.1 SUMMARY OF PRIOR SITE CHARACTERIZATION RESULTS

2.1.1 Sampling Activities

ENSR's site characterization was performed for H. Kramer in 1989 according to an EPA-approved work plan. Soil boring and monitoring well sample locations are shown in Figure 2.

A total of 50-61 soil samples (the exact number depending on analyte) were collected from 23 locations (including 9 borings in and through the slag pile). Soil samples were collected at 5 foot intervals, starting at a depth of 3 to 5 feet and extending to depths of approximately 20-30 feet below the surface. [Note: Surveyed elevations of soil borings were not included in ENSR's Site Characterization Report. Consequently, all soil sample depths cited in this reported are measured relative to the ground or slag pile surface. The slag pile is approximately 8-10 ft above grade.] These samples were analyzed for total metals (the 17 CAM metals plus iron, aluminum, and manganese). Subsets of these samples were analyzed for volatile organic compounds (VOCs) and California Waste Extraction Test (WET) metals. ENSR utilized a decision tree, based on the Total Threshold Limits Concentration (TTLC) and the Soluble Threshold Limits Concentration (STLC), to select additional soil samples for analysis. VOCs were analyzed only for those soil samples with organic vapor readings exceeding 25 parts per million (ppm) using a Photo-ionization Detector (PID) organic vapor meter.

Groundwater samples from eight on-site monitoring wells were analyzed for VOCs and metals. The depths and wells screens of MW-1, MW-2 and MW-3 are not known. Wells MW-4 through MW-8 are 96 to 115 ft deep and have 30 ft zones of perforation beginning at 45 to 85 ft bgs.

2.1.2 Summary of Analytical Results

Soils

Table 2-1 presents ranges and means of metals detected in the subsurface soil/slag samples. In lieu of site-specific background data, metal concentrations were compared with background levels reported in literature (Kabata-Pendias and Pendias, 1984). These comparisons indicate that soil/slag concentrations of antimony, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium and zinc exceed national background levels. [Note: Site-specific background data were not available.] Sample locations in the slag pile, particularly SB-1A and SB-3, contained the highest concentrations of metals. In addition, the majority of the slag pile samples containing the maximum metal concentrations were collected five feet below the surface of the slag pile (this was the shallowest depth sampled). The only exception was the maximum concentration of arsenic, 2,800 mg/kg, detected in a slag pile sample

TABLE 2-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	SUBSURFACE SOIL SAMPLE RESULTS /1/ Frequency	Mean	Minimum	Maximum	Location of Maximum	BACKGROUND LEVELS /2/ CITED IN LITERATURE Reported Range	Mean
METALS (mg/kg)							
Aluminum	49/50	4,276	690	18,000	SB1A-5'	--	--
Antimony	20/54	87.9	2.8	1,780	MW5-5'	0.05 - 4.0	--
Arsenic	61/61	185.7	0.6	2,800	SB3-20'	0.1 - 30	5.1
Barium	50/50	53.7	6.1	501	SB3-5'	20 - 1,500	400
Beryllium	39/50	12.5	0.06	230	SB1A-5'	3 - 200	40
Cadmium	30/50	1.48	0.05	29.5	SB3-5'	0.07 - 1.1	0.5
Chromium	50/50	9.39	1.5	74.60	SB4-10'	3 - 200	40
Chromium (VI)	1/50	1.21	1.21	1.21	SB2-5'	--	--
Cobalt	49/50	4.14	0.5	28	SB1A-5'	0.4 - 20	3.5
Copper	50/50	1,826	2.6	53,800	SB6-5'	1 - 70	14
Iron	50/50	8,252	1,800	31,000	SB1A-5'	--	--
Lead	43/50	242.1	1	2,500	SB1A-5'	10 - 70	17
Manganese	50/50	1,188	16.2	41,000	SB1A-5'	7 - 2,000	345
Mercury	37/50	0.19	0.02	5.80	MW5-5'	0.01 - 0.54	0.08
Molybdenum	34/50	4.45	0.1	33	SB1A-5'	0.05 - 2.0	--
Nickel	46/50	29.1	2.0	310	SB1A-5'	5 - 70	13
Selenium	22/52	10.6	0.09	300	MW5-5'	0.05 - 4.0	--
Silver	15/50	1.35	0.1	3.7	SB8-10'	0.1 - 5.0	--
Vanadium	50/50	9.42	2.3	27	SB1A-5'	7 - 150	47
Zinc	50/50	7,757	5.2	76,000	SB3-5'	15 - 164	40
VOLATILE ORGANIC COMPOUNDS (ug/kg)							
Acetone	4/7	14.0	15.0	30.0	SB4-30'	--	--
Methylene chloride	2/7	3.21	5.0	5.0	B4, MW-8	--	--
Toluene	3/7	4.86	6.0	12.0	B4-X-10	--	--

: Indicates constituents selected as Chemicals of Potential Concern (COPC) based on criteria defined in Section 2.2.1.

*See NOTES on following page.

NOTES:

/1/ Means reported above were calculated by assuming non-detected results were equal to 1/2 the sample-specific detection limit value. Appendix C presents summary statistics for individual constituents, partitioning results according to location and depth.

/2/ National background levels for sandy soils reported by Kabata-Pendias and Pendias (1984).

collected at a depth of 20 feet, in soils at the slag/soil interface. [Appendix A contains detailed sample-specific results of ENSR's investigation.]

Based on results of the initial organic vapor screening, and using the sampling criteria described in Section 2.1.1, seven soil samples were analyzed for VOCs (three in the slag pile and four underlying pavement). As shown in Table 2-1, acetone was detected in 4/7 samples at concentrations ranging from 15 to 30 ug/kg (ppb). Methylene chloride was detected in 2/7 samples at the detection limit of 5 ug/kg. Results for acetone and methylene chloride are both considered suspect given possible cross-contamination reported by the laboratory. Toluene was detected in 3/7 samples at concentrations ranging from 6 ug/kg (in 30' and 70' samples) to 12 ug/kg (10' sample).

Groundwater

Table 2-2 summarizes groundwater sampling results using ENSR analytical data included in Appendix A. Metals detected in groundwater samples taken from 30-foot zones beginning between 45 and 85 feet below grade included: antimony (ND-0.84 mg/l); arsenic (ND-140 mg/l); barium (ND-0.49 mg/l); trivalent chromium (ND-0.21 mg/l); hexavalent chromium (ND-0.23 mg/l); manganese (ND-3.3 mg/l); nickel (ND-0.07 mg/l); selenium (ND-0.19 mg/l) and zinc (ND-0.11 mg/l).

VOCs detected in site groundwater samples included carbon tetrachloride (ND-43.0 ug/l); 1,1-dichloroethene (ND-19 ug/l); ethylbenzene (ND-39 ug/l); tetrachloroethene or PCE (ND-200 ug/l); toluene (ND-270 ug/l); 1,1,1-trichloroethane (ND-12 ug/l); trichloroethene or TCE (18-370 ug/L); trichlorofluoromethane (ND-73 ug/l); and xylenes (ND-300 ug/l). Results of metal and VOC groundwater analyses are discussed in greater detail in Section 2.2.2.

2.2 SUMMARY OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPC) are those chemicals selected for evaluation in the risk assessment. COPC for the H. Kramer site are summarized in Table 2-3 and were identified based on the analytical results of the field investigation discussed above (Tables 2-1 and 2-2). Factors considered in their selection are discussed below.

2.2.1 Soil COPC

Metals

Soil COPC were primarily selected on the basis of two factors: 1] frequency of detection (greater than five percent); and 2] carcinogenic or other toxic effects (as indicated by available toxicity criteria). Comparison to (national) background levels was considered in selecting soil COPC, but was not the sole factor used to exclude a chemical from evaluation. [Site-specific background data were not available.] Consequently, barium and trivalent chromium were retained as soil COPC despite their presence at concentrations below literature background values (Table 2-1; Kabata-Pendias and Pendias, 1984).

TABLE 2-2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	Range of Sample QLs	Drinking Water Guidelines Value	Drinking Water Guidelines Source
	MONITORING WELL LOCATION										
Screen Depth (bgs):	--	--	--	(45-75')	(80-110')	(85-115')	(65-95')	(80-110')			
Screen Elevation (amsl):	--	--	--	(17.2 - 47.2')	(-17.2 - 12.8')	(-16.8 - 13.2')	(12.9 - 42.9')	(-7.6-22.4')			
METALS (mg/l)											
Antimony	<0.1	<0.1	0.84	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	----	
Arsenic	3.2	12	9.8	0.005	140	25	0.011	<0.005	0.005 - 50	0.05 mg/l	EPA/CA MCL
Barium	<0.02	<0.02	0.07	0.49	0.03	0.03	0.04	0.03	0.02	1.0 mg/l	CA MCL
Chromium III	<0.02	0.21	<0.02	0.1	<0.02	0.23	<0.02	0.02	0.02	0.05 mg/l	CA MCL
Chromium VI	<0.05	0.17	<0.05	0.09	<0.05	0.23	NA	<0.05	0.05 - 0.1	----	
Manganese	0.06	3.3	<0.02	<0.02	0.08	1.9	0.5	0.42	0.02	0.05 mg/l	CA MCL
Nickel	0.02	0.06	<0.02	<0.02	0.03	0.07	<0.02	0.06	0.02	----	
Selenium	0.02	0.24	0.19	<0.01	0.02	0.03	<0.01	0.01	0.01- 0.03	0.01 mg/l	CA MCL
Zinc	<0.05	0.04	0.03	<0.02	0.02	0.11	<0.02	0.04	0.02	5.0 mg/l	CA MCL
VOLATILE ORGANIC COMPOUNDS (ug/l)											
Carbon Tetrachloride	<5	<5	<5	<5	<5	43	NA	<5	5	0.5 ug/l	CA MCL
1,1-Dichloroethene	19	<5	<5	<5	<5	8	NA	5	5	6.0 ug/l	CA MCL
Ethylbenzene	<5	<5	<5	6	39	<5	NA	<5	5	680 ug/l	CA MCL
Tetrachloroethene (PCE)	200	16	160	<5	<5	<5	NA	25	5	5 ug/l	EPA/CA MCL
Toluene	<5	18	6	39	270	<5	NA	<5	5	100 ug/l	CA Action Level (AL)
1,1,1-Trichloroethane	12	<5	<5	<5	<5	10	NA	<5	5	200 ug/l	CA MCL
Trichloroethene (TCE)	370	40	120	190	18	110	NA	88	5	5 ug/l	EPA/CA MCL
Trichlorofluoromethane (Freon-11)	<5	<5	<5	<5	<5	73	NA	<5	5	150 ug/l	CA MCL
Xylenes	<5	<5	<5	40	300	<5	NA	<5	5	1750 ug/l	CA MCL

: Shaded chemicals were selected as Chemicals of Potential Concern (COPC). Shaded values indicate sample in which drinking water guidelines were exceeded for a given parameter. NOTE: Decisions to retain or exclude groundwater COPC in the RA were made independent of exposure likelihood. However, as discussed in Section 3.2, groundwater COPC were not quantitatively evaluated in the risk assessment because no exposure pathways were identified for current or potential future site uses.

NA: Not Analyzed
QL: Quantitation Limit
---: No data/criteria available.

TABLE 2-3
SUMMARY OF CHEMICALS OF POTENTIAL CONCERN (COPC)
H. KRAMER & COMPANY SITE

MATRIX/ CHEMICAL	SUBSURFACE SOILS/1/	GROUNDWATER/1/
Metals		
Antimony	X	X
Arsenic	X	X
Barium	X	(below MCL; noncarcinogen)
Beryllium	X	(ND)
Cadmium	X	(ND)
Chromium III	X	X
Chromium VI		X
Copper	X	(ND)
Lead	X	(ND)
Manganese	X	X
Mercury	X	(ND)
Nickel	X	X
Selenium	X	X
Zinc	X	(below MCL; noncarcinogen)
Volatile Organic Compounds /2/		
Acetone	(laboratory blank contaminant)	(ND)
Carbon Tetrachloride	(ND)	X
1,1-Dichloroethene	(ND)	(ND)
Methylene chloride	(laboratory blank contaminant)	X
Tetrachloroethene (PCE)	(ND)	X
Toluene	(See Section 2.1.1 discussion.)	X
Trichloroethene (TCE)	(ND)	X

NOTE:

/1/ "X" indicates chemical chosen as COPC. See Tables 2-1 and 2-2 for ranges of COPC detected in subsurface soil and groundwater samples. Constituents not listed in this table were either not detected or excluded from further evaluation based on lack of toxicity criteria or, for noncarcinogenic constituents in groundwater, comparisons to MCLs. As discussed in Section 3.2, groundwater COPC were not quantitatively evaluated in the risk assessment.

/2/ Using the sampling criteria defined in Section 2.1.1, seven soil samples were analyzed for VOCs. These results indicated the presence of only acetone, methylene chloride and toluene. These constituents were not quantitatively evaluated in the risk assessment for reasons described in Section 2.2.1.

ND - Not Detected

Using these selection criteria, the following soil COPC were selected for evaluation:

- antimony
- arsenic
- barium
- beryllium
- cadmium
- chromium (III)
- zinc
- copper
- lead
- mercury
- manganese
- nickel
- selenium

Hexavalent chromium was not selected due to low frequency of detection (1/50 samples). Cobalt, iron, molybdenum, silver and vanadium were not evaluated given the lack of toxicity criteria and/or presence well within the range of national background levels.

Volatile Organic Compounds (VOCs)

Using the sampling criteria defined in Section 2.1.1, ENSR selected seven soil samples for analysis of VOCs. As shown in Table 2-1, these results indicated the presence of only acetone, methylene chloride and toluene. Given that acetone and methylene chloride were reported as possible laboratory contaminants (ENSR, 1990), and also that methylene chloride was present at the detection limit, neither of these two compounds were selected as soil COPC.

Toluene qualified in theory as a COPC, but was not quantitatively evaluated in the risk assessment. This is because it was found at very low concentrations (6-12 ug/kg) and potential human exposures are only a remote possibility (found in three samples at 10, 30 and 70 feet).

2.2.2 Groundwater COPC

Based solely upon toxicity and drinking water MCLs (for noncarcinogenic constituents) of compounds identified in Table 2-2, groundwater COPC include:

- antimony
- arsenic
- trivalent chromium
- hexavalent chromium
- manganese
- nickel
- selenium
- carbon tetrachloride
- 1,1-dichloroethene
- tetrachloroethene (PCE)
- toluene
- trichloroethene (TCE)

Arsenic, trivalent chromium, manganese, selenium and all VOCs listed above were present above MCLs. Because MCLs are not available for antimony, hexavalent chromium and nickel, these constituents are identified as groundwater COPC based on potential toxicity. As discussed in the following section, however, none of these COPC were quantitatively evaluated because no groundwater exposure pathways were identified for current or expected future site uses. Additionally, it is well known and established that shallow groundwater in the entire El Segundo region is contaminated from a variety of other sources.

3.0 EXPOSURE ASSESSMENT

This section characterizes potential human exposure routes at the H. Kramer site for both current and potential alternate future site uses.

3.1 CHARACTERIZATION OF EXPOSURE SETTING

3.1.1 Physical Setting

Site Features and Surroundings

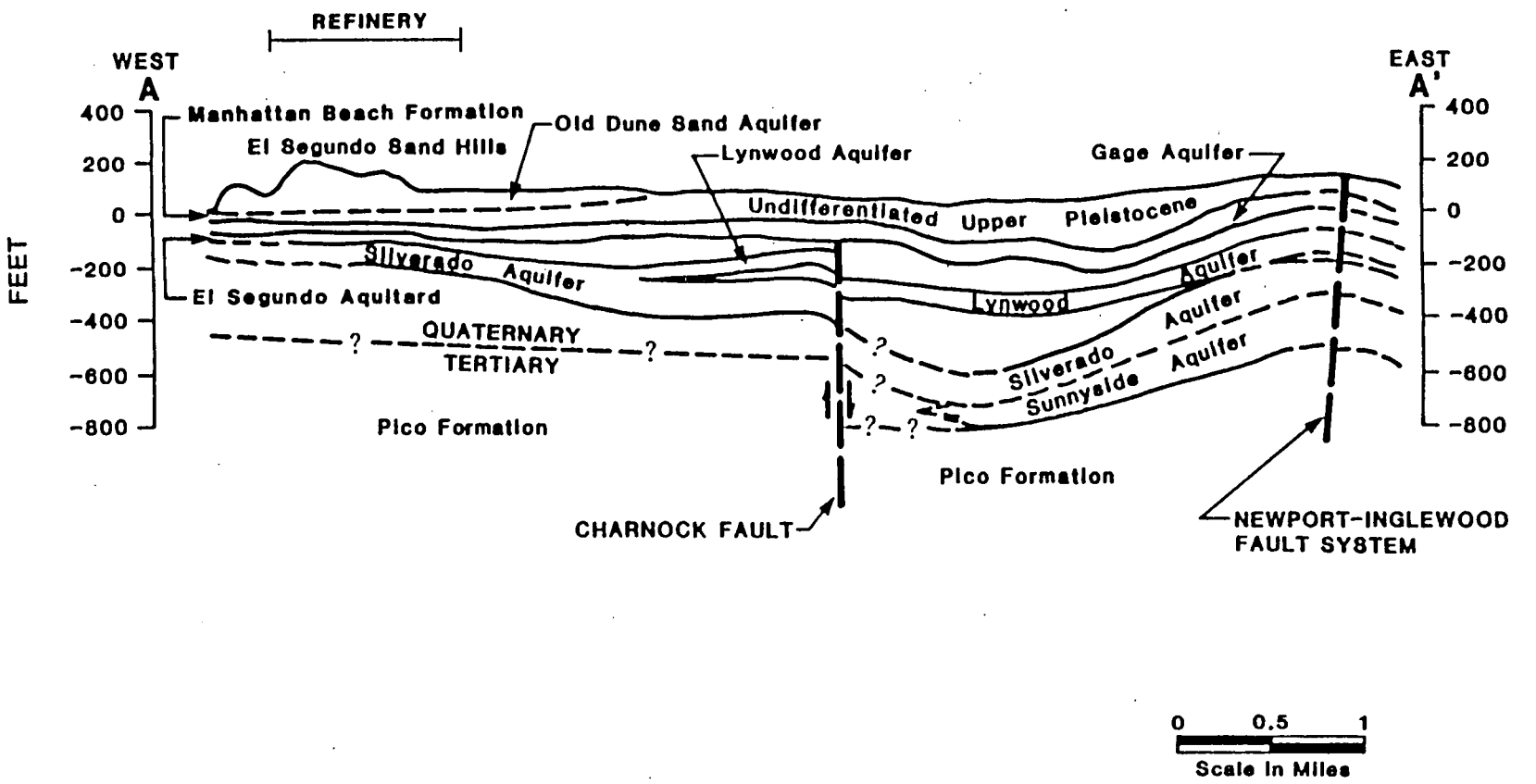
The northeast portion of the site, as shown in Figure 2, is occupied by the slag pile and an office building. A furnace building, blast furnace, bag house, silos, and former cooling basins occupy the central and southwest portions of the site. Principal boundary features include the Southern Pacific Railroad line (northern border); the Atchison, Topeka & Santa Fe rail line (southern border); and a lumber yard (northeast and southern boundaries). Surrounding land use includes a golf course 1/4 mile to the northwest; three schools within 3/4 miles to the east; and extensive industrial park development northeast and southeast of the slag pile. Large areas of vacant property exist west-northwest of the site.

The site is fenced and paved, except for the slag pile and several peripheral small areas (a dirt walkway behind the office building and a plank-covered access way). The surface of the slag pile is littered with debris, and the slag pile itself is not of a constituency which would suggest potential for significant resuspension. [Despite high winds during a recent site visit, the air above the slag pile was not dusty.] There is an office in the eastern portion of the site, but all other buildings are vacant and in disrepair. The general topographic slope of the area is to the east, with the elevation sloping approximately 20 feet approximately 400 feet east of the site.

Geology

The area stratigraphy, shown in Figure 3, was taken from a 1987 report by Radian Corporation. The H. Kramer site is located on the eastern fringe of the El Segundo Sand Hills. Based on drilling work performed at the site by ENSR, and by Radian at the nearby refinery, the stratigraphy includes the uppermost Old Dune Sand formation; the Manhattan Beach formation; the Gage aquifer; the El Segundo aquitard; and the Silverado aquifer.

The Old Dune Sand formation is unconsolidated and consists of brown to reddish brown sands. Based on ENSR's report, there does not appear to be a significant amount of groundwater in the Old Dune Sand formation. Immediately below the Old Dune Sand is the Manhattan Beach Formation. The Manhattan Beach formation in this area consists primarily of the Manhattan Beach aquitard. At the nearby Chevron refinery, the Manhattan Beach aquitard has been found across the site and has been shown to separate the Old Dune Sand from the Gage aquifer (Radian, 1987). At H. Kramer, presence of the Manhattan Beach aquitard has been identified in several of the soil borings which were converted to groundwater wells. Immediately below the Manhattan Beach aquitard is the Gage formation which



Source: Hydrogeological Assessment Report - Radian Corporation, 1987.

FIGURE 3
GENERALIZED REGIONAL GEOGRAPHIC CROSS SECTION

is also an aquifer. The extent of the Manhattan Beach aquitard varies in this general area such that where the Gage is overlain by fine sand, the Manhattan Beach aquitard may not be present.

The Gage aquifer consists mainly of a medium to coarse grained yellow-brown sand with minor silt and clay. Beneath the Gage is the El Segundo aquitard which separates the Gage from the Silverado aquifer. The El Segundo aquitard is comprised of a blue-grey to dark grey, dense, silty clay. At the refinery, shell fragments and traces of wood fragments are also present within this formation. The presence of the El Segundo aquitard under the H. Kramer site has not been defined at present, however nearby wells in the City of Hawthorne and the eastern portion of the refinery have shown it to be present thus bracketing the site.

The Silverado aquifer consists of fine-to coarse sand and gravel, with interbeds of pebbles. In some areas of the refinery, beds of silt and clay up to 10 feet thick occur in the Silverado. These fine-grained deposits are generally described as grey, silty (highly plastic) clay and as brown silt and/or grey silt. According to Radian (1986), the elevation of the Silverado aquifer ranges from 65 feet below mean sea level near the center of the refinery to 23 feet below mean sea-level to the north of the refinery. This large range in depth is probably due to local erosional influences and results. The depth of the Silverado aquifer increases substantially with distance inland.

Hydrology

Groundwater was encountered in on-site wells at depths of 70-90 feet bgs, or 16 to 22 feet above mean sea-level. This groundwater was found to contain contaminants identified in Section 2.1.2, which are common to the area. This may be the Gage aquifer, but it clearly does not represent the deeper Silverado aquifer.

The groundwater hydrology in the vicinity of the site is influenced by variations in the local geology and the presence of a series of groundwater injection wells near the site. Fresh water injection wells are operated by the County of Los Angeles along a saltwater intrusion barrier located one-half mile west of the site along Sepulveda Boulevard. Fresh water is injected from 110 to 347 feet bgs spanning two aquifers, an upper aquifer referred to as the 200-foot dune sand aquifer (which may be a combination of the Gage aquifer and Old Dune Formation), below which lies the Silverado aquifer.

While the available geological data are sufficiently complete to support a conclusion that the H. Kramer site is at least partially underlain by a confining layer of clay (El Segundo aquitard), the hydrogeological data (flow direction and rate) are confounded by effects of the intrusion barrier and therefore subject to greater uncertainty. Reports related to the refinery indicate that flow is to the west, whereas H. Kramer site results and the Radian report on the Section 18 property show an east-southeast flow direction (ENSR, 1990; Radian, 1986). This difference in flow may be a result of the intrusion barrier, but Radian has indicated that the barrier well leakage which could have caused this has been fixed, and the mounding diminished over time. Thus, as the flow direction returns to normal conditions, water flow in the Gage will be toward the ocean and away from the existing groundwater production wells east of the site.

3.1.2 Potentially Exposed Populations

Current Site Uses

The site has not been used for industrial purposes since foundry operations ceased in 1985. The only individual currently working at the site is a daytime security guard who occupies the front portion of the office building but spends some time outdoors. The site is surrounded by a fence, but certain portions of the fence are not intact, thus permitting site access. Evidence of trespassing has been noted during previous site visits. Given these factors, potentially exposed populations for current site uses include on-site workers and trespassers.

The groundwater present in the Old Dune Sand and Gage aquifers is not produced at this time. As a result, no populations are currently exposed to shallow groundwater contaminants in these aquifers since they are not used as potable water sources (see Sections 3.1.1 and 3.2.1.2 for further information).

Potential Alternate Future Site Uses

While no future use of the site has been defined, current zoning suggests that any future use of the site would likely be industrial in nature. Consequently, adult workers are considered potentially exposed populations for future use scenarios.

As described for the current use scenario, no potentially exposed populations were identified for future use groundwater pathways. Future use of groundwater in the Old Dune Sand and Gage aquifers beneath the site is not expected due to groundwater salinity; regional contamination; and production capacity (see Section 3.1.1).

3.2 IDENTIFICATION OF EXPOSURE PATHWAYS

According to EPA risk assessment guidance (USEPA, 1989a), an exposure pathway consists of the following elements:

- a source and mechanism of chemical release to the environment;
- an environmental transport medium;
- a point of human or biota contact with the medium (the exposure point); and
- an exposure route at the contact point (e.g., ingestion, dermal contact, inhalation).

Table 3-1 summarizes potential pathways of exposure to COPC at the H. Kramer site. These exposure pathways are discussed below for both current and potential future site uses. Rationales for exposure scenarios evaluated qualitatively, or not retained, are also presented.

3.2.1 Current Use Exposure Pathways

For assessment of current site uses, the following conditions were assumed:

- no change in worker activity patterns
- no subsurface excavation

- no groundwater use
- no seismic liquefaction

Using these assumptions, potential current use exposure pathways are summarized below.

3.2.1.1 Exposure Pathways Selected for Quantitative Evaluation

Current Use On-Site Worker and Trespasser Pathways

As shown in Table 2-1, subsurface soils at the site contain metals at concentrations exceeding expected background levels. The highest concentrations were detected in slag pile soils, which are exposed and potentially accessed by on-site workers and/or trespassers. Direct exposure to slag soils is likely to occur infrequently because the pile is isolated and in some areas barricaded. Nonetheless, potential direct contact and inhalation exposures to slag pile soils warrant evaluation.

The following current use exposure pathways were quantitatively evaluated:

Exposure Pathway(s)	Current Use Receptor	Receptor Location
•Ingestion, Dermal Contact and Inhalation	Child Trespassers	• Slag Pile Shallow Subsurface Soils ($\leq$ 5 ft)
•Ingestion, Dermal Contact and Inhalation	Adult Workers	• Slag Pile Shallow Subsurface Soils ($\leq$ 5 ft)

3.2.1.2 Exposure Pathways Not Selected for Quantitative Evaluation

Current Use Groundwater Pathways

Groundwater in the Old Dune Sand and Gage aquifers beneath the site contained concentrations of metals and volatile organic compounds exceeding drinking water guidelines (ENSR, 1990; Table 2-2). However, due to salinity and other recognized problems discussed in Section 3.1.1, groundwater from this formation in El Segundo is not used as a drinking water source or for irrigation purposes. As a result, groundwater exposure pathways were not quantitatively evaluated in the risk assessment.

The city of El Segundo is located primarily seaward of the County's saltwater intrusion barrier shown in Appendix B, Figure B-1 (personal communication, Larry Vivian, City of El Segundo, November 14, 1991). In addition, a wedge of saltwater trapped inland upon construction of the barrier has remained in the area just east of the barrier, which includes the H. Kramer site. As a result, groundwater in the Old Dune Sand and Gage aquifers seaward and inland of the barrier in El Segundo is highly saline and non-potable (Bookman-Edmonston Engineering, 1991).

The Silverado aquifer, which underlies the Gage aquifer (below 200 feet bgs), is the primary aquifer utilized for drinking water in the El Segundo area. The nearest drinking water wells to the H. Kramer

TABLE 3-1
POTENTIAL PATHWAYS OF EXPOSURE TO COPC
H. KRAMER & COMPANY SITE
page 1 of 2

EXPOSURE MEDIUM	RECEPTOR LOCATION	POTENTIAL RECEPTOR(S)	EXPOSURE ROUTE	PATHWAY EVALUATED	REASON FOR SELECTION OR EXCLUSION
Current Use Pathways					
Soils (≤5 ft)	Slag Pile	On-site Workers, Trespassers	Ingestion, Dermal Contact	YES	Slag pile soils are contaminated with metals (see Table 2-1). Soils are exposed and potentially accessed by on-site workers and/or trespassers. Access is likely to be infrequent, however, given that the slag pile is isolated, and, in some areas, surrounded by a 4-foot high vinyl net fence.
Air	On-site Areas	On-site Workers, Trespassers	Inhalation of soil containing COPC	YES	Resuspension of slag pile soils could result in emissions of fugitive dust containing COPC. Such exposures are likely to be limited given the apparent large grain size of slag pile soils. [Note: Despite high wind speeds during a recent site visit, resuspension of slag pile soils was not evident.]
Groundwater	On-site or local downgradient wells	Local workers or residents	Ingestion, dermal contact and inhalation of volatilized organic compounds (e.g., while showering)	NO	Shallow groundwater in the Old Dune Sand and Gage beneath the site is saline and not used as a potable water source or for irrigation purposes. There appears to be a high degree of hydrologic isolation between the site and any groundwater production wells completed (several miles from the site) in the Silverado aquifer.
Surface Water	On-site	Local workers or trespassers	Ingestion, dermal contact and/or biota ingestion	NO	The only water at the site is that contained in a former equalization basin located in the western portion of the site. Exposures to this water are not expected and thus were not quantitatively evaluated.
Potential Future Use Pathways					
Soils (≤25 ft); Air	Area 1 Area 2	Construction Workers	Ingestion, dermal contact and inhalation exposures to soil COPC during potential future excavation	YES	No construction has been planned for the H. Kramer site, nor is any planned in the future. However, a hypothetical construction scenario was included to evaluate potential effects associated with exposures to subsurface soils. This scenario assumes major construction and earth-moving activities to depths of 25 feet. Receptor locations are distinguished by two areas (1 and 2) given the differing distribution of contaminants at the site. As shown in Appendix C, metals concentrations were most elevated in areas within and surrounding the slag pile.

TABLE 3-1
POTENTIAL PATHWAYS OF EXPOSURE TO COPC
H. KRAMER & COMPANY SITE
page 2 of 2

EXPOSURE MEDIUM	RECEPTOR LOCATION	POTENTIAL RECEPTOR(S)	EXPOSURE ROUTE	PATHWAY EVALUATED	REASON FOR SELECTION OR EXCLUSION
Potential Future Use Pathways (Cont.)					
Slag Pile Soils; Air	On-site Areas	Future Industrial Workers	Direct contact and inhalation exposures to COPC in slag pile soils	NO	This scenario assumes: 1] future industrial use of the site; 2] no removal of contaminated soils; and 3] subsequent installation of a cap or vegetative cover (e.g., grass). Given that these factors would prevent exposures to subsurface contaminants, this future use pathway was not quantitatively evaluated.
Groundwater	On-site or local downgradient wells	Adult residents	Ingestion, dermal contact, and inhalation of volatilized organic compounds (e.g., while showering)	NO	Future use of shallow groundwater beneath the site is not expected due to salinity problems; regional contamination; and production capacity. Local saline groundwater appears to be hydrologically isolated from deeper groundwater production aquifers as a result of fine-grain silt and clay aquitards. Upper aquifer flow is also toward the ocean and away from any existing production wells. Consequently, future use groundwater exposure pathways were not quantitatively evaluated.

site are located in the cities of Hawthorne (four wells) and Redondo Beach (one well), approximately 1.5 miles northeast (upgradient) and southeast of the site, respectively (personal communication, Melinda Gleason, Water Replenishment District, November 20, 1991). These wells are shown in Appendix B, Figure B-2. Regular chemical monitoring of these five wells has not detected contamination (personal communication, Al Rivier, City of Hawthorne, November 25, 1991). The shallowest screening sections in these wells are located within the Silverado aquifer, or in even deeper aquifers (See Appendix B, Tables B-1 and B-2). As discussed in Section 3.1.1, the shallow groundwater beneath the H. Kramer site and the production wells in the Silverado are probably hydrologically isolated. Consequently, vertical (downward) migration of shallow groundwater contaminants to potable aquifers is not expected.

Surface Water Pathways

The only "surface water" at the H. Kramer site is some standing water which is contained in two small concrete basins located in the western portion of the former foundry. Exposures to this water are not expected and thus are not quantitatively evaluated in the risk assessment.

3.2.2 Future Use Exposure Pathways

3.2.2.1 Exposure Pathways Selected for Quantitative Evaluation

Future Use Construction Worker Pathway

Future use of the site is uncertain, and consequently no construction activities involving soil excavation are planned. However, a quantitative risk assessment to evaluate potential health effects associated with exposures to subsurface soils was performed using a hypothetical construction worker scenario as the most plausible yet conservative case. Ingestion, dermal contact and inhalation exposure pathways were quantitatively evaluated for adult construction worker receptors.

As noted in Table 3-1, receptor locations for this scenario were distinguished according to two areas: Area 1 and Area 2. "Area 1" includes the slag pile and surrounding area encompassing the eastern portion of the site. "Area 2" represents the western paved portion of the site and includes data from corresponding soil boring samples (See Figure 2 delineations). This distinction was made because metals concentrations in soils were most elevated in areas within and surrounding the slag pile. Both (Area 1 and 2) scenarios conservatively assume major construction and earth-moving activities to depths of 25 feet for a period of one year.

3.2.2.2 Exposure Pathways Not Selected for Quantitative Evaluation

Future Industrial Use Pathways

Potential future use of the site for alternate industrial uses is possible. However, this risk assessment assumes that development of the site would be preceded by some form of reduction in slag pile mass, profile and/or lack of cover. Given that these factors would prevent exposures to subsurface contaminants, this future use pathway was not quantitatively evaluated. Assuming no change in the

condition of the slag pile, the current use worker exposure scenario could also apply to future site uses if worker activity patterns remained similar.

Future Residential Use Pathways

Future residential use of the site is not expected given current and future anticipated industrial zoning and land use.

Future Groundwater Use Pathways

Future use groundwater exposure pathways were not quantitatively evaluated in the risk assessment, based on the fact that such use is not foreseeable in the reasonably near future.

3.3 QUANTIFICATION OF EXPOSURES

3.3.1 Exposure Point Concentrations

An exposure point concentration (EPC) is the chemical concentration to which an individual is assumed to be exposed. Tables 3-2 and 3-3 list exposure point concentrations (EPCs) for the soil exposure pathways defined above. Risks were calculated using median soil concentrations and, in accordance with EPA guidance (1989a), 95% upper confidence limits (UCLs) of the means of soil COPC. The purpose of this bounded analysis was to better reflect the distribution of, and the influence of outliers in, the underlying data.

Supporting EPC calculations and summary statistics are included in Appendix C.

3.3.1.1 Soil Direct Contact Pathways

Current Use Exposure Scenarios

EPCs for current use soil exposure pathways were calculated using analytical results of slag pile soil samples collected at 3-5 foot depths. Table 3-2 presents the median and 95% UCL concentrations used to calculate risks associated with these pathways.

The use of these data (vs. surface data, which were not available) is assumed to be representative yet conservative because, as shown in Table 2-1, maximum concentrations of most soil COPC were detected in slag pile samples collected at 5 foot depths. [Note: The lack of surface soil data may have been a function of the presence of debris and the large grain size of material on the surface of the slag pile. These factors could have hindered sample recovery and/or precluded collection of a representative surface sample.] Sample-specific analytical results are provided in Appendix A. Appendix C includes corresponding summary statistics and EPC calculations.

Future Use Construction Worker Scenarios

EPCs for future use soil exposure pathways were determined using analytical results of subsurface soil samples collected at depths ranging from 1 to 25 feet. Median and 95% UCL EPCs are shown in Table 3-2. Receptor locations are distinguished by areas (Areas 1 and 2), given the differing distribution of

TABLE 3-2
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR SOIL EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/ WORKER AND TRESPASSER RECEPTORS		FUTURE USE SCENARIOS /2/ AREA 1 SUBSURFACE SOILS		AREA 2 SUBSURFACE SOILS	
	Soil EPC (mg/kg) Median	95% UCL	Soil EPC (mg/kg) Median	95% UCL	Soil EPC (mg/kg) Median	95% UCL
Antimony	11.5	81.5	5.40	305.4	0.5	4.93
Arsenic	9.85	17.3	18.0	540.3	1.25	45.73
Barium	133.5	382.5	49.4	129.6	22	27.05
Beryllium	48.0	164.07	0.84	45.5	0.13	0.15
Cadmium	5.70	19.8	0.78	5.28	0.06	0.37
Chromium (trivalent)	15.15	28.7	7.90	20.01	5.15	6.35
Copper	3,745	34,413	196	8,084	7.1	12.38
Lead	1,150	2,308	77.7	782.07	1.4	10.10
Manganese	1,575	24,997	290	5602.18	11	168.20
Mercury	0.17	0.57	0.06	0.81	0.02	0.07
Nickel	116	272.3	9.60	87.8	3.85	6.59
Selenium	1.00	1.63	0.90	41.9	0.05	0.12
Zinc	39,800	67,134	847	24,606	14	24.00

NOTES:

/1/

Given the lack of surface data for slag pile soils, results from 3-5' sample depths were conservatively assumed for current-use pathway calculations. (samples SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5, and SB9-3). All 95% upper confidence limit (UCL) values were calculated assuming non-detects were equal to one-half the sample-specific detection limit value (see Appendix C summary statistics).

/2/

For hyphothetical future use scenarios, receptor locations were partitioned into two areas: Area 1 and Area 2 (see Figure 2). Area 1 represents the eastern portion of the site, including the slag pile and surrounding sample locations (all SB-, HB-4, HB-5, MW-4 and MW-5 results). Area 2 represents the western portion of the site, encompassing results from remaining soil samples collected below paved areas not within Area 1. These areas were distinguished because contaminant concentrations were most elevated in samples collected within and surrounding the slag pile (see Appendix C EPC calculations)

Sample results for Area 1 and Area 2 are for 1-25' sample depths; the one-foot sample depths correspond only to the five hand boring (HB) locations shown in Figure 2. All 95% upper confidence limit EPC values were calculated assuming non-detects were equal to 1/2 the sample-specific detection limit values.

TABLE 3-3
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR AIR EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/ WORKER AND TRESPASSER RECEPTORS		FUTURE USE SCENARIOS /2/ AREA 1 SUBSURFACE SOILS		AREA 2 SUBSURFACE SOILS	
	Air EPC (mg/m^3) Median	95% UCL	Air EPC (mg/m^3) Median	95% UCL	Air EPC (mg/m^3) Median	95% UCL
Antimony	4.72E-07	3.36E-06	5.40E-07	3.05E-05	5.00E-08	4.93E-07
Arsenic	4.06E-07	7.14E-07	1.80E-06	5.40E-05	1.25E-07	4.57E-06
Barium	5.50E-06	1.58E-05	4.94E-06	1.30E-05	2.20E-06	2.71E-06
Beryllium	1.98E-06	6.76E-06	8.40E-08	4.55E-06	1.30E-08	1.50E-08
Cadmium	2.35E-07	8.17E-07	7.80E-08	5.28E-07	6.00E-09	3.70E-08
Chromium (trivalent)	6.24E-07	1.18E-06	7.90E-07	2.00E-06	5.15E-07	6.35E-07
Copper	1.54E-04	1.42E-03	1.96E-05	8.08E-04	7.10E-07	1.24E-06
Lead	4.74E-05	9.51E-05	7.77E-06	7.82E-05	1.40E-07	1.01E-06
Manganese	6.49E-05	1.03E-03	2.90E-05	5.60E-04	1.10E-06	1.68E-05
Mercury	7.00E-09	2.35E-08	6.00E-09	8.10E-08	2.00E-09	7.00E-09
Nickel	4.78E-06	1.12E-05	9.60E-07	8.78E-06	3.85E-07	6.59E-07
Selenium	4.12E-08	6.72E-08	9.00E-08	4.19E-06	5.00E-09	1.20E-08
Zinc	1.64E-03	2.77E-03	8.47E-05	2.46E-03	1.40E-06	2.40E-06

NOTES:

/1/

Air EPCs were calculated by multiplying the corresponding soil EPC by the mean annual PM10 concentration reported for Hawthorne, 0.0412 mg/m^3 (see Table 3-2 for soil EPCs).

/2/

Air EPCs were calculated by multiplying the corresponding soil EPC by 0.1 mg/m^3. This value was measured at two construction sites where dust control measures were not employed (Ebasco, 1986). See Table 3-2 for assumptions related to soil EPC derivation.

metals in site soils (Section 3.2.2). Metals were most elevated in areas within and surrounding the slag pile (encompassing Area 1), where, as indicated in Appendix C, sample means were typically one to three orders of magnitude greater than those calculated for Area 2.

3.3.1.2 Inhalation Pathways - COPC Resuspended in Site Soils

As shown in Table 3-3, EPCs for air (inhalation) pathways were calculated by multiplying soil EPCs by the mean annual PM_{10} (respirable fraction) concentration of 0.0412 mg/m^3 reported for Hawthorne (personal communication, Mel Celdin, South Coast Air Quality Management District, November 18, 1991). [Note: Air quality data are not available for El Segundo.] Suspended particulates were conservatively assumed to have the same COPC concentrations as slag pile shallow subsurface (3-5 ft) soils. Subsurface volatilization pathways were not quantitatively evaluated given lack of soil VOC data and the relatively great depth to groundwater (80 ft).

3.3.2 Estimation of Chemical Intakes

To calculate chemical intakes (and corresponding risks), EPCs listed in Tables 3-2 and 3-3 were combined with human exposure assumptions to calculate the chronic daily intake, or CDI. The CDI is an estimated average daily dose received (e.g., via direct contact with soils and/or inhalation) expressed in mg of chemical per kg body weight per day. Key factors incorporated in the CDI equation, include:

- the constituent concentration in the medium to which an individual is exposed
- the amount of constituent taken up by the body (e.g., via dermal absorption)
- the frequency and duration of exposures.

Equations used to calculate CDIs for ingestion, dermal contact and inhalation pathways are summarized in Table 3-4. Values used as input to these equations are listed in Tables 3-5 and 3-6 for current and future use soil exposure pathways, respectively. These tables also list supporting references, assumptions and rationales. Resulting CDI values were then combined with toxicity factors (Section 4.0) to calculate risks (Section 5.0). CDI calculation documentation is provided in Appendix E.

3.4 IDENTIFICATION OF UNCERTAINTIES

The following describes uncertainties surrounding exposure point concentration (EPC) determination and human exposure parameter estimation. There are always a number of statistical uncertainties related to sample size and frequency distribution as well as those inherent to risk assessment paradigms in general. In the present case, any imprecision in the assessment which could be related to data gaps, were compensated for by using conservative assumptions relating to exposure type, frequency, and duration.

TABLE 3-4
EQUATIONS USED TO CALCULATE CHRONIC DAILY INTAKES (CDIs) OF COPC
H. KRAMER & COMPANY SITE

CARCINOGENS

Soil Ingestion

CDI = **Soil EPC** (mg/kg) x **10^{-6}** (kg/mg) x **SIR** (mg/day) x **1/BW** (kg) x (**# days/365 days**) x (**# years/70 years**)

Dermal Contact with Soils

CDI = **Soil EPC** (mg/kg) x **10^{-6}** (kg/mg) x **AF** (mg/cm^2) x **SA** (cm^2) x **ABS/BW** x (**# days/365 days**) x (**# years/70 years**)

Inhalation of Particulates

CDI = **EPC** (mg/kg) x **10^{-6}** (kg/mg) x **PM_{10}** (mg/m^3) x **IR** (m^3/hour) x **ET** (hrs) x **1/BW** x (**# dys/365 dys**) x (**# yrs/70 yrs**)

NONCARCINOGENS

Chronic Daily Intakes (CDIs) for noncarcinogens are calculated in the same manner as that used for carcinogens (above) with one exception: intakes are not averaged over a 70 year lifetime. That is, the last term in the equation (# years/70 years) is excluded in order to account for toxic (noncarcinogenic) effects associated with subchronic exposures to COPC.

DEFINITIONS

CDI = Chronic Daily Intake (mg/kg/day)
EPC = Exposure Point Concentration (mg/kg for soils; mg/m3 for air)
10^{-6} = Unit correction factor (kg/mg)
SIR = Soil Ingestion Rate (mg/day)
BW = Body Weight (kg)
AF = Soil Adherence Factor (mg/cm^2)
SA = Skin Surface Area Exposed (cm^2)
ABS = Dermal Absorption Rate (unitless)
PM_{10} = Mean annual concentration of respirable particulates (<10um in diameter)
IR = Inhalation Rate (m^3/hour)
ET = Exposure Time (hours/day)

NOTE:
EPCS used to calculate CDIs are listed in Tables 3-2 and 3-3. Tables 3-5 and 3-6 summarize human exposure parameters used as input to the above equations.

TABLE 3-5
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC: CURRENT USE SCENARIOS
H. KRAMER & COMPANY SITE
page 1 of 2

Parameter	CURRENT USE RECEPTOR On-site Worker	Trespasser	SOURCE/ASSUMPTIONS
GENERAL EXPOSURE PARAMETERS			
Age During Exposure	Adult	9-16 years	--
Average Body Weight	70 kg	46 kg	USEPA, 1991a.
Frequency	250 days/year	72 days/year	USEPA, 1991a; professional judgement. Trespassers are assumed to access the site 2 times/week, 9 months/year.
Duration Per day Over lifetime	 4 hours (/8 hours) 25 years	 2 hours 5 years	USEPA, 1991a; professional judgement. See Note 1.
SOIL INGESTION EXPOSURE PARAMETERS			
Soil Ingestion Rate	50 mg/day	100 mg/day	USEPA, 1991a; USEPA, 1989b; See Note 2.
DERMAL CONTACT EXPOSURE PARAMETERS			
Soil Adherence Rate	0.5 mg/cm^2	0.5 mg/cm^2	Schaum, 1984.
Surface Area Exposed	3700 cm^2	3000 cm^2	USEPA, 1989b. Assumes hands, forearms and head are exposed (see Note 3).
Dermal Absorption Rate (metals)	1%	1%	SCAQMD, 1988.
INHALATION EXPOSURE PARAMETERS			
Respiratory Volume	2.5 m^3/hour	0.7 m^3/hour	USEPA, 1991a. Assumes moderate activity for both receptor groups.
Total Suspended Respirable (PM_{10}) Dust Concentration	0.0412 mg/m^3	0.0412 mg/m^3	Arithmetic mean annual PM_{10} concentration reported for Hawthorne (personal communication, Mel Celdin, South Coast Air Quality Management District, November 18, 1991). See Note 4.

TABLE 3-5
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC: CURRENT SITE USES
H. KRAMER & COMPANY SITE
page 2 of 2

NOTES:

[1] Because the slag pile is isolated and is not usually accessed by current on-site workers, intakes for these receptors were calculated assuming that 4 hours of an 8-hour work day are spent outside in the vicinity of the slag pile. The trespasser scenario assumes the entire 2-hour duration is spent in contact with slag pile soils.

[2] The soil ingestion rate assumed for on-site workers, 50 mg/day, is the standard default value recommended by EPA for soil ingestion in the workplace (USEPA, 1991a). Average soil ingestion in the population of young children (under the age of 7) has been estimated at approximately 100 to 200 mg/day (USEPA, 1989b). Calabrese (1987) recommends a value of 100 mg/day for children/young adults aged 5 to 18 years, assuming a high tendency to ingest soil. Given the age of trespassers assumed in this study (9-16 years), 100 mg/day was considered a reasonable soil ingestion rate value. This ingestion rate is assumed to apply to an exposure "event" and thus (in contrast to the value assumed for on-site workers) does not represent a daily average rate.

[3] Soil contact rates are assumed equal to the skin surface area exposed (cm^2) multiplied by the amount of soil adhered to skin (mg/cm^2). For both receptor groups (workers and trespassers), the assumed exposed dermal surface includes the hands, forearms and head. These areas comprise approximately 19% of the total body surface area for adult males (1.94 m^2), resulting in an exposed surface area of 3700 cm^2. For trespassers (9-16 years), these areas represent approximately 21% of the total body surface area (1.42 m^2), resulting in an exposed surface area of approximately 3000 cm^2 (USEPA, 1985; USEPA, 1989b).

[4] COPC concentrations in dust particles are assumed to be the same as the soil EPC. All dust particles are assumed to be respirable (less than 10 microns in diameter).

TABLE 3-6
ASSUMPTIONS USED TO EVALUATE EXPOSURES TO SOIL COPC:
FUTURE USE CONSTRUCTION WORKER SCENARIOS
H. KRAMER & COMPANY SITE

Parameter	FUTURE USE RECEPTOR Construction Worker	SOURCE/ASSUMPTIONS
GENERAL EXPOSURE PARAMETERS		
Age During Exposure	Adult	--
Average Body Weight	70 kg	USEPA, 1991a.
Frequency	250 days/year	USEPA, 1991a. Assumes individuals work five days per week, 50 weeks per year.
Duration Per day Over lifetime	 8 hours 1 year	 USEPA, 1991a; professional judgement.
INGESTION EXPOSURE PARAMETERS		
Soil Ingestion Rate	480 mg/day	Estimated soil ingestion rate assuming construction activities in a commercial/industrial setting and an exposure duration generally less than one year (USEPA, 1991a).
DERMAL CONTACT EXPOSURE PARAMETERS		
Soil Adherence Rate	0.5 mg/cm^2	Schaum, 1984.
Surface Area Exposed	3700 cm^2	USEPA, 1989b. Assumes hands, forearms and head are exposed.
Dermal Absorption Rate (metals)	1%	SCAQMD, 1988.
INHALATION EXPOSURE PARAMETERS		
Respiratory Volume	4.5 m^3/hour	USEPA, 1989b. Assumes construction workers are engaged in heavy activity (e.g., vigorous exercise).
Total Suspended Respirable (PM_{10}) Dust Concentration	0.1 mg/m^3	Assumed dust concentration uses the value measured at two construction sites where dust control measures were not employed (PJP Landfill Site Monitoring Program, Ebasco, 1986).

3.4.1 Exposure Point Concentration (EPC) Determination

One source of uncertainty in the exposure point concentrations used in the risk assessment is the lack of surface data for slag pile soils. In lieu of these data, current use risks were calculated using the results of slag pile samples collected at 3 to 5 foot depths. As discussed in Section 3.3.1, this assumption is assumed to be conservative because maximum concentrations of most soil COPC were detected in slag pile samples collected at 5 foot depths. The sample size (N=6) supporting current use EPC calculations represents another source of uncertainty in that statistical estimators are less reliable. However, despite these uncertainties, the data are considered sufficient for the risk assessment given the apparent homogeneity of slag pile soils and, in particular, the conservative assumptions used to estimate exposures/risks. Typically, small sample sizes result in larger variance and positively-biased (i.e., conservative) point estimators (e.g., mean).

EPCs for soil inhalation pathways are also conservative, because these scenarios assume resuspension of slag pile soils at levels equivalent to the local PM_{10} concentration. However, the debris and large grain size of material comprising the surface of the slag pile would likely limit significant resuspension. This assumption was verified during a recent site visit when, despite high winds, dust from slag pile soils was not evident in the air.

3.4.2 Human Exposure Parameter Estimation

Numerous uncertainties surround the determination of exposure parameters because behavior patterns of individuals are not well known. For example, this risk assessment assumes that trespassers walk on and/or play near the slag pile. There is no direct evidence supporting the validity of this assumption, but it (trespassing) is possible. Assumptions regarding the activity patterns of on-site workers (the security guard and occasional metal scavenger) have similar limitations. Also, body weights, breathing rates, soil ingestion rates, and dermal contact rates are likely to vary depending on the actual characteristics of the population exposed. In this evaluation, reasonable maximum ingestion rates and breathing rates were assumed, in accordance with EPA guidance (USEPA, 1989a).

4.0 TOXICITY ASSESSMENT

For risk assessment purposes, COPCs are separated into two categories of chemical toxicity: carcinogenic and noncarcinogenic effects. This distinction assumes the biological mechanism of action for each category is different, as defined below. Tables 4-1 and 4-2 list toxicity values developed for noncarcinogenic and carcinogenic COPC, respectively. These values were combined with CDIs, defined in Section 5.2, to calculate risks (Section 5.4).

4.1 TOXICITY INFORMATION FOR NONCARCINOGENIC EFFECTS

For chemicals exhibiting noncarcinogenic effects, exposed organisms are assumed to have protective mechanisms which must be overcome before the toxic endpoint is manifested. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without appreciable risk of causing an adverse effect (USEPA, 1989a).

Health criteria for chemicals exhibiting noncarcinogenic effects are generally developed using risk reference doses (RfDs). The RfD, expressed in units of mg/kg/day, is an estimate of the daily exposure that a human population (including sensitive subpopulations) can sustain that is not likely to present an unacceptable risk of deleterious effects during a lifetime (USEPA, 1989a). RfDs are generally developed by the EPA RfD Work Group. Alternative sources include Health Effects Assessments (HEAs) and/or Office of Drinking Water criteria documents which support health-based drinking water standards. These values are usually derived from animal studies and, in some cases, from human studies involving occupational exposures. These experimental or epidemiological data are then adjusted using a range of uncertainty factors. The RfDs thereby provide a benchmark to which chemical intakes by other routes (e.g., via exposure to environmental media) may be compared.

RfDs developed for noncarcinogenic effects of COPC are listed in Table 4-1.

4.2 TOXICITY INFORMATION FOR CARCINOGENIC EFFECTS

In assessing risks associated with potential carcinogens, EPA has adopted the position that a small number of molecular events can cause changes in a single cell or a small number of cells that can lead to tumor formation. This is described as a no-threshold mechanism because it is assumed that there is essentially no level of exposure (i.e., a threshold) to a carcinogen that will not result in some finite possibility of causing the disease. Evaluation of carcinogenic effects is a two-step process: weight-of-evidence determination and calculation of slope factors. These steps are described below.

4.2.1 Weight-of-Evidence Classifications

Weight-of-evidence classifications are assigned to account for the likelihood that an agent is a human carcinogen. Using this system, chemicals are classified as either Group A, Group B1, Group B2, Group C, Group D, or Group E. Group A chemicals (human carcinogens) are agents for which there

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
ORAL AND DERMAL EXPOSURE ROUTES							
Antimony	4.0E-04	Oral	2.0E-05	longevity, blood glucose and cholesterol	IRIS	Low	1000
Arsenic	3.0E-04	Oral	1.5E-05	hyperpigmentation, keratosis; possible vascular complications	IRIS	Medium	3
Barium	7.0E-02	Oral	3.5E-03	increased blood pressure	IRIS	Medium	3
Beryllium	5.0E-03	Oral	2.5E-04	none reported	IRIS	Low	100
Cadmium	5.0E-04	Oral (water)	2.5E-05	significant proteinuria	IRIS	High	10
Cadmium	1.0E-03	Oral (food)	2.5E-05	proteinuria	IRIS	High	10
Chromium III	1.0E+00[a], 1.0E+01[b]	Oral	5.0E-02[a], 5.0E-01[b]	none reported	IRIS	Low	100
Chromium VI	5.0E-03[a], 2.0E-02[b]	Oral	2.5E-04[a], 2.5E-03[b]	none reported	IRIS	Low	500
Copper /5/	3.7E-02	Oral	--	local gastrointestinal (GI) irritation	HEAST	--	--
Lead /6/	--	--	--	central nervous system (CNS) effects	See Note 6	--	--

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
Manganese	1.0E-01	Oral (total dietary intake)	5.0E-03	CNS effects	IRIS	Medium	1
Mercury	3.0E-04	Oral	1.5E-05	kidney effects	HEAST	--	1000
Nickel	2.0E-02	Oral (diet)	1.0E-03	decreased body and organ weights	IRIS	Medium	100
Selenium	5.0E-03	Oral	2.5E-04	clinical selenosis	IRIS	High	3
Zinc	2.0E-01	Oral	1.0E-02	anemia	HEAST	--	10
INHALATION EXPOSURE ROUTES /1/							
Antimony	ND	Inhalation	--	cancer, based on studies with antimony trioxide	--	--	--
Arsenic	ND	Inhalation	--	--	--	--	--
Barium	1.0E-04[a], 1.0E-03[b]	Inhalation	--	fetotoxicity	HEAST	--	1000
Beryllium	1.4E-06	Inhalation	--	--	CAPCOA	--	--
Cadmium	1.0E-03	Inhalation	--	cancer	CAPCOA	--	--
Chromium III	5.7E-07[a], 5.7E-06[b]	Inhalation	--	nasal mucosa atrophy	HEAST	--	300

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	RfD /1/ (mg/kg/day)	RfD Basis /1/	RfD Adjusted for Dermal Absorption /2/	Critical Effect	RfD Source /3/	RfD Confidence	Uncertainty Factors /4/
Copper	1.0E-02	Inhalation	--	--	CAPCOA	--	--
Lead /6/		Inhalation	--	CNS effects	See Note 6	--	--
Manganese	1.1E-04	Inhalation	--	increased prevalence of respiratory symptoms and psychomotor disturbances	IRIS	Medium	300
Mercury	8.6E-05	Inhalation		neurotoxicity	HEAST	--	30
Nickel	6.9E-05	Inhalation	--	cancer	CAPCOA	--	--
Selenium	1.0E-03	Inhalation	--	--	CAPCOA	--	--
Zinc	1.0E-02	Inhalation	--	--	CAPCOA	--	--

NOTES:

/1/ Unless otherwise noted, Reference Doses (RfDs) listed above represent both chronic and subchronic RfDs. Where toxicity criteria differ according to the length of the exposure period, RfD values are flagged as follows: [a] for chronic exposures and [b] for subchronic exposures.

A chronic RfD is an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure periods, generally 7 years to a lifetime (EPA, 1989a). Alternatively, subchronic RfDs are estimates of daily exposure levels that are likely to be without an appreciable risk of deleterious effects during a portion of a lifetime, generally 2 weeks to 7 years. In this evaluation, chronic RfDs were used to evaluate the current use worker exposure scenario. Alternatively, subchronic RfDs were used to evaluate current-use trespasser and hypothetical future-use construction worker scenarios. Oral RfDs are expressed as an administered dose in drinking water with an assumed absorption of 1.0.

TABLE 4-1
TOXICITY VALUES FOR POTENTIAL NONCARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

/2/ No RfDs are available for the dermal route of exposure. Where applicable, noncarcinogenic risks associated with dermal exposures were evaluated using an oral RfD adjusted for absorption. With the exception of cadmium and copper, RfDs for dermal exposures to metals were adjusted assuming 5% gastrointestinal absorption (per USEPA, 1986). Thus, oral RfDs (representing administered doses) were multiplied by 0.05 to derive a "surrogate" dermal RfD. The only exceptions are cadmium, for which the RfD for food assumes 2.5% absorption, and copper, for which extrapolation to dermal exposures is not appropriate given the localized nature of the toxic effect (gastrointestinal effects).

/3/ RfD sources include (in order of access) IRIS, HEAST and CAPCOA guidance. These sources are defined below.

IRIS = Integrated Risk Information System, accessed December 1991.
HEAST = Health Effects Summary Tables, FY-1991 Annual (EPA, 1991b)
CAPCOA = California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

/4/ Uncertainty values represent a statement of the confidence in the RfD value, the critical study and the supporting database. See HEAST (1991) for further information.

/5/ Because toxicity data for copper were considered inadequate to calculate an oral RfD (IRIS 1991), an RfD of 3.7 E-02 mg/kg/day was extrapolated from the 1.3 mg/l drinking water standard, assuming a 2 liter/day water ingestion rate and a body weight of 70 kg.

/6/ EPA has not developed an RfD value for lead. Therefore, health effects associated with potential exposures to lead were evaluated by estimating blood lead concentrations according to DTSC guidance (see Section 4.3; Appendix D). Based on this guidance, blood lead concentrations were calculated for ingestion, dermal contact and inhalation pathways. The total blood lead concentration was then compared to DTSC's blood lead concentration of concern, 10 ug/dl (DTSC, 1992, provided in Appendix D).

/7/ Inhalation RfDs were converted from corresponding reference concentrations (RfCs) by assuming a 70 kg individual breathes 20 m^3/day. When inhalation RfDs have not been developed for a COPC, noncancer inhalation risks were calculated using oral RfDs (e.g., for antimony and arsenic).

ND = Not Determined
--: Not available or not applicable.

is sufficient evidence to support the causal association between human exposures and cancer. Group B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1) or inadequate (B2) evidence of carcinogenicity from human studies, but for which there is sufficient evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in animals and no human data. Group D chemicals, not classified as to human carcinogenicity, are agents for which data are inadequate to evaluate either animal or human carcinogenicity. Group E chemicals (evidence of non-carcinogenicity in humans) are agents for which there is no evidence in adequate human or animal studies of carcinogenicity. In this analysis, chemicals with weight of evidence classifications A, B and C are considered carcinogens. Chemicals with unknown carcinogenicity (Class D) are treated as noncarcinogens.

4.2.2 Slope Factors

Based on the weight-of-evidence determinations described above, a slope factor is calculated that quantitatively defines the relationship between dose and response. This factor is expressed in units of $(mg/kg/day)^{-1}$. Slope factors are derived from the results of human epidemiological studies or, in many cases, chronic animal bioassays. These animal studies are usually conducted using relatively high doses to detect possible adverse effects. Because humans are expected to be exposed to lower doses than those used in animal studies, animal data are adjusted by using mathematical models and applying an inter-species scaling factor to derive a comparable low-dose slope factor for humans. Therefore, the use of these slope factors typically results in an upper-bound estimate of the probability of an individual developing cancer (as a result of exposure to a given level of a potential carcinogen). Whereas the actual risks are not likely to be higher than estimated risks, they could be considerably lower.

Table 4-2 lists slope factors and related toxicity information developed for each carcinogenic COPC evaluated.

4.3 CHEMICALS FOR WHICH NO TOXICITY VALUES ARE AVAILABLE

Given the lack of toxicity factors for lead, which is still under review by EPA, risks associated with exposures to lead were evaluated using California EPA's Department of Toxic Substances Control (DTSC) guidance entitled Assessment of Health Risks from Inorganic Lead in Soil (DTSC, 1992). Using this guidance, included in Appendix D, estimated blood lead concentrations were calculated for ingestion, dermal contact and inhalation pathways. The total blood lead concentration was then compared to DTSC's blood lead concentration of concern, 10 ug/dl (DTSC, 1992; see Appendix D).

No RfDs are available for the dermal route of exposure. Where applicable, noncarcinogenic risks associated with dermal exposures were evaluated using an oral RfD adjusted for absorption. With the exception of cadmium and copper, RfDs for dermal exposures to metals were adjusted assuming 5% gastrointestinal absorption (per USEPA, 1986). Thus, oral RfDs (representing administered doses) were multiplied by 0.05 to derive a "surrogate" dermal RfD. The only exceptions are cadmium, for which the RfD for food assumes 2.5% absorption, and copper, for which extrapolation to dermal exposures is not appropriate given the localized nature of the toxic effect (gastrointestinal effects).

TABLE 4-2
TOXICITY VALUES FOR POTENTIAL CARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

CHEMICAL	Slope Factor/1/ $(mg/kg/day)^{-1}$	Slope Factor Adjusted for Dermal Absorption /2/	Weight of Evidence Classification /3/	Species	Type of Cancer (Tumor Site)	Slope Factor Source /4/
ORAL AND DERMAL EXPOSURE ROUTES						
Arsenic	1.5E+00	3.0E+01	A	human	skin	HEAST
Beryllium	4.3E+00	8.6E+01	B2	rat	gross tumors, all sites combined	IRIS
INHALATION EXPOSURE ROUTES /5/						
Arsenic	1.15E+01	--	A	human	lung	CAPCOA
Beryllium	8.40E+00	--	B2	human	lung	CAPCOA
Cadmium	1.47E+01	--	B1	human	lung, trachea, bronchus	CAPCOA

NOTES:

/1/ The slope factor is an upper bound estimate of the probability of a carcinogenic response per unit intake of a chemical over a 70-year lifetime.

/2/ No slope factors are available for the dermal route of exposure. Where applicable, (noncarcinogenic) risks associated with dermal exposures were evaluated using an oral slope factor adjusted for absorption. For metals, this adjustment conservatively assumed 5% gastrointestinal absorption of metal compounds. Thus, oral slope factors for metal COPC (representing administered doses) were divided by 0.05 to derive a "surrogate" dermal slope factor.

TABLE 4-2
TOXICITY VALUES FOR POTENTIAL CARCINOGENIC EFFECTS
H. KRAMER & COMPANY SITE

/3/ The weight-of evidence classification characterizes the extent to which available data indicate that an agent is a human carcinogen. These classifications are defined as follows:

A - Human carcinogen
B - Probable human carcinogen, sufficient evidence in animals but inadequate evidence in humans
C - Possible human carcinogen

/4/ Slope factor sources include IRIS, HEAST and CAPCOA guidance, defined below.

IRIS = Integrated Risk Information System, accessed December 1991.
HEAST = Health Effects Summary Tables, FY-1991 Annual (EPA, 1991b)
CAPCOA = California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

/5/ Inhalation slope factors were converted from corresponding inhalation unit risks (in ug/m^3) by assuming a 70 kg individual breathes 20 m^3/day. Inhalation slope factors are not listed for volatile organic compounds (1,1-dichloroethene, PCE and TCE) because these constituents were not evaluated for inhalation exposures.

ND = Not Determined
--: Not available or not applicable.

4.4 UNCERTAINTIES RELATED TO TOXICITY INFORMATION

A number of uncertainties surround the use of slope factors, which serve as the basis for calculating estimated cancer risks. For example, the dose-response relationship is assumed to be the same for both test animal and humans. Additionally, these factors represent upper bound (95% upper confidence limit) estimates of potency. That is, if an individual's exposure to a constituent is equivalent to that level which defines the potency, there is only a 5% chance that the actual risk to that individual will exceed the calculated risk, where as there is a 95% chance that the risk is at or below the calculated level. Thus, the actual risks associated with exposures to a potential carcinogen are not likely to exceed the risk estimated using these upper bound slope factors, but may be lower.

5.0 RISK CHARACTERIZATION

This section describes the mathematical methods used to calculate pathway-specific cancer and noncancer risks (Section 5.1). Section 5.2 presents the results of the risk assessment; uncertainties inherent in the risk assessment process are discussed in Section 5.3.

5.1 RISK CALCULATION METHODOLOGY

5.1.1 Risk Calculations for Carcinogens

Excess cancer risks associated with exposures to known or potentially carcinogenic COPC are calculated by multiplying the slope factor (SF) by the estimated average lifetime dose, or CDI. "Excess" cancer risks are risks in excess of the normal cancer "burden" in a population and represent the upper bound probability that an individual exposed to a given level of contaminant over a lifetime will develop cancer as a result of those exposures. A 10^{-6} upper bound excess lifetime cancer risk, for example, is a one in a million increase in the probability that an exposed individual would develop cancer.

In equation form, risk is defined:

$$\textbf{Risk} = (\textbf{SF}) * (\textbf{CDI})$$

where: Risk=
a unitless probability of an individual developing cancer attributable to the assumed exposure scenario
SF = slope factor, expressed in $(mg/kg/day)^{-1}$
CDI = chronic daily intake averaged over 70 years (mg/kg/day)

However, the linear equation defined above is valid only at low risk levels (i.e., below estimated risks of 0.01). Because risks calculated for hypothetical groundwater ingestion exposures exceeded 10^{-2} (see Section 5.2.5; Table 5-5), an alternate calculation equation was used for these pathway calculations. This "one-hit" equation, which is consistent with the linear low-dose model given above, is defined as follows:

$$\textbf{Risk} = 1 - \exp(-\textbf{CDI} * \textbf{SF})$$

where "exp" is the exponential.

5.1.2 Risk Calculations for Noncarcinogens

Risks associated with chemicals exhibiting noncarcinogenic effects are generally developed using RfDs (and/or HEAs; Section 5.3). These criteria are estimates of the daily chemical exposures which present an acceptably low risk of adverse effects to an individual over a specified exposure duration. In the absence of any information on the specific chemical mixture in question, the mixture is assessed by means of a hazard index (**HI**).

The HI is defined as the sum of the ratios of the CDI to the RfD for each non-carcinogenic chemical where:

$$\mathbf{HI = CDI_1 / RfD_1 + CDI_2 / RfD_2 + \ldots CDI_i / RfD_i}$$

CDI_i = Chronic daily intake for the ith chemical in mg/kg/day
RfD_i = Chronic reference dose for the ith chemical in mg/kg/day

Any single chemical with an exposure level greater than the reference level would cause the hazard index to exceed unity, indicating concern for potential health risks. For multiple chemical exposures, the hazard index can exceed the 1.0 target criterion even if no single chemical exceeds its corresponding reference dose (RfD). However, the assumption of additivity reflected in the hazard index equation is most properly applied to compounds that induce the same effect by the same mechanism. Consequently, applying this equation to a mixture of compounds that are not expected to induce the same type of effects could overestimate the potential for adverse health impacts. If the hazard index exceeds unity, compounds driving the noncarcinogenic risks are segregated according to their critical toxic effects.

5.2 RESULTS OF THE RISK ASSESSMENT

Tables 5-1 through 5-4 present results of the risk calculations performed for the risk assessment. Each table presents the results of the bounded analyses, using median and upper bound exposure point concentration (EPCs), and identifies the major chemical(s) accounting for calculated risks. Corresponding chemical-specific results and calculations are included in Appendix E.

The context within which to judge the relative risk from each of the pathways has been established by the EPA for the Federal Superfund Program (NCP, 1990). For carcinogens, the target risk range is a 10^{-6} to 10^{-4} incremental cancer risk. For noncarcinogens, where the sum of expected dose/RfD ratios exceeds unity (1.0, expressed in scientific notation as 1.0E+00), assumed exposures may present a health hazard and therefore warrant further evaluation.

5.2.1 Current Use Adult Worker Scenarios

Exposures to Carcinogens

Table 5-1 summarizes risks calculated for exposures to carcinogenic COPC for current use adult worker scenarios. Total risks calculated using median and upper bound (95% UCL) EPCs were 1.6×10^{-4} and 5.4×10^{-4}, respectively. Dermal contact exposures to beryllium accounted for the majority of these risks, both of which exceeded EPA's target risk range (10^{-6} to 10^{-4}). These results should be viewed in light of the conservative assumptions used to calculate these risks, discussed below.

In accordance with EPA guidance, the oral slope factor for beryllium (and other compounds) was adjusted (upward) for absorption to evaluate dermal exposures. A 1% dermal absorption rate was then assumed using the adjusted slope factor (see Table 4-2). However, there is major uncertainty surrounding the dermal toxicity (if any) of beryllium compounds because beryllium is considered to be very poorly absorbed. Also, the oral slope factor was derived from a study using beryllium sulfate which had only

TABLE 5-1
CANCER AND NONCANCER RISKS DETERMINED FOR
CURRENT USE ADULT WORKER SCENARIOS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	1.9E-05	Beryllium	6.4E-05	Beryllium
Dermal Contact	1.4E-04	Beryllium	4.7E-04	Beryllium
Inhalation	8.6E-07	Beryllium	2.7E-06	Beryllium
TOTAL CANCER RISKS, ALL PATHWAYS:	1.6E-04*	Beryllium (dermal contact)	5.4E-04*	Beryllium (dermal contact)

**Both risks exceed EPA's target risk range (10^{-6} to 10^{-4}).*

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	9.8E-02	Zinc, copper	4.5E-01	Copper
Dermal Contact	2.7E-02	Zinc	8.3E-02	Zinc, antimony, manganese
Inhalation	3.3E-01	Beryllium, chromium-III	1.7E+00	Manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	4.6E-01	Beryllium, chromium (inhalation)	2.2E+00*	Manganese (inhalation)

**The upper bound Hazard Index exceeds EPA's target criterion of 1.0.*

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets AD_ING1.WR1, AD_DC1.WR1 and AD_INH1.WR1).

/2/ Source Files: AD_ING2.WR1, AD_DC2.WR1 and AD_INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.51 ug/dl (using median EPC) and 1.01 ud/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

one non-zero dose group and did not indicate a significant increase in tumorigenic response (IRIS, 1991). Finally, the beryllium concentrations used to calculate risks (48.0 ppm and 164.1 ppm for median and upper bound, respectively) are both within the range of (national) soil background concentrations reported in the literature, 3-200 ppm (Kabata-Pendias and Pendias, 1984).

Exposures to Noncarcinogens

Table 5-1 also summarizes noncancer hazard indices (HIs) calculated for current use worker exposures to COPC. Hazard indices calculated using median and upper bound (95% UCL) EPCs were 0.46 and 2.2, respectively. The upper bound HI exceeds EPA's target criterion of 1.0. Inhalation exposures to manganese accounted for the most of the upper bound noncancer risk. [Note: The manganese concentration used to calculate this risk, 25,000 ppm, reflected an "outlier" value of 41,000 ppm; the remaining five soil samples ranged from 696-2200 ppm.]

5.2.2 Current Use Trespasser Scenarios

Exposures to Carcinogens

Table 5-2 summarizes risks calculated for exposures to carcinogenic COPC for current use trespasser scenarios. Total risks calculated using median and upper bound EPCs were 2.7×10^{-5} and 8.9×10^{-5}, respectively. Both risks are within EPA's target risk range (10^{-6} to 10^{-4}). As determined for the current use worker exposure pathways, exposures to beryllium accounted for the majority of calculated risks. The conservative assumptions applied in estimating beryllium exposures/toxicity, discussed above for the on-site worker exposure scenario, also apply here.

Exposures to Noncarcinogens

Hazard indices calculated for current use trespasser exposures were 0.2 and 0.94 using median and upper bound soil EPCs, respectively (Table 5-2). Both HIs are less than the EPA target HI criterion of 1.0. Exposures to copper and zinc via soil ingestion exposures accounted for most of the HI values.

5.2.3 Future Use Construction Worker Scenarios: Area 1 Receptor Locations

Exposures to Carcinogens

Table 5-3 summarizes risks calculated for construction worker exposures to soils in Area 1, the slag pile area. Risks calculated using median and upper bound soil EPCs were 3.8×10^{-6} and 1.2×10^{-4}, respectively. The upper bound risk exceeds EPA's target risk range (10^{-6} to 10^{-4}). For both (median and upper bound) scenarios, arsenic accounted for the majority of calculated risks.

Exposures to Noncarcinogens

Table 5-3 summarizes noncancer risks associated with Area 1 construction worker exposures. Hazard indices (HIs) calculated using median and upper bound soil EPC were 0.61 and 18.0, respectively. The upper bound HI exceeds the EPA's target HI criterion of 1.0. Arsenic accounted for most of the total HI values using both sets of exposure point concentrations.

TABLE 5-2
CANCER AND NONCANCER RISKS DETERMINED FOR
CURRENT USE TRESPASSER SCENARIOS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	6.8E-06	Beryllium	2.2E-05	Beryllium
Dermal Contact	2.0E-05	Beryllium	6.7E-05	Beryllium
Inhalation	1.1E-08	Beryllium	3.3E-08	Beryllium
TOTAL CANCER RISKS, ALL PATHWAYS:	2.7E-05	Beryllium (dermal contact)	8.9E-05	Beryllium (dermal contact)

Both risks are within EPA's target risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	1.7E-01	Zinc, copper	7.9E-01	Copper
Dermal Contact	1.9E-02	Zinc	5.9E-02	Zinc, antimony, manganese
Inhalation	1.4E-02	Beryllium, manganese	9.0E-02	Beryllium, manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	2.0E-01	Zinc, copper (soil ingestion)	9.4E-01	Copper (soil ingestion)

Both Hazard Indices are below EPA's target criterion of 1.0.

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets TRES_ING1.WR1, TRES_DC1.WR1 and TRES_INH1.WR1).

/2/ Source Files: TRES_ING2.WR1, TRES_DC2.WR1 and TRES_INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 1.71 ug/dl (using median EPC) and 3.27 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

TABLE 5-3
CANCER AND NONCANCER RISKS DETERMINED FOR FUTURE USE
CONSTRUCTION WORKER SCENARIOS: AREA 1 RECEPTOR LOCATIONS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	2.1E-06	Arsenic	6.8E-05	Arsenic
Dermal Contact	1.6E-06	Arsenic	5.2E-05	Arsenic
Inhalation	1.1E-07	Arsenic	3.4E-06	Arsenic
TOTAL CANCER RISKS, ALL PATHWAYS:	3.8E-06	Arsenic (soil ingestion)	1.2E-04*	Arsenic (soil ingestion)

**The upper bound risk exceeds EPA's target risk range (10^{-6} to 10^{-4}).*

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	4.2E-01	Arsenic	1.4E+01	Arsenic, antimony
Dermal Contact	1.5E-02	Arsenic	5.0E-01	Arsenic, antimony
Inhalation	1.8E-01	Manganese, chromium-III	3.3E+00	Manganese, beryllium
TOTAL HAZARD INDEX, ALL PATHWAYS:	6.1E-01	Arsenic (soil ingestion)	1.8E+01*	Arsenic, antimony (soil ingestion)

**The upper bound Hazard Index exceeds EPA's target criterion of 1.0.*

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets CWA1ING1.WR1, CWA1_DC1.WR1 and CWA1INH1.WR1).

/2/ Source Files: CWA1ING2.WR1, CWA1_DC2.WR1 and CWA1INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.48 ug/dl (using median EPC) and 4.86 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

5.2.4 Future Use Construction Worker Scenarios: Area 2 Receptor Locations

Exposures to Carcinogens

Table 5-4 summarizes risks calculated for future use construction worker exposures to carcinogenic COPC in Area 2 locations, the western portion of the site. Risks calculated using median and upper bound soil concentrations were 3.0×10^{-7} and 8.5×10^{-6}, respectively. Both risks are within EPA's target risk range (10^{-6} to 10^{-4}), and are more than an order of magnitude lower than risks calculated for Area 1 exposures (3.8×10^{-6} and 1.2×10^{-4}). Exposures to arsenic accounted for the majority of calculated risks.

Exposures to Noncarcinogens

Median and upper bound HIs calculated for Area 2 construction worker exposures were 0.073 and 0.93, respectively (Table 5-4). Both HIs are less than EPA's target HI criterion of 1.0 and significantly lower than the HIs calculated for Area 1 exposures (0.61 and 18.0). Exposures to trivalent chromium and manganese accounted for the majority of these HI values.

5.3 IDENTIFICATION OF UNCERTAINTIES

Risk assessment is an inexact but essential methodology used to characterize and evaluate potential exposures to chemicals. The lack of explicitly relevant toxicity and exposure data, the uncertainty in chemical measurements in both the environment and the laboratory, coupled with the need to extrapolate experimental end-points to assumed human exposures and potential responses make precise quantification of risk difficult. For example, the assumptions used to calculate exposure rates and quantify potential health risks, described in Tables 3-2 through 3-7, are by nature imprecise (given variations in human behavior and physical characteristics). Specific uncertainties relating to chemical concentration and human exposure estimates, discussed in previous sections, also apply to the risk characterization.

Other uncertainties which were evaluated were the future site use; potential use of groundwater from the upper aquifer; and the potential for deeper aquifer contamination. Any uncertainty about future use has been reduced by utility and infrastructure development over the site (i.e., rail and transmission lines), thus limiting use to manufacturing, parking, etc. As far as hydrogeology is concerned, there are uncertainties about groundwater flow rate and direction in the upper aquifer, and site-specific detail on stratigraphy; the volume of regionally contaminated waters contained in the uppermost water-bearing zones; and how much additional contaminant input could derive from Area I of the site during rainfall events.

TABLE 5-4
CANCER AND NONCANCER RISKS DETERMINED FOR
FUTURE USE CONSTRUCTION WORKER SCENARIOS: AREA 2 RECEPTOR LOCATIONS
H. KRAMER & COMPANY SITE

CANCER RISKS				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Excess Cancer Risk	Chemicals Contributing Most to Risk	Excess Cancer Risk	Chemicals Contributing Most to Risk
Soil Ingestion	1.6E-07	Arsenic	4.6E-06	Arsenic
Dermal Contact	1.3E-07	Arsenic	3.6E-06	Arsenic
Inhalation	8.2E-09	Arsenic	2.7E-07	Arsenic
TOTAL CANCER RISKS, ALL PATHWAYS:	3.0E-07	Arsenic (soil ingestion)	8.5E-06	Arsenic (soil ingestion)

Risks are within or below EPA's target risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES /3/				
	MEDIAN SOIL EPC /1/		95% UPPER UCL OF MEAN SOIL EPC /2/	
EXPOSURE PATHWAY	Hazard Index	Chemicals Contributing Most to Hazard Index	Hazard Index	Chemicals Contributing Most to Hazard Index
Soil Ingestion	3.0E-02	Arsenic	7.9E-01	Arsenic
Dermal Contact	1.1E-03	Arsenic	3.0E-02	Arsenic
Inhalation	4.2E-02	Chromium-III	1.1E-01	Chromium, manganese
TOTAL HAZARD INDEX, ALL PATHWAYS:	7.3E-02	Chromium-III (inhalation)	9.3E-01	Chromium, manganese (inhalation)

Both Hazard Indices are below EPA's target criterion of 1.0.

NOTES:

/1/ See Appendix E for detailed chemical-specific risk calculations (worksheets CWA2ING1.WR1, CWA2_DC1.WR1 and CWA2INH1.WR1).

/2/ Source Files: CWA2ING2.WR1, CWA2_DC2.WR1 and CWA2INH2.WR1 (Appendix E).

/3/ For reasons described in Section 4.3, lead was not included in the hazard index calculations summarized above. Instead, estimated blood lead levels were calculated according to DTSC guidance (Appendix D). The total estimated blood levels calculated for ingestion, direct contact and inhalation exposures, 0.008 ug/dl (using median EPC) and 0.063 ug/dl (using 95% UCL EPC), are less than the DTSC blood level of concern, 10 ug/dl (See Appendix E worksheets cited above).

6.0 CONCLUSIONS OF THE HUMAN HEALTH RISK ASSESSMENT

Results of the quantitative risk assessment developed for the H. Kramer site are summarized in Table 6-1. As shown in this table, two sets of exposure point concentrations were used to calculate risks for each pathway -- a median concentration (considered the most representative estimate) and the upper 95% confidence limit of the mean concentration (considered an upper bound value). Based on these quantitative results, and other findings discussed in this report, major conclusions of the human health risk assessment developed for the site are as follows:

- Total cancer risks calculated for current use worker exposures to slag pile soils exceeded EPA's target risk range (10^{-6} to 10^{-4}). Median and upper bound noncancer hazard indices were 0.46 and 2.2; the upper bound value exceeds EPA's target criterion of 1.0. These results should be viewed in light of the conservative assumptions employed and the uncertainty surrounding the toxicity of beryllium, which accounted for the majority of the cancer and noncancer risks calculated for this pathway. Nonetheless, prevention of exposures to slag pile soils would be a recommended course of action.

- Cancer and noncancer risks calculated for current use trespasser exposure scenarios were within or less than corresponding EPA target criteria.

- Cancer and noncancer risks calculated for hypothetical future construction worker exposures to soils located within or near the slag pile (Area 1) exceeded target risk criteria when upper bound soil concentrations were assumed. Risks calculated using median concentrations were within or below EPA target risk criteria.

- Cancer and noncancer risks calculated for future use construction worker exposures to soils in the western portion of the site (Area 2) were within or less than corresponding EPA target criteria. These Area 2 results indicate that the western paved portion of the site does not require remediation, given the assumed conditions of exposure.

- Groundwater under the site contains COPCs sufficiently in excess of MCLs that it was apparent that EPA drinking water risk ranges would be exceeded. Therefore, quantitative risk assessment was considered to be redundant. However, groundwater in the Old Dune Sand and Gage aquifers beneath the site is not used as a potable water source or for irrigation purposes due to salinity problems; regional contamination; and production capacity. These conditions are not expected to change in the future. Also, groundwater in these aquifers appears to be hydrologically isolated from deeper (potable) groundwater production aquifers (e.g., the Silverado) as a result of fine-grain silt and clay aquitards. As a practical matter then, quantitative risk analysis for groundwater pathway scenarios was not included herein.

These results of the cancer and non-cancer risk evaluation are considered conservative given use of conservative estimates of exposure scenarios and contaminant doses, especially where data relevant to some scenarios needed to be extrapolated from sources other than on-site characterization, and future uses are undefined.

TABLE 6-1
SUMMARY OF RISK ASSESSMENT RESULTS
H. KRAMER & COMPANY SITE

	TOTAL EXCESS CANCER RISKS[1]		
EXPOSURE PATHWAY	Calculated Using Median Exposure Point Concentration	Calculated Using Upper Bound (95% UCL) Concentration	CHEMICALS CONTRIBUTING MOST TO TOTAL CANCER RISK
Current Use Receptors			
On-site Worker Exposure to Soils	1.6×10^{-4}	5.4×10^{-4}	Beryllium (dermal contact)
Child Trespasser Exposure to Soils	2.7×10^{-5}	8.9×10^{-5}	Beryllium (dermal contact)
Future Use Receptors			
Construction Scenario: Area 1 Soils	3.8×10^{-6}	1.2×10^{-4}	Arsenic (soil ingestion)
Construction Scenario: Area 2 Soils	3.0×10^{-7}	8.5×10^{-6}	Arsenic (soil ingestion)
EPA CRITERION OF ACCEPTABLE RISK:	**10^{-6} to 10^{-4}** *(Shaded values exceed EPA's target risk range)*		--

	NONCANCER HAZARD INDICES (HIs)[1]		
EXPOSURE PATHWAY	Calculated Using Median Exposure Point Concentration	Calculated Using Upper Bound (95% UCL) Concentration	CHEMICALS CONTRIBUTING MOST TO HAZARD INDEX
Current Use Receptors			
On-site Worker Exposure to Soils	0.46	2.2	Beryllium, chromium (median); manganese (upper bound)
Child Trespasser Exposure to Soils	0.20	0.94	Zinc, copper (soil ingestion)
Future Use Receptors			
Construction Scenario: Area 1 Soils	0.61	18.0	Arsenic, antimony (soil ingestion)
Construction Scenario: Area 2 Soils	0.073	0.93	Chromium, manganese (inhalation)
EPA TARGET HI CRITERION:	**1.0** *(Shaded values exceed HI criterion)*		

[1]Total cancer and noncancer risks are sum of ingestion, dermal contact and inhalation pathways. Total blood lead levels calculated for all exposure scenarios were less than DTSC's level of concern, 10 ug/l.

7.0 REFERENCES

Bookman-Edmonston Engineering Inc., 1991. Annual Report on Results of Water Quality Monitoring Water Year 1989-1990. Prepared for Central and West Basin Water Replenishment District, April 1991.

California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). 1992. Assessment of Health Risks from Inorganic Lead in Soil. IN: Draft Guidance for Site Characterization and Multimedia Risk Assessment for Hazardous Substances Release Sites (Volume 6, Chapter 5). DTSC Review Draft, January 1992.

California Air Pollution Control Officers Association (CAPCOA). January 1991. Air Toxics "Hot Spots" Program Risk Assessment Guidelines. AB 2588 Risk Assessment Committee, January 1991.

Ebasco Services Inc. (EBASCO). 1986. PJP Landfill Site Monitoring Program. Report to New Jersey Department of Environmental Protection (NJDEP).

ENSR Consulting and Engineering. 1991. Site Characterization Report for the H. Kramer & Company Facility, El Segundo, California.

Kabata-Pendias, A. and H. Pendias. 1984. Trace Elements in Soils and Plants. CRC Press, Boca Raton, Florida.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 1990. Final Rule. 300.430(e)[2](i)[A][2], March 1990.

Radian Corporation. 1986. Site Investigation for the Chevron U.S.A. Inc. Section 18 Property.

Radian Corporation. 1987. Hydrogeological Assessment Report for Surface Impoundments at the El Segundo Refinery of Chevron U.S.A., Inc. December 1987.

Schaum, J.L. 1984. Risk Analysis of TCDD Contaminated Soil. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency. EPA/600/8-84/031.

South Coast Air Quality Management District (SCAQMD). 1988. Multi-Pathway Health Risk Assessment Input Parameters Guidance Document. June, 1988.

U.S. Environmental Protection Agency (USEPA). 1985. Development of Statistical Distributions or Ranges of Standard Factors Used in Exposure Assessments. Office of Health and Environmental Assessment, Washington, D.C.

USEPA. 1989a. Risk Assessment Guidance for Superfund. Volumes I and II. Interim Final. December, 1989.

USEPA. 1989b. Exposure Factors Handbook. Exposure Assessment Group, Office to Health and Environmental Assessment. Washington, D.C. May 1989. EPA/600/8-89/043.

USEPA. 1991a. Risk Assessment Guidance for Superfund - Volume I: Human Health Evaluation Manual, Supplemental Guidance, "Standard Default Exposure Factors," Interim Final.

USEPA. 1991a. Health Effects Summary Tables. FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response. Washington, D.C. January 1991.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 1990. Final Rule. 300.430(e)[2](i)[A][2], March 1990.

APPENDIX A

SITE CHARACTERIZATION ANALYTICAL RESULTS (ENSR, 1990)

TABLE 6.1

RESULTS OF LABORATORY ANALYSES

Sample Totals WET	Sb mg/kg mg/L	As mg/kg mg/L	Ba mg/kg mg/L	Be mg/kg mg/L	Cd mg/kg mg/L	Cr mg/kg mg/L	Cr HEX mg/kg mg/L	Co mg/kg mg/L	Cu mg/kg mg/L	Pb mg/kg mg/L	Hg mg/kg mg/L	Mo mg/kg mg/L	Ni mg/kg mg/L	Se mg/kg mg/L	Ag mg/kg mg/L	Tl mg/kg mg/L	V mg/kg mg/L	Zn mg/kg mg/L	Al mg/kg mg/L	Fe mg/kg mg/L	Mn mg/kg mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB1A-5(Total)	ND<100.0	16	310	230	6	37	ND<1.0	28	12000	2500	0.18	33	310	ND<0.1	ND<5.0	ND<1.0	27	65000	18000	31000	41000
SB1A-5(WET)	4.4	0.53	8	6.1	0.4	1	ND<0.05	0.8	[illegible]	130	ND<0.005	1.1	4.3	0.03	ND<0.2	ND<0.3	0.6	3400	530	1400	140
SB1B-15(Total)	ND<1.0	2100	45	0.3	ND<0.05	5.5	ND<1.0	4.7	15	2.6	0.15	0.07	5.3	ND<0.1	ND<0.05	ND<1.0	13	24	7400	9700	380
SB1B-15(WET)		370																			
SB1B-20(Total)		65																			
SB1B-25(Total)		1.4																			
SB1B-30(Total)	ND<1.0	2.5	15	0.13	0.16	5	ND<1.0	1.5	6.1	1.1	0.08	0.18	4.9	0.5	ND<0.05	ND<1	8.8	13	2000	4900	52
SB2-5(Total)	ND<1.0	3.7	68	47	2.2	8.2	1.21	6.3	3300	700	0.16	11	280	1.1	0.72	ND<1.0	3.6	30000	9600	19000	1200
SB2-5(WET)	3.3	0.53	9	6.3	0.4	0.7	ND<0.05	0.6	16	[illegible]	ND<0.005	2.6	11	ND<0.01	ND<0.2	ND<0.3	ND<0.2	3100	810	1100	93
SB2-16(Total	5	200	21	18	0.78	13	ND<1.0	5	1700	420	0.04	6.3	39	1.4	0.25	ND<1.0	4.1	20000	4400	19000	400
SB2-16(WET)		130							ND<0.50	6.1								2500			
SB3-5(Total)	ND<5.0	3.1	501	106	29.5	19.3	ND<1.0	17	3000	2450	0.36	24.4	116	2	1.9	ND<1.0	17.5	76000	10600	22100	1430
SB3-5(WET)	0.76	ND<0.50	14.4	3.9	4.1	0.72	ND<0.05	0.57	101	250	ND<0.005	0.84	2.4	ND<1.0	ND<0.05	ND<10.0	0.26	6830	189	623	44.8
SB3-15(Total)	102	1000	74.3	0.22	ND<0.49	7.9	ND<1	10.6	22	5.2	0.03	ND<1.9	4.6	0.9	0.97	ND<1.0	13.8	61	2910	5630	1110
SB3-15(WET)	8.9	152	4	ND<0.01	ND<0.05	0.23	ND<0.05	0.61	0.099	ND<0.25	ND<0.005	ND<0.1	ND<0.2	ND<1.0	ND<0.05	ND<10.0	0.64	4.1	32.3	160	47.1
SB3-20(Total)	ND<4.9	2800	25.6	ND<0.2	ND<0.49	6.7	ND<1.0	2.8	36.2	5.5	ND<0.02	ND<2.0	6.5	ND<0.1	ND<0.98	ND<1.0	12.9	75.6	3420	6010	104
SB3-20(WET)		12																			
SB3-25(Total)		3.8																			
SB3-30(Total)	ND<5.0	14	23.1	ND<0.2	ND<0.5	4.7	ND<1.0	1.4	13.8	5.6	0.03	ND<2.0	4.6	0.1	ND<1.0	ND<1.0	6.3	56.8	2120	3380	78.7
SB3-30(WET)	0.9	ND<0.50	2.3	ND<0.010	ND<0.025	0.1	ND<0.05	0.09	0.73	0.63	ND<0.005	ND<0.10	ND<0.20	ND<1.0	ND<0.050	ND<10.0	0.15	9.2	10.2	14	5.2

TABLE 6.1 (continued page 2)

RESULTS OF LABORATORY ANALYSES

Sample Totals WET	Sb mg/kg mg/L	As mg/kg mg/L	Ba mg/kg mg/L	Be mg/kg mg/L	Cd mg/kg mg/L	Cr mg/kg mg/L	Cr HEX mg/kg mg/L	Co mg/kg mg/L	Cu mg/kg mg/L	Pb mg/kg mg/L	Hg mg/kg mg/L	Mo mg/kg mg/L	Ni mg/kg mg/L	Se mg/kg mg/L	Ag mg/kg mg/L	Tl mg/kg mg/L	V mg/kg mg/L	Zn mg/kg mg/L	Al mg/kg mg/L	Fe mg/kg mg/L	Mn mg/kg mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB4-10(Total)	ND<10.7	5.1	155	53.6	6.5	74.6	ND<1.0	13.1	4860	1310	0.09	15.9	120	1.3	1.8	ND<1.0	15.2	39500	10300	19000	1480
SB4-10(WET)	1.3	ND<0.5	4.9	3.7	0.72	1.7	ND<0.05	0.75	142	53.8	0.005	1.3	2.9	2.7	ND<0.05	ND<10	0.44	2740	315	903	98.2
SB4-15(Total)	196	11	36.7	ND<0.20	ND<0.49	4.8	ND<1.0	1.7	21.4	ND<4.9	0.04	ND<2.0	ND<3.9	17	ND<0.98	ND<1.0	7.1	36.9	2200	4260	93.6
SB4-15(WET)	41.													0.02							
SB4-30(Total)	180	61	23	0.16	0.09	5	ND<1.0	1.4	6.5	1.0	0.04	0.7	5.3	19	ND<0.05	ND<1.0	7.1	9.4	4500	5300	77
SB4-30(WET)	36.	8.1												0.13							
SB5-5(Total)	ND<11.8	2.8	129	49	5.4	19.5	ND<1.0	13.2	4190	1100	0.09	18.3	116	1	3.3	ND<1.0	13.5	38200	9260	16800	1720
SB5-5(WET)	3.3	ND<0.5	4	2.4	1.7	1.1	ND<0.05	0.68	184	37.4	ND<0.005	1.5	3.7	ND<1	ND<0.05	ND<10	0.42	4040	281	816	101
SB5-18(Total)	ND<4.9	1500	41.3	0.2	ND<0.49	12	ND<1.0	2.8	19.9	5	0.02	ND<2.0	6	ND<0.1	ND<0.98	ND<1.0	15.7	31.1	6560	9340	85.4
SB5-18(WET)		140																			
SB6-5(Total)	17	16	138	21.2	8.6	10	ND<1.0	3.6	53800	713	0.80	4	80.5	1	3.1	ND<1.0	8.4	41400	6420	19400	696
SB6-5(WET)	7.4	0.91	6.1	4.5	8.5	0.63	ND<0.05	0.57	178	494	ND<0.005	0.7	2.8	1.6	ND<0.05	ND<10	0.61	2460	272	1040	53.9
SB6-15(Total)	ND<4.9	220	49.4	0.32	ND<0.49	5.9	ND<1	4.0	13.5	ND<4.9	ND>0.02	ND<2	6.30	ND<0.1	ND<0.99	ND<1.0	13.2	23.7	4710	5310	283
SB6-15(WET)		[illegible]																			
SB6-20(Total)		0.6																			
SB6-25(Total)		13																			
SB6-30(Total)	ND<4.9	2.4	6.9	ND<0.2	ND<0.49	3.3	ND<1.0	ND<0.99	10.5	ND<4.9	ND<0.02	ND<2.0	ND<4.0	ND<1.0	ND<0.99	ND<1.0	5.3	15.7	1220	2270	16.2

TABLE 6.1 (continued page 3)

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
SB8-10(Total)	1000	1.1	63	30	1.3	16	ND<1.0	5.9	1800	440	0.06	5.1	43	2.3	3.7	ND<1.0	4.6	22000	8100	16000	1700
SB8-10(WET)	[illegible]	0.12	5.9	[illegible]	ND<0.2	0.6	ND<0.05	0.81	ND<0.5	[illegible]	ND<0.005	0.45	6.2	ND<0.01	ND<0.2	ND<0.3	ND<0.2	2400	400	1100	200
SB9-3(Total)	120	17	100	44	2.3	11	ND<1.0	9.2	3200	1200	0.14	9.3	90	0.5	2.5	ND<1.0	6.2	25000	12000	23000	2200
SB9-3(WET)	[illegible]	0.04	6.6	[illegible]	ND<0.2	ND<0.2	ND<0.05	1.2	[illegible]	[illegible]	ND<0.005	1	5.2	0.05	ND<0.2	ND<0.3	ND<0.2	[illegible]	360	1100	150
SB10-10(Total)	ND<1.0	0.68	44	16	0.79	5.6	ND<1.0	5.3	1900	800	0.02	5.7	44	0.3	0.52	ND<1.0	3.4	24000	6000	9800	1500
SB10-10(WET)	ND<1.0	0.19	5.6	[illegible]	ND<0.2	0.94	ND<0.05	0.72	[illegible]	[illegible]	ND<0.005	1	5.1	0.06	ND<0.2	ND<0.3	0.22	3200	380	1100	150
SB10-16(Total)	370	19	38	5.3	0.33	5.1	ND<1.0	2.7	300	110	ND<0.02	2.4	12	22	0.11	ND<1.0	6.4	4000	3400	5400	290
SB10-16(WET)	[illegible]	0.046							7.7	2.6				0.03				110			
SB10-30(Total)	240	180	31	0.17	0.08	4.8	ND<1.0	1.8	3.8	1.6	0.03	0.57	5.1	53	ND<0.05	ND<1.0	6.7	9.7	3400	5400	110
SB10-30(WET)	[illegible]	[illegible]												0.31							
SB10-35(Total)	92	82																			
SB10-40(Total)	40	100																			

TABLE 6.2

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
MW4-5(Total)	5.2	2.3	33.7	ND<0.19	ND<0.49	7.5	ND<1.0	2.6	11.3	16.0	0.03	ND<1.9	8.8	ND<0.1	ND<0.97	ND<1.0	16.3	25	2510	5640	68.8
MW4-20(Total)	ND<4.8	430	25.1	ND<0.19	ND<0.48	5	ND<1.0	1.9	8.8	ND<4.8	0.02	ND<1.9	4.8	ND<0.1	ND<0.97	ND<1.0	8.2	13.1	2630	4310	95.6
MW4-20(WET)		86																			
MW4-20xx(Total)	19.5	350	30	ND<0.19	ND<0.48	5.3	ND<1.0	2.4	27.5	ND<4.8	0.22	ND<1.9	3.9	0.1	ND<0.97	ND<1.0	8.9	25.4	2780	4730	94.9
MW4-25(Total)		94																			
MW4-30(Total)		58																			
MW5-5(Total)	1780	1300	52.6	ND<0.2	0.78	7.3	ND<1.0	3.5	45.7	13.1	5.8	ND<2.0	9.6	300	1	ND<1.0	12.5	76.5	2980	7140	134
MW5-5(WET)	380	82																			
MW5-10(Total)	ND<1	2.5												ND<0.10							
MW5-15(Total)	ND<1	1.3												ND<0.10							
MW5-20(Total)	ND<5.0	45	11.1	ND<0.2	ND<0.5	4.3	ND<1.0	1.5	9.7	ND<5.0	ND<0.02	ND<2.0	ND<4.0	ND<0.1	ND<0.99	ND<1	7.1	14.1	1880	3200	44
		0.036																			
MW6-5(Total)	ND<1.0	1.3	29	0.21	0.1	5.47	ND<1.0	2.48	7.53	1.66	0.02	0.09	4.35	ND<0.1	ND<0.05	ND<1.0	11	16	8100	6100	150.00
MW6-20(Total)	ND<1.0	3.9	13	0.07	0.07	2.97	ND<1.0	0.83	5.41	1.11	0.03	0.11	2.94	ND<0.1	ND<0.05	ND<1.0	3.92	14	1700	3500	34
MW7-5(Total)	ND<1.0	1.3	14	0.13	ND<0.05	3.6	ND<1.0	1.4	4.6	1.4	0.02	0.05	3.3	ND<0.1	ND<0.05	ND<1.0	7.50	8.9	2300	4700	50
MW7-20(Total)	ND<1.0	0.95	6.1	ND<0.05	ND<0.05	1.5	ND<1.0	0.47	12	0.54	0.02	0.05	2.0	ND<0.1	ND<0.05	ND<1.0	2.3	15	690	1800	20
MW7-20A(Total)	ND<1.0	0.98	6.7	ND<0.05	ND<0.05	1.9	ND<1.0	0.53	7.6	0.59	0.02	0.05	2.1	ND<0.1	ND<0.05	ND<1.0	2.5	7.1	840	1900	22
MW8-5(Total)	ND<1.0	1.9	19	0.10	0.07	6.1	ND<1.0	2	3.6	1.1	ND>0.02	ND>0.05	3.2	ND<0.1	ND<0.05	ND<1.0	11	8.5	2700	8400	110
MW8-20(Total)	ND<1.0	1.3	9.8	0.06	ND<0.05	4.7	ND<1.0	0.87	7.5	1.8	ND>0.02	ND>0.05	2.9	ND<0.1	ND<0.05	ND<1.0	4.3	21	1100	2600	31

TABLE 6.3

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
83-5(Total)	ND<1.0	0.96	28	0.14	0.08	6.1	ND<1.0	2.2	17	1.4	ND>0.02	0.11	4	ND<0.1	ND<0.05	ND<1.0	12	19	3400	9300	139
83-20(Total)	ND<1.0	0.89	14	0.07	0.06	6.5	ND<1.0	1.3	13	0.86	ND>0.02	0.05	3.9	ND<0.1	ND<0.05	ND<1.0	6.8	9.8	2200	4000	55
84-5(Total)	ND<1.0	0.92	27	0.13	0.08	5.8	ND<1.0	2.3	3.3	1.4	ND>0.02	0.08	3.8	ND<0.1	ND<0.05	ND<1.0	11	10	3200	7800	150
84-20(Total)	ND<1.0	1.1	21	0.11	0.07	5.4	ND<1.0	1.8	6.7	1.4	0.02	0.1	3.6	ND<0.1	ND<0.05	ND<1.0	8.5	14	3100	5200	130
85-5(Total)	ND<1.0	0.69	46	0.14	0.06	6.1	ND<1.0	2.5	4.4	1.4	ND<0.02	0.17	5.5	ND<0.1	ND<0.05	ND<1.0	10	11	3400	7500	150
85-20(Total)	ND<1.0	1.2	30	0.19	0.07	9.3	ND<1.0	3.5	4.4	1.5	ND<0.02	0.16	5.9	ND<0.1	ND<0.05	ND<1.0	13	12	5000	8100	170
85-20A(Total)	ND<1.0	1.4	33	0.21	0.08	10	ND<1.0	3.5	4.4	1.6	ND<0.02	0.14	5.9	ND<0.1	ND<0.05	ND<1.0	14	12	5200	8400	180
86-5(Total)	ND<1.0	270	26	0.16	ND<0.05	4.7	ND<1.0	3.2	6.4	1.3	0.05	0.17	4.4	ND<0.1	ND<0.05	ND<1.0	9.7	14	3000	5900	150
86-5(WET)		47																			
86-20(Total)	ND<1.0	5.9	11	0.06	ND<0.05	3.1	ND<1.0	0.7	2.6	0.79	0.02	0.1	2.8	ND<0.1	ND<0.05	ND<1.0	3.8	5.2	1200	2500	24
86-20A(Total)	ND<1.0	1.2	19	0.13	ND<0.05	5	ND<1.0	1.2	4.8	1.1	ND<0.02	0.17	4.1	ND<0.1	ND<0.05	ND<1.0	6.5	9	2700	3800	60

TABLE 6.4

RESULTS OF LABORATORY ANALYSES

Sample	Sb	As	Ba	Be	Cd	Cr	Cr HEX	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	Al	Fe	Mn
Totals	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WET	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
TTLC	500	500	10000	75	100	500		8000	2500	1000	20	3500	2000	100	500	700	2400	5000			
STLC	15	5	100	0.75	1	5		80	25	5	0.2	350	20	1	5	7	24	250			
MB1-1(Total)	2.8	1.5	32	0.23	0.06	5	ND<1.0	1.8	21	4	0.06	0.59	4.4	ND<0.1	0.14	ND<1.0	8.8	46	1800	4600	500
MB1-5(Total)	ND<1.0	0.99	36	0.14	ND<0.05	5.3	ND<1.0	2.2	9.9	2.6	ND<0.02	0.26	4	ND<0.1	ND>0.05	ND<1.0	7.9	16	2200	4300	110
MB2-1(Total)	25	6.3	28	0.16	2.1	12	ND<1.0	3.1	22	7.5	0.26	7.6	22	0.1	0.09	ND<1.0	9.7	67	2600	12000	180
MB2-5(Total)	9	47	21	0.12	0.14	4.8	ND<1.0	2.4	8.7	55	0.15	0.2	4	ND<0.1	0.15	ND<1.0	8	14	1900	4100	87
MB2-5(WET)		1.5								4											
MB3-1(Total)	ND<1.0	0.98	23	0.15	0.05	4.1	ND<1.0	1.8	2.8	1.5	ND<0.02	1.1	3.2	ND<0.1	ND<0.05	ND<1.0	9.9	8.2	3100	5300	100
MB3-5(Total)	ND<1.0	1.2	13	0.11	ND<0.05	3	ND<1.0	1.1	23	1.6	0.03	0.25	2.2	ND<0.1	ND<0.05	ND<1.0	6.4	16	1900	3600	39
MB4-1(Total)	17.1	24	63.1	1	0.8	10.6	ND<1.0	5.2	613	77.7	0.07	ND<2.0	20.4	1.6	ND<0.98	ND<1.0	15.6	847	ND<9.8	6320	263
MB4-1(WET)									6.6	3.2								90			
MB4-5(Total)	30.8	480	34.5	ND<0.2	ND<0.5	4.1	ND<1.0	2.1	10.7	ND<5.0	0.04	ND<2.0	ND<4	0.09	ND<0.99	ND<1.0	8.8	19	1780	3970	150
MB4-5(WET)		57																			
MB5-1(Total)	334	79	58.8	0.84	2.1	36	ND<1.0	3.6	196	118	0.07	3.1	7.5	5.6	ND<0.99	ND<1.0	10.8	1020	3020	5390	169
MB5-1(WET)	28	3.1																			
MB5-5(Total)	87.8	20	22.5	ND<0.19	ND<0.48	4.1	ND<1.0	2.3	9.9	ND<4.8	0.11	ND<1.9	3.9	120	ND<0.96	ND<1.0	6.3	46.6	1590	3340	55.6

TABLE 6.5.1

RESULTS OF LABORATORY ANALYSES

Sample	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Cd mg/L	Cr mg/L	Cr HEX mg/L	Co mg/L	Cu mg/L	Pb mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Tl mg/L	V mg/L	Zn mg/L	Al mg/L	Fe mg/L	Mn mg/L
MCL's		0.05	1		0.01	0.05				0.05	0.002			0.01	0.05						
MW1	ND<0.1	3.2	ND<0.02	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.02	0.02	ND<0.01	ND<0.3	ND<0.02	ND<0.02	0.17	ND<0.05	0.06
MW2	ND<0.1	12	ND<0.02	ND<0.01	ND<0.01	0.21	0.17	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.05	0.06	0.24	ND<0.01	ND<0.3	0.05	0.04	0.49	0.15	3.3
MW3	0.84	9.8	0.07	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	ND<0.02	0.19	ND<0.01	ND<0.3	0.04	0.03	0.51	0.05	ND<0.02
MW4	ND<0.1	0.005	0.49	ND<0.01	ND<0.01	0.1	0.09	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	ND<0.02	ND<0.01	ND<0.01	ND<0.3	ND<0.02	ND<0.02	1.1	ND<0.05	ND<0.02
MW5	ND<0.1	140	0.03	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.1	0.03	0.02	ND<0.01	ND<0.3	0.13	0.02	0.6	0.41	0.08
MW6	ND<0.1	25	0.03	ND<0.01	ND<0.01	0.23	0.23	ND<0.02	ND<0.05	ND<0.05	ND<0.001	0.05	0.07	0.03	ND<0.01	ND<0.3	0.04	0.11	1.9	1.8	1.9
MW7	ND<0.1	0.011	0.04	ND<0.02	ND<0.02	ND<0.02		ND<0.02	ND<0.02	ND<0.05		ND<0.02	ND<0.02	ND<0.02	ND<0.02		ND<0.02	ND<0.02	0.17	0.12	0.5
MW8	ND<0.1	ND<0.005	0.03	ND<0.01	ND<0.01	0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.06	0.01	ND<0.01	ND<0.3	ND<0.02	0.04	2.2	2.1	0.42
FIELD BLANK MW9	ND<0.1	ND<0.005	ND<0.02	ND<0.01	ND<0.01	ND>0.02	ND<0.05	ND<0.02	ND<0.05	ND<0.05	ND<0.001	ND<0.02	0.03	ND<0.01	ND<0.01	ND<0.3	ND<0.02	ND<0.02	ND<0.1	ND<0.05	ND<0.02

Enseco

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Laboratory Report

ENSR CONSTRUCTORS
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Analysis No.: G-9004528-001
Date Sampled: 13-FEB-1990
Date Sample Rec'd: 13-FEB-1990
Date Analyzed: 20-FEB-1990
16-FEB-1990
Sample Type: LIQUID

Project: (9500-089) KRAMER - EL SEGUNDO
Sample ID: MW7

Parameter	Units	Result	Blank	Detection Limit
Aluminum (EPA 200.7)	mg/L	0.17	ND	0.10
Antimony (EPA 200.7)	mg/L	ND	ND	0.10
Barium (EPA 200.7)	mg/L	0.04	ND	0.02
Beryllium (EPA 200.7)	mg/L	ND	ND	0.02
Cadmium (EPA 200.7)	mg/L	ND	ND	0.02
Chromium (Total) (EPA 200.7)	mg/L	ND	ND	0.02
Cobalt (EPA 200.7)	mg/L	ND	ND	0.02
Copper (EPA 200.7)	mg/L	ND	ND	0.05
Iron (EPA 200.7)	mg/L	0.12	ND	0.05
Lead (EPA 200.7)	mg/L	ND	ND	0.05
Manganese (EPA 200.7)	mg/L	0.50	ND	0.02
Molybdenum (EPA 200.7)	mg/L	ND	ND	0.02
Nickel (EPA 200.7)	mg/L	ND	ND	0.02
Silver (EPA 200.7)	mg/L	ND	ND	0.02
Vanadium (EPA 200.7)	mg/L	ND	ND	0.02
Zinc (EPA 200.7)	mg/L	ND	ND	0.02
Arsenic (EPA 206.3)	mg/L	0.011	ND	0.005
Selenium (EPA 270.3)	mg/L	ND	ND	0.01

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials.

TABLE 6.5.2

RESULTS OF LABORATORY ANALYSES

Sample	PCE ug/L	TCE ug/L	TOLUENE ug/L	XYLENES ug/L	ETYHL-BENZENE ug/L	ACETONE ug/L	2-BUTANONE ug/L	11-DCE ug/L	111-TCA ug/L	TRICHLOROFLUORO-METHANE ug/L	CARBON-TETRACHLORIDE ug/L
MW1	200	370	ND<5	ND<5	ND<5	ND<10	ND<10	19	12	ND<5	ND<5
MW2	16	40	18	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW3	160	120	6	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW4	ND<5	190	39	40	6	74	12	ND<5	ND<5	ND<5	ND<5
MW5	ND<5	18	270	300	39	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5
MW6	ND<5	110	ND<5	ND<5	ND<5	ND<10	ND<10	8	10	73	43
MW7											
MW8	25	88	ND<5	ND<5	ND<5	ND<10	ND<10	5	ND<5	ND<5	ND<5
FIELD BLANK MW9	ND<5	ND<5	ND<5	ND<5	ND<5	ND<10	ND<10	ND<5	ND<5	ND<5	ND<5

TABLE 6.6

MONITORING WELLS REFERENCE ELEVATIONS, DEPTHS TO GROUNDWATER (12/15/89 and 1/9/90), AND GROUNDWATER ELEVATIONS

Well	Reference Elevation (feet above MSL)	Depth to Water(12/15/89) (feet)	Groundwater Elevation (feet above MSL)	Depth to Water(1/9/90) (feet)	Groundwater Elevation (feet above MSL)
W-1	102.06	82.70	19.36	82.72	19.34
W-2	98.79	81.82	16.97	81.80	16.99
W-3	94.17	71.83	22.34	71.52	22.65
MW-4	92.17	71.40	20.77	71.45	20.72
MW-5	92.75	76.94	15.81	77.03	15.72
MW-6	98.15	81.95	16.20	81.86	16.29
MW-7	107.90	89.70	18.20	89.72	18.18
MW-8	102.38	85.44	16.94	85.44	16.94

APPENDIX B

SURROUNDING WELL LOCATION INFORMATION

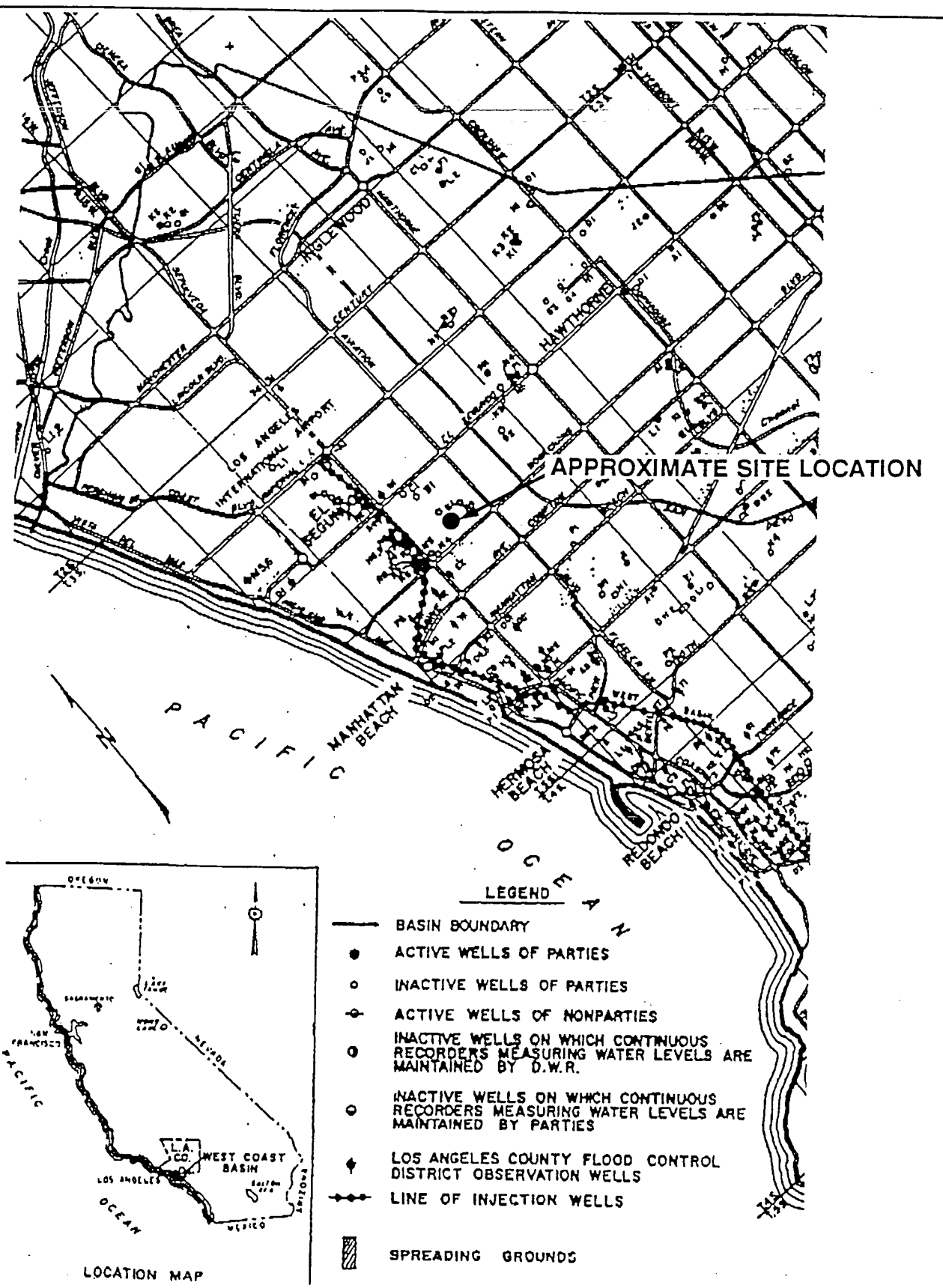
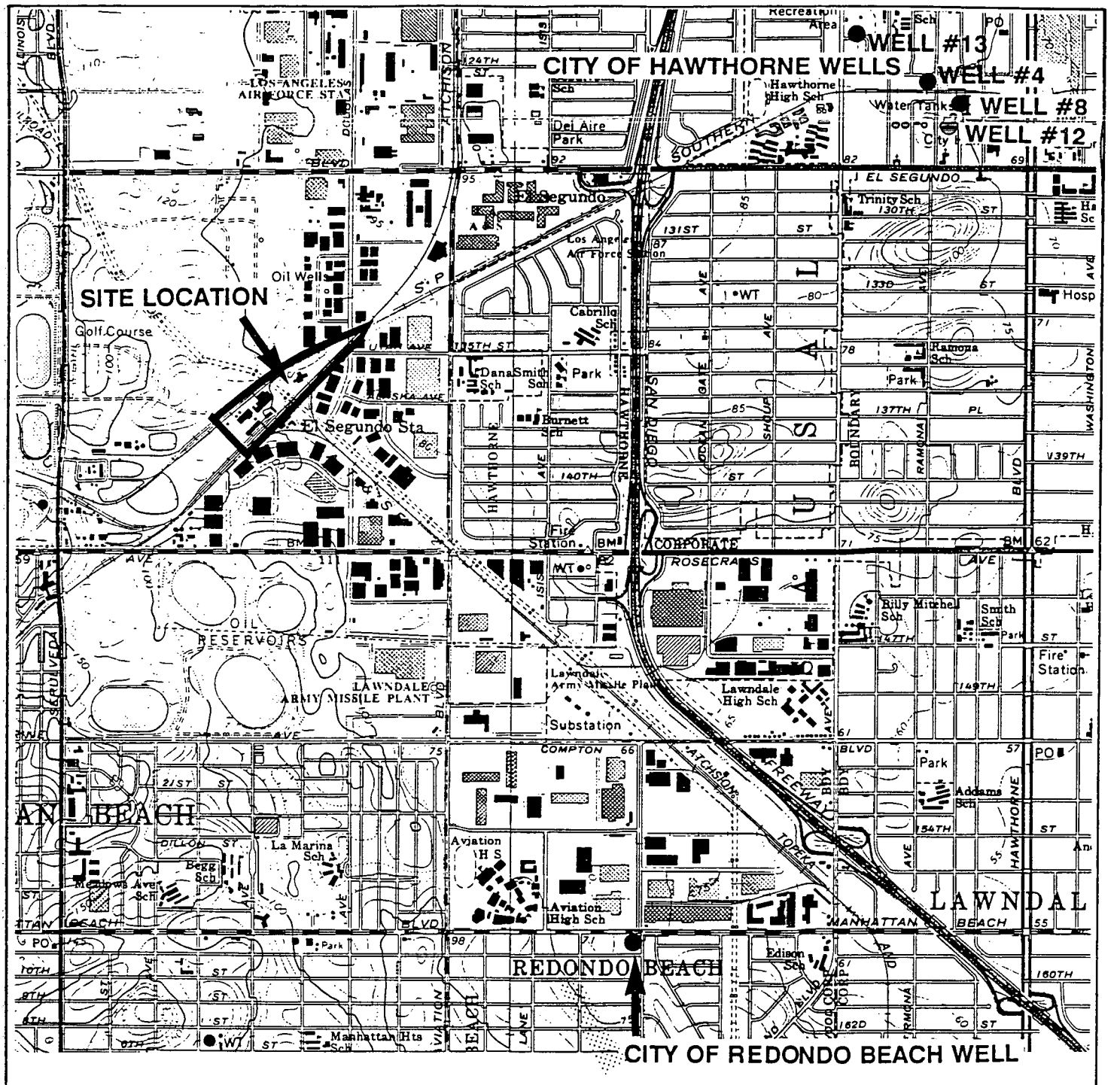


FIGURE B-1
LINE OF INJECTION WELLS
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

Source: West Coast Basin Watermaster Service - June 1991



0 1/2 1

SCALE IN MILES

FIGURE B-2

DRINKING WATER WELL LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981

Table B-1. Drinking Water Well Data for Wells Located Near the Chevron El Segundo Site

Owner/Well Number	Year Drilled	Well Depth (feet)	Highest Perforation Level (feet)
City of Hawthorne No. 4	1941	655	306
City of Hawthorne No.8	1948	518	318
City of Hawthorne No. 12	1968	554	300
City of Hawthorne No. 13	1970	480	282
City of Manhattan Beach Well		320	180

Sources: 1) Rivier, Al, City of Hawthorne, telephone conversation, November 19, 1991.
2) Rivier, J.A., City of Hawthorne, letter and enclosure, November 22, 1991.
3) Beaver, Duane, City of Manhattan Beach, telephone conversation, November 14, 1991.

Note:

1] Data regarding the City of Manhattan Beach well are approximate.

2] Well locations are indicated on Figure B-2.

Table B–2. Groundwater Use as Drinking Water in the Vicinity of the Chevron El Segundo Site

City/Water Purveyor	Number of Wells	Groundwater as a % of Total Drinking Water Supplied	Connections Served
City of Hawthorne	4	15 *	6,100
City of Manhattan Beach	1	40	12,800

Sources: 1) Rivier, Al, City of Hawthorne, telephone conversation, November 19, 1991.
2) Beaver, Duane, City of Manhattan Beach, telephone conversation, November 14, 1991.

Note:

1] City of El Segundo not included because groundwater not used for drinking water. All water supplied by the Metropolitan Water District. (Vivian, Larry, City of El Segundo, telephone conversation, November 14, 1991)

* During drought conditions, groundwater use ranges from 20 to 25% of total drinking water supplied.

APPENDIX C

SOIL AND GROUNDWATER SUMMARY STATISTICS

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ANTIMONY.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ANTIMONY.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	54	24	6	34	27	20
Minimum:	54.0	24.0	6.0	34.0	27.0	20.0
Maximum:	1780	1000	120	1780	1780	25
Mean:	87.89	101.67	32.65	138.26	153.46	2.27
Std. Dev. (/n):	278.08	209.66	42.49	340.51	377.91	5.55
Std Dev, s (/n-1):	280.69	214.17	46.55	345.63	385.11	5.69
CI input, ts/n^0.5:	76.78	90.50	48.86	120.92	151.94	2.66
Upper 95% CI of Mean:	164.67	192.17	81.51	259.18	305.40	4.93
Median:			11.45		5.4	0.5

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ARSENIC.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ARSENIC.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	61	29	6	41	34	20
Minimum:	61.0	29.0	6.0	41.0	34.0	20.0
Maximum:	2800	2800	17.0	2800	2800	270
Mean:	185.70	291.08	9.77	267.74	309.86	17.51
Std. Dev. (/n):	508.06	674.41	6.58	601.52	652.06	58.77
Std Dev, s (/n-1):	512.28	686.35	7.21	608.99	661.87	60.30
CI input, ts/n^0.5:	131.18	261.28	7.57	192.21	230.42	28.22
Upper 95% CI of Mean:	316.88	552.35	17.33	459.95	540.29	45.73
Median:			9.85	18	1.25	

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS BARIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

BARIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	501	501	501	501	501	46
Mean:	53.73	88.10	207.67	74.66	85.63	22.35
Std. Dev. (/n):	80.82	111.69	152.02	98.62	104.58	9.80
Std Dev, s (/n-1):	81.64	114.32	166.53	100.31	106.73	10.05
CI input, ts/n^0.5:	23.21	50.84	174.79	37.40	43.97	4.70
Upper 95% CI of Mean:	76.94	138.95	382.46	112.05	129.60	27.05
Median:			133.5		49.4	22

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS BERYLLIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

BERYLLIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	230	230	230	230	230	0.23
Mean:	12.54	28.27	82.87	20.81	24.95	0.13
Std. Dev. (/n):	36.78	51.31	70.63	45.65	48.97	0.05
Std Dev, s (/n-1):	37.16	52.52	77.37	46.43	49.98	0.05
CI input, ts/n^0.5:	10.56	23.36	81.21	17.31	20.59	0.02
Upper 95% CI of Mean:	23.10	51.63	164.07	38.12	45.54	0.15
Median:			48		0.84	0.13

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS CADMIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

CADMIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	29.5	29.5	29.5	29.5	29.5	2.1
Mean:	1.48	2.99	9.00	2.36	2.79	0.16
Std. Dev. (/n):	4.40	6.28	9.43	5.49	5.92	0.45
Std Dev, s (/n-1):	4.44	6.43	10.33	5.59	6.04	0.46
CI input, ts/n^0.5:	1.26	2.86	10.84	2.08	2.49	0.21
Upper 95% CI of Mean:	2.74	5.85	19.84	4.44	5.28	0.37
Median:			5.7		0.78	0.06

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS COPPER.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

COPPER.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	53800	53800	53800	53800	53800	23
Mean:	1826.19	4100.85	13248.33	3037.46	3643.32	9.29
Std. Dev. (/n):	7685.38	11179.54	18407.50	9735.18	10560.59	6.44
Std Dev, s (/n-1):	7763.40	11442.62	20164.40	9901.60	10778.35	6.61
CI input, ts/n^0.5:	2206.80	5088.95	21164.69	3691.48	4440.68	3.09
Upper 95% CI of Mean:	4032.99	9189.80	34413.02	6728.94	8084.01	12.38
Median:			3745		196	7.1

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS CR_III.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

CR_III.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	74.6	74.6	37	74.6	74.6	12
Mean:	9.39	12.95	17.50	12.13	13.64	5.28
Std. Dev. (/n):	11.62	15.39	9.77	14.24	15.15	2.24
Std Dev, s (/n-1):	11.74	15.76	10.70	14.49	15.47	2.29
CI input, ts/n^0.5:	3.34	7.01	11.23	5.40	6.37	1.07
Upper 95% CI of Mean:	12.72	19.96	28.73	17.53	20.01	6.35
Median:			15.15		7.9	5.15

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS LEAD.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

LEAD.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	2500	2500	2500	2500	2500	55
Mean:	242.05	535.36	1443.83	400.42	480.03	4.49
Std. Dev. (/n):	560.95	748.75	751.99	679.45	718.30	11.68
Std Dev, s (/n-1):	566.65	766.37	823.76	691.07	733.11	11.98
CI input, ts/n^0.5:	161.07	340.83	864.63	257.64	302.04	5.61
Upper 95% CI of Mean:	403.12	876.19	2308.46	658.06	782.07	10.10
Median:			1150		77.7	1.4

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS MANGA.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

MANGANESE
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	41000	41000	41000	41000	41000	500
Mean:	1187.50	2545.72	8041.00	1899.53	2266.08	119.45
Std. Dev. (/n):	5713.13	8418.80	14746.87	7288.72	7933.74	101.53
Std Dev, s (/n-1):	5771.13	8616.92	16154.39	7413.32	8097.34	104.17
CI input, ts/n^0.5:	1640.49	3832.26	16955.75	2763.81	3336.10	48.75
Upper 95% CI of Mean:	2827.98	6377.98	24996.75	4663.34	5602.18	168.20
Median:			1575		290	110

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS MERCURY.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

MERCURY.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	5.8	0.8	0.8	5.8	5.8	0.26
Mean:	0.19	0.11	0.29	0.29	0.33	0.04
Std. Dev. (/n):	0.81	0.17	0.24	1.03	1.13	0.06
Std Dev, s (/n-1):	0.82	0.17	0.27	1.05	1.15	0.06
CI input, ts/n^0.5:	0.23	0.08	0.28	0.39	0.47	0.03
Upper 95% CI of Mean:	0.42	0.19	0.57	0.68	0.81	0.07
Median:			0.17		0.06	0.02

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS NICKEL.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

NICKEL.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	310	310	310	310	310	22
Mean:	29.09	59.23	165.42	45.40	53.61	4.62
Std. Dev. (/n):	62.49	85.00	92.93	76.37	81.21	4.10
Std Dev, s (/n-1):	63.13	87.00	101.80	77.67	82.88	4.20
CI Input, ts/n^0.5:	17.94	38.69	106.85	28.96	34.15	1.97
Upper 95% CI of Mean:	47.03	97.92	272.27	74.36	87.75	6.59
Median:			116	9.6	3.85	

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS SELENIUM.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Non-detects are assumed equal to 1/2 the sample-specific detection limit.
4] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

SELENIUM.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	52	22	6	32	27	20
Minimum:	52.0	22.0	6.0	32.0	27.0	20.0
Maximum:	300	53	2	300	300	0.5
Mean:	10.64	5.64	0.94	17.24	17.73	0.07
Std. Dev. (/n):	44.40	12.17	0.60	55.59	59.86	0.10
Std Dev, s(/n-1):	44.83	12.46	0.65	56.48	61.00	0.10
CI input, ts/n^0.5:	12.50	5.54	0.69	20.39	24.18	0.05
Upper 95% CI of Mean:	23.13	11.18	1.63	37.63	41.91	0.12
Median:			1		0.9	0.05

CHEVRON H. KRAMER & CO. SITE 13-Feb-92
APPENDIX C SUMMARY STATS
SOIL EPC CALCULATIONS ZINC.WR1

1] All units in mg/kg, equivalent to ppm.
2] "Area 1" = Slag Pile and surrounding area; eastern portion of site
"Area 2" = Western portion of site
3] Assigned depths are bottom of depth range sampled.

Source Data: ENSR (1990) Report, Tables 6.1 through 6.4

ZINC.WR1
SUMMARY STATS:

	ALL DATA	SLAG PILE SOILS ONLY	SLAG SOILS <5 FT	AREA 1 ALL	AREA 1 <25 FT	AREA 2 ALL <25 FT
Count:	50	22	6	30	25	20
Minimum:	50.0	22.0	6.0	30.0	25.0	20.0
Maximum:	76000	76000	76000	76000	76000	67
Mean:	7757.28	17520.77	45933.33	12917.27	15496.54	17.28
Std. Dev. (/n):	17163.03	22342.34	18438.97	20600.61	21664.4	14.00
Std Dev, s (/n-1):	17337.28	22868.12	20198.88	20952.78	22111.14	14.36
CI input, ts/n^0.5:	4928.24	10170.29	21200.87	7811.54	9109.79	6.72
Upper 95% CI of Mean:	12685.52	27691.06	67134.20	20728.82	24606.33	24.00
Median:			39,800.00	847.00	14.00	

CALCULATION SHEET
SUMMARY OF EXPOSURE POINT CONCENTRATIONS (EPCs) FOR SOIL AND AIR EXPOSURE PATHWAYS
H. KRAMER & COMPANY SITE

	CURRENT USE SCENARIOS /1/				FUTURE USE SCENARIOS /2/							
	WORKER AND TRESPASSER RECEPTORS				AREA 1 SUBSURFACE SOILS				AREA 2 SUBSURFACE SOILS			
	95% UCL		Median		95% UCL		Median		95% UCL		Median	
PARAMETER	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)	Soil EPC (mg/kg)	Air EPC (mg/m^3)
Antimony	81.51	3.36E-06	11.45	4.72E-07	305.40	3.05E-05	5.4	5.40E-07	4.93	4.93E-07	0.5	5.00E-08
Arsenic	17.33	7.14E-07	9.85	4.06E-07	540.29	5.40E-05	18	1.80E-06	45.73	4.57E-06	1.25	1.25E-07
Barium	382.46	1.58E-05	133.5	5.50E-06	129.60	1.30E-05	49.4	4.94E-06	27.05	2.71E-06	22	2.20E-06
Beryllium	164.07	6.76E-06	48	1.98E-06	45.54	4.55E-06	0.84	8.40E-08	0.15	1.50E-08	0.13	1.30E-08
Cadmium	19.84	8.17E-07	5.7	2.35E-07	5.28	5.28E-07	0.78	7.80E-08	0.37	3.70E-08	0.06	6.00E-09
Chromium (trivalent)	28.73	1.18E-06	15.15	6.24E-07	20.01	2.00E-06	7.9	7.90E-07	6.35	6.35E-07	5.15	5.15E-07
Copper	34,413	1.42E-03	3745	1.54E-04	8,084	8.08E-04	196	1.96E-05	12.38	1.24E-06	7.1	7.10E-07
Lead	2,308	9.51E-05	1150	4.74E-05	782.07	7.82E-05	77.7	7.77E-06	10.10	1.01E-06	1.4	1.40E-07
Manganese	24,997	1.03E-03	1575	6.49E-05	5602.18	5.60E-04	290	2.90E-05	168.20	1.68E-05	11	1.10E-06
Mercury	0.57	2.35E-08	0.17	7.00E-09	0.81	8.10E-08	0.06	6.00E-09	0.07	7.00E-09	0.02	2.00E-09
Nickel	272.27	1.12E-05	116	4.78E-06	87.75	8.78E-06	9.6	9.60E-07	6.59	6.59E-07	3.85	3.85E-07
Selenium	1.63	6.72E-08	1	4.12E-08	41.91	4.19E-06	0.9	9.00E-08	0.12	1.20E-08	0.05	5.00E-09
Zinc	67,134	2.77E-03	39,800	1.64E-03	24,606	2.46E-03	847	8.47E-05	24.00	2.40E-06	14	1.40E-06

MEDAIR.WR1

CHEVRON H. KRAMER & CO. SITE 14-Feb-92
APPENDIX C SUMMARY STATS

GROUNDWATER EPC CALCULATIONS FOR INORGANIC COPC
GWINOEPC.WR1

1] All units in mg/l, roughly equivalent to ppm.
2] All non-detects are assumed equal to 1/2 the sample-specific detection limit value.

Source Data: ENSR (1990) Report, Table 6.5

Sample Location	Antimony	Arsenic	Trivalent Chromium	Hexavalent Chromium	Manganese	Nickel	Selenium
MW-1	0.05	3.2	0.01	0.025	0.06	0.02	0.02
MW-2	0.05	12	0.21	0.17	3.3	0.06	0.24
MW-3	0.84	9.8	0.01	0.025	0.01	0.01	0.19
MW-4	0.05	0.005	0.1	0.09	0.01	0.01	0.005
MW-5	0.05	140	0.01	0.025	0.08	0.03	0.02
MW-6	0.05	25	0.23	0.23	1.9	0.07	0.03
MW-7	0.05	0.011	0.01		0.5	0.01	0.005
MW-8	0.05	0.0025	0.02	0.025	0.42	0.06	0.01
Count:	8	8	8	7	8	8	8
Minimum:	0.050	0.003	0.010	0.025	0.010	0.010	0.005
Maximum:	0.84	140	0.23	0.23	3.3	0.07	0.24
Mean:	0.15	23.75	0.08	0.08	0.79	0.03	0.07
Std. Dev. (/n):	0.26	44.67	0.09	0.08	1.12	0.02	0.09
Std Dev, s (/n-1):	0.279	47.752	0.095	0.084	1.196	0.026	0.094
CI input, ts/n^0.5:	0.234	39.928	0.079	0.078	1.000	0.021	0.079
Upper 95% CI of Mean:	0.38	63.68	0.15	0.162	1.78	0.06	0.14
Median of detects:	0.84	9.8	0.155	0.17	1.2	0.06	0.025

CHEVRON H. KRAMER & CO. SITE 14-Feb-92
APPENDIX C EPC SUMMARY STATS

GROUNDWATER EPC CALCULATIONS FOR ORGANIC COPC
GWORGEPC.WR1

1] All units in mg/l, roughly equivalent to ppm.
2] All non-detects are assumed equal to 1/2 the sample-specific detection limit value.

Source Data: ENSR (1990) Report, Table 6.5

Sample Location	Carbon Tetrachloride	1,1-DCE	PCE	Toluene	TCE
MW-1	0.0025	0.019	0.2	0.0025	0.37
MW-2	0.0025	0.0025	0.016	0.018	0.04
MW-3	0.0025	0.0025	0.16	0.006	0.12
MW-4	0.0025	0.0025	0.0025	0.039	0.19
MW-5	0.0025	0.0025	0.0025	0.27	0.018
MW-6	0.043	0.008	0.0025	0.0025	0.11
MW-7					
MW-8	0.0025	0.005	0.025	0.0025	0.088
Count:	7	7	7	7	7
Minimum:	0.003	0.003	0.003	0.003	0.018
Maximum:	0.043	0.019	0.200	0.270	0.370
Mean:	0.008	0.006	0.058	0.049	0.134
Std. Dev. (/n):	0.014	0.006	0.078	0.091	0.110
Std Dev, s (/n-1):	0.015	0.006	0.084	0.099	0.118
CI input, ts/n^0.5:	0.014	0.006	0.078	0.091	0.109
Upper 95% CI of Mean:	0.022	0.012	0.136	0.140	0.243

APPENDIX D

GUIDANCE FOR ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL (DTSC, 1992)

VOLUME 6

CHAPTER 5

ASSESSMENT OF HEALTH RISKS FROM INORGANIC LEAD IN SOIL

FOREWORD

The Department of Toxic Substances Control (DTSC), within the California Environmental Protection Agency, has the responsibility of managing the State's hazardous waste program to protect public health and the environment. The Toxicology and Risk Assessment Section (TRAS) within the Technical Services Branch provides scientific assistance in the areas of toxicology, risk and environmental assessment, training, and guidance to the regional offices within DTSC. Part of this assistance and guidance is the preparation of regulations, scientific standards, guidance documents, and recommended procedures for use by regional staff, local governmental agencies, or responsible parties and their contractors in the characterization and mitigation of hazardous waste substances release sites.

This chapter is just one part of the DTSC document, Guidance for Site Characterization and Multimedia Risk Assessment for Hazardous Substances Release Sites. The document has been prepared to provide guidelines for the investigation, monitoring, and remediation of hazardous substances release sites. Please note that within each chapter the more commonly used terms, hazardous waste site and toxic waste site, are used synonomously with the term hazardous substances release site.

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ABSTRACT

This guidance describes a mathematical model for estimating blood lead concentration resulting from contact with lead-contaminated environmental media. A lead concentration of concern of ten milligrams per deciliter of whole blood is established. A distributional approach is used, allowing estimation of various percentiles of blood lead concentration associated with a given set of inputs. The method can be adapted to a computer spreadsheet.

TABLE OF CONTENTS

SECTION PAGE

FOREWORD i
ABSTRACT ii
TABLE OF CONTENTS iii

1 INTRODUCTION 1

1.1 PURPOSE 1
1.2 APPLICATION 1
1.3 LIMITATIONS 1

2 PRINCIPLE OR THEORY 1

2.1 BLOOD LEAD CONCENTRATION OF CONCERN 1
2.2 LEAD EXPOSURE PATHWAYS; BLOOD LEAD CALCULATION 1

3 METHODS 2

4 COMMENTS 5

4.1 BLOOD LEAD CONCENTRATION OF CONCERN 5
4.2 ESTIMATING BLOOD LEAD CONCENTRATION FROM ENVIRONMENTAL CONCENTRATIONS 5
4.3 DERIVATION OF MODEL PARAMETERS 5
4.4 USING THIS GUIDANCE 7
4.5 OTHER REGULATORY GUIDANCE 7

REFERENCES 8

Assessment of Health Risks From Inorganic Lead in Soil

1 INTRODUCTION

1.1 PURPOSE

The purpose of this guidance is to provide a methodology for evaluating exposure and the potential for adverse health effects resulting from exposure to lead in the environment.

1.2 APPLICATION

Since most human health effects data are based on blood lead (Pb) concentration, this guidance presents a blood Pb concentration of concern for the protection of human health, and an alogrithm for estimating blood Pb concentrations in children and adults based on a multi-pathway analysis.

1.3 LIMITATIONS

It is anticipated that this guidance will be periodically revised to reflect the changing state of the science.

2 PRINCIPLE OR THEORY

2.1 BLOOD LEAD CONCENTRATION OF CONCERN

The Pb concentration of concern in children and adults is ten micrograms (ug) per deciliter (dl) of whole blood. The point of departure for risk management is a 0.01 risk of exceeding this value.

2.2 LEAD EXPOSURE PATHWAYS--BLOOD LEAD CALCULATION

This method can be used to estimate blood lead concentrations (Pb_b) resulting from exposure via the five pathways listed below. Each pathway is represented by an equation relating incremental blood lead increase to a concentration in a medium, using contact rates and empirically determined ratios. The contributions via the five pathways are added

to arrive at an estimate of median blood lead concentration resulting from the multipathway exposure. Ninety-fifth and ninety-ninth percentile concentrations are estimated from the median by assuming a log-normal distribution with a geometric standard deviation (GSD) of 1.42. The method can be adapted to a computer spreadsheet.

3 METHODS

Generalized equations describing uptake via the five exposure pathways are as follows:

Dietary Intake Equation

$$Pb_b = \text{dietary Pb} * \text{contact rate} * \text{dietary constant}$$

where:

dietary Pb (ug Pb/kg diet) = (9.45 + 0.025 mg Pb/kg soil) [1]
contact rate, adults = 2.2 kg diet/day[2]
contact rate, children = 1.3 kg diet/day[2]
dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Drinking Water Intake Equation

$$Pb_b = \text{water Pb} * \text{contact rate} * \text{water constant}$$

where:

drinking water Pb (ug Pb/l water) is a site-specific, measured value[5]
contact rate, adults = 1.4 l water/day[6]
contact rate, children = 0.4 l water/day[6]
dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Soil and Dust Ingestion Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

soil Pb (ug/g) is a site-specific, measured value
contact rate, children = 0.000055 kg/day[7]
contact rate, adults = 0.000025 kg/day[8]
soil constant, children = 0.07 (ug Pb/dl blood)/(ug ingested Pb/day)[9]
soil constant, adults = 0.018 (ug Pb/dl blood)/(ug ingested Pb/day)[9]

Inhalation Intake Equation

$$Pb_b = \text{atmospheric Pb} * \text{inhalation constant}$$

where:

atmospheric Pb = local or regional ambient Pb (ug/m^3) [10]
inhalation constant, children = 1.92 (ug/dl)/(ug/m^3)[11]
inhalation constant, adults = 1.64 (ug/dl)/(ug/m^3)[11]

Dermal Contact Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

soil Pb (ug Pb/gm soil) is a site-specific, measured value
contact rate, children = 1.4 gm soil/day [12]
contact rate, adults = 1.85 gm soil/day [13]
soil constant = 0.0001 (ug Pb/dl blood)/(ug dermal Pb/day)[14]

---

1 Derived as follows: (0.945 * 10 ug/kg) + (0.055 * 0.00045 * soil Pb in mg/kg * 1000 ug/mg). Assumes that 5.5% of the diet consists of home-grown produce with the other 94.5% supplied by a homogeneous source with a lead content of 10 ug/kg. If food production on the site can be ruled out, use 10 ug/kg for dietary lead (EPA, 1989b, Bolger, et.al., 1990). Home-grown produce is assumed to contain 0.045% of the lead level in the soil.

2 Based on a report by Pennington (1983). For this method, a one-year-old child shall represent all children, based on the assumption that protecting the one-year-old child will protect all children.

3 Based on a study by Ryu, et.al. (1983)

4 Based on a report by FDA (1990)

5 Pb concentrations in local water supplies as consumed. If site-specific data are unavailable, a value of 15 ug/l may be used.

6 EPA (1989b)

7 Based on Calabrese (1990). Deliberate soil ingestion (soil pica) is represented as 0.00079 kg soil/day average.

8 For residential exposures and most occupational exposures, based on Calabrese (1990). Occupations with a high potential for soil ingestion (such as construction) should be represented as 0.00005 kg soil/day average.

9 These values are 44% of that for lead ingested with food or water, based on a study in rats which compared the bioavailability of lead acetate mixed with the diet to that of soil-bound lead (Chaney et.al., 1990).

10 The ambient air Pb concentration data are available from the California Air Resources Board, Technical Support Division. Data for the most recent year for the nearest monitoring station should be used. If monitoring data collected within the same air basin are unavailable, a value of 0.18 ug/m^3 may be used, or consult with the DTSC project manager.

11 Based on EPA (1986)

12 Based on a soil adherence of 5 g/m^2 and 0.28 m^2 of exposed skin (EPA, 1989b).

13 Based on a soil adherence of 5 g/m^2 and 0.37 m^2 of exposed skin (EPA, 1989b).

14 This value is derived by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [11% (ATSDR, 1990)].

4 COMMENTS

4.1 BLOOD LEAD CONCENTRATION OF CONCERN

The traditional reference dose approach to toxic chemicals is not applied to Pb because most human health effects data are based on blood Pb concentrations rather than external dose. Blood Pb concentration is an integrated measure of internal dose, reflecting total exposure from site-related and background sources. A clear no-observed-effect concentration has not been established for such Pb-related endpoints as birth weight, gestation period, heme synthesis and neurobehavioral development in children and fetuses, and blood pressure in middle-aged men. Dose-response curves for these endpoints appear to extend down to 10 ug Pb/dl or less (ATSDR, 1990).

4.2 ESTIMATING BLOOD LEAD CONCENTRATIONS FROM ENVIRONMENTAL CONCENTRATIONS

Total Pb is generally used as the measure of Pb in various media, even though the disposition of Pb may differ according to its form. Insufficient data are available to justify differential treatment of different forms of inorganic Pb, and most of the published toxicity data and most site characterization data are in terms of total Pb. Organic Pb is more readily absorbed through the skin and other membranes than inorganic Pb, and it must therefore be treated separately. Since it is less stable in the environment, it is usually a minor source of exposure. In the absence of specific information for the population of interest, background exposures are estimated using norms developed from survey data.

4.3 DERIVATION OF MODEL PARAMETERS

Unless the potential for on-site gardening can be ruled out, it is assumed that 5.5% of the diet consists of home-grown produce, based on EPA guidance (USEPA, 1991). Pb concentration in home-grown produce is calculated as 0.045% of that in the soil, based on plant uptake studies (Chaney, et.al., 1982). Background dietary Pb concentration (10 ug/kg) is based on a 1990 report based on FDA data (Bolger, et.al., 1990). The default drinking water Pb concentration is based on the federal action concentration of 15 ug/l at the tap (USEPA, 1991b).

The distribution of blood Pb concentrations for a given set of environmental inputs is a critical factor in protecting sensitive members of the population. Based on a review of data from NHANES II and from several published studies of blood Pb concentrations in children living near point sources of lead, EPA concluded that blood Pb was generally log-normally distributed, that the geometric standard deviation (GSD) for children was between 1.3 and 1.53, and that 1.42 was a representative value for the

GSD (USEPA, 1989c). Adult GSDs ranged from 1.34 to 1.40, which we do not consider to be sufficiently different from the range for children to justify using a different value for adults. The model assumes a log-normal distribution with a GSD of 1.42 and uses this information to estimate the fiftieth, ninety-fifth, and ninety-ninth percentile blood Pb concentration for a set of inputs. Since this distribution reflects the physiologic and behavioral variables including soil consumption, using upper bound values for exposure inputs would distort the percentiles corresponding to blood Pb concentrations.

The availability of Pb ingested with soil is based on a study which compared the absorption of soil Pb and Pb acetate incorporated into the diet of rats (Chaney, et.al., 1990). While the authors found a direct relationship between the Pb concentration in the soil and Pb bioavailability, the data did not define the shape of the concentration/bioavailability curve sufficiently to allow extrapolation beyond the range studied. The highest observed bioavailability for soil lead concentrations less than 1000 ppm was 44% of that observed for Pb acetate, and this guideline adopts this value as a conservative estimate of bioavailability. To accurately assess the matrix effect, a variety of variables, including lead species, particle size, and soil type would have to be systematically examined at realistic Pb concentrations in soil.

The daily soil adherence to skin of 5 gm/m^2 is based on Driver et.al (1989). The dermal absorption factor of 0.0001 ug Pb/dl blood per ug dermal Pb/day was developed by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [(11% (ATSDR, 1990)]. Based on data in the Exposure Factors Handbook (USEPA, 1989b), the median skin area of arms, hands, feet, and legs of 1-year-old boys is estimated to be 0.28 m^2, and the median skin area of arms and hands of men is estimated to be 0.37 m^2.

The ratio of 0.16 ug/dl per ug/day ingested by children is a value derived from studies in infants by Ryu et.al. (1983). The ratio of 0.04 ug/dl per ug/day ingested by adults is an empirically-determined value recommended by EPA (1986) and FDA (1990). The default value for inadvertent soil/dust ingestion by children, 55 mg/day, is based on tracer studies reviewed by Calabrese, et.al. (1991). Adult soil consumption is 25 mg/day, based on EPA (1991a). DTSC uses soil consumption rates of 200 and 100 mg/day in calculating a reasonable maximum exposure for children and adults, respectively. However, reasonable maximum inputs are not recommended for use with the lead model because the model already considers the distribution of blood lead, which reflects variation in soil ingestion along with other variables. Soil consumption representing pica is 0.79 g/day, based on estimates by Calabrese et.al. (1991).

The slopes of 1.92 and 1.64 ug/dl of blood per ug/m^3 of continuously-breathed air at atmospheric Pb concentrations <5 ug/m^3 are based on results of experimental exposures and epidemiological studies which adjusted for airborne lead contributions to pathways other than inhalation. These studies found slopes ranging from 1.52 to 2.46 ug/dl per ug/m^3 in children and 1.25 to 2.14 in adults (USEPA, 1986). The default airborne lead concentration is the highest monthly mean 24-hour value recorded in California in 1990.

4.4 USING THIS GUIDANCE

This guidance may be implemented using a computer spreadsheet, which may be obtained from DTSC. The spreadsheet is based on DTSC Guidance, Volume 4, Chapter 1, which should be consulted for more general aspects of spreadsheet application. For this spreadsheet, soil concentration in mg/kg (ppm w/w) is entered in cell E6. The spreadsheet uses it in each calculation that is affected by soil Pb. Atmospheric Pb is entered in cell E5. Drinking-water Pb is entered in cell E7. If omission of the site-grown produce pathway can be justified, a "0" is entered in cell E8. The remainder of the cells are protected and should not be altered without approval of DTSC. Any such changes will require sufficient justification and must be documented.

4.5 OTHER STANDARDS AND GUIDANCE

USEPA (1991c) considers lead to be a class B-2 carcinogen, with sufficient evidence in animals and inadequate evidence in humans. A carcinogenic potency has not been assigned. The federal MCL is 15 ug/l maximum at the tap with a maximum of 5 ug/l as a system-wide average (USEPA, 1991b). The Centers for Disease Control recommends that blood Pb concentrations exceeding 25 ug/dl require follow-up and intervention (CDC, 1985). The EPA has set 1.5 ug/m^3 as the Pb concentration limit for ambient air (quarterly average) (USEPA, 1978). California's standard is also 1.5 ug/m^3, but is based on a monthly average. The threshold limit value is 50 ug/m^3 for workplace air (ACGIH, 1989).

FDA (1990) considers the Lowest Observable Adverse Effect Level (LOAEL) to be 10 ug/dl in children and fetuses, and 30 ug/dl in adults. They use empirically-derived ratios of 0.16 and 0.04 ug/dl per ug/day ingested to predict concentrations in young children and adults, respectively. Applying an uncertainty factor of ten results in provisional tolerable intake levels of 6 ug/day for children six or less, 15 ug/day for children over six, 25 ug/day for pregnant women, and 75 ug/day for men.

REFERENCES

ACGIH. 1989. American conference of Governmental Industrial Hygienists, Documentation of TLVs and BEIs.

ATSDR. 1990. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service; Toxicological Profile for Lead.

Bolger, P. M., S. G. Capar, and M. A. Adams. 1990. Reductions in Dietary Lead Exposure in the United States. Presented at the Symposium on the Bioavailability and Dietary Exposure of Lead, Sept 24-27, 1990.

Calabrese, E. J., E. S. Stanek, and C. E. Gilbert. 1991. A Preliminary Decision Framework for Deriving Soil Ingestion Rates. In: Hydrocarbon-Contaminated Soils and Groundwater, Volume 1, Kostecki and Calabrese, eds., Lewis, Chelsea, MI.

CDC. 1985. Centers for Disease Control, U.S. Public Health Service; Preventing Lead Poisoning in Young Children; Publ. #99-2230, pp 7-19.

Chaney, R. L., H. W. Mielke, and S. B. Sterrett. 1990. Speciation, Mobility, and Bioavailability of Soil Lead; Environ. Geochem. and Health.

Chaney, R. L., S. B. Sterrett, and H. W. Mielke. 1982. The Potential for Heavy Metal Exposure from Urban Gardens and Soils; In: Proceedings of a Symposium on Heavy Metals in Urban Gardens, Agricultural Experiment Station, University of the District of Columbia, James M. Preer, ed.

DTSC. 1990. Default Risk Assessment Formulas for Determination of Soil Remediation Levels, California Environmental Protection Agency. Department of Toxic Substances Control. Draft.

Driver, J. H., J. J. Konz, and G. K. Whitmyre. 1989. Soil adherence to human skin. Bull. Environ. Contam. Toxicol. 43: 814-820.

FDA. 1990. Contaminants Team, Division of Toxicological Review and Evaluation, Food and Drug Administration, Public Health Service, U.S. Department of Health and Human services; Memorandum to Elizabeth Campbell, Division of Regulatory Guidance.

Moore, M. R., P. A. Meridith, W. S. Watson, D. J. Summer, M. K. Taylor, and A. Goldberg. 1980. The percutaneous absorption of lead-203 in humans from cosmetic preparations containing lead acetate, as assessed by whole-body counting and other techniques. Food Cosmet. Toxicol. 18: 636.

Pennington, J. A. T. 1983. Revision of the total diet study food list and diets. J. Am. Dietetic Association, 82: 166.

Ryu, J. E., E. E. Ziegler, S. E. Nelson, and S. J. Fomon. 1983. Dietary intake of lead and blood lead concentration in early infancy. Am. J. Dis. Early Child. 137: 886.

USEPA. 1978. U.S. Environmental Protection Agency; National Primary and Secondary Ambient Air Quality Standards for Lead. Fed. Regist. 43(194): 46246-46261.

USEPA. 1986. Environmental Criteria And Assessment Office, U.S. Environmental Protection Agency. Air Quality Criteria for Lead, EPA 600/8-83-028, June 1986.

USEPA. 1989a. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund, Volume 1; EPA 540/1-89-002 December, 1989.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Exposure Factors Handbook. EPA/600/8-89/043

USEPA. 1989c. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Review of the National Ambient Air Quality Standards for Lead, EPA 450/2-89-011 June 1989.

USEPA. 1991a. Office of Solid Waste and Emergency Response U.S. Environmental Protection Agency. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors; OSWER Directive 9285.6-03.

USEPA. 1991b. U.S. Environmental Protection Agency. National Primary Drinking Water Quality Standards for Lead and Copper. Fed. Regist. 56(110): June 7, 1991, p. 26460.

USEPA. 1991c. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Health Effects Assessment Summary Tables, NTIS No. PB91-921199, January 1991.

APPENDIX E

RISK ASSESSMENT CALCULATION DOCUMENTATION

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF, AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	70	50	0.122	8.6E-07	1.5E+00	1.3E-06	0.07
Beryllium	48	1.0E-06	70	50	0.122	4.2E-06	4.3E+00	1.8E-05	0.93
							TOTAL EXCESS CANCER RISK:	1.9E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	11.45	1.0E-06	70	50	0.342	2.8E-06	4.0E-04	7.0E-03	0.07
Arsenic	9.85	1.0E-06	70	50	0.342	2.4E-06	3.0E-04	8.0E-03	0.08
Barium	133.5	1.0E-06	70	50	0.342	3.3E-05	7.0E-02	4.7E-04	0.00
Beryllium	48	1.0E-06	70	50	0.342	1.2E-05	5.0E-03	2.3E-03	0.02
Cadmium	5.7	1.0E-06	70	50	0.342	1.4E-06	1.0E-03	1.4E-03	0.01
Chromium (trivalent)	15.15	1.0E-06	70	50	0.342	3.7E-06	1.0E+00	3.7E-06	0.00
Copper	3745	1.0E-06	70	50	0.342	9.2E-04	3.7E-02	2.5E-02	0.25
Lead	1150	1.0E-06	70	50	0.342	2.8E-04	See Note Below	NA	NA
Manganese	1575	1.0E-06	70	50	0.342	3.9E-04	1.0E-01	3.9E-03	0.04
Mercury	0.17	1.0E-06	70	50	0.342	4.2E-08	3.0E-04	1.4E-04	0.00
Nickel	116	1.0E-06	70	50	0.342	2.8E-05	2.0E-02	1.4E-03	0.01
Selenium	1.0	1.0E-06	70	50	0.342	2.4E-07	5.0E-03	4.9E-05	0.00
Zinc	39800	1.0E-06	70	50	0.342	9.7E-03	2.0E-01	4.9E-02	0.50
							HAZARD INDEX:	9.81E-02	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.8E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.354 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	9.85	1.0E-06	70	0.50	3700	0.01	0.122	3.2E-07	3.0E+01	9.6E-06	0.07
Beryllium	48	1.0E-06	70	0.50	3700	0.01	0.122	1.6E-06	8.6E+01	1.3E-04	0.93
									TOTAL EXCESS CANCER RISK:	1.4E-04	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	11.45	1.0E-06	70	0.50	3700	0.01	0.342	1.0E-06	4.0E-04	2.6E-03	0.10
Arsenic	9.85	1.0E-06	70	0.50	3700	0.01	0.342	8.9E-07	3.0E-04	3.0E-03	0.11
Barium	133.5	1.0E-06	70	0.50	3700	0.01	0.342	1.2E-05	7.0E-02	1.7E-04	0.01
Beryllium	48	1.0E-06	70	0.50	3700	0.01	0.342	4.3E-06	5.0E-03	8.7E-04	0.03
Cadmium	5.70	1.0E-06	70	0.50	3700	0.01	0.342	5.2E-07	1.0E-03	5.2E-04	0.02
Chromium (trivalent)	15.15	1.0E-06	70	0.50	3700	0.01	0.342	1.4E-06	1.0E+00	1.4E-06	0.00
Copper	3745.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1150.00	1.0E-06	70	0.50	3700	See Below	0.342	1.0E-02	See Note Below	--	--
Manganese	1575.00	1.0E-06	70	0.50	3700	0.01	0.342	1.4E-04	1.0E-01	1.4E-03	0.05
Mercury	0.17	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-08	3.0E-04	5.1E-05	0.00
Nickel	116.00	1.0E-06	70	0.50	3700	0.01	0.342	1.0E-05	2.0E-02	5.2E-04	0.02
Selenium	1.00	1.0E-06	70	0.50	3700	0.01	0.342	9.1E-08	5.0E-03	1.8E-05	0.00
Zinc	39800.00	1.0E-06	70	0.50	3700	0.01	0.342	3.6E-03	2.0E-01	1.8E-02	0.66
									HAZARD INDEX:	2.72E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.0E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.073 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

AD_INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on median soil EPC and local PM10 concentrations

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	0.0412	4.06E-07	70	2.5	4.0	0.245	1.4E-08	1.15E+01	1.6E-07	0.19
Beryllium	48	1.0E-06	0.0412	1.98E-06	70	2.5	4.0	0.245	6.9E-08	8.40E+00	5.8E-07	0.67
Cadmium	5.7	1.0E-06	0.0412	2.35E-07	70	2.5	4.0	0.245	8.2E-09	1.47E+01	1.2E-07	0.14
										TOTAL EXCESS CANCER RISK:	8.6E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	11.45	1.0E-06	0.0412	4.72E-07	70	2.5	4.0	0.685	4.6E-08	4.0E-04	1.2E-04	0.00
Arsenic*	9.85	1.0E-06	0.0412	4.06E-07	70	2.5	4.0	0.685	4.0E-08	3.0E-04	1.3E-04	0.00
Barium	133.5	1.0E-06	0.0412	5.50E-06	70	2.5	4.0	0.685	5.4E-07	1.0E-04	5.4E-03	0.02
Beryllium	48	1.0E-06	0.0412	1.98E-06	70	2.5	4.0	0.685	1.9E-07	1.4E-06	1.4E-01	0.41
Cadmium	5.70	1.0E-06	0.0412	2.35E-07	70	2.5	4.0	0.685	2.3E-08	1.0E-03	2.3E-05	0.00
Chromium (trivalent)	15.15	1.0E-06	0.0412	6.24E-07	70	2.5	4.0	0.685	6.1E-08	5.7E-07	1.1E-01	0.32
Copper	3745	1.0E-06	0.0412	1.54E-04	70	2.5	4.0	0.685	1.5E-05	1.0E-02	1.5E-03	0.00
Lead	1150	1.0E-06	0.0412	4.74E-05	70	2.5	4.0	0.685	4.6E-06	See Note Below	NA	NA
Manganese	1575	1.0E-06	0.0412	6.49E-05	70	2.5	4.0	0.685	6.3E-06	1.1E-04	5.8E-02	0.17
Mercury	0.17	1.0E-06	0.0412	7.00E-09	70	2.5	4.0	0.685	6.9E-10	8.6E-05	8.0E-06	0.00
Nickel	116.00	1.0E-06	0.0412	4.78E-06	70	2.5	4.0	0.685	4.7E-07	6.9E-05	6.8E-03	0.02
Selenium	1.00	1.0E-06	0.0412	4.12E-08	70	2.5	4.0	0.685	4.0E-09	1.0E-03	4.0E-06	0.00
Zinc	39800	1.0E-06	0.0412	1.64E-03	70	2.5	4.0	0.685	1.6E-04	1.0E-02	1.6E-02	0.05
										HAZARD INDEX:	3.33E-01	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.74E-05 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.078 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRESING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	46	100	0.014	3.0E-07	1.5E+00	4.5E-07	0.07
Beryllium	48	1.0E-06	46	100	0.014	1.5E-06	4.3E+00	6.3E-06	0.93
							TOTAL EXCESS CANCER RISK:	6.8E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	11.45	1.0E-06	46	100	0.197	4.9E-06	4.0E-04	1.2E-02	0.07
Arsenic	9.85	1.0E-06	46	100	0.197	4.2E-06	3.0E-04	1.4E-02	0.08
Barium	133.5	1.0E-06	46	100	0.197	5.7E-05	7.0E-02	8.2E-04	0.00
Beryllium	48	1.0E-06	46	100	0.197	2.1E-05	5.0E-03	4.1E-03	0.02
Cadmium	5.70	1.0E-06	46	100	0.197	2.4E-06	1.0E-03	2.4E-03	0.01
Chromium (trivalent)	15.15	1.0E-06	46	100	0.197	6.5E-06	1.0E+01	6.5E-07	0.00
Copper	3745	1.0E-06	46	100	0.197	1.6E-03	3.7E-02	4.3E-02	0.25
Lead	1150	1.0E-06	46	100	0.197	4.9E-04	See Note Below	NA	NA
Manganese	1575	1.0E-06	46	100	0.197	6.8E-04	1.0E-01	6.8E-03	0.04
Mercury	0.17	1.0E-06	46	100	0.197	7.3E-08	3.0E-04	2.4E-04	0.00
Nickel	116.00	1.0E-06	46	100	0.197	5.0E-05	2.0E-02	2.5E-03	0.01
Selenium	1.00	1.0E-06	46	100	0.197	4.3E-07	5.0E-03	8.6E-05	0.00
Zinc	39800	1.0E-06	46	100	0.197	1.7E-02	2.0E-01	8.5E-02	0.50
							HAZARD INDEX:	1.72E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.9E-04 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.07 [Soil Pb constant: (ug Pb/dl blood)(ug ingested Pb/day)].
1.588 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRES_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Median of shallow subsurface soil concentrations
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	9.85	1.0E-06	46	0.50	3000	0.01	0.014	4.5E-08	3.0E+01	1.4E-06	0.07
Beryllium	48	1.0E-06	46	0.50	3000	0.01	0.014	2.2E-07	8.6E+01	1.9E-05	0.93
									TOTAL EXCESS CANCER RISK:	2.0E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	11.45	1.0E-06	46	0.50	3000	0.01	0.197	7.4E-07	4.0E-04	1.8E-03	0.10
Arsenic	9.85	1.0E-06	46	0.50	3000	0.01	0.197	6.3E-07	3.0E-04	2.1E-03	0.11
Barium	133.5	1.0E-06	46	0.50	3000	0.01	0.197	8.6E-06	7.0E-02	1.2E-04	0.01
Beryllium	48	1.0E-06	46	0.50	3000	0.01	0.197	3.1E-06	5.0E-03	6.2E-04	0.03
Cadmium	5.70	1.0E-06	46	0.50	3000	0.01	0.197	3.7E-07	1.0E-03	3.7E-04	0.02
Chromium (trivalent)	15.15	1.0E-06	46	0.50	3000	0.01	0.197	9.7E-07	1.0E+01	9.7E-08	0.00
Copper	3745.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1150.00	1.0E-06	46	0.50	3000	See Below	0.197	7.4E-03	See Note Below	--	--
Manganese	1575.00	1.0E-06	46	0.50	3000	0.01	0.197	1.0E-04	1.0E-01	1.0E-03	0.05
Mercury	0.17	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-08	3.0E-04	3.6E-05	0.00
Nickel	116.00	1.0E-06	46	0.50	3000	0.01	0.197	7.5E-06	2.0E-02	3.7E-04	0.02
Selenium	1.00	1.0E-06	46	0.50	3000	0.01	0.197	6.4E-08	5.0E-03	1.3E-05	0.00
Zinc	39800.00	1.0E-06	46	0.50	3000	0.01	0.197	2.6E-03	2.0E-01	1.3E-02	0.66
									HAZARD INDEX:	1.93E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.4E-03 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.034 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

TRESINH1.WR1
14-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers
AIR EPC: Estimated particulate concentration in air based on median soil EPC and PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	9.85	1.0E-06	0.0412	4.06E-07	46	0.7	2.0	0.014	1.7E-10	1.15E+01	2.0E-09	0.19
Beryllium	48	1.0E-06	0.0412	1.98E-06	46	0.7	2.0	0.014	8.5E-10	8.40E+00	7.1E-09	0.67
Cadmium	5.7	1.0E-06	0.0412	2.35E-07	46	0.7	2.0	0.014	1.0E-10	1.47E+01	1.5E-09	0.14
										TOTAL EXCESS CANCER RISK:	1.1E-08	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	11.45	1.0E-06	0.0412	4.72E-07	46	0.7	2.0	0.197	2.8E-09	4.0E-04	7.1E-06	0.00
Arsenic*	9.85	1.0E-06	0.0412	4.06E-07	46	0.7	2.0	0.197	2.4E-09	3.0E-04	8.1E-06	0.00
Barium	133.5	1.0E-06	0.0412	5.50E-06	46	0.7	2.0	0.197	3.3E-08	1.0E-03	3.3E-05	0.00
Beryllium	48	1.0E-06	0.0412	1.98E-06	46	0.7	2.0	0.197	1.2E-08	1.4E-06	8.5E-03	0.60
Cadmium	5.70	1.0E-06	0.0412	2.35E-07	46	0.7	2.0	0.197	1.4E-09	1.0E-03	1.4E-06	0.00
Chromium (trivalent)	15.15	1.0E-06	0.0412	6.24E-07	46	0.7	2.0	0.197	3.7E-09	5.7E-06	6.6E-04	0.05
Copper	3745	1.0E-06	0.0412	1.54E-04	46	0.7	2.0	0.197	9.3E-07	1.0E-02	9.3E-05	0.01
Lead	1150	1.0E-06	0.0412	4.74E-05	46	0.7	2.0	0.197	2.8E-07	See Note Below	NA	NA
Manganese	1575	1.0E-06	0.0412	6.49E-05	46	0.7	2.0	0.197	3.9E-07	1.1E-04	3.5E-03	0.25
Mercury	0.17	1.0E-06	0.0412	7.00E-09	46	0.7	2.0	0.197	4.2E-11	8.6E-05	4.9E-07	0.00
Nickel	116.00	1.0E-06	0.0412	4.78E-06	46	0.7	2.0	0.197	2.9E-08	6.9E-05	4.2E-04	0.03
Selenium	1.00	1.0E-06	0.0412	4.12E-08	46	0.7	2.0	0.197	2.5E-10	1.0E-03	2.5E-07	0.00
Zinc	39800	1.0E-06	0.0412	1.64E-03	46	0.7	2.0	0.197	9.8E-06	1.0E-02	9.8E-04	0.07
										HAZARD INDEX:	1.42E-02	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.
Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.74E-05 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.92 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.091 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	18	1.0E-06	70	480	0.010	1.2E-06	1.5E+00	1.8E-06	0.88
Beryllium	0.84	1.0E-06	70	480	0.010	5.6E-08	4.3E+00	2.4E-07	0.12
							TOTAL EXCESS CANCER RISK:	2.1E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	5.4	1.0E-06	70	480	0.685	2.5E-05	4.0E-04	6.3E-02	0.15
Arsenic	18.0	1.0E-06	70	480	0.685	8.5E-05	3.0E-04	2.8E-01	0.68
Barium	49.4	1.0E-06	70	480	0.685	2.3E-04	7.0E-02	3.3E-03	0.01
Beryllium	0.84	1.0E-06	70	480	0.685	3.9E-06	5.0E-03	7.9E-04	0.00
Cadmium	0.78	1.0E-06	70	480	0.685	3.7E-06	1.0E-03	3.7E-03	0.01
Chromium (trivalent)	7.90	1.0E-06	70	480	0.685	3.7E-05	1.0E+01	3.7E-06	0.00
Copper	196	1.0E-06	70	480	0.685	9.2E-04	3.7E-02	2.5E-02	0.06
Lead	77.7	1.0E-06	70	480	0.685	3.6E-04	See Note Below	NA	NA
Manganese	290	1.0E-06	70	480	0.685	1.4E-03	1.0E-01	1.4E-02	0.03
Mercury	0.06	1.0E-06	70	480	0.685	2.8E-07	3.0E-04	9.4E-04	0.00
Nickel	9.60	1.0E-06	70	480	0.685	4.5E-05	2.0E-02	2.3E-03	0.01
Selenium	0.90	1.0E-06	70	480	0.685	4.2E-06	5.0E-03	8.5E-04	0.00
Zinc	847	1.0E-06	70	480	0.685	4.0E-03	2.0E-01	2.0E-02	0.05
							HAZARD INDEX:	4.15E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 3.6E-04 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.46 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	18	1.0E-06	70	0.50	3700	0.01	0.010	4.7E-08	3.0E+01	1.4E-06	0.88
Beryllium	0.84	1.0E-06	70	0.50	3700	0.01	0.010	2.2E-09	8.6E+01	1.9E-07	0.12
									TOTAL EXCESS CANCER RISK:	1.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	5.4	1.0E-06	70	0.50	3700	0.01	0.685	9.8E-07	4.0E-04	2.4E-03	0.16
Arsenic	18.0	1.0E-06	70	0.50	3700	0.01	0.685	3.3E-06	3.0E-04	1.1E-02	0.72
Barium	49.4	1.0E-06	70	0.50	3700	0.01	0.685	8.9E-06	7.0E-02	1.3E-04	0.01
Beryllium	0.84	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-07	5.0E-03	3.0E-05	0.00
Cadmium	0.78	1.0E-06	70	0.50	3700	0.01	0.685	1.4E-07	1.0E-03	1.4E-04	0.01
Chromium (trivalent)	7.90	1.0E-06	70	0.50	3700	0.01	0.685	1.4E-06	1.0E+01	1.4E-07	0.00
Copper	196	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	77.7	1.0E-06	70	0.50	3700	See Below	0.685	1.4E-03	See Note Below	--	--
Manganese	290	1.0E-06	70	0.50	3700	0.01	0.685	5.2E-05	1.0E-01	5.2E-04	0.03
Mercury	0.06	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-08	3.0E-04	3.6E-05	0.00
Nickel	9.60	1.0E-06	70	0.50	3700	0.01	0.685	1.7E-06	2.0E-02	8.7E-05	0.01
Selenium	0.90	1.0E-06	70	0.50	3700	0.01	0.685	1.6E-07	5.0E-03	3.3E-05	0.00
Zinc	847	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-04	2.0E-01	7.7E-04	0.05
									HAZARD INDEX:	1.51E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.4E-3 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.010 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA1INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 1

AIR EPC: Estimated particulate concentration in air based on Area 1 median soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	18.0	1.0E-06	0.1	1.80E-06	70	4.5	8.0	0.010	9.1E-09	1.15E+01	1.0E-07	0.92
Beryllium	0.84	1.0E-06	0.1	8.40E-08	70	4.5	8.0	0.010	4.2E-10	8.40E+00	3.6E-09	0.03
Cadmium	0.78	1.0E-06	0.1	7.80E-08	70	4.5	8.0	0.010	3.9E-10	1.47E+01	5.8E-09	0.05
										TOTAL EXCESS CANCER RISK:	1.1E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	5.4	1.0E-06	0.1	5.40E-07	70	4.5	8.0	0.685	1.9E-07	4.0E-04	4.8E-04	0.00
Arsenic*	18.0	1.0E-06	0.1	1.80E-06	70	4.5	8.0	0.685	6.3E-07	3.0E-04	2.1E-03	0.01
Barium	49.4	1.0E-06	0.1	4.94E-06	70	4.5	8.0	0.685	1.7E-06	1.0E-03	1.7E-03	0.01
Beryllium	0.84	1.0E-06	0.1	8.40E-08	70	4.5	8.0	0.685	3.0E-08	1.4E-06	2.1E-02	0.12
Cadmium	0.78	1.0E-06	0.1	7.80E-08	70	4.5	8.0	0.685	2.7E-08	1.0E-03	2.7E-05	0.00
Chromium (trivalent)	7.90	1.0E-06	0.1	7.90E-07	70	4.5	8.0	0.685	2.8E-07	5.7E-06	4.9E-02	0.28
Copper	196	1.0E-06	0.1	1.96E-05	70	4.5	8.0	0.685	6.9E-06	1.0E-02	6.9E-04	0.00
Lead	77.7	1.0E-06	0.1	7.77E-06	70	4.5	8.0	0.685	2.7E-06	See Note Below	NA	NA
Manganese	290	1.0E-06	0.1	2.90E-05	70	4.5	8.0	0.685	1.0E-05	1.1E-04	9.3E-02	0.53
Mercury	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.685	2.1E-09	8.6E-05	2.5E-05	0.00
Nickel	9.60	1.0E-06	0.1	9.60E-07	70	4.5	8.0	0.685	3.4E-07	6.9E-05	4.9E-03	0.03
Selenium	0.90	1.0E-06	0.1	9.00E-08	70	4.5	8.0	0.685	3.2E-08	1.0E-03	3.2E-05	0.00
Zinc	847	1.0E-06	0.1	8.47E-05	70	4.5	8.0	0.685	3.0E-05	1.0E-02	3.0E-03	0.02
										HAZARD INDEX:	1.76E-01	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.77E-6 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.013 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2ING1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 2 subsurface soils (3-25').

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	1.25	1.0E-06	70	480	0.010	8.4E-08	1.5E+00	1.3E-07	0.77
Beryllium	0.13	1.0E-06	70	480	0.010	8.7E-09	4.3E+00	3.8E-08	0.23
							TOTAL EXCESS CANCER RISK:	1.6E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	0.50	1.0E-06	70	480	0.685	2.3E-06	4.0E-04	5.9E-03	0.19
Arsenic	1.25	1.0E-06	70	480	0.685	5.9E-06	3.0E-04	2.0E-02	0.65
Barium	22.00	1.0E-06	70	480	0.685	1.0E-04	7.0E-02	1.5E-03	0.05
Beryllium	0.13	1.0E-06	70	480	0.685	6.1E-07	5.0E-03	1.2E-04	0.00
Cadmium	0.06	1.0E-06	70	480	0.685	2.8E-07	1.0E-03	2.8E-04	0.01
Chromium (trivalent)	5.15	1.0E-06	70	480	0.685	2.4E-05	1.0E+01	2.4E-06	0.00
Copper	7.10	1.0E-06	70	480	0.685	3.3E-05	3.7E-02	9.0E-04	0.03
Lead	1.40	1.0E-06	70	480	0.685	6.6E-06	See Note Below	NA	NA
Manganese	11.00	1.0E-06	70	480	0.685	5.2E-05	1.0E-01	5.2E-04	0.02
Mercury	0.02	1.0E-06	70	480	0.685	9.4E-08	3.0E-04	3.1E-04	0.01
Nickel	3.85	1.0E-06	70	480	0.685	1.8E-05	2.0E-02	9.0E-04	0.03
Selenium	0.05	1.0E-06	70	480	0.685	2.3E-07	5.0E-03	4.7E-05	0.00
Zinc	14.00	1.0E-06	70	480	0.685	6.6E-05	2.0E-01	3.3E-04	0.01
							HAZARD INDEX:	3.03E-02	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 6.6E-6 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.008 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2_DC1.WR1
13-Feb-92
CHKD: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: Median of soil concentrations; Area 2 subsurface soils (3-25').

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	1.25	1.0E-06	70	0.50	3700	0.01	0.010	3.2E-09	3.0E+01	9.7E-08	0.77
Beryllium	0.13	1.0E-06	70	0.50	3700	0.01	0.010	3.4E-10	8.6E+01	2.9E-08	0.23
									TOTAL EXCESS CANCER RISK:	1.3E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	0.50	1.0E-06	70	0.50	3700	0.01	0.685	9.1E-08	4.0E-04	2.3E-04	0.20
Arsenic	1.25	1.0E-06	70	0.50	3700	0.01	0.685	2.3E-07	3.0E-04	7.5E-04	0.66
Barium	22.00	1.0E-06	70	0.50	3700	0.01	0.685	4.0E-06	7.0E-02	5.7E-05	0.05
Beryllium	0.13	1.0E-06	70	0.50	3700	0.01	0.685	2.4E-08	5.0E-03	4.7E-06	0.00
Cadmium	0.06	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-08	1.0E-03	1.1E-05	0.01
Chromium (trivalent)	5.15	1.0E-06	70	0.50	3700	0.01	0.685	9.3E-07	1.0E+01	9.3E-08	0.00
Copper	7.10	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	1.40	1.0E-06	70	0.50	3700	See Below	0.685	2.5E-05	See Note Below	--	--
Manganese	11.00	1.0E-06	70	0.50	3700	0.01	0.685	2.0E-06	1.0E-01	2.0E-05	0.02
Mercury	0.02	1.0E-06	70	0.50	3700	0.01	0.685	3.6E-09	3.0E-04	1.2E-05	0.01
Nickel	3.85	1.0E-06	70	0.50	3700	0.01	0.685	7.0E-07	2.0E-02	3.5E-05	0.03
Selenium	0.05	1.0E-06	70	0.50	3700	0.01	0.685	9.1E-09	5.0E-03	1.8E-06	0.00
Zinc	14.00	1.0E-06	70	0.50	3700	0.01	0.685	2.5E-06	2.0E-01	1.3E-05	0.01
									HAZARD INDEX:	1.13E-03	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.5E-05 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.000 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING MEDIAN SOIL EPCs

CWA2INH1.WR1
13-Feb-92
CHECKED: cac_02/13/92

RECEPTOR POPULATION: Construction Workers, Area 2

AIR EPC: Estimated particulate concentration in air based on Area 2 median soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	1.25	1.0E-06	0.1	1.25E-07	70	4.5	8.0	0.010	6.3E-10	1.15E+01	7.2E-09	0.88
Beryllium	0.13	1.0E-06	0.1	1.30E-08	70	4.5	8.0	0.010	6.5E-11	8.40E+00	5.5E-10	0.07
Cadmium	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.010	3.0E-11	1.47E+01	4.4E-10	0.05
										TOTAL EXCESS CANCER RISK:	8.2E-09	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	0.50	1.0E-06	0.1	5.00E-08	70	4.5	8.0	0.685	1.8E-08	4.0E-04	4.4E-05	0.00
Arsenic*	1.25	1.0E-06	0.1	1.25E-07	70	4.5	8.0	0.685	4.4E-08	3.0E-04	1.5E-04	0.00
Barium	22.00	1.0E-06	0.1	2.20E-06	70	4.5	8.0	0.685	7.7E-07	1.0E-03	7.7E-04	0.02
Beryllium	0.13	1.0E-06	0.1	1.30E-08	70	4.5	8.0	0.685	4.6E-09	1.4E-06	3.3E-03	0.08
Cadmium	0.06	1.0E-06	0.1	6.00E-09	70	4.5	8.0	0.685	2.1E-09	1.0E-03	2.1E-06	0.00
Chromium (trivalent)	5.15	1.0E-06	0.1	5.15E-07	70	4.5	8.0	0.685	1.8E-07	5.7E-06	3.2E-02	0.76
Copper	7.10	1.0E-06	0.1	7.10E-07	70	4.5	8.0	0.685	2.5E-07	1.0E-02	2.5E-05	0.00
Lead	1.40	1.0E-06	0.1	1.40E-07	70	4.5	8.0	0.685	4.9E-08	See Note Below	NA	NA
Manganese	11.00	1.0E-06	0.1	1.10E-06	70	4.5	8.0	0.685	3.9E-07	1.1E-04	3.5E-03	0.08
Mercury	0.02	1.0E-06	0.1	2.00E-09	70	4.5	8.0	0.685	7.0E-10	8.6E-05	8.2E-06	0.00
Nickel	3.85	1.0E-06	0.1	3.85E-07	70	4.5	8.0	0.685	1.4E-07	6.9E-05	2.0E-03	0.05
Selenium	0.05	1.0E-06	0.1	5.00E-09	70	4.5	8.0	0.685	1.8E-09	1.0E-03	1.8E-06	0.00
Zinc	14.00	1.0E-06	0.1	1.40E-06	70	4.5	8.0	0.685	4.9E-07	1.0E-02	4.9E-05	0.00
										HAZARD INDEX:	4.16E-02	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.40E-7 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.000 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	70	50	0.122	1.5E-06	1.5E+00	2.3E-06	0.04
Beryllium	164.07	1.0E-06	70	50	0.122	1.4E-05	4.3E+00	6.2E-05	0.96
							TOTAL EXCESS CANCER RISK:	6.4E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	81.51	1.0E-06	70	50	0.342	2.0E-05	4.0E-04	5.0E-02	0.11
Arsenic	17.33	1.0E-06	70	50	0.342	4.2E-06	3.0E-04	1.4E-02	0.03
Barium	382.46	1.0E-06	70	50	0.342	9.4E-05	7.0E-02	1.3E-03	0.00
Beryllium	164.07	1.0E-06	70	50	0.342	4.0E-05	5.0E-03	8.0E-03	0.02
Cadmium	19.84	1.0E-06	70	50	0.342	4.9E-06	1.0E-03	4.9E-03	0.01
Chromium (trivalent)	28.73	1.0E-06	70	50	0.342	7.0E-06	1.0E+00	7.0E-06	0.00
Copper	34413	1.0E-06	70	50	0.342	8.4E-03	3.7E-02	2.3E-01	0.50
Lead	2308	1.0E-06	70	50	0.342	5.6E-04	See Note Below	NA	NA
Manganese	24997	1.0E-06	70	50	0.342	6.1E-03	1.0E-01	6.1E-02	0.14
Mercury	0.57	1.0E-06	70	50	0.342	1.4E-07	3.0E-04	4.6E-04	0.00
Nickel	272.27	1.0E-06	70	50	0.342	6.7E-05	2.0E-02	3.3E-03	0.01
Selenium	1.63	1.0E-06	70	50	0.342	4.0E-07	5.0E-03	8.0E-05	0.00
Zinc	67134	1.0E-06	70	50	0.342	1.6E-02	2.0E-01	8.2E-02	0.18
							HAZARD INDEX:	4.53E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 5.6E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.711 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	17.33	1.0E-06	70	0.50	3700	0.01	0.122	5.6E-07	3.0E+01	1.7E-05	0.04
Beryllium	164.07	1.0E-06	70	0.50	3700	0.01	0.122	5.3E-06	8.6E+01	4.6E-04	0.96
									TOTAL EXCESS CANCER RISK:	4.7E-04	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	81.51	1.0E-06	70	0.50	3700	0.01	0.342	7.4E-06	4.0E-04	1.8E-02	0.22
Arsenic	17.33	1.0E-06	70	0.50	3700	0.01	0.342	1.6E-06	3.0E-04	5.2E-03	0.06
Barium	382.46	1.0E-06	70	0.50	3700	0.01	0.342	3.5E-05	7.0E-02	4.9E-04	0.01
Beryllium	164.07	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-05	5.0E-03	3.0E-03	0.04
Cadmium	19.84	1.0E-06	70	0.50	3700	0.01	0.342	1.8E-06	1.0E-03	1.8E-03	0.02
Chromium (trivalent)	28.73	1.0E-06	70	0.50	3700	0.01	0.342	2.6E-06	1.0E+00	2.6E-06	0.00
Copper	34413.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	2308.00	1.0E-06	70	0.50	3700	See Below	0.342	2.1E-02	See Note Below	--	--
Manganese	24997.00	1.0E-06	70	0.50	3700	0.01	0.342	2.3E-03	1.0E-01	2.3E-02	0.27
Mercury	0.57	1.0E-06	70	0.50	3700	0.01	0.342	5.2E-08	3.0E-04	1.7E-04	0.00
Nickel	272.27	1.0E-06	70	0.50	3700	0.01	0.342	2.5E-05	2.0E-02	1.2E-03	0.01
Selenium	1.63	1.0E-06	70	0.50	3700	0.01	0.342	1.5E-07	5.0E-03	3.0E-05	0.00
Zinc	67134.00	1.0E-06	70	0.50	3700	0.01	0.342	6.1E-03	2.0E-01	3.0E-02	0.36
									HAZARD INDEX:	8.34E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.
For Carcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days)*(25 years/70 years) = 0.122.
For Noncarcinogens, EF (exposure fraction) = (4 hrs/8 hrs)*(250 days/365 days) = 0.342.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 2.1E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.146 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

AD_INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.14E-07	70	2.5	4.0	0.245	2.5E-08	1.15E+01	2.9E-07	0.11
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	70	2.5	4.0	0.245	2.4E-07	8.40E+00	2.0E-06	0.74
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	70	2.5	4.0	0.245	2.9E-08	1.47E+01	4.2E-07	0.16
										TOTAL EXCESS CANCER RISK:	2.7E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	81.51	1.0E-06	0.0412	3.36E-06	70	2.5	4.0	0.685	3.3E-07	4.0E-04	8.2E-04	0.00
Arsenic*	17.33	1.0E-06	0.0412	7.14E-07	70	2.5	4.0	0.685	7.0E-08	3.0E-04	2.3E-04	0.00
Barium	382.46	1.0E-06	0.0412	1.58E-05	70	2.5	4.0	0.685	1.5E-06	1.0E-04	1.5E-02	0.01
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	70	2.5	4.0	0.685	6.6E-07	1.4E-06	4.7E-01	0.28
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	70	2.5	4.0	0.685	8.0E-08	1.0E-03	8.0E-05	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.18E-06	70	2.5	4.0	0.685	1.2E-07	5.7E-07	2.0E-01	0.12
Copper	34413	1.0E-06	0.0412	1.42E-03	70	2.5	4.0	0.685	1.4E-04	1.0E-02	1.4E-02	0.01
Lead	2308	1.0E-06	0.0412	9.51E-05	70	2.5	4.0	0.685	9.3E-06	See Note Below	NA	NA
Manganese	24997	1.0E-06	0.0412	1.03E-03	70	2.5	4.0	0.685	1.0E-04	1.1E-04	9.2E-01	0.55
Mercury	0.57	1.0E-06	0.0412	2.35E-08	70	2.5	4.0	0.685	2.3E-09	8.6E-05	2.7E-05	0.00
Nickel	272.27	1.0E-06	0.0412	1.12E-05	70	2.5	4.0	0.685	1.1E-06	6.9E-05	1.6E-02	0.01
Selenium	1.63	1.0E-06	0.0412	6.72E-08	70	2.5	4.0	0.685	6.6E-09	1.0E-03	6.6E-06	0.00
Zinc	67134	1.0E-06	0.0412	2.77E-03	70	2.5	4.0	0.685	2.7E-04	1.0E-02	2.7E-02	0.02
										HAZARD INDEX:	1.67E+00	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.51E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.156 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRESING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	46	100	0.014	5.3E-07	1.5E+00	8.0E-07	0.04
Beryllium	164.07	1.0E-06	46	100	0.014	5.0E-06	4.3E+00	2.2E-05	0.96
							TOTAL EXCESS CANCER RISK:	2.2E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	81.51	1.0E-06	46	100	0.197	3.5E-05	4.0E-04	8.7E-02	0.11
Arsenic	17.33	1.0E-06	46	100	0.197	7.4E-06	3.0E-04	2.5E-02	0.03
Barium	382.46	1.0E-06	46	100	0.197	1.6E-04	7.0E-02	2.3E-03	0.00
Beryllium	164.07	1.0E-06	46	100	0.197	7.0E-05	5.0E-03	1.4E-02	0.02
Cadmium	19.84	1.0E-06	46	100	0.197	8.5E-06	1.0E-03	8.5E-03	0.01
Chromium (trivalent)	28.73	1.0E-06	46	100	0.197	1.2E-05	1.0E+01	1.2E-06	0.00
Copper	34413	1.0E-06	46	100	0.197	1.5E-02	3.7E-02	4.0E-01	0.50
Lead	2308	1.0E-06	46	100	0.197	9.9E-04	See Note Below	NA	NA
Manganese	24997	1.0E-06	46	100	0.197	1.1E-02	1.0E-01	1.1E-01	0.14
Mercury	0.57	1.0E-06	46	100	0.197	2.4E-07	3.0E-04	8.1E-04	0.00
Nickel	272.27	1.0E-06	46	100	0.197	1.2E-04	2.0E-02	5.8E-03	0.01
Selenium	1.63	1.0E-06	46	100	0.197	7.0E-07	5.0E-03	1.4E-04	0.00
Zinc	67134	1.0E-06	46	100	0.197	2.9E-02	2.0E-01	1.4E-01	0.18
							HAZARD INDEX:	7.94E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.9E-4 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.07 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
3.187 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
CURRENT USE SCENARIO: DERMAL CONTACT WITH SOILS
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRES_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration
(based on SB1A-5, SB2-5, SB3-5, SB5-5, SB6-5 and SB9-3 results, 3-5' sample depths)

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	17.33	1.0E-06	46	0.50	3000	0.01	0.014	8.0E-08	3.0E+01	2.4E-06	0.04
Beryllium	164.07	1.0E-06	46	0.50	3000	0.01	0.014	7.5E-07	8.6E+01	6.5E-05	0.96
									TOTAL EXCESS CANCER RISK:	6.7E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	81.51	1.0E-06	46	0.50	3000	0.01	0.197	5.2E-06	4.0E-04	1.3E-02	0.22
Arsenic	17.33	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-06	3.0E-04	3.7E-03	0.06
Barium	382.46	1.0E-06	46	0.50	3000	0.01	0.197	2.5E-05	7.0E-02	3.5E-04	0.01
Beryllium	164.07	1.0E-06	46	0.50	3000	0.01	0.197	1.1E-05	5.0E-03	2.1E-03	0.04
Cadmium	19.84	1.0E-06	46	0.50	3000	0.01	0.197	1.3E-06	1.0E-03	1.3E-03	0.02
Chromium (trivalent)	28.73	1.0E-06	46	0.50	3000	0.01	0.197	1.8E-06	1.0E+01	1.8E-07	0.00
Copper	34413.00	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	2308.00	1.0E-06	46	0.50	3000	See Below	0.197	1.5E-02	See Note Below	--	--
Manganese	24997.00	1.0E-06	46	0.50	3000	0.01	0.197	1.6E-03	1.0E-01	1.6E-02	0.27
Mercury	0.57	1.0E-06	46	0.50	3000	0.01	0.197	3.7E-08	3.0E-04	1.2E-04	0.00
Nickel	272.27	1.0E-06	46	0.50	3000	0.01	0.197	1.8E-05	2.0E-02	8.8E-04	0.01
Selenium	1.63	1.0E-06	46	0.50	3000	0.01	0.197	1.0E-07	5.0E-03	2.1E-05	0.00
Zinc	67134.00	1.0E-06	46	0.50	3000	0.01	0.197	4.3E-03	2.0E-01	2.2E-02	0.36
									HAZARD INDEX:	5.93E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.5E-2 mg/kg/day (Pb CDI) * 46 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.068 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

CURRENT USE SCENARIO: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

TRESINH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.14E-07	46	0.7	2.0	0.014	3.1E-10	1.15E+01	3.5E-09	0.11
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	46	0.7	2.0	0.014	2.9E-09	8.40E+00	2.4E-08	0.74
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	46	0.7	2.0	0.014	3.5E-10	1.47E+01	5.2E-09	0.16
										TOTAL EXCESS CANCER RISK:	3.3E-08	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	81.51	1.0E-06	0.0412	3.36E-06	46	0.7	2.0	0.197	2.0E-08	4.0E-04	5.0E-05	0.00
Arsenic*	17.33	1.0E-06	0.0412	7.14E-07	46	0.7	2.0	0.197	4.3E-09	3.0E-04	1.4E-05	0.00
Barium	382.46	1.0E-06	0.0412	1.58E-05	46	0.7	2.0	0.197	9.5E-08	1.0E-03	9.5E-05	0.00
Beryllium	164.07	1.0E-06	0.0412	6.76E-06	46	0.7	2.0	0.197	4.1E-08	1.4E-06	2.9E-02	0.32
Cadmium	19.84	1.0E-06	0.0412	8.17E-07	46	0.7	2.0	0.197	4.9E-09	1.0E-03	4.9E-06	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.18E-06	46	0.7	2.0	0.197	7.1E-09	5.7E-06	1.2E-03	0.01
Copper	34413	1.0E-06	0.0412	1.42E-03	46	0.7	2.0	0.197	8.5E-06	1.0E-02	8.5E-04	0.01
Lead	2308	1.0E-06	0.0412	9.51E-05	46	0.7	2.0	0.197	5.7E-07	See Note Below	NA	NA
Manganese	24997	1.0E-06	0.0412	1.03E-03	46	0.7	2.0	0.197	6.2E-06	1.1E-04	5.6E-02	0.62
Mercury	0.57	1.0E-06	0.0412	2.35E-08	46	0.7	2.0	0.197	1.4E-10	8.6E-05	1.6E-06	0.00
Nickel	272.27	1.0E-06	0.0412	1.12E-05	46	0.7	2.0	0.197	6.7E-08	6.9E-05	9.8E-04	0.01
Selenium	1.63	1.0E-06	0.0412	6.72E-08	46	0.7	2.0	0.197	4.0E-10	1.0E-03	4.0E-07	0.00
Zinc	67134	1.0E-06	0.0412	2.77E-03	46	0.7	2.0	0.197	1.7E-05	1.0E-02	1.7E-03	0.02
										HAZARD INDEX:	9.01E-02	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.
For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.
Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 9.51E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.92 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.183 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: SOIL INGESTION PATHWAY

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	540.29	1.0E-06	70	480	0.010	3.6E-05	1.5E+00	5.4E-05	0.81
Beryllium	45.54	1.0E-06	70	480	0.010	3.1E-06	4.3E+00	1.3E-05	0.19
							TOTAL EXCESS CANCER RISK:	6.8E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	305.4	1.0E-06	70	480	0.685	1.4E-03	4.0E-04	3.6E+00	0.26
Arsenic	540.3	1.0E-06	70	480	0.685	2.5E-03	3.0E-04	8.5E+00	0.60
Barium	129.6	1.0E-06	70	480	0.685	6.1E-04	7.0E-02	8.7E-03	0.00
Beryllium	45.54	1.0E-06	70	480	0.685	2.1E-04	5.0E-03	4.3E-02	0.00
Cadmium	5.28	1.0E-06	70	480	0.685	2.5E-05	1.0E-03	2.5E-02	0.00
Chromium (trivalent)	20.01	1.0E-06	70	480	0.685	9.4E-05	1.0E+01	9.4E-06	0.00
Copper	8084	1.0E-06	70	480	0.685	3.8E-02	3.7E-02	1.0E+00	0.07
Lead	782.1	1.0E-06	70	480	0.685	3.7E-03	See Note Below	NA	NA
Manganese	5602	1.0E-06	70	480	0.685	2.6E-02	1.0E-01	2.6E-01	0.02
Mercury	0.81	1.0E-06	70	480	0.685	3.8E-06	3.0E-04	1.3E-02	0.00
Nickel	87.75	1.0E-06	70	480	0.685	4.1E-04	2.0E-02	2.1E-02	0.00
Selenium	41.91	1.0E-06	70	480	0.685	2.0E-04	5.0E-03	3.9E-02	0.00
Zinc	24606	1.0E-06	70	480	0.685	1.2E-01	2.0E-01	5.8E-01	0.04
							HAZARD INDEX:	1.41E+01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 3.7E-3 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
4.63 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 1 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	540.29	1.0E-06	70	0.50	3700	0.01	0.010	1.4E-06	3.0E+01	4.2E-05	0.81
Beryllium	45.54	1.0E-06	70	0.50	3700	0.01	0.010	1.2E-07	8.6E+01	1.0E-05	0.19
									TOTAL EXCESS CANCER RISK:	5.2E-05	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	305.4	1.0E-06	70	0.50	3700	0.01	0.685	5.5E-05	4.0E-04	1.4E-01	0.28
Arsenic	540.3	1.0E-06	70	0.50	3700	0.01	0.685	9.8E-05	3.0E-04	3.3E-01	0.65
Barium	129.6	1.0E-06	70	0.50	3700	0.01	0.685	2.3E-05	7.0E-02	3.4E-04	0.00
Beryllium	45.54	1.0E-06	70	0.50	3700	0.01	0.685	8.2E-06	5.0E-03	1.6E-03	0.00
Cadmium	5.28	1.0E-06	70	0.50	3700	0.01	0.685	9.6E-07	1.0E-03	9.6E-04	0.00
Chromium (trivalent)	20.01	1.0E-06	70	0.50	3700	0.01	0.685	3.6E-06	1.0E+01	3.6E-07	0.00
Copper	8084	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	782.1	1.0E-06	70	0.50	3700	See Below	0.685	1.4E-02	See Note Below	--	--
Manganese	5602	1.0E-06	70	0.50	3700	0.01	0.685	1.0E-03	1.0E-01	1.0E-02	0.02
Mercury	0.81	1.0E-06	70	0.50	3700	0.01	0.685	1.5E-07	3.0E-04	4.9E-04	0.00
Nickel	87.75	1.0E-06	70	0.50	3700	0.01	0.685	1.6E-05	2.0E-02	7.9E-04	0.00
Selenium	41.91	1.0E-06	70	0.50	3700	0.01	0.685	7.6E-06	5.0E-03	1.5E-03	0.00
Zinc	24606	1.0E-06	70	0.50	3700	0.01	0.685	4.5E-03	2.0E-01	2.2E-02	0.04
									HAZARD INDEX:	5.02E-01	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.4E-2 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
= 0.099 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 1: INHALATION OF SUSPENDED SOIL COPC

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA1INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 1

AIR EPC: Estimated particulate concentration in air based on Area 1 soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	540.3	1.0E-06	0.1	5.40E-05	70	4.5	8.0	0.010	2.7E-07	1.15E+01	3.1E-06	0.93
Beryllium	45.54	1.0E-06	0.1	4.55E-06	70	4.5	8.0	0.010	2.3E-08	8.40E+00	1.9E-07	0.06
Cadmium	5.28	1.0E-06	0.1	5.28E-07	70	4.5	8.0	0.010	2.7E-09	1.47E+01	3.9E-08	0.01
										TOTAL EXCESS CANCER RISK:	3.4E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	305.4	1.0E-06	0.1	3.05E-05	70	4.5	8.0	0.685	1.1E-05	4.0E-04	2.7E-02	0.01
Arsenic*	540.3	1.0E-06	0.1	5.40E-05	70	4.5	8.0	0.685	1.9E-05	3.0E-04	6.3E-02	0.02
Barium	129.6	1.0E-06	0.1	1.30E-05	70	4.5	8.0	0.685	4.6E-06	1.0E-03	4.6E-03	0.00
Beryllium	45.54	1.0E-06	0.1	4.55E-06	70	4.5	8.0	0.685	1.6E-06	1.4E-06	1.1E+00	0.35
Cadmium	5.28	1.0E-06	0.1	5.28E-07	70	4.5	8.0	0.685	1.9E-07	1.0E-03	1.9E-04	0.00
Chromium (trivalent)	20.01	1.0E-06	0.1	2.00E-06	70	4.5	8.0	0.685	7.0E-07	5.7E-06	1.2E-01	0.04
Copper	8084	1.0E-06	0.1	8.08E-04	70	4.5	8.0	0.685	2.8E-04	1.0E-02	2.8E-02	0.01
Lead	782.1	1.0E-06	0.1	7.82E-05	70	4.5	8.0	0.685	2.8E-05	See Note Below	NA	NA
Manganese	5602	1.0E-06	0.1	5.60E-04	70	4.5	8.0	0.685	2.0E-04	1.1E-04	1.8E+00	0.54
Mercury	0.81	1.0E-06	0.1	8.10E-08	70	4.5	8.0	0.685	2.9E-08	8.6E-05	3.3E-04	0.00
Nickel	87.75	1.0E-06	0.1	8.78E-06	70	4.5	8.0	0.685	3.1E-06	6.9E-05	4.5E-02	0.01
Selenium	41.91	1.0E-06	0.1	4.19E-06	70	4.5	8.0	0.685	1.5E-06	1.0E-03	1.5E-03	0.00
Zinc	24606	1.0E-06	0.1	2.46E-03	70	4.5	8.0	0.685	8.7E-04	1.0E-02	8.7E-02	0.03
										HAZARD INDEX:	3.32E+00	

: Shaded chemicals contributed most to calculated inhalation risks.

*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 7.82E-5 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.128 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: SOIL INGESTION PATHWAY
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2ING2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 2 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	45.73	1.0E-06	70	480	0.010	3.1E-06	1.5E+00	4.6E-06	0.99
Beryllium	0.15	1.0E-06	70	480	0.010	1.0E-08	4.3E+00	4.3E-08	0.01
							TOTAL EXCESS CANCER RISK:	4.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: UNIT CONVERSION (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	INGESTION CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony	4.93	1.0E-06	70	480	0.685	2.3E-05	4.0E-04	5.8E-02	0.07
Arsenic	45.73	1.0E-06	70	480	0.685	2.1E-04	3.0E-04	7.2E-01	0.91
Barium	27.05	1.0E-06	70	480	0.685	1.3E-04	7.0E-02	1.8E-03	0.00
Beryllium	0.15	1.0E-06	70	480	0.685	7.0E-07	5.0E-03	1.4E-04	0.00
Cadmium	0.37	1.0E-06	70	480	0.685	1.7E-06	1.0E-03	1.7E-03	0.00
Chromium (trivalent)	6.35	1.0E-06	70	480	0.685	3.0E-05	1.0E+01	3.0E-06	0.00
Copper	12.38	1.0E-06	70	480	0.685	5.8E-05	3.7E-02	1.6E-03	0.00
Lead	10.10	1.0E-06	70	480	0.685	4.7E-05	See Note Below	NA	NA
Manganese	168.20	1.0E-06	70	480	0.685	7.9E-04	1.0E-01	7.9E-03	0.01
Mercury	0.07	1.0E-06	70	480	0.685	3.3E-07	3.0E-04	1.1E-03	0.00
Nickel	6.59	1.0E-06	70	480	0.685	3.1E-05	2.0E-02	1.5E-03	0.00
Selenium	0.12	1.0E-06	70	480	0.685	5.6E-07	5.0E-03	1.1E-04	0.00
Zinc	24.00	1.0E-06	70	480	0.685	1.1E-04	2.0E-01	5.6E-04	0.00
							HAZARD INDEX:	7.90E-01	

: Shaded chemicals contributed most to calculated ingestion risks.

CDI EQUATIONS:

INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 4.7E-5 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.018 [Soil Pb constant: (ug Pb/dl blood)/(ug ingested Pb/day)].
0.060 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE

FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: DERMAL CONTACT WITH SOILS

CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2_DC2.WR1
13-Feb-92
CHKD: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

SOIL EPC: 95% upper confidence limit (UCL) of mean soil concentrations; Area 2 subsurface soils (3-25')

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted SF (mg/kg/day^-1)	EXCESS CANCER RISK	% Total Risk
Arsenic	45.73	1.0E-06	70	0.50	3700	0.01	0.010	1.2E-07	3.0E+01	3.5E-06	0.99
Beryllium	0.15	1.0E-06	70	0.50	3700	0.01	0.010	3.9E-10	8.6E+01	3.3E-08	0.01
									TOTAL EXCESS CANCER RISK:	3.6E-06	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC: Unit Conversion (kg/mg)	BW (kg)	SOIL AF (mg/cm^2)	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Adjusted RfD (mg/kg/day)	CDI:RfD RATIO	Percent of HI
Antimony	4.93	1.0E-06	70	0.50	3700	0.01	0.685	8.9E-07	4.0E-04	2.2E-03	0.07
Arsenic	45.73	1.0E-06	70	0.50	3700	0.01	0.685	8.3E-06	3.0E-04	2.8E-02	0.91
Barium	27.05	1.0E-06	70	0.50	3700	0.01	0.685	4.9E-06	7.0E-02	7.0E-05	0.00
Beryllium	0.15	1.0E-06	70	0.50	3700	0.01	0.685	2.7E-08	5.0E-03	5.4E-06	0.00
Cadmium	0.37	1.0E-06	70	0.50	3700	0.01	0.685	6.7E-08	1.0E-03	6.7E-05	0.00
Chromium (trivalent)	6.35	1.0E-06	70	0.50	3700	0.01	0.685	1.1E-06	1.0E+01	1.1E-07	0.00
Copper	12.38	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	--
Lead	10.10	1.0E-06	70	0.50	3700	See Below	0.685	1.8E-04	See Note Below	--	--
Manganese	168.20	1.0E-06	70	0.50	3700	0.01	0.685	3.0E-05	1.0E-01	3.0E-04	0.01
Mercury	0.07	1.0E-06	70	0.50	3700	0.01	0.685	1.3E-08	3.0E-04	4.2E-05	0.00
Nickel	6.59	1.0E-06	70	0.50	3700	0.01	0.685	1.2E-06	2.0E-02	6.0E-05	0.00
Selenium	0.12	1.0E-06	70	0.50	3700	0.01	0.685	2.2E-08	5.0E-03	4.3E-06	0.00
Zinc	24.00	1.0E-06	70	0.50	3700	0.01	0.685	4.3E-06	2.0E-01	2.2E-05	0.00
									HAZARD INDEX:	3.04E-02	

: Shaded chemicals contributed most to calculated dermal contact risks.

CDI EQUATIONS:

DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).
NOTE: Where subchronic toxicity data are available, noncancer risks are calculated using subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.8E-4 mg/kg/day (Pb CDI) * 70 (kg) * 1000 (mg->ug unit conversion) * 0.0001 [Soil Pb constant: (ug Pb/dl blood)/(ug dermal Pb/day)].
0.001 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

H. KRAMER & COMPANY SITE
FUTURE USE CONSTRUCTION WORKER SCENARIO, AREA 2: INHALATION OF SUSPENDED SOIL COPC
CDI, SF AND RfD CALCULATIONS USING 95% UCL SOIL EPCs

CWA2INH2.WR1
13-Feb-92
CHECKED: cac_02/12/92

RECEPTOR POPULATION: Construction Workers, Area 2

AIR EPC: Estimated particulate concentration in air based on Area 2 soil EPCs.

CARCINOGENS:

CARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation Slope Factor (SF) (mg/kg/day^-1)	EXCESS CANCER RISK	Percent of Total Risk
Arsenic	45.73	1.0E-06	0.1	4.57E-06	70	4.5	8.0	0.010	2.3E-08	1.15E+01	2.6E-07	0.99
Beryllium	0.15	1.0E-06	0.1	1.50E-08	70	4.5	8.0	0.010	7.5E-11	8.40E+00	6.3E-10	0.00
Cadmium	0.37	1.0E-06	0.1	3.70E-08	70	4.5	8.0	0.010	1.9E-10	1.47E+01	2.7E-09	0.01
										TOTAL EXCESS CANCER RISK:	2.7E-07	

NONCARCINOGENS:

NONCARCINOGENIC PARAMETER	SOIL EPC (mg/kg)	UC - Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	INHALATION CDI (mg/kg/day)	Inhalation RfD (mg/kg/day)	CDI:RfD RATIO	Percent of Hazard Index
Antimony*	4.93	1.0E-06	0.1	4.93E-07	70	4.5	8.0	0.685	1.7E-07	4.0E-04	4.3E-04	0.00
Arsenic*	45.73	1.0E-06	0.1	4.57E-06	70	4.5	8.0	0.685	1.6E-06	3.0E-04	5.4E-03	0.05
Barium	27.05	1.0E-06	0.1	2.71E-06	70	4.5	8.0	0.685	9.5E-07	1.0E-03	9.5E-04	0.01
Beryllium	0.15	1.0E-06	0.1	1.50E-08	70	4.5	8.0	0.685	5.3E-09	1.4E-06	3.8E-03	0.04
Cadmium	0.37	1.0E-06	0.1	3.70E-08	70	4.5	8.0	0.685	1.3E-08	1.0E-03	1.3E-05	0.00
Chromium (trivalent)	6.35	1.0E-06	0.1	6.35E-07	70	4.5	8.0	0.685	2.2E-07	5.7E-06	3.9E-02	0.37
Copper	12.38	1.0E-06	0.1	1.24E-06	70	4.5	8.0	0.685	4.4E-07	1.0E-02	4.4E-05	0.00
Lead	10.10	1.0E-06	0.1	1.01E-06	70	4.5	8.0	0.685	3.6E-07	See Note Below	NA	NA
Manganese	168.20	1.0E-06	0.1	1.68E-05	70	4.5	8.0	0.685	5.9E-06	1.1E-04	5.4E-02	0.50
Mercury	0.07	1.0E-06	0.1	7.00E-09	70	4.5	8.0	0.685	2.5E-09	8.6E-05	2.9E-05	0.00
Nickel	6.59	1.0E-06	0.1	6.59E-07	70	4.5	8.0	0.685	2.3E-07	6.9E-05	3.4E-03	0.03
Selenium	0.12	1.0E-06	0.1	1.20E-08	70	4.5	8.0	0.685	4.2E-09	1.0E-03	4.2E-06	0.00
Zinc	24.00	1.0E-06	0.1	2.40E-06	70	4.5	8.0	0.685	8.5E-07	1.0E-02	8.5E-05	0.00
										HAZARD INDEX:	1.07E-01	

: Shaded chemicals contributed most to calculated inhalation risks.
*Calculations use oral RfD due to lack of inhalation toxicity criteria.

CDI EQUATIONS:

INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS

CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios. Where subchronic toxicity data are available, noncancer risk calculations use subchronic RfDs.

ASSESSMENT OF HEALTH RISKS FROM EXPOSURES TO INORGANIC LEAD IN SOIL

Estimated Blood Lead Level = 1.0E-06 mg/m^3 (estimated atmospheric Pb conc.) * 1000 (mg->ug unit conversion) * 1.64 [Pb inhalation constant: (ug Pb/dl blood)/(ug Pb/m^3)].
0.002 ug Pb/dl blood. This value is less than the blood lead concentration of concern -- 10 ug Pb/dl blood (DTSC, 1992). See Appendix D.

PART II

RISK ASSESSMENT
H. KRAMER & COMPANY SITE
CHEVRON CHEMICAL CORPORATION

CONTENTS

PART II: HEALTH RISK ASSESSMENT ADDENDA

ADDENDUM #1: 14 AUGUST 1992 OEHHA COMMENTS ON MAY 1992 RISK ASSESSMENT

ADDENDUM #2: 14 OCTOBER 1992 RESPONSES TO OEHHA COMMENTS OF 14 AUGUST 1992

ADDENDUM #3: 16 NOVEMBER 1992 OEHHA COMMENTS

ADDENDUM #4: 18 DECEMBER 1992 DIRECTIVE FROM LARWQCB

ADDENDUM #5: RESPONSES TO 16 NOVEMBER OEHHA COMMENTS AS DISCUSSED WITH LARWQCB AND OEHHA ON 4 DECEMBER 1992. Addendum #5 includes the following five Attachments:

Attachment #1 -- Revised HRA Results Based on OEHHA-Recommended Intake and Exposure Parameters

Attachment #2 -- Risk Assessment Calculation Documentation for February 1993 HRA Addenda

Attachment #3 -- Latest DTSC Blood Lead Guidance (July 1992)

Attachment #4 -- Toxicity Profiles for Aluminum, Cobalt, Molybdenum, Silver and Vanadium (Source: Klaasen, C.D., M.O. Amdurer and J. Doull. 1986. Casarett and Doull's Toxicology)

ADDENDUM #6: CURRENT RESIDENTIAL USE SCENARIO: REASONABLE MAXIMUM EXPOSURE (RME) RISKS AT THE LOCATION OF THE MAXIMALLY EXPOSED INDIVIDUAL (MEI). This evaluation, which used very conservative assumptions, includes dispersion modeling and exposure and risk estimation for the following RME exposure pathways: soil ingestion; dermal contact; inhalation; and ingestion of garden vegetables.

ADDENDUM #1

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14 AUGUST 1992 OEHHA COMMENTS ON MAY 1992 RISK ASSESSMENT
(transmitted by LARWQCB via letter dated 20 August 1992)

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

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

M E M O R A N D U M

TO: James E. Ross
Senior Water Resource Control Engineer
California Regional Water Quality
Control Board
Los Angeles Region
100 Centre Plaza Drive
Monterey Park, CA 91754

FROM: Jean Rabovsky, Ph.D.
Staff Toxicologist
Hazardous Waste Toxicology Section

DATE: August 14, 1992

SUBJECT: Public Health Risk Assessment for the H. Kramer & Company Site

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Thank you for asking me to review the document entitled *Public Health Risk Assessment for the H. Kramer & Company Site*. The risk assessment, dated May 1992, was prepared by Ebasco Environmental (EBASCO), San Francisco, California. The Hazardous Waste Toxicology Section (HWTS), Office of Environmental Health Hazard Assessment (OEHHA), was contacted in June 1992 at which time the document was received.

The H. Kramer & Co. Site (HKC) is located in El Segundo, California and is surrounded by residential communities, including El Segundo, Redondo Beach, and Manhattan Beach. According to the document, HKC was the site of a brass foundry from 1951 to mid-1985. Previous activity included the manufacture of ammunition casings by Harshaw Chemical Co., a subsidiary of Chevron. Two concerns about the site include the presence of slag in which metals have been encased in silica and/or silicate materials and the presence of arsenic (As) in an aquifer.

According to EBASCO's assessment, HKC is associated with exposure-related cancer and non-cancer risks. The major cancer risk (greater than one in a million) results from dermal exposure to beryllium, although exposure to arsenic also represents a cancer risk. According to EBASCO, non-cancer risk (hazard index greater than one) is associated primarily with exposure to manganese.

I believe the Risk Assessment as prepared by EBASCO for HKC requires additional work. The issues will be detailed below, but I wish to emphasize some points at this time. <u>As requested, I focused my review of the risk assessment on the metal contamination of the slag and soil and the potential for human health risk.</u> Questions remain about chemicals excluded from the risk assessment, including organic chemicals and arsenic contamination of the

Gage aquifer. Please let me know if you would like me to evaluate these issues further.

After reading the risk assessment and discussing it with representatives of EBASCO and HKC, I understand the document is a baseline risk assessment which includes current and future land-use scenarios. Scenarios based on remediation are not part of the risk assessment. Should a remediation risk assessment be prepared, the first step would be a baseline or no action risk assessment, hence the necessity of this document.

As I understand the document, some metals were omitted from the assessment because toxicity values were unavailable for a quantitative evaluation. According to USEPA Guidelines, chemicals with no toxicity values should not be eliminated from the risk assessment. The following options exist. (1) Derive toxicity values where data are available (as was done for lead blood levels). (2) Discuss, qualitatively, the toxicity concerns of the metals. The ATSDR Profiles can be consulted for qualitative although not quantitative information.

The following metals were excluded from the risk assessment as chemicals of potential concern (COPC): aluminum, cobalt, iron, molybdenum, silver, and vanadium. When I checked *IRIS* (update, June 1991) no entries were found for aluminum and iron. Risk assessments were under review by USEPA for cobalt, molybdenum, and vanadium. Silver toxicity values are as follows: RfD - 5 E-3 mg/mg-d/Conf is L/ UF = 3; Cancer ID is D; AWQC for HH (water & fish consumption) = 5 E+1 ug/L.

The remainder of the review will deal only with the risk from exposure to the slag-metal COPCs as defined by EBASCO. Comments on other issues may be found at the end of the memo. I have divided the review into four major sections.

1. <u>Exposure concentration</u> is the concentration of the contaminant in the medium of interest, e.g. soil or water. This part of the evaluation requires an in-depth knowledge of sampling protocols and analytical procedures, both of which are outside by area of expertise. I believe, however, problems exist and I strongly suggest an appropriate individual be consulted. I will express my concerns below.

2. <u>Exposure scenarios</u> describe the exposed populations and their activities.

3. <u>Intake factors</u> is a general term which describes factors that affect the total amount of the substance absorbed by an individual. These terms include but are not limited to physiological parameters such as body weight, skin permeability, ventilation rate, and soil ingestion rate. Although exposure time terms are usually considered separately, I will include them here for purposes of simplicity, because they also affect the total absorbed dose.

4. <u>Risk characterization</u>. To quantify the cancer and non-cancer risks, standard values (cancer potency slopes (CPSs) and reference doses

(RfDs)) are applied to the estimated chronic daily intake (CDI). CPSs and RfDs are derived from epidemiologic or non-human animal laboratory studies and are available from Federal and State documents. Because new studies are often in progress, these numbers are subject to change.

EXPOSURE CONCENTRATION

Exposure concentrations are based on data collected by ENSR. In general, I proceed with the assumption that all exposure concentrations are based on adequate and valid sampling and analytical procedures and protocols. This condition also includes the adequacy and validity of data analysis. My remarks about the use of data to estimate human health risk are subject to change any time we are informed additional evaluation requires a change in the exposure concentration.

Below are topics I believe need discussion.

1. Have the data been verified?

2. In terms of composition, what is the relationship between the composition of the below ground-level slag and the above ground-level slag, the dust stored in the on-site bins, and the ZnO dust sent to the recycling center?

3. According to the risk assessment, Cr(VI) was omitted from the COPCs because of USEPA guidance that allows the elimination of chemicals when they occur in less than 1/50 samples. Because Cr(VI) is a carcinogen, I believe the ability of the ENSR data to distinguish between a spurious result and a hot spot should be verified.

4. What analyses exist for the on-site ponds (water and sludge), tanks, and drums located in area 2?

5. Is air monitoring data available? I am thinking of measured levels of respirable dust (less than 10 μm).

6. For some samples, WET analyses were not performed although the total analyses exhibited values less than TTLC but greater than 10% STLC. Included in this group are five As samples.

7. EBASCO chooses to use a median rather than an arithmetic average for the average exposure concentration. According to USEPA guidelines for Superfund sites (1989, 1990) the arithmetic mean is preferable over other mean values. Under site-specific situations, a geometric mean is allowable, but its use should be justified in terms suggested by the guidelines. Such justification does not appear in the risk assessment.

   When I compared the arithmetic mean and median values for the soil metal data for the groups *slag soil-5 ft* and *area 1-25 ft* (Tables 1 and 2), only As and Se in the *slag soil-5 ft* appear normally distributed. All other data were skewed to different extents. Such skewing suggests

migration may be occurring. I suggest a person with expertise in soil sampling take a look at this data.

As I understand the tables in Appendix C, the exposure concentration for the reasonable maximally exposed individual (RME) is the 95% upper confidence limit (UCL) on the arithmetic mean. This value is appropriate and should be used for the RME.

8. When the site data were grouped, no information was given for *area 1-5 ft*. I will discuss this omission in more detail in the section on *"Scenarios"*. Nevertheless, I believe data from this section should also undergo analysis as it was for the other sections.

9. No information on airborne particulates was found. In the absence of air monitoring data, air modeling results could give some idea as to the extent of anticipated airborne contamination.

EXPOSURE SCENARIOS

Two basic scenarios are proposed. One is a current use scenario in which a maintenance/security person and a 9-16 yr child trespasser are the receptors. From my visit to the site, I find this a reasonable scenario for the baseline assessment. My only concern is the absence of residential receptors who could be affected by airborne particulates. In the absence of air monitoring data, you may want to consider the inclusion of air modeling to determine if this scenario is important. For this scenario, only the *slag soil-5 ft* section is considered because it is assumed this area is the site of highest metal exposure.

The second scenario is a construction scenario and takes place in the absence of any remediation. Such a scenario will represent a worst case situation and is appropriate for a baseline risk assessment. Although I have been told no excavation will occur on this site, such information on potential exposure is useful. I disagree, however, that the child trespasser should be omitted from this scenario. Fences and security guards notwithstanding, 9-16 year old children can figure out how to gain access to the site, including during excavation.

The sites for exposure during future excavation are area 1 and area 2, each at a depth of 25 ft or less. I can understand dividing the total property between these areas because they are different in terms of the slag. I do not understand using area 1 (which includes the soil slag area) for the future construction scenario and the soil slag area for the current scenario.

Each scenario requires estimating an exposure concentration from data obtained at various depth levels from 1-25 ft. I was unable to find in the risk assessment how these data were combined to arrive at a single number. Were all volume increments equal, or were differences in volumes of the bore samples taken into consideration for the calculations?

INTAKE FACTORS

Although many intake factors have become standardized, many are subject to discussion. In Table 3, I have shown where I disagree with EBASCO on the use of exposure factors and exposure frequency. Note that the differences are tabulated for the RME. The risk assessment is a baseline assessment, and health protective considerations are important. I have therefore focused my attention on the RME. In the EBASCO risk assessment, the RME is based only on the 95% UCL exposure concentration; no allowances were made for exposure factors and/or frequencies. I believe this is a mistake.

In Table 3, I have listed intake factors and exposure frequencies, which I believe more adequately describe the characteristics of current RME adult workers and 9-16 yr child trespassers. Only those values are listed that differ from the ones used by EBASCO. I have also calculated the amount by which subsequent CDIs and cancer and non-cancer risks would increase when these numbers are combined for the three routes of exposure for each receptor. The results are in Table 4.

RISK CHARACTERIZATION

Four issues need to be discussed in this section. They are toxicity values, cancer risk, non-cancer risk, and blood lead levels. According to my preliminary calculations, I am concerned risks may be underestimated. This conclusion is based solely on the chemicals analyzed by EBASCO and does not include chemicals which were omitted. Furthermore, I am assuming the exposure point concentration is correct. Changes in this value will require another evaluation.

The estimation of cancer and non-cancer risks requires the knowledge of the chronic daily intakes and the toxicity values of the metals. In the previous section, I discussed possible changes in the CDIs due to the use of different exposure factors and frequencies. Below I discuss how I applied this information to the current worker and child trespasser RME risks of exposure.

1. <u>Toxicity values</u>. As we discussed in our meeting of 20 July, the State of California uses the following hierarchy of information.

   a. *California Environmental Protection Agency Criteria for Carcinogens*, July 1992.

   b. *California Air Pollution Control Officers Association (CAPCOA), Hot Spots (AB 2588)*, January 1992.

   c. USEPA / *Integrated Risk Information Service (IRIS)*, updated June 1992.

   d. USEPA / *Health Effects Summary Tables (HEAST)*, January 1992.

Some of the documents may have been released after EBASCO completed the document and we regret any inconvenience. Nevertheless, cancer potency slopes (CPSs) now used by the State should be included in the revised document.

Included among non-cancer risks are reproductive and developmental risks. I did not find any discussion of such exposure related health hazards in the risk assessment prepared by EBASCO. Where applicable, reproductive and developmental effects should be noted.

Below are comments on specific toxicity values.

Cancer Potency Slopes.

As. Ingestion Based on *Heast* recommendation (1991), I calculate 1.75 E+0. Inhalation. *Cal/EPA Criteria for Carcinogens*, 1.2 E+1. As is under review at the State and Federal levels, and I suggest close attention should be paid to this chemical and its associated cancer risk.

Be. Numbers supplied by the *Cal/EPA Criteria for Carcinogens* are for beryllium oxide and beryllium sulfate. What is the composition of the beryllium analyzed by ENSR for HKC?

Reference Dose. RfD refers to ingestion. RfC refers to inhalation. Although inhalation reference dose units may be in terms of mg/kg-d, the conversion originates with ug/m^3 based on air concentration.

As. Inhalation *CAPCOA* uses 1.4 E-4.

Cd. Ingestion I do not understand the second entry. According to *HEAST 1991*, the RfD for food intake = 1 E-3, is based on cancer, not proteinuria.

Cr 3 & 6. Ingestion The subchronic RfDs are obtained from *HEAST*, not *IRIS*.

Cu. Inhalation Using CAPCOA value of 2.4 E-3 ug/m^3, I calculate and RfC = 6.8 E-4 mg/kg-d.

Pb. Inhalation According to *CAPCOA*, RfC = 1.5 E+0 ug/m^3, from which I calculate 4.3 E-4 mg/kg-d.

Ni. Ingestion *IRIS* numbers are for soluble salts. What is the composition of the Ni analyzed by ENSR for HKC?

Se. Inhalation Using the *CAPCOA* value of 5.1 E-1 ug/m^3, I calculate 1.4 E-4 mg/kg-d.

2. Cancer risk is defined as the product of CDI x cancer potency slope (CPS). In general, cancer risks less than one in a million (E-6) are considered not at a level of regulatory concern. Nevertheless, my remarks should not be interpreted as to what I consider acceptable, because this is a community decision.

A spot-check of the tables in Appendix E indicates arithmetic is correct and equations are appropriate.

The final risks will change, however, if the exposure factors suggested in this memo are used instead of the exposure factors of EBASCO. In Table 5, I have compared the cancer risks estimated by HWTS and by EBASCO for the current worker and child RME. For the current RME child trespasser, the cancer risk changes from less than E-6 to 2 E-6 for the soil ingestion of As. A contributor to the higher cancer risk is the exposure frequency of 180/365 (d) rather than 72/365 (d) for this child (Table 3).

Other changes involve As and Be for which cancer risks were already estimated as greater than E-6, but the values will be increased as indicated. In the risk assessment by EBASCO, the summary tables for cancer risk include only beryllium, the major contributor to the risk. I believe any chemical that contributes to a cancer risk greater than E-6 should be indicated, in this case As. I suggest EBASCO revise accordingly.

2. Non-cancer risk is defined as the CDI divided by the reference dose (RfD/RfC) and is called the hazard index (HI). An HI greater than 1 is considered a value of regulatory concern which can also be applied to the summation of HIs for all the chemicals being analyzed. Again, the change in CDIs due to changes in exposure factors and frequencies will change the HI, and the comparison between EBASCO and HWTS is in Table 5.

The use of subchronic vs chronic RfD/RfCs is open to question. USEPA allows the use of the subchronic value when the exposure time is less than 10% the 70 yr lifetime. However, USEPA is now considering a normal residential lifetime = 30 yrs. I am therefore uncertain what the subchronic standard should be. In the case of the HKC, however, non-cancer hazard indices do not exceed 1.0 when the subchronic RfD/RfCs are replaced by chronic RfD/RfCs.

The estimated total non-cancer risk due to soil ingestion by the current RME worker and child trespasser changes from less than 1.0 to 1.8 and 2.8, respectively, when the different exposure factors are applied. The non-cancer risk due to inhalation by the worker is increased (EBASCO estimated the total HI as 1.7), and that of the child trespasser changes from less than 1 to 1.0. Although an HI = 1.0 is not representative of a risk, I suggest a level of concern may exist because of questions about the characterization of the site. If the site data are reevaluated, I suggest this calculation be reviewed.

3. LEAD. To estimate a risk due to exposure to lead, a blood lead level in ug/dl is estimated and compared to the current level of concern, 10 ug/m^3. In the absence of actual measurements of blood lead levels, calculations that use assumptions on exposure factors may be used with a correction factor for blood volume. At the present time DTSC has issued a draft method on the calculations for estimating blood lead levels. This document is undergoing review and does not represent a final standard. I commend EBASCO for including a copy of this draft document in their risk assessment. My question is, why wasn't the methodology applied to the soil lead contamination? EBASCO chooses, instead, to use the calculated CDIs and conversion factors to derive a blood lead level. The calculations show that for each route of exposure, the lead concentration less than 10 ug/dl. EBASCO then concludes the blood lead level is below a level of concern. I was unable to find a calculation wherein the three routes of exposure were summed.

   I compared the EBASCO results with the results obtained by using the DTSC methods and the comparisons are in Table 6. In addition, I applied the HWTS correction factors to the EBASCO CDIs. I did not evaluate the assumptions in the DTSC methods, and the values in Table 6 should therefore be considered preliminary. According to Table 6, the blood lead level for the current RME child trespasser is at a level of concern. The level predicted by the draft DTSC document is also at the level of concern. Given the questions about site characterization, I suggest lead exposure should be considered an issue for human health risk at HKC.

ISSUES NOT COVERED BY SLAG SOIL METALS

The major issue not covered in the EBASCO risk assessment is exposure to contaminated water. The omission of water ingestion is based on the contamination of a non-potable water supply, the Gage aquifer. EBASCO contends that the separation of the Gage aquifer from the water supply results in an incomplete pathway.

Draft calculations exist that show the risk to exposure to arsenic in the Gage aquifer are very high and I believe you have a copy of the summary. Even if the probability of a subsequent connection between the contaminated and uncontaminated supply is low, the risk is still high. In my opinion, this issue requires very careful scrutiny, and I am not convinced by the risk assessment that the issue has been settled.

The data summary in the EBASCO document suggests organic chemical contamination of water. Because water was omitted from the risk assessment, this issue was not addressed.

Regarding MCLs, please be aware the arsenic MCL(s) is (are) undergoing extensive discussion at the State and Federal levels. I am looking into the status of the MCL for lead.

CONCLUSIONS

The following conclusions are based on data supplied by EBASCO/ENSR. Although I cannot adequately evaluate the completeness of the site characterization or the validity of laboratory results and calculations, I believe additional work is necessary. Should future evaluations lead to different exposure concentrations, the risk assessment will have to be reviewed again.

1. Water should not be omitted as a possible source of exposure under the conditions of the current risk assessment. The presence of an incomplete pathway has not been proven. If calculations indicate exposure through a potable water is minimal, discussion can be included. In the meantime, risk due to groundwater contamination on the site may exist and it should be acknowledged.

2. A future use construction scenario should include a child receptor.

3. Exposure factors should be more health conservative, particularly for the RME.

4. Cancer potency slopes and non-cancer Reference Doses should be corrected where applicable.

5. Cancer and non-cancer risks will need recalculations due to changes in *2 and 3*.

cc: William A. Vance, Ph.D.
Staff Toxicologist
Hazardous Waste Toxicology Section

Table 1

KRAMER SOIL DATA / METALS

	Sb		As		Ba		Be	
	S/5	A1/25	S/5	A1/25	S/5	A1/25	S/5	A1/25
MEAN	32.65	153.46	9.77	309.86	207.67	85.63	82.87	24.95
95% UCL	81.51	305.40	17.33	540.29	382.46	129.60	164.07	45.54
MEDIAN	11.45	5.4	9.85	1.25	133.50	49.4	48.00	0.84
MEDIAN/MEAN	0.35	0.035	1.01	0.004	0.64	0.58	0.58	0.034

S/5: slag soil, 5ft

A1/25: area 1 25 ft

	Cd		Cu		Cr3		Pb	
	S/5	A1/25	S/5	A1/25	S/5	A1/25	S/5	A1/25
MEAN	9.OO	2.79	13248	3643	17.50	13.64	1444	480
95% UCL	19.84	5.28	34413	8084	28.73	20.01	2308	782
MEDIAN	5.7	0.78	3745	196	15.15	7.9	1150	78
MEDIAN/MEAN	0.63	0.28	0.28	0.054	0.87	0.58	0.80	0.16

	Mn		Hg		Ni		Se		Zn	
	S/5	A1/25	S/5	A1/25	S/5	A1/25	S/5	A1/25	S/5	A1/25
MEAN	8041	2266	0.29	0.33	165.42	53.61	0.94	17.73	45933	15497
95% UCL	24997	5602	0.57	0.80	272.27	87.75	1.63	41.91	69134	24606
MEDIAN	1575	290	0.17	0.06	116.00	3.85	1.01	0.90	39800	14
MEDIAN/MEAN	0.20	0.13	0.59	0.18	0.70	0.072	1.06	0.051	0.87	0.001

Table 2

MEDIAN / MEAN

1.0–0.80	0.79–0.60	0.59–0.40	0.39–0.20	0.19–0.00
As	Ba	Be	Sb	Sb
Cr3	Cd	Hg	Mn	As
Pb	Ni	Cr3	Cd	Be
Se	Ba		Cu	Cu
Zn				Pb
				Mn
				Hg
				Ni
				Se
				Zn

Bold: area 1, 25 ft

Regular: soil slag, 5 ft

EXPOSURE FACTORS

Table 3

RME (95% UCL)
Current

Parameter		EBASCO	HWTS	HWTS/EBASCO
ADULT WORKER (outdoors & dusty)				
INTAKE FACTORS				
Ingestion	Soil ingestion (mg/d)	50	100	2.0
Dermal	Soil adherence (mg/cm2) (b)	0.50	1	2.0
	SA exposed (cm2) (b)	3700	5000	1.35
	Dermal abs. (metals) (c)			
Inhalation	Resp. dust (mg.m3) (d)			
EXPOSURE FREQUENCY		4/8 = 0.5	8/8 = 1 (e)	2.0
CHILD TRESPASSER (9-16 yrs)				
INTAKE FACTORS				
Dermal	Soil adherence (mg/cm2) (b)	0.5	1	2.0
	Dermal abs. (metals) (c)			
Inhalation	Air intake (m3/hr) (f)	0.7	3.2	4.5
EXPOSURE FREQUENCY (d/d)		72/365= 0.197	180/365= 0.493 (g)	2.5

a. RAGS, Supplement, March 1991
b. 0.5/CAPCOA, AB2588; 1.0/USEPA, Dermal Exposure Factors, 1992
c. SCAQCD - 1% CAPCOA - 0.1% Since HKC is in the South Coast area, use 1%.
d. Air-monitoring or air-modeling data would be helpful. Is 0.0142 mg/m3 an average or upper bound value?
e. I recall during the site visit, the maintenance/security person lives on the site most of the time.
f. USEPA, Exposure Factors Handbook, Table 3.1
g. The 9-16 yr old trespassers probably come from surrounding schools, and for the RME the total school year would be appropriate.

Table 4

SUGGESTED CORRECTION FACTORS
(INTAKE FACTORS & EXPOSURE FREQUENCY)

RME (95%UCL)
Current

	ROUTE	CORRECTION FACTOR
WORKER	Soil Ingestion	4.0
	Dermal	5.4
	Inhalation	2.0
CHILD TR	Soil Ingestion	2.5
	Dermal	5.0
	Inhalation	11.2

Table 5

CANCER & NON-CANCER RISK CALCULATIONS (a)

CURRENT RME(95%UCL)

HWTS

		Cancer			Non-cancer (b)		
		Soil Ingest.	Dermal	Inhal	Soil Ingest.	Dermal	Inhal
WORKER	As	9.2 E-6	9.2 E-5	<E-6			
	Be	2.5 E-4	2.5 E-3	4 E-6			
	Total	2.6 E-4	2.6 E-3	5.4 E-6 (c)	1.8 (Cu)	<1.0	3.3 (Mn, Be)
CHILD TR	As	2.0 E-6	1.2 E-5	E-6			
	Be	5.5 E-5	3.2 E-4	<E-6			
	Total	5.7 E-6	3.4 E-4	<E-6	2.0	<1.0	1.0

EBASCO

WORKER	As	2.3 E-6	1.7 E-5	<E-6			
	Be	6.2 E-5	4.6 E-4	2.0 E-6			
	Total	6.4 E-5	4.7 E-4	2.7 E-6 (c)	<1.0	<1.0	1.7 (Mn, Be)
CHILD TR	As	<E-6	2.4 E-6	<F-6			
	Be	2.2 E-5	6.5 E-5	<E-6			
	Total	2.2 E-5	6.7 E-5	E-6	<1.0	<1.0	<1.0

a. HWTS calculations do not include corrected RfDs, RfCs, or CPSs. The purpose of the calculations is to show the effect of using different exposure factors and frequencies.

b. Only the total HI is given. Where HI >1.0, contributing metal(s) are indicated in parentheses.

c. Total includes Cd, which by itself yields a risk <E-6.

Table 6

BLOOD LEAD LEVELS

CURENT SCENARIO 95% UCL

	Route	EBASCO	CORR	EBASCO corr	APPENDIX D
WORKER					
	Soil Ingestion	0.711	4.0	2.84	1.04
	Dermal	0.146	5.4	0.788	0.427
	Inhalation	0.156	2.0	0.312	0.295
	TOTAL	1.0		3.9	1.8
CHILD TR					
	Soil Ingestion	3.19	2.5	7.975	8.89
	Dermal	0.068	5.0	0.34	0.323
	Inhalation	0.183	11.2	2.045	0.346
	TOTAL	3.4		10.4	9.6

ADDENDUM #2

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14 OCTOBER 1992 RESPONSES TO OEHHA COMMENTS OF 14 AUGUST 1992

EBASCO

October 14, 1992

Mr. J. E. Ross, Unit Chief
Site Cleanup Unit
California Regional Water Quality Control Board
Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

RE: H. KRAMER SITE, EL SEGUNDO, CA

Dear Mr. Ross:

Enclosed please find Ebasco's responses to OEHHA's comments on our May, 1992 risk assessment for the subject site. We will be happy to discuss these with you at your convenience.

Yours truly,

Glenn Piehler
Manager, San Francisco Operations

cc: W. Potter
L. Sutton
S. Kamp

GP:slk 14oct03

RESPONSES TO AUGUST 14, 1992 OEHHA COMMENTS

PREFACE

Included herein are EBASCO's responses to OEHHA comments (dated August, 1992) on the Public Health Risk Assessment prepared and issued by EBASCO in May, 1992. OEHHA comments are duplicated for ease of review (numbered and italicized); responses (indented) follow below each comment in the same order as presented by OEHHA.

It is important to identify at the outset some general observations concerning the nature and extent of the OEHHA comments, and restate the intended purpose of the risk assessment in the context of remedial action planning for the Kramer site. The purpose was to identify and quantify, using accepted EPA protocols and/or recognized numerical standards, the public health risks associated with exposure to contaminated environmental media. This assessment is a logical first step in determining what, if any, remedial actions might be deemed necessary and reasonable to prevent people from coming into contact with such media, at frequencies and durations assumed to represent worst-case scenarios.

The risk assessment was not considered to be a necessary tool for evaluating what to do with bins, drums, or water/sludge which has accumulated in the old cooling pond. The handling of these items is a separate issue neither related to, nor as difficult to reconcile as, longer-term remedial concerns dealing with the condition of (in-situ) environmental media.

Since the risk assessment did identify instances of exceedances in health-based criteria for worst-case scenarios projected, it served its intended purpose; this step in a remedial action process is complete. Therefore, while it is possible that certain additional evaluations may be necessary prior to any actual disturbance of contaminated media (i.e., construction), continued massaging of existing data using alternate risk assessment assumptions and/or parameters would be of little or no value at this stage of the site planning process. For example, covering the slag pile, to prevent off-site dispersal of dust, was suggested even in the absence of ambient air monitoring or modeling. Modeling is considered unnecessary, and monitoring would be performed when actual grading (or other disturbance) of slag went forward.

Recognizing the above, responses to specific OEHHA comments follow below.

◻ COMMENTS ON EXPOSURE CONCENTRATIONS

Comment #1, Page 3
Have the data been verified?

> **Response:** The data were collected in accordance with an EPA-approved work plan, and subjected to standard laboratory QA/QC procedures as well as ENSR's internal QA/QC reviews and checks. Independent data validation was considered unwarranted.

RESPONSES TO AUGUST 14, 1992 OEHHA COMMENTS

□ COMMENTS ON EXPOSURE CONCENTRATIONS (cont.)

Comment #2, Page 3

In terms of composition, what is the relationship between the composition of the below ground-level slag and the above ground-level slag, the dust stored in the on-site bins, and the ZnO dust sent to the recycling center.

Response: All of the slag in the pile resulted from the same process, and differences should only relate to age. For the intended purpose of the risk assessment, as indicated in the preface, the other issues were considered not relevant.

Comment #3, Page 3

According to the risk assessment Cr(VI) was omitted from the COPCs because of USEPA guidance that allows the elimination of chemicals when they occur in less than 1/50 samples. Because CR(VI) is a carcinogen, I believe the ability of the ENSR data to distinguish between a spurious result and a hot spot should be verified.

Response: Cr(VI) occurred in one of fifty samples (sample SB2-5). Thus it was right at the criterion. Also, the concentration (1.21 mg/kg) barely exceeded the corresponding method detection limit of 1.0 mg/kg. The combination of these results led to the conclusion that the result was probably anomalous, and would not contribute anything to the quantitative analysis of carcinogenic risks.

Comment #4, Page 3

What analyses exist for the on-site ponds (water and sludge), tanks, and drums located in area 2?

Response: These issues are being handled separately from the baseline risk assessment of environmental media.

Comment #5, Page 3

Is air monitoring data available? I am thinking of measured levels of respirable dust (less than 10 um).

Response: Air monitoring data were neither available nor considered necessary to perform the baseline risk assessment. EBASCO used very conservative assumptions in evaluating the inhalation pathway, basically **assuming** that it could be inhaled for several hours at 100 percent respirable particle size.

□ COMMENTS ON EXPOSURE CONCENTRATIONS (cont.)

Comment #6, Page 3

For some samples, WET analyses were not performed although the total analyses exhibited values less than TTLC but greater than 10% STLC. Included in this group are five As samples.

Response: WET analyses are more relevant to land ban restrictions than to public health baseline risk assessments. These are typically performed for batches of soil sent to TSDFs, or sometimes on a subset of site investigation samples to provide relevant data for feasibility studies during the remedial planning process.

Comment #7, Page 3

EBASCO chooses to use a median rather than an arithmetic average for the average exposure concentration. According to USEPA guidelines for Superfund sites (1989, 1990) the arithmetic mean is preferable over other mean values. Under site-specific situations, a geometric mean is allowable, but its use should be justified in terms suggested by the guidelines. Such justification does not appear in the risk assessment.

When I compared the arithmetic mean and median values for the soil metal data for the groups slag soil-5 ft and area 1-25 ft (Table 1 and 2), only As and Se in the slag soil-5 ft appear normally distributed. All other data were skewed to different extents. Such skewing suggests migration may be occurring. I suggest a person with expertise in soil sampling take a look at this data.

As I understand the tables in Appendix C, the exposure concentration for the reasonable maximally exposed individual (RME) is the 95% upper confidence limit (UCL) on the arithmetic mean. This value is appropriate and should be used for the RME.

Response: The median was considered to be the most representative estimate of central tendency, particularly in recognition of the "skewedness" of the data. However, in accordance with EPA (RAGS) guidelines, the 95% upper confidence limit (UCL) of the arithmetic mean was also used, and was considered a reasonable maximum exposure point concentration. EBASCO did not use (and therefore need not justify) geometric means.

Skewing in distributions (e.g., histograms) of data generally says nothing about migration unless data from widely divergent areas (spatially) are cumulated and all high values come from one area and all low values from another. Skewedness normally is taken as an indication of heterogeneity ("patchiness"), a common occurrence in chemical or biological sampling. Heterogeneity can occur due to a large number of factors (e.g., disposal practice, even sampling design). Migration, per se, would be examined through a number of other investigative techniques (as would degradation, absorption, etc.). It is conceivable (but irrelevant to the purposes of this risk assessment) that metals are more concentrated in the central parts of the slag pile, but migration to Area II soils has not occurred.

□ COMMENTS ON EXPOSURE CONCENTRATIONS (cont.)

Comment #8, Page 4

When the site data were grouped, no information was given for area I -5 ft. I will discuss this omission in more detail in the section on "Scenarios." Nevertheless, I believe data from this section should also undergo analysis as it was for the other sections.

Response: We believe that further stratification and analysis of data would serve no useful purpose at this time. In a design phase, it would be important relative to determining engineering parameters. The soil statistical summaries included in Appendix C address the 0- to 5-ft interval only for (exposed) slag pile soils. Data for this (0-5') interval were not summarized for other areas (e.g., Area 1, which includes the slag pile as well as surrounding paved areas in the eastern portion of the site) because these data were not used to calculate exposure point concentrations (EPCs) and risks. Rather, future-use construction worker evaluations assumed exposures to depths of 25 ft in both Area 1 and Area 2 (corresponding statistics are included in Appendix C).

Comment #9, Page 4

No information on airborne particulates was found. In the absence of air monitoring data, air modeling results could give some idea as to the extent of anticipated airborne contamination.

Response: See response to Comment #5 (re Page 3).

□ COMMENTS ON EXPOSURE SCENARIOS

Comment #1, Page 4

My only concern is the absence of residential receptors who could be affected by airborne particulates. In the absence of air monitoring data, you may want to consider the inclusion of air modeling to determine if this scenario is important. For this scenario, only the slag soil-5 ft section is considered because it is assumed this area is the site of highest metal exposure.

Response: See response to Comments #5 and #9 under "exposure concentrations," and the preface to this correspondence.

Given the conservative assumptions used to estimate on-site inhalation risks, it is reasonable to assume that on-site exposures would be greater than any occurring off-site (even accounting for a longer exposure duration for off-site receptors, which implies continuous occupancy and windrose patterns).

RESPONSES TO AUGUST 14, 1992 OEHHA COMMENTS

□ COMMENTS ON EXPOSURE SCENARIOS (cont.)

Comment #2, Page 4

The second scenario is a construction scenario and takes place in the absence of any remediation. I disagree, however, that the child trespasser should be omitted from this scenario. Fences and security guards notwithstanding, 9-16 year old children can figure out how to gain access to the site, including excavation.

Response: It is doubtful that such an exposure scenario (trespassing one-half of the days in a year) would happen, even if the site were not fenced, in view of more palatable open spaces available in the area.

In the case of future construction around the slag pile (e.g., that associated with remediation), our experience argues against the premise that children would trespass. Contractors must adhere to rigid OSHA regulations; dust monitoring /suppression is performed; fences are erected with warning signs; access is regulated; and guards are often posted all night.

Comment #3, Page 4

The sites for exposure during future excavation are area 1 and area 2, each at a depth of 25 ft or less. I can understand dividing the total property between these areas because they are different in terms of the slag. I do not understand using area 1 (which includes the soil slag area) for the future construction scenario and the soil slag area for the current scenario.

Response: This could be subject to endless conjecture. However, current-use risk evaluations used analytical data from exposed soil areas only (i.e., the slag pile), but excavation was assumed to accompany the future-use construction scenario. Therefore, future-use pathway evaluations used data from both (currently) exposed and paved areas (since practical use would conceivably involve attention to improvements over the entire site property).

Comment #4, Page 4

Each scenario requires estimating an exposure concentration from data obtained at various depth levels from 1-25 ft. I was unable to find in the risk assessment how these data were combined to arrive at a single number. Were all volume increments equal, or were differences in volumes of the bore samples taken into consideration for the calculations?

Response: EBASCO simply entered all sample concentrations (for samples taken between 1 and 25 feet) into a database. [Sample results were taken from ENSR's tables included in the Site Characterization Report and provided in Appendix A of the baseline RA.] These data were then sorted and analyzed to determine the mean, median and upper confidence limit concentrations summarized in Appendix C. The sample results were not

□ COMMENTS ON EXPOSURE SCENARIOS (cont.)

volumetrically weighted to reveal data more relevant to a RAP or RD (i.e., "X" cubic yards at one concentration; "Y" cubic yards at another).

□ COMMENTS ON INTAKE FACTORS

Comment #1, Page 5

Although many intake factors have become standardized, many are subject to discussion. In Table 3, I have shown where I disagree with EBASCO on the use of exposure factors and exposure frequency...The risk assessment is a baseline assessment, and health protective considerations are important. I have therefore focused my attention on the RME. In the EBASCO risk assessment, the RME is based only on the 95% UCL exposure concentration; no allowances were made for exposure factors and/or frequencies. I believe this is a mistake.

In Table 3, I have listed intake factors and exposure frequencies, which I believe more adequately describe the characteristics of current RME adult workers and 9-17 yr child trespassers. Only those values are listed that differ from the ones used by EBASCO. I have also calculated the amount by which subsequent CDIs and cancer and non-cancer risks would increase when these numbers are combined for the three routes of exposure for each receptor. The results are in Table 4.

Response: We think our approach was correct, albeit subject to discussion, but have responded to comments on individual parameters listed in Table 3 as follows:

Adult Worker Exposure Parameters

- ***Soil Ingestion Rate*** -- The ingestion rate assumed by EBASCO, 50 mg/day, was chosen because it reflects the most recent EPA risk assessment guidance. In EPA's 1991 Supplemental RA Guidance, this 50 mg/day value is cited as the "standard default value for soil ingestion in the workplace." OEHHA proposes using a value of 100 mg/day based on RAGS (EPA 1989). One could argue that an alternate (e.g., 100 mg/day) value may be appropriate for an RME here because the Kramer site doesn't represent a "typical workplace." However, use of the 100 mg/day value (vs. 50 mg/day) would still not alter the conclusions of the risk assessment.

- ***Soil Adherence Rate*** -- The 0.5 mg/cm^2 adherence rate assumed by EBASCO was based on the only dermal exposure assessment guidance available at the time the risk assessment was prepared. The value suggested by OEHHA, 1.0 mg/cm^2, is based on new EPA guidance which recommends a range of 0.2-1.5 mg/cm^2. [This guidance was published in January 1992, but was not issued until May 1992.] EBASCO believes that the 0.5 mg/cm^2 adherence rate is not unreasonable given that it is within the recommended (0.2-1.5 mg/cm^2) range. Also, in citing

□ COMMENTS ON INTAKE FACTORS (cont.)

this range, EPA acknowledges that since the range is derived from hand measurements only, it may overestimate average adherence for the entire exposed skin area. Again, use of the higher value would not alter the conclusions of the RA.

- ***Surface Area Exposed*** -- EBASCO used the 3700 cm^2 surface area value assuming that the hands, forearms and head (of the on-site worker) would be exposed. OEHHA suggests a higher value, 5,000 cm^2/day, based on the newly issued dermal exposure assessment guidance. This 5,000 cm^2/day represents approximately 25% of the total body surface area for adult males, and assumes that exposure would occur at the hands, legs, arms, neck and head. EBASCO feels that the 3700 cm^2 value is correct, given that OSHA regulations for on-site workers typically require use of standard coveralls and shirts even under "Level D" (lowest level) protection.

- ***Dermal Absorption Rate for Metals*** -- The dermal absorption rate for metals used by EBASCO, 1.0%, was very conservative. OEHHA acknowledges that CAPCOA recommends a rate of 0.1% (which is one order of magnitude lower than the value used in the RA). Based on the literature, this 0.1% value is probably more representative of true metal absorption rates. [Note: EBASCO chose the higher rate because it reflected local South Coast Air Quality Management District (SCAQMD) guidance.] Had EBASCO used the more realistic 0.1% dermal absorption rate in conjunction with the alternative exposure factors recommended by OEHHA in Table 3, resulting risk estimates would be similar (or, in some cases, even lower) than the risks estimated for the baseline RA.

- ***Exposure Duration*** -- EBASCO adjusted the exposure duration because the slag pile is isolated, of no use, and therefore probably of no interest to on-site workers. Therefore, intakes were adjusted assuming that 4 hours of an 8-hour workday are spent in the vicinity of the slag pile, which in itself is probably an exaggeration.

Child Trespasser Exposure Parameters

- ***Soil Adherence Rate (0.5 mg/cm^2 vs. 1.0 mg/cm^2)*** -- See response for adult worker receptors above.

- ***Inhalation Rate*** -- The 0.7 m^3/hour value used in the RA was obtained from EPA's Exposure Factor's Handbook (EPA, 1991; Table 3-A-2). However, EBASCO agrees with OEHHA that the breathing rate for the assumed age group should be higher (e.g., 1.0 - 3.2 m^3/hour) given moderate activity. Again, substitution of the higher value would not impact the conclusions of the risk assessment.

RESPONSES TO AUGUST 14, 1992 OEHHA COMMENTS

□ COMMENTS ON INTAKE FACTORS (cont.)

- *Exposure Frequency* -- As indicated earlier, we can conceive of no way that children would be interested in going on the Kramer site one out of every two days of their lives. Even EBASCO's use of 72 days/year is considered highly conservative.

□ COMMENTS ON THE RISK CHARACTERIZATION

Comment #1, Bottom of Page 5 (Toxicity Values)
As we discussed in our meeting of 20 July, the State of California uses the following hierarchy of information:

a. *California Environmental Protection Agency Criteria for Carcinogens, July 1992.*

b. *California Air Pollution Control Officers Association (CAPCOA), Hot Spots (AB 2588), January 1992.*

c. *USEPA / Integrated Risk Information Service (IRIS), updated June 1992.*

d. *USEPA / Health Effects Summary Tables (HEAST), January 1992.*

Some of the documents may have been released after EBASCO completed the document and we regret any inconvenience...Included among non-cancer risks are reproductive and developmental risks. I did not find any discussion of such exposure related health hazards in the risk assessment prepared by EBASCO. Where applicable, reproductive and developmental effects should be noted.

Response: Source "a" was not available at the time EBASCO prepared the report; however, the remaining three sources listed above were consulted as noted in Tables 4-1 and 4-2 (footnotes /3/ and /4/, respectively) of the RA report. Thus, aluminum, cobalt, iron, molybdenum, silver and vanadium were not included in the risk assessment due to lack of toxicity criteria.

Receptors assumed to work at or access the Kramer site included adult males and 9- to 16-year old (male) trespassers. Pregnant females were excluded, and, in general, metals are not considered to be of teratogenic concern.

Comment #2a, Page 7
A spot-check of the tables in Appendix E indicates arithmetic is correct and equations are appropriate. The final risks will change, however, if the exposure factors suggested in this memo are used instead of the exposure factors of EBASCO...

RESPONSES TO AUGUST 14, 1992 OEHHA COMMENTS

□ COMMENTS ON THE RISK CHARACTERIZATION (cont.)

Response: We believe that quantitative revisions at this time would shed no additional light on the subject. Given exceedances of 10^{-6} and (in some cases) 10^{-4} risk levels (i.e., worker exposure scenarios) calculated in the May 1992 risk assessment, the conclusions of the assessment would not change using the higher exposure factors and alternative toxicity values suggested by OEHHA.

Comment #2b, Page 7

The use of subchronic vs. chronic RfD/RfCs is open to question. EPA allows the use of the subchronic value when the exposure time is less that 10% of the 70 year lifetime. However, USEPA is now considering a normal residential lifetime of ≈ 30 years. I am therefore uncertain what the subchronic standard should be. In the case of the HKC, however, non-cancer hazard indices do not exceed 1.0 when the subchronic RfD/RfDs are replaced by chronic RfD/RfCs...

Response: The necessity to resolve this comment is unclear. However, EBASCO's use of the subchronic RfD values for current-use trespasser and hypothetical future-use construction worker scenarios is considered appropriate. According to RAGS (EPA, 1989), chronic RfDs are specifically developed to be protective for long-term exposure periods, generally greater than 7 years (or more than 10% of a 70-year lifetime). Alternatively, subchronic RfDs are estimates of daily exposure levels that are likely to be without an appreciable risk of deleterious effects during a portion of a lifetime, generally 2 weeks to 7 years.

Comment #3, Page 8

...Why wasn't the (DTSC lead guidance) methodology applied to the soil lead contamination? EBASCO chooses, instead, to use the calculated CDIs and conversion factors to derive a blood lead level. The calculations shown that for each route of exposure, the lead concentration is less than 10 ug/dl. EBASCO then concludes the blood lead level is below a level of concern. I was unable to find a calculation wherein the three routes of exposure were summed...

Response: The values calculated by EBASCO are correct and in accordance with DTSC guidelines. The generalized equations used to estimate blood lead uptake for the Kramer risk assessment were taken directly from DTSC's Draft guidance (pages 2-3), and are summarized as follows:

Soil/Dust Ingestion and Dermal Contact Intake Equation:

Blood Lead Level (Pb_b) = soil Pb * contact rate (kg or gram soil/day)* soil constant

Inhalation Intake Equation:

Blood Lead Level (Pb_b) = atmospheric Pb * soil constant

◻ COMMENTS ON THE RISK CHARACTERIZATION (cont.)

Soil lead values used the median and upper 95% UCL exposure point concentrations determined for the assumed area/depth interval. Atmospheric lead concentrations were calculated based on the soil concentration and the assumed PM_{10}, as described in the RA report. For ingestion and dermal contact pathways, the contact rate was site- and pathway-specific; essentially, "soil Pb * contact rate" was equivalent to the pathway-specific lead CDI multiplied by the body weight. Contact rate values cited in DTSC's draft guidance were not used because they are not consistent with the exposure assumptions used to calculate risks for the other chemicals of concern. The soil constants used DTSC's values, which differ according to the pathway (ingestion, dermal contact or inhalation) and receptor (adult or child) evaluated. The calculations are straightforward, although careful attention to unit conversions is required. Blood lead levels estimated for the Kramer risk assessment can be verified by consulting (pathway-specific) Appendix E worksheets (specific files are referenced in Section 5 summary tables). The total blood lead level was calculated by simply adding the pathway-specific blood lead values.

◻ ISSUES NOT COVERED BY SLAG SOIL METALS

The major issue not covered in the EBASCO risk assessment is exposure to contaminated water. The omission of water ingestion is based on the contamination of a non-potable water supply, the Gage aquifer. EBASCO contends that the separation of the Gage aquifer from the water supply results in an incomplete pathway...Even if the probability of a subsequent connection between the contaminated and uncontaminated supply is low, the risk is still high. In my opinion, this issue require very careful scrutiny, and I am not convince by the risk assessment that the issue has been settled...

> **Response:** Without an exposure pathway there is no risk, but as discussed in the meeting/conference call held August 25, 1992, data pertaining to the competency of the aquiclude beneath the site need to be collected before the groundwater pathway can be conclusively addressed. These investigations are presently being discussed with the LARWQCB. Based on existing data and data expected to derive from supplemental sampling (including groundwater), this is perceived now as more of a risk management task rather than a risk assessment one.

◻ CONCLUSIONS

OEHHA's comments listed on page 9 of the summary memorandum have been addressed above and are therefore not listed again here.

In summary, exceedances of EPA target risk levels identified in the baseline risk assessment indicate that prevention of exposures to slag pile soils would be a recommended course of action. This conclusion would be no different if the higher exposure factors and alternative toxicity values suggested by OEHHA had been used. Consequently, revision of the risk assessment is not considered necessary at this time. Rather, additional site investigations and attention to ancillary issues (i.e., bins, drums, etc.) are actively being addressed.

ADDENDUM #3

16 NOVEMBER 1992 OEHHA COMMENTS
(transmitted by LARWQCB via letter dated 25 November 1992)

STATE OF CALIFORNIA PETE WILSON, *Governor*

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
LOS ANGELES REGION
101 CENTRE PLAZA DRIVE
MONTEREY PARK, CA 91754-2156
(213) 266-7500

November 25, 1992

Mr. Glenn Piehler, Manager
EBASCO Environmental
120 Montgomery Street, Suite 715
San Francisco, CA 94104-4310

H. KRAMER AND COMPANY/HARSHAW CHEMICAL COMPANY, EL SEGUNDO - PUBLIC HEALTH RISK ASSESSMENT (FILE NO. 92-57)

The following will update the progress to date on the subject project.

We have received your response to comments letter dated October 14, 1992. You were requested to submit these comments in the form of an addendum to the original August 14, 1992, Public Health Risk Assessment (HRA) which appears to not have been done. The Office of Environmental Health Hazard Assessment (OEHHA) representative, Jean Rabovsky, has reviewed this October 14, 1992, document and has met with Board staff on November 8, 1992, concerning this submittal. As a result of these action, a second and final set of review comments for the HRA by OEHHA has been prepared and is enclosed. We believe these comments are sufficiently detailed to provide exact direction in completing the HRA for this project as has been requested in previous meetings and correspondence. Therefore, these comments shall constitute our final review for this phase of the work and shall be used in preparing the final iteration of this phase of the HRA.

You are directed to review and incorporate all required revision to the original HRA, in the form of an addendum thereto, and to also document any areas of unresolved difference in the draft addendum. We will meet on December 4, 1992, to provide for final resolution of these issues. Following this meeting, the last acceptable version of this phase of the HRA shall be submitted for approval on or before December 15, 1992.

For your information, at the meeting on November 19, 1992, between Board staff, Linda Sutton and Bill Potter, we discussed the final draft version of the Cleanup and Abatement Order (CAO) and time schedule. This CAO will be issued on December 15, 1992.

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Also, by way of interest, the supplemental field work is progressing essentially on schedule and satisfactorily to staff and the report of this activity is due January 15, 1993.

If you have any questions, please contact me at 213/266-7550.

J. E. ROSS, Unit Chief
Site Cleanup Unit

Enclosure

cc: see mailing list

Post-It™ brand fax transmittal memo 7671	# of pages ▸ 9
To Glenn Piehler	From DAVID HUNG
Co. Ebasco	Co. RWQCB – LA
Dept.	Phone # 213/266-7611
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MEMORAN

TO: James E. Ross
Senior Water Resource Control Engineer
California Regional Water Quality
Control Board
Los Angeles Region
101 Centre Plaza Drive
Monterey Park, California 91754

FROM: Jean Rabovsky, Ph.D.
Hazardous Waste Toxicology Section

DATE: November 16, 1992

SUBJECT: Public Health Risk Assessment for the H. Kramer and Company Site

---

I received and reviewed the comments by EBASCO ENVIRONMENTAL (EBASCO) (October 14, 1992) on my review of the risk assessment of the H. Kramer & Company Site (HKC Site). The purpose of my review and commentaries is to ensure the technical adequacy of the assessment which will become part of the public record. I have approached the risk assessment on the HKC site by looking for health protective considerations and checking that procedures follow basic State of California and USEPA (Risk Assessment Guidelines [RAGS, 1989]) guidelines. EBASCO does incorporate health protective assumptions into their procedures and they also apply basic guidelines in most cases. I agree with the overall conclusions of the risk assessment that risks due to exposure to the site do exist.

Some issues, however, require additional discussion and I include them here. Resolution of these issues may require a reevaluation of portions of the risk assessment or they may be resolved by specifying a set of assumptions in an addendum. In this way, completion of the document may be facilitated. Specifying the assumptions does not mean ignoring the issues. In many cases, a few calculations and some specific information are all that are needed. I do not believe the EBASCO letter of October 14, 1992, constitutes an addendum.

General Comments

The overriding approach by EBASCO appears to rely on the assumption that changes to the overall risk (which is already a source for concern) would be irrelevant. I am not convinced this assumption is accurate. While a 5 percent increase in risk may not add to the current concern, a 10-fold increase in risk may engender a different response. I further suggest EBASCO consider the total effect of making more than one change. Hence, if EBASCO

believes suggested changes and/or considerations will add nothing to the risk assessment, specific assumptions should be included.

Since the risk assessment is part of a process in progress, now is the time to make appropriate changes or specifically justify why they are not necessary. Some issues, in particular, need to be addressed. Although they will be discussed in detail under Specific Comments, I include them here so that you may be aware of them. (1) Current documents (e.g. the *California Environmental Protection Agency* (Cal/EPA) *Criteria for Carcinogens*) should be acknowledged. (2) Incorrect exposure factors should be corrected (e.g. breathing rate for a child trespasser). (3) The residential population for current and future uses and the child trespasser for the future use construction scenario should be included. If EBASCO considers these receptors to be irrelevant to the exposure scenarios, specific assumptions should be listed to justify the conclusion.

Please keep in mind, for health protective purposes, unless otherwise stated, I am focusing on a reasonable maximally exposed (RME) individual.

Specific Comments

Arsenic. During the review of the EBASCO risk assessment, information on the GI absorption of arsenic has come to my attention. Unlike most metals, arsenic exists in the anionic state (arsenite or arsenate / +3 or +5) and is well absorbed by the GI tract. Hence a factor of five percent for converting the ingestion toxicity value to a dermal value is unnecessary. Also in the case of arsenic, dermal absorption appears to be negligible.

The above remarks on arsenic should not be construed to trivialize the importance of this metal to an overall risk from exposure to the HKC site. According to the EBASCO summary tables, soil ingestion is the main contributor to arsenic related toxicity or carcinogenicity risk. The issue of arsenic contaminated groundwater has yet to be resolved. Also, inorganic arsenic has been given a level of high priority in the review process for identifying reproductive/developmental toxins (Donald, et al., 1992, see Table 1 which was presented to the attendees at the meeting on July 20, 1992).

Preface. The issue of risk assessment and the items left in/on area 2 is not the use of the assessment to determine the disposition of the items. The purpose of the risk assessment is to determine the potential health risk to a population that is exposed to the items. So long as the items are on the site, they constitute a point of potential exposure.

EBASCO states that revising the risk assessment of May 1992 would be of little value, and presents a suggestion that the slag pile could be covered in the absence of additional analysis. I believe control steps that minimize exposure are always advisable. In the absence of air-

monitoring data, air-modeling analysis based on available data could be initiated. In the meantime, has the slag pile been covered?

page 1 (comment 1, p.3). The question about data verification relates to the more global issue of the quality of data. Since I do not have the expertise in site characterization, I ask for evidence of the adequacy of the sampling and analysis. I assume questions about the adequacy of the data do exist because the Cleanup and Abatement Order (CAO) asks for additional information. I therefore stress again the risk assessment submitted to the Water Board is as good as the data on which it is based.

page 2 (comment 2, p.3). The response to the question on the composition of the various dusts implies differences do exist. What are the *"other issues"* that are considered by EBASCO to be irrelevant? The above ground slag and below ground soil slag are on area 1 and are part of the risk assessment submitted to the Water Board. The dusts associated with area 2 will be *"considered not relevant"* when they no longer exist on the HKC site. Until then, all sources of emissions are relevant for a base-line risk assessment, until analysis shows otherwise.

page 2 (comment 3, p.3). In the time it has taken to avoid dealing with this issue, a preliminary calculation could have been conducted many times. Using the EBASCO risk assessment and the *California Environmental Agency (Cal/EPA) Criteria for Carcinogens*, I was able, with a hand calculator, to estimate risks for the currently exposed worker and trespasser by three routes of exposure. Surely EBASCO, with a spread sheet, can do the same. The point is, a quick calculation would provide a satisfactory answer.

page 2 (comment 4, p.3). I do not understand the response. Is a risk assessment on the ponds, sludge, etc. on area 2 being prepared? Has the HKC site been divided into more than one operable unit? Have the indicated items on area 2 been removed?

page 2 (comment 5, p.3). According to the map, the city of Hawthorne (the basis for the PM10 level for current use) is adjacent to the site. Two questions remain. Is the city of Hawthorne a proper surrogate for PM10 levels at the HKC site? What specific assumptions/calculations does EBASCO use to justify excluding the residential population?

A higher PM10 level is used for the future use construction scenario and I agree the value is health protective for the RME construction worker. My question is how does the level of air-borne PM10 particulates affect the residential population? This population will be exposed to PM10 particulates for the year of construction plus 29 years USEPA-suggested residential time. What assumptions and/or calculations, specifically, does EBASCO use to justify omitting the residential population as a receptor for dust traveling off-site?

page 3 (comment 6, p.3). As I understand the response, the base-line risk assessment is based on the total metal content of the soil (mg metal per kg soil), and regulatory numbers such as TTLC/STLC are irrelevant. For purposes of this risk assessment, I agree.

A question about the data exists. By regulation, data showing a WET analysis ¢ 10 X the STLC could lead to a classification of "hazardous". I believe the issue should be resolved.

page 3 (comment 7, p.3). The answer to the question about the use of a median value for the average exposure point concentration consists of two explanations. The second explanation is a justification for the use of the 95 percent upper confidence level on the arithmetic mean for the RME, which was not questioned (see original review).

Justification for the use of a *"median"* rather than a *"mean"* value rests on EBASCO's contention that the median is considered the most representative estimate of central tendency. I believe a number of issues are being grouped together and this grouping may be the source of confusion.

A characteristic of a population (e.g. body weight) that does not have a base-line level, may be described by a median. A concentration term for which a base-line level (e.g. metals in soil) often exists is not best expressed by a median, because such a number will underestimate the level of the contamination. The underestimation occurs because the base-line level contributes to the low end of the concentration curve and drives the choice of the median value. For this reason, I believe the average exposure point concentrations (EPCs) of soil metals in the risk assessment are underestimations. A better estimate of the average EPCs would be a mean.

The decision becomes which mean to use: arithmetic (normal distribution), geometric (geometric distribution), or log-normal mean (log-normal distribution). If the data are normally distributed, the median and the mean are the same, and in the case of Kramer such equivalence is observed for selenium and arsenic. If the data are not normally distributed, as exists for the majority of the soil metals at the HKC site, USEPA provides for the use of the geometric mean, provided certain conditions are met. The appropriate sections from USEPA RAGS (1989) and the USEPA Reg.IX Supplement (1990) are given below.

USEPA, in the RAGS (1989) and Supplement to RAGS (1990) considers the use of *"means"* for risk assessment purposes. *"The concentration term in the intake equation is the arithmetic average over the concentration that is contacted over the exposure period. Although this concentration does not reflect the maximum concentration that could be contacted at any one time, it is regarded as a reasonable estimate of the*

concentration likely to be contacted over time." (RAGS, 1989 p.6-19, Section 6.4.1). *"RAGS 6.4.1 states that exposure scenarios should be based on the arithmetic mean of the reported concentrations of contaminants at the site. There is currently debate in the scientific community about whether environmental contamination is best summarized by arithmetic or geometric means (i.e. whether it is normally or log-normally distributed). For a particular Superfund site, the Toxicology Group may consider the use of geometric means, provided: - Data were ...."* (Region IX Superfund Program, Suggested Risk Assessment Reference Materials, September 1990).

Nowhere have I found guidelines from USEPA on the use of the *"median"* in lieu of a *"mean"*. I suggest that to conform to USEPA guidelines, the most representative estimate of soil concentration should be based on a *"mean"* value.

page 4 (comment 8, p.4). See my discussion on page 5 of this memo to page 5 (comment 3, p.4).

page 4 (comment 9, p.4). See my comment on page 3 of this memo in answer to page 2 (comment 5, p.3).

page 4 (comment 1, p.4 - exposure scenario). See page 2, (comment 5, p.3)

page 5 (comment 2, p.4). The suggested exposure frequency of 180 d/yr for the 9-16 yr trespasser is based on a school year of 180 d, not an arbitrary assumption on the trespassers' choice of days to spend at the facility. EBASCO assumes what motivates the children to trespass or to avoid the area, including time during future construction scenarios. For an RME school child, health protective assumptions would consider that such individuals do not necessarily abide by fences, night guards, and OSHA regulations.

page 5 (comment 3, p.4). As I understand the response, the assumption is that under current use scenario, exposure to contamination under the pavement in area 1 is prevented because of the pavement barrier. If the pavement is intact, I agree current exposure is probably negligible. If the pavement is broken, current exposure may be possible.

pages 6-8 (comment 1, p.5) Intake factors. In general, EBASCO argues against making any of the suggested changes, because the contribution of each increment to the chronic daily intake (CDI) would not lead to a substantial change in cancer risk or hazard quotient. Hence, the conclusion of the current risk assessment, which already shows a need for concern, would not be significantly changed.

The statement may or may not be true. It certainly avoids the issue of applying other exposure factors and frequencies. My suggested values are generally upper values that are consistent with USEPA suggested

values. It may be possible that when the cancer risks and hazard quotients are summed over all chemicals, the total risks may change. If EBASCO feels that careful recalculations of CDIs and risks will not result in significant changes in estimated risks, they could justify the assumption by placing in an addendum, the expected percent change due to a different intake factor. The justification should be specific, i.e. quantitative. The comments on this issue should also include a discussion on the use of average exposure factors/frequencies for the RME, except where specified by RAGS and the Supplements to RAGS.

Soil ingestion rate - adult worker. I do not agree 50 mg/m^3 represents the workplace at the HKC site, and suggest the use of 100 mg/m^3. This value is in accordance with the discussion of adult soil ingestion in the commercial/industrial setting (OSWER Directive 9285.6-03, USEPA, *Standard Default Exposure Factors, Supplemental Guidance*, March 25, 1991, Appendix B).

Surface area exposed - adult worker. The 1992 USEPA guidance on dermal exposure suggests a default of 5000 cm^2 as a central value and 5800 cm^2 as an upper value. While I understand the final document was not issued until after the risk assessment was prepared, it is now available. The review document was available March 1991. Now is the time to make appropriate corrections. If EBASCO believes the subsequent increase risk would be inconsequential, they may indicate the estimated change and justify their conclusions in an addendum.

The risk manager should be aware that in a base-line risk assessment risk management decisions do not drive the risk assessment. Hence OSHA regulations - which are not always followed - are not relevant to this scenario. Also, the risks we are now discussing are not average risks but reasonable maximal risks (in this case, the RME).

Exposure duration - adult worker. EBASCO's comment is probably accurate for an average adult worker exposure. I do not agree it applies to the RME.

Inhalation rate - child trespasser. The inhalation rate of 0.7 m^3/hr represents the breathing rate for an adult male at rest and is incorrect for a moderately active child (USEPA Exposure Factors Handbook, March 1990, Table 3.1, page 3-4). I suggest EBASCO should use a value between 1.0 and 3.2 m^3/hr as suggested for a 10 yr old child engaging in light to moderate activity.

Exposure frequency - child trespasser. See page 5 (comment 2, p.4)

<u>page 8. Toxicity values</u>. The response covers three issues.

Sources of toxicity values. Since July 1992, the State of California has adopted the *Cal/EPA Criteria for Carcinogens* as the primary source

for cancer potency factors (CPFs). I understand the document was not available at the time the risk assessment was in preparation and have given apologies on at least three occasions. If the May 1992 risk assessment were a final document, omission of the *Cal/EPA Criteria for Carcinogens* would be understandable. As I understand the EBASCO document of May 1992, it is a draft document, which implies that appropriate changes can be made. If simple arithmetic indicates insubstantial changes, EBASCO can indicate the information in an addendum. For example, substitution with a Cal/EPA value of "a" will change the risk by "X" percent.

Exclusion of chemicals due to lack of toxicity values. Some chemicals were omitted from the list of chemicals of potential concern (COPC) because no toxicity values were available. In my memo of August 14, 1992, (p.2, par.2-3), I pointed out absence of reference doses (RfDs) and/or cancer potency factors (CPFs) is not justification for omitting a chemical from the COPC list.

The USEPA Risk Assessment Guidelines (RAGS, 1989) states, *"Chemicals without toxicity values .... should always be discussed in the risk assessment as chemicals of potential concern; they should not be eliminated from the risk assessment."* (p. 5-24). In Chapter 7, USEPA (RAGS, 1989) provides a list of data bases (including EPA's Environmental Criteria and Assessment Office) where toxicity values may be located. In the circumstance where toxicity values cannot be found, RAGS (1989) states, *"If information is not available, ... the assessor should describe the effects of the chemical qualitatively and discuss the implications of the absence of the chemical from the risk estimate in the uncertainty section of the risk assessment."* (p.7-16).

The risk assessor is, of course, free to derive a toxicity value from available data or from information on a surrogate chemical. A good reference for qualitative information on chemicals lacking toxicity values, is the Agency for Toxic Substances and Disease Registry (ATSDR) Profiles. ATSDR profiles (final or draft) on cobalt, aluminum, vanadium, and silver are available. Also, see the memo of August 14, 1991, for an RfD for silver.

Reproductive & developmental effects. The exclusion of pregnant females assumes no off-site emissions, particularly resuspension of particulate matter. Such resuspension could be exacerbated during a future use scenario involving construction. What specific assumptions does EBASCO use to justify omitting the residential population from the risk assessment? An air-modeling analysis could indicate if such assumptions are valid.

The statement, *"...in general, metals are not considered to be of teratogenic concern."* is incorrect. For example, EBASCO is referred to the text, Textbook of Teratology (JG Wilson and FC Fraser, eds, Plenum

Press, New York, Vol.I) Chapter 9 and to the article, *Human Reproductive Hazards: Evaluation and Chemical Etiology* by B Shane (Environmental Science & Technology, 23 1187-1195 [1989]). During the meeting of July 20, 1992, I distributed a table that included metals, for use as a guide, from a recent article on agents to be evaluated as reproductive/developmental toxicants (Donald, et al., Reproductive Toxicology, 6, 99-108, [1992]).

page 8/9 (comment 2, p.7). See comment on intake factors (page 6-8). Specifically, what is the increase in risk that does not warrant a reconsideration? I agree the results reported in the risk assessment indicate a concern due to exposure-related risk. A 5 percent increase would probably not add to the concern for remediation. A 10-fold increase in risk might engender a different response. I suggest EBASCO, should provide some quantitative or at the least, semi-quantitative results.

page 9 (comment 3, p.8 - lead). Before I discuss the use of consistency to accept of ignore the draft lead equations of the Department of Toxic Substances Control (DTSC), I want to correct some errors in Table 6 of my memo of 14 August 1992. My comments are directed at the child trespasser, because for lead this receptor is the more important one.

For inhalation, the application of the factor of 11.2 is incorrect because the lead value uses an assumed air concentration of lead that is independent of the CDI, and EBASCO's value of 0.183 is correct (excluding the assumptions of the DTSC). (The factor of 11.2 is still applicable to the CDIs for the other metals.) I also believe lead CDI calculated by EBASCO was overestimated by a factor of 100. As I understand the blood lead level for dermal exposure, the absorption factor of 0.01 (SCAQMD - 1%) was not used. The result therefore suggests 100 percent dermal uptake. When I apply the 0.01 factor and use my suggested exposure factors/frequencies, I calculate a dermal blood lead level of 0.0034 g/dl. The ingestion blood lead level remains the same and the total from the three routes of exposure is just under 8 g/dl.

If I have overlooked something in the dermal uptake equation, please inform me.

The comparison between total blood lead levels (g/dl) is now: EBASCO - 3.4, HWTS - 7.9, and DTSC - 9.6. In all cases the major contributor is ingestion. For HWTS, the exposure factors/frequencies were in general upper levels consistent with USEPA values. I did not investigate the individual exposure factors/frequencies used by DTSC. I do not believe they should be discounted because they are inconsistent with the values used by EBASCO for calculating the CDIs for the other metals. To do so suggests a higher importance for consistency over accuracy.

The total blood lead level due to the HKC site, calculated by EBASCO and HWTS, is less than 10 g/dl. The value 10 g/dl is a guideline for a level of concern for children and applies to the total blood lead level from all sources. Therefore, the blood lead level allowed for the receptors from the HKC site is 10 g/dl - the base-line blood lead level. This value has not yet been released and does not include sub-populations (e.g. among children and workers) that experience high blood lead levels. The issue here is an estimated blood lead level less than 10 g/dl due to exposure to the HKC site is not sufficient to conclude a level of concern does not exist. Since DTSC calculations bring the value to 9.6, this issue should be carefully considered.

If EBASCO believes the soil lead levels do not constitute a concern for risk, specific questions should be addressed. On what basis are exposure factors/frequencies chosen, particularly those that are average values for an RME. What assumptions are used to ignore a child trespasser from the future use construction scenario and the residential population, including young children and pregnant females, from the current or future use scenarios?

page 10, (remaining issues). I do not understand the last sentence. If the newly acquired data do not support a total separation of the arsenic contaminated aquifer from the potable groundwater, a risk assessment will be needed. In my opinion, the arsenic contaminated groundwater is a critically important issue that has been omitted from the risk assessment. I understand additional monitoring has been requested to resolve this issue.

page 10, (conclusions). I agree the current risk assessment indicates an exposure-related health risk. I do not agree the risk assessment is complete. Justifications for no changes rely on generalities and not specific information. I have indicated throughout the text of this memo how completion of the risk assessment document may be facilitated. My remarks do not consider agency-specific requirements of the California Regional Water Quality Control Board.

cc: William A. Vance, Ph.D.

ADDENDUM #4

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18 DECEMBER 1992 DIRECTIVE FROM LARWQCB

STATE OF CALIFORNIA PETE WILSON, Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD—
LOS ANGELES REGION
101 CENTRE PLAZA DRIVE
MONTEREY PARK, CA 91754-2156
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December 18, 1992

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H. KRAMER AND COMPANY/HARSHAW CHEMICAL COMPANY, EL SEGUNDO - PUBLIC HEALTH RISK ASSESSMENT (FILE NO. 92-57)

The following will summarize the outcome of our meeting with Chevron and Ebasco on December 4, 1992, to finalize the initial phase of the Public Health Risk Assessment (HRA).

The Office of Environmental Health Hazard Assessment's, November 16, 1992, letter responding to previous comments was used as the basis for discussion at this meeting.

All comments were discussed and resolved to the satisfaction of all in attendance regarding the presentation of the data in the final HRA. It was agreed to extend the date for submittal of the HRA to January 6, 1993, and to submit it in draft format including addendum. A meeting on January 15, 1993, at Ebasco will follow at which time the HRA will be finalized in a single bound volume for formal submittal for approval by regulators.

It was noted that Water Board staff will take responsibility for verification of all field sampling data that is used in the development of this HRA. Additionally, it was noted that at the directions of Water Board staff, this iteration of the HRA shall be based upon the specific assumption that a competent aquitard is present beneath the surface impoundment to prevent arsenic contamination in deeper aquifers of significantly more beneficial use. The supplemental field investigation currently underway at this site will be used to verify the accuracy of these specific assumptions.

Please note, the January 15, 1993, submittal date for the supplemental field data and the December 31, 1992, data for issuance for the Cleanup and Abatement Order for this site remain in effect.

RECEIVED

If you have any questions, please call me at 213/266-7550 or David Hung at 213/266-7611.

J. E. ROSS, Unit Chief
Site Cleanup Unit

cc: See mailing list

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ADDENDUM #5

RESPONSES TO 16 NOVEMBER OEHHA COMMENTS AS DISCUSSED WITH LARWQCB AND OEHHA ON 4 DECEMBER 1992

ADDENDUM #5
Responses to 16 November 1992 OEHHA Comments
(Partially completed in response to 14 August 1992 comments)

This addendum is for the Health Risk Assessment (HRA) dated May 1992 in response to California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) comments dated August 14, 1992 (Addendum #1). Ebasco's responses to each of these comments are presented in a memorandum dated October 14, 1992 (Addendum #2). In that memorandum, Ebasco concluded that revision of the May 1992 risk assessment was not necessary, given that recalculation of risks (with alternate exposure factors and updated criteria recommended by OEHHA) would not alter the conclusions of the original HRA report, i.e., that prevention of exposures to slag pile soils would be a recommended course of action. This conclusion would still hold using the higher exposure factors and alternative toxicity values suggested by OEHHA.

However, in response to subsequent requests by the LARWQCB and OEHHA, Ebasco has recalculated cancer risks and non-cancer hazard indices (HIs) in accordance with certain OEHHA recommendations. Blood lead estimates were also re-calculated to reflect more recent DTSC guidance (July 1992 Interim Final). Results of these recalculations are presented in Attachment #1 to this addendum, which includes:

- Table A-1 - Summary of Parameters Used to Calculate Risks for Current Use Exposure Scenarios (comparison of factors used in the May 1992 HRA vs. those used in attached recalculations)
- Table A-2 - Summary of Parameters Used to Calculate Risks for Future Use Exposure Scenarios (comparison of factors used in the May 1992 HRA vs. those used in attached recalculations)
- Table A-3 - Summary of Toxicity Factors Used in the Risk Assessment (comparison of toxicity criteria used in the May 1992 HRA vs. the updated values used in the attached recalculations)
- Table A-4 - Current Use Worker Exposure Scenario: Comparison of Original and Recalculated Risk Estimates (compare with Table 5-1 in May 1992 HRA)
- Table A-5 - Current Use Trespasser Exposure Scenario: Comparison of Original and Recalculated Risk Estimates (compare with Table 5-2 in 5/92 HRA)
- Table A-6 - Future Use Construction Worker Scenario for Area 1 Soils: Comparison of Original and Recalculated Risk Estimates (compare with Table 5-3 in May 1992 HRA)
- Table A-7 - Future Use Construction Worker Scenario for Area 2 Soils: Comparison of Original and Recalculated Risk Estimates (compare with Table 5-4 in May 1992 HRA)

Detailed pathway- and chemical-specific documentation for the risk calculations performed for this addendum is provided in Attachment #2. A copy of DTSC's Interim Final Blood Lead Guidance (July 1992) is included herein as Attachment #3.

Of the many recommendations/comments given by OEHHA in Addendum #1, a subset considered by the LARWQCB to merit additional consideration was reanalyzed. A list of those recommendations is presented in the table below, citing the applicable comment number, and paraphrasing the recommendation included in recalculations given in Attachment #1.

Pathway/Parameter Affected, OEHHA (8/14 or 11/16) Comment Number	**Recommendation Incorporated**
RE: Adult Worker Exposure Pathways 8/14 Comment on Intake Factors (p. 5), as detailed in Table 3 (p. 12)	For reasonable maximum exposure (RME) pathway calculations, the following exposure parameters were changed: - soil ingestion rate was increased from 50 mg/day to 100 mg/day (factor of 2 increase) - dermal contact rate was increased from 0.5 mg/cm^2 to 1.0 mg/cm^2 (factor of 2 increase) - the assumed skin surface area exposed was increased from 3700 cm^2 to 5000 cm^2 (factor of 1.35 increase) - exposure duration was increased from 4 hrs/8-hr day to 8 hrs (factor of 2 increase)
RE: Child Trespasser Exposure Pathways Comment on Intake Factors (p. 5), as detailed in Table 3 (p. 12)	For RME calculations, the following exposure parameters were changed: - dermal contact rate was increased from 0.5 mg/cm^2 to 1.0 mg/cm^2 (factor of 2 increase) - the inhalation rate was increased from 0.7 m^3/hour to 3.2 m^3/hour (factor of 4.5 increase) - the exposure frequency was increased from 72 days/year to 180 days/year (factor of 2.5 increase)
Toxicity Factors OEHHA Comments, p. 6	Toxicity factors were modified/updated in accordance with DTSC recommendations as summarized in Attachment #1, Table A-3 (attached).
RE: All "Best Estimate" Exposure Pathways 16 November 1992 OEHHA Comments (Addendum #3), page 4	For all "best estimate" exposure pathways, risks were re-calculated using arithmetic means (instead of median soil COC concentrations, as used in the original May 1992 RA). Performance of such calculations notwithstanding, Ebasco still maintains that the validity/basis for using means is debatable, and leads to exaggerated estimates of risk.
NOTE: *See Tables A-1 through A-3 for additional clarification regarding (alternative) parameters used in the recalculations.*	

Having incorporated the above recommendations, few of the original results changed. Results which did change (e.g., trespasser exceedances) did so as a result of using much more conservative parameters for pathway scenarios (e.g., child trespasser on site every other day, all year). Such assumptions, as noted in the original October 14, 1992 response (Addendum #2), are still considered to be unrealistic.

In the following sections of this addendum, specific responses are provided to each comment in the November 16, 1992 OEHHA memorandum.

1. GENERAL COMMENTS

Basically, the tables included in Attachments #1 and #2 of this addendum satisfy the spirit and intent of OEHHA's 11/16/92 comments, as originally detailed in their 8/14/92 comments.

Regarding paragraph 2 of this comment (see p.2, Addendum #3): (1) the California Environmental Protection Agency (Cal-EPA) Criteria for Carcinogens has been reviewed and is acknowledged herein; and (2) exposure factors have been adjusted per OEHHA comments. The following assumptions are noted relative to why the risk assessment need not consider the current/future residential population risks due to airborne dispersion/deposition, nor the child trespasser under a future-use construction scenario:

Residential Population

a. Current Use

- Impact could realistically only involve the inhalation route, and this has been accounted for by considering the maximally exposed individual (MEI) in executing the current-use pathway evaluation.

- Slag pile particle size distribution indicates very limited potential for off-site PM10 dust emissions (see p. 4, response to OEHHA comments on "Preface" and Addendum #6 modeling results).

Given the above, potential risks to the off-site residential population were considered to be much less than on-site, continuous exposures. Nonetheless, current-use exposures and risks were ultimately modeled for the Maximum Exposed Individual (MEI) at potential off-site residential receptor locations. The following (RME) exposure pathways were evaluated: inhalation; soil ingestion; dermal contact; and ingestion of garden vegetables. The methods used to estimate airborne dispersion/deposition, as well as the intake factors used in calculating human exposures, were very conservative. The results of this evaluation are provided in Addendum #6.

b. Future Use

- Future residential use of the site and adjoining properties is not considered to be a viable option in view of present zoning (i.e. industrial); overhead transmission lines; the light rail; and the location of the site.

- It is therefore assumed that future residential risks (off-site) would be no higher than those estimated for current off-site residential receptors.

Child Trespasser (future use construction scenario)

Given the hypothetical nature of future-use pathway calculations, only the most conservative of plausible future-use pathways was selected for quantitative evaluation. For this analysis, the construction worker was assumed to represent a maximally exposed individual (as evidenced by the very conservative exposure parameters used for both "best estimate" and RME evaluations; see Table A-2 in Attachment #1). Concomitant exposures/risks to child trespassers would be lower than those calculated for the future-use construction worker, and comparable to those estimated for the current-use trespasser scenario. [This is because the shorter, 1-year, exposure duration (consistent with a construction scenario) would offset any increase in risks stemming from the use of higher soil exposure point concentrations.] Consequently, such risks were not quantitatively evaluated in the risk assessment.

The reason that child trespasser risks would be lower is that serious measures would be taken to prevent such trespassing. Such measures would include:

- constant surveillance by construction management staff during working hours
- providing site security during non-working hours
- fencing and posting "No Trespassing" signs.

There are standard measures to preclude accident liability and theft, and in this case also mitigate against contact, ingestion or inhalation of exposed slag. Additional mitigative measures for preventing exposure to airborne particles to potential on-lookers (outside of, but in immediate proximity to the fence line) include dust monitoring and use of suppressants as necessary, depending on proximity of activity to the fence line and/or wind conditions.

2. SPECIFIC COMMENTS

Resolution of these comments is based upon the December 4, 1992 meeting with LARWQCB and OEHHA, as largely satisfied by the foregoing portion of this Addendum and its Attachments #1, #2, and #3.

□ Arsenic (GI absorption and groundwater contamination)

OEHHA is correct is asserting that, because arsenic is well absorbed by the GI tract, conversion of the ingestion toxicity value to a dermal value (e.g., a 5% adjustment) is unnecessary. Therefore, dermal contact risks for arsenic were recalculated using an unadjusted slope factor and reference dose (RfD). Results of these recalculations are reflected in Tables A-4 through A-7, as well as in the detailed documentation provided in Attachment #2.

□ Preface (bins, pile cover, air modeling)

As per the December 18, 1992 letter from the LARWQCB, the risk assessment considers the "final site condition." As such, the bins, drums, other debris and/or cooling pond are not part of this quantitative risk assessment. [Note: These issues are also being addressed as a separate condition of the cleanup and abatement order dated December 28, 1992.]

According to the LARWQCB, USEPA has provided written documentation that they consider the site "stabilized" relative to fugitive dusts. The LARWQCB also recognizes that the slag is composed of relatively large grain sizes, unlikely to be entrapped and dispersed off-site by wind. To support this, Ebasco had a representative (i.e. top foot) sample of slag analyzed for grain size distribution. The results of this analysis, shown in Figure 1, indicate that:

- the median grain size was 1.99 mm
- the mean grain size was 2.25 mm
- the PM10 (<0.01 mm) fraction is clearly insignificant since less than 0.5% of the sample passed through the 0.03 mm sieve (which is, of course, triple the PM 10 particle size).

Even if PM10 fractions were significant, it should be pointed out that steady state models used as a basis for risk assessment do not accurately reflect the short-lived (episodic) emissions from waste piles of varying dimensions and composition. A complete discussion of such phenomena and modeling technique is given in USEPA's *Compilation of Air Pollution Emission Factors - Supplement C* (EP-42, September 1990).

Nonetheless, Addendum #6 presents results of modeling which assumes very conservative conditions, not the least of which is assuming that all of the material which passed through the 0.03 mm sieve is in the PM10 fraction.

□ Comment 1/p.3* (data verification)

Ebasco acknowledges that the risk assessment can only be as accurate as the original data are valid. [The LARWQCB took samples the last week of November, 1992, as a means of validating prior (ENSR) results.]

□ Comment 2/p.3 (composition of dusts, Areas 1 vs. 2)

As noted above, USEPA considers the site "stabilized" from the standpoint of dusts on Area 2, and the grain size distribution is very coarse. The Ebasco HRA defined risks on the basis of the present site scenario as best as it is known.

□ Comment 3/p.3 (Cr VI)

Hexavalent chromium was not selected as a COPC given its low occurrence (1/50 samples). Consequently, hexavalent chromium risks were not quantitatively evaluated. Ebasco has not avoided dealing with this issue, as OEHHA suggests. Rather, we have just applied the standard risk assessment approach of not calculating risks for constituents not identified as chemicals of concern. However, another two (2) samples were taken in December 1992 from the same location in the slag pile to corroborate the previous single occurrence of Chromium VI. Hexavalent chromium was not detected in either sample; one taken at 5 feet, the other in the top foot of the pile.

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*Nomenclature used in 16 November comments refers to page no./comment no. in original OEHHA comments of 8/14/92.

- Comment 4/p.3 (analysis of ponds, tanks and drums)

  A risk assessment has not been performed for these items, per agreement with the LARWQCB.

- Comment 5/p.3 (air monitoring, PM10)

  As noted above, the assumptions used as a basis for considering the residential population to be at low risk are:

  - The residential population could not under any circumstances be exposed to the MEI scenario used to quantify inhalation risks.
  - The site has been considered "stabilized" by USEPA.
  - The particle size distribution of slag pile constituents includes only a tiny fraction of grain sizes even below the 0.03 mm size.
  - Erosion of particles is episodic, not steady state, and extremely high winds would be required to entrain the slag pile particles even on an episodic basis.
  - The residential population, even if slag particles could be entrained in wind, would not be exposed 29 years beyond construction, because following construction the pile will have been permanently covered.

  Results of modeling in Addendum #6 provide additional support for lack of residential impact even using conservative assumptions which are in no opposition to the above-stated facts.

- Comment 6/p.3 (WET analyses)

  It is understood that from the standpoint of new landfill disposal restrictions, WET analyses are required when the soil concentration exceeds 10X STLC.

- Comment 7/p.3 (medians vs. means)

  Attachment #1 of this addendum presents HRA results using arithmetic mean concentrations in slag (see detailed documentation in Attachment #2). However, the use of means is considered to impart a positive bias in the estimates of central tendency.

- Comment 8/p.4 (see below under Comment 3/p.4)

- Comment 9/p.4 (see above under Comment 5/p.3)

- Comment 1/p.4 (see above under Comment 5/p.3)

- Comment 2/p.4 (child trespasser frequency)

  The current use child trespasser pathway has been recalculated using an exposure frequency of 180 days/year (see Attachment #1, Tables A-1 and A-5).

□ Comment 3/p.4 (Areas 1 vs. 2)

This concerns the area in front of the office. That area is, in general, paved. Presence of cracks would expose underlying soils, but such cracks would have to reveal more than (approximately) ten percent of the surface area for Ebasco to consider the assumption to be an inaccurate representation.

□ Comment 1/p.5 (intake factors)

All alternative intake factors requested by OEHHA have been incorporated in Attachments #1 and #2, as discussed in the opening section of this addendum.

- **soil ingestion rate:**
  Increased from 50 mg/day to 100 mg/day.

- **surface area exposed:**
  Increased from 3700 cm^2 to 5000 cm^2.

- **exposure duration:**
  Increased to 8 hours/day.

- **inhalation rate:**
  Increased from 0.7 m^3/hour to 3.2 m^3/hour.

- **exposure frequency (child trespasser):**
  Increased from 72 to 180 days/year.

- **sources of toxicity values:**
  See Attachment #1, Table A-3.

- **reproductive & developmental effects:**
  These factors are acknowledged in Note 4 of Table A-3 (Attachment #1).

Because part of this OEHHA comment also referred to residential populations, assumptions for considering these populations to be at minimal risk are restated herein as follows:

Current Use:

- Site (dust) stabilized by USEPA.
- Slag pile partially covered.
- Slag particle size distribution is not of a constituency which would be conducive to wind erosion and dust emissions.

Future Construction Use:

- Site to be fenced, and necessary security provided.
- Air modeling could be used in the remedial action plan (RAP) phase to more

accurately estimate potential receptor directions and identify the proper level of suppression and/or monitoring points.

- Airborne dust would be monitored.
- Dust suppression would be employed in accordance with standard protocol at construction sites.

These conditions plus the results of the air modeling and residential receptor risk assessment (provided in Addendum #6) indicate that risks are in the acceptable range (7.5×10^{-7} and 0.28 for total RME cancer risk and hazard index, respectively, at the MEI location) even if particles are dispersed off-site.

□ Comment 2/p.7 (toxicity values)

Risks were recalculated using the toxicity criteria recommended by OEHHA; see Table A-3 (Attachment #1). In response to OEHHA's request that a qualitative assessment be provided for chemicals lacking toxicity criteria, toxicity profiles for aluminum, cobalt, molybdenum, silver and vanadium are provided in Attachment #4 (Source: Klaasen, C.D., M.O. Amdurer and J. Doull. 1986. Casarett and Doull's Toxicology). Note, however, that the exclusion of silver and vanadium from the list of chemicals of concern is considered valid because levels of these constituents in site soils were well within established (national) background levels.

Nonetheless, in response to OEHHA's request, a worst-case screening level noncancer risk calculation was performed for silver. Specifically, the maximum detected silver concentration in slag pile soils (3.7 ppm, in SB08 @ 10 ft) was used in conjunction with the chronic daily intake assumed for the future-use construction worker pathway. [This scenario was chosen for screening because estimated risks were highest for this pathway/receptor; see Table A-6.] The CDI/Rfd ratio for silver calculated for this pathway, assuming an RfD of 0.005 mg/kg-day (as recommended by OEHHA), was 0.004. This value is much less than EPA's target hazard index criterion of 1.0. Additionally, it represents less than 1% (0.014%) of the total HI calculated for this pathway (which was 28.0). The same general trend would apply to all other pathway scenarios (even though total HIs were lower). Consequently, the exclusion of silver from the quantitative risk assessment is not considered important.

□ Comment 3/p.8 (lead)

Blood lead estimates were recalculated to reflect DTSC's July 1992 Interim Guidance, which is provided in Attachment #3 (also see Table A-3, Note 2). [See Ebasco's response provided in Addendum #2 for a summary of the assumption used in initial blood lead calculations.] Results of the revised blood lead calculations are summarized in Tables A-4 through A-7; detailed results are provided in Attachment #2 (pathway-specific) worksheets.

□ Remaining Issues (groundwater)

Hydrogeologic studies are currently being performed specifically for the purpose of evaluating contamination in groundwater. These studies are being performed according to a LARWQCB-approved work plan developed in November 1992.

ADDENDUM #5

Attachment #1

REVISED HRA RESULTS BASED ON OEHHA-RECOMMENDED INTAKE AND EXPOSURE PARAMETERS

TABLE A-1

SUMMARY OF PARAMETERS USED TO CALCULATE RISKS FOR CURRENT USE EXPOSURE SCENARIOS

H. KRAMER & COMPANY SITE

Comparison of Parameters Used in May 1992 HRA with those Used in Addendum #5 Recalculations

ADULT WORKER RECEPTORS

PARAMETER	*May 1992 HRA* Best Estimate	*May 1992 HRA* RME	*Recalculations (11/92 to 02/93)* Best Estimate	*Recalculations (11/92 to 02/93)* RME	Comment/Rationale
Soil Exposure Point Concentration (EPC)	Median	95% UCL	**Arithmetic Mean**	95% UCL	
Age During Exposure	Adult	Adult	Adult	Adult	*Shaded and bolded values were*
Average Body Weight	70 kg	70 kg	70 kg	70 kg	*changed in response to OEHHA*
Annual Exposure Frequency	250 days/year	250 days/year	250 days/year	250 days/year	*comments (see OEHHA Table 3). For*
Lifetime Exposure (over 70-year lifetime)	25 years	25 years	25 years	25 years	*dermal absorption, the 0.1% value*
Exposure Time (assumes 8-hour work day)	4 hours/day	4 hours/day	4 hours/day	**8 hours/day**	*was considered most appropriate for*
Soil Ingestion Rate	50 mg/day	50 mg/day	**100 mg/day**	**100 mg/day**	*best-estimate calculations. This 0.1%*
Soil Adherence Rate	0.5 mg/cm^2	0.5 mg/cm^2	0.5 mg/cm^2	**1.0 mg/cm^2**	*value, which applies only to inorganic*
Surface Area Exposed	3700 cm^2	3700 cm^2	3700 cm^2	**5000 cm^2**	*metals, is recommended in both*
Dermal Absorption Rate	1.0%	1.0%	**0.1%**	1.0%	*CAPCOA and EPA's newly issued*
Respiratory Volume (Inhalation Rate)	2.5 m^3/hour	2.5 m^3/hour	2.5 m^3/hour	2.5 m^3/hour	*dermal assessment guidance.*
TSP Dust Concentration	.0412 mg/m^3	.0412 mg/m^3	.0412 mg/m^3	.0412 mg/m^3	

CHILD TRESPASSER RECEPTORS

PARAMETER	*May 1992 HRA* Best Estimate	*May 1992 HRA* RME	*Recalculations (11/92 to 02/93)* Best Estimate	*Recalculations (11/92 to 02/93)* RME	Comment/Rationale
Soil Exposure Point Concentration (EPC)	Median	95% UCL	**Arithmetic Mean**	95% UCL	
Age During Exposure	9-16 years	9-16 years	9-16 years	9-16 years	*See comments listed above for*
Average Body Weight	46 kg	46 kg	46 kg	46 kg	*adult worker receptors.*
Annual Exposure Frequency	72 days/year	72 days/year	72 days/year	**180 days/year**	
Lifetime Exposure (over 70-year lifetime)	5 years	5 years	5 years	5 years	
Exposure Time (for inhalation calcs. only)	2 hours/day	2 hours/day	2 hours/day	2 hours/day	
Soil Ingestion Rate	100 mg/day	100 mg/day	100 mg/day	100 mg/day	
Soil Adherence Rate	0.5 mg/cm^2	0.5 mg/cm^2	0.5 mg/cm^2	**1.0 mg/cm^2**	
Surface Area Exposed	3000 cm^2	3000 cm^2	3000 cm^2	3000 cm^2	
Dermal Absorption Rate	1.0%	1.0%	**0.1%**	1.0%	
Respiratory Volume (Inhalation Rate)	0.7 m^3/hour	0.7 m^3/hour	**3.2 m^3/hour**	**3.2 m^3/hour**	
TSP Dust Concentration	.0412 mg/m^3	.0412 mg/m^3	.0412 mg/m^3	.0412 mg/m^3	

TABLE A-2
SUMMARY OF PARAMETERS USED TO CALCULATE RISKS FOR FUTURE USE WORKER EXPOSURE SCENARIOS
H. KRAMER & COMPANY SITE
Comparison of Parameters Used in May 1992 HRA with those Used in Addendum #5 Recalculations

CONSTRUCTION WORKER RECEPTORS

	May 1992 HRA		*Recalculations (11/92 to 02/93)*		
PARAMETER	**Best Estimate**	**RME**	**Best Estimate**	**RME**	Comment/Rationale
Soil Exposure Point Concentration (EPC)	Median	95% UCL	**Arithmetic Mean**	95% UCL	
Age During Exposure	Adult	Adult	Adult	Adult	*Shaded and bolded values were*
Average Body Weight	70 kg	70 kg	70 kg	70 kg	*changed in response to OEHHA*
Annual Exposure Frequency	250 days/year	250 days/year	250 days/year	250 days/year	*comments (see OEHHA Table 3). For*
Lifetime Exposure (over 70-year lifetime)	1 year	1 year	1 year	1 year	*dermal absorption, the 0.1% value*
Exposure Time (assumes 8-hour work day)	8 hours/day	8 hours/day	8 hours/day	8 hours/day	*was considered most appropriate for*
Soil Ingestion Rate	480 mg/day	480 mg/day	480 mg/day	480 mg/day	*best-estimate calculations. This 0.1%*
Soil Adherence Rate	0.5 mg/cm^2	0.5 mg/cm^2	0.5 mg/cm^2	**1.0 mg/cm^2**	*value, which applies only to*
Surface Area Exposed	3700 cm^2	3700 cm^2	3700 cm^2	**5000 cm^2**	*inorganic metals, is recommended in*
Dermal Absorption Rate	1.0%	1.0%	**0.1%**	1.0%	*both CAPCOA and EPA's newly issued*
Respiratory Volume (Inhalation Rate)	4.5 m^3/hour	4.5 m^3/hour	4.5 m^3/hour	4.5 m^3/hour	*dermal assessment guidance.*
TSP Dust Concentration	0.1 mg/m^3	0.1 mg/m^3	0.1 mg/m^3	0.1 mg/m^3	

TABLE A-3
SUMMARY OF TOXICITY FACTORS USED IN THE RISK ASSESSMENT
H. KRAMER & COMPANY SITE
Comparison of Criteria Used in May 1992 HRA with those Used in Addendum #5 Recalculations

CANCER SLOPE FACTORS

PARAMETER	*Oral Slope Factors*		*Dermal Slope Factors*		*Inhalation Slope Factors*	
	May 1992 HRA	Updated Value	May 1992 HRA	Updated Value	May 1992 HRA	Updated Value
Arsenic	1.5E+00	**1.75E+00**	3.0E+01	**1.75E+00**	1.15E+01	**1.20E+01**
Beryllium	4.3E+00	**7.0E+00**	8.6E+01	**1.4E+02**	8.4E+00	**7.00E+00**
Cadmium	NA	NA	NA	NA	1.5E+01	1.5E+01

NONCANCER REFERENCE DOSES (RfDs)

PARAMETER	*Oral RfDs*		*Dermal RfDs*		*Inhalation RfDs*	
	May 1992 HRA	Updated Value	May 1992 HRA	Updated Value	May 1992 HRA	Updated Value
Antimony	4.0E-04	4.0E-04	4.0E-04	**2.0E-05**	4.0E-04	4.0E-04
Arsenic	3.0E-04	3.0E-04	3.0E-04	3.0E-04	3.0E-04	**1.4E-04**
Barium	7.0E-02	7.0E-02	7.0E-02	**3.5E-03**	1.0E-04	1.0E-04
Beryllium	5.0E-03	5.0E-03	5.0E-03	**2.5E-04**	1.4E-06	1.4E-06
Cadmium	1.0E-03	1.0E-03	1.0E-03	**2.5E-05**	1.0E-03	1.0E-03
Chromium (trivalent)	1.0E+00	1.0E+00	1.0E+00	**5.0E-02**	5.7E-07	5.7E-07
Copper	3.7E-02	3.7E-02	NA	NA	1.0E-02	**6.9E-04**
Lead	NA	NA	NA	NA	NA	**4.3E-04**
Manganese	1.0E-01	1.0E-01	1.0E-01	**5.0E-03**	1.1E-04	1.1E-04
Mercury	3.0E-04	3.0E-04	3.0E-04	**1.5E-05**	8.6E-05	8.6E-05
Nickel	2.0E-02	2.0E-02	2.0E-02	**1.0E-03**	6.9E-05	6.9E-05
Selenium	5.0E-03	5.0E-03	5.0E-03	**2.5E-04**	1.0E-03	**1.4E-04**
Zinc	2.0E-01	2.0E-01	2.0E-01	**1.0E-02**	1.0E-02	1.0E-02

Shaded and bolded values were modified to reflect more recent toxicity criteria and in response to OEHHA comments.
See NOTES on following page.

TABLE A-3
SUMMARY OF TOXICITY FACTORS USED IN THE RISK ASSESSMENT
H. KRAMER & COMPANY SITE
Comparison of Criteria Used in May 1992 HRA with those Used in Addendum #5 Recalculations

NOTES:

1] Noncancer risks for dermal exposures presented in the May 1992 report were inadvertently calculated using unadjusted RfDs. That is, oral RfDs were not adjusted for dermal absorption using the methods/approach described in Note 2 of Table 4-1. Therefore, for this addendum, noncancer hazard indices for dermal contact pathways were recalculated using the adjusted RfD values (shaded above; also see Note 2 in Table 4-1 of the May 1992 HRA report).

The only exception is arsenic, for which toxicity factors were not adjusted for dermal absorption due to the fact that arsenic is well absorbed by the GI tract and dermal absorption is reportedly negligible. Although similar characteristics (i.e., poor dermal absorption) are expected to be exhibited by the other metals, the oral to dermal toxicity criteria (e.g., 5%) adjustment suggested in EPA RAGS guidance was performed. ***It is important to note that this adjustment is a very conservative approach; thus dermal contact risks are likely to be overestimated for most chemicals*** *(e.g., beryllium, which "drove" total cancer risks estimated for most RME pathway evaluations).*

2] As described in Ebasco's response to OEHHA's comment regarding the methodology used to estimate blood lead levels, the generalized equations and soil constants presented in DTSC's (January 1992 Draft) blood lead guidance were used in the May 1992 HRA. However, the contact rate values cited in this guidance were not used because they are not consistent with the exposure assumptions used to calculate risks for the other chemicals of concern. For example, no adjustment for exposure duration or exposure frequency is made when DTSC guidance is adhered to strictly. Additionally, DTSC requires that background lead exposures from the diet, drinking water and ambient air are also calculated (this was not done in the May 1992 HRA).

Therefore, in response to OEHHA's concerns, blood lead level estimates presented in this addendum were recalculated in strict accordance with DTSC's updated blood lead guidance (July 1992 Interim Final, provided in Attachment #3 of this addendum). Given the assumptions specified by DTSC in this guidance, described above (e.g., no adjustment for exposure duration and inclusion of background dietary lead intake), the blood lead level estimates calculated in this addendum are considered to be very conservative (see Tables A-4 through A-7 and pathway-specific documentation provided in Attachment #2 of this addendum).

3] Subchronic RfD values, used for future-use construction worker pathway calculations, were not changed and thus are not listed here.

4] Reproductive and/or teratogenic effects have been documented for some of the chemicals under evaluation. However, these endpoints were generally not considered in deriving the slope factors and RfD values (specified by EPA/CALEPA) which were used in the risk assessment. A discussion of general reproductive effects associated with exposures to metals can be found in the following source: *Textbook of Teratology* (JG Wilson and FC Fraser, eds, Plenum Press, New York, Vol. I). Toxicity profiles for chemicals which were not quantitatively evaluated in the risk assessment are provided in Attachment #4 of this addendum.

TABLE A-4
CURRENT USE WORKER EXPOSURE SCENARIO:
COMPARISON OF ORIGINAL AND RECALCULATED RISK ESTIMATES
H. KRAMER & COMPANY SITE

CANCER RISKS				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate
Soil Ingestion	1.9E-05	1.0E-04	6.4E-05	4.1E-04
Dermal Contact	1.4E-04	3.8E-05	4.7E-04	4.0E-03
Inhalation	8.6E-07	1.2E-06	2.7E-06	4.7E-06
TOTAL CANCER RISKS, ALL PATHWAYS:	**1.6E-04**	**1.4E-04**	**5.4E-04**	**4.4E-03**

Shaded values exceed EPA's target cancer risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index
Soil Ingestion	9.8E-02	4.0E-01	4.5E-01	1.8E+00
Dermal Contact	2.7E-02	8.0E-02	8.3E-02	8.7E+00
Inhalation	3.3E-01	7.9E-01	1.7E+00	3.8E+00
Estimated Mean Blood Lead Levels *(See Note 2)*	0.5 ug/dl	2.3 ug/dl	1.0 ug/dl	2.9 ug/dl
TOTAL HAZARD INDEX, ALL PATHWAYS:	**4.6E-01**	**1.3E+00**	**2.2E+00**	**1.4E+01**

Shaded values exceed EPA's target Hazard Index criterion of 1.0.

NOTES:

1] In response to RWQCB's request and OEHHA comments, risk estimates presented in the May 1992 risk assessment were recalculated; results of both versions are summarized above. Cancer risks and noncancer hazard indices were calculated using the exposure and toxicity parameters listed in Tables A-1 and A-3. Detailed (chemical-and pathway-specific) documentation for all recalculations is provided in Attachment #2 of this addendum. The "original" risks are the same as those presented in Table 5-1 of the (May 1992) HRA report.

2] Blood lead level estimates were re-calculated in accordance with the most recent (interim final) DTSC guidance, issued in July 1992 (see Table A-3, Note 2). Detailed results of blood lead calculations (e.g., including mean, 95th, and 99th percentile estimates) are provided in Attachment #2 worksheets.

TABLE A-5
CURRENT USE TRESPASSER EXPOSURE SCENARIO:
COMPARISON OF ORIGINAL AND RECALCULATED RISK ESTIMATES
H. KRAMER & COMPANY SITE

CANCER RISKS				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate
Soil Ingestion	6.8E-06	1.8E-05	2.2E-05	9.0E-05
Dermal Contact	2.0E-05	5.3E-06	6.7E-05	5.3E-04
Inhalation	1.1E-08	6.7E-08	3.3E-08	3.3E-07
TOTAL CANCER RISKS, ALL PATHWAYS:	**2.7E-05**	**2.4E-05**	**8.9E-05**	**6.2E-04**

Shaded values exceed EPA's target cancer risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index
Soil Ingestion	1.7E-01	3.5E-01	7.9E-01	2.0E+00
Dermal Contact	1.9E-02	5.7E-02	5.9E-02	5.7E+00
Inhalation	1.4E-02	2.2E-01	9.0E-02	1.3E+00
Estimated Mean Blood Lead Levels *(See Note 2)*	1.7 ug/dl	8.5 ug/dl	3.3 ug/dl	12.0 ug/dl
TOTAL HAZARD INDEX, ALL PATHWAYS:	**2.0E-01**	**6.3E-01**	**9.4E-01**	**9.0E+00**

Shaded values exceed EPA's target Hazard Index criterion of 1.0 (or 10 ug/dl blood Pb level).

NOTES:

1] In response to RWQCB's request and OEHHA comments, risk estimates presented in the May 1992 risk assessment were recalculated; results of both versions are summarized above. Cancer risks and noncancer hazard indices were calculated using the exposure and toxicity parameters listed in Tables A-1 and A-3. Detailed (chemical-and pathway-specific) documentation for all recalculations is provided in Attachment #2 of this addendum. The "original" risks are the same as those presented in Table 5-2 of the (May 1992) HRA report.

2] Blood lead level estimates were re-calculated in accordance with the most recent (interim final) DTSC guidance, issued in July 1992 (see Table A-3, Note 2). Detailed results of blood lead calculations (including mean, 95th, and 99th percentile estimates) are provided in Attachment #2 worksheets.

TABLE A-6
FUTURE USE CONSTRUCTION WORKER SCENARIO FOR AREA 1 SOILS:
COMPARISON OF ORIGINAL AND RECALCULATED RISK ESTIMATES
H. KRAMER & COMPANY SITE

CANCER RISKS				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate
Soil Ingestion	2.1E-06	4.8E-05	6.8E-05	8.5E-05
Dermal Contact	1.6E-06	1.0E-06	5.2E-05	5.1E-05
Inhalation	1.1E-07	2.0E-06	3.4E-06	3.5E-06
TOTAL CANCER RISKS, ALL PATHWAYS:	**3.8E-06**	**5.1E-05**	**1.2E-04**	**1.4E-04**

Shaded values exceed EPA's target cancer risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index
Soil Ingestion	4.2E-01	7.7E+00	1.4E+01	1.4E+01
Dermal Contact	1.5E-02	2.0E-01	5.0E-01	1.0E+01
Inhalation	1.8E-01	1.8E+00	3.3E+00	3.9E+00
Estimated Mean Blood Lead Levels *(See Note 2)*	0.5 ug/dl	1.7 ug/dl	4.9 ug/dl	1.9 ug/dl
TOTAL HAZARD INDEX, ALL PATHWAYS:	**6.1E-01**	**9.7E+00**	**1.8E+01**	**2.8E+01**

Shaded values exceed EPA's target Hazard Index criterion of 1.0.

NOTES:

1] In response to RWQCB's request and OEHHA comments, risk estimates presented in the May 1992 risk assessment were recalculated; results of both versions are summarized above. Cancer risks and noncancer hazard indices were calculated using the exposure and toxicity parameters listed in Tables A-2 and A-3. Detailed (chemical-and pathway-specific) documentation for all recalculations is provided in Attachment #2 of this addendum. The "original" risks are the same as those presented in Table 5-3 of the (May 1992) HRA report.

2] Blood lead level estimates were re-calculated in accordance with the most recent (interim final) DTSC guidance, issued in July 1992 (see Table A-3, Note 2). Detailed results of blood lead calculations are provided in Attachment #2 worksheets.

TABLE A-7
FUTURE USE CONSTRUCTION WORKER SCENARIO FOR AREA 2 SOILS: COMPARISON OF ORIGINAL AND RECALCULATED RISK ESTIMATES
H. KRAMER & COMPANY SITE

CANCER RISKS				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate	***May 1992 Original*** Cancer Risk Estimate	***Recalculation*** Cancer Risk Estimate
Soil Ingestion	1.6E-07	2.1E-06	4.6E-06	5.4E-06
Dermal Contact	1.3E-07	1.3E-08	3.6E-06	7.1E-07
Inhalation	8.2E-09	1.1E-07	2.7E-07	2.8E-07
TOTAL CANCER RISKS, ALL PATHWAYS:	**3.0E-07**	**2.2E-06**	**8.5E-06**	**6.4E-06**

Shaded values exceed EPA's target cancer risk range (10^{-6} to 10^{-4}).

NONCANCER HAZARD INDICES				
	BEST ESTIMATE EXPOSURES		REASONABLE MAXIMUM EXPOSURES (RME)	
EXPOSURE PATHWAY	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index	***May 1992 Original*** Hazard Index	***Recalculation*** Hazard Index
Soil Ingestion	3.0E-02	3.1E-01	7.9E-01	7.9E-01
Dermal Contact	1.1E-03	4.0E-03	3.0E-02	2.3E-01
Inhalation	4.2E-02	8.3E-02	1.1E-01	1.1E-01
Estimated Mean Blood Lead Levels *(See Note 2)*	0.008 ug/dl	1.3 ug/dl	0.063 ug/dl	1.3 ug/dl
TOTAL HAZARD INDEX, ALL PATHWAYS:	**7.3E-02**	**4.0E-01**	**9.3E-01**	**1.1E+00**

Shaded values exceed EPA's target Hazard Index criterion of 1.0.

NOTES:

1] In response to RWQCB's request and OEHHA comments, risk estimates presented in the May 1992 risk assessment were recalculated; results of both versions are summarized above. Cancer risks and noncancer hazard indices were calculated using the exposure and toxicity parameters listed in Tables A-2 and A-3. Detailed (chemical-and pathway-specific) documentation for all recalculations is provided in Attachment #2 of this addendum. The "original" risks are the same as those presented in Table 5-4 of the (May 1992) HRA report.

2] Blood lead level estimates were re-calculated in accordance with the most recent (interim final) DTSC guidance, issued in July 1992 (see Table A-3, Note 2). Detailed results of blood lead calculations are provided in Attachment #2 worksheets.

ADDENDUM #5

Attachment #2

RISK ASSESSMENT CALCULATION DOCUMENTATION
FOR FEBRUARY 1993 HRA ADDENDA

Risk Calculations for Current-Use Worker Receptors

CURRENT USE WORKER EXPOSURE SCENARIO: BEST ESTIMATE RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	9.77	1.75E+00	1.75E+00	1.2E+01	3.0E-06	5.5E-08	1.7E-07	3.2E-06	0.02
Beryllium	82.9	7.0E+00	1.4E+02	7.0E+00	1.0E-04	3.8E-05	8.4E-07	1.4E-04	0.98
Cadmium	9.0	NA	NA	1.5E+01	NA	NA	1.9E-07	1.9E-07	0.00
				EXCESS CANCER RISKS:	**1.0E-04**	**3.8E-05**	**1.2E-06**	**1.4E-04**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	32.65	4.0E-04	2.0E-05	4.0E-04	4.0E-02	1.5E-02	3.3E-04	5.5E-02	0.04
Arsenic	9.77	3.0E-04	3.0E-04	1.4E-04	1.6E-02	2.9E-04	2.8E-04	1.7E-02	0.01
Barium	207.67	7.0E-02	3.5E-03	1.0E-04	1.5E-03	5.4E-04	8.4E-03	1.0E-02	0.01
Beryllium	82.9	5.0E-03	2.5E-04	1.4E-06	8.1E-03	3.0E-03	2.4E-01	2.5E-01	0.20
Cadmium	9.00	1.0E-03	2.5E-05	1.0E-03	4.4E-03	3.3E-03	3.6E-05	7.7E-03	0.01
Chromium (trivalent)	17.50	1.0E+00	5.0E-02	5.7E-07	8.6E-06	3.2E-06	1.2E-01	1.2E-01	0.10
Copper	13,248	3.7E-02	NA	6.9E-04	1.8E-01	NA	7.8E-02	2.5E-01	0.20
Lead	1,444	NA	NA	4.3E-04	NA	NA	1.4E-02	1.4E-02	0.01
Manganese	8,041	1.0E-01	5.0E-03	1.1E-04	3.9E-02	1.5E-02	2.9E-01	3.5E-01	0.28
Mercury	0.29	3.0E-04	1.5E-05	8.6E-05	4.7E-04	1.7E-04	1.4E-05	6.6E-04	0.00
Nickel	165.4	2.0E-02	1.0E-03	6.9E-05	4.0E-03	1.5E-03	9.7E-03	1.5E-02	0.01
Selenium	0.94	5.0E-03	2.5E-04	1.4E-04	9.2E-05	3.4E-05	2.7E-05	1.5E-04	0.00
Zinc	45,933	2.0E-01	1.0E-02	1.0E-02	1.1E-01	4.2E-02	1.9E-02	1.7E-01	0.14
				HAZARD INDICES (HIs):	**4.0E-01**	**8.0E-02**	**7.9E-01**	**1.3E+00**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	2.3 ug/dl	4.1 ug/dl	5.3 ug/dl
HAZARD INDICES:	0.23	0.41	0.53

DTSC Blood Lead Level of Concern: 10 ug/dl

CURRENT USE WORKER SCENARIO: BEST ESTIMATE SOIL INGESTION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Arithmetic mean of shallow subsurface soil concentrations

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	9.77	1.0E-06	70	100	0.122	1.7E-06	1.75E+00	3.0E-06	0.03
Beryllium	82.9	1.0E-06	70	100	0.122	1.4E-05	7.0E+00	1.0E-04	0.97
							TOTAL EXCESS CANCER RISK:	1.0E-04	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	32.65	1.0E-06	70	100	0.342	1.6E-05	4.0E-04	4.0E-02	0.10
Arsenic	9.77	1.0E-06	70	100	0.342	4.8E-06	3.0E-04	1.6E-02	0.04
Barium	207.67	1.0E-06	70	100	0.342	1.0E-04	7.0E-02	1.5E-03	0.00
Beryllium	82.9	1.0E-06	70	100	0.342	4.1E-05	5.0E-03	8.1E-03	0.02
Cadmium	9.00	1.0E-06	70	100	0.342	4.4E-06	1.0E-03	4.4E-03	0.01
Chromium (trivalent)	17.50	1.0E-06	70	100	0.342	8.6E-06	1.0E+00	8.6E-06	0.00
Copper	13,248	1.0E-06	70	100	0.342	6.5E-03	3.7E-02	1.8E-01	0.44
Lead	1,444	*See AD PBM.XLS Blood Lead Calculations.*						NA	NA
Manganese	8,041	1.0E-06	70	100	0.342	3.9E-03	1.0E-01	3.9E-02	0.10
Mercury	0.29	1.0E-06	70	100	0.342	1.4E-07	3.0E-04	4.7E-04	0.00
Nickel	165.4	1.0E-06	70	100	0.342	8.1E-05	2.0E-02	4.0E-03	0.01
Selenium	0.94	1.0E-06	70	100	0.342	4.6E-07	5.0E-03	9.2E-05	0.00
Zinc	45,933	1.0E-06	70	100	0.342	2.2E-02	2.0E-01	1.1E-01	0.28
							HAZARD INDEX:	4.0E-01	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (4 hours/8 hours)*(250 days/365 days)*(25 years/70 years) = 0.122.

For Noncarcinogens, EF (exposure fraction) = (4 hours/8 hours)*(250 days/365 days) = 0.342.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE WORKER SCENARIO: BEST ESTIMATE DERMAL CONTACT PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: Arithmetic mean of shallow subsurface soil concentrations

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	9.77	1.0E-06	70	0.5	3,700	0.1%	0.122	3.2E-08	1.75E+00	5.5E-08	0.00
Beryllium	82.9	1.0E-06	70	0.5	3,700	0.1%	0.122	2.7E-07	1.4E+02	3.8E-05	1.00
									TOTAL EXCESS CANCER RISK:	3.8E-05	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	32.65	1.0E-06	70	0.5	3,700	0.1%	0.342	3.0E-07	2.0E-05	1.5E-02	0.19
Arsenic	9.77	1.0E-06	70	0.5	3,700	0.1%	0.342	8.8E-08	3.0E-04	2.9E-04	0.00
Barium	207.67	1.0E-06	70	0.5	3,700	0.1%	0.342	1.9E-06	3.5E-03	5.4E-04	0.01
Beryllium	82.9	1.0E-06	70	0.5	3,700	0.1%	0.342	7.5E-07	2.5E-04	3.0E-03	0.04
Cadmium	9.00	1.0E-06	70	0.5	3,700	0.1%	0.342	8.1E-08	2.5E-05	3.3E-03	0.04
Chromium (trivalent)	17.50	1.0E-06	70	0.5	3,700	0.1%	0.342	1.6E-07	5.0E-02	3.2E-06	0.00
Copper	13,248	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	1,444	*See AD PBM.XLS Blood Lead Calculations.*								NA	NA
Manganese	8,041	1.0E-06	70	0.5	3,700	0.1%	0.342	7.3E-05	5.0E-03	1.5E-02	0.18
Mercury	0.29	1.0E-06	70	0.5	3,700	0.1%	0.342	2.6E-09	1.5E-05	1.7E-04	0.00
Nickel	165.4	1.0E-06	70	0.5	3,700	0.1%	0.342	1.5E-06	1.0E-03	1.5E-03	0.02
Selenium	0.94	1.0E-06	70	0.5	3,700	0.1%	0.342	8.5E-09	2.5E-04	3.4E-05	0.00
Zinc	45,933	1.0E-06	70	0.5	3,700	0.1%	0.342	4.2E-04	1.0E-02	4.2E-02	0.52
									HAZARD INDEX:	8.0E-02	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (4 hours/8 hours)*(250 days/365 days)*(25 years/70 years) = 0.122.

For Noncarcinogens, EF (exposure fraction) = (4 hours/8 hours)*(250 days/365 days) = 0.342.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE WORKER SCENARIO: BEST ESTIMATE PARTICULATE INHALATION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on arithmetic mean soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	9.77	1.0E-06	0.0412	4.0E-07	70	2.5	4	0.245	1.4E-08	1.20E+01	1.7E-07	0.14
Beryllium	82.9	1.0E-06	0.0412	3.4E-06	70	2.5	4	0.245	1.2E-07	7.00E+00	8.4E-07	0.70
Cadmium	9.0	1.0E-06	0.0412	3.7E-07	70	2.5	4	0.245	1.3E-08	1.5E+01	1.9E-07	0.16

TOTAL EXCESS CANCER RISK: **1.2E-06**

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	32.65	1.0E-06	0.0412	1.3E-06	70	2.5	4	0.685	1.3E-07	4.0E-04	3.3E-04	0.00
Arsenic	9.77	1.0E-06	0.0412	4.0E-07	70	2.5	4	0.685	3.9E-08	1.4E-04	2.8E-04	0.00
Barium	207.67	1.0E-06	0.0412	8.6E-06	70	2.5	4	0.685	8.4E-07	1.0E-04	8.4E-03	0.01
Beryllium	82.9	1.0E-06	0.0412	3.4E-06	70	2.5	4	0.685	3.3E-07	1.4E-06	2.4E-01	0.30
Cadmium	9.00	1.0E-06	0.0412	3.7E-07	70	2.5	4	0.685	3.6E-08	1.0E-03	3.6E-05	0.00
Chromium (trivalent)	17.50	1.0E-06	0.0412	7.2E-07	70	2.5	4	0.685	7.1E-08	5.7E-07	1.2E-01	0.16
Copper	13,248	1.0E-06	0.0412	5.5E-04	70	2.5	4	0.685	5.3E-05	6.9E-04	7.8E-02	0.10
Lead	1,444	1.0E-06	0.0412	5.9E-05	70	2.5	4	0.685	5.8E-06	4.3E-04	1.4E-02	0.02
Manganese	8,041	1.0E-06	0.0412	3.3E-04	70	2.5	4	0.685	3.2E-05	1.1E-04	2.9E-01	0.38
Mercury	0.29	1.0E-06	0.0412	1.2E-08	70	2.5	4	0.685	1.2E-09	8.6E-05	1.4E-05	0.00
Nickel	165.4	1.0E-06	0.0412	6.8E-06	70	2.5	4	0.685	6.7E-07	6.9E-05	9.7E-03	0.01
Selenium	0.94	1.0E-06	0.0412	3.9E-08	70	2.5	4	0.685	3.8E-09	1.4E-04	2.7E-05	0.00
Zinc	45,933	1.0E-06	0.0412	1.9E-03	70	2.5	4	0.685	1.9E-04	1.0E-02	1.9E-02	0.02

**For lead inhalation risks calculated acc. to DTSC guidance, see AD_PBM.XLS Blood Lead Calculations.*

HAZARD INDEX: **7.9E-01**

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

Workers are assumed to spend 4 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years)=0.245. For Noncarcinogens, EF = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

AD_PBM.XLS:

BLOOD LEAD LEVELS ESTIMATED FOR CURRENT USE ADULT WORKER EXPOSURE SCENARIOS: BEST ESTIMATE

H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	**0.18**	ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	2.33	4.14	5.27	ug/dl
LEAD IN SOIL	**1,444**	ug/g	HAZARD INDICES:	0.23	0.41	0.53	
LEAD IN WATER	**2.5**	ug/l					
DUST IN AIR	**0.0412**	mg/m^3					
SITE-GROWN PRODUCE?	**0**	(1 = Yes; 0 = No)					

********** **EQUATIONS** **********

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	**0.267**	=	0.0001 (ug/dl)/(ug/day) *	1444 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	11%
SOIL INGESTION:	**0.650**	=	0.018 (ug/dl)/(ug/day) *	1444 ug/g *	0.025 g soil/day	28%
DUST INHALATION:	**0.393**	=	1.64 (ug/dl)/(ug/m^3) *	0.239 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	17%
WATER INGESTION:	**0.140**	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	6%
FOOD INGESTION:	**0.880**	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	38%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 1444 ppm, is the arithmetic mean lead concentration detected in 0-5 ft slag pile soils.

3] Assumed PM10 concentration, 0.0412 mg/m^3, is the arithmetic mean annual particulate matter (PM10) concentration reported for Hawthorne.

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

CURRENT USE WORKER EXPOSURE SCENARIO: REASONABLE MAXIMUM RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	17.33	1.75E+00	1.75E+00	1.2E+01	1.1E-05	5.3E-06	6.0E-07	1.7E-05	0.00
Beryllium	164.1	7.0E+00	1.4E+02	7.0E+00	4.0E-04	4.0E-03	3.3E-06	4.4E-03	1.00
Cadmium	19.84	NA	NA	1.5E+01	NA	NA	8.4E-07	8.4E-07	0.00
				EXCESS CANCER RISKS:	**4.1E-04**	**4.0E-03**	**4.7E-06**	**4.4E-03**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	81.51	4.0E-04	2.0E-05	4.0E-04	2.0E-01	2.0E+00	1.6E-03	2.2E+00	0.15
Arsenic	17.33	3.0E-04	3.0E-04	1.4E-04	5.7E-02	2.8E-02	1.0E-03	8.6E-02	0.01
Barium	382.46	7.0E-02	3.5E-03	1.0E-04	5.3E-03	5.3E-02	3.1E-02	9.0E-02	0.01
Beryllium	164.1	5.0E-03	2.5E-04	1.4E-06	3.2E-02	3.2E-01	9.4E-01	1.3E+00	0.09
Cadmium	19.84	1.0E-03	2.5E-05	1.0E-03	1.9E-02	3.9E-01	1.6E-04	4.1E-01	0.03
Chromium (trivalent)	28.73	1.0E+00	5.0E-02	5.7E-07	2.8E-05	2.8E-04	4.1E-01	4.1E-01	0.03
Copper	34,413	3.7E-02	NA	6.9E-04	9.1E-01	NA	4.0E-01	1.3E+00	0.09
Lead	2,308	NA	NA	4.3E-04	NA	NA	4.3E-02	4.3E-02	0.00
Manganese	24,997	1.0E-01	5.0E-03	1.1E-04	2.4E-01	2.4E+00	1.8E+00	4.5E+00	0.32
Mercury	0.57	3.0E-04	1.5E-05	8.6E-05	1.9E-03	1.9E-02	5.3E-05	2.1E-02	0.00
Nickel	272.3	2.0E-02	1.0E-03	6.9E-05	1.3E-02	1.3E-01	3.2E-02	1.8E-01	0.01
Selenium	1.63	5.0E-03	2.5E-04	1.4E-04	3.2E-04	3.2E-03	9.4E-05	3.6E-03	0.00
Zinc	67,134	2.0E-01	1.0E-02	1.0E-02	3.3E-01	3.3E+00	5.4E-02	3.7E+00	0.26
				HAZARD INDICES (HIs):	**1.8E+00**	**8.7E+00**	**3.8E+00**	**1.4E+01**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	2.9 ug/dl	5.2 ug/dl	6.6 ug/dl
HAZARD INDICES:	0.29	0.52	0.66

DTSC Blood Lead Level of Concern: 10 ug/dl

CURRENT USE WORKER SCENARIO: REASONABLE MAXIMUM SOIL INGESTION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	70	**100**	**0.245**	6.1E-06	**1.75E+00**	1.1E-05	0.03
Beryllium	164.07	1.0E-06	70	**100**	**0.245**	5.7E-05	**7.0E+00**	4.0E-04	0.97
							TOTAL EXCESS CANCER RISK:	**4.1E-04**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	70	**100**	**0.685**	8.0E-05	4.0E-04	2.0E-01	0.11
Arsenic	17.33	1.0E-06	70	**100**	**0.685**	1.7E-05	3.0E-04	5.7E-02	0.03
Barium	382.46	1.0E-06	70	**100**	**0.685**	3.7E-04	7.0E-02	5.3E-03	0.00
Beryllium	164.07	1.0E-06	70	**100**	**0.685**	1.6E-04	5.0E-03	3.2E-02	0.02
Cadmium	19.84	1.0E-06	70	**100**	**0.685**	1.9E-05	1.0E-03	1.9E-02	0.01
Chromium (trivalent)	28.73	1.0E-06	70	**100**	**0.685**	2.8E-05	1.0E+00	2.8E-05	0.00
Copper	34,413	1.0E-06	70	**100**	**0.685**	3.4E-02	3.7E-02	9.1E-01	0.50
Lead	2,308	*See AD_PB2.XLS Blood Lead Calculations.*						NA	NA
Manganese	24,997	1.0E-06	70	**100**	**0.685**	2.4E-02	1.0E-01	2.4E-01	0.14
Mercury	0.57	1.0E-06	70	**100**	**0.685**	5.6E-07	3.0E-04	1.9E-03	0.00
Nickel	272.27	1.0E-06	70	**100**	**0.685**	2.7E-04	2.0E-02	1.3E-02	0.01
Selenium	1.63	1.0E-06	70	**100**	**0.685**	1.6E-06	5.0E-03	3.2E-04	0.00
Zinc	67,134	1.0E-06	70	**100**	**0.685**	6.6E-02	2.0E-01	3.3E-01	0.18
							HAZARD INDEX:	**1.8E+00**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

Workers are assumed to spend all 8 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE WORKER SCENARIO: REASONABLE MAXIMUM DERMAL CONTACT PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.245**	3.0E-06	**1.75E+00**	5.3E-06	0.00
Beryllium	164.07	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.245**	2.9E-05	**1.4E+02**	4.0E-03	1.00
									TOTAL EXCESS CANCER RISK:	**4.0E-03**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	4.0E-05	**2.0E-05**	2.0E+00	0.23
Arsenic	17.33	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	8.5E-06	3.0E-04	2.8E-02	0.00
Barium	382.46	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	1.9E-04	**3.5E-03**	5.3E-02	0.01
Beryllium	164.07	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	8.0E-05	**2.5E-04**	3.2E-01	0.04
Cadmium	19.84	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	9.7E-06	**2.5E-05**	3.9E-01	0.04
Chromium (trivalent)	28.73	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	1.4E-05	**5.0E-02**	2.8E-04	0.00
Copper	34,413	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	2,308	*See AD PB2.XLS Blood Lead Calculations.*								NA	NA
Manganese	24,997	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	1.2E-02	**5.0E-03**	2.4E+00	0.28
Mercury	0.57	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	2.8E-07	**1.5E-05**	1.9E-02	0.00
Nickel	272.27	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	1.3E-04	**1.0E-03**	1.3E-01	0.02
Selenium	1.63	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	8.0E-07	**2.5E-04**	3.2E-03	0.00
Zinc	67,134	1.0E-06	70	**1.0**	**5,000**	1.0%	**0.685**	3.3E-02	**1.0E-02**	3.3E+00	0.38
									HAZARD INDEX:	**8.7E+00**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

Workers are assumed to spend all 8 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years) = 0.245.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE WORKER SCENARIO: REASONABLE MAXIMUM INHALATION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Local Adult Workers

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.1E-07	70	2.5	**8**	0.245	5.0E-08	**1.20E+01**	6.0E-07	0.13
Beryllium	164.07	1.0E-06	0.0412	6.8E-06	70	2.5	**8**	0.245	4.7E-07	**7.00E+00**	3.3E-06	0.70
Cadmium	19.84	1.0E-06	0.0412	8.2E-07	70	2.5	**8**	0.245	5.7E-08	1.5E+01	8.4E-07	0.18
										TOTAL EXCESS CANCER RISK:	**4.7E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	0.0412	3.4E-06	70	2.5	**8**	0.685	6.6E-07	4.0E-04	1.6E-03	0.00
Arsenic	17.33	1.0E-06	0.0412	7.1E-07	70	2.5	**8**	0.685	1.4E-07	**1.4E-04**	1.0E-03	0.00
Barium	382.46	1.0E-06	0.0412	1.6E-05	70	2.5	**8**	0.685	3.1E-06	1.0E-04	3.1E-02	0.01
Beryllium	164.07	1.0E-06	0.0412	6.8E-06	70	2.5	**8**	0.685	1.3E-06	1.4E-06	9.4E-01	0.25
Cadmium	19.84	1.0E-06	0.0412	8.2E-07	70	2.5	**8**	0.685	1.6E-07	1.0E-03	1.6E-04	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.2E-06	70	2.5	**8**	0.685	2.3E-07	5.7E-07	4.1E-01	0.11
Copper	34,413	1.0E-06	0.0412	1.4E-03	70	2.5	**8**	0.685	2.8E-04	**6.9E-04**	4.0E-01	0.11
Lead	2,308	1.0E-06	0.0412	9.5E-05	70	2.5	**8**	0.685	1.9E-05	**4.3E-04**	4.3E-02	0.01
Manganese	24,997	1.0E-06	0.0412	1.0E-03	70	2.5	**8**	0.685	2.0E-04	1.1E-04	1.8E+00	0.49
Mercury	0.57	1.0E-06	0.0412	2.3E-08	70	2.5	**8**	0.685	4.6E-09	8.6E-05	5.3E-05	0.00
Nickel	272.27	1.0E-06	0.0412	1.1E-05	70	2.5	**8**	0.685	2.2E-06	6.9E-05	3.2E-02	0.01
Selenium	1.63	1.0E-06	0.0412	6.7E-08	70	2.5	**8**	0.685	1.3E-08	**1.4E-04**	9.4E-05	0.00
Zinc	67,134	1.0E-06	0.0412	2.8E-03	70	2.5	**8**	0.685	5.4E-04	1.0E-02	5.4E-02	0.01
										HAZARD INDEX:	**3.8E+00**	

**For lead inhalation risks calculated acc. to DTSC guidance, see AD_PB2.XLS Blood Lead Calculations.*

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

Workers are assumed to spend all 8 hours of an 8-hour work day outdoors in the vicinity of the slag pile.

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(25 years/70 years)=0.245. For Noncarcinogens, EF = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

AD_PB2.XLS:

BLOOD LEAD LEVELS ESTIMATED FOR CURRENT USE ADULT WORKER EXPOSURE SCENARIOS: REASONABLE MAXIMUM

H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18	ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	2.94	5.22	6.64	ug/dl
LEAD IN SOIL	2,308	ug/g	HAZARD INDICES:	0.29	0.52	0.66	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	0.0412	mg/m^3					
SITE-GROWN PRODUCE?	0	(1 = Yes; 0 = No)					

EQUATIONS

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.427	=	0.0001 (ug/dl)/(ug/day) *	2308 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	15%
SOIL INGESTION:	1.039	=	0.018 (ug/dl)/(ug/day) *	2308 ug/g *	0.025 g soil/day	35%
DUST INHALATION:	0.451	=	1.64 (ug/dl)/(ug/m^3) *	0.275 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	15%
WATER INGESTION:	0.140	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	5%
FOOD INGESTION:	0.880	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	30%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 2308 ppm, is the 95% upper confidence limit (UCL) of the mean lead concentration in 0-5 ft slag pile soils.

3] Assumed PM10 concentration, 0.0412 mg/m^3, is the arithmetic mean annual particulate matter (PM10) concentration reported for Hawthorne.

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

Risk Calculations for Current-Use Trespasser Receptors

CURRENT USE CHILD TRESPASSER EXPOSURE SCENARIO: BEST ESTIMATE RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	9.77	1.75E+00	1.75E+00	1.2E+01	5.2E-07	7.9E-09	9.5E-09	5.4E-07	0.02
Beryllium	82.9	7.0E+00	1.4E+02	7.0E+00	1.8E-05	5.3E-06	4.7E-08	2.3E-05	0.98
Cadmium	9.0	NA	NA	1.5E+01	NA	NA	1.1E-08	1.1E-08	0.00
				EXCESS CANCER RISKS:	**1.8E-05**	**5.3E-06**	**6.7E-08**	**2.4E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	32.65	4.0E-04	2.0E-05	4.0E-04	3.5E-02	1.1E-02	9.2E-05	4.6E-02	0.07
Arsenic	9.77	3.0E-04	3.0E-04	1.4E-04	1.4E-02	2.1E-04	7.9E-05	1.4E-02	0.02
Barium	207.67	7.0E-02	3.5E-03	1.0E-04	1.3E-03	3.8E-04	2.3E-03	4.0E-03	0.01
Beryllium	82.9	5.0E-03	2.5E-04	1.4E-06	7.1E-03	2.1E-03	6.7E-02	7.6E-02	0.12
Cadmium	9.00	1.0E-03	2.5E-05	1.0E-03	3.9E-03	2.3E-03	1.0E-05	6.2E-03	0.01
Chromium (trivalent)	17.50	1.0E+00	5.0E-02	5.7E-07	7.5E-06	2.3E-06	3.5E-02	3.5E-02	0.06
Copper	13,248	3.7E-02	NA	6.9E-04	1.5E-01	NA	2.2E-02	1.8E-01	0.28
Lead	1,444	NA	NA	4.3E-04	NA	NA	3.8E-03	3.8E-03	0.01
Manganese	8,041	1.0E-01	5.0E-03	1.1E-04	3.4E-02	1.0E-02	8.3E-02	1.3E-01	0.20
Mercury	0.29	3.0E-04	1.5E-05	8.6E-05	4.1E-04	1.2E-04	3.8E-06	5.4E-04	0.00
Nickel	165.4	2.0E-02	1.0E-03	6.9E-05	3.5E-03	1.1E-03	2.7E-03	7.3E-03	0.01
Selenium	0.94	5.0E-03	2.5E-04	1.4E-04	8.1E-05	2.4E-05	7.6E-06	1.1E-04	0.00
Zinc	45,933	2.0E-01	1.0E-02	1.0E-02	9.8E-02	3.0E-02	5.2E-03	1.3E-01	0.21
				HAZARD INDICES (HIs):	**3.5E-01**	**5.7E-02**	**2.2E-01**	**6.3E-01**	

CHILD BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	8.46 ug/dl	15.0 ug/dl	19.1 ug/dl
HAZARD INDICES:	0.85	1.5	1.9

Note: Approximately 31% of the assumed lead intake is not site-related, but attributable to "background" lead exposures (i.e., lead in diet, drinking water and ambient air).

DTSC Blood Lead Level of Concern: 10 ug/dl

TRESTOTM.XLS, 2/1/93

CURRENT USE TRESPASSER SCENARIO: BEST ESTIMATE SOIL INGESTION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

[shaded box]: *Bolded and shaded cells represent input parameters which were modified since original May 1992 version.*

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Arithmetic mean of shallow subsurface soil concentrations

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	**9.77**	1.0E-06	46	100	0.014	3.0E-07	**1.75E+00**	5.2E-07	0.03
Beryllium	**82.9**	1.0E-06	46	100	0.014	2.5E-06	**7.0E+00**	1.8E-05	0.97
							TOTAL EXCESS CANCER RISK:	**1.8E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	**32.65**	1.0E-06	46	100	0.197	1.4E-05	4.0E-04	3.5E-02	0.10
Arsenic	**9.77**	1.0E-06	46	100	0.197	4.2E-06	3.0E-04	1.4E-02	0.04
Barium	**207.67**	1.0E-06	46	100	0.197	8.9E-05	7.0E-02	1.3E-03	0.00
Beryllium	**82.9**	1.0E-06	46	100	0.197	3.6E-05	5.0E-03	7.1E-03	0.02
Cadmium	**9.00**	1.0E-06	46	100	0.197	3.9E-06	1.0E-03	3.9E-03	0.01
Chromium (trivalent)	**17.50**	1.0E-06	46	100	0.197	7.5E-06	1.0E+00	7.5E-06	0.00
Copper	**13,248**	1.0E-06	46	100	0.197	5.7E-03	3.7E-02	1.5E-01	0.44
Lead	**1,444**	*See CH PBM.XLS Blood Lead Calculations.*						NA	NA
Manganese	**8,041**	1.0E-06	46	100	0.197	3.4E-03	1.0E-01	3.4E-02	0.10
Mercury	**0.29**	1.0E-06	46	100	0.197	1.2E-07	3.0E-04	4.1E-04	0.00
Nickel	**165.4**	1.0E-06	46	100	0.197	7.1E-05	2.0E-02	3.5E-03	0.01
Selenium	**0.94**	1.0E-06	46	100	0.197	4.0E-07	5.0E-03	8.1E-05	0.00
Zinc	**45,933**	1.0E-06	46	100	0.197	2.0E-02	2.0E-01	9.8E-02	0.28
							HAZARD INDEX:	**3.5E-01**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.

For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE TRESPASSER SCENARIO: BEST ESTIMATE DERMAL CONTACT PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: *Bolded and shaded cells represent input parameters which were modified since original May 1992 version.*

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: Arithmetic mean of shallow subsurface soil concentrations

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	9.77	1.0E-06	46	0.5	3,000	0.1%	0.014	4.5E-09	1.75E+00	7.9E-09	0.00
Beryllium	82.9	1.0E-06	46	0.5	3,000	0.1%	0.014	3.8E-08	1.4E+02	5.3E-06	1.00
									TOTAL EXCESS CANCER RISK:	**5.3E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	32.65	1.0E-06	46	0.5	3,000	0.1%	0.197	2.1E-07	2.0E-05	1.1E-02	0.19
Arsenic	9.77	1.0E-06	46	0.5	3,000	0.1%	0.197	6.3E-08	3.0E-04	2.1E-04	0.00
Barium	207.67	1.0E-06	46	0.5	3,000	0.1%	0.197	1.3E-06	3.5E-03	3.8E-04	0.01
Beryllium	82.9	1.0E-06	46	0.5	3,000	0.1%	0.197	5.3E-07	2.5E-04	2.1E-03	0.04
Cadmium	9.00	1.0E-06	46	0.5	3,000	0.1%	0.197	5.8E-08	2.5E-05	2.3E-03	0.04
Chromium (trivalent)	17.50	1.0E-06	46	0.5	3,000	0.1%	0.197	1.1E-07	5.0E-02	2.3E-06	0.00
Copper	13,248	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	1,444	*See CH PBM.XLS Blood Lead Calculations.*								NA	NA
Manganese	8,041	1.0E-06	46	0.5	3,000	0.1%	0.197	5.2E-05	5.0E-03	1.0E-02	0.18
Mercury	0.29	1.0E-06	46	0.5	3,000	0.1%	0.197	1.9E-09	1.5E-05	1.2E-04	0.00
Nickel	165.4	1.0E-06	46	0.5	3,000	0.1%	0.197	1.1E-06	1.0E-03	1.1E-03	0.02
Selenium	0.94	1.0E-06	46	0.5	3,000	0.1%	0.197	6.0E-09	2.5E-04	2.4E-05	0.00
Zinc	45,933	1.0E-06	46	0.5	3,000	0.1%	0.197	3.0E-04	1.0E-02	3.0E-02	0.52
									HAZARD INDEX:	**5.7E-02**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.

For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE TRESPASSER SCENARIO: BEST ESTIMATE INHALATION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

AIR EPC: Estimated particulate concentration in air based on arithmetic mean soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	9.77	1.0E-06	0.0412	4.0E-07	46	3.2	2	0.014	7.9E-10	1.20E+01	9.5E-09	0.14
Beryllium	82.9	1.0E-06	0.0412	3.4E-06	46	3.2	2	0.014	6.7E-09	7.00E+00	4.7E-08	0.70
Cadmium	9.0	1.0E-06	0.0412	3.7E-07	46	3.2	2	0.014	7.3E-10	1.5E+01	1.1E-08	0.16

TOTAL EXCESS CANCER RISK: 6.7E-08

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	32.65	1.0E-06	0.0412	1.3E-06	46	3.2	2	0.197	3.7E-08	4.0E-04	9.2E-05	0.00
Arsenic	9.77	1.0E-06	0.0412	4.0E-07	46	3.2	2	0.197	1.1E-08	1.4E-04	7.9E-05	0.00
Barium	207.67	1.0E-06	0.0412	8.6E-06	46	3.2	2	0.197	2.3E-07	1.0E-04	2.3E-03	0.01
Beryllium	82.9	1.0E-06	0.0412	3.4E-06	46	3.2	2	0.197	9.4E-08	1.4E-06	6.7E-02	0.30
Cadmium	9.00	1.0E-06	0.0412	3.7E-07	46	3.2	2	0.197	1.0E-08	1.0E-03	1.0E-05	0.00
Chromium (trivalent)	17.50	1.0E-06	0.0412	7.2E-07	46	3.2	2	0.197	2.0E-08	5.7E-07	3.5E-02	0.16
Copper	13,248	1.0E-06	0.0412	5.5E-04	46	3.2	2	0.197	1.5E-05	6.9E-04	2.2E-02	0.10
Lead	1,444	1.0E-06	0.0412	5.9E-05	46	3.2	2	0.197	1.6E-06	4.3E-04	3.8E-03	0.02
Manganese	8,041	1.0E-06	0.0412	3.3E-04	46	3.2	2	0.197	9.1E-06	1.1E-04	8.3E-02	0.38
Mercury	0.29	1.0E-06	0.0412	1.2E-08	46	3.2	2	0.197	3.3E-10	8.6E-05	3.8E-06	0.00
Nickel	165.4	1.0E-06	0.0412	6.8E-06	46	3.2	2	0.197	1.9E-07	6.9E-05	2.7E-03	0.01
Selenium	0.94	1.0E-06	0.0412	3.9E-08	46	3.2	2	0.197	1.1E-09	1.4E-04	7.6E-06	0.00
Zinc	45,933	1.0E-06	0.0412	1.9E-03	46	3.2	2	0.197	5.2E-05	1.0E-02	5.2E-03	0.02

**For lead inhalation risks calculated acc. to DTSC guidance, see CH_PBM.XLS Blood Lead Calculations.*

HAZARD INDEX: 2.2E-01

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (72 days/365 days)*(5 years/70 years) = 0.014.

For Noncarcinogens, EF (exposure fraction) = (72 days/365 days) = 0.197.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CH_PBM.XLS:
BLOOD LEAD LEVELS ESTIMATED FOR CURRENT USE TRESPASSER SCENARIOS: BEST ESTIMATE
H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18	ug/m^3	ESTIMATED CHILD BLOOD LEAD LEVELS:	8.46	15.04	19.13	ug/dl
LEAD IN SOIL	1,444	ug/g	HAZARD INDICES:	0.85	1.50	1.91	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	0.0412	mg/m^3					
SITE-GROWN PRODUCE?	0	(1 = Yes; 0 = No)					

********** **EQUATIONS (TYPICAL CHILD)** ********

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.202	=	0.0001 (ug/dl)/(ug/day) *	1444 ug/g *	1.4 g soil/day (5 g/m^2 * 0.28 m^2)	2%
SOIL INGESTION:	5.559	=	0.07 (ug/dl)/(ug/day) *	1444 ug/g *	0.055 g soil/day	66%
DUST INHALATION:	0.460	=	1.92 (ug/dl)/(ug/m^3) *	0.239 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	5%
WATER INGESTION:	0.160	=	0.16 (ug/dl)/(ug/day) *	2.50 ug/l *	0.4 liter water/day	2%
FOOD INGESTION:	2.080	=	0.16 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	1.30 kg diet/day	25%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 1444 ppm, is the arithmetic mean lead concentration detected in 0-5 ft slag pile soils.

3] Assumed PM10 concentration, 0.0412 mg/m^3, is the arithmetic mean annual particulate matter (PM10) concentration reported for Hawthorne.

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

CURRENT USE CHILD TRESPASSER EXPOSURE SCENARIO: REASONABLE MAXIMUM RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	17.33	1.75E+00	1.75E+00	1.2E+01	2.3E-06	7.0E-07	4.2E-08	3.1E-06	0.00
Beryllium	164.1	7.0E+00	1.4E+02	7.0E+00	8.8E-05	5.3E-04	2.3E-07	6.2E-04	0.99
Cadmium	19.84	NA	NA	1.5E+01	NA	NA	5.9E-08	5.9E-08	0.00
				EXCESS CANCER RISKS:	**9.0E-05**	**5.3E-04**	**3.3E-07**	**6.2E-04**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	81.51	4.0E-04	2.0E-05	4.0E-04	2.2E-01	1.3E+00	5.8E-04	1.5E+00	0.17
Arsenic	17.33	3.0E-04	3.0E-04	1.4E-04	6.2E-02	1.9E-02	3.5E-04	8.1E-02	0.01
Barium	382.46	7.0E-02	3.5E-03	1.0E-04	5.9E-03	3.5E-02	1.1E-02	5.2E-02	0.01
Beryllium	164.1	5.0E-03	2.5E-04	1.4E-06	3.5E-02	2.1E-01	3.3E-01	5.8E-01	0.06
Cadmium	19.84	1.0E-03	2.5E-05	1.0E-03	2.1E-02	2.6E-01	5.6E-05	2.8E-01	0.03
Chromium (trivalent)	28.73	1.0E+00	5.0E-02	5.7E-07	3.1E-05	1.8E-04	1.4E-01	1.4E-01	0.02
Copper	34,413	3.7E-02	NA	6.9E-04	1.0E+00	NA	1.4E-01	1.1E+00	0.13
Lead	2,308	NA	NA	4.3E-04	NA	NA	1.5E-02	1.5E-02	0.00
Manganese	24,997	1.0E-01	5.0E-03	1.1E-04	2.7E-01	1.6E+00	6.4E-01	2.5E+00	0.28
Mercury	0.57	3.0E-04	1.5E-05	8.6E-05	2.0E-03	1.2E-02	1.9E-05	1.4E-02	0.00
Nickel	272.3	2.0E-02	1.0E-03	6.9E-05	1.5E-02	8.8E-02	1.1E-02	1.1E-01	0.01
Selenium	1.63	5.0E-03	2.5E-04	1.4E-04	3.5E-04	2.1E-03	3.3E-05	2.5E-03	0.00
Zinc	67,134	2.0E-01	1.0E-02	1.0E-02	3.6E-01	2.2E+00	1.9E-02	2.5E+00	0.28
				HAZARD INDICES (HIs):	**2.0E+00**	**5.7E+00**	**1.3E+00**	**9.0E+00**	

CHILD BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	12.0 ug/dl	21.3 ug/dl	27.1 ug/dl
HAZARD INDICES:	1.2	2.1	2.7

Note: Approximately 21% of the assumed lead intake is not site-related, but attributable to "background" lead exposures (i.e., lead in diet, drinking water and ambient air).

DTSC Blood Lead Level of Concern: 10 ug/dl

TRESTOT2.XLS, 2/1/93

CURRENT USE TRESPASSER SCENARIO: REASONABLE MAXIMUM SOIL INGESTION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	46	100	0.035	1.3E-06	1.75E+00	2.3E-06	0.03
Beryllium	164.07	1.0E-06	46	100	0.035	1.3E-05	7.0E+00	8.8E-05	0.97
							TOTAL EXCESS CANCER RISK:	9.0E-05	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	46	100	0.493	8.7E-05	4.0E-04	2.2E-01	0.11
Arsenic	17.33	1.0E-06	46	100	0.493	1.9E-05	3.0E-04	6.2E-02	0.03
Barium	382.46	1.0E-06	46	100	0.493	4.1E-04	7.0E-02	5.9E-03	0.00
Beryllium	164.07	1.0E-06	46	100	0.493	1.8E-04	5.0E-03	3.5E-02	0.02
Cadmium	19.84	1.0E-06	46	100	0.493	2.1E-05	1.0E-03	2.1E-02	0.01
Chromium (trivalent)	28.73	1.0E-06	46	100	0.493	3.1E-05	1.0E+00	3.1E-05	0.00
Copper	34,413	1.0E-06	46	100	0.493	3.7E-02	3.7E-02	1.0E+00	0.50
Lead	2,308	*See CH PB2.XLS Blood Lead Calculations.*						NA	NA
Manganese	24,997	1.0E-06	46	100	0.493	2.7E-02	1.0E-01	2.7E-01	0.14
Mercury	0.57	1.0E-06	46	100	0.493	6.1E-07	3.0E-04	2.0E-03	0.00
Nickel	272.27	1.0E-06	46	100	0.493	2.9E-04	2.0E-02	1.5E-02	0.01
Selenium	1.63	1.0E-06	46	100	0.493	1.7E-06	5.0E-03	3.5E-04	0.00
Zinc	67,134	1.0E-06	46	100	0.493	7.2E-02	2.0E-01	3.6E-01	0.18
							HAZARD INDEX:	2.0E+00	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (180 days/365 days)*(5 years/70 years) = 0.035.

For Noncarcinogens, EF (exposure fraction) = (180 days/365 days) = 0.493.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE TRESPASSER SCENARIO: REASONABLE MAXIMUM DERMAL CONTACT PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

SOIL EPC: 95% upper confidence limit (UCL) of mean shallow subsurface soil concentration

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	46	**1.0**	3,000	1.0%	**0.035**	4.0E-07	**1.75E+00**	7.0E-07	0.00
Beryllium	164.07	1.0E-06	46	**1.0**	3,000	1.0%	**0.035**	3.8E-06	**1.4E+02**	5.3E-04	1.00
									TOTAL EXCESS CANCER RISK:	**5.3E-04**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	2.6E-05	**2.0E-05**	1.3E+00	0.23
Arsenic	17.33	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	5.6E-06	3.0E-04	1.9E-02	0.00
Barium	382.46	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	1.2E-04	**3.5E-03**	3.5E-02	0.01
Beryllium	164.07	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	5.3E-05	**2.5E-04**	2.1E-01	0.04
Cadmium	19.84	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	6.4E-06	**2.5E-05**	2.6E-01	0.04
Chromium (trivalent)	28.73	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	9.2E-06	**5.0E-02**	1.8E-04	0.00
Copper	34,413	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	2,308	*See CH PB2.XLS Blood Lead Calculations.*								NA	NA
Manganese	24,997	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	8.0E-03	**5.0E-03**	1.6E+00	0.28
Mercury	0.57	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	1.8E-07	**1.5E-05**	1.2E-02	0.00
Nickel	272.27	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	8.8E-05	**1.0E-03**	8.8E-02	0.02
Selenium	1.63	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	5.2E-07	**2.5E-04**	2.1E-03	0.00
Zinc	67,134	1.0E-06	46	**1.0**	3,000	1.0%	**0.493**	2.2E-02	**1.0E-02**	2.2E+00	0.38
									HAZARD INDEX:	**5.7E+00**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (180 days/365 days)*(5 years/70 years) = 0.035.

For Noncarcinogens, EF (exposure fraction) = (180 days/365 days) = 0.493.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CURRENT USE TRESPASSER SCENARIO: REASONABLE MAXIMUM INHALATION PATHWAY CALCULATIONS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Child (9-16 yr old) Trespassers

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.0E-06	0.0412	7.1E-07	46	3.2	2	0.035	3.5E-09	1.20E+01	4.2E-08	0.13
Beryllium	164.07	1.0E-06	0.0412	6.8E-06	46	3.2	2	0.035	3.3E-08	7.00E+00	2.3E-07	0.70
Cadmium	19.84	1.0E-06	0.0412	8.2E-07	46	3.2	2	0.035	4.0E-09	1.5E+01	5.9E-08	0.18

TOTAL EXCESS CANCER RISK: 3.3E-07

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	1.0E-06	0.0412	3.4E-06	46	3.2	2	0.493	2.3E-07	4.0E-04	5.8E-04	0.00
Arsenic	17.33	1.0E-06	0.0412	7.1E-07	46	3.2	2	0.493	4.9E-08	1.4E-04	3.5E-04	0.00
Barium	382.46	1.0E-06	0.0412	1.6E-05	46	3.2	2	0.493	1.1E-06	1.0E-04	1.1E-02	0.01
Beryllium	164.07	1.0E-06	0.0412	6.8E-06	46	3.2	2	0.493	4.6E-07	1.4E-06	3.3E-01	0.25
Cadmium	19.84	1.0E-06	0.0412	8.2E-07	46	3.2	2	0.493	5.6E-08	1.0E-03	5.6E-05	0.00
Chromium (trivalent)	28.73	1.0E-06	0.0412	1.2E-06	46	3.2	2	0.493	8.1E-08	5.7E-07	1.4E-01	0.11
Copper	34,413	1.0E-06	0.0412	1.4E-03	46	3.2	2	0.493	9.7E-05	6.9E-04	1.4E-01	0.11
Lead	2,308	1.0E-06	0.0412	9.5E-05	46	3.2	2	0.493	6.5E-06	4.3E-04	1.5E-02	0.01
Manganese	24,997	1.0E-06	0.0412	1.0E-03	46	3.2	2	0.493	7.1E-05	1.1E-04	6.4E-01	0.49
Mercury	0.57	1.0E-06	0.0412	2.3E-08	46	3.2	2	0.493	1.6E-09	8.6E-05	1.9E-05	0.00
Nickel	272.27	1.0E-06	0.0412	1.1E-05	46	3.2	2	0.493	7.7E-07	6.9E-05	1.1E-02	0.01
Selenium	1.63	1.0E-06	0.0412	6.7E-08	46	3.2	2	0.493	4.6E-09	1.4E-04	3.3E-05	0.00
Zinc	67,134	1.0E-06	0.0412	2.8E-03	46	3.2	2	0.493	1.9E-04	1.0E-02	1.9E-02	0.01

**For lead inhalation risks calculated acc. to DTSC guidance, see CH_PB2.XLS Blood Lead Calculations.*

HAZARD INDEX: 1.3E+00

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (180 days/365 days)*(5 years/70 years) = 0.035.

For Noncarcinogens, EF (exposure fraction) = (180 days/365 days) = 0.493.

Assumed PM10 concentration (0.0412 mg/m^3) is the arithmetic mean annual PM10 concentration reported for Hawthorne (adjacent to El Segundo).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CH_PB2.XLS:

BLOOD LEAD LEVELS ESTIMATED FOR CURRENT USE TRESPASSER SCENARIOS: REASONABLE MAXIMUM

H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18	ug/m^3	ESTIMATED CHILD BLOOD LEAD LEVELS:	11.98	21.29	27.08	ug/dl
LEAD IN SOIL	2,308	ug/g	HAZARD INDICES:	1.20	2.13	2.71	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	0.0412	mg/m^3					
SITE-GROWN PRODUCE?	0	(1 = Yes; 0 = No)					

********** **EQUATIONS (TYPICAL CHILD)** ********

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.323	=	0.0001 (ug/dl)/(ug/day) *	2308 ug/g *	1.4 g soil/day (5 g/m^2 * 0.28 m^2)	3%
SOIL INGESTION:	8.886	=	0.07 (ug/dl)/(ug/day) *	2308 ug/g *	0.055 g soil/day	74%
DUST INHALATION:	0.528	=	1.92 (ug/dl)/(ug/m^3) *	0.275 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	4%
WATER INGESTION:	0.160	=	0.16 (ug/dl)/(ug/day) *	2.50 ug/l *	0.4 liter water/day	1%
FOOD INGESTION:	2.080	=	0.16 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	1.30 kg diet/day	17%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 2308 ppm, is the 95% upper confidence limit (UCL) of the mean lead concentration in 0-5 ft slag pile soils.

3] Assumed PM10 concentration, 0.0412 mg/m^3, is the arithmetic mean annual particulate matter (PM10) concentration reported for Hawthorne.

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

Risk Calculations For Future-Use Construction Worker Receptors:

Area 1 Locations

FUTURE USE CONSTRUCTION WORKER EXPOSURE SCENARIO (AREA 1 SOILS): BEST ESTIMATE RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	309.86	1.75E+00	1.75E+00	1.2E+01	3.6E-05	1.4E-07	1.9E-06	3.8E-05	0.75
Beryllium	24.95	7.0E+00	1.4E+02	7.0E+00	1.2E-05	9.0E-07	8.8E-08	1.3E-05	0.25
Cadmium	2.79	NA	NA	1.5E+01	NA	NA	2.1E-08	2.1E-08	0.00
				EXCESS CANCER RISKS:	**4.8E-05**	**1.0E-06**	**2.0E-06**	**5.1E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	153.46	4.0E-04	2.0E-05	4.0E-04	1.8E+00	1.4E-01	1.4E-02	2.0E+00	0.20
Arsenic	309.86	3.0E-04	3.0E-04	1.4E-04	4.9E+00	1.9E-02	7.8E-02	4.9E+00	0.51
Barium	85.63	7.0E-02	3.5E-03	1.0E-03	5.7E-03	4.4E-04	3.0E-03	9.2E-03	0.00
Beryllium	24.95	5.0E-03	2.5E-04	1.4E-06	2.3E-02	1.8E-03	6.3E-01	6.5E-01	0.07
Cadmium	2.79	1.0E-03	2.5E-05	1.0E-03	1.3E-02	2.0E-03	9.8E-05	1.5E-02	0.00
Chromium (trivalent)	13.64	1.0E+01	5.0E-01	5.7E-06	6.4E-06	4.9E-07	8.4E-02	8.4E-02	0.01
Copper	3643.32	3.7E-02	NA	6.9E-04	4.6E-01	NA	1.9E-01	6.5E-01	0.07
Lead	480.03	NA	NA	4.3E-04	NA	NA	3.9E-02	3.9E-02	0.00
Manganese	2266.08	1.0E-01	5.0E-03	1.1E-04	1.1E-01	8.2E-03	7.3E-01	8.4E-01	0.09
Mercury	0.33	3.0E-04	1.5E-05	8.6E-05	5.2E-03	4.0E-04	1.4E-04	5.7E-03	0.00
Nickel	53.61	2.0E-02	1.0E-03	6.9E-05	1.3E-02	9.7E-04	2.7E-02	4.1E-02	0.00
Selenium	17.73	5.0E-03	2.5E-04	1.4E-04	1.7E-02	1.3E-03	4.5E-03	2.2E-02	0.00
Zinc	15496.54	2.0E-01	1.0E-02	1.0E-02	3.6E-01	2.8E-02	5.5E-02	4.5E-01	0.05
				HAZARD INDICES (HIs):	**7.7E+00**	**2.0E-01**	**1.8E+00**	**9.7E+00**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	1.7 ug/dl	3.0 ug/dl	3.8 ug/dl
HAZARD INDICES:	0.17	0.30	0.38

DTSC Blood Lead Level of Concern: 10 ug/dl

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): BEST ESTIMATE SOIL INGESTION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: *Bolded and shaded cells represent input parameters which were modified since original May 1992 version.*

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Arithmetic mean of soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	309.9	1.0E-06	70	480	0.010	2.1E-05	1.75E+00	3.6E-05	0.76
Beryllium	24.95	1.0E-06	70	480	0.010	1.7E-06	7.0E+00	1.2E-05	0.24
							TOTAL EXCESS CANCER RISK:	**4.8E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	153.46	1.0E-06	70	480	0.685	7.2E-04	4.0E-04	1.8E+00	0.24
Arsenic	309.9	1.0E-06	70	480	0.685	1.5E-03	3.0E-04	4.9E+00	0.63
Barium	85.6	1.0E-06	70	480	0.685	4.0E-04	7.0E-02	5.7E-03	0.00
Beryllium	24.95	1.0E-06	70	480	0.685	1.2E-04	5.0E-03	2.3E-02	0.00
Cadmium	2.79	1.0E-06	70	480	0.685	1.3E-05	1.0E-03	1.3E-02	0.00
Chromium (trivalent)	13.64	1.0E-06	70	480	0.685	6.4E-05	1.0E+01	6.4E-06	0.00
Copper	3643	1.0E-06	70	480	0.685	1.7E-02	3.7E-02	4.6E-01	0.06
Lead	480.0	*See FA1 PBM.XLS Blood Lead Calculations.*						NA	NA
Manganese	2266	1.0E-06	70	480	0.685	1.1E-02	1.0E-01	1.1E-01	0.01
Mercury	0.33	1.0E-06	70	480	0.685	1.5E-06	3.0E-04	5.2E-03	0.00
Nickel	53.61	1.0E-06	70	480	0.685	2.5E-04	2.0E-02	1.3E-02	0.00
Selenium	17.73	1.0E-06	70	480	0.685	8.3E-05	5.0E-03	1.7E-02	0.00
Zinc	15497	1.0E-06	70	480	0.685	7.3E-02	2.0E-01	3.6E-01	0.05
							HAZARD INDEX:	**7.7E+00**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): BEST ESTIMATE DERMAL CONTACT RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: Arithmetic mean of soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	309.9	1.0E-06	70	0.5	3,700	0.1%	0.010	8.0E-08	1.75E+00	1.4E-07	0.13
Beryllium	24.95	1.0E-06	70	0.5	3,700	0.1%	0.010	6.5E-09	1.4E+02	9.0E-07	0.87
									TOTAL EXCESS CANCER RISK:	**1.0E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	153.46	1.0E-06	70	0.5	3,700	0.1%	0.685	2.8E-06	2.0E-05	1.4E-01	0.69
Arsenic	309.9	1.0E-06	70	0.5	3,700	0.1%	0.685	5.6E-06	3.0E-04	1.9E-02	0.09
Barium	85.6	1.0E-06	70	0.5	3,700	0.1%	0.685	1.6E-06	3.5E-03	4.4E-04	0.00
Beryllium	24.95	1.0E-06	70	0.5	3,700	0.1%	0.685	4.5E-07	2.5E-04	1.8E-03	0.01
Cadmium	2.79	1.0E-06	70	0.5	3,700	0.1%	0.685	5.1E-08	2.5E-05	2.0E-03	0.01
Chromium (trivalent)	13.64	1.0E-06	70	0.5	3,700	0.1%	0.685	2.5E-07	5.0E-01	4.9E-07	0.00
Copper	3643	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	480.0	*See FA1 PBM.XLS Blood Lead Calculations.*								NA	NA
Manganese	2266	1.0E-06	70	0.5	3,700	0.1%	0.685	4.1E-05	5.0E-03	8.2E-03	0.04
Mercury	0.33	1.0E-06	70	0.5	3,700	0.1%	0.685	6.0E-09	1.5E-05	4.0E-04	0.00
Nickel	53.61	1.0E-06	70	0.5	3,700	0.1%	0.685	9.7E-07	1.0E-03	9.7E-04	0.00
Selenium	17.73	1.0E-06	70	0.5	3,700	0.1%	0.685	3.2E-07	2.5E-04	1.3E-03	0.01
Zinc	15497	1.0E-06	70	0.5	3,700	0.1%	0.685	2.8E-04	1.0E-02	2.8E-02	0.14
									HAZARD INDEX:	**2.0E-01**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): BEST ESTIMATE INHALATION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

AIR EPC: Estimated particulate concentration in air based on arithmetic mean soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	**309.9**	1.0E-06	0.10	3.1E-05	70	4.5	8	0.010	1.6E-07	**1.20E+01**	1.9E-06	0.95
Beryllium	**24.95**	1.0E-06	0.10	2.5E-06	70	4.5	8	0.010	1.3E-08	**7.00E+00**	8.8E-08	0.04
Cadmium	**2.79**	1.0E-06	0.10	2.8E-07	70	4.5	8	0.010	1.4E-09	1.5E+01	2.1E-08	0.01

TOTAL EXCESS CANCER RISK: **2.0E-06**

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	**153.46**	1.0E-06	0.10	1.5E-05	70	4.5	8	0.685	5.4E-06	4.0E-04	1.4E-02	0.01
Arsenic	**309.9**	1.0E-06	0.10	3.1E-05	70	4.5	8	0.685	1.1E-05	**1.4E-04**	7.8E-02	0.04
Barium	**85.6**	1.0E-06	0.10	8.6E-06	70	4.5	8	0.685	3.0E-06	1.0E-03	3.0E-03	0.00
Beryllium	**24.95**	1.0E-06	0.10	2.5E-06	70	4.5	8	0.685	8.8E-07	1.4E-06	6.3E-01	0.34
Cadmium	**2.79**	1.0E-06	0.10	2.8E-07	70	4.5	8	0.685	9.8E-08	1.0E-03	9.8E-05	0.00
Chromium (trivalent)	**13.64**	1.0E-06	0.10	1.4E-06	70	4.5	8	0.685	4.8E-07	5.7E-06	8.4E-02	0.05
Copper	**3643**	1.0E-06	0.10	3.6E-04	70	4.5	8	0.685	1.3E-04	**6.9E-04**	1.9E-01	0.10
Lead	**480.0**	1.0E-06	0.10	4.8E-05	70	4.5	8	0.685	1.7E-05	**4.3E-04**	3.9E-02	0.02
Manganese	**2266**	1.0E-06	0.10	2.3E-04	70	4.5	8	0.685	8.0E-05	1.1E-04	7.3E-01	0.39
Mercury	**0.33**	1.0E-06	0.10	3.3E-08	70	4.5	8	0.685	1.2E-08	8.6E-05	1.4E-04	0.00
Nickel	**53.61**	1.0E-06	0.10	5.4E-06	70	4.5	8	0.685	1.9E-06	6.9E-05	2.7E-02	0.01
Selenium	**17.73**	1.0E-06	0.10	1.8E-06	70	4.5	8	0.685	6.2E-07	**1.4E-04**	4.5E-03	0.00
Zinc	**15497**	1.0E-06	0.10	1.5E-03	70	4.5	8	0.685	5.5E-04	1.0E-02	5.5E-02	0.03

**For lead inhalation risks calculated acc. to DTSC guidance, see FA1_PBM.XLS Blood Lead Calculations.*

HAZARD INDEX: **1.8E+00**

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FA1_PBM.XLS:

BLOOD LEAD LEVELS ESTIMATED FOR FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): BEST ESTIMATE

H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18	ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	1.70	3.02	3.84	ug/dl
LEAD IN SOIL	480.0	ug/g	HAZARD INDICES:	0.17	0.30	0.38	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	0.1	mg/m^3					
SITE-GROWN PRODUCE?	0	(1 = Yes; 0 = No)					

EQUATIONS

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.089	=	0.0001 (ug/dl)/(ug/day) *	480.03 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	5%
SOIL INGESTION:	0.216	=	0.018 (ug/dl)/(ug/day) *	480.03 ug/g *	0.025 g soil/day	13%
DUST INHALATION:	0.374	=	1.64 (ug/dl)/(ug/m^3) *	0.228 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	22%
WATER INGESTION:	0.140	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	8%
FOOD INGESTION:	0.880	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	52%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 480.03, is the arithmetic mean lead concentration detected in Area 1 soils (3-25').

3] Assumed PM10 concentration, 0.1 mg/m^3, is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

FUTURE USE CONSTRUCTION WORKER EXPOSURE SCENARIO (AREA 1 SOILS): REASONABLE MAXIMUM RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (See Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	540.3	1.75E+00	1.75E+00	1.2E+01	6.3E-05	6.6E-06	3.3E-06	7.3E-05	0.53
Beryllium	45.54	7.0E+00	1.4E+02	7.0E+00	2.1E-05	4.5E-05	1.6E-07	6.6E-05	0.47
Cadmium	5.28	NA	NA	1.5E+01	NA	NA	3.9E-08	3.9E-08	0.00
				EXCESS CANCER RISKS:	**8.5E-05**	**5.1E-05**	**3.5E-06**	**1.4E-04**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	305.40	4.0E-04	2.0E-05	4.0E-04	3.6E+00	7.5E+00	2.7E-02	1.1E+01	0.39
Arsenic	540.3	3.0E-04	3.0E-04	1.4E-04	8.5E+00	8.8E-01	1.4E-01	9.5E+00	0.33
Barium	129.6	7.0E-02	3.5E-03	1.0E-03	8.7E-03	1.8E-02	4.6E-03	3.1E-02	0.00
Beryllium	45.54	5.0E-03	2.5E-04	1.4E-06	4.3E-02	8.9E-02	1.1E+00	1.3E+00	0.05
Cadmium	5.28	1.0E-03	2.5E-05	1.0E-03	2.5E-02	1.0E-01	1.9E-04	1.3E-01	0.00
Chromium (trivalent)	20.01	1.0E+01	5.0E-01	5.7E-06	9.4E-06	2.0E-05	1.2E-01	1.2E-01	0.00
Copper	8084	3.7E-02	NA	6.9E-04	1.0E+00	NA	4.2E-01	1.4E+00	0.05
Lead	782.1	NA	NA	4.3E-04	NA	NA	6.4E-02	6.4E-02	0.00
Manganese	5602	1.0E-01	5.0E-03	1.1E-04	2.6E-01	5.5E-01	1.8E+00	2.6E+00	0.09
Mercury	0.81	3.0E-04	1.5E-05	8.6E-05	1.3E-02	2.6E-02	3.3E-04	3.9E-02	0.00
Nickel	87.75	2.0E-02	1.0E-03	6.9E-05	2.1E-02	4.3E-02	4.5E-02	1.1E-01	0.00
Selenium	41.91	5.0E-03	2.5E-04	1.4E-04	3.9E-02	8.2E-02	1.1E-02	1.3E-01	0.00
Zinc	24606	2.0E-01	1.0E-02	1.0E-02	5.8E-01	1.2E+00	8.7E-02	1.9E+00	0.07
				HAZARD INDICES (HIs):	**1.4E+01**	**1.0E+01**	**3.9E+00**	**2.8E+01**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	1.9 ug/dl	3.4 ug/dl	4.4 ug/dl
HAZARD INDICES:	0.19	0.34	0.44

DTSC Blood Lead Level of Concern: 10 ug/dl

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): REASONABLE MAXIMUM SOIL INGESTION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils
SOIL EPC: 95% upper confidence limit of mean soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	540.3	1.0E-06	70	480	0.010	3.6E-05	**1.75E+00**	6.3E-05	0.75
Beryllium	45.54	1.0E-06	70	480	0.010	3.1E-06	**7.0E+00**	2.1E-05	0.25
							TOTAL EXCESS CANCER RISK:	**8.5E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	305.40	1.0E-06	70	480	0.685	1.4E-03	4.0E-04	3.6E+00	0.26
Arsenic	540.3	1.0E-06	70	480	0.685	2.5E-03	3.0E-04	8.5E+00	0.60
Barium	129.6	1.0E-06	70	480	0.685	6.1E-04	7.0E-02	8.7E-03	0.00
Beryllium	45.54	1.0E-06	70	480	0.685	2.1E-04	5.0E-03	4.3E-02	0.00
Cadmium	5.28	1.0E-06	70	480	0.685	2.5E-05	1.0E-03	2.5E-02	0.00
Chromium (trivalent)	20.01	1.0E-06	70	480	0.685	9.4E-05	1.0E+01	9.4E-06	0.00
Copper	8084	1.0E-06	70	480	0.685	3.8E-02	3.7E-02	1.0E+00	0.07
Lead	782.1	*See FA1 PB2.XLS Blood Lead Calculations.*						NA	NA
Manganese	5602	1.0E-06	70	480	0.685	2.6E-02	1.0E-01	2.6E-01	0.02
Mercury	0.81	1.0E-06	70	480	0.685	3.8E-06	3.0E-04	1.3E-02	0.00
Nickel	87.75	1.0E-06	70	480	0.685	4.1E-04	2.0E-02	2.1E-02	0.00
Selenium	41.91	1.0E-06	70	480	0.685	2.0E-04	5.0E-03	3.9E-02	0.00
Zinc	24606	1.0E-06	70	480	0.685	1.2E-01	2.0E-01	5.8E-01	0.04
							HAZARD INDEX:	**1.4E+01**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): REASONABLE MAXIMUM DERMAL CONTACT RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: *Bolded and shaded cells represent input parameters which were modified since original May 1992 version.*

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

SOIL EPC: 95% upper confidence limit of mean soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	540.3	1.0E-06	70	1.0	5,000	1.0%	0.010	3.8E-06	**1.75E+00**	6.6E-06	0.13
Beryllium	45.54	1.0E-06	70	1.0	5,000	1.0%	0.010	3.2E-07	**1.4E+02**	4.5E-05	0.87
									TOTAL EXCESS CANCER RISK:	**5.1E-05**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	305.40	1.0E-06	70	1.0	5,000	1.0%	0.685	1.5E-04	**2.0E-05**	7.5E+00	0.71
Arsenic	540.3	1.0E-06	70	1.0	5,000	1.0%	0.685	2.6E-04	3.0E-04	8.8E-01	0.08
Barium	129.6	1.0E-06	70	1.0	5,000	1.0%	0.685	6.3E-05	**3.5E-03**	1.8E-02	0.00
Beryllium	45.54	1.0E-06	70	1.0	5,000	1.0%	0.685	2.2E-05	**2.5E-04**	8.9E-02	0.01
Cadmium	5.28	1.0E-06	70	1.0	5,000	1.0%	0.685	2.6E-06	**2.5E-05**	1.0E-01	0.01
Chromium (trivalent)	20.01	1.0E-06	70	1.0	5,000	1.0%	0.685	9.8E-06	**5.0E-01**	2.0E-05	0.00
Copper	8084	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	782.1	*See FA1 PB2.XLS Blood Lead Calculations.*								NA	NA
Manganese	5602	1.0E-06	70	1.0	5,000	1.0%	0.685	2.7E-03	**5.0E-03**	5.5E-01	0.05
Mercury	0.81	1.0E-06	70	1.0	5,000	1.0%	0.685	4.0E-07	**1.5E-05**	2.6E-02	0.00
Nickel	87.75	1.0E-06	70	1.0	5,000	1.0%	0.685	4.3E-05	**1.0E-03**	4.3E-02	0.00
Selenium	41.91	1.0E-06	70	1.0	5,000	1.0%	0.685	2.1E-05	**2.5E-04**	8.2E-02	0.01
Zinc	24606	1.0E-06	70	1.0	5,000	1.0%	0.685	1.2E-02	**1.0E-02**	1.2E+00	0.12
									HAZARD INDEX:	**1.0E+01**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): REASONABLE MAXIMUM INHALATION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 1 Subsurface Soils

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	540.3	1.0E-06	0.10	5.4E-05	70	4.5	8	0.010	2.7E-07	**1.20E+01**	3.3E-06	0.94
Beryllium	45.54	1.0E-06	0.10	4.6E-06	70	4.5	8	0.010	2.3E-08	**7.00E+00**	1.6E-07	0.05
Cadmium	5.28	1.0E-06	0.10	5.3E-07	70	4.5	8	0.010	2.7E-09	1.5E+01	3.9E-08	0.01

TOTAL EXCESS CANCER RISK: **3.5E-06**

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	305.40	1.0E-06	0.10	3.1E-05	70	4.5	8	0.685	1.1E-05	4.0E-04	2.7E-02	0.01
Arsenic	540.3	1.0E-06	0.10	5.4E-05	70	4.5	8	0.685	1.9E-05	**1.4E-04**	1.4E-01	0.04
Barium	129.6	1.0E-06	0.10	1.3E-05	70	4.5	8	0.685	4.6E-06	1.0E-03	4.6E-03	0.00
Beryllium	45.54	1.0E-06	0.10	4.6E-06	70	4.5	8	0.685	1.6E-06	1.4E-06	1.1E+00	0.30
Cadmium	5.28	1.0E-06	0.10	5.3E-07	70	4.5	8	0.685	1.9E-07	1.0E-03	1.9E-04	0.00
Chromium (trivalent)	20.01	1.0E-06	0.10	2.0E-06	70	4.5	8	0.685	7.0E-07	5.7E-06	1.2E-01	0.03
Copper	8084	1.0E-06	0.10	8.1E-04	70	4.5	8	0.685	2.8E-04	**6.9E-04**	4.2E-01	0.11
Lead	782.1	1.0E-06	0.10	7.8E-05	70	4.5	8	0.685	2.8E-05	**4.3E-04**	6.4E-02	0.02
Manganese	5602	1.0E-06	0.10	5.6E-04	70	4.5	8	0.685	2.0E-04	1.1E-04	1.8E+00	0.47
Mercury	0.81	1.0E-06	0.10	8.1E-08	70	4.5	8	0.685	2.9E-08	8.6E-05	3.3E-04	0.00
Nickel	87.75	1.0E-06	0.10	8.8E-06	70	4.5	8	0.685	3.1E-06	6.9E-05	4.5E-02	0.01
Selenium	41.91	1.0E-06	0.10	4.2E-06	70	4.5	8	0.685	1.5E-06	**1.4E-04**	1.1E-02	0.00
Zinc	24606	1.0E-06	0.10	2.5E-03	70	4.5	8	0.685	8.7E-04	1.0E-02	8.7E-02	0.02

**For lead inhalation risks calculated acc. to DTSC guidance, see FA1_PB2.XLS Blood Lead Calculations.*

HAZARD INDEX: **3.9E+00**

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FA1_PB2.XLS:
BLOOD LEAD LEVELS ESTIMATED FOR FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 1): REASONABLE MAXIMUM
H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18	ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	1.94	3.45	4.39	ug/dl
LEAD IN SOIL	782.1	ug/g	HAZARD INDICES:	0.19	0.34	0.44	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	0.1	mg/m^3					
SITE-GROWN PRODUCE?	0	(1 = Yes; 0 = No)					

EQUATIONS

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.145	=	0.0001 (ug/dl)/(ug/day) *	782.1 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	7%
SOIL INGESTION:	0.352	=	0.018 (ug/dl)/(ug/day) *	782.1 ug/g *	0.025 g soil/day	18%
DUST INHALATION:	0.423	=	1.64 (ug/dl)/(ug/m^3) *	0.258 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	22%
WATER INGESTION:	0.140	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	7%
FOOD INGESTION:	0.880	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	45%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.
2] Assumed lead concentration, 782.1 ppm, is the 95% UCL of the mean lead concentration detected in Area 1 soils (3-25').
3] Assumed PM10 concentration, 0.1 mg/m^3, is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).
4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.
5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

Risk Calculations For Future-Use Construction Worker Receptors:

Area 2 Locations

FUTURE USE CONSTRUCTION WORKER EXPOSURE SCENARIO (AREA 2 SOILS): BEST ESTIMATE RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	17.51	1.75E+00	1.75E+00	1.2E+01	2.1E-06	7.9E-09	1.1E-07	2.2E-06	0.97
Beryllium	0.13	7.0E+00	1.4E+02	7.0E+00	6.1E-08	4.7E-09	4.6E-10	6.6E-08	0.03
Cadmium	0.16	NA	NA	1.5E+01	NA	NA	1.2E-09	1.2E-09	0.00
				EXCESS CANCER RISKS:	**2.1E-06**	**1.3E-08**	**1.1E-07**	**2.2E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	2.27	4.0E-04	2.0E-05	4.0E-04	2.7E-02	2.1E-03	2.0E-04	2.9E-02	0.07
Arsenic	17.51	3.0E-04	3.0E-04	1.4E-04	2.7E-01	1.1E-03	4.4E-03	2.8E-01	0.70
Barium	22.35	7.0E-02	3.5E-03	1.0E-03	1.5E-03	1.2E-04	7.9E-04	2.4E-03	0.01
Beryllium	0.13	5.0E-03	2.5E-04	1.4E-06	1.2E-04	9.4E-06	3.3E-03	3.4E-03	0.01
Cadmium	0.16	1.0E-03	2.5E-05	1.0E-03	7.5E-04	1.2E-04	5.6E-06	8.7E-04	0.00
Chromium (trivalent)	5.28	1.0E+01	5.0E-01	5.7E-06	2.5E-06	1.9E-07	3.3E-02	3.3E-02	0.08
Copper	9.29	3.7E-02	NA	6.9E-04	1.2E-03	NA	4.8E-04	1.7E-03	0.00
Lead	4.49	NA	NA	4.3E-04	NA	NA	3.7E-04	3.7E-04	0.00
Manganese	119.45	1.0E-01	5.0E-03	1.1E-04	5.6E-03	4.3E-04	3.8E-02	4.4E-02	0.11
Mercury	0.04	3.0E-04	1.5E-05	8.6E-05	6.3E-04	4.8E-05	1.6E-05	6.9E-04	0.00
Nickel	4.62	2.0E-02	1.0E-03	6.9E-05	1.1E-03	8.4E-05	2.4E-03	3.5E-03	0.01
Selenium	0.07	5.0E-03	2.5E-04	1.4E-04	6.6E-05	5.1E-06	1.8E-05	8.8E-05	0.00
Zinc	17.28	2.0E-01	1.0E-02	1.0E-02	4.1E-04	3.1E-05	6.1E-05	5.0E-04	0.00
				HAZARD INDICES (HIs):	**3.1E-01**	**4.0E-03**	**8.3E-02**	**4.0E-01**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	1.3 ug/dl	2.3 ug/dl	3.0 ug/dl
HAZARD INDICES:	0.13	0.23	0.30

DTSC Blood Lead Level of Concern: 10 ug/dl

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): BEST ESTIMATE SOIL INGESTION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils
SOIL EPC: Arithmetic mean of soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	**17.51**	1.0E-06	70	480	0.010	1.2E-06	**1.75E+00**	2.1E-06	0.97
Beryllium	**0.13**	1.0E-06	70	480	0.010	8.7E-09	**7.0E+00**	6.1E-08	0.03
							TOTAL EXCESS CANCER RISK:	**2.1E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	**2.27**	1.0E-06	70	480	0.685	1.1E-05	4.0E-04	2.7E-02	0.09
Arsenic	**17.51**	1.0E-06	70	480	0.685	8.2E-05	3.0E-04	2.7E-01	0.88
Barium	**22.35**	1.0E-06	70	480	0.685	1.0E-04	7.0E-02	1.5E-03	0.00
Beryllium	**0.13**	1.0E-06	70	480	0.685	6.1E-07	5.0E-03	1.2E-04	0.00
Cadmium	**0.16**	1.0E-06	70	480	0.685	7.5E-07	1.0E-03	7.5E-04	0.00
Chromium (trivalent)	**5.28**	1.0E-06	70	480	0.685	2.5E-05	1.0E+01	2.5E-06	0.00
Copper	**9.29**	1.0E-06	70	480	0.685	4.4E-05	3.7E-02	1.2E-03	0.00
Lead	**4.49**	*See FA2 PBM.XLS Blood Lead Calculations.*						NA	NA
Manganese	**119.45**	1.0E-06	70	480	0.685	5.6E-04	1.0E-01	5.6E-03	0.02
Mercury	**0.04**	1.0E-06	70	480	0.685	1.9E-07	3.0E-04	6.3E-04	0.00
Nickel	**4.62**	1.0E-06	70	480	0.685	2.2E-05	2.0E-02	1.1E-03	0.00
Selenium	**0.07**	1.0E-06	70	480	0.685	3.3E-07	5.0E-03	6.6E-05	0.00
Zinc	**17.28**	1.0E-06	70	480	0.685	8.1E-05	2.0E-01	4.1E-04	0.00
							HAZARD INDEX:	**3.1E-01**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): BEST ESTIMATE DERMAL CONTACT RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils
SOIL EPC: Arithmetic mean of soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.51	1.0E-06	70	0.5	3,700	0.1%	0.010	4.5E-09	1.75E+00	7.9E-09	0.63
Beryllium	0.13	1.0E-06	70	0.5	3,700	0.1%	0.010	3.4E-11	1.4E+02	4.7E-09	0.37
									TOTAL EXCESS CANCER RISK:	**1.3E-08**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Mean Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	2.27	1.0E-06	70	0.5	3,700	0.1%	0.685	4.1E-08	2.0E-05	2.1E-03	0.52
Arsenic	17.51	1.0E-06	70	0.5	3,700	0.1%	0.685	3.2E-07	3.0E-04	1.1E-03	0.27
Barium	22.35	1.0E-06	70	0.5	3,700	0.1%	0.685	4.0E-07	3.5E-03	1.2E-04	0.03
Beryllium	0.13	1.0E-06	70	0.5	3,700	0.1%	0.685	2.4E-09	2.5E-04	9.4E-06	0.00
Cadmium	0.16	1.0E-06	70	0.5	3,700	0.1%	0.685	2.9E-09	2.5E-05	1.2E-04	0.03
Chromium (trivalent)	5.28	1.0E-06	70	0.5	3,700	0.1%	0.685	9.6E-08	5.0E-01	1.9E-07	0.00
Copper	9.29	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	4.49	*See FA2 PBM.XLS Blood Lead Calculations.*								NA	NA
Manganese	119.45	1.0E-06	70	0.5	3,700	0.1%	0.685	2.2E-06	5.0E-03	4.3E-04	0.11
Mercury	0.04	1.0E-06	70	0.5	3,700	0.1%	0.685	7.2E-10	1.5E-05	4.8E-05	0.01
Nickel	4.62	1.0E-06	70	0.5	3,700	0.1%	0.685	8.4E-08	1.0E-03	8.4E-05	0.02
Selenium	0.07	1.0E-06	70	0.5	3,700	0.1%	0.685	1.3E-09	2.5E-04	5.1E-06	0.00
Zinc	17.28	1.0E-06	70	0.5	3,700	0.1%	0.685	3.1E-07	1.0E-02	3.1E-05	0.01
									HAZARD INDEX:	**4.0E-03**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): BEST ESTIMATE INHALATION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

AIR EPC: Estimated particulate concentration in air based on arithmetic mean soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	**17.5**	1.0E-06	0.10	1.8E-06	70	4.5	8	0.010	8.8E-09	**1.20E+01**	1.1E-07	0.98
Beryllium	**0.13**	1.0E-06	0.10	1.3E-08	70	4.5	8	0.010	6.5E-11	**7.00E+00**	4.6E-10	0.00
Cadmium	**0.16**	1.0E-06	0.10	1.6E-08	70	4.5	8	0.010	8.1E-11	1.5E+01	1.2E-09	0.01
										TOTAL EXCESS CANCER RISK:	**1.1E-07**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	Mean Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	**2.27**	1.0E-06	0.10	2.3E-07	70	4.5	8	0.685	8.0E-08	4.0E-04	2.0E-04	0.00
Arsenic	**17.51**	1.0E-06	0.10	1.8E-06	70	4.5	8	0.685	6.2E-07	**1.4E-04**	4.4E-03	0.05
Barium	**22.35**	1.0E-06	0.10	2.2E-06	70	4.5	8	0.685	7.9E-07	1.0E-03	7.9E-04	0.01
Beryllium	**0.13**	1.0E-06	0.10	1.3E-08	70	4.5	8	0.685	4.6E-09	1.4E-06	3.3E-03	0.04
Cadmium	**0.16**	1.0E-06	0.10	1.6E-08	70	4.5	8	0.685	5.6E-09	1.0E-03	5.6E-06	0.00
Chromium (trivalent)	**5.28**	1.0E-06	0.10	5.3E-07	70	4.5	8	0.685	1.9E-07	5.7E-06	3.3E-02	0.39
Copper	**9.29**	1.0E-06	0.10	9.3E-07	70	4.5	8	0.685	3.3E-07	**6.9E-04**	4.8E-04	0.01
Lead	**4.49**	1.0E-06	0.10	4.5E-07	70	4.5	8	0.685	1.6E-07	**4.3E-04**	3.7E-04	0.00
Manganese	**119.45**	1.0E-06	0.10	1.2E-05	70	4.5	8	0.685	4.2E-06	1.1E-04	3.8E-02	0.46
Mercury	**0.04**	1.0E-06	0.10	4.0E-09	70	4.5	8	0.685	1.4E-09	8.6E-05	1.6E-05	0.00
Nickel	**4.62**	1.0E-06	0.10	4.6E-07	70	4.5	8	0.685	1.6E-07	6.9E-05	2.4E-03	0.03
Selenium	**0.07**	1.0E-06	0.10	7.0E-09	70	4.5	8	0.685	2.5E-09	**1.4E-04**	1.8E-05	0.00
Zinc	**17.28**	1.0E-06	0.10	1.7E-06	70	4.5	8	0.685	6.1E-07	1.0E-02	6.1E-05	0.00
										HAZARD INDEX:	**8.3E-02**	

**For lead inhalation risks calculated acc. to DTSC guidance, see FA2_PBM.XLS Blood Lead Calculations.*

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.
Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FA2_PBM1.XLS:
BLOOD LEAD LEVELS ESTIMATED FOR FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): BEST ESTIMATE
H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	**0.18**	ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	1.32	2.34	2.98	ug/dl
LEAD IN SOIL	**4.5**	ug/g	HAZARD INDICES:	0.13	0.23	0.30	
LEAD IN WATER	**2.5**	ug/l					
DUST IN AIR	**0.1**	mg/m^3					
SITE-GROWN PRODUCE?	**0**	(1 = Yes; 0 = No)					

********** **EQUATIONS** **********

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	**0.001**	=	0.0001 (ug/dl)/(ug/day) *	4.49 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	0%
SOIL INGESTION:	**0.002**	=	0.018 (ug/dl)/(ug/day) *	4.49 ug/g *	0.025 g soil/day	0%
DUST INHALATION:	**0.296**	=	1.64 (ug/dl)/(ug/m^3) *	0.180 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	22%
WATER INGESTION:	**0.140**	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	11%
FOOD INGESTION:	**0.880**	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	67%

TOTAL DIETARY LEAD = 10.00 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 4.49 ppm, is the arithmetic mean lead concentration detected in Area 2 soils (3-25').

3] Assumed PM10 concentration, 0.1 mg/m^3, is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

FUTURE USE CONSTRUCTION WORKER EXPOSURE SCENARIO (AREA 2 SOILS): REASONABLE MAXIMUM RISKS

H. KRAMER & COMPANY SITE

Risks Recalculated in Response to OEHHA Comments (see Addendum Nos. 1 and 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral Slope Factor (mg/kg/day^-1)	Dermal Slope Factor (mg/kg/day^-1)	Inhalation Slope Factor (mg/kg/day^-1)	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISK	Proportion of Total Risk
Arsenic	45.7	1.75E+00	1.75E+00	1.2E+01	5.4E-06	5.6E-07	2.8E-07	6.2E-06	0.97
Beryllium	0.15	7.0E+00	1.4E+02	7.0E+00	7.0E-08	1.5E-07	5.3E-10	2.2E-07	0.03
Cadmium	0.37	NA	NA	1.5E+01	NA	NA	2.7E-09	2.7E-09	0.00
				EXCESS CANCER RISKS:	**5.4E-06**	**7.1E-07**	**2.8E-07**	**6.4E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Oral RfD (mg/kg/day)	Dermal RfD (mg/kg/day)	Inhalation RfD (mg/kg/day)	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIO	Proportion of Hazard Index
Antimony	4.93	4.0E-04	2.0E-05	4.0E-04	5.8E-02	1.2E-01	4.3E-04	1.8E-01	0.16
Arsenic	45.7	3.0E-04	3.0E-04	1.4E-04	7.2E-01	7.5E-02	1.2E-02	8.0E-01	0.71
Barium	27.1	7.0E-02	3.5E-03	1.0E-03	1.8E-03	3.8E-03	9.5E-04	6.5E-03	0.01
Beryllium	0.15	5.0E-03	2.5E-04	1.4E-06	1.4E-04	2.9E-04	3.8E-03	4.2E-03	0.00
Cadmium	0.37	1.0E-03	2.5E-05	1.0E-03	1.7E-03	7.2E-03	1.3E-05	9.0E-03	0.01
Chromium (trivalent)	6.35	1.0E+01	5.0E-01	5.7E-06	3.0E-06	6.2E-06	3.9E-02	3.9E-02	0.03
Copper	12	3.7E-02	NA	6.9E-04	1.6E-03	NA	6.4E-04	2.2E-03	0.00
Lead	10.1	NA	NA	4.3E-04	NA	NA	8.3E-04	8.3E-04	0.00
Manganese	168	1.0E-01	5.0E-03	1.1E-04	7.9E-03	1.6E-02	5.4E-02	7.8E-02	0.07
Mercury	0.07	3.0E-04	1.5E-05	8.6E-05	1.1E-03	2.3E-03	2.9E-05	3.4E-03	0.00
Nickel	6.59	2.0E-02	1.0E-03	6.9E-05	1.5E-03	3.2E-03	3.4E-03	8.1E-03	0.01
Selenium	0.12	5.0E-03	2.5E-04	1.4E-04	1.1E-04	2.3E-04	3.0E-05	3.8E-04	0.00
Zinc	24	2.0E-01	1.0E-02	1.0E-02	5.6E-04	1.2E-03	8.5E-05	1.8E-03	0.00
				HAZARD INDICES (HIs):	**7.9E-01**	**2.3E-01**	**1.1E-01**	**1.1E+00**	

ADULT BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean	95th Percentile	99th Percentile
ESTIMATED BLOOD LEAD LEVELS	1.3 ug/dl	2.3 ug/dl	3.0 ug/dl
HAZARD INDICES:	0.13	0.24	0.30

DTSC Blood Lead Level of Concern: 10 ug/dl

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): REASONABLE MAXIMUM SOIL INGESTION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils
SOIL EPC: 95% upper confidence limit of mean soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	45.7	1.0E-06	70	480	0.010	3.1E-06	**1.75E+00**	5.4E-06	0.99
Beryllium	0.15	1.0E-06	70	480	0.010	1.0E-08	**7.0E+00**	7.0E-08	0.01
							TOTAL EXCESS CANCER RISK:	**5.4E-06**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	4.93	1.0E-06	70	480	0.685	2.3E-05	4.0E-04	5.8E-02	0.07
Arsenic	45.7	1.0E-06	70	480	0.685	2.1E-04	3.0E-04	7.2E-01	0.91
Barium	27.1	1.0E-06	70	480	0.685	1.3E-04	7.0E-02	1.8E-03	0.00
Beryllium	0.15	1.0E-06	70	480	0.685	7.0E-07	5.0E-03	1.4E-04	0.00
Cadmium	0.37	1.0E-06	70	480	0.685	1.7E-06	1.0E-03	1.7E-03	0.00
Chromium (trivalent)	6.35	1.0E-06	70	480	0.685	3.0E-05	1.0E+01	3.0E-06	0.00
Copper	12	1.0E-06	70	480	0.685	5.8E-05	3.7E-02	1.6E-03	0.00
Lead	10.1	*See FA2 PB2.XLS Blood Lead Calculations.*						NA	NA
Manganese	168	1.0E-06	70	480	0.685	7.9E-04	1.0E-01	7.9E-03	0.01
Mercury	0.07	1.0E-06	70	480	0.685	3.3E-07	3.0E-04	1.1E-03	0.00
Nickel	6.59	1.0E-06	70	480	0.685	3.1E-05	2.0E-02	1.5E-03	0.00
Selenium	0.12	1.0E-06	70	480	0.685	5.6E-07	5.0E-03	1.1E-04	0.00
Zinc	24	1.0E-06	70	480	0.685	1.1E-04	2.0E-01	5.6E-04	0.00
							HAZARD INDEX:	**7.9E-01**	

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): REASONABLE MAXIMUM DERMAL CONTACT RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils
SOIL EPC: 95% upper confidence limit of mean soil concentrations (3-25')

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	45.7	1.0E-06	70	1.0	5,000	1.0%	0.010	3.2E-07	**1.75E+00**	5.6E-07	0.79
Beryllium	0.15	1.0E-06	70	1.0	5,000	1.0%	0.010	1.0E-09	**1.4E+02**	1.5E-07	0.21
									TOTAL EXCESS CANCER RISK:	**7.1E-07**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	4.93	1.0E-06	70	1.0	5,000	1.0%	0.685	2.4E-06	**2.0E-05**	1.2E-01	0.52
Arsenic	45.7	1.0E-06	70	1.0	5,000	1.0%	0.685	2.2E-05	3.0E-04	7.5E-02	0.32
Barium	27.1	1.0E-06	70	1.0	5,000	1.0%	0.685	1.3E-05	**3.5E-03**	3.8E-03	0.02
Beryllium	0.15	1.0E-06	70	1.0	5,000	1.0%	0.685	7.3E-08	**2.5E-04**	2.9E-04	0.00
Cadmium	0.37	1.0E-06	70	1.0	5,000	1.0%	0.685	1.8E-07	**2.5E-05**	7.2E-03	0.03
Chromium (trivalent)	6.35	1.0E-06	70	1.0	5,000	1.0%	0.685	3.1E-06	**5.0E-01**	6.2E-06	0.00
Copper	12	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	10.1	*See FA2 PB2.XLS Blood Lead Calculations.*								NA	NA
Manganese	168	1.0E-06	70	1.0	5,000	1.0%	0.685	8.2E-05	**5.0E-03**	1.6E-02	0.07
Mercury	0.07	1.0E-06	70	1.0	5,000	1.0%	0.685	3.4E-08	**1.5E-05**	2.3E-03	0.01
Nickel	6.59	1.0E-06	70	1.0	5,000	1.0%	0.685	3.2E-06	**1.0E-03**	3.2E-03	0.01
Selenium	0.12	1.0E-06	70	1.0	5,000	1.0%	0.685	5.9E-08	**2.5E-04**	2.3E-04	0.00
Zinc	24	1.0E-06	70	1.0	5,000	1.0%	0.685	1.2E-05	**1.0E-02**	1.2E-03	0.01
									HAZARD INDEX:	**2.3E-01**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.
For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): REASONABLE MAXIMUM INHALATION RISKS

H. KRAMER AND COMPANY SITE

Risks Recalculated In Response to OEHHA Comments

: Bolded and shaded cells represent input parameters which were modified since original May 1992 version.

RECEPTOR POPULATION: Construction Workers, Area 2 Subsurface Soils

AIR EPC: Estimated particulate concentration in air based on 95% UCL soil EPC and local PM10 concentration.

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	45.7	1.0E-06	0.10	4.6E-06	70	4.5	8	0.010	2.3E-08	**1.20E+01**	2.8E-07	0.99
Beryllium	0.15	1.0E-06	0.10	1.5E-08	70	4.5	8	0.010	7.5E-11	**7.00E+00**	5.3E-10	0.00
Cadmium	0.37	1.0E-06	0.10	3.7E-08	70	4.5	8	0.010	1.9E-10	1.5E+01	2.7E-09	0.01
										TOTAL EXCESS CANCER RISK:	**2.8E-07**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC	95% UCL Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	PM10 (mg/m^3)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/hr)	ED (hrs/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	4.93	1.0E-06	0.10	4.9E-07	70	4.5	8	0.685	1.7E-07	4.0E-04	4.3E-04	0.00
Arsenic	45.7	1.0E-06	0.10	4.6E-06	70	4.5	8	0.685	1.6E-06	**1.4E-04**	1.2E-02	0.10
Barium	27.1	1.0E-06	0.10	2.7E-06	70	4.5	8	0.685	9.5E-07	1.0E-03	9.5E-04	0.01
Beryllium	0.15	1.0E-06	0.10	1.5E-08	70	4.5	8	0.685	5.3E-09	1.4E-06	3.8E-03	0.03
Cadmium	0.37	1.0E-06	0.10	3.7E-08	70	4.5	8	0.685	1.3E-08	1.0E-03	1.3E-05	0.00
Chromium (trivalent)	6.35	1.0E-06	0.10	6.4E-07	70	4.5	8	0.685	2.2E-07	5.7E-06	3.9E-02	0.34
Copper	12	1.0E-06	0.10	1.2E-06	70	4.5	8	0.685	4.4E-07	**6.9E-04**	6.4E-04	0.01
Lead	10.1	1.0E-06	0.10	1.0E-06	70	4.5	8	0.685	3.6E-07	**4.3E-04**	8.3E-04	0.01
Manganese	168	1.0E-06	0.10	1.7E-05	70	4.5	8	0.685	5.9E-06	1.1E-04	5.4E-02	0.47
Mercury	0.07	1.0E-06	0.10	7.0E-09	70	4.5	8	0.685	2.5E-09	8.6E-05	2.9E-05	0.00
Nickel	6.59	1.0E-06	0.10	6.6E-07	70	4.5	8	0.685	2.3E-07	6.9E-05	3.4E-03	0.03
Selenium	0.12	1.0E-06	0.10	1.2E-08	70	4.5	8	0.685	4.2E-09	**1.4E-04**	3.0E-05	0.00
Zinc	24	1.0E-06	0.10	2.4E-06	70	4.5	8	0.685	8.5E-07	1.0E-02	8.5E-05	0.00
										HAZARD INDEX:	**1.1E-01**	

**For lead inhalation risks calculated acc. to DTSC guidance, see FA2_PB2.XLS Blood Lead Calculations.*

CDI EQUATIONS: INHALATION CDI = (SOIL EPC)*(UC)*(PM10)*(1/BW)*(IR*ED*EF)

For Carcinogens, EF (exposure fraction) = (250 days/365 days)*(1 year/70 years) = 0.010.

For Noncarcinogens, EF (exposure fraction) = (250 days/365 days) = 0.685.

Assumed PM10 concentration (0.1 mg/m^3) is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

FA2_PB2.XLS:

BLOOD LEAD LEVELS ESTIMATED FOR FUTURE USE CONSTRUCTION WORKER SCENARIO (AREA 2): REASONABLE MAXIMUM

H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL	RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.18 ug/m^3	ESTIMATED ADULT BLOOD LEAD LEVELS:	1.32	2.35	2.99	ug/dl
LEAD IN SOIL	10.1 ug/g	HAZARD INDICES:	0.13	0.24	0.30	
LEAD IN WATER	2.5 ug/l					
DUST IN AIR	0.1 mg/m^3					
SITE-GROWN PRODUCE?	0 (1 = Yes; 0 = No)					

EQUATIONS

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.002	=	0.0001 (ug/dl)/(ug/day) *	10.1 ug/g *	1.85 g soil/day (5 g/m^2 * 0.37 m^2)	0%
SOIL INGESTION:	0.005	=	0.018 (ug/dl)/(ug/day) *	10.1 ug/g *	0.025 g soil/day	0%
DUST INHALATION:	0.297	=	1.64 (ug/dl)/(ug/m^3) *	0.181 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	22%
WATER INGESTION:	0.140	=	0.04 (ug/dl)/(ug/day) *	2.50 ug/l *	1.4 liters water/day	11%
FOOD INGESTION:	0.880	=	0.04 (ug/dl)/(ug/day) *	10.00 ug Pb/kg diet *	2.20 kg diet/day	67%
TOTAL DIETARY LEAD		=	10.00 ug/kg			

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.

2] Assumed lead concentration, 10.1 ppm, is the 95% UCL of the mean lead concentration detected in Area 2 soils (3-25').

3] Assumed PM10 concentration, 0.1 mg/m^3, is the value measured at construction sites where dust control measures were not employed (Ebasco, 1986).

4] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see Section 3.2.1.2). Therefore , lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.

5] In the absence of site-specific data for ambient lead, a default value of 0.18 ug/m^3 is conservatively assumed per DTSC guidance.

ADDENDUM #5

Attachment #3

LATEST DTSC BLOOD LEAD GUIDANCE (JULY 1992)

Assessment of Health Risks From Inorganic Lead in Soil

Post-it™ brand fax transmittal memo 7671	# of pages ▸ 9
To Susan Kamp	From J. Carlisle
Co.	Co.
Dept.	Phone # 916 255 2049
Fax #	Fax #

1 INTRODUCTION

1.1 PURPOSE

The purpose of this guidance is to provide a methodology for evaluating exposure and the potential for adverse health effects resulting from exposure to lead in the environment.

1.2 APPLICATION

Since most human health effects data are based on blood lead (Pb) concentration, this guidance presents a blood Pb concentration of concern for the protection of human health, and an alogrithm for estimating blood Pb concentrations in children and adults based on a multi-pathway analysis.

1.3 LIMITATIONS

It is anticipated that this guidance will be periodically revised to reflect the changing state of the science.

2 PRINCIPLES

2.1 BLOOD LEAD CONCENTRATION OF CONCERN

The Pb concentration of concern in children and adults is ten micrograms (ug) per deciliter (dl) of whole blood. The point of departure for risk management is a 0.01 risk of exceeding this value.

2.2 LEAD EXPOSURE PATHWAYS--BLOOD LEAD CALCULATION

This method can be used to estimate blood lead concentrations resulting from exposure via the five pathways listed below. Each pathway is represented by an equation relating incremental blood lead increase to a concentration in a medium, using contact rates and empirically determined ratios. The contributions via the five pathways are added to arrive

at an estimate of median blood lead concentration resulting from the multipathway exposure. Ninetieth, ninety-fifth, ninety-eighth, and ninety-ninth percentile concentrations are estimated from the median by assuming a log-normal distribution with a geometric standard deviation (GSD) of 1.42. The method can be adapted to a computer spreadsheet.

3 METHODS

Generalized equations describing uptake via the five exposure pathways are as follows:

Dietary Intake Equation

$$Pb_b = \text{dietary Pb} * \text{contact rate} * \text{dietary constant}$$

where:

- dietary Pb (ug Pb/kg diet) = (9.45 + 0.025 * mg Pb/kg soil) [1]
- contact rate, adults = 2.2 kg diet/day[2]
- contact rate, children = 1.3 kg diet/day[2]
- dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
- dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Drinking Water Intake Equation

$$Pb_b = \text{water Pb} * \text{contact rate} * \text{dietary constant}$$

where:

- drinking water Pb (ug Pb/l water) is a site-specific, measured value[5]
- contact rate, adults = 1.4 l water/day[6]
- contact rate, children = 0.4 l water/day[6]
- dietary constant, children = 0.16 (ug Pb/dl blood)/(ug Pb/day)[3]
- dietary constant, adults = 0.04 (ug Pb/dl blood)/(ug Pb/day)[4]

Soil and Dust Ingestion Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

- soil Pb (ug/g) is a site-specific, measured value[15]
- contact rate, children = ~~0.000055 kg/day~~[7] 0.055 g/day
- contact rate, adults = ~~0.000025 kg/day~~[8] 0.025 g/day
- soil constant, children = 0.07 (ug Pb/dl blood)/(ug ingested Pb/day)[9]
- soil constant, adults = 0.018 (ug Pb/dl blood)/(ug ingested Pb/day)[9]

Inhalation Intake Equation

$$Pb_b = \text{atmospheric Pb} * \text{inhalation constant}$$

where:

atmospheric Pb = local or regional ambient Pb (ug/m^3) + (airborne dust * soil Pb)[10]
inhalation constant, children = 1.92 (ug/dl)/(ug/m^3)[11]
inhalation constant, adults = 1.64 (ug/dl)/(ug/m^3)[11]
airborne dust (g/m^3) is a site-specific, measured value with a default value of 0.00005.

Dermal Contact Intake Equation

$$Pb_b = \text{soil Pb} * \text{contact rate} * \text{soil constant}$$

where:

soil Pb (ug Pb/gm soil) is a site-specific, measured value
contact rate, children = 1.4 gm soil/day [12]
contact rate, adults = 1.85 gm soil/day [13]
soil constant = 0.0001 (ug Pb/dl blood)/(ug dermal Pb/day)[14]

---

1 Derived as follows: (0.945 * 10 ug/kg) + (0.055 * 0.00045 * soil Pb in mg/kg * 1000 ug/mg). Assumes that 5.5% of the diet consists of home-grown produce with the other 94.5% supplied by a homogeneous source with a lead content of 10 ug/kg. If food production on the site can be ruled out, use 10 ug/kg for dietary lead (EPA, 1989b, Bolger, et.al., 1990). Home-grown produce is assumed to contain 0.045% of the lead level in the soil.

2 Based on a report by Pennington (1983). For this method, a one-year-old child shall represent all children, based on the assumption that protecting the one-year-old child will protect all children.

3 Based on a study by Ryu, et.al. (1983)

4 Based on a report by FDA (1990)

5 Pb concentrations in local water supplies as consumed. If site-specific data are unavailable, a value of 15 ug/l may be used.

6 EPA (1989b)

7 Based on Calabrese (1990). Deliberate soil ingestion (soil pica) is represented as 0.00079 kg soil/day average.

8 For residential exposures and most occupational exposures, based on Calabrese (1990). Occupations with a high potential for soil ingestion (such as construction) should be represented as 0.00005 kg soil/day average.

9 These values are 44% of that for lead ingested with food or water, based on a study in rats which compared the bioavailability of lead acetate mixed with the diet to that of soil-bound lead (Chaney et.al., 1990).

10 The ambient air Pb concentration data are available from the California Air Resources Board, Technical Support Division. Data for the most recent year for the nearest monitoring station should be used. If monitoring data collected within the same air basin are unavailable, a value of 0.18 ug/m^3 may be used, or consult with the DTSC project manager. Respirable airborne dust is assumed to be 0.00005 g/m^3 unless site-specific data are available.

11 Based on EPA (1986)

12 Based on a soil adherence of 5 g/m^2 and 0.28 m^2 of exposed skin (EPA, 1989b).

13 Based on a soil adherence of 5 g/m^2 and 0.37 m^2 of exposed skin (EPA, 1989b).

14 This value is derived by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [11% (ATSDR, 1990)].

15 Developed according to Volume 3, Chapter 7 of this Guidance.

4 COMMENTS

4.1 BLOOD LEAD CONCENTRATION OF CONCERN

The traditional reference dose approach to toxic chemicals is not applied to Pb because most human health effects data are based on blood Pb concentrations rather than external dose. Blood Pb concentration is an integrated measure of internal dose, reflecting total exposure from site-related and background sources. A clear no-observed-effect concentration has not been established for such Pb-related endpoints as birth weight, gestation period, heme synthesis and neurobehavioral development in children and fetuses, and blood pressure in middle-aged men. Dose-response curves for these endpoints appear to extend down to 10 ug Pb/dl or less (ATSDR, 1990).

4.2 ESTIMATING BLOOD LEAD CONCENTRATIONS FROM ENVIRONMENTAL CONCENTRATIONS

Total Pb is generally used as the measure of Pb in various media, even though the disposition of Pb may differ according to its form. Insufficient data are available to justify differential treatment of different forms of inorganic Pb. However, if the lead at a particular site has been shown, in studies acceptable to DTSC, to be less bioavailable than the assumed values, lower bioavailability factors may be substituted for the default factors. Organic Pb is more readily absorbed through the skin and other membranes than inorganic Pb, and it must therefore be treated separately. Since it is less stable in the environment, it is usually a minor source of exposure.

In the absence of specific information about the population of interest, background exposures are estimated using norms developed from survey data.

4.3 DERIVATION OF MODEL PARAMETERS

Unless the potential for on-site gardening can be ruled out, it is assumed that 5.5% of the diet consists of home-grown produce, based on EPA guidance (USEPA, 1991). Pb concentration in home-grown produce is calculated as 0.045% of that in the soil, based on plant uptake studies (Chaney, et.al., 1982). Background dietary Pb concentration (10 ug/kg) is based on a 1990 report based on FDA data (Bolger, et.al., 1990). The default drinking water Pb concentration is based on the federal action concentration of 15 ug/l at the tap (USEPA, 1991b).

The distribution of blood Pb concentrations for a given set of environmental inputs is a critical factor in protecting sensitive members of the population. Based on a review of data from NHANES II and from several published studies of blood Pb concentrations in children living near point sources of lead, EPA concluded that blood

Pb was generally log-normally distributed, that the geometric standard deviation (GSD) for children was between 1.3 and 1.53, and that 1.42 was a representative value for the GSD (USEPA, 1989c). Adult GSDs ranged from 1.34 to 1.40, which we do not consider to be sufficiently different from the range for children to justify using a different value for adults. The model assumes a log-normal distribution with a GSD of 1.42 and uses this information to estimate the fiftieth, ninetieth, ninety-fifth, ninety-eighth, and ninety-ninth percentile blood Pb concentration for a set of inputs. Since this distribution reflects the physiologic and behavioral variables including soil consumption, using upper bound values for contact rates would distort the percentiles corresponding to blood Pb concentrations.

The availability of Pb ingested with soil is based on a study which compared the absorption of soil Pb and Pb acetate incorporated into the diet of rats (Chaney, et.al., 1990). While the authors found a direct relationship between the Pb concentration in the soil and Pb bioavailability, the data did not define the shape of the concentration/bioavailability curve sufficiently to allow extrapolation beyond the range studied. The highest observed bioavailability for soil lead concentrations less than 1000 ppm was 44% of that observed for Pb acetate, and this guideline adopts this value as a conservative estimate of bioavailability. To accurately assess the matrix effect, a variety of variables, including lead species, particle size, and soil type would have to be systematically examined at various Pb concentrations in soil.

The daily soil adherence to skin of 5 g/m^2 (0.5 mg/cm^2) is based on Driver et.al (1989). The dermal absorption factor of 0.0001 ug Pb/dl blood per ug dermal Pb/day was developed by multiplying the Pb ingestion:blood concentration ratio for adults (0.018 ug/dl per ug/day) by the ratio of dermal absorption [0.06% (Moore, et. al., 1980)] to oral absorption [(11% (ATSDR, 1990)]. Based on data in the Exposure Factors Handbook (USEPA, 1989b), the median skin area of arms, hands, feet, and legs of 1-year-old boys is estimated to be 0.28 m^2, and the median skin area of arms and hands of men is estimated to be 0.37 m^2.

The ratio of 0.16 ug/dl per ug/day ingested by children is a value derived from studies in infants by Ryu et.al. (1983). The ratio of 0.04 ug/dl per ug/day ingested by adults is an empirically-determined value recommended by EPA (1986) and FDA (1990). The default value for inadvertent soil/dust ingestion by children, 55 mg/day, is based on tracer studies reviewed by Calabrese, et.al. (1991). Adult soil consumption is 25 mg/day, based on EPA (1991a). DTSC uses soil consumption rates of 200 and 100 mg/day in calculating a reasonable maximum exposure for children and adults, respectively. However, reasonable maximum inputs are not recommended for use with the lead model because the model already considers the distribution of blood lead,

which reflects variation in soil ingestion along with other variables. Soil consumption representing pica is 0.79 g/day, based on estimates by Calabrese et.al. (1991).

The slopes of 1.92 and 1.64 ug/dl of blood per ug/m^3 of continuously-breathed air at atmospheric Pb concentrations <5 ug/m^3 are based on results of experimental exposures and epidemiological studies which adjusted for airborne lead contributions to pathways other than inhalation. These studies found slopes ranging from 1.52 to 2.46 ug/dl per ug/m^3 in children and 1.25 to 2.14 in adults (USEPA, 1986). The default airborne lead concentration is the highest monthly mean 24-hour value recorded in California in 1990.

4.4 USING THIS GUIDANCE

This guidance may be implemented using a computer spreadsheet, which may be obtained from DTSC. The spreadsheet is based on DTSC Guidance, Volume 4, Chapter 1, which should be consulted for more general aspects of spreadsheet application. For this spreadsheet, soil concentration in mg/kg (ppm w/w) is entered in cell E7. The spreadsheet uses it in each calculation that is affected by soil Pb. Atmospheric Pb is entered in cell E6. Drinking-water Pb is entered in cell E8. If omission of the site-grown produce pathway can be justified, a "0" is entered in cell E9. Airborne dust level is entered in cell E10. The remainder of the cells are protected and should not be altered without approval of DTSC. Any such changes will require sufficient justification and must be documented.

4.5 OTHER STANDARDS AND GUIDANCE

USEPA (1991c) considers lead to be a class B-2 carcinogen, with sufficient evidence in animals and inadequate evidence in humans. A carcinogenic potency has not been assigned. The federal MCL is 15 ug/l maximum at the tap with a maximum of 5 ug/l as a system-wide average (USEPA, 1991b). The Centers for Disease Control has stated that prevention activities should be directed at reducing children's blood Pb concentrations at least to below 10 ug/dl (CDC, 1991). The EPA has set 1.5 ug/m^3 as the Pb concentration limit for ambient air (quarterly average) (USEPA, 1978). California's standard is also 1.5 ug/m^3, but is based on a monthly average. The threshold limit value is 50 ug/m^3 for workplace air (ACGIH, 1989).

FDA (1990) considers the Lowest Observable Adverse Effect Level (LOAEL) to be 10 ug/dl in children and fetuses, and 30 ug/dl in adults. They use empirically-derived ratios of 0.16 and 0.04 ug/dl per ug/day ingested to predict concentrations in young children and adults, respectively. Applying an uncertainty factor of ten results in provisional tolerable intake levels of 6 ug/day for children six or less, 15 ug/day for children over six, 25 ug/day for pregnant women, and 75 ug/day for men.

REFERENCES

ACGIH. 1989. American conference of Governmental Industrial Hygienists, Documentation of TLVs and BEIs.

ATSDR. 1990. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service; Toxicological Profile for Lead.

Bolger, P. M., S. G. Capar, and M. A. Adams. 1990. Reductions in Dietary Lead Exposure in the United States. Presented at the Symposium on the Bioavailability and Dietary Exposure of Lead, Sept 24-27, 1990.

Calabrese, E. J., E. S. Stanek, and C. E. Gilbert. 1991. A Preliminary Decision Framework for Deriving Soil Ingestion Rates. In: Hydrocarbon-Contaminated Soils and Groundwater, Volume 1, Kostecki and Calabrese, eds., Lewis, Chelsea, MI.

CDC. 1991. Centers for Disease Control, U.S. Public Health Service; Preventing Lead Poisoning in Young Children.

Chaney, R. L., H. W. Mielke, and S. B. Sterrett. 1990. Speciation, Mobility, and Bioavailability of Soil Lead; Environ. Geochem. and Health.

Chaney, R. L., S. B. Sterrett, and H. W. Mielke. 1982. The Potential for Heavy Metal Exposure from Urban Gardens and Soils; In: Proceedings of a Symposium on Heavy Metals in Urban Gardens, Agricultural Experiment Station, University of the District of Columbia, James M. Preer, ed.

DTSC. 1990. Default Risk Assessment Formulas for Determination of Soil Remediation Levels, California Environmental Protection Agency. Department of Toxic Substances Control. Draft.

Driver, J. H., J. J. Konz, and G. K. Whitmyre. 1989. Soil adherence to human skin. Bull. Environ. Contam. Toxicol. 43: 814-820.

FDA. 1990. Contaminants Team, Division of Toxicological Review and Evaluation, Food and Drug Administration, Public Health Service, U.S. Department of Health and Human services; Memorandum to Elizabeth Campbell, Division of Regulatory Guidance.

Moore, M. R., P. A. Meridith, W. S. Watson, D. J. Summer, M. K. Taylor, and A. Goldberg. 1980. The percutaneous absorption of lead-203 in humans from cosmetic preparations containing lead acetate, as assessed by whole-body counting and other techniques. Food Cosmet. Toxicol. 18: 636.

Pennington, J. A. T. 1983. Revision of the total diet study food list and diets. J. Am. Dietetic Association, 82: 166.

Ryu, J. E., E. E. Ziegler, S. E. Nelson, and S. J. Fomon. 1983. Dietary intake of lead and blood lead concentration in early infancy. Am. J. Dis. Early Child. 137: 886.

USEPA. 1978. U.S. Environmental Protection Agency; National Primary and Secondary Ambient Air Quality Standards for Lead. Fed. Regist. 43(194): 46246-46261.

USEPA. 1986. Environmental Criteria And Assessment Office, U.S. Environmental Protection Agency. Air Quality Criteria for Lead, EPA 600/8-83-028, June 1986.

USEPA. 1989a. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund, Volume 1; EPA 540/1-89-002 December, 1989.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Health and Environmental Assessment. Exposure Factors Handbook. EPA/600/8-89/043

USEPA. 1989c. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Review of the National Ambient Air Quality Standards for Lead, EPA 450/2-89-011 June 1989.

USEPA. 1991a. Office of Solid Waste and Emergency Response U.S. Environmental Protection Agency. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors; OSWER Directive 9285.6-03.

USEPA. 1991b. U.S. Environmental Protection Agency. National Primary Drinking Water Quality Standards for Lead and Copper. Fed. Regist. 56(110): June 7, 1991, p. 26460.

USEPA. 1991c. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Health Effects Assessment Summary Tables, NTIS No. PB91-921199, January 1991.

ADDENDUM #5

Attachment #4

TOXICITY PROFILES FOR ALUMINUM, COBALT, MOLYBDENUM, SILVER AND VANADIUM
(Source: Klaasen, C.D., M.O. Amdurer and J. Doull. 1986. Casarett and Doull's Toxicology)

tis; 4 to 9 percent of persons with contact dermatitis react positively to nickel patch tests. Sensitization might occur from any of the numerous metal products in common use, such as coins and jewelry. The notion that increased ingestion of nickel-containing food increases the probability of external sensitization to nickel is supported by finding increased urinary nickel excretion in association with episodes of acute nickel dermatitis (Menne and Thorboe, 1976).

Indicators of Nickel Toxicity. Blood nickel levels immediately following exposure to nickel carbonyl provide a guideline as to severity of exposure and indication for chelation therapy (Sunderman, 1981a). Sodium diethyldithiocarbamate is the preferred drug, but other chelating agents, such as *d*-penicillamine and triethylenetetraamine, provide some degree of protection from clinical effects.

ESSENTIAL METALS WITH POTENTIAL FOR TOXICITY

This group includes seven metals generally accepted as essential: cobalt, copper, iron, manganese, molybdenum, selenium, and zinc. Each of the seven essential metals has three levels of biologic activity, trace levels required for optimium growth and development, homeostatic levels (storage levels), and toxic levels. For these metals, environmental accumulations are generally less important routes of excess exposure than accidents or occupation.

Although chromium and arsenic are regarded as essential to humans and animals, respectively, the toxicologic significance of chromium and arsenic warrant their being discussed as major toxic metals in the context of this chapter. Tin and vanadium are also essential to animals but are of less importance toxicologically and are included in the group of minor toxic metals.

Cobalt

Cobalt is essential as a component of vitamin B_{12} required for the production of red blood cells and prevention of pernicious anemia. There is 0.0434 μg of cobalt per microgram of vitamin B_{12}. If other requirements for cobalt exist, they are not well understood. Deficiency diseases of cattle and sheep, caused by insufficient natural levels of cobalt, are characterized by anemia and loss of weight or retarded growth.

Cobalt is a relatively rare metal produced primarily as a by-product of other metals, chiefly copper. It is used in high-temperature alloys and in permanent magnets. Its salts are useful in paint driers, as catalysts, and in the production of numerous pigments.

Cobalt salts are generally well absorbed after oral ingestion, probably in the jejunum. Despite this fact, increased levels tend not to cause significant accumulation. About 80 percent of the ingested cobalt is excreted in the urine. Of the remaining, about 15 percent is excreted in the feces by an enterohepatic pathway, while the milk and sweat are other secondary routes of excretion. The total body burden has been estimated as 1.1 mg.

The muscle contains the largest total fraction, but the fat has the highest concentration. The liver, heart, and hair have significantly higher concentrations than other organs, but the concentration in these organs is relatively low. The normal levels in human urine and blood are about 98 and 0.18 μg/liter, respectively. The blood level is largely in association with the red cells.

Significant species differences have been observed in the excretion of radiocobalt. In rats and cattle, 80 percent is eliminated in the feces (Schroeder *et al.*, 1967b).

Polycythemia is the characteristic response of most mammals, including humans, to ingestion of excessive amounts of cobalt. Toxicity resulting from overzealous therapeutic administration has been reported to produce vomiting, diarrhea, and a sensation of warmth. Intravenous administration leads to flushing of the face, increased blood pressure, slowed respiration, giddiness, tinnitus, and deafness due to nerve damage (Browning, 1969).

High levels of chronic oral administration may result in the production of goiter. Epidemiologic studies suggest that the incidence of goiter is higher in regions containing increased levels of cobalt in the water and soil (Wills, 1966). The goitrogenic effect has been elicited by the oral administration of 3 to 4 mg/kg to children in the course of sickle cell anemia therapy (Browning, 1969).

Cardiomyopathy has been caused by excessive intake of cobalt, particularly from the drinking of beer to which 1 ppm cobalt was added to enhance its foaming qualities. Why such a low concentration should produce this effect in the absence of any similar change when cobalt is used therapeutically is unknown. The signs and symptoms were those of congestive heart failure. Autopsy findings revealed a tenfold increase in the cardiac levels of cobalt. Alcohol may have served to potentiate the effect of the cobalt (Morin and Daniel, 1967).

Hyperglycemia due to β-cell pancreatic damage has been reported after injection into rats. Reduction of blood pressure has also been observed in rats after injection and has led to some experimental use in humans (Schroeder *et al.*, 1967b).

Occupational inhalation of cobalt salts in the cemented carbide industry may cause respiratory symptoms probably as a result of irritation of the pulmonary tract. Allergic dermatitis of an erythematous papular type may also occur, and affected persons may have positive skin tests.

Single and repeated subcutaneous or intramuscular injection of cobalt powder and salts to rats may cause sarcomas at the site of injection, but there is no evidence of carcinogenicity from any other route of exposure (Gilman, 1962).

Copper

Copper is widely distributed in nature and is an essential element. Copper deficiency is characterized by hypochromic, microcytic anemia resulting from defective hemoglobin synthesis. Oxidative enzymes, such as catalase, peroxidase, cytochrome oxides, and others, also require copper. Medicinally, copper sulfate is used as an emetic. It has also been used for its astringent and caustic action and as an anthelmintic. Copper sulfate mixed with lime has been used as a fungicide.

Gastrointestinal absorption of copper is normally regulated by body stores (Aspin and Sass-Kortsak, 1981; Sarkar *et al.*, 1983). It is transported in serum bound initially to albumin and later more firmly bound to α-ceruloplasmin where it is exchanged in the cupric form. The normal serum level of copper is 120 to 145 μg/liter. The bile is the normal excretory pathway and plays a primary role in copper homeostasis. Most copper is stored in liver and bone marrow where it may be bound to metallotheionein. The amount of copper in milk is not enough to maintain adequate copper levels in the liver, lung, and spleen of the newborn. Tissue levels gradually decline up to about ten years of age, remaining relatively constant thereafter. Brain levels, on the other hand, tend to almost double from infancy to adulthood. The ratios of newborn to adult liver copper levels show considerable species difference: human, 15:4; rat, 6:4, and rabbit, 1:6. Since urinary copper levels may be increased by soft water, under these conditions concentrations of approximately 60 μg/liter are not uncommon.

Copper is an essential part of several enzymes, including tyrosinase, involved in the formation of melanin pigments, cytochrome oxidase, superoxide dismutane, amine oxidases, and uricase. It is essential for the utilization of iron. Iron deficiency anemia in infancy is sometimes accompanied by copper deficiency as well. Molybdenum also influences tissue levels of copper.

There are two genetically inherited inborn errors of copper metabolism that are in a sense a form of copper toxicity (Sarkar *et al.*, 1983). Wilson's disease is characterized by excessive accumulation of copper in liver, brain, kidneys, and cornea. Serum ceruloplasmin is low, and serum copper, not bound to ceruloplasmin, is elevated. Urinary excretion of copper is high. The disorder is sometimes referred to as hepatolenticular degeneration in reference to the major symptoms. Clinical abnormalities of the nervous system, liver, kidneys, and cornea are related to copper accumulation. Although the etiology of this disorder is genetic, the basic defect at the biochemical level is not known. Increased binding of copper to an abnormal intracellular thionein or altered tissue excretion has been proposed. Cultured fibroblasts from persons with Wilson's disease have increased intracellular copper when cultured in Eagle's minimum essential medium with fetal bovine serum (Chan *et al.*, 1983). Clinical improvement can be achieved by chelation of copper with penicillamine (Walshe, 1964). Trien (triethylene tetramine, 2HCl) is also effective and has been used in patients with Wilson's disease who have toxic reactions to penicillamine (Walshe, 1983).

Menke's disease or Menke's "kinky-hair syndrome" is a sex-linked trait characterized by peculiar hair, failure to thrive, severe mental retardation, neurologic impairment, and death before three years of age. There is extensive degeneration of the cerebral cortex and of white matter. Again, the basic defect is not known. There are low levels of copper in liver and brain but high concentrations in other tissues. Even in cells with increased copper concentration there is a relative deficiency in activities of some copper-dependent enzymes. Some laboratories have reported that larger-than-normal quantities of copper-thionein accumulated in fibroblasts so that the basic defect may be in regulation of metallothionein synthesis. The finding of increased amounts of other metallothionein binding metals (zinc, cadmium, mercury) in kidneys of patients with this disease supports this hypothesis (Riordan, 1983).

Acute poisoning resulting from ingestion of excessive amounts of oral copper salts, most frequently copper sulfate, may produce death. The symptoms are vomiting, sometimes with a blue-green color observed in the vomitus, hematemesis, hypotension, melena, coma, and jaundice. Autopsy findings have revealed centrilobular hepatic necrosis (Chuttani *et al.*, 1965). Few cases of copper intoxication as a result of burn treatment with copper compounds have resulted in hemolytic anemia. Copper poisoning producing hemolytic anemia has also been reported as the result of using copper-containing dialysis equipment (Manzler and Schreiner, 1970).

son's disease, has been more consistently effective in the treatment of chronic manganese poisoning than in Parkinson's disease (Cotzias *et al.*, 1971).

The syndrome of chronic nervous system effects has not been successfully duplicated in any experimental animals except monkeys and then only by inhalation or intraperitoneal injection. After intraperitoneal administration of manganese to squirrel monkeys, dopamine and serotonin levels markedly decreased in the caudate nucleus regardless of whether or not behavioral effects were present. Manganese levels were increased in the basal ganglia and cerebellum. Histopathologic examination of animals did not reveal any morphologic changes (Neff *et al.*, 1969). Exposure of rats to manganese dioxide for 100 days does increase the brain manganese concentration but does not produce any hematologic, behavioral, or histologic effects.

Molybdenum

Molybdenum is an essential metal as a cofactor for the enzymes xanthine oxidase and aldehyde oxidase. In plants it is necessary for fixing of atmospheric nitrogen by bacteria at the start of protein synthesis. Because of these functions it is ubiquitous in food. Since plankton tend to concentrate molybdenum 25 times that of seawater, shellfish tend to have high concentrations of molybdenum. Molybdenum is added in trace amounts to fertilizers to stimulate plant growth. The average daily human intake in food is approximately 350 μg. The concentration of molybdenum in urban air is minimal, but it is present in more than one-third of fresh-water supplies (Table 19–1) and in certain areas the concentration may be near 1 μg/liter. Excess exposure can result in toxicity to animals and humans (Underwood, 1977; Winston, 1981).

The most important mineral source of molybdenum is molybdenite (MoS_2). The United States is the major world producer of molybdenum. The industrial uses of this metal include the manufacture of high-temperature resistant steel alloys for use in gas turbines and jet aircraft engines, production of catalysts, lubricants, and dyes.

Disposition. While molybdenum exists in various valence forms, biologic differences with respect to valence are not clear. The soluble hexavalent compounds are well absorbed from the gastrointestinal tract into the liver. It is a component of xanthine oxidase, which has a role in purine metabolism and has been shown to be a component of aldehyde oxidase and sulfite oxidase. Increased molybdenum intake in experimental animals has been shown to increase tissue levels of xanthine oxidase. In humans, molybdenum is contained principally in the liver, kidney, fat, and blood. Of the approximate total of 9 mg in the body, most is concentrated in the liver, kidney, adrenal, and omentum. More than 50 percent of molybdenum in the liver is contained in a nonprotein cofactor bound to the mitochondrial outer membrane and can be transferred to an apoenzyme transforming it into an active enzyme molecule (Johnson *et al.*, 1977). The molybdenum level is relatively low in the newborn and increases until age 20, declining in concentration thereafter. More than half of the molybdenum excreted is in the urine. The blood level, at least in sheep, is in association with the red blood cells. However, molybdenum has been detected in only about 25 percent of the blood samples of the human urban population. The excretion of molybdenum is rapid, mainly as molybdate. Excesses may be excreted also by the bile, particularly the hexavalent forms.

Inhalation of molybdenum by guinea pigs has resulted in increased bone levels. Injected radiomolybdenum increased liver and kidney levels, but the endocrine glands were also exceptionally high in content.

Toxicity. Pastures containing 20 to 100 ppm molybdenum may produce a disease referred to as "teart" in cattle and sheep. It is characterized by anemia, poor growth rate, and diarrhea. Copper or sulfate in the diet prevents the disease, and removal of the animals from pastures containing high levels of molybdenum facilitates their rapid recovery. Prolonged exposure has led to deformities of the joints. Experimental studies have revealed differences in toxicity of molybdenum salts. Molybdenum sulfide was well tolerated in rats at 500 mg/kg/day and was not injurious to guinea pigs at 28 mg/m^3. Hexavalent compounds were more toxic. In rats molybdenum trioxide at a dose of 100 mg/kg/day, by inhalation, was irritating to the eyes and mucous membranes and subsequently lethal. After repeated oral administration at sufficient levels, fatty degeneration of the liver and kidney was induced. In comparison with chromium and tungsten salts, sodium molybdate by intraperitoneal injection was less toxic in mice.

Interesting relationships of molybdenum with other metals with respect to toxicity in cattle and sheep have been documented. For example, copper prevents the accumulation of molybdenum in the liver and may antagonize the absorption of molybdenum from food. It is reported that by alternating the intake of copper and molybdenum at weekly intervals, black sheep can be made to grow striped wool. White wool in black sheep is a sign of copper deficiency. The

antagonism of copper is dependent on sulfate in the diet. It has been suggested that sulfate may displace molybdate in the body. It may be that the anemia caused by molybdenum is due to the reduction of sulfide oxidase in the liver, resulting in the formation of copper sulfide, thereby inducing a functional copper deficiency. Feeding of tungstate has also been shown to displace molybdate. In addition, it has been reported that molybdenum may promote fluoride retention and thereby decrease dental caries (see Underwood), but the incidences of caries in children living in high molybdenum areas compared to children living in normal or low molybdenum areas do not differ (Curzan *et al.*, 1970).

Selenium

The availability as well as the toxic potential for selenium and selenium compounds is related to chemical form and, most important, to solubility. Selenium occurs in nature and biologic systems as selenate (Se^{6+}), selenite (Se^{4+}), elemental selenium (Se^{0}), and selenide (Se^{2-}), and deficiency leads to a cardiomyopathy in mammals including humans (Underwood, 1977; Wilber, 1983).

Selenium in foodstuffs provides a daily source of selenium (NAS, 1975). Seafoods, especially shrimp, meat, milk products, and grains provide the largest amounts in the diet. River water levels of selenium vary depending on environmental and geologic factors; 0.02 ppm has been reported as a representative estimate. Selenium has also been detected in urban air, presumably from sulfur-containing materials.

Disposition. Selenates are relatively soluble compounds, similar to sulfates, and are readily taken up by biologic systems, whereas selenites and elemental selenium are virtually insoluble. Because of their insolubility, these forms may be regarded as a form of inert selenium sink. Selenides of heavy metals are also very insoluble compounds, in fact, so insoluble that the *in vivo* formation of mercury selenide by dietary administration of selenite has been proposed as a method for detoxication of methyl mercury. Other metallic selenides such as arsenic, cadmium, and copper also have low solubility affecting absorption, retention, and distribution within the body of selenium and heavy metal. Elemental selenium is probably not absorbed from the gastrointestinal tract. Absorption of selenite is from the duodenum. Monogastric animals have a higher intestinal absorption than ruminants, probably because selenite is reduced to an insoluble form in rumen. Over 90 percent of milligram doses of sodium selenite may be absorbed by man and widely distributed in organs, with highest accumulation initially in liver and kidney, but appreciable levels remain in blood, brain, myocardium, and skeletal muscle and testis. Selenium is transferred through the placenta to the fetus and it also appears in milk. Levels in milk are dependent on dietary intake. Selenium in red cells is associated with glutathione peroxidase and is about three times more concentrated than in plasma (Burk, 1976).

Selenium compounds may be biotransformed in the body by incorporation into amino acids or proteins or by methylation (Diplock, 1976). Selenium amino acids, Se-cysteine, and Se-methionine are formed in plants and absorbed as free amino acid or from digested protein. Se-methionine can be directly incorporated into proteins in place of methionine (McConnell and Hoffman, 1972). It is also suggested that selenite may be converted to Se-cysteine and incorporated into protein. Dimethyl selenium is an intermediate in the formation of a urinary metabolite, trimethyl selenium. It may be exhaled during acute selenium toxicity when its formation exceeds the rate of further methylation and urinary excretion (Palmer *et al.*, 1969).

The excretion pattern of a single exposure to selenite appears to have at least two phases: a rapid initial phase with as much as 15 to 40 percent of the absorbed dose excreted in the urine the first week. There is exponential excretion of the remainder of the dose with a half-life of 103 days. The half-life of Semethionine is 234 days. In the steady state, urine contains about twice as much as feces and increased urinary levels provide a measure of exposure. Urinary selenium is usually less than 100 μg/liter.

Excretory products appear in sweat and expired air. The latter may have a garlicky odor due to dimethyl selenide. Within certain physiologic limits, the body appears to have a homeostatic mechanism for retaining trace amounts of selenium and excreting the excess material. Selenium toxicity occurs when the intake exceeds the excretory capacity (McConnell and Portman, 1952; Schroeder and Mitchner, 1972).

Essentiality. A biologic role for selenium is attributed to its incorporation in Se-cysteine at each of the four catalytic sites of the enzyme glutathione peroxidase. This enzyme uses glutathione to reduce organic hydroperoxides and protects membrane lipids and possibly proteins and nucleic acids against oxidant damage (Sunde and Hoekstra, 1980). Selenium is also a component of heme oxidase. The antioxidant activity of selenium-containing enzymes suggests a close relationship to vitamin E, but it may have a more subtle effect not yet defined in that selenium is beneficial to animals adequately supplied with vitamin E.

Selenium-deficient diets cause liver necrosis

carbon moxoxide diffusing capacity that persisted 72 hours after exposure. These functional changes were correlated with microscopic evidence of interstitial thickening and cellular infiltrate in alveolar ducts and alveoli (Lam *et al.*, 1985).

Testicular tumors have been produced by direct intratesticular injection in rats and chickens. This effect is probably related to the concentration of zinc normally in the gonads and may be hormonally dependent. Zinc salts have not produced carcinogenic effects when administered to animals by other routes (Furst, 1981).

METALS WITH TOXICITY RELATED TO MEDICAL THERAPY

Metals considered in this group include aluminum, bismuth, gold, lithium, and platinum. Metals at one time were used to treat a number of human ills, particularly heavy metals like mercury and arsenic. Gold salts are still useful for the treatment of forms of rheumatism, and organic bismuth compounds are used to treat gastrointestinal disturbances. Lithium has become an important aid in the treatment of depression. The toxicologic hazards from aluminum are not from its use as an antacid but rather the accumulations that occur in bone and other tissues in patients with chronic renal failure receiving hemodialysis therapy. Platinum is receiving attention as an antitumor agent. Barium and gallium are used as a radiopaque and radiotracer material, respectively, so they do have importance in medical therapy. Toxicologic effects are unlikely and seldom occur.

Aluminum

Aluminum is one of the most abundant metals in the earth's crust, and it is ubiquitous in air and water, as well as soil.

The toxicity of aluminum may be divided into three major categories: (1) the effect of aluminum compounds on the gastrointestinal tract; (2) the effect of inhalation of aluminum compounds; and (3) systemic toxicity of aluminum (Alfrey, 1981).

Aluminum compounds can affect absorption of other elements in the gastrointestinal tract and alter intestinal function. Aluminum inhibits fluoride absorption and may decrease the absorption of calcium and iron compounds (Spencer *et al.*, 1969, 1977) and possibly the absorption of cholesterol by forming an aluminum-pectin complex that binds fats to nondigestible vegetable fibers (Nagyvary and Bradbury, 1977). The binding of phosphorus in the intestinal tract can lead to phosphate depletion and osteomalacia (Lotz, 1968). Aluminum may alter gastrointestinal tract motility by inhibition of acetylcholine-induced contractions and may be the explanation of why aluminum-containing antacids often produce constipation.

Pulmonary effects of aluminum occur following inhalation of bauxite (Al_2O_3–$3H_2O$) fumes. The resultant pulmonary fibrosis produces both restrictive and obstructive pulmonary disease (Schaver, 1948). Interestingly, inhalation of aluminum mists was used in the 1930s to serve as prophylaxis of pulmonary fibrosis due to inhalation of silica particles. It is suggested that aluminum and silicic acid compete for a common reactive site in the oxidative phosphorylation pathway (Engelbrecht and Jordaan, 1972).

There has been increasing interest in the possible relationship of aluminum to dementia in humans (Wills and Savory, 1983). Intracerebral injection of aluminum phosphate or injection of aluminum powder in cerebrospinal fluid of animals has been noted to induce a progressive encephalopathy and neurofibrillary degeneration histologically comparable to the changes found in persons with senile and presenile dementia of the Alzheimer type (Deboni *et al.*, 1976). However, some morphologic differences have been noted at the ultrastructural level, and why specific individuals are affected by such a ubiquitous metal is an unresolved question.

A progressive fatal neurologic syndrome has also been reported in patients on long-term intermittent hemodialysis treatment for chronic renal failure (Alfrey *et al.*, 1972). The first symptom in these patients is a speech disorder followed by dementia, convulsions, and myoclonus. The disorder, which typically arises after three to seven years of dialysis treatment, may be due to aluminum intoxication. Aluminum content of brain, muscle, and bone tissues is increased in these patients. Crapper (1976) has shown that brain tissue of mammals normally contains 1 to 2 μg of aluminum per gram dry weight and that the toxic range is 4 to 8 μg/g dry weight of brain for the cat and rabbit.

Sources of the excess aluminum may be from oral aluminum hydroxide commonly given to these patients or from aluminum in dialysis fluid derived from tap water used to prepare the dialysate fluid. High serum and aluminum concentrations are generally present in these patients, and it is postulated that increased absorption may be related to increased parathyroid hormone due to low blood calcium and osteodystrophy common in patients with chronic renal disease. The syndrome may be prevented by avoidance of the use of aluminum-containing oral phosphate binders and monitoring of aluminum in the dialysate. Chelation of aluminum may be achieved with use of desferrioxamine,

and progression of the dementia may be arrested or slowed (Crapper-McLachlan, 1983).

Bismuth

Bismuth has a long history of use in pharmaceuticals in Europe and North America. Both inorganic and organic salts have been used, depending on the specific application. There are three major categories of uses: antisyphylitic agents, topical creams, and antacids. Trivalent insoluble bismuth salts are used medicinally to control diarrhea and other types of gastorintestinal distress. Various bismuth salts have been used externally for their astringent and slight antiseptic property. Bismuth salts have also been used as radiocontrast agents. Further potential for exposure comes from the use of insoluble bismuth salts in cosmetics. Injections of soluble and insoluble salts, suspended in oil to maintain adequate blood levels, have been used to treat syphilis. Bismuth sodium thioglycollamate, a water-soluble salt, was injected intramuscularly for malaria *(Plasmodium vivax)*. Bismuth glycolyarsanilate is one of the few pentavalent salts that have been used medicinally. This material was formerly used for treatment of amebiasis (Fowler and Vouk, 1977). Exposure to various bismuth salts for medicinal use has decreased with the advent of newer therapeutic agents. However, in the 1970s reports appeared from France and Australia of unique encephalopathy occurring in colostomy and ileostomy patients using bismuth subgallate, bismuth subnitrate, and tripotassium-dicitrate-bismuthate for control of fecal odor and consistency. The symptoms included progressive mental confusion, irregular myoclonic jerks, a distinctive pattern of disordered gait, and a variable degree of dysarthria. The disorder was fatal to patients who continued use of the bismuth compounds, but full recovery was rapid in those in whom therapy was discontinued. The severity of the disorder seemed to be independent of dose and duration of therapy (Thomas *et al.*, 1977).

Most bismuth compounds are insoluble and poorly absorbed from the gastrointestinal tracts, or when applied to the skin, even if the skin is abraded or burned. Symptomatic patients taking bismuth subgallate had an elevated median blood bismuth level of 14.6 μg Bi/dl, patients without clinical symptoms had a median blood level of 3 μg/dl, and colostomy patients not on bismuth therapy had a median bismuth blood level of 0.8 μg/dl. Health laboratory workers had a median bismuth blood level of 1.0 μg/dl. Binding in blood is thought to be largely to a plasma protein with a molecular weight greater than 50,000 daltons.

A diffusible equilibrium between tissues, blood, and urine is established. Tissue distribution, omitting injection depots, reveals the kidney as the site of the highest concentration. The liver concentration is considerably lower at therapeutic levels, but with massive doses in experimental animals (dogs), the kidney/liver ratio is decreased. Passage of bismuth into the amniotic fluid and into the fetus has been demonstrated. The urine is the major route of excretion. Traces of bismuth can be found in milk and saliva. The total elimination of bismuth after injection is slow and dependent on mobilization from the injection site.

Acute renal failure can occur following oral administration of such compounds as bismuth sodium triglycollamate or thioglycollate particularly in children (Urizar and Vernier, 1966). The tubular epithelium is the primary site of toxicity producing degeneration of renal tubular cells and nuclear inclusion bodies composed of a bismuth-protein complex analogous to those found in lead toxicity (Beaver and Burr, 1963; Fowler and Goyer, 1975).

The symptoms of chronic toxicity in humans consist of decreased appetite, weakness, rheumatic pain, diarrhea, fever, metal line on the gums, foul breath, gingivitis, and dermatitis. Jaundice and conjuctival hemorrhage are rare, but have been reported. Bismuth nephropathy with proteinuria may occur.

Chelation therapy using dimercaprol (BAL) is said to be helpful in removal of bismuth from children with acute toxicity (Arena, 1974).

Gallium

Gallium is of interest because of the use of radiogallium as a diagnostic tool for localization of bone lesions. It is obtained as a by-product of copper, zinc, lead, and aluminum refining and is used in high-temperature thermometers, as a substitute for mercury in arc lamps, as a component of metal alloys, and as a seal for vacuum equipment. It is only sparsely absorbed from the gastrointestinal tract, but concentrations of less than 1 ppm can be localized radiographically in bone lesions. Higher doses will visualize liver, spleen, and kidney as well.

Gallium is not readily absorbed by the oral route, but occurs in bone at concentrations less than 1 ppm. Increasing intake produces slight increases in gallium levels in the liver, spleen, kidney, and bone. The urine is the major route of excretion.

There are no reported adverse effects of gallium following industrial exposure. Therapeutic use of radiogallium produced some adverse effects, mild dermatitis, and gastrointestinal disturbances. Bone marrow depression has been

is reported that particles of magnesium in the subcutaneous tissue produce lesions that resist healing. In animals, magnesium subcutaneously or intramuscularly administered produces gas gangrene as a result of interaction with the body fluids and subsequent generation of hydrogen and magnesium hydroxide. The tissue lesion is reversible.

Conjunctivitis, nasal catarrh, and coughing up of discolored sputum results from industrial inhalation exposure. With industrial exposures, increases of serum magnesium up to twice the normal levels failed to produce ill effects but were accompanied by calcium increases. Intoxication occurring after oral administration of magnesium salts is rare, but may be present in the face of renal impairment. The symptoms include a sharp drop in blood pressure and respiratory paralysis due to central nervous system depression (Browning, 1969).

Silver

The principal industrial use of silver is as silver halide in the manufacture of photographic plates. Other uses are for jewelry, coins, and eating utensils. Silver nitrate is used for making indelible inks and for medicinal purposes. The use of silver nitrate for prophylaxis of ophthalmia neonatorum is a legal requirement in some states. Other medicinal uses of silver salts are as a caustic, germicide, antiseptic, and astringent.

Silver does not occur regularly in animal or human tissue. The major effect of excessive absorption of silver is local or generalized impregnation of the tissues where it remains as silver sulfide, which forms an insoluble complex in elastic fibers resulting in argyria. Silver can be absorbed from the lungs and gastrointestinal tract. Complexes with serum albumin accumulate in the liver from which a fractional amount is excreted. Intravenous injection produces accumulation in the spleen, liver, bone marrow, lungs, muscle, and skin. The major route of excretion is via the gastrointestinal tract. Urinary excretion has not been reported to occur even after intravenous injection.

Industrial argyria, a chronic occupational disease, has two forms, local and generalized. The local form involves the formation of gray-blue patches on the skin or may manifest itself in the conjunctiva of the eye. In generalized argyria, the skin shows widespread pigmentation, often spreading from the face to most uncovered parts of the body. In some cases the skin may become black with a metallic luster. The eyes may be affected to such a point that the lens and vision are disturbed. The respiratory tract may also be affected in severe cases.

Large oral doses of silver nitrate cause severe gastrointestinal irritation due to its caustic action. Lesions of the kidneys and lungs and the possibility of arteriosclerosis have been attributed to both industrial and medicinal exposures. Large doses of colloidal silver administered intravenously to experimental animals produced death due to pulmonary edema and congestion. Hemolysis and resulting bone marrow hyperplasia have been reported. Chronic bronchitis has also been reported to result from medicinal use of colloidal silver (Browing, 1969; Luckey *et al.*, 1975).

Tellurium

Tellurium is found in various sulfide ores along with selenium and is produced as a byproduct of metal refineries. Its industrial uses include applications in the refining of copper and in the manufacture of rubber. Tellurium vapor is used in "daylight" lamps. It is used in various alloys as a catalyst and as a semiconductor.

Condiments, dairy products, nuts, and fish have high concentrations of tellurium. Food packaging contains some tellurium; higher concentrations are found in aluminum cans than tin cans. Some plants, such as garlic, accumulate tellurium from the soil. Potassium tellurate has been used to reduce sweating.

The average body burden in humans is about 600 mg; the majority is in bone. The kidney is the highest in content among the soft tissues. Some data suggest that tellurium also accumulates in liver (Schroeder *et al.*, 1967a). Soluble tetravalent tellurities, absorbed into the body after oral administration, are reduced to tellurides, partly methylated, and then exhaled as dimethyl telluride. The latter is responsible for the garlic odor in persons exposed to tellurium compounds. Tellurium in the food is probably in the form of tellurates. The urine and bile are the principal routes of excretion. Sweat and milk are secondary routes of excretion.

Tellurates and tellurium are of low toxicity, but tellurites are generally more toxic. Acute inhalation exposure results in decreased sweating, nausea, a metallic taste, and sleeplessness. The typical garlic breath is a reasonable indicator of exposure to tellurium by the dermal inhalation, or oral route. Serious cases of tellurium intoxication from industrial exposure have not been reported. In rats, chronic exposure to high doses of tellurium dioxide has produced decreased growth and necrosis of the liver and kidney (Cerwenka and Cooper, 1961; Browning, 1969).

Sodium tellurite at 2 ppm in drinking water or potassium tellurate at 2 ppm of tellurium plus 0.16 μg/g in the diet of mice for their lifetime produced no effects in the tellurate group. The

of titanium between two cyclopentadiene molecules. Titanium dioxide was found not to be carcinogenic in a bioassay study in rats and mice (NCI, 1979).

Uranium

The chief raw material of uranium is pitchblende or carnotite ore. This element is largely limited to use as a nuclear fuel.

The uranyl ion is rapidly absorbed from the gastrointestinal tract. About 60 percent is carried as a soluble bicarbonate complex, while the remainder is bound to plasma protein. Sixty percent is excreted in the urine within 24 hours. About 25 percent may be fixed in the bone (Chen *et al.*, 1961). Following inhalation of the insoluble salts, retention by the lungs is prolonged. Uranium tetrafluoride and uranyl fluoride can produce a typical toxicity because of hydrolysis to HF. Skin contact (burned skin) with uranyl nitrate has resulted in nephritis.

The soluble uranium compound (uranyl ion) and those that solubilize in the body by the formation of bicarbonate complex produce systemic toxicity in the form of acute renal damage and renal failure, which may be fatal. However, if exposure is not severe enough, the renal tubular epithelium is regenerated and recovery occurs. Renal toxicity with the classic signs of impairment, including albuminuria, elevated blood urea nitrogen, and loss of weight, is brought about by filtration of the bicarbonate complex through the glomerulus, reabsorption by the proximal tubule, liberation of uranyl ion, and subsequent damage to the proximal tubular cells. Uranyl ion is most likely concentrated intracellularly in lysosomes (Voegtlin and Hodge, 1949–1951; Passow *et al.*, 1961; Ghadially *et al.*, 1982).

Inhalation of uranium dioxide dust by rats, dogs, and monkeys at a concentration of 5 mg U/m^3 for up to five years produced accumulation in the lungs and tracheobronchial lymph nodes that accounted for 90 percent of the body burden. No evidence of toxicity was observed despite the long duration of observation (Leach *et al.*, 1970).

Vanadium

Vanadium is a ubiquitous element. It is a byproduct of petroleum refining, and vanadium pentoxide is used as a catalyst in the various chemicals including sulfuric acid. It is used in the hardening of steel, in the manufacture of pigments, in photography, and in insecticides. It is common in many foods; significant amounts are found in milk, seafoods, cereals, and vegetables. Vanadium has a natural affinity for fats and oils; food oils have high concentrations. Municipal water supplies may contain on the average about 1 to 6 ppb. Urban air contains some vanadium, perhaps due to the use of petroleum products or from refineries (Table 19–1), about 30 mg. The largest single compartment is the fat. Bone and teeth stores contribute to the body burden. It has been postulated that some homeostatic mechanism maintains the normal levels of vanadium in the face of excessive intake, since the element, in most forms, is moderately absorbed. The principal route of excretion of vanadium is the urine. The normal serum level is 35 to 48 μg/100 ml. When excess amounts of vanadium are in the diet, the concentration in the red cells tends to increase. Parenteral administration increases levels in the liver and kidney, but these increased amounts may only be transient. The lung tissue may contain some vanadium, depending on the exposure by that route, but normally the other organs contain negligible amounts.

The toxic action of vanadium is largely confined to the respiratory tract. Bronchitis and bronchopneumonia are more frequent in workers exposed to vanadium compounds. In industrial exposures to vanadium pentoxide dust a greenish-black discoloration of the tongue is characteristic. Irritant activity with respect to skin and eyes has also been ascribed to industrial exposure. Gastrointestinal distress, nausea, vomiting, abdominal pain, cardiac palpitation, tremor, nervous depression, and kidney damage, too, have been linked with industrial vanadium exposure.

Ingestion of vanadium compounds (V_2O_5) for medicinal purposes produced gastrointestinal disturbances, slight abnormalities of clinical chemistry related to renal function, and nervous system effects. Acute vanadium poisoning in animals is characterized by marked effects on the nervous system, hemorrhage, paralysis, convulsions, and respiratory depression. Short-term inhalation exposure of experimental animals tend to confirm the effects on the lungs as well as the effect on the kidney. In addition, experimental investigations have suggested that the liver, adrenals, and bone marrow may be adversely affected by subacute exposure at high levels (Waters, 1977).

REFERENCES

Adams, R. G.; Harrison, J. G.; and Scott, P.: The development of cadmium-induced proteinuria, impaired renal function and osteomalacia in alkaline battery workers. *J. Med.*, 38:425–43. 1969.

Ainsworth, S. K.; Swain, R. P.; Watabe, N.; Brackett, N. C.; Pilia, P.; and Hennigar, G. R.: Gold nephropathy, ultrastructural fluorescent, and energy-dispersive

ADDENDUM #6

CURRENT RESIDENTIAL USE SCENARIO: REASONABLE MAXIMUM EXPOSURE (RME) RISKS AT THE LOCATION OF THE MAXIMALLY EXPOSED INDIVIDUAL (MEI)

ADDENDUM #6
Reasonable Maximum Exposure (RME) Risks for
Potential Current-Use Offsite Residential Receptors

Methods and Objectives

In response to OEHHA requests, this assessment of off-site residential exposures was developed to estimate cancer and noncancer risks potentially resulting from the dispersal of resuspended slag pile soils at the H. Kramer site to off-site residential locations. The dispersion modeling and risk calculations were performed using the results of shallow subsurface concentrations of metals in the slag in combination with the methods and assumptions specified in the following two guidance documents:

- *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites* (Cowherd et. al. 1985. Office of Health and Environmental Assessment, Office of Research and Development, U.S. EPA Document No. EPA/600/8-85/002. February 1985).

- The California Air Pollution Control Officers Association (CAPCOA) document entitled *Air Toxics "Hot Spots" Program Risk Assessment Guidelines* (CAPCOA, 1992).

EPA risk assessment guidance was also drawn upon where relevant to the determination of reasonable maximum exposure (RME) intake factors (e.g., RAGS March 1991 Supplemental Guidance and the 1992 Dermal Assessment guidelines).

Assumed Target Receptors

This residential risk assessment is considered to be a worst-case analysis, focusing on the maximum exposed individual or MEI. The MEI thus represents the residential receptor for which maximum health impacts are calculated, irrespective of the likelihood of exposure. For example, the hypothetical receptors in this analysis are conservatively assumed to live one-half mile north of the site in a home with a garden. [The north direction was chosen because it corresponded to the highest (most conservative) dispersion scaling factors provided in Cowherd et. al. However, the nearest residence is likely to be no closer than one-half mile east of the site as shown in Figure 1 in the May 1992 RA.] Given the immediate surroundings of the site, such an approximation is conservative. The MEI approach also assumes that a single individual will be exposed to the constant dose of a (slag-derived) contaminant, at the same location, 24 hours a day, over a 30-year period (see below). For carcinogenic endpoints, the MEI is assumed to be an adult whereas for noncarcinogenic endpoints, the MEI is conservatively assumed to be a 6-year old (15 kg) child.

ADDENDUM #6
Reasonable Maximum Exposure (RME) Risks for
Potential Current-Use Offsite Residential Receptors

Exposure Pathways Evaluated
The primary means for residential exposure is assumed to be the inhalation pathway. However, the following additional pathways were also quantitatively evaluated using estimated ground level concentrations and deposition rates: soil ingestion; dermal contact with soils; and vegetable ingestion (direct deposition on leafy garden vegetables).

The assumptions used in the dispersion modeling and subsequent risk calculations are summarized in the worksheets provided in this addendum. These assumptions are very conservative, and include (but are not limited to) the following:

- The site is conservatively assumed to be "disturbed" (i.e., fresh surface material is exposed) fifteen times per month. Additionally, all (15) disturbances are assumed to occur concurrent with the annual fastest-mile event.

- No decay is assumed, thus long-term average COC concentrations and associated cancer risks are likely to be overestimated.

- The dispersion model assumes a source extent of 10,000 m^2, whereas the site is only approximately 7,600 m^2 (or 81,250 ft^2. [The only other option available in Cowherd's model was a 10m x 10m source.]

- The scaling factor (fI) used to estimate off-site respirable concentrations was the highest value cited in Cowherd's source tables. Use of this value assumes the wind is blowing toward the resident receptor all the time, which is conservative given that no residences are located north of the site within an approximate one-half mile radius.

- An exposure duration of 30 years (350 days/year, 24 hours/day) for carcinogenic endpoints (for adult receptors)

- An exposure duration of 350 days/year for 24 hours/day for noncarcinogenic endpoints (for 6-year old child receptors)

- Reasonable maximum assumptions for intake factors (e.g., soil ingestion rates, dermal contact rates, etc.)

Results

As shown in Table 1, this worst-case screening analysis indicates negligible impacts for both cancer and noncancer health effects. The total cancer risk calculated for the MEI adult receptor (summed over inhalation and non-inhalation pathways), 7.5×10^{-7}, is below the lower bound of EPA's 10^{-6} to 10^{-4} target risk range. The hazard index (HI) estimated for the MEI child receptor for noncarcinogenic endpoints, 0.28, is below EPA's target HI criterion of 1.0.

TABLE 1
REASONABLE MAXIMUM RISKS AT THE OFF-SITE RESIDENTIAL MEI LOCATION
H. KRAMER & COMPANY SITE

Risks Calculated February 1993 in Response to OEHHA Comments (see Addendum No. 3)

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	On-Site Soil EPC (mg/kg)	AIR EPC (mg/m^3)	Estimated Off-site Soil Conc. (Cs) (mg/kg)
Arsenic	17.33	1.1E-08	0.007
Beryllium	164.1	9.9E-08	0.071
Cadmium	19.84	1.2E-08	0.009

ESTIMATED WORST-CASE CANCER RISKS

	Vegetable Ingestion Cancer Risk	Soil Ingestion Cancer Risk	Dermal Contact Cancer Risk	Soil Inhalation Cancer Risk	TOTAL CANCER RISKS
	1.7E-09	7.7E-09	4.4E-10	1.5E-08	2.3E-08
	4.1E-08	2.9E-07	3.4E-07	8.2E-08	7.1E-07
	NA	NA	NA	2.1E-08	2.1E-08
Total Risks:	**4.3E-08**	**3.0E-07**	**3.4E-07**	**1.2E-07**	**7.5E-07**

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	On-site Soil EPC (mg/kg)	AIR EPC (mg/m^3)	Estimated Off-site Soil Conc. (Cs) (mg/kg)
Antimony	81.51	4.9E-08	0.035
Arsenic	17.33	1.1E-08	0.007
Barium	382.46	2.3E-07	0.165
Beryllium	164.1	9.9E-08	0.071
Cadmium	19.84	1.2E-08	0.009
Chromium (trivalent)	28.73	1.7E-08	0.012
Copper	34,413	2.1E-05	14.803
Lead	2,308	1.4E-06	0.993
Manganese	24,997	1.5E-05	10.75
Mercury	0.57	3.5E-10	0.000
Nickel	272.3	1.7E-07	0.117
Selenium	1.63	9.9E-10	0.001
Zinc	67,134	4.1E-05	28.88

ESTIMATED WORST-CASE HAZARD INDICES

	Veg. Ingestion CDI:RfD Ratio	Soil Ingestion CDI:RfD Ratio	Dermal Contact CDI:RfD Ratio	Soil Inhalation CDI:RfD Ratio	TOTAL CDI:RfD RATIOS
	3.4E-05	1.1E-03	2.7E-04	1.2E-04	1.5E-03
	1.5E-05	3.2E-04	3.8E-06	7.2E-05	4.1E-04
	9.2E-07	3.0E-05	7.2E-06	2.2E-03	2.3E-03
	5.5E-06	1.8E-04	4.3E-05	6.8E-02	6.8E-02
	3.7E-05	1.1E-04	5.2E-05	1.2E-05	2.1E-04
	4.7E-09	1.6E-07	3.8E-08	2.9E-02	2.9E-02
	1.6E-04	5.1E-03	NA	2.9E-02	3.4E-02
	NA	NA	NA	3.1E-03	3.1E-03
	4.2E-05	1.4E-03	6.9E-04	1.3E-01	1.3E-01
	5.2E-06	1.0E-05	2.5E-06	3.9E-06	2.2E-05
	2.3E-06	7.5E-05	1.8E-05	2.3E-03	2.4E-03
	5.5E-08	1.8E-06	4.3E-07	6.8E-06	9.0E-06
	5.6E-05	1.8E-03	4.4E-04	3.9E-03	6.2E-03
Total HIs:	**3.5E-04**	**1.0E-02**	**1.5E-03**	**2.7E-01**	**2.8E-01**

CHILD BLOOD LEAD LEVELS ESTIMATED USING DTSC GUIDANCE (July 1992 Interim Final)

	Mean (ug/dl)	95th Percentile (ug/dl)	99th Percentile (ug/dl)
ESTIMATED BLOOD LEAD LEVELS	2.14	3.80	4.83
HAZARD INDICES:	0.21	0.38	0.48

DTSC Blood Lead Level of Concern: 10 ug/dl

RES_TOT.XLS, 2/1/93

See Attached worksheets for detailed documentation re: methods and assumptions used.

ESTIMATION OF RESPIRABLE COC CONCENTRATIONS AT THE (MEI) OFF-SITE RESIDENTIAL LOCATION

H. KRAMER AND COMPANY SITE

MAJOR ASSUMPTIONS USED IN THE DISPERSION MODELING

1] The dispersion modeling was performed in accordance with guidelines presented in the document entitled *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites* (Cowherd et. al. 1985. Office of Health and Environmental Assessment, Office of Research and Development, U.S. EPA Document No. EPA/600/8-85/002. February 1985).

2] Subsequent dispersion modeling and risk calculations (e.g., the vegetable intake pathway) were performed in accordance with guidelines presented in the document entitled *Air Toxics "Hot Spots" Program: Risk Assessment Guidelines*, prepared by the AB 2588 Risk Assessment Committee of the California Air Pollution Control officers Association (CAPCOA), January 1992.

3] The site is assumed to have **limited** erosion potential. This assumption is based on the results of a sieve analysis performed on a sample collected on 12/24/92, and using the following criteria recommended in Cowherd et. al. (1985):

> "...if more than 60% of the soil passes a 1-mm sieve, the 'unlimited reservoir' model will apply;
> if not, the 'limited reservoir' model will apply."

The results of the sieve analysis indicated that less than 35% of the soil sample passed through the 1-mm sieve (see Figure 1 in Addendum #5), thus the limited erosion model applies.

4] The fraction of vegetative cover is assumed to be zero (0%).

5] Mechanical disturbance of the slag pile is not expected at the site. However, for this assessment, a rate of 15 times per month (15 mo^-1) is conservatively assumed. Additional conservatism stems from the assumption that all (15) disturbances would occur just prior to the annual fastest-mile event. [A disturbance is defined as an action which results in the exposure of fresh surface material. For example, this would occur whenever aggregate material is either added to or removed from the old surface, or as a result of the turning of surface material to a depth exceeding the size of the largest pieces of material present.]

6] No decay is assumed. Thus respirable COC concentrations at the residential MEI are likely to be overestimated, as are associated risks.

7] Assumed source extent is 7,558 m^2, given that the area of the slag pile is approximately 125' x 650' (or 81,250 ft^2). The entire area of the slag pile is assumed to be exposed.

8] For purposes of calculations, the nearest residence is assumed to be 750 m (north) of the site (see Notes 2 and 3 on pg. 3 of this worksheet). This assumption is somewhat conservative given that the nearest residential area is approximately 804 m (one-half mile) east of the site. Additionally, the scaling factor (fl) used to calculate respirable concentrations, 0.464 us/m^3, is the highest value cited in Appendix D of Cowherd's source tables. This value assumes the wind is blowing to the north, which is conservative given that no residences are located north of the site within a one-mile radius (see Figure 1 in the original risk assessment).

ESTIMATION OF RESPIRABLE COC CONCENTRATIONS AT THE (MEI) OFF-SITE RESIDENTIAL LOCATION

H. KRAMER AND COMPANY SITE

Equation 1: Calculation of Wind Erosion from Surfaces with Limited Erosion Potential

$$E10 = 0.83 \frac{f\,P(u+)\,(1-V)}{(PE/50)^2}$$

Source: Cowherd et. al. (1985), Equation 4-1 (page 29)

where:

E10 = PM10 emission rate per unit area of contaminated surface (mg/m^2-hr)

f = frequency of disturbance per month = 15 mo^-1; see Note 5 on page 1.

u+ = observed (or probable) fastest mile of wind for the period between disturbances (m/s) = 15.4 m/s.
This value is based on data for San Diego, the weather station closest to the Kramer site as listed in Table 4-1 of Cowherd et. al. 1985.

P(u+) = erosion potential, i.e., quantity of erodible particles present on the surface prior to the onset of wind erosion (g/m^2)
=6.7*(u+ - ut) = 6.7*(15.4-15.0) = **2.68 g/m^2**
where ut = the erosion threshold wind speed (in m/s), measured at a height of 7m, which was calculated assuming:
-- the mode of the aggregate particle size distribution is 2.8 mm (see sieve analysis results)
-- a threshold friction velocity (u*) of 100 cm/sec or 1 m/sec (see Figure 3-4 in Cowherd et. al.)
-- a roughness height (z0) of 2.0 cm (see Figures 3-6 and 4-1 in Cowherd et. al.)

V = fraction of contaminated surface area covered by continuous vegetative cover = 0 (assumes bare soil)

PE = Thornthwaite's Precipitation Evaporation Index used as a measure of average soil moisture content = 35
[See location of El Segundo in P-E Index in Figure 4-2 in Cowherd et. al.]

Result:

E10= [(0.83)*(15 mo^-1)*(2.68 g/m^2)*(1-0)] / (35/50)^2 g/m^2-mo
= 68.09 g/m^2-mo * (1000 mg/g)*(mo/30 days)*(day/24 hrs)

E10= 94.57 mg/m^2-hr

Equation 2: Determination of Emission Rates

$$R10 = a*E10*A$$

Source: Cowherd et. al. (1985), Equation 2-1 (page 38)

where:

R10 = emission rate of contaminant as PM10 (mg/hour)

a = mass fraction of contaminant in PM10 emissions
Assumed to be 25 ppm for this exercise; see RESAIR2.XLS for contaminant-specific calculations.

E10 = PM10 emission factor = 94.57 mg/m^2-hr, as calculated in Equation 1 above.

A = source extent = 7558.28 m^2 (based on an approximate slag pile area of 125' x 650', or 81,250 ft^2).

Result:

R10= (25 mg/kg) * (10^-6 kg/mg)* (94.57 mg/m^2-hr)*(7558.28 m^2)

R10= 17.87 mg/hour

ESTIMATION OF RESPIRABLE COC CONCENTRATIONS AT THE (MEI) OFF-SITE RESIDENTIAL LOCATION

H. KRAMER AND COMPANY SITE

DISPERSION MODELING: Annual Average Concentration Model

Assumptions:

-- Climatic Region 1 (see Figure 4-5 on page 42 of Cowherd et. al. 1985)

-- A 100m x 100m source size. Although this area is larger than that of the H. Kramer slag pile, this assumption apparently results in reasonable (albeit conservative in this case) approximations to the concentrations for other source sizes (see explanation on pg. 41 of Cowherd).

-- Wind erosion rate, R10 (calculated in Equation 2 above) = 17.87 **4.96E-06 g/s**

-- PR = the fraction of time in the model runs that wind erosion occurs = 0.152 (assuming Climatic Region 1; see page 4-6 of Cowherd).

QI = Wind erosion scaling factor = R10/PR

= 3.27E-05 g/s for Annual Average scenario.

Equation 3: Estimation of Annual Average Respirable Concentrations

x = QI*fI *Source: Cowherd et. al. (1985), Equation 4-11 (page 46). Also see Appendix D, pg. D-6 for source of fI estimates.*

where:

x = respirable concentration (ug/m^3)

QI = wind erosion scaling factor (calculated above)

fI = unscaled concentration (us/m^3) due to a unit erosion rate (from Appendix D, page D-6, of Cowherd)

NOTE: 1] The nearest residential area is Hawthorne, located approximately one-half mile (804.5 m) east of the H. Kramer site.

2] Given the nearest distance of 804.5 m, the coarse grid in Cowherd (p. D-6) was used as the source of fI values.
Note: The fine grid did not apply because this grid applied only to distances less than or equal to 500 m.

3] A grid distance of 750 m was conservatively assumed. For this distance, the maximum fI value is 0.464 us/m^3 (for the northerly direction). A value of 0.126 us/m^3 is cited for the easterly direction (which is most applicable to this scenario).
The maximum fI value of 0.464 us/m^3 is conservatively assumed in this analysis, even though the northerly direction would apply only a portion of the time.

Result: **x = (3.27E-05 g/s) * (0.464 us/m^3)**

x = 1.52E-05 ug/m^3

OR: x = 1.52E-08 mg/m^3

PM10 CONCENTRATION ESTIMATES FOR CALCULATION OF POTENTIAL OFF-SITE RME INHALATION RISKS

H. KRAMER AND COMPANY SITE

Receptor Location: Nearest residential area, which, for purposes of these calculations, is assumed to be 750 meters (< one-half mile) north of the site. The northerly direction corresponds to the highest (and thus most conservative) scaling factors documented in Cowherd.

Off-site Respirable Concentration (x): Based on 95% UCL shallow subsurface soil EPC concentrations (exposed soils only) and methodology and equations summarized in RESAIR1.XLS for the ANNUAL AVERAGE scenario.

Source File(s): *See RESAIR1.XLS.*

CARCINOGENS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	E10 mg/m^2-hr	A (m^2)	Conversion Factor (kg/mg)	R10 (mg/hr)	Conversion Factor g/s per mg/hr	R10 (g/s)	PR (unitless)	QI (g/s)	fI (us/m^3)	Respirable Concentration (x) (ug/m^3)	(x) (mg/m^3)
Arsenic	17.33	94.57	7558.28	1.00E-06	12.39	2.78E-07	3.44E-06	0.152	2.26E-05	0.464	1.05E-05	1.05E-08
Beryllium	164.07	94.57	7558.28	1.00E-06	117.28	2.78E-07	3.26E-05	0.152	2.14E-04	0.464	9.94E-05	9.94E-08
Cadmium	19.84	94.57	7558.28	1.00E-06	14.18	2.78E-07	3.94E-06	0.152	2.59E-05	0.464	1.20E-05	1.20E-08

NONCARCINOGENS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	E10 mg/m^2-hr	A (m^2)	Conversion Factor (kg/mg)	R10 (mg/hr)	Conversion Factor g/s per mg/hr	R10 (g/s)	PR (unitless)	QI (g/s)	fI (us/m^3)	Respirable Concentration (x) (ug/m^3)	(x) (mg/m^3)
Antimony	81.51	94.57	7558.28	1.00E-06	58.26	2.78E-07	1.62E-05	0.152	1.06E-04	0.464	4.94E-05	4.94E-08
Arsenic	17.33	94.57	7558.28	1.00E-06	12.39	2.78E-07	3.44E-06	0.152	2.26E-05	0.464	1.05E-05	1.05E-08
Barium	382.46	94.57	7558.28	1.00E-06	273.38	2.78E-07	7.59E-05	0.152	5.00E-04	0.464	2.32E-04	2.32E-07
Beryllium	164.07	94.57	7558.28	1.00E-06	117.28	2.78E-07	3.26E-05	0.152	2.14E-04	0.464	9.94E-05	9.94E-08
Cadmium	19.84	94.57	7558.28	1.00E-06	14.18	2.78E-07	3.94E-06	0.152	2.59E-05	0.464	1.20E-05	1.20E-08
Chromium (trivalent)	28.73	94.57	7558.28	1.00E-06	20.54	2.78E-07	5.70E-06	0.152	3.75E-05	0.464	1.74E-05	1.74E-08
Copper	34,413	94.57	7558.28	1.00E-06	24597.95	2.78E-07	6.83E-03	0.152	4.50E-02	0.464	2.09E-02	2.09E-05
Lead	2,308	94.57	7558.28	1.00E-06	1649.73	2.78E-07	4.58E-04	0.152	3.01E-03	0.464	1.40E-03	1.40E-06
Manganese	24,997	94.57	7558.28	1.00E-06	17867.52	2.78E-07	4.96E-03	0.152	3.27E-02	0.464	1.52E-02	1.52E-05
Mercury	0.57	94.57	7558.28	1.00E-06	0.41	2.78E-07	1.13E-07	0.152	7.45E-07	0.464	3.45E-07	3.45E-10
Nickel	272.27	94.57	7558.28	1.00E-06	194.61	2.78E-07	5.41E-05	0.152	3.56E-04	0.464	1.65E-04	1.65E-07
Selenium	1.63	94.57	7558.28	1.00E-06	1.17	2.78E-07	3.24E-07	0.152	2.13E-06	0.464	9.88E-07	9.88E-10
Zinc	67,134	94.57	7558.28	1.00E-06	47986.48	2.78E-07	1.33E-02	0.152	8.77E-02	0.464	4.07E-02	4.07E-05

Where:

E10 = PM10 emission rate per unit area of contaminated surface (mg/m^2-hr) for annual average scenario
A = source extent = 7558.28 m^2 (based on an approximate slag pile area of 125' x 650', or 81,250 ft^2)
R10 = emission rate of contaminant as PM10 (mg/hour or g/s)
PR = the fraction of time in the model runs that wind erosion occurs
QI = wind erosion scaling factor (calculated above)
fI = unscaled concentration (us/m^3) due to a unit erosion rate (from Appendix D, page D-6, of Cowherd)
x = respirable concentration (ug/m^3 or mg/m^3)

ESTIMATED RME INHALATION RISKS AT THE MEI OFF-SITE RESIDENTIAL RECEPTOR LOCATION

H. KRAMER AND COMPANY SITE

Receptor Population: --Assumed to be the nearest resident, which, given the assumptions defined in preceding worksheets, is assumed to be the maximally exposed individual, i.e.: **the MEI.**

--Adults are the assumed receptors for carcinogenic endpoints.

Alternatively, 6-year old children are assumed for noncarcinogenic endpoints given the shorter duration assumed (exposures over a lifetime are not relevant for noncarcs) and that children are most sensitive (with lower body weights, etc.)

Air EPC (PM10 Conc Based on assumed RME chemical-specific respirable (PM10) concentrations at the MEI location *(see assumptions, methods and calculations in RESAIR1.XLS and RESAIR2.XLS).*

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	17.33	1.1E-08	70	20.0	0.411	1.2E-09	1.20E+01	1.5E-08	12.6%
Beryllium	164.07	9.9E-08	70	20.0	0.411	1.2E-08	7.00E+00	8.2E-08	69.7%
Cadmium	19.84	1.2E-08	70	20.0	0.411	1.4E-09	1.5E+01	2.1E-08	17.7%
							TOTAL EXCESS CANCER RISK:	**1.2E-07**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	95% UCL Soil EPC (mg/kg)	AIR EPC (mg/m^3)	BW (kg)	IR (m^3/day)	EF (unitless)	Inhalation CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	81.51	4.9E-08	15	15.0	0.96	4.7E-08	4.0E-04	1.2E-04	0.0%
Arsenic	17.33	1.1E-08	15	15.0	0.96	1.0E-08	1.4E-04	7.2E-05	0.0%
Barium	382.46	2.3E-07	15	15.0	0.96	2.2E-07	1.0E-04	2.2E-03	0.8%
Beryllium	164.07	9.9E-08	15	15.0	0.96	9.5E-08	1.4E-06	6.8E-02	25.2%
Cadmium	19.84	1.2E-08	15	15.0	0.96	1.2E-08	1.0E-03	1.2E-05	0.0%
Chromium (trivalent)	28.73	1.7E-08	15	15.0	0.96	1.7E-08	5.7E-07	2.9E-02	10.8%
Copper	34,413	2.1E-05	15	15.0	0.96	2.0E-05	6.9E-04	2.9E-02	10.8%
Lead	2,308	1.4E-06	15	15.0	0.96	1.3E-06	4.3E-04	3.1E-03	1.2%
Manganese	24,997	1.5E-05	15	15.0	0.96	1.5E-05	1.1E-04	1.3E-01	48.8%
Mercury	0.57	3.5E-10	15	15.0	0.96	3.3E-10	8.6E-05	3.9E-06	0.0%
Nickel	272.27	1.7E-07	15	15.0	0.96	1.6E-07	6.9E-05	2.3E-03	0.8%
Selenium	1.63	9.9E-10	15	15.0	0.96	9.5E-10	1.4E-04	6.8E-06	0.0%
Zinc	67,134	4.1E-05	15	15.0	0.96	3.9E-05	1.0E-02	3.9E-03	1.4%
							TOTAL HAZARD INDEX:	**2.7E-01**	

INHALATION CDI = (AIR EPC)*(1/BW)*(IR*EF) CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios

where : Nearby residents are assumed to be exposed to airborne particulate for 30 years, 350 days/year, 24 hours/day in accordance with EPA OSWER guidance re: RME evaluations. Therefore, EF = 30/70 (yrs/yrs) * 350/365 (dys/dys) for carcinogens (0.411) and 350/365 (days) for noncarcinogenic endpoints.

CALCULATION OF SOIL CONCENTRATION ESTIMATES AT MEI RESIDENTIAL LOCATION

EMITTED SUBSTANCE	Average Annual Deposition (ug/m^2/day)	Ks (days^-1)	t1/2 (days)	To (days)	Tf (days)	Tt (days)	X (Integral Function)	SD (meters)	BD (kg/m^3)	Cs (ug/kg)	Cs (mg/kg)
Arsenic	1.82E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	7.45	0.007
Beryllium	1.72E-01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	70.6	0.071
Cadmium	2.08E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	8.53	0.009
NONCARCINOGENS											
Antimony*	8.54E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	35.1	0.035
Arsenic	1.82E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	7.45	0.007
Barium*	4.01E-01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	165	0.165
Beryllium	1.72E-01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	70.6	0.071
Cadmium	2.08E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	8.53	0.009
Chromium (trivalent)	3.01E-02	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	12.4	0.012
Copper*	3.60E+01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	14,803	14.8
Lead	2.42E+00	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	993	0.993
Manganese*	2.62E+01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	10753	10.8
Mercury	5.97E-04	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	0.25	0.0002
Nickel*	2.85E-01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	117	0.117
Selenium*	1.71E-03	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	0.70	0.001
Zinc*	7.03E+01	6.93E-09	1.00E+08	0	10,950	10,950	4.15E-01	0.01	1,333	28,879	28.9

**Contaminant-specific half-life values could not be found for these compounds. In the absence of these data, this analysis uses the same value used for the other metals (1.0E+08).*

Cs = Average concentration in soil = Dep * X / (Ks * SD * BD * Tt)

Source: Appendix E-II of ATHS RA guidelines (CAPCOA 1992).

Where:

Cs = Average concentration in soil (ug/kg)

Dep = Deposition in ug/m^2/day = GLC * Dep-rate * 86,400 *where:*

GLC = ground-level concentration in ug/m^3 (see RESAIR2.XLS); Dep-rate = 0.02 m/s; and 86,400 = seconds per day conversion factor

Ks = (0.693(/(t1/2) where t1/2 = half-life (using values from Table 1 in Appendix E-II in ATHS RA guidance)

To = Beginning of evaluation period. Tf = End of evaluation period. Tt = Total days of exposure period (Tf-To) = 30 years (10,950 days) .

Even though the thirty-year exposure period would not apply to noncarcinogenic endpoints, it is assumed here because it yields a more conservative estimate of X.

X = [{EXP(-Ks * Tf) - EXP(-Ks * To)} / Ks] + Tt

SD = Soil mixing depth (meters). Value of 0.01m used here assumes playground setting (vs. 0.15 m for agricultural setting).

BD = Soil Bulk Density = 1,333 kg/m^3 (default value recommended in Appendix E-II of CAPCOA's ATHS RA guidelines.

Assumptions:

1] Substances are uniformly mixed in soil. 2] No background contribution from either soil or air. 3] Substances are not leached or washed away.

c:\rescalc\RES_DEP.XLS, 2/1/93

CALCULATION OF RME SOIL INGESTION CANCER RISKS AT THE OFF-SITE RESIDENTIAL MEI LOCATION

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Cs Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	0.0075	1.0E-06	70	100	0.411	4.4E-09	1.75E+00	7.7E-09	0.03
Beryllium	0.0706	1.0E-06	70	100	0.411	4.1E-08	7.0E+00	2.9E-07	0.97

TOTAL EXCESS CANCER RISK: **3.0E-07**

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Cs Soil EPC (mg/kg)	UC: Unit Conv. (kg/mg)	BW (kg)	SI (mg/day)	EF (unitless)	Ingestion CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	0.0351	1.0E-06	15	200	0.959	4.5E-07	4.0E-04	1.1E-03	0.11
Arsenic	0.0075	1.0E-06	15	200	0.959	9.5E-08	3.0E-04	3.2E-04	0.03
Barium	0.1645	1.0E-06	15	200	0.959	2.1E-06	7.0E-02	3.0E-05	0.00
Beryllium	0.0706	1.0E-06	15	200	0.959	9.0E-07	5.0E-03	1.8E-04	0.02
Cadmium	0.0085	1.0E-06	15	200	0.959	1.1E-07	1.0E-03	1.1E-04	0.01
Chromium (trivalent)	0.0124	1.0E-06	15	200	0.959	1.6E-07	1.0E+00	1.6E-07	0.00
Copper	14.80	1.0E-06	15	200	0.959	1.9E-04	3.7E-02	5.1E-03	0.50
Lead	0.9928	*See RES PB.XLS Blood Lead Calculations.*						NA	NA
Manganese	10.75	1.0E-06	15	200	0.959	1.4E-04	1.0E-01	1.4E-03	0.14
Mercury	0.0002	1.0E-06	15	200	0.959	3.1E-09	3.0E-04	1.0E-05	0.00
Nickel	0.1171	1.0E-06	15	200	0.959	1.5E-06	2.0E-02	7.5E-05	0.01
Selenium	0.0007	1.0E-06	15	200	0.959	9.0E-09	5.0E-03	1.8E-06	0.00
Zinc	28.88	1.0E-06	15	200	0.959	3.7E-04	2.0E-01	1.8E-03	0.18

HAZARD INDEX: **1.0E-02**

CDI EQUATIONS: INGESTION CDI = (EPC)*(UC)*(1/BW)*(SI)*(EF)

For Carcinogens, EF (exposure fraction) = (350 days/365 days)*(30 years/70 years) = 0.411.
For Noncarcinogens, EF (exposure fraction) = (350 days/365 days) = 0.959.

RISK EQUATIONS: CANCER RISK = (CDI) * (SF); NONCANCER HI = Sum of CDI/RfD ratios (over all noncarcinogenic COPC).

CALCULATION OF RME DERMAL CONTACT RISKS AT THE OFF-SITE RESIDENTIAL MEI LOCATION

CARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Cs Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	Slope Factor (SF) (mg/kg/day^-1)	Excess Cancer Risk	Proportion of Total Risk
Arsenic	0.0075	1.0E-06	70	1.0	5,800	0.1%	0.411	2.5E-10	1.75E+00	4.4E-10	0.00
Beryllium	0.0706	1.0E-06	70	1.0	5,800	0.1%	0.411	2.4E-09	1.4E+02	3.4E-07	1.00
									TOTAL EXCESS CANCER RISK:	**3.4E-07**	

NONCARCINOGENIC RISK ENDPOINTS:

PARAMETER (COPC)	Cs Soil EPC (mg/kg)	Unit Conv. (kg/mg)	BW (kg)	SOIL AF mg/cm^2	SA (cm^2)	% Dermal Absorption	EF (unitless)	Dermal Contact CDI (mg/kg/day)	RfD (mg/kg/day)	CDI:RfD Ratio	Proportion of Hazard Index
Antimony	0.0351	1.0E-06	15	1.0	2,380	0.1%	0.959	5.3E-09	2.0E-05	2.7E-04	0.18
Arsenic	0.0075	1.0E-06	15	1.0	2,380	0.1%	0.959	1.1E-09	3.0E-04	3.8E-06	0.00
Barium	0.1645	1.0E-06	15	1.0	2,380	0.1%	0.959	2.5E-08	3.5E-03	7.2E-06	0.00
Beryllium	0.0706	1.0E-06	15	1.0	2,380	0.1%	0.959	1.1E-08	2.5E-04	4.3E-05	0.03
Cadmium	0.0085	1.0E-06	15	1.0	2,380	0.1%	0.959	1.3E-09	2.5E-05	5.2E-05	0.03
Chromium (trivalent)	0.0124	1.0E-06	15	1.0	2,380	0.1%	0.959	1.9E-09	5.0E-02	3.8E-08	0.00
Copper	14.80	NA	NA	NA	NA	NA	NA	NA	See Table 4-1	NA	NA
Lead	0.9928	*See RES PB.XLS Blood Lead Calculations.*								NA	NA
Manganese	10.75	1.0E-06	15	1.0	5,000	0.1%	0.959	3.4E-06	5.0E-03	6.9E-04	0.45
Mercury	0.0002	1.0E-06	15	1.0	2,380	0.1%	0.959	3.7E-11	1.5E-05	2.5E-06	0.00
Nickel	0.1171	1.0E-06	15	1.0	2,380	0.1%	0.959	1.8E-08	1.0E-03	1.8E-05	0.01
Selenium	0.0007	1.0E-06	15	1.0	2,380	0.1%	0.959	1.1E-10	2.5E-04	4.3E-07	0.00
Zinc	28.88	1.0E-06	15	1.0	2,380	0.1%	0.959	4.4E-06	1.0E-02	4.4E-04	0.29
									HAZARD INDEX:	**1.5E-03**	

CDI EQUATIONS: DERMAL CONTACT CDI = (EPC)*(UC)*(1/BW)*(AF*SA)*(ABS)*(EF)

where : Nearby residents are assumed to be exposed to airborne particulate for 30 years, 350 days/year, 24 hours/day (per EPA OSWER guidance).

See preceding worksheets for additional descriptions regarding assumptions used.
All assumptions represent RME exposures in accordance with relevant CAPCOA and EPA risk assessment guidance.

CALCULATION OF VEGETATION CONCENTRATIONS AT MEI LOCATION

EMITTED SUBSTANCE	Dep (Average Annual) (ug/m^2/day)	IF (unitless)	k (1/days)	Y (kg/m^2)	T (days)	Cdepv (ug/kg)	BIO (unitless)	UF2 (unitless)	Cs (ug/kg)	Ctrans (unitless)	Cf ug/kg)
Arsenic	1.82E-02	0.2	0.0495	2	90	0.036	1.0	0.004	7.45	0.030	0.066
Beryllium	1.72E-01	0.2	0.0495	2	90	0.343	1.0	0.001	70.58	0.071	0.414
NONCARCINOGENS											
Antimony*	8.54E-02	0.2	0.0495	2	90	0.170	1.0	0.001	35.06	0.035	0.206
Arsenic	1.82E-02	0.2	0.0495	2	90	0.036	1.0	0.004	7.45	0.030	0.066
Barium*	4.01E-01	0.2	0.0495	2	90	0.800	1.0	0.001	164.52	0.165	0.964
Beryllium	1.72E-01	0.2	0.0495	2	90	0.343	1.0	0.001	70.58	0.071	0.414
Cadmium	2.08E-02	0.2	0.0495	2	90	0.041	1.0	0.06	8.53	0.512	0.554
Chromium (trivalent)	3.01E-02	0.2	0.0495	2	90	0.060	1.0	0.0008	12.36	0.010	0.070
Copper*	3.60E+01	0.2	0.0495	2	90	72.0	1.0	0.001	14803.27	14.803	86.77
Lead	2.42E+00	0.2	0.0495	2	90	4.83	1.0	0.005	992.82	4.964	9.791
Manganese*	2.62E+01	0.2	0.0495	2	90	52.3	1.0	0.001	10752.83	10.753	63.03
Mercury	5.97E-04	0.2	0.0495	2	90	0.001	1.0	0.09	0.25	0.022	0.023
Nickel*	2.85E-01	0.2	0.0495	2	90	0.569	1.0	0.001	117.12	0.117	0.687
Selenium*	1.71E-03	0.2	0.0495	2	90	0.003	1.0	0.001	0.70	0.001	0.004
Zinc*	7.03E+01	0.2	0.0495	2	90	140.4	1.0	0.001	28878.69	28.879	169.27

**Contaminant-specific UF2 values could not be found for these compounds. In the absence of these data, this analysis assumes a value of 1.0E-03.*

Cf = Vegetation Concentration = (Cdepv * BIO) + Ctrans

Where:

Cf = Average concentration in and on specific types of vegetation (ug/kg); leafy crops are assumed for this analysis.

Cdepv = Concentration due to direct deposition (ug/kg)

Where: Cdepv = [Dep * IF / (k * Y)] * (1-EXP[-kT])

Dep = Deposition on affected vegetation per day (ug/m^2/day) = Substance-specific (see RES_DEP.XLS)

IF = Interception Fraction (unitless). This analysis assumes 0.2 for leafy crops.

k = Weathering constant = 0.693/14 Days [Source: Clement]

Y = Yield = 2 kg/m^2 [CA Department of Food and Agriculture]

EXP = Exponent base e

T = Growth period = 90 days [Clement]

BIO = Bioavailability. **Conservatively assumed to be 1.0, even though this factor is not considered applicable to metals in CAPCOA guidance.**

Ctrans = Concentration due to root translocation or uptake (ug/kg)

Where: Ctrans = Cs * UF2

where: Cs = Soil concentration in ug/kg; see RES_DEP.XLS

UF2 = Uptake factor based on soil concentration (for leafy crops; see Table 1 in App. E-II of CAPCOA guidelines).

CALCULATION OF VEGETABLE INGESTION RISKS AT OFF-SITE RESIDENTIAL MEI LOCATION

EMITTED SUBSTANCE	Cf (ug/kg)	IF (kg/day)	GI	L	ABW (kg)	Cf (ug/mg)	CDI (mg/kg/day)	SF / RfD	Cancer Risk CDI/RfD Ratio
Arsenic	0.066	0.01	1.00	0.10	70	1000	9.44E-10	1.75E+00	1.65E-09
Beryllium	0.414	0.01	1.00	0.10	70	1000	5.91E-09	7.00E+00	4.14E-08
NONCARCINOGENS									
Antimony	0.206	0.01	1.00	0.10	15	1000	1.37E-08	4.0E-04	3.43E-05
Arsenic	0.066	0.01	1.00	0.10	15	1000	4.40E-09	3.0E-04	1.47E-05
Barium	0.964	0.01	1.00	0.10	15	1000	6.43E-08	7.0E-02	9.18E-07
Beryllium	0.414	0.01	1.00	0.10	15	1000	2.76E-08	5.0E-03	5.52E-06
Cadmium	0.554	0.01	1.00	0.10	15	1000	3.69E-08	1.0E-03	3.69E-05
Chromium (trivalent)	0.070	0.01	1.00	0.10	15	1000	4.66E-09	1.0E+00	4.66E-09
Copper	86.770	0.01	1.00	0.10	15	1000	5.78E-06	3.7E-02	1.56E-04
Lead	9.791	*See RES_PB.XLS Blood Lead Calculations.*							NA
Manganese	63.028	0.01	1.00	0.10	15	1000	4.20E-06	1.0E-01	4.20E-05
Mercury	0.023	0.01	1.00	0.10	15	1000	1.55E-09	3.0E-04	5.17E-06
Nickel	0.687	0.01	1.00	0.10	15	1000	4.58E-08	2.0E-02	2.29E-06
Selenium	0.004	0.01	1.00	0.10	15	1000	2.74E-10	5.0E-03	5.48E-08
Zinc	169.274	0.01	1.00	0.10	15	1000	1.13E-05	2.0E-01	5.64E-05

CDI = Cf * IF * GI * L / ABW * CF

Where:

CDI = Exposure dose through ingestion of plant products (mg/kg/day)

Cf = Concentration in plant type F in ug/kg. See VEG_CONC.XLS for derivation.

IF = Consumption of plant type F = 0.01 kg/day for leafy crops [USDA Western Region]; also conservatively assumed for child receptors

GI = Gastrointestinal absorption factor. Assumes 100% for all values based on Appendix E-II, Table 1 of ATHS RA guidelines.

L = Fraction of plant type F homegrown. This analysis assumes a value of 10%.

ABW = Average Body Weight = 70 kg

CF = Conversion Factor = 1000 ug/mg

Vegetable Ingestion Cancer Risk = CDI * Potency Slope (upper two rows)

Vegetable Ingestion Hazard Index = CDI/RfD (lower rows under "NONCARCINOGENS")

RES_PB.XLS:
BLOOD LEAD LEVELS ESTIMATED FOR CHILD RECEPTORS AT THE OFF-SITE RESIDENTIAL MEI LOCATION:
REASONABLE MAXIMUM EXPOSURES
H. KRAMER AND COMPANY SITE

MEDIUM	LEVEL		RESULTS	Mean	95th Percentile	99th Percentile	
LEAD IN AIR	0.001399	ug/m^3	ESTIMATED CHILD BLOOD LEAD LEVELS:	2.14	3.80	4.83	ug/dl
LEAD IN SOIL	0.9928	ug/g	HAZARD INDICES:	0.21	0.38	0.48	
LEAD IN WATER	2.5	ug/l					
DUST IN AIR	NA	mg/m^3					
SITE-GROWN PRODUCE?	1	(1 = Yes; 0 = No)					

********** EQUATIONS (TYPICAL CHILD) **********

Pathway	Blood Pb ug/dl		Route-specific Factor	Concentration in Medium	Contact Rate	Percent of Total
SOIL CONTACT:	0.000	=	0.0001 (ug/dl)/(ug/day) *	0.9928 ug/g *	1.4 g soil/day (5 g/m^2 * 0.28 m^2)	0%
SOIL INGESTION:	0.004	=	0.07 (ug/dl)/(ug/day) *	0.9928 ug/g *	0.055 g soil/day	0%
DUST INHALATION:	0.003	=	1.92 (ug/dl)/(ug/m^3) *	0.0014 ug/m^3	[= ambient Pb + (airborne dust * soil Pb)]	0%
WATER INGESTION:	0.160	=	0.16 (ug/dl)/(ug/day) *	2.50 ug/l *	0.4 liter water/day	7%
FOOD INGESTION:	1.971	=	0.16 (ug/dl)/(ug/day) *	9.47 ug Pb/kg diet *	1.30 kg diet/day	92%

TOTAL DIETARY LEAD = 9.47 ug/kg

If produce is grown on site, dietary lead = [9.45 + (0.025*soil lead in ug/g)]. If produce is not grown on site, default value is 10 ug/kg per DTSC guidance.

Notes/Assumptions:

1] With the exception of the site-specific parameters noted below, all equations and assumptions are based on DTSC's "Assessment of Health Risks from Inorganic Lead in Soil" (DTSC, July 1992). A copy of this (more recent) guidance is attached to this addendum.
2] See preceding worksheets (RESAIR*.* and RES_DEP.XLS) for derivation of assumed soil and air lead concentrations.
3] Regular chemical monitoring of local drinking water wells has not detected contamination to date (see May 1992 HRA text Section 3.2.1.2). Therefore, lead was assumed to be present in drinking water at one-half the (5.0 ug/l) method detection limit value, or 2.5 ug/l.
4] Produce is assumed to be grown at the off-site residential MEI location.

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EBASCO
ENVIRONMENTAL

BASIS OF REMEDIAL DESIGN REPORT

FOR THE

H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

NOVEMBER, 1993

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BASIS OF REMEDIAL DESIGN REPORT

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NOVEMBER, 1993

BASIS OF REMEDIAL DESIGN REPORT
H. KRAMER & COMPANY SITE

CONTENTS

Page

1.0 INTRODUCTION 1

1.1 PURPOSE 1
1.2 OBJECTIVES 1
1.3 SITE BACKGROUND AND HISTORY 2

2.0 BACKGROUND DATA 3

2.1 SITE DESCRIPTION 3
2.1.1 Topography 3
2.1.2 Climate 3
2.1.3 Drainage 7
2.2 GEOLOGY 7
2.3 HYDROGEOLOGY 9
2.4 CONCLUSIONS AND RECOMMENDATIONS 9

3.0 ASPHALT CONCRETE (AC) CAP 14

3.1 ASSUMPTIONS AND REQUIREMENTS 14
3.2 DESIGN CRITERIA 16
3.3 SLAG PILE CONFIGURATION 18

4.0 DESIGN PHASE REQUIREMENTS 21

4.1 ENGINEERING DRAWINGS 21
4.2 SPECIFICATIONS/BID DOCUMENTS 21
4.3 PERMITS 22
4.4 GROUNDWATER MONITORING PLAN 23
4.5 HEALTH AND SAFETY PLAN 23
4.6 CONSTRUCTION SCHEDULE 23

FIGURES

Page

1 Site Location Map 4
2 Site and Sample Location Map 5
3 Geologic Cross-Section 8
4 Hydrologic Cross-Section - Gage Aquifer 10
5 Groundwater Contour Map - Old Dunes Sand Aquifer 11
6 Groundwater Contour Map - Gage Aquifer 12
7 Asphalt Concrete (AC) Cap 15
8 Slag Pile AC Cap Design 20

TABLES

1 Rainfall Record for El Segundo/Los Angeles Int'l Airport (1959 - 1993) . . . 6

1.0 INTRODUCTION

This Basis of Remedial Design Report (Report) is submitted in compliance with Cleanup and Abatement Order N° 92-094 (CAO), dated December 28, 1992, issued by the California Regional Water Quality Control Board - Los Angeles Region (RWQCB-LA) to H. Kramer & Company (H. Kramer) and Harshaw Chemical Company and its successor companies (Harshaw), which requires, among other things, that the respondents implement site investigations and remedial activities at the property, located at One Chapman Way, El Segundo, California (Property). As discussed further below, the remediation proposed herein calls for a capping of that portion of the property occupied by the slag pile and formerly occupied by a surface lagoon, with minor reconfiguration of the slag pile itself.

The objectives of the cap are to minimize precipitation infiltration of the slag pile area to protect the underlying aquifers from potential leachate of metals, and to eliminate all reasonably likely exposure pathways to previously identified chemicals of concern (COC).

1.1 PURPOSE

The purpose of the Basis of Remedial Design Report is to describe and summarize the technical design parameters, materials, and construction specifications for the remedial design and closure of the slag pile area at the Property. It describes and evaluates an asphalt concrete (AC) capping system and the basis for selecting this system.

This Report utilizes all information developed from the following investigation studies:

- Site Characterization Report, prepared by ENSR Consulting and Engineering, dated February, 1990.
- Public Health Risk Assessment, prepared by Ebasco Environmental, dated February, 1993.
- Supplemental Site Investigation (Phase I), prepared by Ebasco Environmental, dated November/December, 1992.
- Supplemental Site Investigation (Phase II), completed by Ebasco Environmental in August, 1993.

1.2 OBJECTIVES

The primary objective of this Report is to identify the design parameters and technical specifications for the preparation of the remedial cap design with sufficient specificity for the RWQCB-LA to approve the proposed cap under the CAO.

This Report contains a summary of the background data available for the site, including site history, topography, climate, geology, hydrology, surface drainage and existing groundwater, geotechnical and waste conditions, all of which are pertinent to selecting the proposed cap remedy and establishing appropriate design and performance parameters and criteria.

This Report concludes with the recommended configuration and capping system, including an enumeration of the most significant engineering and design requirements.

1.3 SITE BACKGROUND AND HISTORY

The Property is located on industrially zoned Property in the city of El Segundo, California. Industrial activity ceased here in 1985. H. Kramer operated a brass foundry at the site from 1951 through mid-1985. Slag generated from H. Kramer's operation was placed in a waste pile, filling and now extending beyond a waste lagoon originally used by H. Kramer's site predecessor, Harshaw Chemical Company. Harshaw generated, in the process of antimony smelting, wastes which contained heavy metals (in particular arsenic).

Arsenic and other metals were detected in previous investigations which involved the installation of a number of groundwater monitoring wells, a number of soil borings and hydropunch investigation of the upper and lower aquifers at the Property.

The sampling results from these previous soil and groundwater studies revealed patterns of arsenic presence in the soils and groundwater beneath and around the slag pile. They also 1) confirmed the presence of a competent aquitard (Bellflower Aquiclude) beneath the property as posited in the Public Health Risk Assessment, 2) established that the presence of arsenic in the deeper aquifer (Gage Aquifer) is probably the result of two monitoring wells having been screened across both the Old Dune Sand Aquifer (the shallow aquifer) and the Gage Aquifer, 3) demonstrated that arsenic contamination in the underlying aquifer is largely contained within site boundaries, and 4) indicated that the Old Dune Sand Aquifer and Gage Aquifer beneath the Property have been impacted by the regional VOC contamination.

2.0 BACKGROUND DATA

2.1 SITE DESCRIPTION

The Property is located within the City of El Segundo, California (Figure 1). It is bounded on the north side by the Southern Pacific Railroad (SPRR) line and the Atchison, Topeka and Santa Fe Railroad (AT&SF) line to the south. Douglas Street borders the east side of the site and open undeveloped lands exist to the west. Harshaw conducted antimony smelting operations at the Property for a number of years until approximately 1951, when it sold the Property to H. Kramer, which operated a brass and bronze smelting facility until mid-1985, when H. Kramer ceased operations in California. Construction of a high voltage transmission power line and an extension of the Los Angeles light rail transit system across the central and northeast portions of the Property have recently been completed.

The sampling locations and key features of the Property are shown in Figure 2. Of particular note to this Report is the slag pile located in the northeast corner of the Property. This pile is roughly 40,000 cubic yards in volume and occupies a former surface lagoon which was used by Harshaw to dispose of wastes (containing arsenic and other heavy metals) generated during its antimony smelting operations.

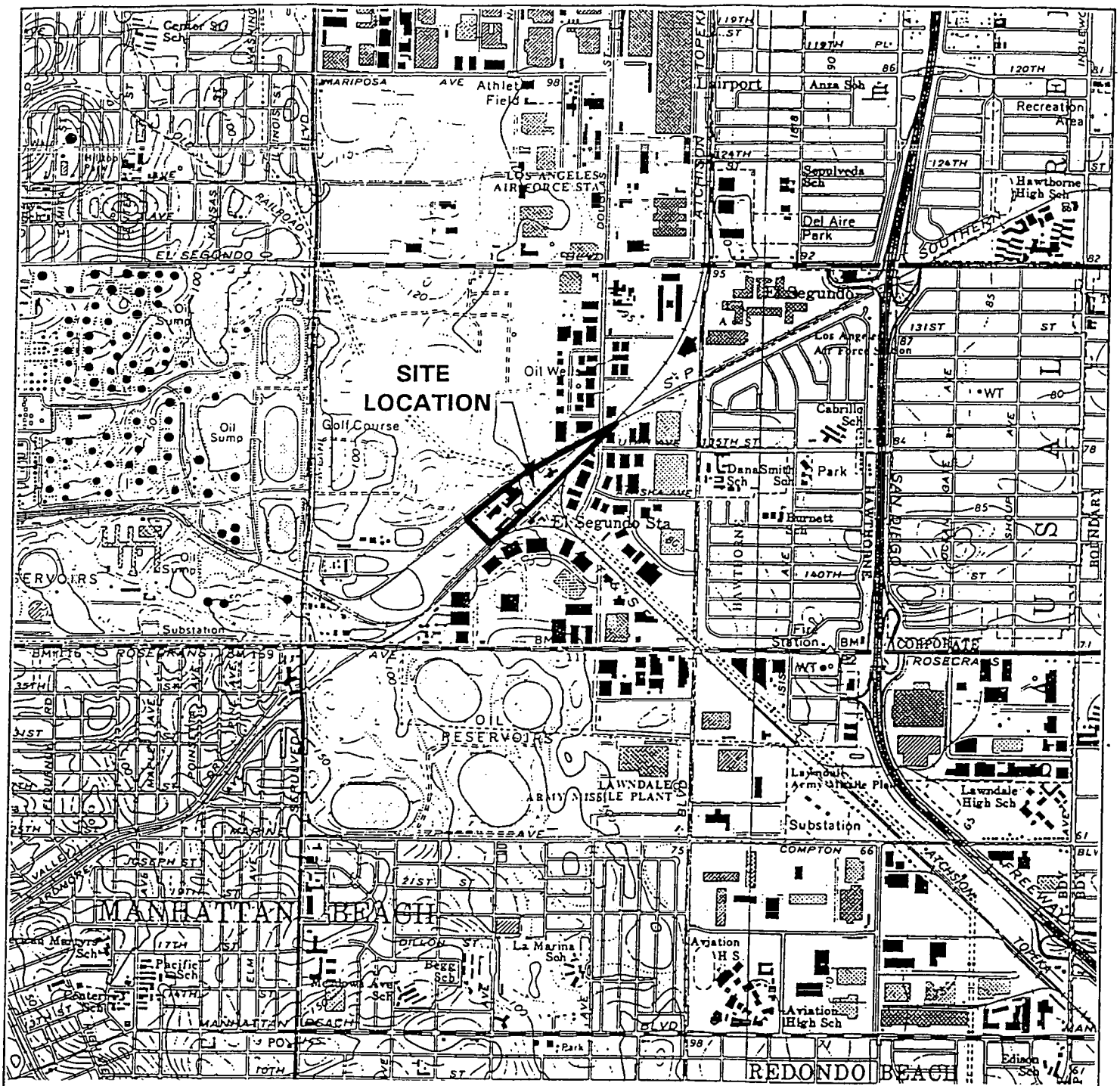
2.1.1 Topography

Review of aerial photography and topographic maps shows that the site is situated in an area of relatively lower elevation than the surrounding land. In general, the area exhibits the rolling topography typical of wind-deposited sand dunes. The site surface elevation is approximately 100 feet above mean sea level (MSL). The general topographic slope is to the east. Elevated areas have existed in the past; approximately 200 feet directly south of the site (elevation approximately 110 feet MSL), approximately 300 feet southwest (elevation approximately 120 feet MSL), and approximately 500 feet west (elevation approximately 140 feet MSL). The surface elevation slopes to an elevation of approximately 80 feet MSL, approximately 400 feet east of the site.

2.1.2 Climate

The National Oceanic and Atmospheric Administration (NOAA) reports that daily temperatures in the El Segundo/Los Angeles International Airport (LAX) area range from approximately 68°F in spring and summer to around 59°F in fall and winter. Prevailing daytime winds are from the west; however, night and early morning breezes are usually light and from east to northeast. At times during the fall, winter and spring, gusty dry northeasterly "Santa Ana" winds blow over southern California mountains and through passes to the coast.

Table 1 summarizes monthly rainfall at nearby LAX. Average annual rainfall is approximately 12 inches, of which 86 percent occurs between the months of November and March. Measurable rain may fall on an average of about one day in four from late October into early April, but in three years out of four, traces or less are reported for the entire months of July and August.



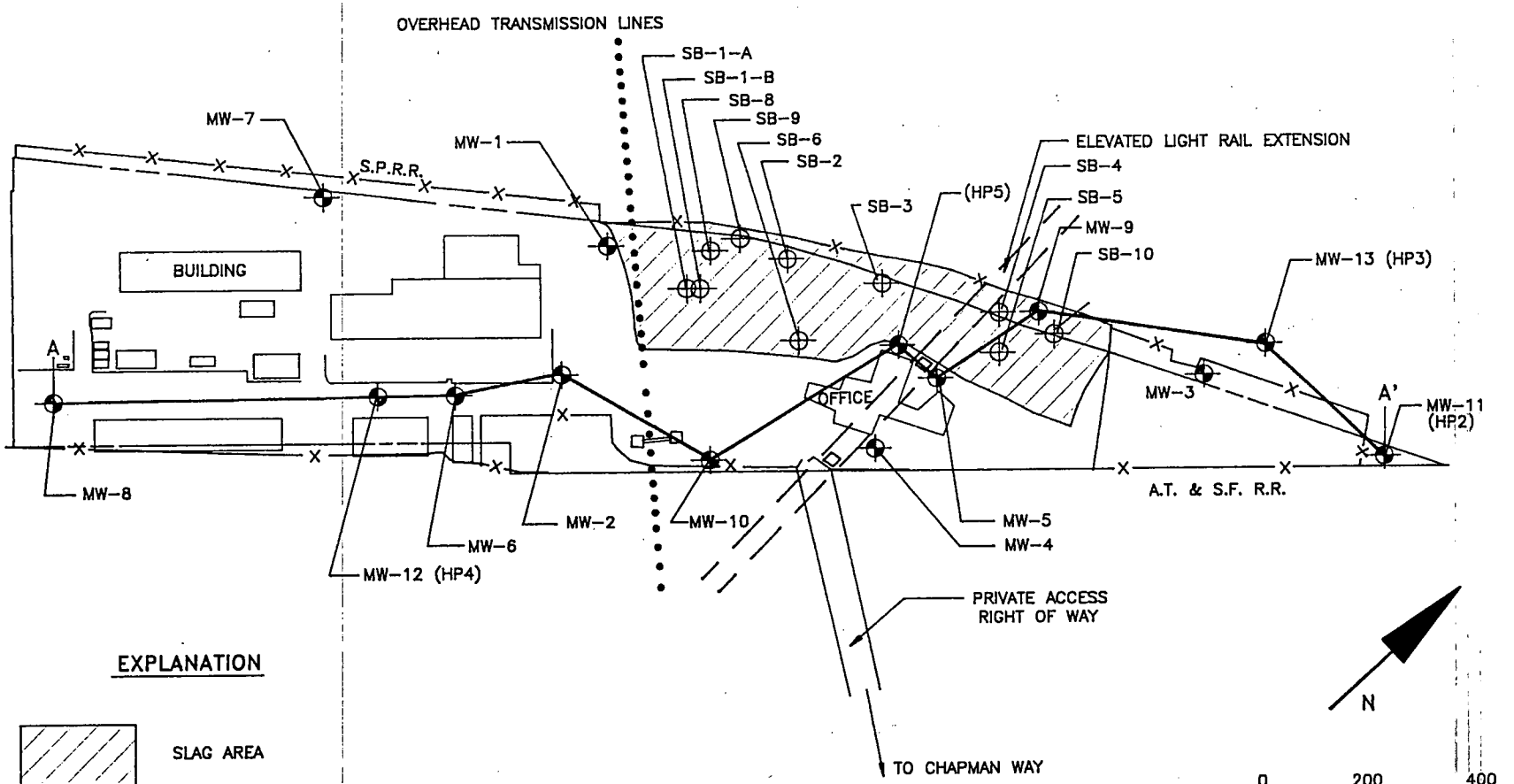
0 1/2 1

SCALE IN MILES

FIGURE 1

SITE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981



EXPLANATION

SLAG AREA

SOIL BORINGS BY ENSR

(HP4) HYDRO PUNCH/MONITORING WELL

A A' GEOLOGIC/HYDROGEOLOGIC CROSS-SECTION

FIGURE 2

SAMPLING LOCATIONS AND KEY FEATURES
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

AK, 11-22-93

PLSC: FIT, CHKV-23

TABLE 1

RAINFALL RECORD
FOR EL SEGUNDO/LOS ANGELES INT'L AIRPORT
(1959-1993)

LAX Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1959	1.11	3.72	0.00	0.39	0.00	0.00	0.00	0.00	0.04	0.01	0.06	1.11	6.44
1960	2.83	2.90	0.21	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.67	0.06	10.67
1961	1.27	0.00	0.46	0.02	0.00	0.00	0.01	0.30	0.04	0.00	1.88	1.07	5.05
1962	2.68	11.07	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.01	14.96
1963	0.62	4.48	2.42	1.41	0.02	0.24	0.00	0.01	1.13	0.42	2.76	0.00	13.51
1964	1.49	0.00	1.20	0.20	0.01	0.29	0.00	0.00	0.00	0.30	1.07	1.95	6.51
1965	0.43	0.34	1.63	4.52	0.00	0.03	0.00	0.12	0.11	0.00	6.38	3.25	16.81
1966	0.84	1.40	0.49	0.01	0.02	0.00	0.01	0.00	0.19	0.04	2.69	3.67	9.36
1967	2.71	0.05	1.47	2.68	0.03	0.00	0.00	0.00	0.44	0.00	7.47	1.05	15.90
1968	0.84	0.44	3.77	0.49	0.00	0.00	0.04	0.00	0.00	0.32	0.24	1.42	7.56
1969	9.60	3.76	0.42	0.38	0.00	0.00	0.15	0.00	0.01	0.00	1.37	0.01	15.70
1970	1.44	1.39	1.29	0.00	0.00	0.01	0.00	0.00	0.00	0.02	3.68	4.12	11.95
1971	0.66	0.36	0.23	0.68	0.17	0.00	0.00	0.00	0.00	0.28	0.22	5.70	8.30
1972	0.00	0.16	0.00	0.00	0.01	0.06	0.00	0.06	0.03	1.79	3.13	1.88	7.12
1973	3.16	4.87	2.42	0.00	0.01	0.00	0.00	0.02	0.00	0.08	1.92	0.45	12.93
1974	5.68	0.13	2.49	0.14	0.02	0.00	0.00	0.00	0.00	0.54	0.00	3.76	12.76
1975	0.01	3.21	2.98	0.74	0.04	0.00	0.00	0.00	0.00	0.24	0.00	0.10	7.32
1976	0.00	2.15	0.83	0.77	0.00	0.28	0.02	0.03	1.85	1.50	0.87	0.95	9.25
1977	3.21	0.26	1.23	0.00	2.55	0.00	0.00	2.47	0.00	0.00	0.04	3.92	13.68
1978	7.48	7.66	5.75	1.23	0.00	0.00	0.00	0.00	0.39	0.04	1.20	0.83	24.58
1979	5.26	2.53	4.74	0.00	0.00	0.00	0.00	0.00	0.04	0.31	0.22	0.42	13.52
1980	6.97	9.13	3.69	0.17	0.07	0.00	0.00	0.00	0.00	0.00	0.00	1.57	21.60
1981	1.51	1.58	3.24	0.46	0.00	0.00	0.00	0.00	0.05	0.40	2.63	1.52	11.39
1982	2.78	0.66	3.41	1.61	0.11	0.01	0.00	0.00	0.78	0.18	3.48	0.66	13.68
1983	5.25	5.64	6.37	3.18	0.04	0.03	0.00	1.25	1.91	0.94	2.74	2.11	29.46
1984	0.39	0.01	0.14	1.16	0.00	0.00	0.00	0.29	0.09	0.28	1.24	4.21	7.81
1985	0.70	1.91	0.72	0.00	0.16	0.00	0.00	0.00	0.28	0.36	4.75	0.44	9.32
1986	2.31	5.36	4.89	0.30	0.00	0.00	0.09	0.00	1.44	0.10	1.14	0.30	15.93
1987	1.27	0.64	0.92	0.02	0.00	0.09	0.08	0.00	0.08	1.74	0.60	1.79	7.23
1988	1.61	1.79	0.08	1.14	0.00	0.00	0.00	0.02	0.07	0.00	0.73	2.52	7.96
1989	0.59	1.72	0.86	0.00	0.04	0.00	0.00	0.00	0.26	0.34	0.38	0.00	4.19
1990	1.18	2.60	0.14	0.34	0.83	0.00	0.00	0.02	0.00	0.21	0.00	0.00	5.32
1991	1.38	2.53	3.96	0.00	0.00	0.00	0.17	0.00	0.09	0.06	0.00	2.86	11.05
1992	1.61	4.70	5.08	0.18	0.04	0.00	0.32	0.00	0.00	0.50	0.00	4.16	16.59
1993	10.63	5.48	1.83	-	0.00	-	-	-	-	-	-	-	17.94
Avg	2.56	2.70	2.01	0.71	0.12	0.03	0.03	0.14	0.27	0.33	1.63	1.70	12.10
Average	2.56	2.70	2.01	0.71	0.12	0.03	0.03	0.14	0.27	0.33	1.63	1.70	12.10

2.1.3 Drainage

The Property's stormwater surface runoff appears to drain to the east and northeast. The general area's storm runoff is collected by a 30-inch storm sewer located north of the SPRR right-of-way which drains into a 60-inch storm sewer at the junction of the SPRR and AT&SF right-of-ways northeast of the Kramer site and northeast of Douglas Street. A six-inch storm sewer is located in Douglas Street and junctions with a 42-inch storm sewer in Alaska Avenue. It appears that storm runoff drainage from the proposed slag pile cap can be collected by these storm sewers.

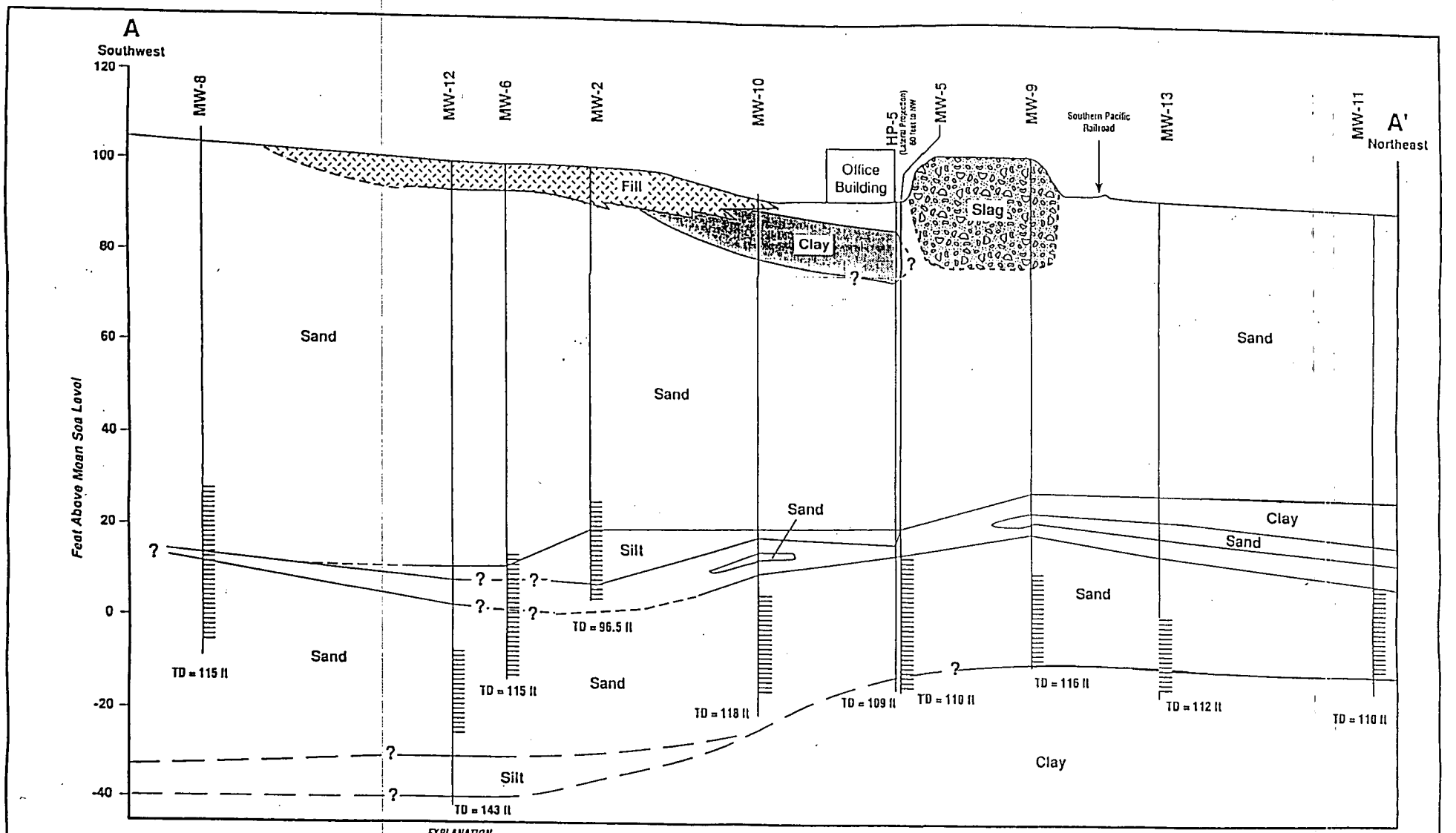
2.2 GEOLOGY

The subsurface geology of the site has been established by literary research for the region and from lithologic logs compiled during prior drill programs at the Property. A geologic cross-section illustrating the subsurface lithology is presented as Figure 3. The line of cross-section, A - A', starts southwest of monitoring well MW-8 and ends northeast of monitoring well MW-13. The upper most unit, the Old Dune Sand Formation (also known in literature as the Older Dune Sand Formation), consists of fine to medium grained sand with minor sandy silt, clay, and gravel lenses. Within the weathered zone the materials are yellow to brown in color although the unweathered formation in place is white, gray and black in color. The Old Dune Sand generally consists of three divisions: a deeply weathered surface, an intermediate horizon of clean sands and basal beach sands and gravels, and a lowermost horizon which apparently includes a transition zone to the underlying Bellflower Aquiclude (DWR, Bulletin 104, 1961). Beneath the site, the Old Sand Dune Formation is between 60 to 90 feet in thickness. The zone of transition, otherwise referred to as the transition zone, is discontinuous along the line of projection. When the zone of transition is present, as between monitoring wells MW-8 and MW-5, it consists of sandy silt to silty sand.

Underlying the Old Dune Sand Formation is the Bellflower Aquiclude (also known as the Manhattan Beach Formation). The aquiclude consists of silty clay to clayey silt and silt with clay. Beneath the site, the upper surface of the Bellflower Aquiclude dips gently to the west to southwest. The vertical thickness varies along the line of projection with the aquiclude being most thick in the northwest and decreasing in thickness to the southwest. The fine sediments of the Bellflower Aquiclude act as a competent barrier under the Property by restricting the vertical movement of groundwater from above. Locally, the aquiclude is not present along the ocean (west of the site) and groundwater can percolate downward into the lower Gage Aquifer (DWR, Bulletin 104, 1961).

The Gage Aquifer underlies the Bellflower Aquiclude beneath the Property. The aquifer is the basal or lower most unit of the Lakewood Formation, upper Pleistocene in age. The composition of the Gage Aquifer varies from a fine to medium sand with variable amounts of gravel, sandy silt, and clay (DWR, Bulletin 104, 1961). The thickness of the aquifer beneath the site ranges from roughly 18 feet in the northeast to greater than 30 feet in the southwest.

Beneath the Gage Aquifer are greenish-gray to yellowish-brown silts and clays belonging to the El Segundo Aquitard of the San Pedro Formation, lower Pleistocene in age. The aquitard is laterally extensive beneath the site and separates the upper Gage Aquifer form the deeper Silverado Aquifer. The elevation of the upper contact of the El Segundo Aquitard ranges from 15 feet below mean sea level in the northeast to 33 feet below mean sea level in the southwest.



Old Dune Sand Formation
Bellflower Aquiclude (Manhattan Beach Formation)
Gage Aquifer (Lakewood Formation)
El Segundo Aquiclude (San Pedro Formation)

EXPLANATION

Approximate Geologic Contact, Dashed where Inferred

Monitoring Well Screened Interval with Total Depth of Boring
TD = 115 ft

SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

FIGURE 3

Geologic Cross-Section
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

2.3 HYDROGEOLOGY

Figure 4 is a hydrogeologic cross-section for the Property. The cross-section illustrates the presence of two aquifers. The uppermost aquifer is the unconfined Old Dune Sand Aquifer. The deeper, confined aquifer is the Gage Aquifer. The two aquifers are separated by the Bellflower Aquiclude. Groundwater elevations are presented for the Gage Aquifer to show the potentiometric surface. The potentiometric surface indicates the aquifer has artesian properties in areas where the groundwater elevation lies above the Bellflower Aquiclude.

Figure 5 is a groundwater contour map of the Old Dune Sand Aquifer for August 23, 1993. The contour gradients indicate groundwater flows to the southwest to the south across the Property. The hydraulic gradient (i) across the Property is approximately 0.012 ft/ft. The saturated thickness of the Old Dune Sand Aquifer has been assessed to range from approximately 1 foot thick within the northeastern portion of the site to approximately 10 feet thick in the southwest portion of the site.

Figure 6 is a groundwater contour map for the Gage Aquifer for August 26, 1993. Contour gradients for the potentiometric surface of the aquifer indicate groundwater flows to the northeast within the lower aquifer. The hydraulic gradient across the majority of the Property (between monitoring wells MW-8 and MW-13) has been calculated to be 0.002 ft/ft. The gradient of the potentiometric surface steepens between monitoring wells MW-13 and MW-11 and has a calculated hydraulic gradient of 0.024 ft/ft. The artesian properties of the Gage Aquifer, combined with the groundwater gradient maps and the known lithology of the Bellflower Aquiclude derived from both supplemental geologic investigations, indicate the Bellflower Aquiclude is a competent barrier to the vertical migration of groundwater. Apparently, monitoring wells MW-5, MW-6 and MW-8 have been constructed so as to allow the two aquifers to be hydrogeologically interconnected at these two locations.

2.4 CONCLUSIONS AND RECOMMENDATIONS

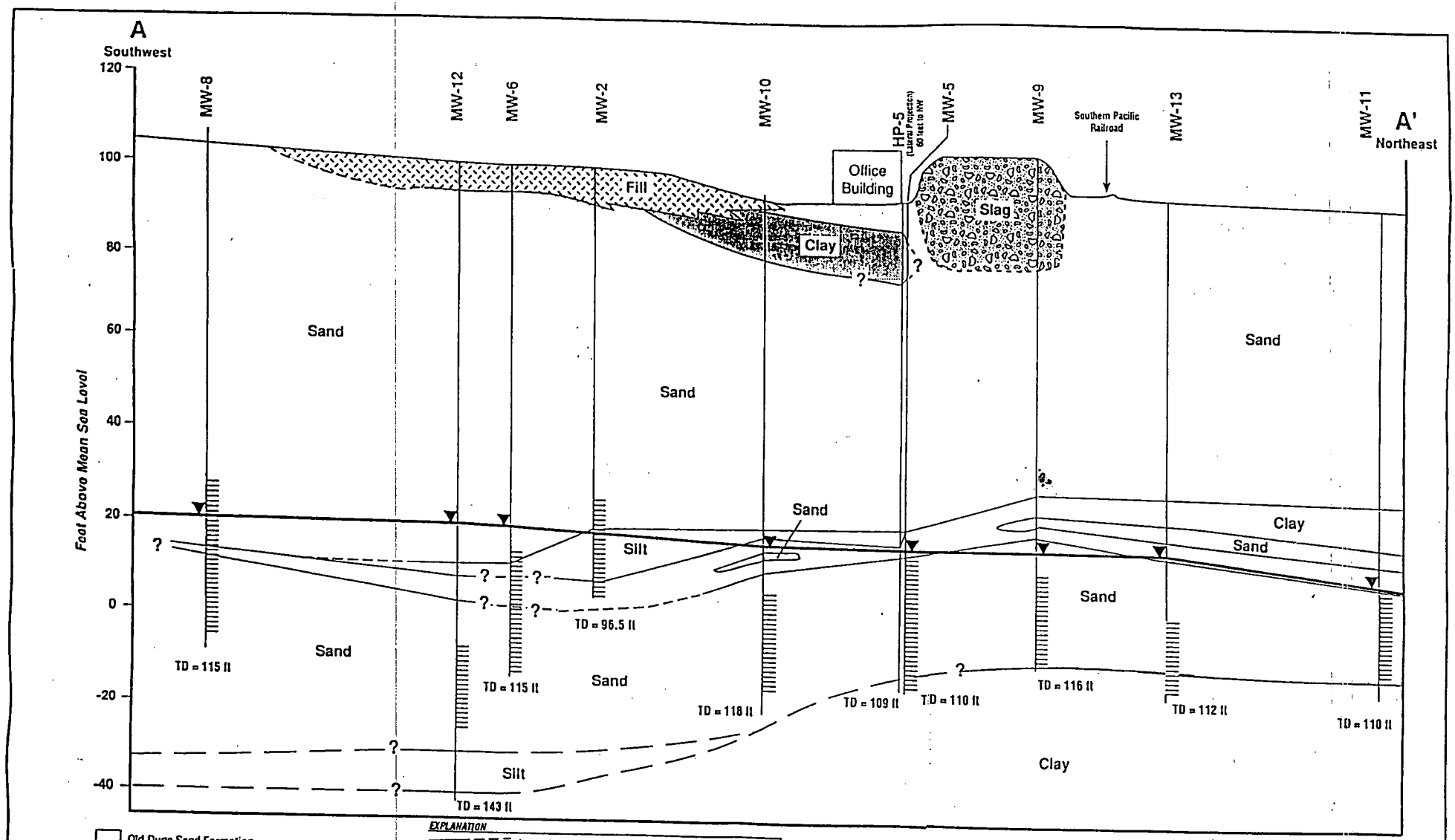
Based on the results of previous site investigations, the following conclusions have been drawn:

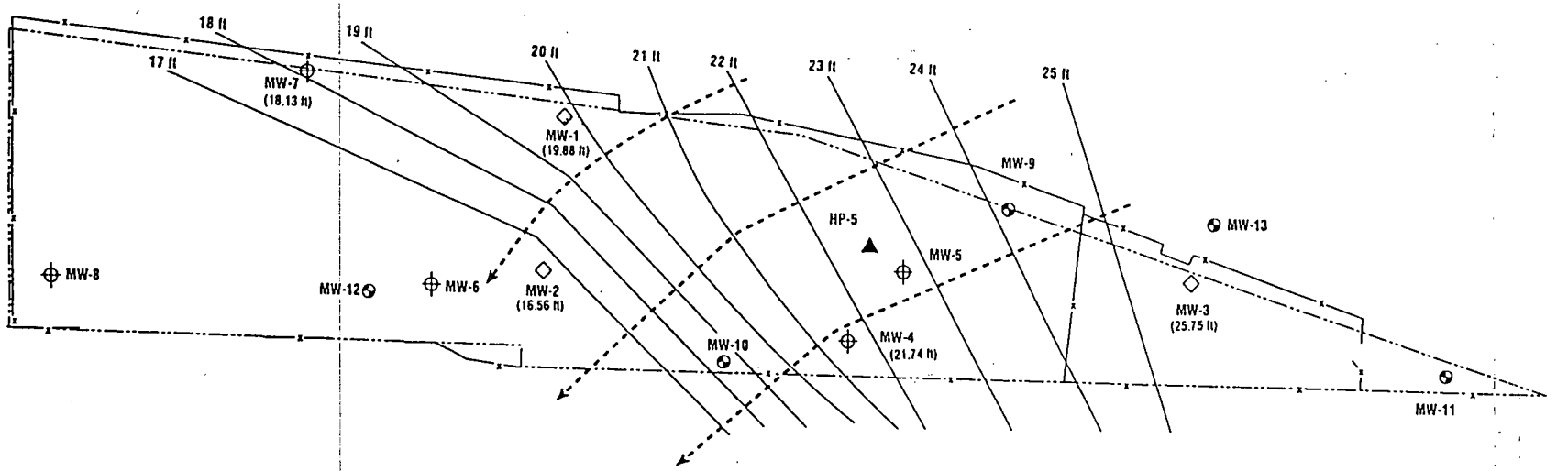
- The Bellflower Aquiclude is a competent barrier that effectively separates the Old Dune Sand Aquifer from the underlying Gage Aquifer both hydrogeologically, and with respect to vertical migration of the COCs.

- Elevated arsenic concentrations within the Gage Aquifer are largely confined to the area beneath the slag pile, specifically, near MW-5 and MW-6, which is also within the regional VOC contamination. Such contamination is apparently not due to any natural incompetence in the Bellflower Aquiclude.

- Monitoring wells MW-5, MW-6 and MW-8 have been constructed such that each well has been screened across the Bellflower Aquiclude, thus allowing the Old Dune Sand Aquifer to be hydrogeologically connected with the Gage Aquifer. Cross-contamination has apparently occurred at MW-5 and MW-6.

In order to eliminate any additional potential vertical migration of arsenic into both aquifers, it is recommended that the slag pile area be capped and that MW-5, -6, and -8 be properly


A
Southwest
A'
Northeast
Feet Above Mean Sea Level
120
100
80
60
40
20
0
-20
-40
MW-8
MW-12
MW-6
MW-2
MW-10
HP-5
(Lateral Projection) 60 feet to NW
MW-5
MW-9
MW-13
MW-11
Southern Pacific Railroad
Office Building
Fill
Clay
Slag
Sand
Silt
TD = 115 ft
TD = 115 ft
TD = 96.5 ft
TD = 118 ft
TD = 109 ft
TD = 110 ft
TD = 116 ft
TD = 112 ft
TD = 110 ft
TD = 143 ft
Old Dune Sand Formation
Bellflower Aquiclude (Manhattan Beach Formation)
Gage Aquifer (Lakewood Formation)
El Segundo Aquiclude (San Pedro Formation)
EXPLANATION
Approximate Geologic Contact, Dashed where Inferred
Potentiometric Groundwater Surface
Monitoring Well Screened Interval with Total Depth of Boring
TD = 115 ft
SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft
This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.
FIGURE 4
Hydrologic Cross-Section
Gage Aquifer, August 26, 1993
Phase II Supplemental Geologic Investigation
H. Kramer & Co. Facility
El Segundo, California



EXPLANATION

- Property Boundary
- Fence
- MW-3 (25.75 ft) ◇ Monitoring Well Installed by I.T. Corp (1985) with Water Elevation (ft above mean sea level)
- MW-8 (18.13 ft) ⊕ Monitoring Well Installed by ENSR (1989) with Water Elevation (ft above mean sea level)
- MW-13 ⊗ Monitoring Well Installed by Ebasco Environmental (1992, 1993)
- HP-5 ▲ Hydropunch Boring Location by Ebasco Environmental (1993)
- Groundwater Flow Lines

Note: Groundwater Elevations Provided for Monitoring Wells Screened Exclusively within the Old Dune Sand Aquifer

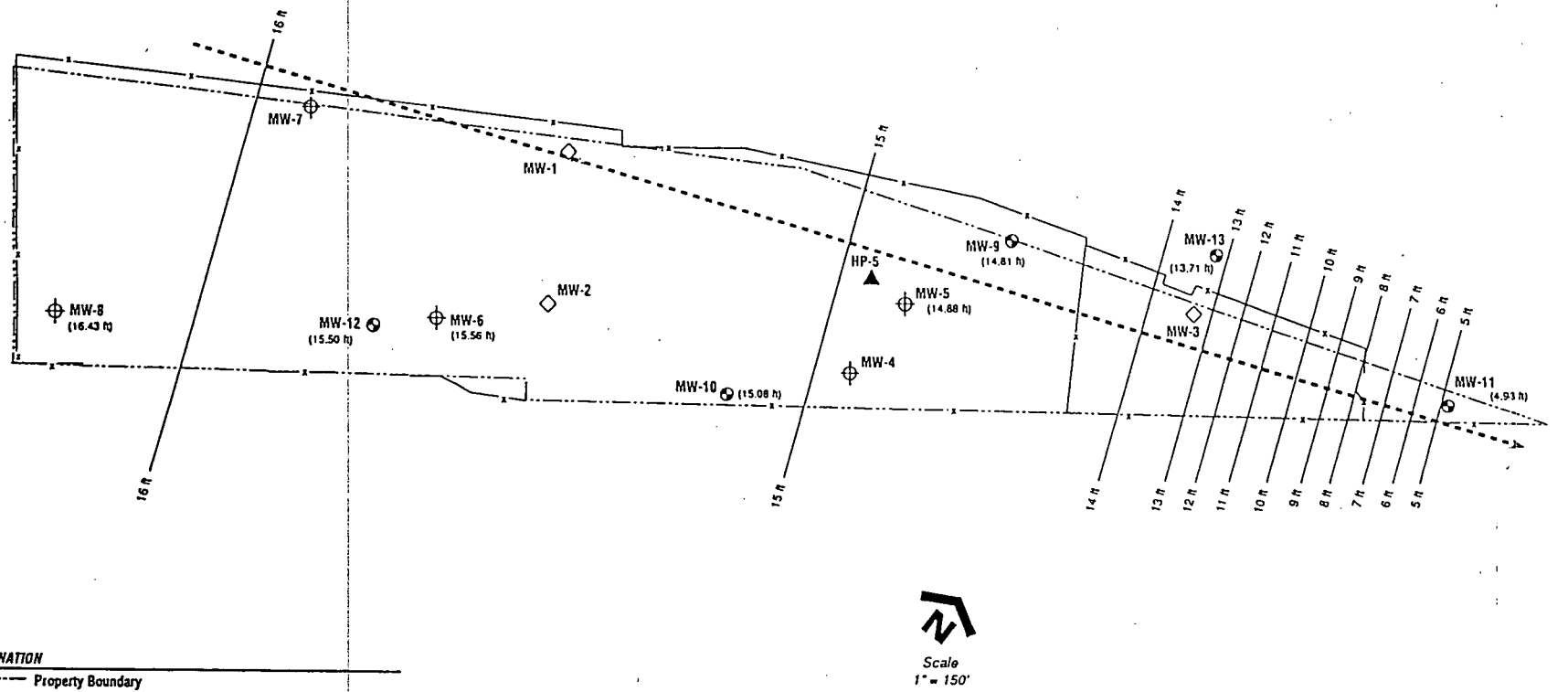
N

Scale
1" = 150'

FIGURE 5

Groundwater Contour Map -
Old Dune Sand Aquifer
August 26, 1993
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California



EXPLANATION

- Property Boundary
- Fence
- MW-3 ◇ Monitoring Well Installed by I.T. Corp (1985)
- MW-8 ⊕ Monitoring Well Installed by ENSR (1989) with Water Elevation (ft above mean sea level)
- MW-13 (13.71 ft) Monitoring Well Installed by Ebasco Environmental (1992, 1993) (ft above mean sea level)
- HP-5 ▲ Hydropunch Boring Location by Ebasco Environmental (1993)
- Groundwater Flow Lines

Note: Grounwater Elevations Provided for Monitoring Wells Screened Wholly or Partially within the Gage Aquifer.

FIGURE 6

Groundwater Contour Map - Gage Aquifer
August 26, 1993
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

abandoned. An asphalt concrete cap is recommended in order to facilitate effective utility for the Property. The basis for this cap design is presented in Section 3 of this report.

3.0 ASPHALT CONCRETE (AC) CAP

This proposal presents the design basis for an asphalt concrete (AC) cap. The slag pile placement and configuration will be based on design criteria, regulatory requirements, and cost. More specifically, the design will consider grading and retainment requirements; synthetic liner, base material and drainage materials; paving and subsequent base materials; excavation, grading, backfill, and final grade and elevation; surface drainage; and protection of light rail footings.

3.1 ASSUMPTIONS AND REQUIREMENTS

The objectives of the cap are to minimize precipitation infiltration of the slag pit area to protect the underlying aquifers from potential leachate of metals, and to eliminate all reasonably likely exposure pathways to chemicals of concern (COC).

The basis of the design is to provide a cap meeting the regulatory requirements (40 CFR 264, Subpart N). The requirements specify that the final cover be designed and constructed to:

- provide long-term minimization of migration of rainfall and surface runoff through the site;
- function with minimum maintenance;
- promote drainage and minimize erosion or abrasion of the cover;
- accommodate settling and subsidence so that the cover's integrity is maintained;
- have a permeability less than or equal to 10^{-7} cm/sec.

The required input data for analysis of the cap are:

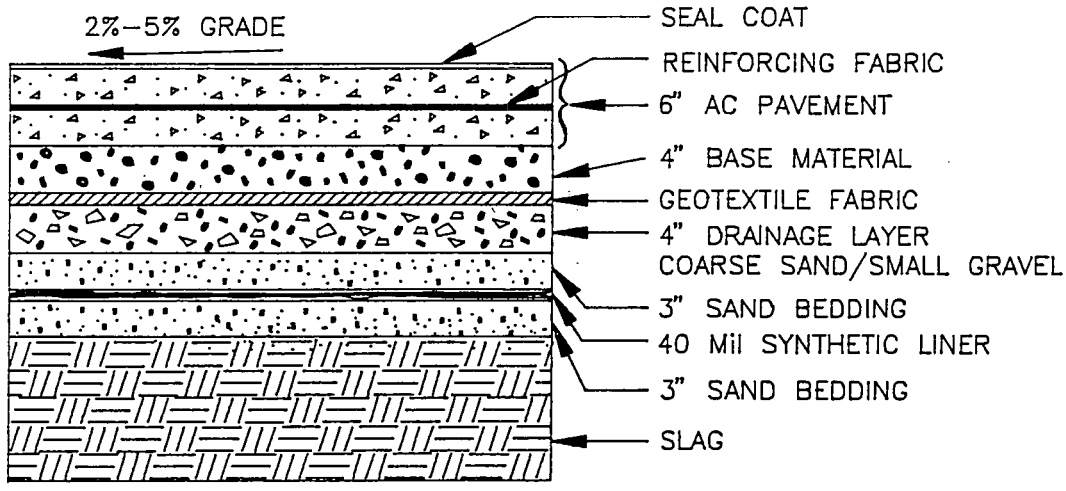
- Los Angeles County Flood Control District's Hydrology Manual (1991), and California Department of Water Resources precipitation data for LAX to determine surface runoff;
- site stratigraphy;
- unit weights of materials used in capping;
- total and differential settlement in the waste pile due to the additional load of the cap over the slag pit area;
- equivalent permeability of the cap system that is less than or equal to the permeability of the underlying natural subsoils;
- AC cap designs based on State of California Department of Transportation (CALTRANS) and American Association of State Highway and Transportation Officials (AASHTO) specifications.

An asphalt concrete cap will be both useable and accessible for potential future occupants while remaining cost effective. In addition, the design of the AC cap will allow for easy access to the light rail system footings for the Los Angeles Metro Light Rail System.

Figure 7 illustrates the AC cap design system, which consists of the following:

- three-inch-thick sand bedding for synthetic liner;
- 40 mil thick synthetic liner with permeability less than or equal to 10^{-12} cm/sec;

AK, 10-27-93



NOT TO SCALE

FIGURE 7

ASPHALT CONCRETE (AC) CAP

BASIS OF DESIGN REPORT
H. KRAMER SITE
EL SEGUNDO, CALIFORNIA

PLSC:1=16, CHEV-25

- three-inch-thick sand bedding for drainage layer material with permeability greater than or equal to 10^{-5} cm/sec;
- four-inch-thick drainage layer - coarse sand or small gravel with permeability greater than or equal to 10^{-3} cm/sec;
- geotextile fabric - openings small enough to prevent clogging of drainage layer;
- four-inch-thick base material;
- six inches AC pavement with a pavement reinforcing fabric at the mid-point;
- seal coat covering the AC pavement.

The equivalent permeability of the AC cap system is given by the following equation:

$$K_{equivalent} = \frac{ThicknessofCapSystem}{\sum \frac{thicknessofeachlayerofcapsystem}{permeabilityofrespectivelayer}}$$

$K_{equivalent}$ = ***permeability of the cap system through all layers***

$$K_{equivalent} = \frac{1.41}{\frac{0.00333}{10^{-12}} + \frac{0.25}{10^{-5}} + \frac{0.333}{10^{-3}} + \frac{0.333}{10^{-1}} + \frac{0.5}{10^{-5}}}$$

$$= 4.23 \times 10^{-10} cm/\text{sec}$$

3.2 DESIGN CRITERIA

Based on the evaluations of field investigations and capping material specifications, the maximum total and differential settlements in the slag pile resulting from the additional loads imposed by the cap system will be estimated. The stress increase in the materials constituting the slag pile will be determined by the use of VSTRESS, a computer software program which applies the classical Boussinesque stress distribution analytical method. The computed stress increase will be used to calculate the elastic or immediate settlements. Since the sieve analyses of the slag and the underlying soils indicate the materials to be granular in nature, consolidation settlement is not a design concern. The calculation of the immediate settlement is a function of the cap width, elevation of the groundwater table, and the modulus of subgrade reaction within the depth affected by the cap loading. The calculation will be in accordance with NAVFAC DM-7.1, Soil Mechanics, published by the Department of the Navy, which is a standard design manual used in the field of geotechnical engineering. The bearing capacity will be determined in accordance with NAVFAC DM-7.2, Foundations and Earth structures, published by the Department of the Navy. Slope stability analysis will be performed for the most critical cross-section of the cap using the STABL computer program developed by Purdue University.

The internal friction angles of the cap system will be estimated from published literature data for the following granular materials: the three-inch sand bedding for the liner, the three-inch

sand bedding for the drainage layer, the four-inch drainage layer and the four-inch base layer. These values will be based on the relative densities given the compactive effort to be specified for construction. The interface friction between the liner and the sand bedding, and the geotextile fabric and the base layer will be estimated from the vendors' specifications and other published literature. The interface friction between the AC pavement and the base layer will be assumed as 3/4 of the angle of internal friction of the base layer.

The design criteria will be as follows:

Bearing Capacity:	Minimum factor of safety = 3
Slope Stability:	Minimum factor of safety = 1.3
Settlement:	Differential settlement not to exceed 90% of the tensile capacity of the synthetic liner as measured by the seam strength with a factor of safety = 2.5
Cap Deck Slopes:	Minimum 2%, Maximum 5% after settlement
Slag Pile Side Slopes:	3 horizontal to 1 vertical
Permeability:	The equivalent permeability of the cap system will less than 10^{-7} cm/sec.
Soil erosion:	The normal criterion of the cover soil erosion limitation of 2 tons/acre/year is not applicable as an AC cover will be applied.
Drainage:	Assumes a final cap area of approximately three acres (850 feet by 150 feet) with a cap deck slope of 2% to 3% and slag pile side slopes of 3 horizontal to 1 vertical. Collection of storm water in an asphalt concrete ditch will be required at the north and south sides of the capped slag pile. Sheet pile retention may be required in some areas to facilitate the slag pile configuration; this will be determined in the capping design phase.

In accordance with the Los Angeles County Department of Public Works policy, the storm runoff drainage and collection system for the cap will be designed for the Urban Flood, defined as runoff from a 25-year frequency design storm falling on a saturated watershed (Los Angeles County Department of Public Works Hydrology Manual, 1991). Preliminary calculations using the County's Rational Method methodology for watershed with areas less than 100 acres as well as the rainfall intensity data published in the Hydrology Manual, indicate a design peak runoff rate of 12.1 cfs and a corresponding time of concentration of five minutes. It is important to note that these calculations are based on numerous assumptions regarding the final cap configuration. While the County's Small Developed Drainage Area Method is a highly simplified method that tends to result in peak flow rates larger than those calculated from the Rational Method, no assumptions other than watershed area are required; this method indicates an Urban Flood peak runoff flow rate of 11.5 cfs for a watershed area of three acres.

California Department of Water Resources precipitation data indicate a 25-year storm, 24-hour rainfall of 4.98 inches and a 25-year storm, 2-hour rainfall of 2.03 inches for the Los Angeles area.

The asphalt concrete cap loading design will be based on CALTRANS and AASHTO procedures using the following assumptions: ten 4-axle trucks (1-32k dual tire - tandem axle, 2- 20k dual tire - single axle, and 1-20k single tire, single axle) per day over 20 years, resulting in an equivalent axle loading (EAL) of 3.93×10^5; a terminal serviceability factor for low traffic loads; and a soil support value based on a subgrade predominantly comprised of sand and gravel.

The asphalt concrete cap materials (aggregate and bituminous), seal and tack coats, mix designs, course placement, joints, compaction and finishings, and pavement reinforcement fabric shall conform to the California Department of Transportation standard specifications, Sections 37, 39, and 88, respectively.

The geotextile fabric and synthetic liner, as placed beneath the AC cap (see Figure 8), shall be constructed of multi-layered, alloyed, high-density polyethylene or similar material to prevent bacterial/fungal transmittivity and to be UV stable.

During excavation, backfilling and grading, active dust control will be practiced and monitored to prevent wind-blown dust. Portable monitoring equipment will be strategically located around the site and active dust control will be accomplished with a water truck.

3.3 SLAG PILE CONFIGURATION

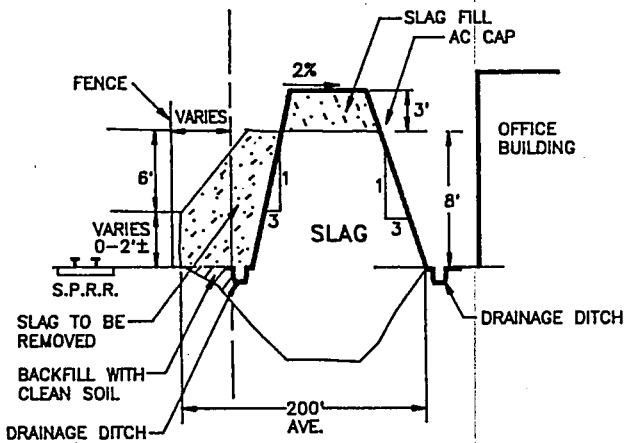
Analysis of the slag pile assumes that the existing slag pile length is 850 feet with a width of 150 feet. Also, the average depth of slag above grade is 8 feet and below natural grade is assumed to be 15 feet based on topographic mapping, visual field and existing boring data observations.

Effective slag spreading area appears to be approximately 3.0 acres in the general area currently covered by slag. The visual inspection of the slag pile surface showed that the slag over this area is interlaced with organic and inorganic debris. Organic debris mixed with the slag appears to constitute less than five percent by volume. Inorganic debris may run from 10 to 15 percent by volume and is inert. Subsurface determinations for these percentages were made from boring logs and monitoring well logs, as illustrated in Figure 2.

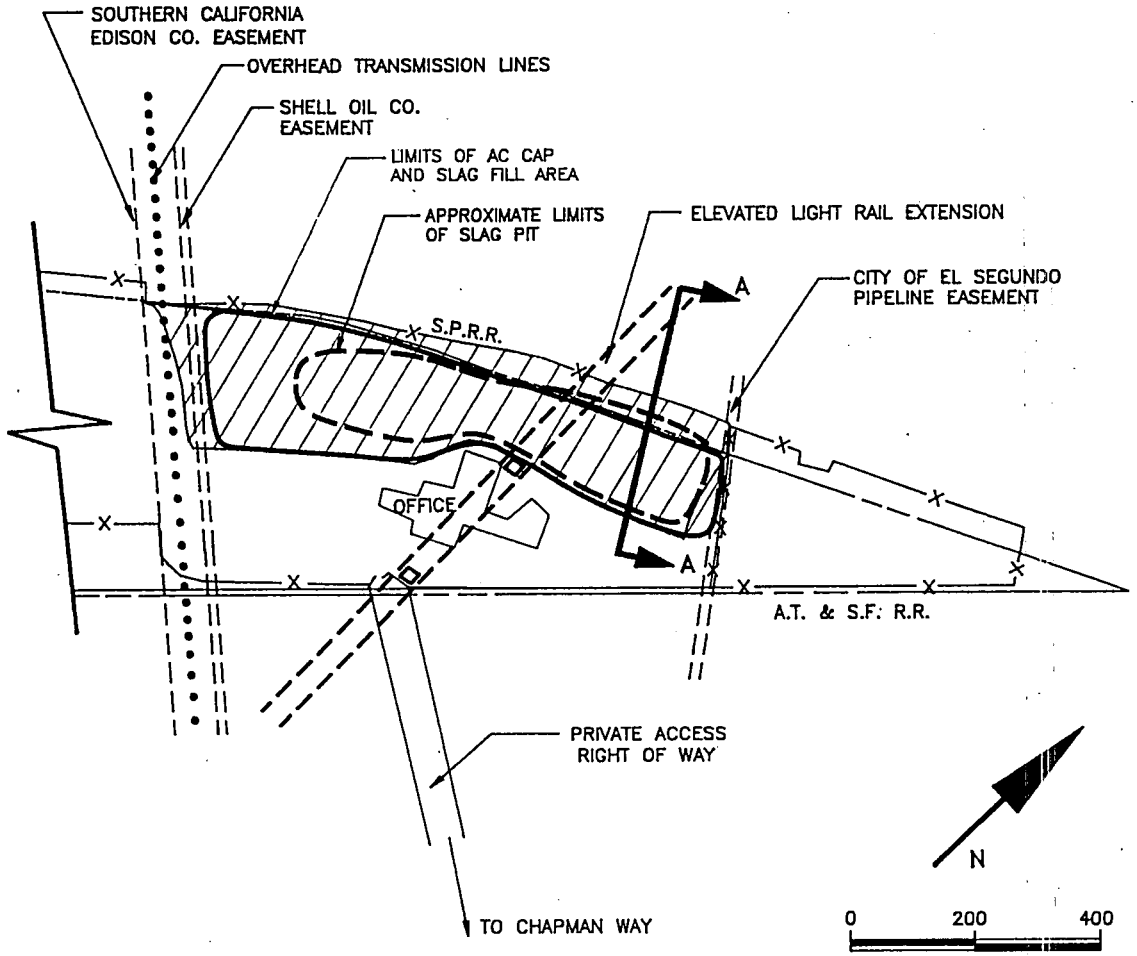
Major large pieces of organic debris such as exposed wood boards and tree trunks will be removed. The current existing slag area surface will be raked to extract wood pieces in the top 12 inches of the slag pile prior to any grading or excavating. The remaining organics (wood), if any, within the slag pit will pose no fill settlement problem due to decomposition because the AC cap over the slag pile/pit area will keep water from seeping into the subsurface and thus prevent small wood pieces from decomposing, causing voids and later settlement. Decomposition under anaerobic conditions requires a moisture content of at least 50 percent (analogous to composting). The AC cap design with a permeability equivalent of 4.23×10^{-10} cm/sec will prevent precipitation from percolating (leaching) into the pile area.

Slag placement and capping will not encroach the Shell Oil Company pipeline easement that parallels the Southern California Edison Company transmission line easement on its west boundary or the Los Angeles light rail transit system footings located south of the existing slag pile.

The proposed slag pile capping configuration contemplates pulling back the existing slag pile and grading it so that the peripheral slag pile sides have a slope of 3 horizontal to 1 vertical. The peripheral side slopes will toe into a AC drainage ditch on the northwest and southeast sides of the graded slag pile. This configuration will generate approximately 9,500 cubic yards of slag to be placed uniformly on top of the existing slag deck, as shown in Figure 8, Section A-A, and will provide an average slag thickness above grade of 11 feet.



SECTION A–A
NTS



EXPLANATION

EXISTING SLAG AREA

PROPERTY LINE

FENCE LINE

FIGURE 8
SLAG PILE AC CAP DESIGN
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

4.0 DESIGN PHASE REQUIREMENTS

This section presents the AC cap engineering design phase requirements covering the necessary engineering drawings, engineering specifications, permits, groundwater monitoring plan, site-specific health and safety plan, and an engineering design schedule in addition to a tentative construction schedule.

4.1 ENGINEERING DRAWINGS

The engineering design phase will provide the following set of engineering drawings as part of a construction bid package:

- Sheet 1 - cover sheet, showing contents, site vicinity and location map
- Sheet 2 - project description, general notes, abbreviations and general legend and symbols
- Sheet 3 - existing site plan and conditions
- Sheet 4 - site grading and paving plan
- Sheet 5 - grading and paving section profiles
- Sheet 6 - surface drainage and storm drainage plan and profiles
- Sheet 7 - miscellaneous details and notes
- Sheet 8 - miscellaneous details and notes

4.2 SPECIFICATIONS

Specifications for the AC cap design will supplement the engineering design drawings and follow the Construction Specification Institute (CSI) specifications format that are commonly used by Ebasco and the construction industry. A listing of the specifications expected in the AC cap design follow.

DIVISION 1: GENERAL REQUIREMENTS

Summary of Work
Measurement and Payment
Field Engineering
Regulatory Requirements
Health and Safety Requirements
Pre-Construction and Pre-Work Conference
Submittals
Site-Specific Quality Management Plan
Construction Quality Control
Mobilization/Demobilization
Temporary Site Facilities and Utilities
Security
Temporary Controls/Environmental Protection
Dust Control

Erosion and Sediment Control
Spill Control
Equipment and Materials Handling
Off-Site Transportation and Disposal
Project Closeout
Project Record Documents
As-Built Drawings

DIVISION 2: SITE WORK

Pavement Removal
Excavation
Rough Grading
Backfill and Grading
Trenching
Aggregate Base Course
Asphaltic Concrete Paving
Storm Drainage System

DIVISIONS 3 THROUGH 12: Not Used

DIVISION 13: SPECIAL CONSTRUCTION

Synthetic Liner

4.3 PERMITS AND AGENCY COORDINATION

The following permits will be required:

- Excavation and grading permit from the City of El Segundo Building Department. This permit will cover grading, excavation, backfill and sheet piling.
- Storm drain permit from the City of El Segundo Drainage Department if site drainage will connect to El Segundo's storm drain.
- Storm drain permit from the Los Angeles County Department of Public Works if site drainage will connect to the Los Angeles County Flood Control District's storm sewer.
- Paving permit from the City of El Segundo if street excavation and resurfacing is required for any storm drain construction.

It is recommended that a meeting with City of El Segundo engineering and building departments be held early in the design phase to better facilitate their specification and standard drawing requirements. Also, coordination should be established with the Los Angeles Metro Light Rail System to define any restrictions and requirements that relate to the System's two structural footings on the Property.

4.4 GROUNDWATER MONITORING PLAN

A groundwater monitoring plan will be prepared that will outline post-capping sampling procedures, analytical requirements, monitoring frequencies over time, and quality assurance and control procedures.

4.5 HEALTH AND SAFETY PLAN

A site-specific health and safety plan (SSHSP) will be prepared as part of the engineering specifications. This plan will be implemented during the construction period at the Kramer site. Certain elements of the SSHSP will be contractor-specific, such as names of personnel working on-site and verification of their associated medical records which will require addition to the SSHSP prior to the initiation of construction.

The SSHSP will include the following elements:

- staff organization and responsibilities
- description of the site
- hazard assessment and risk analysis
- accident prevention
- identification of action levels
- health and safety training/medical surveillance requirements
- personal protection
- site control/work zone delineation
- decontamination procedures
- emergency response plan and contingency plan for the site personnel and local affected population
- standard operating procedures and work practices
- record-keeping procedures

4.6 CONSTRUCTION SCHEDULE

The engineering design phase will commence upon approval of the Basis of Remedial Design Report by the RWQCB. The following schedule is anticipated:

RWQCB approval	December 15, 1993
engineering design and specification	December 15, 1993 (start)
submittal to agencies	February 21, 1994
construction bidding and contractor award	March 2 through 30, 1994
construction start-up	March 31, 1994
construction completion	July 29, 1994

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ENVIRONMENTAL

SUPPLEMENTAL SITE INVESTIGATION NOVEMBER/DECEMBER 1992

FOR
H. KRAMER & COMPANY SITE
EL SEGUNDO, CALIFORNIA

JANUARY 1993

A Division of Ebasco Services Incorporated
120 MONTGOMERY STREET • SUITE 715
SAN FRANCISCO, CA • 94104-4310
(415) 249-0831 • (415) 249-0931 FAX

EBASCO

January 14, 1993

Mr. James E. Ross, Unit Chief
Site Cleanup Unit
California Regional Water Quality Control Board
Los Angeles Region
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

RE: H. KRAMER & CO. SITE, EL SEGUNDO, CALIFORNIA
SUPPLEMENTAL SITE INVESTIGATION

Dear Mr. Ross:

Enclosed please find Ebasco's report on the subject investigation, including boring logs, well construction details, and laboratory data. It is our understanding that you will be meeting with our staff to discuss results and conclusions of this report on January 20, 1993; we look forward to such meeting.

Yours truly,

Glenn Piehler
Manager, San Francisco Operations

cc: R. W. (Bill) Potter, Chevron
L. Sutton, Alschuler et al.
R. Tweidt, SNA

GP:slk 14jan01

EBASCO ENVIRONMENTAL *A Division of Ebasco Services Incorporated*
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H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

SUPPLEMENTAL SITE INVESTIGATION
NOVEMBER/DECEMBER 1992

Prepared By

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
120 Montgomery Street, Suite 715
San Francisco, California 94104

January 1993

2

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

Supplemental Site Investigation
November/December, 1992

EXECUTIVE SUMMARY

INTRODUCTION

In November 1992, Ebasco Environmental performed a supplemental site investigation of the geology and groundwater beneath the H. Kramer & Company site in order to further assess certain issues identified during performance and review of a public health risk assessment first issued in May 1992. Specifically, while it is known that shallow groundwater is regionally contaminated and (therefore) not suitable for human consumption, the purpose of this investigation was to further assess and/or validate the bounds of local groundwater contamination and the competency of known regional aquicludes.

BACKGROUND

The H. Kramer site is located on industrially zoned property in the city of El Segundo, California. Industrial activity ceased here in 1985. Currently, new construction has restricted further use of the site (overhead electrical transmission lines and Los Angeles light rail spur). H. Kramer operated a brass foundry at the site from 1951 through mid-1985. Slag generated from site operations was disposed in a waste pile, filling and now extending beyond a waste lagoon used by Kramer's site predecessor, Harshaw Chemical Company. Harshaw generated, in the process of manufacturing ammunition casings, wastes which contained heavy metals (in particular arsenic).

Arsenic and other metals, as well as volatile organics, were detected in previous investigations conducted for H. Kramer by IT Corporation in 1985 and ENSR Corporation in 1989. Three groundwater monitoring wells were installed around the slag pile by IT; five more were completed by ENSR, providing coverage of the entire site. In addition, ENSR performed a wide range of additional soil borings, sample analyses, and site stabilization tasks.

The sampling results from these previous studies revealed patterns of arsenic presence which could not be explained in terms of geology and hydrology as inferred from the boring logs and water level measurements. Hence, since site-specific logs failed to validate generally assumed stratigraphy, especially continuity of the Bellflower Aquiclude separating the upper (Old Dune Sand) and lower (Gage) aquifers, the present study was performed. Objectives of this study were to: provide additional detail on the local stratigraphy; to verify previously reported groundwater quality results; to bracket (in the Gage Aquifer) the point of highest arsenic concentrations previously reported (MW-5); and to further assess boundary conditions upgradient and downgradient of the waste pile.

SCOPE OF WORK

In this study, two new monitoring wells (MW-9 and MW-10) were completed and screened within the Gage Aquifer at depths between 90 and 115 feet below ground surface [approximately 0 to -20 ft mean sea level (msl)]. A reverse-air percussion hammer drill was used to drive casing as drilling proceeded in order to prevent cross-contamination of groundwater between the Old Dune Sand and Gage Aquifers. Standard penetration tests were performed and soils were taken from split-spoon samplers to prepare logs according to the Unified Soils Classification System. Borings MW-9 and -10 were converted to four-inch I.D. PVC monitoring wells according to a work plan approved by the Los Angeles Regional Water Quality Control Board.

Following development of the two new wells, all monitoring wells (MW-1 through MW-10) were sampled for analysis of general minerals and dissolved arsenic. Depth to water table measurements were also measured to determine groundwater gradients. Samples from wells MW-5, -6, -8, -9 and -10 were also analyzed for volatile organic compounds. In addition, two samples of slag were taken from a location in the northwest part of the slag pile, in the top five feet, to verify previously reported incidence of hexavalent chromium (results were negative). [Complete details of the present scope of work are presented in Section 3.0 of this report.]

RESULTS

Boring observations/logs for new MW-9 and -10 revealed presence of a competent clay layer between 10-15 feet above msl at those locations (i.e., about 80-85 feet below ground surface). This layer is representative of the Bellflower Aquiclude (Also known as Manhattan Beach Formation), which generally separates the Old Dune Sand and Gage Aquifers. Presence of the Bellflower was also noted at the terminus of IT logs for MW-1, -2, and -3. The Bellflower Aquiclude was also seen within ENSR logs for MW-4, -5 and -8. However, in MW-6 its presence was not specifically identified, possibly due to sample intervals (five-foot spacings) within the boring.

Hydrogeologically, water level measurements indicate the presence of two aquifers beneath the site (Old Dune Sand and Gage), with evidence of possible hydraulic connection in the area of MW-2, -6, and possibly -8. The Old Dune Sand Aquifer contours suggest a southwesterly flow; the Gage Aquifer contours, a northeasterly flow. Possible hydraulic connections in the southwest part of the site notwithstanding, the difference in elevations between Old Dune Sand and Gage Aquifer wells in the area of the slag pile are pronounced enough to support this conclusion.

Chemical results confirmed presence of dissolved arsenic above the detection limit (0.01 mg/l) in eight of the ten monitoring wells. Concentrations of arsenic ranged from 0.017-8.70 mg/l, except for MW-5, where concentrations in excess of 100 mg/l have been recorded both in 1989 and the present study. This incongruously high level is still difficult to explain relative to the distribution of arsenic in surrounding wells in both aquifers. If it does reflect residual well construction-related difficulties and/or local anomalies in the Bellflower Aquiclude, it is most likely a very localized situation.

Volatile organic compound results for samples taken in the Gage (MW-5, -9, -10) and/or Gage and Old Dune Sand Aquifers (MW-6 and -8) attest to the general nature of the groundwater problem in the region. Samples from MW-6, -8, and -10 all had concentrations of volatile organics exceeding state maximum containment levels (MCLs), and none of these compounds are considered to be related (spatially or functionally) to historic operations at the site.

CONCLUSIONS

Results of this study confirm the presence of two aquifers (Old Dune Sand and Gage) beneath the site; presence of a competent Bellflower Aquiclude in MW-9 and -10 locations; and presence of arsenic in eight of ten wells. Results of VOC sample analyses in monitoring wells (MW) -5, -6, -8, and -10 confirm regional contamination (including Gage Aquifer) by various VOCs. Results of hexavalent chromium analysis for two slag samples (0.5- and 5-foot depths) refuted previously reported presence of Cr IV at that location.

Analysis of boring logs for MW-6 and -8 indicate that the screened interval for these wells bracketed both aquifers, apparently creating hydraulic connections, competency of the Bellflower Aquiclude notwithstanding at those locations. The log for MW-6 did not reveal presence of the Bellflower, but logging observation intervals may have bracketed and therefore missed a clay layer which could be as much as 2-3 feet thick.

The single most important issue which remains poorly understood is that of the high arsenic concentrations noted in MW-5 in both ENSR's and Ebasco's work. These values (> 100 mg/l) are anomalous and extremely difficult to reconcile with the rest of the values, be they representative of the Old Dune Sand *or* Gage Aquifers. Otherwise, results show an area of groundwater beneath the site which contains from 0.017 to 8.7 mg/l arsenic. Resolution of the incongruous result from MW-5 remains to be determined, as does accuracy and precision of plume maps presented herein.

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

SUPPLEMENTAL SITE INVESTIGATION
NOVEMBER/DECEMBER 1992

Prepared By

EBASCO ENVIRONMENTAL
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120 Montgomery Street, Suite 715
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January 1993

Reviewed By: _____
Mark Cutler, R.G. #4487

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

SUPPLEMENTAL SITE INVESTIGATION
NOVEMBER/DECEMBER, 1992

TABLE OF CONTENTS

SECTION		PAGE
1.0	INTRODUCTION	1
1.1	PURPOSE AND OBJECTIVES	1
1.2	SITE BACKGROUND	1
1.2.1	Site Description	1
1.2.2	Site History	3
1.2.3	Previous Investigations	3
2.0	FIELD ACTIVITIES	3
2.1	DRILLING AND SAMPLING	5
2.1.1	Soil Sampling	5
2.1.1.1	Chromium Sampling	5
2.1.2	Groundwater Monitoring Well Installation	5
2.1.3	Well Development and Sampling	7
3.0	LABORATORY ANALYSIS	7
4.0	RESULTS	8
4.1	GEOLOGY	8
4.2	HYDROGEOLOGY	8
4.3	GEOCHEMISTRY OF GROUNDWATER	13
5.0	HEALTH AND SAFETY SUMMARY	16
6.0	SUMMARY AND CONCLUSIONS	20
6.1	SUMMARY	20
6.1.1	Nature and Extent of	20
6.1.2	Fate and Transport	21
6.2	CONCLUSIONS	21

7

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

SUPPLEMENTAL SITE INVESTIGATION
NOVEMBER/DECEMBER, 1992

LIST OF TABLES

Table 1: Well Construction Details 6
Table 2: Arsenic and VOC Concentrations in Groundwater 15

LIST OF FIGURES

Figure 1: Site Location Map 2
Figure 2: Site Plan 4
Figure 3: Groundwater Contour Map-Old Dune Sand Aquifer 11
Figure 4: Groundwater Contour Map-Gage Aquifer 12
Figure 5: Stiff Diagrams 14
Figure 6: Arsenic Concentrations Within Old Dune Sand Aquifer 17
Figure 7: Arsenic Concentrations Within Gage Aquifer 18
Figure 8: TCE Concentrations Within Gage Aquifer 19

LIST OF DRAWINGS

Drawing No. 1: Geologic Cross-Section A-A' 9
Drawing No. 2: Hydrogeologic Cross-Section A-A' 10

APPENDICES

Appendix A: Lithologic Logs
Appendix B: Well Construction Logs
Appendix C: Development/Sampling Logs
Appendix D: Laboratory Reports

8

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

SUPPLEMENTAL SITE INVESTIGATION
NOVEMBER/DECEMBER, 1992

1.0 INTRODUCTION

This report describes a supplemental site investigation performed by Ebasco Environmental (Ebasco) at the H. Kramer & Company (H. Kramer) site located in El Segundo, California. The investigation was performed at the request of the Los Angeles Regional Water Quality Control Board ("Board"), as a second step in the process of assessing present and potential future public health risks, and appropriate levels of remedial action. A risk assessment was performed by Ebasco in May 1992 which concluded that risks were marginal and controllable, especially in view of the fact that groundwater in the site vicinity is regionally contaminated by a variety of sources, and no production wells occur within a mile of the site.

The present investigation is one of several initiatives now being taken pursuant to a Cleanup and Abatement Order (No. 92-094) from the Board dated December 28, 1992, issued under Section 13304 of the California Water Code.

1.1 PURPOSE AND OBJECTIVES

The purpose of this study was to further evaluate the quality of the Old Dune Sand and Gage aquifers beneath the Kramer site. Both aquifers are affected by a host of regional water quality impacts which preclude beneficial use of the water. However, to the extent that historical activities at the Kramer site might have added, on a local scale, to this situation, objectives were to: evaluate groundwater quality; evaluate the competency and continuity of potential aquicludes (re contaminant migration); and establish groundwater gradients and flow direction. A minor objective was to validate whether incidence of hexavalent chromium in one slag sample was, in fact, an anomaly.

1.2 SITE BACKGROUND

1.2.1 Site Description

The H. Kramer site is located within the city of El Segundo, California (Figure 1). It is bounded on the north side by the Southern Pacific Railroad line and the Atchison, Topeka and Santa Fe Railroad line to the south. Douglas Street borders the east side of the site and open undeveloped lands exist to the west. The H. Kramer facility has not been active since mid-1985 when the company ceased operations in California. Construction of a high voltage transmission power line and an extension of the Los Angeles light rail transit system across the central and northeast portions of the property, respectively, has recently been completed. The presence of

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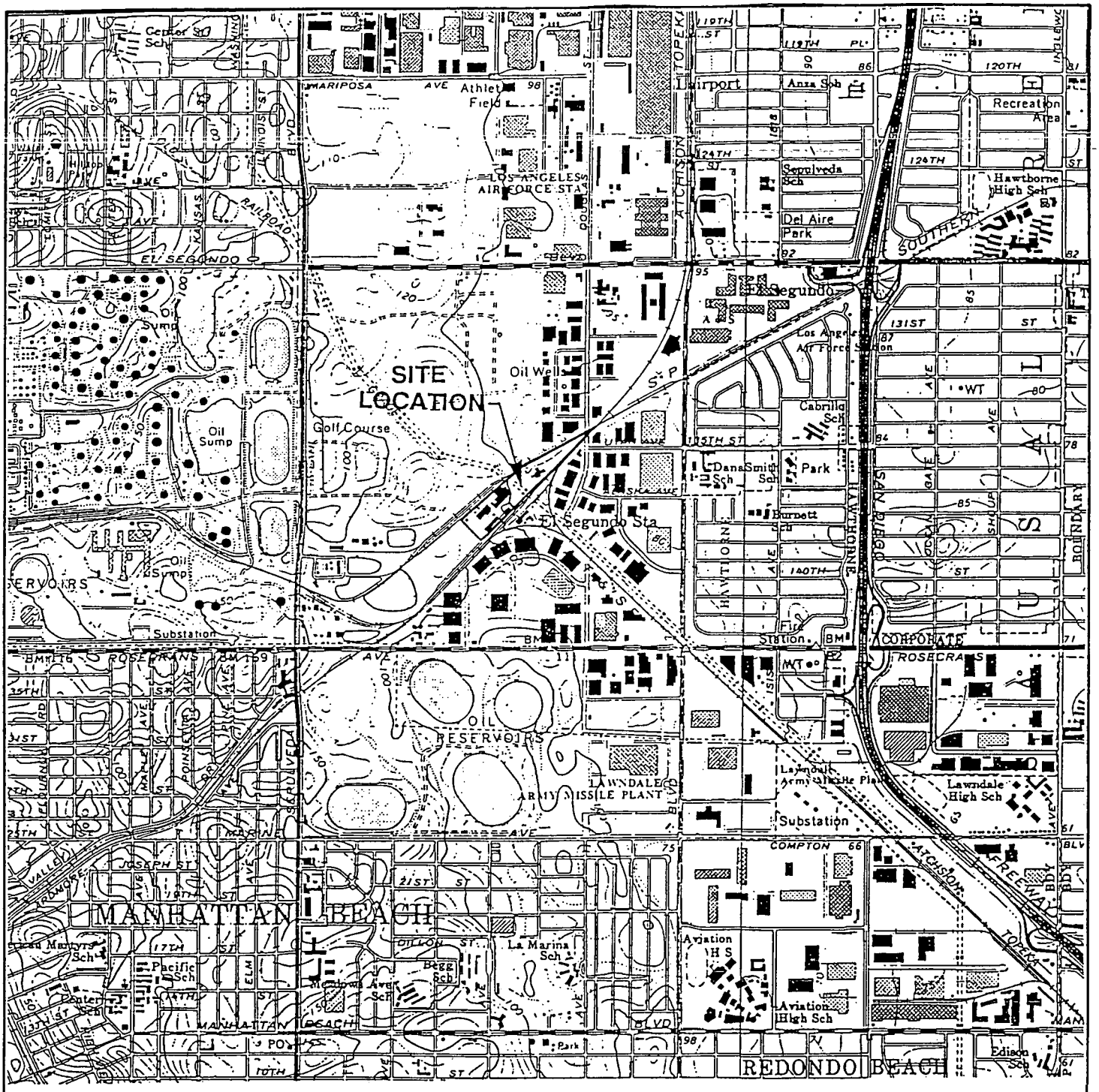

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SCALE IN MILES

FIGURE 1

SITE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981

these two features will further restrict opportunities for future property use.

1.2.2 Site History

H. Kramer operated a brass foundry at the site from 1951 through mid-1985. The layout of the site showing key features is shown in Figure 2. Of particular note to this report is the slag pile located in the northeast corner of the property. This pile is roughly 35,000 cubic yards in volume. The slag pile occupies a former surface lagoon which was used by Harshaw Chemical Company (Harshaw), the previous owner and occupant of the site. The lagoon was used to dispose of wastes (containing heavy metals) generated during the manufacturing of ammunition casings. Initial subsurface investigations by International Technology Corporation (IT) (1985) and ENSR Corporation (1989) have detected arsenic in soil and groundwater in several monitoring wells on site.

1.2.3 Previous Investigations

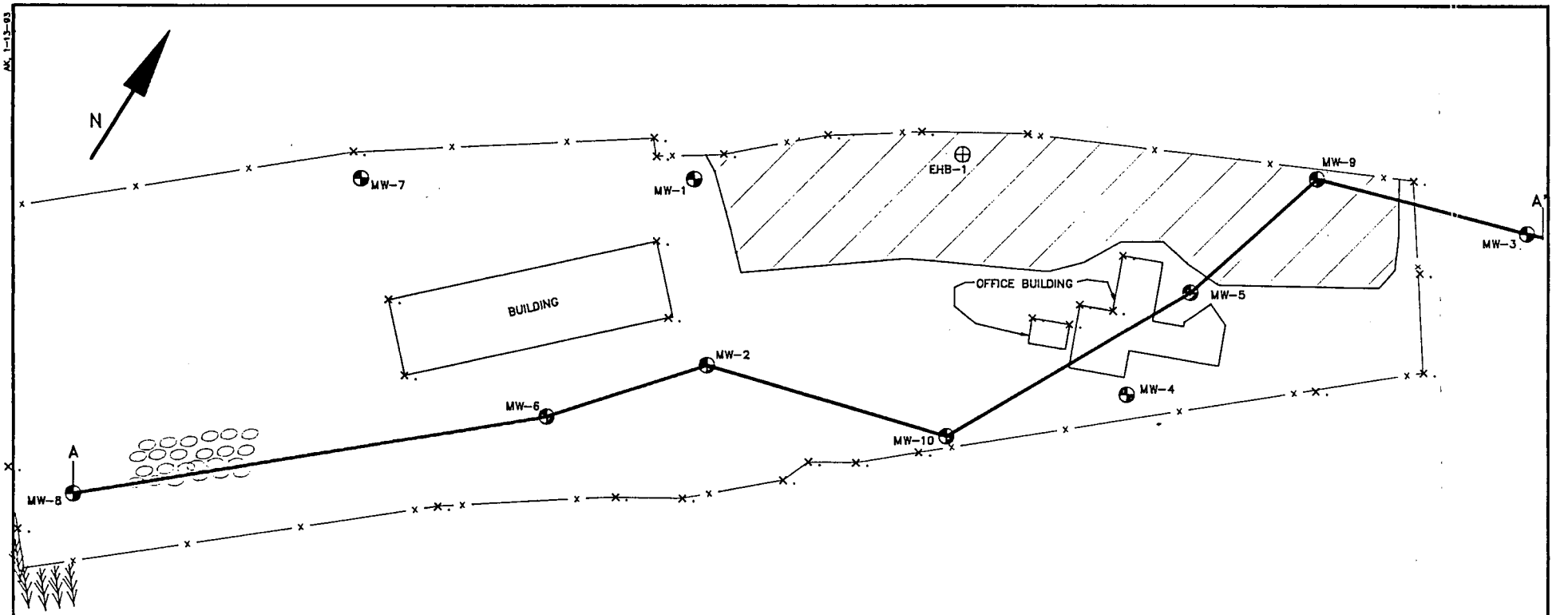
ENSR Consulting and Engineering performed the principal subsurface investigation of the H. Kramer site in November, 1989. During this investigation nineteen subsurface borings were drilled, five of which were converted into monitoring wells. Soil analyses collected from the slag pile indicated that lead, copper, and zinc exceeded both the TTLC and the Soluble Threshold Limit Concentrations (STLC) set by the State. Arsenic was detected above TTLC limits within several soil samples collected at the interface between the overlying slag and underlying native soil. Several exceeded ten times the STLC, but no Waste Extraction Test (WET) was performed upon these samples. No soil samples below the soil/slag interface exceeded the TTLC for arsenic.

Results of ENSR's groundwater sampling and analysis revealed the presence of arsenic in six wells, most notably monitoring well (MW) -5, located between the office building and the slag pile (see Figure 2). Arsenic concentration in MW-5 exceeded 100 mg/l, well above all other readings (which were <10 mg/l).

With the exception of the latter, a previous investigation performed by IT Corporation in 1985, which was of more limited scope (three wells and some soil analyses), provided results similar to ENSR's. Arsenic was found in three shallow groundwater monitoring wells, as were VOCs (TCE, TCA, PCE).

2.0 FIELD ACTIVITIES

This investigation was performed according to a work plan prepared by Ebasco and approved by the Board by letter dated November 5, 1992.



EXPLANATION

SLAG PILE
LOCATION IS APPROXIMATE

EBASCO HAND AUGER

SOIL BORING/MONITORING WELL

PHRAGMITES (vegetation)

55 GALLON DRUMS

A — A' LINE OF GEOLOGIC CROSS-SECTION (SEE DRAWING NO.1)

0 100 200
SCALE IN FEET

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 2

SITE AND SAMPLE LOCATION MAP
SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK 1-13-93

PLSC-FIT, CHEV-13

12

2.1 DRILLING AND SAMPLING

2.1.1 Soil Sampling

Ebasco's subsurface boring activities began on Thursday, November 12, 1992. A Drill Systems AP-1000 reverse-air percussion hammer drill was utilized to drive casing as drilling proceeded to ensure that no cross-contamination of groundwater would occur between the upper Old Dune Sand Aquifer and the lower Gage Aquifer. An 18-inch long by 2.5-inch (I.D.) California Modified split-spoon sampler, containing three 6-inch long by 2.5-inch (O.D.) diameter brass sampling sleeves, was used to collect undisturbed soil samples at selected intervals while drilling for lithologic interpretation and soil analyses.

Standard penetration tests (SPT) were accomplished during sampling with blow counts being recorded on boring logs (Appendix A). Soils were removed from the split-spoon samplers and logged using the Unified Soils Classification System (USCS). Soils from one of the sample sleeves was extruded into a Zip-lock plastic bag to allow any volatile organics within the sample to volatilize. After approximately fifteen minutes, the soil-gas was tested for organic vapors by means of a organic vapor analyzer (OVA). Soil samples collected for analyses were sealed, labelled, placed within a Zip-loc plastic bag and preserved with ice. Soil samples were also collected for the Los Angeles Regional Water Quality Control Board (LARWQCB) and given to their representative (Mr. David Hung), who was present to monitor Ebasco's work and retain split samples for independent analyses by the state.

2.1.1.1 Chromium Sampling

On November 20, 1992, a properly decontaminated hand auger was used to collect two soil (slag) samples from the 0.5-foot and 5-foot depths within hand auger boring EHB-1 (Figure 2). Located in close proximity to former soil boring SB-2, both samples were analyzed for hexavalent chromium using EPA Method 7196. Analytical results indicated that concentrations were below detection limits (0.10mg/Kg) for both samples. Laboratory results are presented within Appendix D.

2.1.2 Groundwater Monitoring Well Installation

Both soil borings were converted into groundwater monitoring wells (MW-9 and MW-10). Each well was constructed with 4-inch I.D. PVC screen and casing. Well locations are shown on Figure 2. Well construction details are summarized in Table 1 and shown in Appendix B. Monitoring well MW-9 was installed at a depth of 114 feet below ground surface (bgs) and is located along the north-west edge of the slag pile. Monitoring well MW-10 was installed at a depth of 111 feet bgs and is located along the north-east side of the H. Kramer site. Both wells were constructed with 0.020 slot PVC screen penetrating the top 20 feet of the lower Gage Aquifer. Number 3 Lonestar filter pack was placed within the annulus between the casing and the borehole and extended several feet above the top of the well screen. Upon installation of the sand pack, the well was swabbed with a 5-foot long bar with a rubber disk attached at the

TABLE 1

WELL CONSTRUCTION DETAILS

Monitoring Wells	Date Drilled	Total Depth (ft)	Monitoring Well Diameter (in)	Screened Aquifers	Screened Interval	Screen Slot Size	Well Material	Reference Elevation (ft above msl)
MW-1	12/02/85	95	4	Old Dune Sand	75-95	NA	PVC	101.91
MW-2	12/04/85	95	4	Old Dune Sand	74-95	NA	PVC	98.90
MW-3	12/06/85	80	4	Old Dune Sand	60-80	NA	PVC	94.22
MW-4	11/20/89	75	4	Old Dune Sand	45-75	0.020	PVC	92.44
MW-5	11/17/89	110	4	Gage	80-110	0.020	PVC	93.00
MW-6	11/16/89	115	4	Old Dune Sand/ Gage	84-115	0.020	PVC	98.26
MW-7	11/16/89	95	4	Old Dune Sand	65-95	0.020	PVC	108.15
MW-8	11/14/89	110	4	Old Dune Sand/ Gage	80-110	0.020	PVC	102.64
MW-9	11/16/92	114	4	Gage	94-114	0.020	PVC	99.46
MW-10	11/12/92	111	4	Gage	91-111	0.020	PVC	93.70

Notes: NA - Not Available

bottom to remove any voids within the sand pack. Sand was then added to return the top of sand pack to the desired level. A 5.5-foot- and a 9.0-foot-thick hydrated 3/8" bentonite pellet seal was placed on top of the filter packs for monitoring wells MW-10 and MW-9, respectively. Volclay grout was tremmied into place from the top of the bentonite seal to groundsurface within the remainder of the open annulus for both monitoring wells to ensure that the two aquifers were properly and competently sealed off from each other. During installation, the depth to the top of the various materials was continually measured, and the volume of materials used was verified against calculated values.

2.1.3 Well Development and Sampling

The two new monitoring wells were developed following their installation. Well development began on November 19, 1992 at MW-10. MW-9 was developed November 20, 1992. Each well was developed to clear the well screen and sandpack of fine-grained material that could possibly reduce the effectiveness of the screen. The monitoring wells were developed by bailing, surging and pumping in accordance with EPA methods.

Well development began by using a development truck to lower a bottom-filling bailer into each well to remove sediment that entered the well during installation. The wells were then surged with a swabbing tool to force water in and out of the well screen, sandpack and surrounding formation. The bailer was used again to remove additional sediments that entered each well during the surging procedure. The surging and bailing operations were repeated until the water in the well was relatively free of large sediment particles.

Once the coarser sediments were removed, a submersible pump was lowered into the well. The wells were purged with the pump until a minimum of three casing volumes were removed and the pH, electrical conductivity, temperature and turbidity of the developed water stabilized and turbidity of the groundwater was less than 5 Nephalometric Units. The information and data collected during purging were recorded on Well Development/Sampling Log Forms, which are included in Appendix C. The developed water was pumped and stored in 55 gallon drums. The 55 gallon drums were labelled with the date, contents and well number.

Prior to sampling, depth to water level measurements were taken using a Solinist conductivity meter. Groundwater samples were collected from the two new wells and the eight existing wells using disposable teflon bailers. MW-4 produced very little water, and hence only arsenic was analyzed due to insufficient sample volume. One trip blank and one field blank were also collected for QA/QC protocol. Split samples for monitoring wells MW-4, -5, -6, -8, -9, and -10 were provided to the LARWQCB for independent analysis.

3.0 LABORATORY ANALYSIS

Groundwater samples collected during the investigation were submitted following Chain-of-Custody procedures to Curtis and Tompkins, Ltd., a state certified laboratory located in Los Angeles, Ca. Samples were analyzed for general minerals (except MW-4) and dissolved arsenic

(EPA Method 6010/7000 series). Groundwater samples were also collected from monitoring wells MW-5, -6, -8, -9, and -10 to be analyzed for volatile organics (EPA Method 8240).

4.0 RESULTS

4.1 GEOLOGY

Drawing No. 1 is a schematic geologic cross-section interpretation of subsurface conditions beneath the H. Kramer site from monitoring well MW-8 to MW-3 along line A-A' (see Figure 2). This interpretation has been compiled from borehole logs generated by various investigations. Based upon this information, the Bellflower Aquiclude (also known as Manhattan Beach Formation) appears to dip at a shallow angle toward the south beneath the property. Within monitoring well MW-3 the Bellflower Aquiclude exists at 25 feet above mean sea level (msl) as a competent clay layer. The vertical thickness of the clay layer varies along the line of projection. Overall, the clay layer appears to thin with a lateral facies change into a clayey silt to silt within the vicinity of monitoring wells MW-2 and MW- 6. Within monitoring well MW-8, the Bellflower Aquiclude reappears as a 1.5 foot-thick clay layer. However, Ebasco's results for new MW-9 and -10 reveal a fairly thick, stiff and competent aquiclude at those locations.

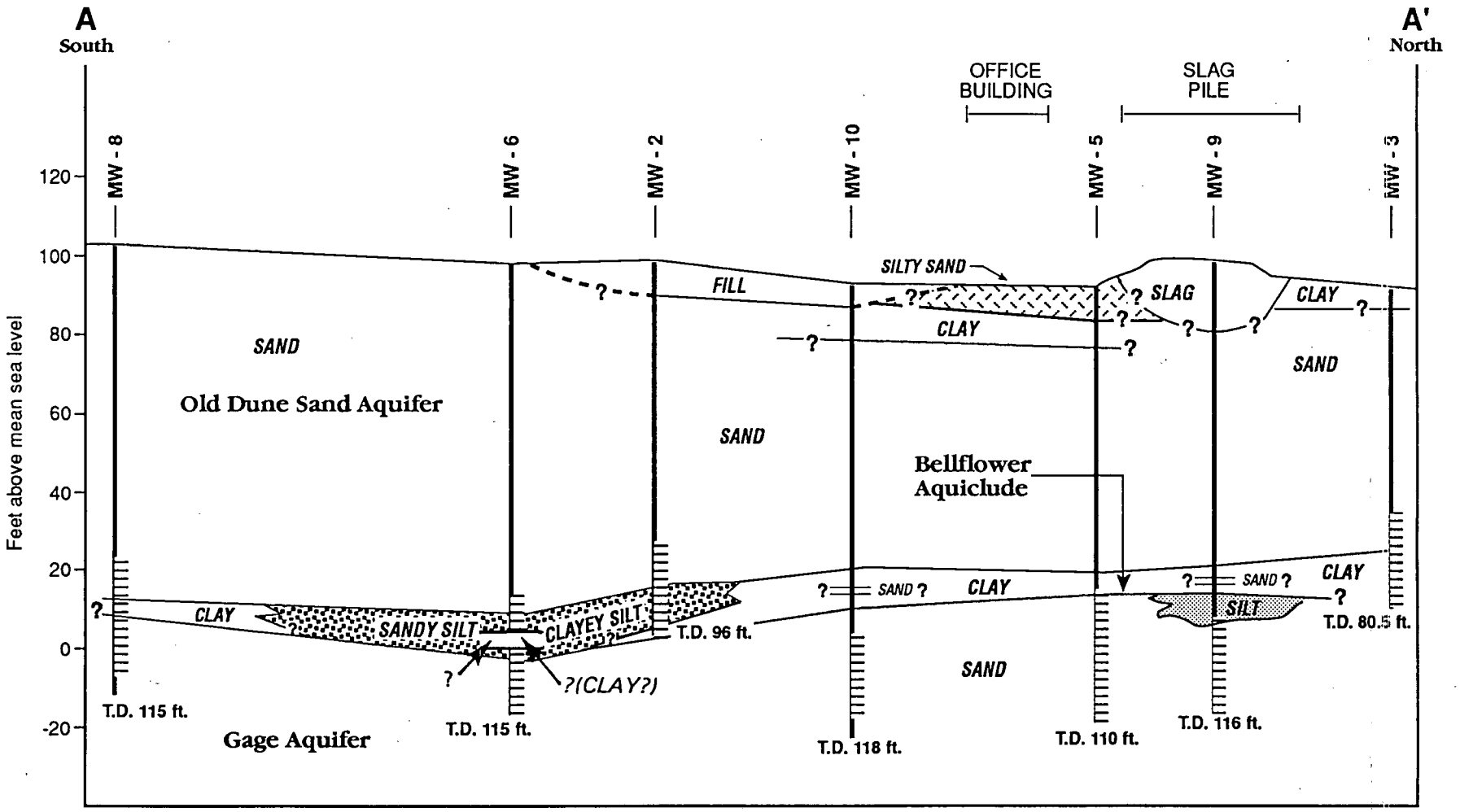
The transition zone between the Bellflower Aquiclude and the overlying Old Dune Sand Aquifer may or may not be present. When present, it occurs as either a sandy silt or a silty sand. The Old Dune Sands have an average thickness of 80 feet across the site and consists predominantly of a sand to gravelly sand. Fill material was present within two monitoring wells (MW-2 and MW-10) between 6.5 feet to 4 feet respectively. Slag material was identified as being 13 feet thick below ground surface and 8 feet above ground surface at monitoring well MW-9. The Gage Aquifer, below the Bellflower Aquiclude, consists of sands with varying amounts of silt and gravel. The vertical thickness of the Gage Aquifer beneath the facility cannot be determined from the information presently available for the site.

4.2 HYDROGEOLOGY

Drawing No. 2 is a hydrogeologic cross-section for the H. Kramer site. Based on the cross-section, there are two aquifers present beneath the facility. The two aquifers are the (upper) Old Dune Sand Aquifer and the (lower) Gage Aquifer. These two aquifers are separated by the Bellflower Aquiclude. Figure 3 is a groundwater contour map for the upper Old Dune Sand Aquifer. The contour gradients suggest that groundwater flows to the southwest within the aquifer. The hydraulic gradient (i) across the property is approximately 0.017 ft/ft. The saturated thickness of the Old Dune Sand Aquifer has been assessed to range from approximately 10 feet thick in the southwestern half of the site to approximately one foot in the northeastern portion of the site.

Figure 4 is a groundwater contour map for the lower Gage Aquifer. Contour gradients suggest that groundwater flows to the northeast within the lower aquifer. The hydraulic gradient (i)

GEOLOGIC CROSS-SECTION A - A'



EXPLANATION

- Geologic Contact
- Monitoring Well Screened Interval

Horizontal Scale 1" = 200'
Vertical Scale 1" = 40'

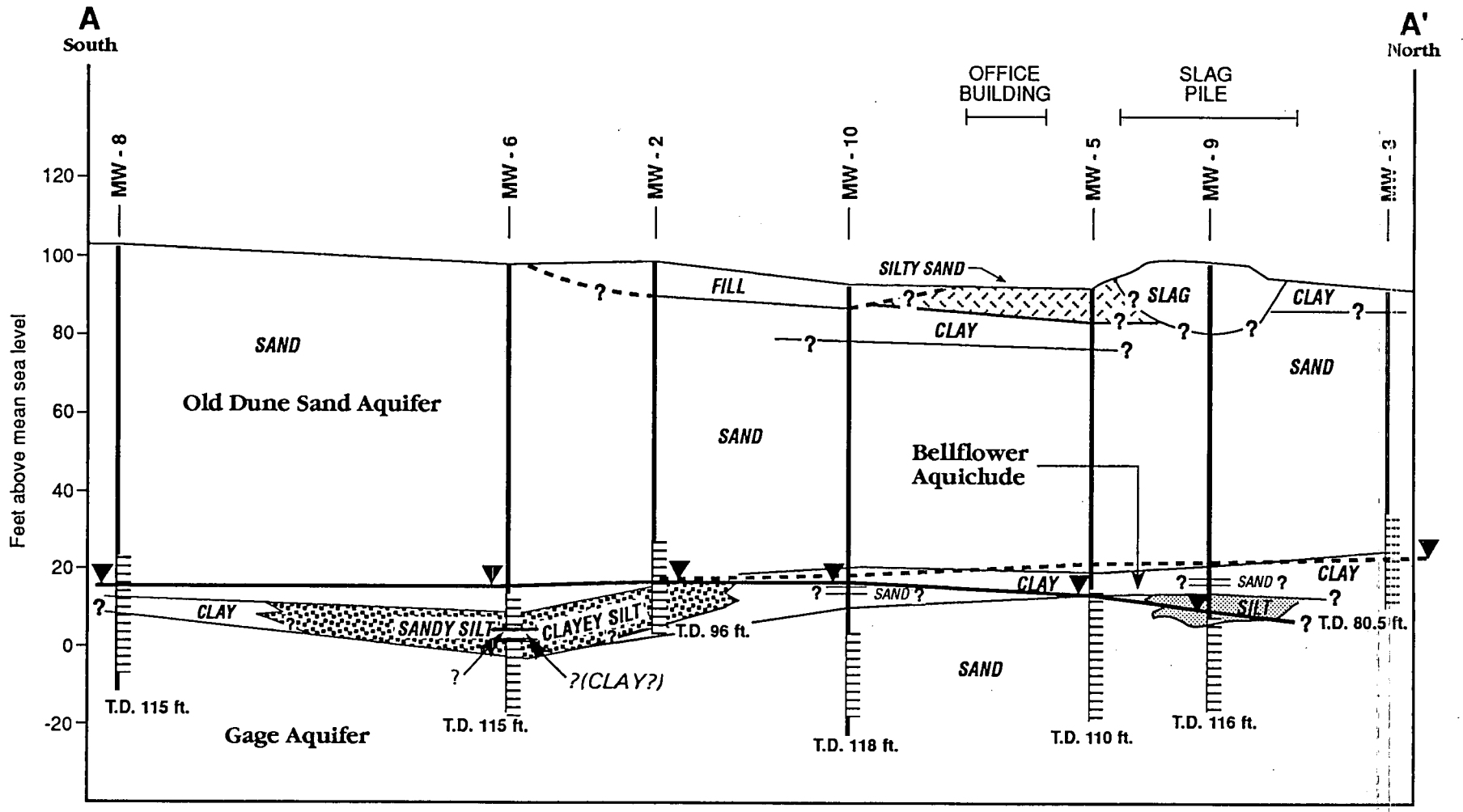
This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Drawing No. 1
Geologic Cross-section
Supplemental Geologic Investigation

H. Kramer & Co.
El Segundo, CA

E-17

HYDROGEOLOGIC CROSS-SECTION A - A'



EXPLANATION

- Geologic Contact
- Monitoring Well Screened Interval
- Gage Aquifer Potentiometric Static Groundwater Level (11/30/92)
- Old Dune Sand Aquifer Static Groundwater Level (11/30/92)

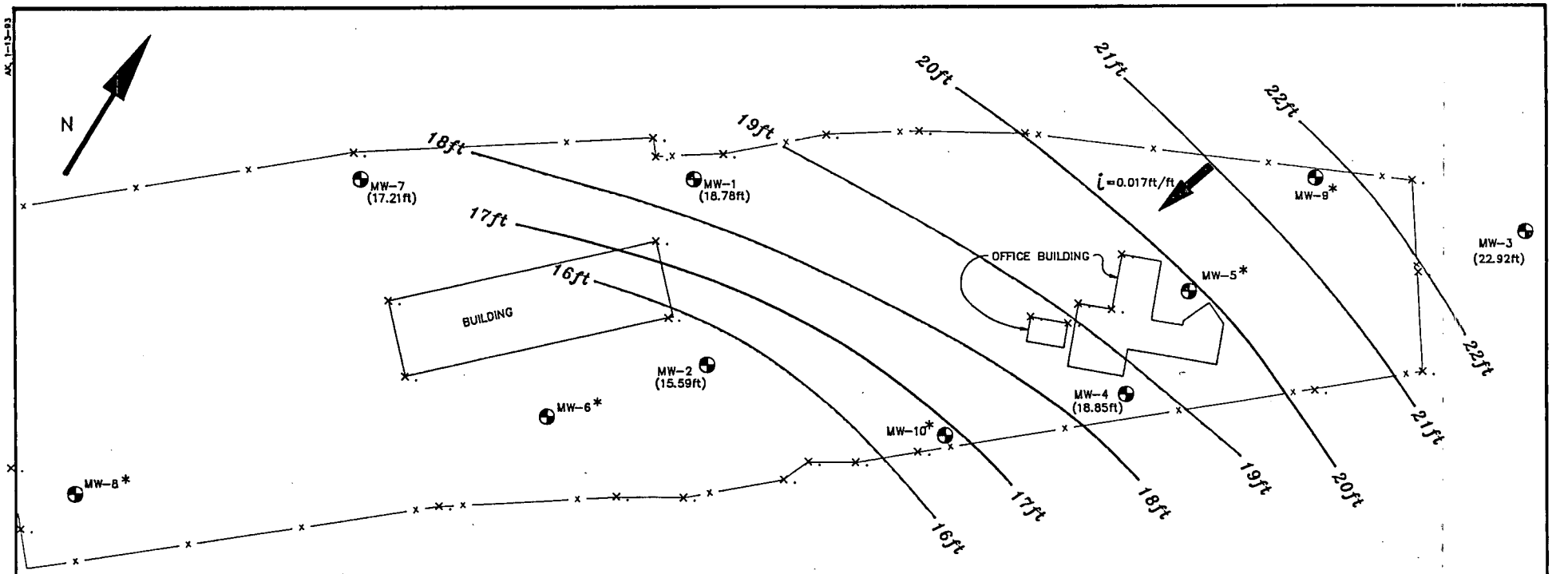
Horizontal Scale 1" = 200'
Vertical Scale 1" = 40'

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Drawing No. 2
Hydrogeologic Cross-section
Supplemental Geologic Investigation

H. Kramer & Co.
El Segundo, CA

E-17



EXPLANATION

(15.59ft) — MONITORING WELL WITH WATER LEVEL ELEVATION (ft above msl)

22ft — GROUNDWATER ELEVATION CONTOUR LINE

DIRECTION OF GROUNDWATER FLOW

i = HYDRALIC GRADIENT OF GROUNDWATER FLOW

* = WATER LEVEL FOR THIS WELL NOT REPRESENTATIVE OF OLD DUNE SAND AQUIFER

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 3

GROUNDWATER CONTOUR MAP – OLD DUNE SAND AQUIFER

SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK 1-13-93

PLSCFIT, CHEV-11

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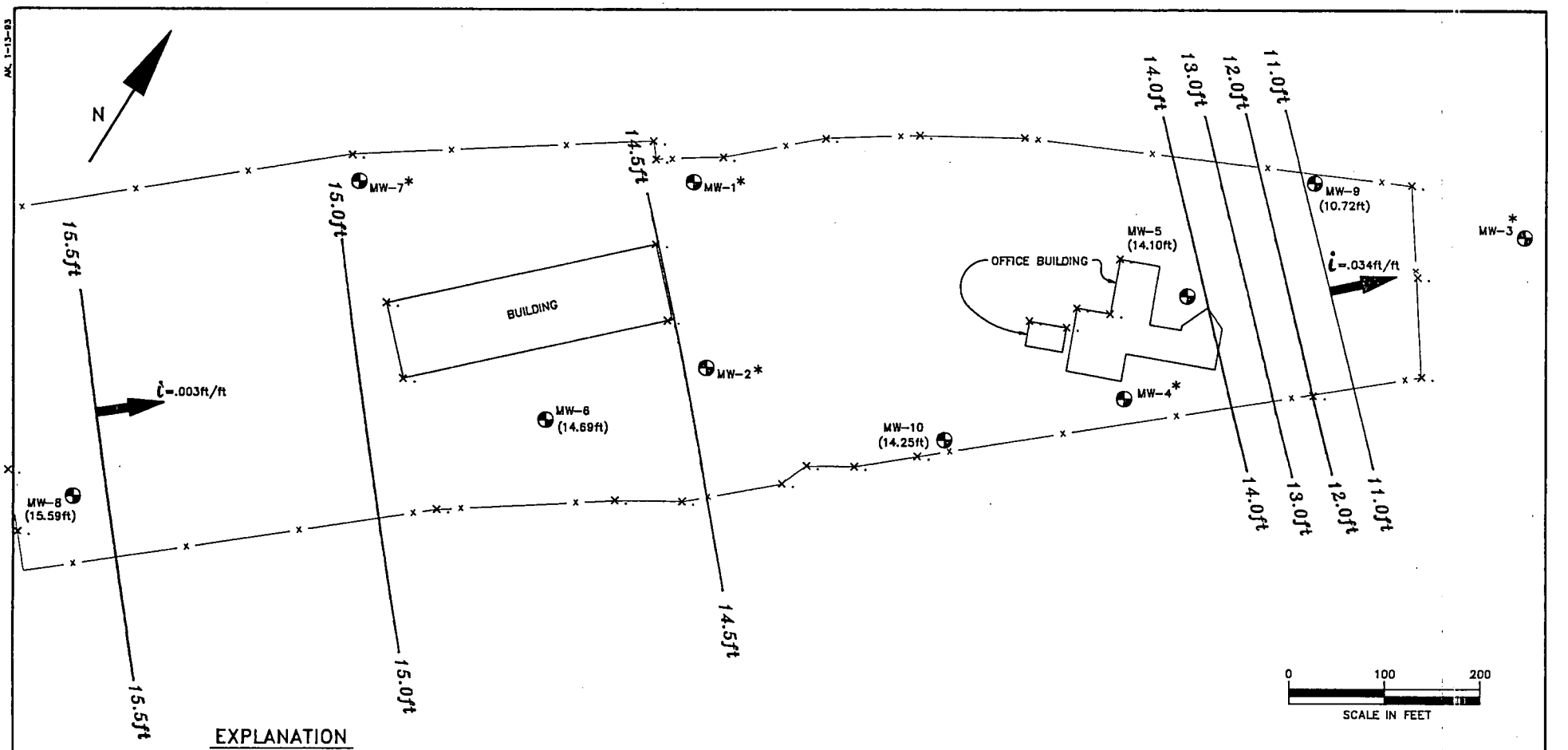


EXPLANATION

(15.59ft) MONITORING WELL WITH WATER LEVEL ELEVATION (ft above msl)

15.0ft —— GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION CONTOUR LINE

DIRECTION OF GROUNDWATER FLOW

i = HYDRALIC GRADIENT OF GROUNDWATER FLOW

* = WATER LEVEL FOR THIS WELL NOT REPRESENTATIVE OF GAGE AQUIFER

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 4

GROUNDWATER CONTOUR MAP – GAGE AQUIFER
SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK, 1-13-93

PLSO.FIT, DREV-12

20

within the southwestern half of the site (between MW-8 and MW-2) is calculated to be 0.003 ft/ft. The gradient steepens within the vicinity of the slag pile (between MW-5 and MW-9) with a calculated hydraulic gradient (i) of 0.034 ft/ft.

Based upon available data, it appears that the two aquifers may be hydraulically connected within the southern half of the property within the vicinity of monitoring wells MW-2 and MW-6. This is based upon the existing hydraulic conditions which suggest that the water table for the Old Dune Sand Aquifer merges with the projected potentiometric surface of the Gage Aquifer within this area (Drawing No. 2). At this location the lithology of the Bellflower Aquiclude laterally changes from a competent clay to less competent clayey-silts and silts. These less competent soils may allow groundwater to migrate vertically. It must be noted that monitoring wells MW-6 and MW-8 have been screened at depths which may allow the two aquifers to be hydraulically connected.

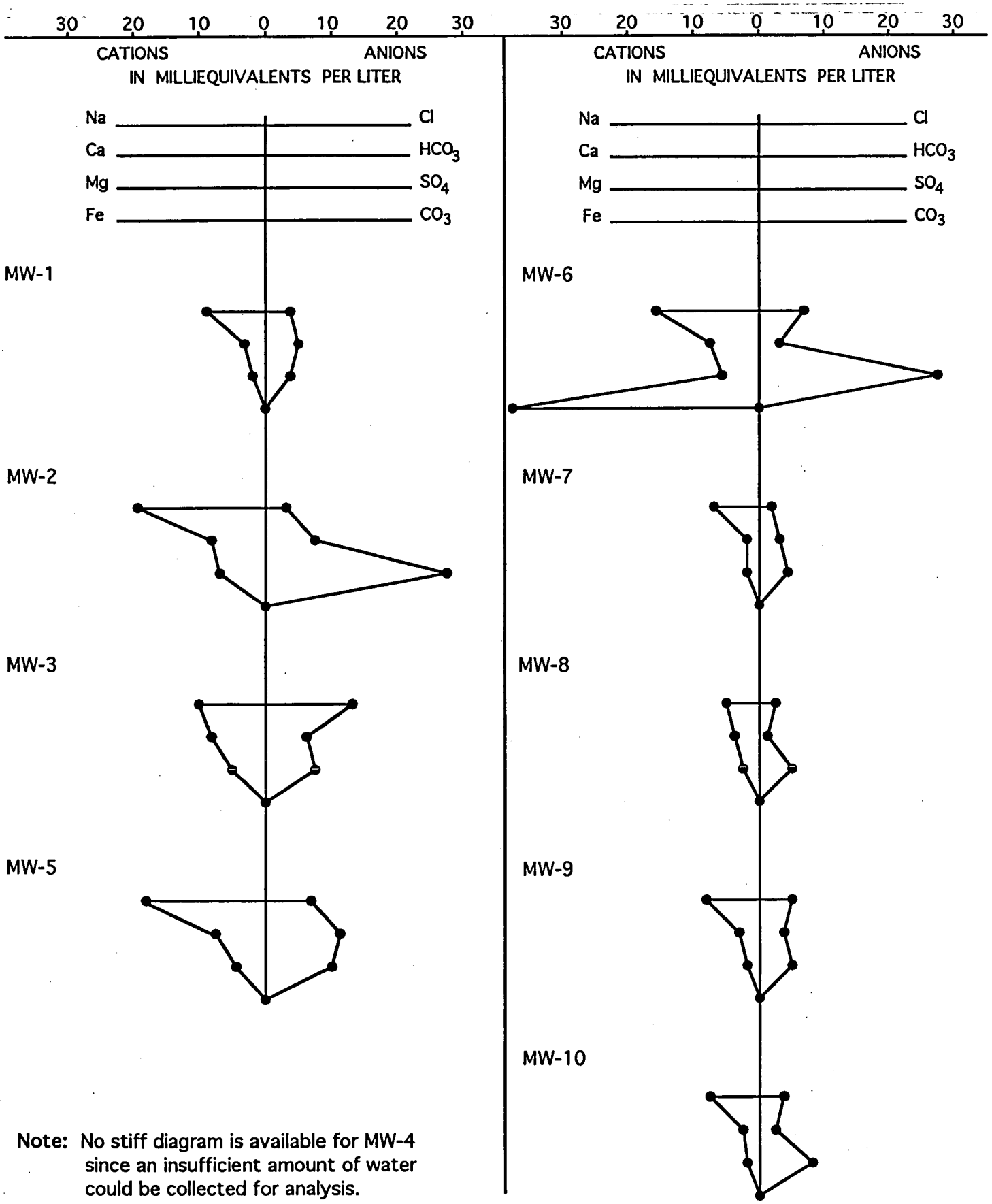
4.3 GEOCHEMISTRY OF GROUNDWATER

Stiff diagrams showing cation and anion concentrations have been presented for nine monitoring wells at the H. Kramer facility (Figure 5). Stiff patterns can be a relatively distinctive method of showing water-composition differences and similarities. Overall, the geochemistry for background conditions for groundwater of the Old Dune Sand Aquifer and the Gage Aquifer are very similar, except in wells MW-2, -5, and -6. The geochemistry in these wells is slightly different. Monitoring well MW-2 is located within the Old Dune Sand Aquifer downgradient of the slag pile. Except for the iron anomaly, the geochemistry of monitoring well MW-6 (located primarily within the Gage Aquifer and apparently upgradient of the slag pile), however, is very similar to monitoring well MW-2. This information complements lithologic and groundwater elevations by suggesting that within this area the two aquifers may be hydraulically interconnected. Another possibility, however, is that monitoring well MW-6 has been constructed such that it is screened within both aquifers thereby allowing mixing of the two aquifers, which may (in turn) affect MW-5.

Monitoring well MW-5 has been screened within the Gage Aquifer. However, the geochemistry of the groundwater, as inferred from stiff diagrams (Figure 5), suggests that the groundwater is being influenced by the upper Old Dune Sand Aquifer. This may be explained by either an incompetency in the Bellflower Aquiclude within the vicinity of MW-5, or that MW-5 was constructed in a manner which has allowed the two aquifers to mix. The lithologic logs of monitoring well MW-5 and other wells in closest proximity suggest that the Bellflower Aquiclude is greater than 5 feet thick in this area. This would suggest that the Bellflower Aquiclude is competent. A literature research on the installation of monitoring well MW-5 has indicated that 30 feet of hollow-stem auger were left in place during its construction. The augers may have possibly compromised the integrity of the well's construction and allowed the two aquifers to be hydraulically connected.

Results of arsenic analyses for groundwater samples taken from all ten wells are shown in Table 2. Also included for comparison in Table 2 are results of ENSR's 1989 investigation.

FIGURE 5
STIFF DIAGRAMS
H. Kramer & Co.
El Segundo, CA.



Note: No stiff diagram is available for MW-4 since an insufficient amount of water could be collected for analysis.

TABLE 2

VOLATILE ORGANIC COMPOUNDS AND ARSENIC IN GROUNDWATER
SUPPLEMENTAL GEOLOGIC INVESTIGATION
H. KRAMER SITE
EL SEGUNDO, CA
NOVEMBER 1992

Compound	Monitoring Wells										State MCL
	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	
Benzene	--	--	--	--	ND <5	ND <5	--	ND <5	ND <5	ND <5	1*
Toluene	--	--	--	--	ND <5	ND <5	--	ND <5	ND <5	ND <5	100*
Ethylbenzene	--	--	--	--	ND <5	ND <5	--	ND <5	ND <5	ND <5	680
Total Xylenes	--	--	--	--	ND <5	ND <5	--	ND <5	ND <5	ND <5	1,750
1,1 DCE	--	--	--	--	ND <5	ND <5	--	5	ND <5	ND <5	6
CIS-1,2 DCE	--	--	--	--	ND <5	ND <5	--	ND <5	ND <5	8	6
1,1,1-TCA	--	--	--	--	ND <5	ND <5	--	6	ND <5	ND <5	200
CCl_4	--	--	--	--	ND <5	59	--	46	ND <5	190	0.5
TCE	--	--	--	--	22	86	--	43	19	180	5
PCE	--	--	--	--	ND <5	40	--	ND <5	ND <5	ND <5	5
Trichloro-fluoromethane	--	--	--	--	ND <5	150	--	170	ND <5	300	150
Chloroform	--	--	--	--	ND <5	120	--	63	10	85	100**
Arsenic											
Nov. 1992	3.60	8.70	8.2	0.12	110	6.9	ND	ND	7.4	0.17	0.05
Dec. 1989	3.20	12.0	9.8	0.005	140	25	--	ND	--	--	

Arsenic values are indicated as mg/l dissolved arsenic. VOC values are indicated in ug/l; equivalent to parts per billion (ppb).

MCL: Maximum Contaminant Level
ND: Not detected at Method Detection Limit

* State Department of Health Services Action Level (AL)
** Federal EPA Drinking Water Standard set for total trialomethanes (chloroform, bromoform, dibromochloroform, bromodichloromethane)

These results show essentially identical patterns for MW-1 through -8, with the exception of MW-6, where concentrations changed from 25 mg/l to 6.9 mg/l (MW-9 and -10 were not in place in 1989). Basically, values ranged from less than 0.01 to 9.0 mg/l, except MW-5. Figure 6 indicates that elevated arsenic concentrations within the Old Dune Sand Aquifer occur along a northeast-southwest axis trending beneath the area of the main slag pile and former pond. Highest concentrations were detected within monitoring well MW-2 at 8.70 mg/l. Arsenic concentrations were not detected in downgradient wells MW-7 or MW-8.

Arsenic concentrations within the Gage Aquifer are presented on Figure 7. Elevated arsenic concentrations occur along a northeast-southwest-axis with highest concentrations occurring within monitoring well MW-5 at 110 mg/l. The lateral boundary of the zone of elevated arsenic is relatively well understood upgradient (MW-6, -8, and -10) but has not been delineated downgradient of monitoring well MW-9. From Table 2 and Figure 7, it can be seen that arsenic levels in MW-5 are incongruous with the levels measured in all other wells, even those ± 100 feet of MW-5. This result remains very difficult to explain at this time. It is for that reason, and the fact that this work was performed strictly on site, that isoconcentration maps of arsenic in the Gage Aquifer still require additional work to improve accuracy and precision.

Table 2 also presents results of volatile organic compound (VOC) analyses performed on Gage Aquifer well samples. VOCs detected include 1,1-Dichloroethene (1,1 DCE), Cis-1,2-Dichloroethene (Cis-1,2 DCE), 1,1,1-Trichloroethane (1,1,1-TCA), Carbon Tetrachloride (CCl_4), Trichloroethene (TCE), Tetrachloroethene (PCE), Trichlorofluoromethane, and chloroform. Highest concentrations were detected within upgradient monitoring wells MW-8, MW-6, and MW-10. Figure 8 is a graphic representation for TCE concentrations within the Gage Aquifer. Overall, evidence suggests that VOCs within the Gage Aquifer are a result of a regional groundwater problem and not the result of historic activities at the facility (i.e., the slag pile and former lagoon).

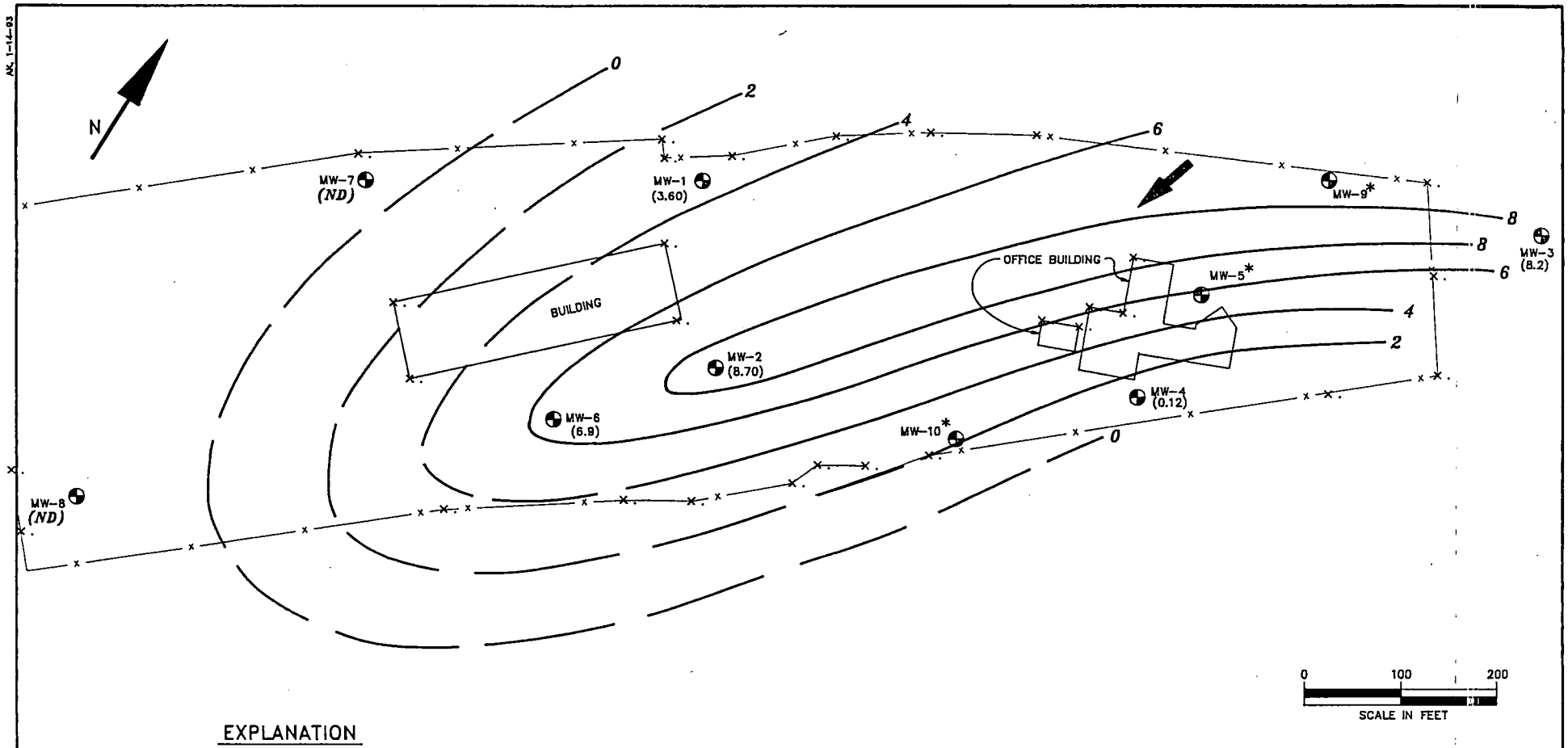
5.0 HEALTH AND SAFETY SUMMARY

Field investigation activities at the H. Kramer site were conducted in accordance with the Ebasco Environmental Corporate Health and Safety Program. Also, a project specific Health and Safety Plan was prepared and distributed to all Ebasco Environmental personnel and their subcontractors working on the site.

The predominant areas of health and safety concern to personnel working on the site during field activities were the following:

- Injury from mechanized drilling.
- Inhalation, ingestion or skin absorption of dust, vapors, or gases.
- Explosion of ignitable vapors or gases.

The health and safety program was successfully implemented and no adverse health and safety incidents were reported. To protect personnel from site-specific hazards, air monitoring and



EXPLANATION

(3.60)	MONITORING WELL WITH ARSENIC CONCENTRATIONS (mg/l)
*	ARSENIC CONCENTRATION WITHIN THIS WELL NOT REPRESENTATIVE OF OLD DUNE SAND AQUIFER
ND	NOT DETECTED
———	CONTOUR LINE OF EQUAL CONCENTRATION (mg/l) DASHED WHERE INFERRED

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 6

ARSENIC CONCENTRATIONS WITHIN
OLD DUNE SAND AQUIFER

SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK, 1-14-93

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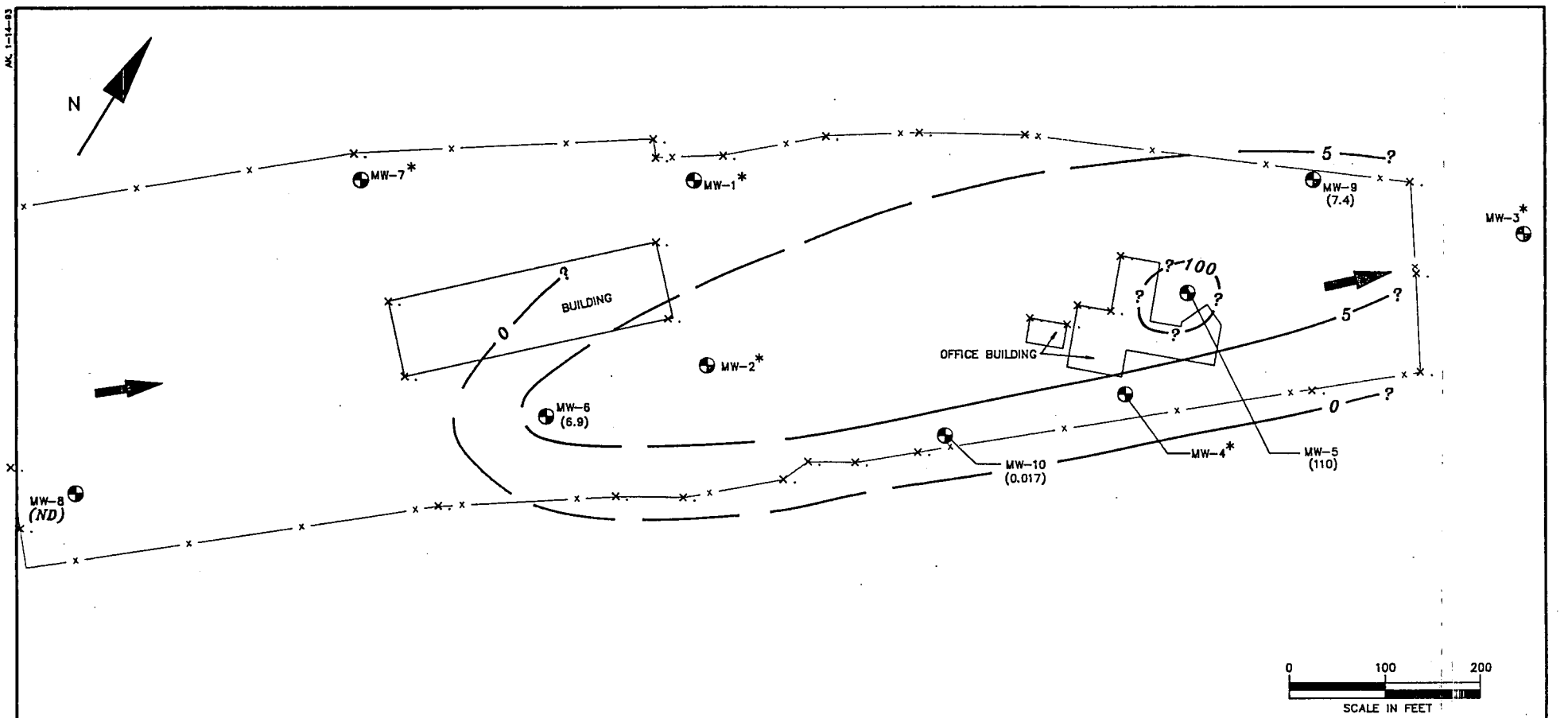

EXPLANATION

(6.9) MONITORING WELL WITH ARSENIC CONCENTRATIONS (mg/l)

* ARSENIC CONCENTRATION WITHIN THIS WELL NOT REPRESENTATIVE OF GAGE AQUIFER

ND NOT DETECTED

CONTOUR LINE OF EQUAL CONCENTRATION (mg/l) DASHED WHERE INFERRED

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 7

ARSENIC CONCENTRATIONS WITHIN GAGE AQUIFER

SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK 1-14-93

PLSCFIT, CHEV-18

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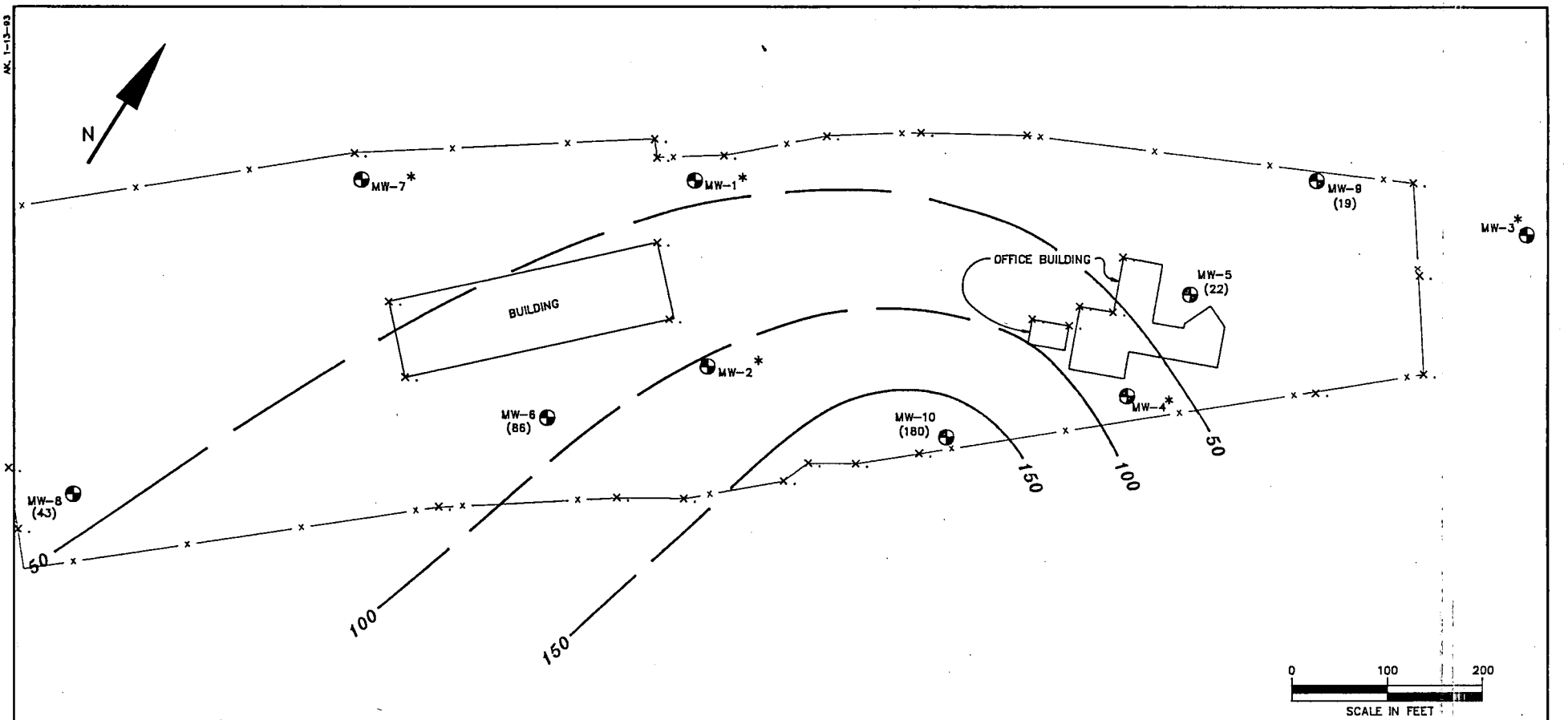


EXPLANATION

(43) MONITORING WELL WITH TRICHLOROETHENE (TCE) CONCENTRATIONS (ug/l)

* MONITORING WELL NOT SAMPLED AND ANALYZED FOR TCE

CONTOUR LINE OF EQUAL CONCENTRATION (ug/l)
DASHED WHERE INFERRED

BENCHMARK
CITY OF EL SEGUNDO
PK IN TOP OF CONCRETE HEADWALL
NE COR EL SEGUNDO BLVD AND DOUGLAS ST
ELEV=92.38

DATE OF SURVEY: 25 NOV 92

FIGURE 8

TCE CONCENTRATIONS WITHIN
GAGE AQUIFER
SUPPLEMENTAL GEOLOGIC INVESTIGATION

H.KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK, 1-13-93

PLSD FIT, CHEV-14

personal protective equipment were used. Organic vapors and combustible mixtures of gases and vapors were monitored using an organic vapor analyzer (OVA) and a combustible gas indicator (Explosimeter). No organic vapors were encountered that required personnel to use masks or respirators. Since it was expected that site personnel would be subject to only minimal levels of potential chemical contaminants, field activities were conducted with a modified Level C (i.e., Tyvek, boots, gloves), with respirators on hand.

- Hardhat
- Eye protection
- Work overalls and tyvek
- Steel-toed rubber boots
- Chemical-resistant gloves

No other specific equipment was required because of the relatively low hazard potential on the site.

6.0 SUMMARY AND CONCLUSIONS

6.1 SUMMARY

6.1.1 Nature and Extent of Impacted Groundwater

In general, shallow groundwater (Old Dune Sand and/or Gage) in the study area is impacted by a host of sources, including VOC contaminants from unrelated (to Kramer) industrial activities, although arsenic has been the main focus of this investigative phase. Based upon the existing groundwater monitoring data, it appears that arsenic has impacted both the upper Old Dune Sand and the lower Gage Aquifers in the immediate vicinity of the slag pile, although it is not entirely clear through what mechanism the impact on the Gage has occurred. Arsenic within the Old Dune Sand Aquifer has been detected in the four monitoring wells within the northern half of the H. Kramer site. Arsenic has not been detected within downgradient monitoring wells MW-7 and MW-8.

Arsenic has been detected in four of the five monitoring wells reaching the Gage Aquifer, with the exception of the most upgradient well (MW-8). [Data from MW-8 have been used to assess arsenic in both aquifers since it appears to bracket both aquifers.] Highest concentrations detected were within monitoring well MW-5 at 110 mg/l. The lateral extent of groundwater impacted with arsenic within the Gage Aquifer has not been assessed downgradient of monitoring well MW-9.

VOCs have been detected within all monitoring wells within the Gage Aquifer. Volatile organics detected include 1,1 DCE, CIS-1,2 DCE, 1,1,1-TCA, CCl_4, TCE, PCE, trichloro-fluromethane, and chloroform. Evidence suggests that the organics within the groundwater are not a result of historic operations at the site, but reflect a regional condition.

6.1.2 Fate and Transport

Evidence indicates that localized concentrations of arsenic within the groundwater are associated with percolation of water containing residues of wastes from the former lagoon. Groundwater with elevated arsenic concentrations has moved downgradient (southwest) of the slag pile with the leading edge in the Old Dune Sand being located between monitoring wells MW-6 and MW-8. Based upon the lithology of the Bellflower Aquiclude, and possibly the result of monitoring wells MW-6 being screened within the upper and lower aquifers, arsenic appears to have migrated downwards within the central portion of the property into the Gage Aquifer. Based on gradients measured in the Old Dune Sand and Gage Aquifers, such arsenic could have migrated north, below the slag pile, i.e., toward MW-5, which had similarly shaped stiff diagrams. Stiff diagrams for MW-5 are not as exaggerated as those for MW-2 and -6, but they are slightly different from the rest. This suggests either transport from the MW-6 area, or some hydraulic connection in the immediate vicinity of MW-5. Arsenic concentrations in MW-5, however, are not explained fully by either hypothesis.

6.2 CONCLUSIONS

Results of the supplemental site investigation of the H. Kramer site have indicated the following:

- Two aquifers exist beneath the H. Kramer site; the upper Old Dune Sand Aquifer and the lower Gage Aquifer.

- The Old Dune Sand Aquifer flows to the southwest with a hydraulic gradient of approximately 0.017 ft/ft.

- The Gage Aquifer flows to the northeast with a hydraulic gradient ranging from 0.003 ft/ft to 0.034 ft/ft from southwest to northeast, respectively.

- The Bellflower Aquiclude separates the upper Old Dune Sand Aquifer from the lower Gage Aquifer.

- Based on the thickness of the clay (MW-5, -9, -10) in geologic cross-section A-A' and stiff diagrams (MW-9, -10), the Bellflower Aquiclude appears to be competent as a barrier between the two aquifers underneath the former lagoon.

- Based on geologic cross-section A-A', Stiff diagrams, and arsenic concentrations within the groundwater, the competency of the Bellflower Aquiclude as a barrier between the two aquifers becomes questionable within the vicinity of monitoring well MW-6.

- Geologic cross-section A-A' indicates that monitoring wells MW-6 and MW-8 are screened within both aquifers. Stiff diagrams and literature research indicate monitoring well MW-5 may also be allowing the two aquifers to be hydraulically connected, but this is less certain.

- Stiff diagrams indicate that the background groundwater quality of both aquifers are similar.

- The downgradient lateral extent of arsenic within the Old Dune Sand Aquifer is presently known to extend to an area between monitoring wells MW-6 and MW-8.

- Arsenic concentrations measured in nine of the ten wells range from non-detected (at 0.01 mg/l) to almost 9.0 mg/l, the exception being MW-5 (110 mg/l). This anomalously high value cannot be explained at the present time, as arsenic concentrations in other wells near the slag pile are all an order of magnitude less.

- The downgradient lateral extent of arsenic within the Gage Aquifer has not been fully assessed beyond monitoring well MW-9, but MW-10 served its purpose in bracketing MW-5 on the northeast upgradient boundary.

- Arsenic plumes in both the Old Dune Sand and the Gage Aquifers have been drawn with the greatest degree of accuracy/precision possible, given the number and distribution of wells in place and installed per this work plan.

- Additional investigations will be necessary to increase the accuracy of the plume maps included herein; to better define downgradient boundaries for the Gage Aquifer and upgradient boundaries for the Old Dune Sand Aquifer; and to determine the basis for the anomalously high MW-5 reading.

- Hand-auger boring EHB-1 results failed to confirm presence of hexavalent chromium in the slag pile.

- VOC analyses from wells reaching the Gage Aquifer confirm regional contamination of groundwater by organic compounds such as TCE, carbon tetrachloride, and trichloro-fluoromethane.

APPENDIX A

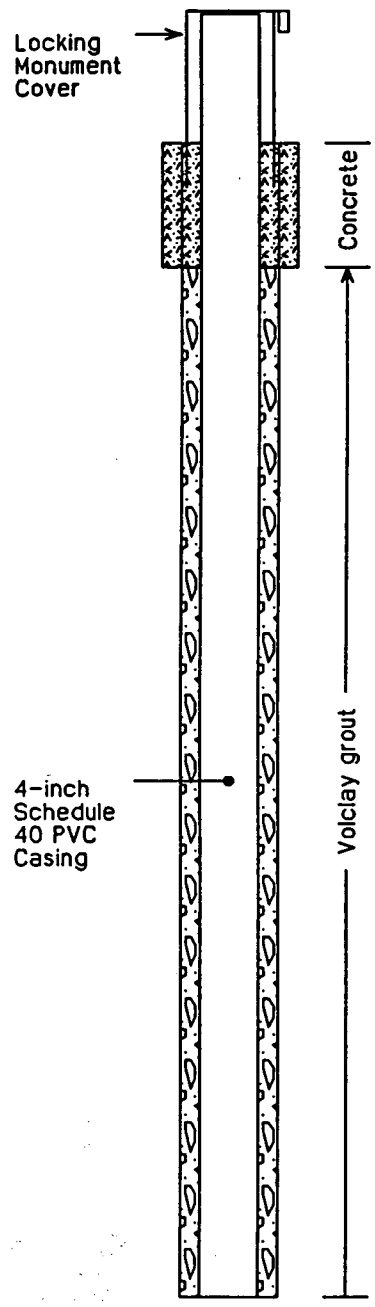
MONITORING WELL LOGS

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/16/92 to 11/18/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *97.4*
TOTAL DEPTH (ft) *116*
DEPTH TO WATER (ft) *72*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
										
0										SLAG, dark black with wood, rebar, steel cable and other debris.
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										Old ammunition cartridge in slag cuttings.
18										

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/16/92 to 11/18/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *97.4*
TOTAL DEPTH (ft) *116*
DEPTH TO WATER (ft) *72*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
18										
19										
20										
21									SP	SAND, fine to medium grained, dark yellowish brown (10YR 6/6), slight sewage odor.
22										
23				3						
24				4	0.5	SM	L			
				4						
25				4						
26				4	0.5	SM	L			
				5						
27										
28										
29										
30	4-inch Schedule 40 PVC Casing; Volclay grout									
31										
32										Color change to yellowish brown (10YR 5/6) at 32 feet.
33										
34										
35										
36										
37										
38				5						Color change to brownish yellow (10YR 6/8) at 37 feet.
39				8	0	SM	MD			

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/16/92 to 11/18/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *97.4*
TOTAL DEPTH (ft) *116*
DEPTH TO WATER (ft) *72*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
39				7					SP	
40										
41										
42										Increased fine sand.
43										
44										
45										
46										
47										
48				5						
49				5	0	SM	L			
50				5						Encounter fine rounded to subangular gravel (< 2.5 cm diameter) composed of schists and slates.
51	4-inch Schedule 40 PVC Casing									
52										
53										
54										Gravel decreasing in size (< 1 cm diameter).
55										
56										
57										
58				5						
59				6	0	SM	MD			
60				5						

Volclay grout

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/16/92 to 11/18/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *97.4*
TOTAL DEPTH (ft) *116*
DEPTH TO WATER (ft) *72*

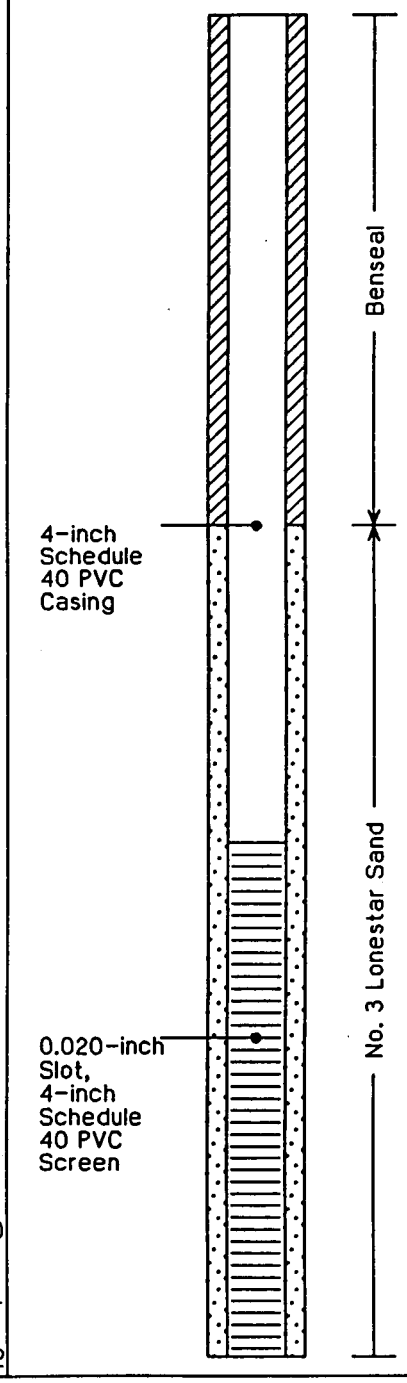
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
60									SP	
61										
62										
63										No gravel in cuttings.
64										
65										
66										
67										
68										Stop drilling for day 11/16/92.
69				7 8 8	0	SM	MD			
70										
71										
72						▼				Encounter water while drilling.
73	4-inch Schedule 40 PVC Casing									
74										
75										
76				4 4 4	0	WT	L			
77				7 7	0	WT	MS			
78				5 3					CL	CLAY, yellowish brown (10YR 5/8), micaceous, low dilatency, medium to strong.
79				5 8 2	--	WT	L		SM ML	SILTY SAND/SANDY SILT, fine grained, clayey, yellowish brown (10YR 5/8), micaceous.
80	Volclay grout; Benseal			2 5	--	WT	MS		CL	SILTY SANDY CLAY fine grained, yellowish brown (10YR 5/8), micaceous.
81										

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST R. Tweidt
DRILLING CO Beylik Drilling
DATE (start/finish) 11/16/92 to 11/18/92

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD 2.5-inch ID Split Spoon
SURFACE ELEVATION 97.4
TOTAL DEPTH (ft) 116
DEPTH TO WATER (ft) 72



Depth (ft)	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
81		4					CL/	Encounter occasional clay lenses, light brownish gray (10YR 6/2).
82		5	--	WT	L		SP	SAND, fine to medium grained, light yellowish brown (10YR 6/4), micaceous.
		5						
83		2					CL	
		2	0	WT	SO			Stop drilling for day 11/17/92.
84		4						
85								
86							SM	SILTY SAND, fine grained, yellowish brown (10YR 5/8), micaceous.
87		3						
88		4	0	MO	L			
		3		ST				Becomes saturated.
89								
90		2						
91		4	0	WT	L			
		4					ML	SILT, light olive brown (2.5Y 5/6), trace clay, low dilatency, plastic, alternating layers of iron oxide staining.
92								
93								
94							SM	SILTY SAND, fine to medium grained, yellowish brown (10YR 5/6), trace subrounded to rounded fine gravel (< 2 cm diameter), iron oxide mottling.
95		2						
96		2	0	MO	L			
		3						
97				ST				Becomes saturated.
				ST				
98							SP	SAND, medium to coarse grained, yellowish brown (10YR 5/6), trace silt, trace subrounded to rounded fine gravel (<4 cm diameter).
99								
100								
101								
102								

EBASCO ENVIRONMENTAL

Monitoring Well MW-9

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/16/92 to 11/18/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *97.4*
TOTAL DEPTH (ft) *116*
DEPTH TO WATER (ft) *72*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
102									SP	
103										
104										
105										Occasional balls of silty clay in cuttings.
106										
107										
108										
109	0.020-inch Slot, 4-inch Schedule 40 PVC Screen; No. 3 Lonestar Sand									
110						ST			SW	GRAVELLY SAND, medium to coarse grained, pale brown (10YR 6/3), subrounded to rounded fine gravel (< 4 cm diameter) composed of felsic metasediments.
111										
112										
113										
114						WT	VS		ML CL	SILTY CLAY/CLAYEY SILT, light yellowish brown (10YR 6/4), medium dilatency.
115										
116										Total Depth of boring 116 feet (11/18/92).
117										
118										
119										
120										
121										
122										
123										

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/12/92 to 11/14/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *94.25*
TOTAL DEPTH (ft) *118*
DEPTH TO WATER (ft) *74 ft.*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Cristy Box; Concrete									ASPHALT, 0.20 feet thick.
1										FILL, silty sand with occasional fine gravel.
2										
3										
4									CL	SILTY CLAY, dark brown (10YR 4/3), slow dilatency, trace fine sand.
5										
6										
7										
8				1						
9				1 1	0	MO	VL			
10	4-inch Schedule 40 PVC Casing; Volclay Grout									
11										
12										
13									SM	SILTY SAND, fine grained, brownish yellow (10YR 6/8).
14										
15										
16										
17										
18										

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/12/92 to 11/14/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *94.25*
TOTAL DEPTH (ft) *118*
DEPTH TO WATER (ft) *74 ft.*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
18				3					SM	
19				3 4	0	SM	L		SP	SAND, fine to medium grained, brownish yellow (10YR 6/8), poorly graded.
20										
21										
22										
23										
24										
25										
26										
27										
28				5						
29				10 7	0	SM	MD			
30	4-inch Schedule 40 PVC Casing; Volclay Grout									As Above but slightly more compacted.
31										
32										
33										
34										
35										
36										
37										
38				2						Color change to yellow (10YR 7/8) at 38 feet.
39				7	0	SM	MD			

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST R. Tweidt
DRILLING CO Beylik Drilling
DATE (start/finish) 11/12/92 to 11/14/92

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD 2.5-inch ID Split Spoon
SURFACE ELEVATION 94.25
TOTAL DEPTH (ft) 118
DEPTH TO WATER (ft) 74 ft.

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
39				11					SP	
40										
41										
42										
43										
44										
45										
46										
47										
48				3						
49				5 5	0	SM	L			
50	4-inch Schedule 40 PVC Casing									
51										
52										
53										
54										
55										
56										
57										Occasional fine gravel.
58				4						
59				5 5	--	SM	L			End drilling for day 11/12/92.
60										

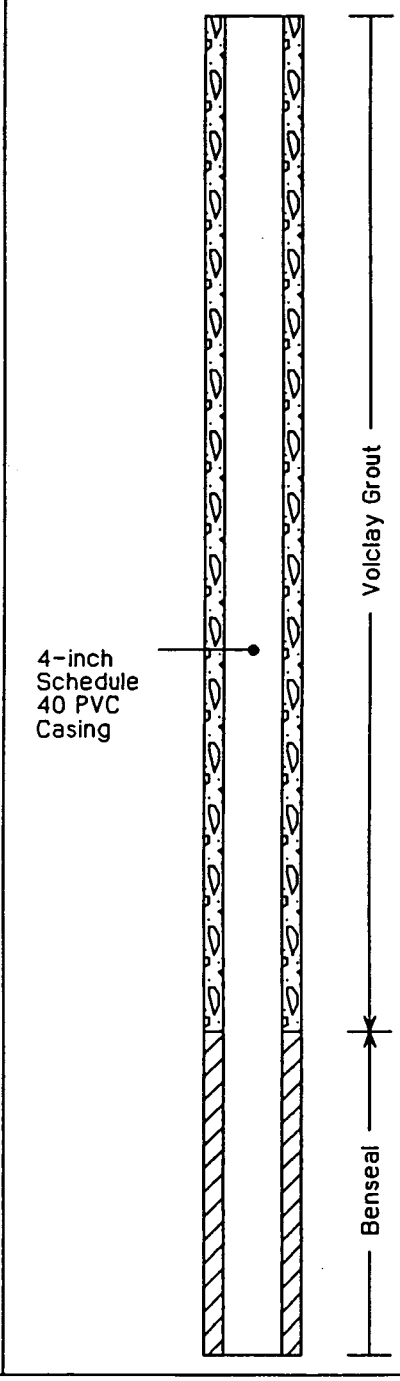
Volclay Grout

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/12/92 to 11/14/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *94.25*
TOTAL DEPTH (ft) *118*
DEPTH TO WATER (ft) *74 ft.*



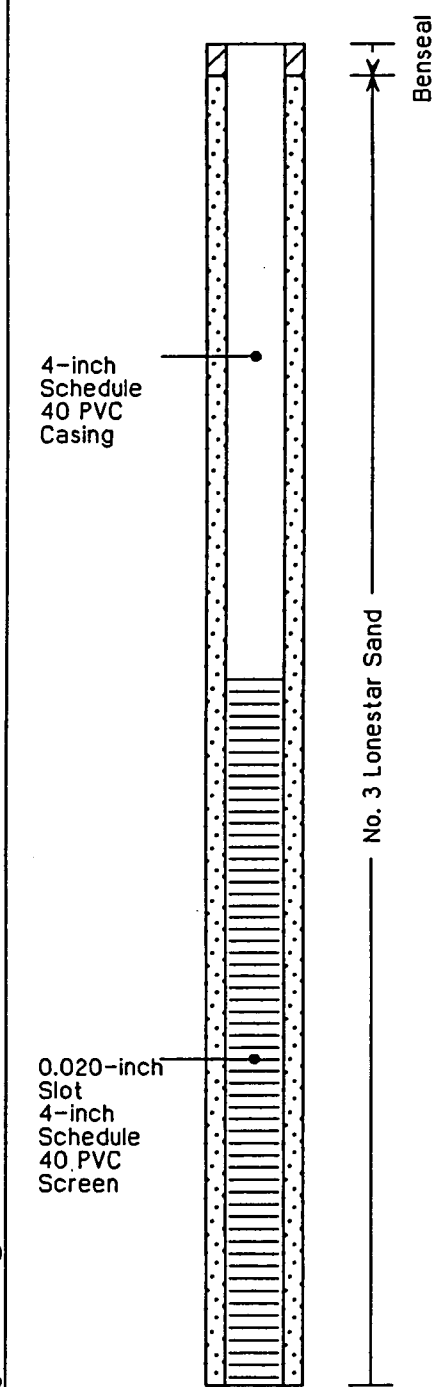
Depth (ft)	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
60							SP	
61								
62								
63								
64								
65								
66								
67								
68		5						
69		6 7	0	SM	MD			
70								
71								
72								
73								
74				▼				Encounter water while drilling. Color change to yellowish brown (10YR 5/6) at 74.5 feet, increased rounded coarse lithic fragments (< 0.5 cm diameter) composed of slate.
75								
76		3					SM ML	SILTY SAND/SANDY SILT, fine to medium grained, yellowish brown (10YR 5/8), trace clay, micaceous, cohesive, plastic.
77		3 4	0	MO	SO			
78		7 9	0	WT	SO		CL	As above but increased clay, iron oxide staining, burrow casts filled with sand evident.
79		11 2						SILTY CLAY, yellowish brown (10YR 5/4), micaceous, cohesive, plastic.
80		4 4	0	WT	L			
81		1					SP CL	SAND, fine to medium grained, light yellowish brown (10YR 6/4), poorly graded, micaceous.

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/12/92 to 11/14/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *94.25*
TOTAL DEPTH (ft) *118*
DEPTH TO WATER (ft) *74 ft.*



Depth (ft)	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
81		2	0	WT	SO		CL	SILTY CLAY, yellowish brown (10YR 5/4), cohesive, plastic, micaceous.
82		3						
		3						
83		5	0	WT	SO			As above but iron staining evident, occasional subrounded to rounded fine gravel (< 1 cm dia.) composed of felsic material.
		6						
84							SM	
85		3						SILTY SAND, fine grained, yellowish brown (10YR 5/4), moderately graded, trace clay.
86		3	0	MO	L			
		3						
87		3						
		7	0	MO	MD			
88		10						
89								
90								
91								
92								
93							SP	SAND, medium to coarse grained, brownish yellow (10YR 6/6), trace subrounded to rounded fine gravel (< 1 cm diameter) composed of slates.
94								
95		4						
96		5	0	ST	L			
		5						
97								
98								
99								
100								
101								
102								Increased fine gravel (< 4 cm diameter).

EBASCO ENVIRONMENTAL

Monitoring Well MW-10

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *R. Tweidt*
DRILLING CO *Beylik Drilling*
DATE (start/finish) *11/12/92 to 11/14/92*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *2.5-inch ID Split Spoon*
SURFACE ELEVATION *94.25*
TOTAL DEPTH (ft) *118*
DEPTH TO WATER (ft) *74 ft.*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
102									SP	
103										
104										
105						WT	VS		CL	CLAY, light yellowish brown (10YR 6/4), cohesive, plastic, micaceous.
106	0.020-inch Slot 4-inch Schedule 40 PVC Screen								SP	SAND, medium to coarse grained, brownish yellow (10YR 6/6), trace subrounded to rounded fine gravel (< 1 cm diameter) composed of slates.
107										
108										
109										
110										
111	No. 3 Lonestar Sand					WT	VS		CL	SILTY CLAY, light yellowish brown (10YR 6/4), cohesive, plastic, micaceous, iron oxide mottling.
112									SP	SAND, fine to medium grained, brownish yellow (10YR 6/6), trace subrounded to rounded fine gravel (< 1 cm diameter) composed of slates.
113										
114										
115										
116										
117										
118										Total Depth of boring 118 feet (11/14/92).
119										
120										
121										
122										
123										

APPENDIX B

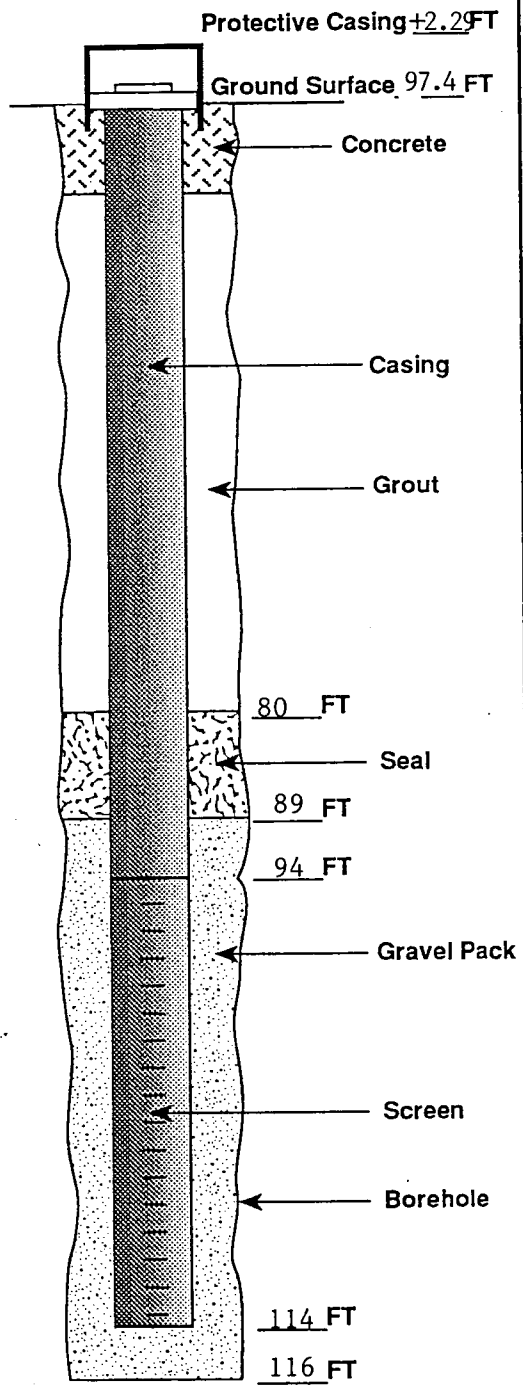
WELL CONSTRUCTION LOGS

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4050

WELL CONSTRUCTION LOG

PROJECT NAME: H. Kramer & Co.
PROJECT OFS: CHEC 3135.004
LOCATION: El Segundo, California
EBASCO PERSONNEL: Rob Tweidt/Dan Holmquist

WELL NUMBER: MW-9
WELL LOCATION: See Site Plan
SURFACE ELEV (ft. above MSL): 97.4 ft.
CASING ELEV (ft. above MSL): 99.69 ft.



DRILLING SUMMARY

DATE: 11/16/92
DRILLING COMPANY: Beylik Drilling
DRILLING FOREMAN: Steve Garber
RIG TYPE: Drill Systems AP-1000
TOTAL DEPTH OF BORING: 116 ft.
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

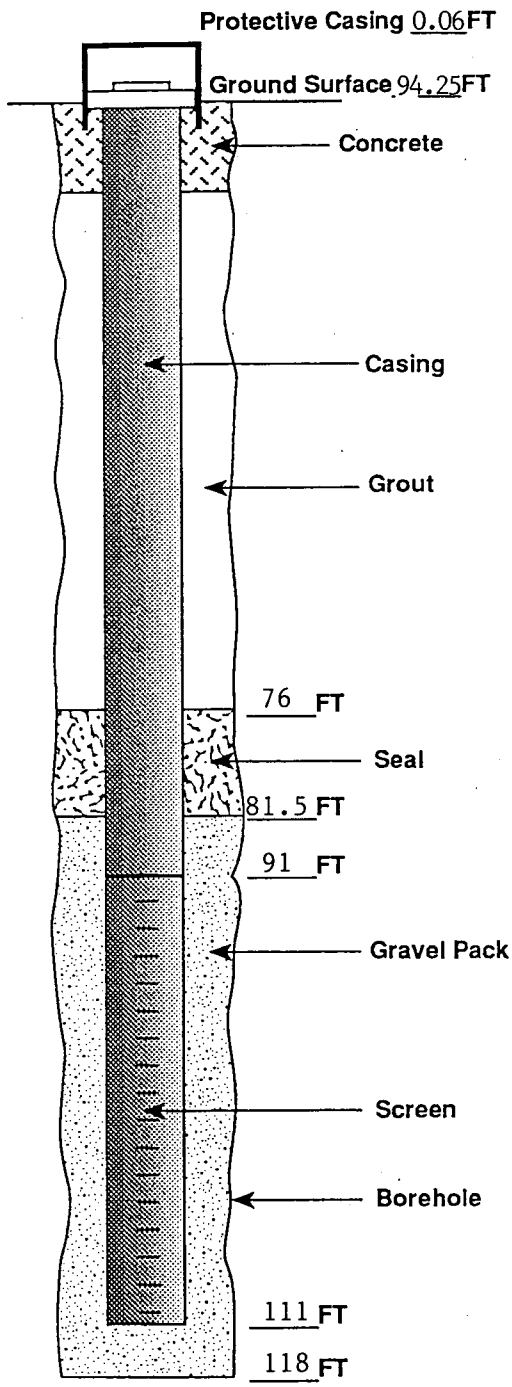
WELL TYPE: Monitoring
BORING DIAMETER: 10.25 inch
TOTAL WELL DEPTH: 114 ft.
CASING TYPE: Sch. 40 PVC
CASING DIAMETER: 4 inch
CASING LENGTH: 94 ft.
SCREEN TYPE: Sch. 40 PVC
SCREEN SIZE: 0.020
SCREEN LENGTH: 20 ft.
TAILPIPE LENGTH: None
CASING STICKUP: 2.06 ft.
PROTECTIVE CASING TYPE: Low carbon steel
PROTECTIVE CASING STICKUP: 2.29 ft.
CENTRALIZERS: None
GROUT MATERIAL: Volclay grout
GROUT VOLUME: 36.8 cubic feet
SEAL MATERIAL: 3/8 inc. bentonite pellets
SEAL VOLUME: 4-50 lb buckets
FILTER MATERIAL: No. 3 Lonestar sand
FILTER VOLUME: 11.5 cubic feet
COMMENTS:

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4050

WELL CONSTRUCTION LOG

PROJECT NAME: H. Kramer & Co.
PROJECT OFS: CHEC 3135.004
LOCATION: El Segundo
California
EBASCO PERSONNEL: Rob Tweidt/Dan Holmquist

WELL NUMBER: MW-10
WELL LOCATION: See Site Plan
SURFACE ELEV (ft. above MSL): 94.25 ft.
CASING ELEV (ft. above MSL): 94.31 ft.



DRILLING SUMMARY

DATE: 11/12/92
DRILLING COMPANY: Beylik Drilling
DRILLING FOREMAN: Steve Garber
RIG TYPE: Drill Systems AP-1000
TOTAL DEPTH OF BORING: 118 ft.
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

WELL TYPE: Monitoring
BORING DIAMETER: 10.25 inch
TOTAL WELL DEPTH: 111 ft.
CASING TYPE: Sch. 40 PVC
CASING DIAMETER: 4 inch
CASING LENGTH: 91 ft.
SCREEN TYPE: Sch. 40 PVC
SCREEN SIZE: 0.020
SCREEN LENGTH: 20 ft.
TAILPIPE LENGTH: None
CASING STICKUP: -0.55 ft.
PROTECTIVE CASING TYPE: Christy Box
PROTECTIVE CASING STICKUP: 0.06 ft.
CENTRALIZERS: None
GROUT MATERIAL: Volclay grout
GROUT VOLUME: 34.96 cubic feet
SEAL MATERIAL: 3/8 inch bentonite pellets
SEAL VOLUME: 4-50 lb buckets
FILTER MATERIAL: No. 3 Lonestar sand
FILTER VOLUME: 16.79 cubic feet
COMMENTS:

E-12

APPENDIX C

WELL DEVELOPMENT LOGS/WELL SAMPLING LOGS

1/319/424-9332

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/19/92
Site Engineer : Rob Tweidt

Well Number : MW-10
Equipment : 5-T Development Rig with swab/bailer/submersible pump
Contractor : Boylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	80.0 ft bgl	ground surface	
Depth to Sediment (ft)	111.2 ft	ground surface	
Thickness of Sediment (ft)			

Depth of Well (ft): 111.5 ft
Water Column Height (ft): 31.5 ft
Diameter of Casing (ft): 4 inch
Diameter of Boring (ft): 10.75 inch
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals):
Casing/Well Volumes Purged: 1

Time	pH	Turbidity (NTU)	Temp. ~~(°C)~~ °F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1020	Begin		bailing			
1045	7.13	high	72.6°	1680		Bailed 50 gallons
1050						Start swabbing screen
1135						Finish swabbing screen
1143	7.15		74.0 F	1880		1st bailer full
1152						Stop bailing, little sediment
1245	6.65	high	69.8 F	1240	10 gpm	start pumping from bottom of screen
1250	6.53	high	75.4	1200	10 gpm	cleaning up
1255	6.54	mod	72.4	1210	10 gpm	↓
1300	6.60	mod	72.3	1220	10 gpm	↓
1305	6.63	slight	72.2	1230	10 gpm	↓
1310	6.64	75	72.4	1230	10 gpm	82.6' bgl = H_2O pumping level
1315	6.63	51	72.4	1220	10 gpm	82.6' " " " "
1320	6.61	41	72.4	1220	10 gpm	
1325	6.61	30	72.8	1220	10 gpm	
1330	6.62	24	72.5	1230	10 gpm	82.7' bgl " " "
1340	6.64	18	72.5	1230	10 gpm	82.7' " " " " /raise pump (middle scr.)
1350	6.66	mod	72.4	1240	10 gpm	82.95' bgl " "
1400	6.63	8	71.1	1160	10 gpm	82.98' " "
1405	6.64	5.5	71.4	1230	10 gpm	82.98" " "
1410	6.62	4.00	71.6	1230	10 gpm	83.00 " " " /raise pump (to scr.)
1420	6.61	20	71.1	1220	10 gpm	83.02 " "

Notes Sampling Procedures: Using a 5 gallon bailer. Well swabbed using 1-foot strokes beginning at bottom of screen and working upwards. Roughly 2 minutes per foot of screen for swabbing time.

F4

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/19/92
Site Engineer : Bob Twelt

Well Number : MW-10
Equipment :
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	80.0 ft bgl	ground surface	83 feet
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) _____ Water Column Height (ft) _____
Diameter of Casing (ft) _____ Diameter of Boring (ft) _____
Casing Volume (gals) = π(Diam. of Casing (ft)/2)^2(Water Column Height (ft))(7.48 gals/ft^3) = _____
Well Volume (gals) = π(Diam. of Boring (ft)/2)^2(Water Column Height (ft))(7.48 gals/ft^3) = _____
Total Volume Purged (gals) _____ Casing/Well Volumes Purged 1

Time	pH	Turbidity (NTU)	Temp. (°C) F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1425	6.61	5.11	70.6	1210	10 gpm	83.04 feet bgl - H_2O level
1430	6.60	2.84	70.8	1220	10 gpm	83.05' " "
1433					5gpm	Start running pump down screen
						while pumping.
1508					5gpm	stop pump

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/20/92
Site Engineer : Rob Tweidt

Well Number : MW-9
Equipment : S-T Development Rig with swab/bailer/submersible pump
Contractor : Baylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	88.64 ft	top PVC casing	
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 114 ft
Water Column Height (ft)
Diameter of Casing (ft)
Diameter of Boring (ft)
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals)
Casing/Well Volumes Purged 1

Time	pH	Turbidity (NTU)	Temp. ~~(°C)~~ °F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
0805						Begin bailing
0820	8.22	mod.	56	1900	50 gallons bailed	Begin swabbing / little sediment
1000					10 gpm	Start pump
1003	7.53	high	69.2	1490	10 gpm	cleaning up
1008	7.37	high	68.3	1400	10 gpm	W.L. 89.95 ft top of PVC
1015	7.30	mod	64.9	1280	10 gpm	W.L. 89.96 " " " "
1021	7.26	mod	67.4	1310	10 gpm	W.L. 89.98 " " "
1030	7.19	slight	67	1280	10 gpm	W.L. 90.00 " " "
1040	7.13	slight	68.3	1320	10 gpm	W.L 90.00 " "
1045	7.19	31.5	68.8	1330	10 gpm	
1050	7.17	21.0	70.0	1350	10 gpm	W.L. 90.01 " "
1055	7.14	15	68.7	1320	10 gpm	W.L. 90.03 " "
1100	7.15	10	67.4	1310	10 gpm	W.L. 90.04 " / raise pump (bar.
1115	7.15	7.20	69.2	1310	10 gpm	W.L. 90.07 " / raise pump (top
1140	7.14	3.33	67.5	1320	10 gpm	
1143					10 gpm	Stop pump

Notes Sampling Procedures: locking riser (monument) stick-up = 2'4"
PVC stick-up = 2' 1½"

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co
Project Number : CHEC 3135.004
Date : 11/20/92
Site Engineer : Rob Tweidt

Well Number : MW-7
Equipment : ST development rig with submersible pump/bailer
Contractor : Beglik Drilling

	Before	Reference Point	After
Depth to Water (ft)	90.90	top PVC (marked pt.)	93.67
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 92.90 /93.96 — Water Column Height (ft) 2.90 ft
Diameter of Casing (ft) 4" - sch 40 PVC — Diameter of Boring (ft)
Casing Volume (gals) = π(Diam. of Casing (ft)/2)^2(Water Column Height (ft))(7.48 gals/ft^3) =
Well Volume (gals) = π(Diam. of Boring (ft)/2)^2(Water Column Height (ft))(7.48 gals/ft^3) =
Total Volume Purged (gals) — Casing/Well Volumes Purged /

Time	pH	Turbidity (NTU)	Temp. ~~(°C)~~ F°	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1330	6.92	very turbid	71.4	1110	bailed	very brown water with PVC tie cuttings in bottom along with sand and silt
1357	7.13	high	68.1	1090	3 gallons bailed	
1412	7.00		69.3	1120	4 gallons bailed	Stop to let well recover 80% of static since bailed dry.

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/20/92
Site Engineer : Rob Tweidt

Well Number : MW-1
Equipment : 5-T developmenting submersible pump / s.s. bailer
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	83.07		
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 91.52 — Water Column Height (ft) ____
Diameter of Casing (ft) ____ — Diameter of Boring (ft) ____
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = ____
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = ____
Total Volume Purged (gals) ____ — Casing/Well Volumes Purged 1

Time	pH	Turbidity (NTU)	Temp. (°C)/F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1450	—	turbid	~~65.3~~	~~1370~~		Start bailing
1500	7.00	turbid	65.3	1370	2 gal	
1510	7.16	mod	65.0	1440	7 gal	
1515	7.03	mod	64.7	1390	12 gal.	clearing, no sheen
1525	7.09	sl. to mod	64.6	1450	18 gal.	no odor
1533	7.12	slight	66	1460	22 gal	clearing, no sheen

Notes Sampling Procedures: ____

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : KRAMER & Co.
Project Number : CHEC 3135.004
Date : 11-24-92
Site Engineer : Rob Tweidt

Well Number : MW-2
Equipment : S-T development rig
s.s. bailer & s.s. submersible pump
Contractor : Beglik Drilling

	Before	Reference Point	After
Depth to Water (ft)	83.03	top 4" PVC	88.60
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 93.10 — Water Column Height (ft) ____
Diameter of Casing (ft) ____ — Diameter of Boring (ft) ____
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = ____
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = ____
Total Volume Purged (gals) ____ — Casing/Well Volumes Purged /

Time	pH	Turbidity (NTU)	Temp. ~~(°C)~~ F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
0900	6.73	mod.	68.1	3940	5gal bailer-5gal/hr	Begin bailing
0903	6.97	mod	68.1	3820	15 gallons	
0910	6.92	mod	67.2	3800	20 gallons	
0913	6.96	mod	67.6	3770	23 gallons	
0916	6.98	mod	68.4	3800	25 gallons	
0920	7.02	mod	68.3	3790	29 gallons	
0930	6.96	slight	67.1	3690	35 gallons	
0935					39 gallons	Stop bailing.

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/24/92
Site Engineer : Rob Tweidt

Well Number : MW-8
Equipment : S.S. submersible pump
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	87.05 ft	top 4" PVC	
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft): 110 ft
Water Column Height (ft): 22.95 ft
Diameter of Casing (ft):
Diameter of Boring (ft): 10"
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 15.38 gallons
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 8.45 times
Total Volume Purged (gals): 130
Casing/Well Volumes Purged: 1

Time	pH	Turbidity (NTU)	Temp. (~~°C~~) °F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1100	6.06	high	70.4	890	2.5	start pumping
1105	6.17	mod	70.9	800	2.5	cleaning up H_2O level = 91.0
1110	6.07	mod	70.6	890	2.5	" " H_2O level = 90.7
1115	6.10	slight	71.0	970	2.5	cleaning up / raise pump to m of s.
1120	6.18	v. slight	71.0	948	2.5	" H_2O level 90.55
1125	6.16	v. slight	72.2	945	2.5	raise pump H_2O level = 90.80
1130	6.35	v. slight	71.5	730	2.5	H_2O level = 90.45
1135	6.34	v. slight	72.1	750	2.5	H_2O level 90.53
1140	6.29	clear	71.5	769	2.5	H_2O level = 90.53
1145	6.28	clear	70.9	796	2.5	slight sheen, no odor H_2O level = 90.52
1150	6.22	clear	71.1	859	2.5	" " H_2O level = 90.53
1152					2.5	stop pump

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

Page ____ of ____.

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/24/92
Site Engineer : Rob Tweidt

Well Number : MW-6
Equipment : 5-T Development Rig
s.s. submersible pump
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	83.46	top 4" PVC	85.78
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 115 ft
Water Column Height (ft) 31.54
Diameter of Casing (ft) 4"
Diameter of Boring (ft) 10"
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 20.82
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals) 140 gallons
Casing/Well Volumes Purged 6.72 X

Time	pH	Turbidity (NTU)	Temp. (~~°C~~)F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1338	6.58	high	70.5	4510	~ 5 gpm	Start pumping
1343	6.56	mod	70.9	4160	~ 5 gpm	H_2O level = 85.80
1347	6.57	mod/slight	70.5	3960	~ 5 gpm	" " = 85.95' / raise pump (middl
1353	6.59	mod	70.5	3970	~ 5 gpm	" " 85.93'
1358	6.57	mod/slight	70.8	3750	~ 5 gpm	" " 85.82' raise pump (top
1403	6.56	mod/slight	70.1	3660	~ 5 gpm	" " 85.82'
1408	6.55	slight/clear	71.0	3600	~ 5 gpm	" " 85.81'
1413	6.55	clear	70.8	3560	~ 5 gpm	" " 85.78
1415						Stop pumping

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/24/92
Site Engineer : Rob Tweidt

Well Number : MW-4
Equipment : 5-T development rig s.s. bailer
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	72.20	top 4" PVC	
Depth to Sediment (ft)	74.40		
Thickness of Sediment (ft)	.60		

Depth of Well (ft) 75
Diameter of Casing (ft) 4" PVC
Water Column Height (ft) 2.8
Diameter of Boring (ft)
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 1.85
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals)
Casing/Well Volumes Purged 1

Time	pH	Turbidity (NTU)	Temp. (°C) F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1541	10.00	high	68	2790	2 gallons	Start bailing
						white "milky" color
1551					3 gallons	- Bailed dry
1730						Water level 74.3'
11/25/92 0630						Water level 73.9'
0700						Sample MW-4

Notes Sampling Procedures: Bail MW-4 dry. Will let recover 80%. For 80% recovery, water level needs to come up to 72.7 feet bgl.

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/25/92
Site Engineer : Rob Tweidt

Well Number : MW-10
Equipment : ST development rig
s.s. submersible pump
Contractor : Baylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	79.55	top 4" PVC	
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) ____ Water Column Height (ft) 31.45
Diameter of Casing (ft) ____ Diameter of Boring (ft) ____
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 21.07
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = ____
Total Volume Purged (gals) 165 gallons Casing/Well Volumes Purged > 7 X

Time	pH	Turbidity (NTU)	Temp. ~~(°C)~~ F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
0749	6.64	mod	63.3	1710	5gpm	Start pumping
0757	6.61	slight	66.5	1750	"	
0800	6.67	slight	65.4	1930	"	80.80' = w.l. / raise pump (mud scar)
0805	6.62	v. slight	65.2	1740	"	80.78 = w.l.
0810	6.68	clear	65.8	1760	"	raise pump (top screen)
0815	6.63	mod slight	66.2	1760	"	80.77 = w.l
0820	6.62	clear	66.0	1760	"	80.77 = w.l.
0822					"	Stop pump

Notes Sampling Procedures:

F4

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/25/92
Site Engineer : Rob Tweidt

Well Number : MW-9
Equipment : 5-T development rig S.S. submersible pump
Contractor : Beylik Drilling

	Before	Reference Point	After
Depth to Water (ft)	88.85	top 4" PVC	89.48
Depth to Sediment (ft)	Ø		
Thickness of Sediment (ft)	Ø		

Depth of Well (ft): 114 ft
Water Column Height (ft): 25.15
Diameter of Casing (ft): 4"
Diameter of Boring (ft): 16.60
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals): 240
Casing/Well Volumes Purged: >9 X

Time	pH	Temp. (°C) F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
0940	7.19	68.3	2350	5 gpm	Start pumping (bottom of sc
0946	7.42	67.2	1870	"	WL = 89.45, cleaning up
0950	7.32	68.8	1780	"	WL = 89.46' / raise pump (middle
0955	7.26	69.2	1650	"	WL = 89.47' bgl
1000	7.26	69.7	1670	"	WL = 89.49 bgl / raise pump (top
1010	7.25	69.9	1700	"	
1015	7.23	69.6	1620	"	WL = 89.47
1020	7.19	69.7	1600	"	WL = 89.48
1025	7.18	69.6	1580	"	WL = 89.48
1028				"	Turn off pump

Notes Sampling Procedures:

48/240

EBASCO ENVIRONMENTAL

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/25/92
Site Engineer : Rob Tweidt

Well Number : MW-5
Equipment : 5-T Development Rig
S.S. Submersible pump
Contractor : Beglik Drilling

	Before	Reference Point	After
Depth to Water (ft)	78.95'	top 4" PVC	
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 110'
Water Column Height (ft) 31.05
Diameter of Casing (ft)
Diameter of Boring (ft)
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 20.50 gallons
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals) 150
Casing/Well Volumes Purged ~7.5 X

Time	pH	Temp. ~~(°C)~~ F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1144	7.17	68.9	3540	~5 gpm	Start pump (bottom screen)
1147	7.15	69.8	3610	~5 gpm	
1150	7.11	69.9	3600	"	W.L. = 85.70 / raise pump (mid
1155	7.14	68.4	3530	"	W.L = 85.49
1200	7.13	67.7	3480	"	Raise pump / top screen
1205	7.13	67.6	3490	"	W.L. = 85.60
1210	7.13	67.6	3470	"	W.L. = 85.66
1213	7.13	68.8	3480	"	Stop pump

Notes Sampling Procedures:

EBASCO ENVIRONMENTAL

Page ____ of ____.

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. Kramer & Co.
Project Number : CHEC 3135.004
Date : 11/25/92
Site Engineer : Rob Tweidt

Well Number : MW-3
Equipment : 5-T development rig
s.s. bailer
Contractor : Beyhk Drilling

	Before	Reference Point	After
Depth to Water (ft)	71.56	top 4" PVC	
Depth to Sediment (ft)			
Thickness of Sediment (ft)			

Depth of Well (ft) 81
Water Column Height (ft) 9.44
Diameter of Casing (ft)
Diameter of Boring (ft)
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 6.23
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) =
Total Volume Purged (gals)
Casing/Well Volumes Purged 1

Time	pH	Temp. (°C) F	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1405	6.72	69.7	3030	4 gallons	Start bailing
1413	6.84	68.6	2980	10 gallons	
1416	6.83	66.6	2960	14 gallons	
1420	6.90	66.6	3020	16 gallons	
1422	6.94	66.9	3030	18 gallons	
1425	6.88	66.8	3070	19 gallons	
1428	6.91	67.0	3070	20 gallons	

Notes Sampling Procedures:

.44
66

APPENDIX D

LABORATORY RESULTS

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023, Phone (213) 269-7421, Fax (213) 268-5328

EBASCO ENVIRONMENTAL
3000 WEST MACARTHUR BLVD.
SANTA ANA, CA 92704-6993
ATTN: ROB TWEIDT

DATE RECEIVED: 11/13-25/92
DATE REPORTED: 12/18/92

LAB NUMBER: 205869, 205895, 205900, 206950
ARSENIC (FILTERED/ACIDIFIED IN LAB)

PROJECT ID: CHEC 3135.004

REPORT ON: ELEVEN LIQUID SAMPLES ANALYZED AS SPECIFIED ON ATTACHED CHAIN OF CUSTODY.

LOCATION: H. KRAMER & CO., EL SEGUNDO, CA

Reviewed By: _____ _____

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869,205895,205900,205
CLIENT: EBASCO ENVIRONMENTAL

DATE SAMPLED: 11/13-25/92
DATE ANALYZED: SEE BELOW

ARSENIC*

MATRIX: LIQUID
METHOD: EPA 6010

LAB ID	SAMPLE ID	RESULT (ug/L)	DETECTION LIMIT	DATE ANALYZED	QC BATCH
205895-1	MW-2	8,700	210**	12/18	A
205895-2	MW-8	ND	11	12/18	A
205895-4	MW-6	6,900	210**	12/18	A
205900-1	MW-10	17	11	12/18	A
205900-2	MW-9	7,400	210**	12/18	A
205900-3	MW-5	110,000	210**	12/18	A
205900-4	MW-3	8,200	210**	12/18	A
205969-3	MW-1	3,600***	500**	12/03	B
205869-4	MW-7	ND	11	12/18	A
205950-7	MW-4	120	500**	01/04	C
205950-8	EQUIP BLANK	ND	10	12/18	A

* SAMPLES WERE FILTERED AND ACIDIFIED AT THE LAB. SAMPLES WERE NOT DIGESTED
** RAISED DETECTION LIMIT DUE TO HIGH LEVELS OF ARSENIC.

QUALITY CONTROL SUMMARY

	QC BATCH	LCS % RECOVERY	RPD
LABORATORY CONTROL SAMPLE:	A	101	
SAMPLE/SAMPLE DUPLICATE RPD:	A		1
LABORATORY CONTROL SAMPLE:	B	95	
SAMPLE/SAMPLE DUPLICATE RPD:	B		<1
LABORATORY CONTROL SAMPLE:	C	95	
SAMPLE/SAMPLE DUPLICATE RPD:	C		11

ABBREVIATIONS

BTEX - Benzene, Toluene, Ethyl Benzene, and Total Xylenes.

CCR - California Code of Regulations.

DHS - California Department of Health Services.

EPA - United States Environmental Protection Agency.

LCS - Laboratory Control Spike

LUFT - Leaking Underground Fuel Tank.

MDL - Method Detection Limit

NA - Not Applicable.

NC - Not Calculable

ND - Not Detected at or above the defined detection limit.

PQL - Practical Quantitation Limit

RPD - Relative percent difference.

STLC - Soluble Threshold Limit Concentration.

Surr. - Surrogates.

TCLP - Toxicity Characteristic Leaching Procedure.

TEH - Total Extractable Petroleum Hydrocarbons.

Title 26 - Title 26 of the California Code of Regulations (CCR).

TR~ - Trace, estimated value .

TTLC - Total Threshold Limit Concentration.

TVH - Total Volatile Hydrocarbons.

WET - Waste Extraction Test.

UNITS

cm3 - Cubic centimeter
Kg - kilogram.
L - Liter.
mg - Milligrams.
M3 - Cubic meter.

1umhos/cm - uS/cm - Micro Siemens/centimeter
ppb - Parts Per Billion.
ppm - Parts per Million.
ug - Micrograms.

Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023, Phone (213) 269-7421, Fax (213) 268-5328

EBASCO ENVIRONMENTAL
3000 WEST MACARTHUR BLVD.
SANTA ANA, CA 92704-6993
ATTN: ROB TWEIDT

DATE RECEIVED: 11/25/92
DATE REPORTED: 12/08/92

LAB NUMBER: 205900

PROJECT ID: CHEC 3135.004

REPORT ON: FOUR LIQUID SAMPLES ANALYZED AS SPECIFIED ON ATTACHED CHAIN OF CUSTODY.

LOCATION: H. KRAMER & CO., EL SEGUNDO, CA

Reviewed By: _____ _____

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-1
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-10

DATE SAMPLED: 11/25/92
DATE ANALYZED: 12/03/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	8	5
trans-1,2-Dichloroethene	ND	5
Chloroform	85	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	ND	5
Carbon tetrachloride	190	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	180	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	300-a	5
Vinyl acetate	ND	10
2-Chloroethylvinyl ether	ND	10

a = 1:5 DILUTION RUN ON 12/04/92.

QUALITY CONTROL SUMMARY ON NEXT PAGE

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-1
SAMPLE ID: MW-10

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	93
	Toluene-d8:	94
	Bromofluorobenzene:	100

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	90	87	3

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-2
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-9

DATE SAMPLED: 11/25/92
DATE ANALYZED: 12/03/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	10	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	ND	5
Carbon tetrachloride	ND	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	19	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	ND	5
Vinyl acetate	ND	10
2-Chloroethylvinyl ether	ND	10

▲QUALITY CONTROL SUMMARY ON NEXT PAGE

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-2
SAMPLE ID: MW-9

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	108
	Toluene-d8:	95
	Bromofluorobenzene:	98

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	90	87	3

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-5

DATE SAMPLED: 11/25/92
DATE ANALYZED: 12/03/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	ND	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	ND	5
Carbon tetrachloride	ND	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	22	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	ND	5
Vinyl acetate	ND	10
2-Chloroethylvinyl ether	ND	10

QUALITY CONTROL SUMMARY ON NEXT PAGE

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-3
SAMPLE ID: MW-5

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	108
	Toluene-d8:	96
	Bromofluorobenzene:	96

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	90	87	3

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-1
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-10

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	57,000	100	12/03	6010
Copper	ND	10	12/03	6010
Iron	ND	1,000*	12/03	6010
Magnesium	27,000	100	12/03	6010
Manganese	920	15	12/03	6010
Nickel	ND	32	12/03	6010
Sodium	160,000	100	12/03	6010
Zinc	1,900	1,000*	12/03	6010

* RAISED DETECTION LIMIT DUE TO SUSPECTED BACKGROUND CONTAMINATION.

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	99	3
Copper	90	<1
Iron	92	3
Magnesium	103	3
Manganese	89	3
Nickel	91	<1
Sodium	100	1
Zinc	149	182

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-2
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-9

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	65,000	100	12/03	6010
Copper	57	10	12/03	6010
Iron	ND	1,000*	12/03	6010
Magnesium	24,000	100	12/03	6010
Manganese	140	15	12/03	6010
Nickel	ND	32	12/03	6010
Sodium	190,000	100	12/03	6010
Zinc	3,100	1,000*	12/03	6010

* RAISED DETECTION LIMIT DUE TO SUSPECTED BACKGROUND CONTAMINATION.

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	99	3
Copper	90	<1
Iron	92	3
Magnesium	103	3
Manganese	89	3
Nickel	91	<1
Sodium	100	1
Zinc	149	182

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-5

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	150,000	100	12/03	6010
Copper	ND	10	12/03	6010
Iron	ND	1,000*	12/03	6010
Magnesium	51,000	100	12/03	6010
Manganese	57	15	12/03	6010
Nickel	ND	32	12/03	6010
Sodium	390,000	100	12/03	6010
Zinc	ND	1,000*	12/03	6010

* RAISED DETECTION LIMIT DUE TO SUSPECTED BACKGROUND CONTAMINATION.

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	99	3
Copper	90	<1
Iron	92	3
Magnesium	103	3
Manganese	89	3
Nickel	91	<1
Sodium	100	1
Zinc	149	182

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-3

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	160,000	100	12/03	6010
Copper	ND	10	12/03	6010
Iron	ND	1,000*	12/03	6010
Magnesium	64,000	100	12/03	6010
Manganese	ND	15	12/03	6010
Nickel	ND	32	12/03	6010
Sodium	230,000	100	12/03	6010
Zinc	ND	1,000*	12/03	6010

* RAISED DETECTION LIMIT DUE TO SUSPECTED BACKGROUND CONTAMINATION.

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	99	3
Copper	90	<1
Iron	92	3
Magnesium	103	3
Manganese	89	3
Nickel	91	<1
Sodium	100	1
Zinc	149	182

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900
CLIENT: EBASCO ENVIRONMENTAL

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

ARSENIC

MATRIX: LIQUID
METHOD: SEE BELOW

LAB ID	SAMPLE ID	RESULT* (ug/L)	DETECTION LIMIT	EPA METHOD	DATE ANALYZED	QC BATCH
1	MW-10	17	500**	7060	12/03	A
2	MW-9	7,400	2,000**	7060	12/03	A
3	MW-5	110,000	200	6010	12/03	B
4	MW-3	8,200	2,000**	7060	12/03	A

* SAMPLE WAS PRESERVED IN THE FIELD. SAMPLE WAS NOT FILTERED PRIOR TO ANALYSIS.
** RAISED DETECTION LIMIT.

QUALITY CONTROL SUMMARY

Arsenic (EPA 7060)	QC BATCH	LCS % RECOVERY	RPD
LABORATORY CONTROL SAMPLE:	A	101	
SAMPLE/SAMPLE DUPLICATE RPD:	A		1
Arsenic (EPA 7060)			
LABORATORY CONTROL SAMPLE:	B	86	
SAMPLE/SAMPLE DUPLICATE RPD:	B		<1

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-1
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-10

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	210	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	210	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	140	0.50	mg/L	EPA 325.2	11/27
Conductivity	1,600	50	umhos/cm	EPA 120.1	12/03
Hardness	250	100	ug/L	EPA 6010	12/03
pH	7.6	+/- 0.1	pH	EPA 150.1	11/30
Sulfate	360	5.0	mg/L	EPA 375.2	11/29
Total Dissolved Solids	1,100	4.0	mg/L	EPA 160.1	11/27
Surfactants (MBAS)	0.2	0.1	mg/L	EPA 425.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	93	96	3
Hardness (%)	101*	-	-
Sulfate (%)	92	83	10
Surfactants (MBAS) (%)	87	88	1

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	205.0	205.0	<1
Conductivity (mg/L)	1626.5	1626.5	<1
pH (pH)	7.18	7.14	<1
Total Dissolved Solids (mg/L)	1080	1080	<1

* DETERMINED FROM THE AVERAGE OF THE CALCIUM AND MAGNESIUM LCS RESULTS.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-2
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-9

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	270	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	270	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	180	0.50	mg/L	EPA 325.2	11/27
Conductivity	1,600	50	umhos/cm	EPA 120.1	12/03
Hardness	260	100	ug/L	EPA 6010	12/03
pH	7.5	+/- 0.1	pH	EPA 150.1	11/30
Sulfate	230	5.0	mg/L	EPA 375.2	11/29
Total Dissolved Solids	1,000	4.0	mg/L	EPA 160.1	11/27
Surfactants (MBAS)	0.1	0.1	mg/L	EPA 425.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	93	96	3
Hardness (%)	101*	-	-
Sulfate (%)	92	83	10
Surfactants (MBAS) (%)	87	88	1

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	205.0	205.0	<1
Conductivity (mg/L)	1626.5	1626.5	<1
pH (pH)	7.18	7.14	<1
Total Dissolved Solids (mg/L)	1080	1080	<1

* DETERMINED FROM THE AVERAGE OF THE CALCIUM AND MAGNESIUM LCS RESULTS.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-5

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	650	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	650	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	230	0.50	mg/L	EPA 325.2	11/27
Conductivity	3,000	50	umhos/cm	EPA 120.1	12/03
Hardness	580	100	ug/L	EPA 6010	12/03
pH	7.5	+/- 0.1	pH	EPA 150.1	11/30
Sulfate	500	5.0	mg/L	EPA 375.2	11/29
Total Dissolved Solids	2,300	4.0	mg/L	EPA 160.1	11/27
Surfactants (MBAS)	0.1	0.1	mg/L	EPA 425.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	93	96	3
Hardness (%)	101*	-	-
Sulfate (%)	92	83	10
Surfactants (MBAS) (%)	87	88	1

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	205.0	205.0	<1
Conductivity (mg/L)	1626.5	1626.5	<1
pH (pH)	7.18	7.14	<1
Total Dissolved Solids (mg/L)	1080	1080	<1

* DETERMINED FROM THE AVERAGE OF THE CALCIUM AND MAGNESIUM LCS RESULTS.

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205900-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-3

DATE SAMPLED: 11/25/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	380	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	380	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	450	0.50	mg/L	EPA 325.2	11/27
Conductivity	2,800	50	umhos/cm	EPA 120.1	12/03
Hardness	660	100	ug/L	EPA 6010	12/03
pH	7.1	+/- 0.1	pH	EPA 150.1	11/30
Sulfate	320	5.0	mg/L	EPA 375.2	11/29
Total Dissolved Solids	1,800	4.0	mg/L	EPA 160.1	11/27
Surfactants (MBAS)	ND	0.1	mg/L	EPA 425.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	93	96	3
Hardness (%)	101*	-	-
Sulfate (%)	92	83	10
Surfactants (MBAS) (%)	87	88	1

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	205.0	205.0	<1
Conductivity (mg/L)	1626.5	1626.5	<1
pH (pH)	7.18	7.14	<1
Total Dissolved Solids (mg/L)	1080	1080	<1

* DETERMINED FROM THE AVERAGE OF THE CALCIUM AND MAGNESIUM LCS RESULTS.

ABBREVIATIONS

BTEX - Benzene, Toluene, Ethyl Benzene, and Total Xylenes.

CCR - California Code of Regulations.

DHS - California Department of Health Services.

EPA - United States Environmental Protection Agency.

LCS - Laboratory Control Spike

LUFT - Leaking Underground Fuel Tank.

MDL - Method Detection Limit

NA - Not Applicable.

NC - Not Calculable

ND - Not Detected at or above the defined detection limit.

PQL - Practical Quantitation Limit

RPD - Relative percent difference.

STLC - Soluble Threshold Limit Concentration.

Surr. - Surrogates.

TCLP - Toxicity Characteristic Leaching Procedure.

TEH - Total Extractable Petroleum Hydrocarbons.

Title 26 - Title 26 of the California Code of Regulations (CCR).

TR~ - Trace, estimated value .

TTLC - Total Threshold Limit Concentration.

TVH - Total Volatile Hydrocarbons.

WET - Waste Extraction Test.

UNITS

cm3 - Cubic centimeter
Kg - kilogram.
L - Liter.
mg - Milligrams.
M3 - Cubic meter.

1umhos/cm - uS/cm - Micro Siemens/centimeter
ppb - Parts Per Billion.
ppm - Parts per Million.
ug - Micrograms.

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10018

205900

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Project Name: H. Kramer & Co.

OFS No.: CHEC 3135.004

Sampling Date: 11/25/92

Shipment Date: 11/25/92

HAZARD IDENTIFICATION: Nonhazard ☒ Reactive ☐ Flammable ☐ Toxic ☐ Skin Irritant ☐ Infectious ☐

Time Required: NORMAL ☒ ____ DAYS; RUSH ☐ ____ DAYS

Project Address: One Chapman Way, El Segundo, CA.

Sampler (Name): Rob Tweidt

Sampler: (Signature): Robert K Tweidt

Laboratory/DHS No.: Curtis & Tompkins, Ltd.

Reports to Be Sent to: Rob Tweidt

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	General Minerals (MBAS)	General Minerals (alk, pH, EC, Cl⁻, SO₄)	General Minerals (misc. inorganics, hardness)	Arsenic (6010/7060)	VOC's (8240/624)			
MW-10 (1of3)	0845	ice	1 liter plastic	X													X							
MW-10 (2of3)	0845	ice	"	X														X						
MW-10 (3of3)	0845	ice + HNO3	"	X															X					
MW-10	0845	ice	"	X																X				
one sample (MW-10 (Set of 3)	0845	ice + HCl ~~40 ml VOAs~~	40 ml VOAs	X																	X			
MW-9 (1of3)	1045	ice	1 liter plastic	X													X							
MW-9 (2of3)	1045	ice	"	X														X						
MW-9 (3of3)	1045	ice + HNO3	"	X															X					
MW-9	1045	ice	"	X																X				
one sample (MW-9 (set of 3)	1045	ice + HCl	40 ml VOAs	X																	X			

LABORATORY INSTRUCTIONS/COMMENTS:

Filter all arsenic samples in lab prior to analysis

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
Robert K Tweidt	11/25/92	[illegible]			
Company: Ebasco Environmental	Time: 1506	Company: C&T	Company:	Time:	Company:

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F-2

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10017

205900

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Project Name: H. Kramer & Co.

OFS No.: EHEC 3135.004

Sampling Date: 11/25/92

Shipment Date: 11/25/92

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☒ ____ DAYS; RUSH ☐ ____ DAYS

Project Address: One Chapman Way, El Segundo

Sampler (Name): Rob Tweidt

Sampler: (Signature): Robert K. Tweidt

Laboratory/DHS No.: Curtis & Tompkins, Ltd

Reports to Be Sent to: Rob Tweidt

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	General Minerals (MDAS)	General Minerals (alk, pH, EC, Cl, SO4, TDS)	General Minerals (mg, K, Na, hardness)	General Arsenic (6010/7060)	VOAs (8240/624)			
MW-5 (1 of 3)	1230	ice	1 liter plastic	X													X							
MW-5 (2 of 3)	1230	ice	"	X														X						
MW-5 (3 of 3)	1230	ice + HNO_3	"	X															X					
MW-5	1230	ice	"	X																X				
one sample MW-5 (set of 3)	1230	ice + HCl	40 ml VOAs	X																	X			
MW-3	1445	ice	1 liter plastic	X													X							
MW-3	1445	ice	"	X														X						
MW-3	1445	ice & HCl	"	X															X					
MW-3	1445	ice	"	X																X				

LABORATORY INSTRUCTIONS/COMMENTS:

Filter arsenic samples in lab prior to analyses

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
Robert K. Tweidt	11/25/92	[illegible]			
Company: Ebasco Environmental	Time: 1506	Company: C&T	Company:	Time:	Company:

F-2

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Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023, Phone (213) 269-7421, Fax (213) 268-5328

EBASCO ENVIRONMENTAL
3000 WEST MacARTHUR BOULEVARD
SANTA ANA, CA 92704
ATTN: ROB TWEIDT

DATE RECEIVED: 11/20/92
DATE REPORTED: 12/07/92

LAB NUMBER: 205869

PROJECT ID: CHEC 3135.004

REPORT ON: TWO SOLID AND TWO LIQUID SAMPLES ANALYZED AS SPECIFIED ON ATTACHED CHAIN OF CUSTODY

LOCATION: H. KRAMER & CO., EL SEGUNDO, CALIFORNIA

Reviewed By: _____ _____

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-1

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	54,000	500	12/01	6010
Copper	ND	10	12/01	6010
Iron	270	100	12/01	6010
Magnesium	26,000	100	12/01	6010
Manganese	150	15	12/01	6010
Sodium	210,000	500	12/01	6010
Zinc	90	10	12/01	6010

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	102	2
Copper	96	<1
Iron	105	2
Manganese	100	2
Magnesium	99	2
Sodium	99	3
Zinc	102	8

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-7

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

METALS

MATRIX: LIQUID
METHOD: SEE BELOW

METAL	RESULT (ug/L)	DETECTION LIMIT (ug/L)	DATE ANALYZED	EPA METHOD
Calcium	47,000	500	12/01	6010
Copper	ND	10	12/01	6010
Iron	4,200	100	12/01	6010
Magnesium	19,000	100	12/01	6010
Manganese	110	15	12/01	6010
Sodium	170,000	500	12/01	6010
Zinc	150	10	12/01	6010

QUALITY CONTROL SUMMARY

METAL	LCS % RECOVERY	RPD
Calcium	102	2
Copper	96	<1
Iron	105	2
Magnesium	99	2
Manganese	100	2
Sodium	99	3
Zinc	102	8

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869
CLIENT: EBASCO ENVIRONMENTAL

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

ARSENIC

MATRIX: LIQUID
METHOD: EPA 7060

LAB ID	SAMPLE ID	RESULT (ug/L)	DETECTION LIMIT	DATE ANALYZED	QC BATCH
3	MW-1	3,600*	500***	12/03	A
4	MW-7	ND**	10	12/03	B

* SAMPLE WAS PRESERVED IN THE FIELD. SAMPLE WAS NOT FILTERED PRIOR TO ANALYSIS.
** SAMPLE WAS FILTERED AND ACIDIFIED AT THE LAB. SAMPLE WAS NOT DIGESTED.
*** 1:50 DILUTION REQUIRED.

QUALITY CONTROL SUMMARY

Arsenic	QC BATCH	LCS % RECOVERY	RPD
LABORATORY CONTROL SAMPLE:	A	95	
SAMPLE/SAMPLE DUPLICATE RPD:	A		<1
Arsenic - Filtered/preserved in lab			
LABORATORY CONTROL SAMPLE:	B	101	
SAMPLE/SAMPLE DUPLICATE RPD:	B		1

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869
CLIENT: EBASCO ENVIRONMENTAL

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

HEXAVALENT CHROMIUM

MATRIX: SOLID
METHOD: EPA 7196

LAB ID	SAMPLE ID	RESULT (mg/Kg)	DATE ANALYZED	QC BATCH
1	EHB1-.5FT	ND	11/25	A
2	EHB1-5FT	ND	11/25	A

DETECTION LIMIT: 0.10

QUALITY CONTROL SUMMARY

	BATCH	SPIKE % REC.	SPIKE DUP. % REC.	RPD
SAMPLE/SAMPLE DUPLICATE DATA:	A	104	87	18

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-1

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	280	10	mg/L	EPA 310.1	11/24
Carbonate	ND	10	mg/L	EPA 310.1	11/24
Bicarbonate	280	10	mg/L	EPA 310.1	11/24
Hydroxide	ND	10	mg/L	EPA 310.1	11/24
Chloride	150	0.50	mg/L	EPA 325.2	11/27
Conductivity	1,400	50	umhos/Cm	EPA 120.1	11/23
Hardness	240	NA	mg/L	EPA 6010	12/01
MBAS	ND	0.05	mg/L	EPA 425.1	11/21
pH	7.25	+/- 0.1	pH	EPA 150.1	11/23
Sulfate	210	5.0	mg/L	EPA 375.2	12/17
Total Dissolved Solids	940	4.0	mg/L	EPA 160.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	96	92	4
MBAS (%)	88	88	<1
Sulfate	85	88	3

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	277.38	275.37	<1
Conductivity (umhos/Cm)	1786.2	1786.2	<1
pH (pH)	7.25	7.28	<1
Total Dissolved Solids (mg/L)	940	912	3

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205869-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-7

DATE SAMPLED: 11/20/92
DATE ANALYZED: SEE BELOW

GENERAL CHEMISTRY

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	190	10	mg/L	EPA 310.1	11/24
Carbonate	ND	10	mg/L	EPA 310.1	11/24
Bicarbonate	190	10	mg/L	EPA 310.1	11/24
Hydroxide	ND	10	mg/L	EPA 310.1	11/24
Chloride	63	0.50	mg/L	EPA 325.2	11/27
Conductivity	1,200	50	umhos/Cm	EPA 120.1	11/23
Hardness	200	NA	mg/L	EPA 6010	12/01
MBAS	ND	0.05	mg/L	EPA 425.1	11/21
pH	7.3	+/- 0.1	pH	EPA 150.1	11/23
Sulfate	200	5.0	mg/L	EPA 375.2	12/17
Total Dissolved Solids	810	4.0	mg/L	EPA 160.1	11/27

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	96	92	4
MBAS (%)	88	88	<1
Sulfate	85	88	3

	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	277.38	275.37	<1
Conductivity (umhos/Cm)	1786.2	1786.2	<1
pH (pH)	7.25	7.28	<1
Total Dissolved Solids (mg/L)	940	912	3

ABBREVIATIONS

BTEX - Benzene, Toluene, Ethyl Benzene, and Total Xylenes.

CCR - California Code of Regulations.

DHS - California Department of Health Services.

EPA - United States Environmental Protection Agency.

LCS - Laboratory Control Spike

LUFT - Leaking Underground Fuel Tank.

MDL - Method Detection Limit

NA - Not Applicable.

NC - Not Calculable

ND - Not Detected at or above the defined detection limit.

PQL - Practical Quantitation Limit

RPD - Relative percent difference.

STLC - Soluble Threshold Limit Concentration.

Surr. - Surrogates.

TCLP - Toxicity Characteristic Leaching Procedure.

TEH - Total Extractable Petroleum Hydrocarbons.

Title 26 - Title 26 of the California Code of Regulations (CCR).

TR~ - Trace, estimated value .

TTLC - Total Threshold Limit Concentration.

TVH - Total Volatile Hydrocarbons.

WET - Waste Extraction Test.

UNITS

cm3 - Cubic centimeter
Kg - kilogram.
L - Liter.
mg - Milligrams.
M3 - Cubic meter.

1umhos/cm - uS/cm - Micro Siemens/centimeter
ppb - Parts Per Billion.
ppm - Parts per Million.
ug - Micrograms.

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10009

205869

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Page ___ of ___

Project Name: H. Kramer & Co.

OFS No.: CHEC 3135.004

Sampling Date: 11/20/92

Shipment Date:

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☒ ___ DAYS; RUSH ☐ ___ DAYS

Project Address: One Chapman Way, El Segundo, CA.

Sampler (Name): Rob Tweidt

Sampler: (Signature): Robert K. Tweidt

Laboratory/DHS No. :

Reports to Be Sent to: Rob K. Tweidt

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	Hexavalent Chromium	General Minerals	MBA's	Arsenic			
EHB 1 - .5ft	0800	ice	2" x 6" brass sleeve		X												X						
EHB 1 - 5ft	0815	ice	2" x 6" brass sleeve		X												X						
																		~~X~~					
MW-1	1600	ice	1 liter	X														X					
MW-1	1600	ice	1 liter	X															X				
MW-1	1600	ice	500 ml	X																X			
MW-7	1630	ice	1 liter	X														X					
MW-7	1630	ice	1 liter	X															X				
MW-7	1630	ice	~~500 ml~~ 1 liter PKT	X																X			

one sample

one sample

LABORATORY INSTRUCTIONS/COMMENTS:

MW-7 water sample for arsenic needs to be filtered in lab prior to analysis.

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
Robert K. Tweidt	11-20-92	[signature]			
Company: Ebasco Environmental	Time: 18:40	Company: Curtis & Tompkins	Company:	Time:	Company:

F-2

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Curtis & Tompkins, Ltd., Analytical Laboratories, Since 1878
1250 S. Boyle Ave., Los Angeles, CA 90023, Phone (213) 269-7421, Fax (213) 268-5328

EBASCO ENVIRONMENTAL
3000 WEST MacARTHUR BOULEVARD
SANTA ANA, CA 92704
ATTN: ROB TWEIDT

DATE RECEIVED: 11/24/92
DATE REPORTED: 11/08/92

LAB NUMBER: 205895

PROJECT ID: CHEC 3135.004

REPORT ON: FOUR LIQUID SAMPLES ANALYZED AS SPECIFIED ON ATTACHED CHAIN OF CUSTODY

LOCATION: H. KRAMER & CO., EL SEGUNDO, CALIFORNIA

Reviewed By: _____ _____

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 205895-2
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-8

DATE SAMPLED: 11/24/92
DATE ANALYZED: 12/03/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	5	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	63	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	6	5
Carbon tetrachloride	46	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	43	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	170	5
Vinyl acetate	ND	10

QUALITY CONTROL SUMMARY ON NEXT PAGE

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	92
	Toluene-d8:	94
	Bromofluorobenzene:	100

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	77	93	19

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 205895-3
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: TRIP BLANK

DATE SAMPLED: 11/24/92
DATE ANALYZED: 12/02/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	ND	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	ND	5
Carbon tetrachloride	ND	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	ND	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	ND	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	ND	5
Vinyl acetate	ND	10

QUALITY CONTROL SUMMARY ON NEXT PAGE

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205895-3
SAMPLE ID: TRIP BLANK

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	104
	Toluene-d8:	95
	Bromofluorobenzene:	101

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	77	93	19

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205895-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-6

DATE SAMPLED: 11/24/92
DATE ANALYZED: 12/02/92

VOLATILE ORGANICS

MATRIX: LIQUID
METHOD: EPA 8240 - CAPILLARY COLUMN
EXTRACTION: EPA 5030 PURGE AND TRAP

COMPOUND	RESULT (ug/L)	DETECTION LIMIT (ug/L)
Chloromethane	ND	10
Bromomethane	ND	10
Vinyl chloride	ND	10
Chloroethane	ND	10
Methylene chloride	ND	30
Acetone	ND	10
Carbon Disulfide	ND	5
1,1-Dichloroethene	ND	5
1,1-Dichloroethane	ND	5
cis-1,2-Dichloroethene	ND	5
trans-1,2-Dichloroethene	ND	5
Chloroform	120	5
1,2-Dichloroethane	ND	5
2-Butanone	ND	10
1,1,1-Trichloroethane	ND	5
Carbon tetrachloride	59	5
Bromodichloromethane	ND	5
1,2-Dichloropropane	ND	5
cis-1,3-Dichloropropene	ND	5
Trichloroethene	86	5
Dibromochloromethane	ND	5
1,1,2-Trichloroethane	ND	5
Benzene	ND	5
trans-1,3-Dichloropropene	ND	5
Bromoform	ND	5
2-Hexanone	ND	10
4-Methyl-2-Pentanone	ND	10
1,1,2,2-Tetrachloroethane	ND	5
Tetrachloroethene	40	5
Toluene	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
Styrene	ND	5
Total Xylenes	ND	5
Freon 113	ND	30
Trichlorofluoromethane	150	5
Vinyl acetate	ND	10

QUALITY CONTROL SUMMARY ON NEXT PAGE

QUALITY CONTROL SUMMARY

SURROGATE PERCENT RECOVERY -	1,2-Dichloroethane-d4:	107
	Toluene-d8:	94
	Bromofluorobenzene:	96

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
AVERAGE SPIKE/SPIKE DUPLICATE DATA:	77	93	19

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205895
CLIENT: EBASCO ENVIRONMENTAL

DATE SAMPLED: 11/24/92
DATE ANALYZED: SEE BELOW

ARSENIC

MATRIX: LIQUID
METHOD: EPA 7060

LAB ID	SAMPLE ID	RESULT (ug/L)	DETECTION LIMIT	RESULT* (ug/L)	DETECTION* LIMIT	DATE ANALYZED	QC BATCH
1	MW-2	7,600	2,000**	8,700	210***	12/03	A
2	MW-8	ND	10	ND	10	12/03	A
4	MW-6	6,500	2,000**	6,900	210***	12/03	A

* SAMPLE WAS FILTERED AND ACIDIFIED AT THE LAB. SAMPLE WAS NOT DIGESTED. (ANALYZED 12/18/92.)
** 1:200 DILUTION DUE TO HIGH LEVELS OF ARSENIC.
*** 1:20 DILUTION DUE TO HIGH LEVELS OF ARSENIC.

QUALITY CONTROL SUMMARY

Arsenic	QC BATCH	LCS % RECOVERY	RPD
LABORATORY CONTROL SAMPLE:	A	95	
SAMPLE/SAMPLE DUPLICATE RPD:	A		<1
Arsenic - Filtered/preserved in lab			
LABORATORY CONTROL SAMPLE:	A	101	
SAMPLE/SAMPLE DUPLICATE RPD:	A		1

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 205895-1
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-2

DATE SAMPLED: 11/24/92
DATE ANALYZED: SEE BELOW

GENERAL MINERALS

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	420	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	420	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	100	0.50	mg/L	EPA 325.2	11/27
Conductivity	3,500	50	umhos/Cm	EPA 120.1	11/25
Surfactants (MBAS)	ND	0.05	mg/L	EPA 425.1	11/25
pH	6.9	+/- 0.1	pH	EPA 150.1	11/25
Sulfate	1,300	5.0	mg/L	EPA 375.2	12/03
Total Dissolved Solids	2,900	4.0	mg/L	EPA 160.1	11/27
Copper	ND	10	ug/L	EPA 6010	12/03
Hardness	710	100	mg/L	EPA 6010	12/03
Calcium	150,000	100	ug/L	EPA 6010	12/03
Magnesium	81,000	100	ug/L	EPA 6010	12/03
Manganese	3,300	100	ug/L	EPA 6010	12/03
Iron	ND	1,000	ug/L	EPA 6010	12/03
Sodium	440,000	100	ug/L	EPA 6010	12/03
Zinc	ND	1,000	ug/L	EPA 6010	12/03

* 1:200 DILUTION.

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	419.08	420.09	<1
Conductivity (umhos/Cm)	1,427.8	1,427.8	<1
pH (pH)	7.32	7.36	<1
Total Dissolved Solids (mg/L)	2904.0	2912.0	<1

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	96	98	2
Surfactants (MBAS) (%)	111	103	7
Sulfate (%)	102	100	2
Copper (%)	90		<1
Calcium (%)	99	___	3
Magnesium (%)	103	___	3
Manganese (%)	89	___	3
Iron (%)	92	___	3
Sodium (%)	100	___	1
Zinc (%)	149	___	182

Curtis & Tompkins, Ltd

LABORATORY NUMBER: 205895-2
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-8

DATE SAMPLED: 11/24/92
DATE ANALYZED: SEE BELOW

GENERAL MINERALS

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	56	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	56	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	75	0.50	mg/L	EPA 325.2	11/27
Conductivity	880	50	umhos/Cm	EPA 120.1	11/25
Surfactants (MBAS)	0.06	0.05	mg/L	EPA 425.1	11/25
pH	6.4	+/- 0.1	pH	EPA 150.1	11/25
Sulfate	230	5.0	mg/L	EPA 375.2	12/03
Total Dissolved Solids	640	4.0	mg/L	EPA 160.1	11/27
Copper	ND	10	ug/L	EPA 6010	12/03
Hardness	210	100	mg/L	EPA 6010	12/03
Calcium	51,000	100	ug/L	EPA 6010	12/03
Magnesium	19,000	100	ug/L	EPA 6010	12/03
Manganese	930	100	ug/L	EPA 6010	12/03
Iron	ND	1,000	ug/L	EPA 6010	12/03
Sodium	95,000	100	ug/L	EPA 6010	12/03
Zinc	ND	1,000	ug/L	EPA 6010	12/03

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	419.08	420.09	<1
Conductivity (umhos/Cm)	1,427.8	1,427.8	<1
pH (pH)	7.32	7.36	<1
Total Dissolved Solids (mg/L)	2904.0	2912.0	<1

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	96	98	2
Surfactants (MBAS) (%)	111	103	7
Sulfate (%)	102	100	2
Copper (%)	90		<1
Calcium (%)	99	___	3
Magnesium (%)	103	___	3
Manganese (%)	89	___	3
Iron (%)	92	___	3
Sodium (%)	100	___	1
Zinc (%)	149	___	182

Curtis & Tompkins, Ltd.

LABORATORY NUMBER: 205895-4
CLIENT: EBASCO ENVIRONMENTAL
SAMPLE ID: MW-6

DATE SAMPLED: 11/24/92
DATE ANALYZED: SEE BELOW

GENERAL MINERALS

MATRIX: LIQUID

ANALYSIS	RESULT	DETECTION LIMIT	UNITS	METHOD	DATE ANALYZED
Alkalinity	180	10	mg/L	EPA 310.1	12/02
Carbonate	ND	10	mg/L	EPA 310.1	12/02
Bicarbonate	180	10	mg/L	EPA 310.1	12/02
Hydroxide	ND	10	mg/L	EPA 310.1	12/02
Chloride	230	0.50	mg/L	EPA 325.2	11/27
Conductivity	3,300	50	umhos/Cm	EPA 120.1	11/25
Surfactants (MBAS)	0.11	0.05	mg/L	EPA 425.1	11/25
pH	6.8	+/- 0.1	pH	EPA 150.1	11/25
Sulfate	1,300	5.0	mg/L	EPA 375.2	12/03
Total Dissolved Solids	2,600	4.0	mg/L	EPA 160.1	11/27
Copper	18	10	ug/L	EPA 6010	12/03
Hardness	690	100	mg/L	EPA 6010	12/03
Calcium	150,000	100	ug/L	EPA 6010	12/03
Magnesium	77,000	100	ug/L	EPA 6010	12/03
Manganese	1,800	100	ug/L	EPA 6010	12/03
Iron	710	1,000	ug/L	EPA 6010	12/03
Sodium	340,000	100	ug/L	EPA 6010	12/03
Zinc	690	1,000	ug/L	EPA 6010	12/03

* 1:200 DILUTION.

QUALITY CONTROL SUMMARY

ANALYSIS (units)	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD
Alkalinity (mg/L)	419.08	420.09	<1
Conductivity (umhos/Cm)	1,427.8	1,427.8	<1
pH (pH)	7.32	7.36	<1
Total Dissolved Solids (mg/L)	2,904.0	2,912.0	<1

	SPIKE % REC.	SPIKE DUP. % REC.	RPD
Chloride (%)	96	98	2
Surfactants (MBAS) (%)	111	103	7
Sulfate (%)	102	100	2
Copper (%)	90		<1
Calcium (%)	99	___	3
Magnesium (%)	103	___	3
Manganese (%)	89	___	3
Iron (%)	92	___	3
Sodium (%)	100	___	1
Zinc (%)	149	___	182

ABBREVIATIONS

BTEX - Benzene, Toluene, Ethyl Benzene, and Total Xylenes.

CCR - California Code of Regulations.

DHS - California Department of Health Services.

EPA - United States Environmental Protection Agency.

LCS - Laboratory Control Spike

LUFT - Leaking Underground Fuel Tank.

MDL - Method Detection Limit

NA - Not Applicable.

NC - Not Calculable

ND - Not Detected at or above the defined detection limit.

PQL - Practical Quantitation Limit

RPD - Relative percent difference.

STLC - Soluble Threshold Limit Concentration.

Surr. - Surrogates.

TCLP - Toxicity Characteristic Leaching Procedure.

TEH - Total Extractable Petroleum Hydrocarbons.

Title 26 - Title 26 of the California Code of Regulations (CCR).

TR~ - Trace, estimated value .

TTLC - Total Threshold Limit Concentration.

TVH - Total Volatile Hydrocarbons.

WET - Waste Extraction Test.

UNITS

cm3 - Cubic centimeter
Kg - kilogram.
L - Liter.
mg - Milligrams.
M3 - Cubic meter.

1umhos/cm - uS/cm - Micro Siemens/centimeter
ppb - Parts Per Billion.
ppm - Parts per Million.
ug - Micrograms.

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0660
UA6

EBASCO

Report

Phase II
Supplemental Site Investigation
August 1993

for the

H. Kramer & Company Site

El Segundo, California

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated

October 1993

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H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

Prepared By

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October 1993

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H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

EXECUTIVE SUMMARY

INTRODUCTION

In August 1993, Ebasco Environmental performed Phase II of a supplemental site investigation of the geology and groundwater beneath the H. Kramer & Company site. Phase II was designed to further assess issues identified in previous studies, and comply with Cleanup and Abatement Order No. 92-094 (Order), issued by the Los Angeles Regional Water Quality Control Board (Board) on December 28, 1992. Specifically, while it is known that the groundwater is regionally contaminated and (therefore) not suitable for human consumption, this investigation was designed to comply with the Order's requirement for the definition of the arsenic plume in the Gage Aquifer within the regionally contaminated volatile organic compound (VOC) plume. downgradient of the site. Equally important to the Phase II study was resolution of anomalous concentrations of arsenic found consistently in monitoring well MW-5, installed for H. Kramer & Company in 1989.

BACKGROUND

The H. Kramer site is located in industrially zoned property in the city of El Segundo, California. H. Kramer operated a brass foundry at the site from 1951 through mid-1985, generating slag waste which was deposited in a former liquid waste lagoon used by Kramer's site predecessor, Harshaw Chemical Company. Harshaw generated, in the process of smelting antimony, wastes containing arsenic.

Previous studies (IT Corporation, 1985; ENSR Consulting and Engineering, 1989; and Ebasco, 1992) identified arsenic, as well as volatile organic compounds, in both the upper (Old Sand Dune) and lower (Gage) aquifers beneath the site. These two aquifers are separated by the Bellflower Aquiclude. However, Phase I work concluded that the presence of arsenic in the Gage could be due in part to cross-screening of the two aquifers by wells constructed during the 1989 ENSR investigation (MW-5 and MW-6 in particular).

Objectives of the Phase II supplemental site investigation were to determine the downgradient boundary of the arsenic plume in the Gage Aquifer and to resolve questions about the arsenic reading from MW-5 and the suspected screening of MW-6 across the Bellflower Aquiclude. Additionally, historical aerial photographs were to be evaluated in order to establish the bounds of Harshaw's original waste disposal lagoon, now filled with slag deposits.

SCOPE OF WORK

The Phase II study was designed to efficiently and economically delineate the downgradient extent of the arsenic plume through use of field screening and laboratory verification methods detailed in a work plan approved by the Board in April 1993. The approach entailed use of a dual-wall percussion drilling rig with reverse-air circulation to accomplish the boring. Sampling of the groundwater in the Gage Aquifer was done with a Hydropunch HP-II tool, and a field determination of order-of-magnitude arsenic concentrations in the HP sample was performed using an EM Quant Test Strip© Kit (with a detection range of 0.1 mg/l to 3.0 mg/l). Based on field screening results, a decision was made to abandon the boring or (given lab verification) construct a monitoring well in it. The concept behind this method was that if the field screening results registered high on the detection scale, the location was still well within the plume and it would serve no purpose to install a permanent well there. In such case, the plan was to backfill the boring and step out (further downgradient) with another boring until arsenic levels decreased to levels low enough (i.e., $\leq$ 0.05 mg/l) to be considered outside the plume. Once accomplishing this objective, a monitoring well was to be constructed/screened to monitor the Gage Aquifer concentrations of arsenic.

Near MW-5 and MW-6, this technique was used, along with new lithological data (boring observations and logs), to further evaluate potential cross-contamination problems suggested by anomalies in results of previous studies.

For lagoon delineation, aerial photographs were reviewed at the Fairchild Collection, Department of Geology, Whittier College.

RESULTS

Use of the Hydropunch approach resulted in quick definition of the downgradient extent of arsenic contamination with only two borings. One boring was located on the northeast tip of the site, (HP-2); the other just northwest of the property on the Southern Pacific railway right-of-way (HP-3). With the approval of the Boards' on-site representative, monitoring wells were constructed within these borings (MW-11 and MW-13), and the objective (i.e., downgradient plume definition) was considered to have been achieved.

HP-4, located just upgradient of MW-6 in the Gage Aquifer, did not have detectable levels of arsenic in field screening or laboratory verification samples of Gage Aquifer groundwater, and MW-12 was constructed therein to eventually replace upgradient MW-6. HP-5, proximal to MW-5, validated the fact the MW-5 construction was creating a conduit between the Old Dune

Sand and Gage Aquigers, and therefore was responsible for anomalously high arsenic results of previous studies. HP samples of Gage Aquifer groundwater at this location had concentrations of 6.0 mg/l at the top of the Gage Aquifer; and less than 0.03 mg/l at the bottom of the Gage (vs. 110 mg/l found in Phase I within MW-5).

The Bellflower Aquiclude was found to be present and competent in all new borings (HP-2 through HP-5). But, VOCs were detected in all Gage Aquifer samples, verifying again the extent of regional contamination in the Gage Aquifer (similar to that found in the Old Dune Sand Aquifer) which cannot be ascribed to Kramer site activities.

CONCLUSIONS

Results of the Phase II supplemental site investigation indicate the following:

- The Bellflower Aquiclude is competent beneath the site except where breached by MW-5, MW-6 and probably MW-8;
- There is regional VOC contamination in both the Old Dune Sand and Gage Aquifers;
- The arsenic plume is largely confined to site boundaries; and
- Monitoring wells MW-5, MW-6, and MW-8 should be properly destroyed in order to prevent additional migration of arsenic to the Gage Aquifer, even though arsenic has not been detected off the site after 4 years of such potential.

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

Prepared By

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October 1993

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5

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

TABLE OF CONTENTS

SECTION		PAGE
1.0	INTRODUCTION	1
1.1	PURPOSE AND OBJECTIVES	1
1.2	SITE BACKGROUND	1
2.0	HISTORIC AERIAL PHOTOGRAPHY RESEARCH	3
3.0	FIELD METHODS AND MATERIALS	5
3.1	DRILLING ACTIVITIES	5
3.2	SOIL SAMPLING	5
3.3	GROUNDWATER SAMPLING	6
3.5	MONITORING WELL DEVELOPMENT	9
3.6	BORING ABANDONMENT	9
4.0	LABORATORY ANALYSIS	10
4.1	SOIL SAMPLES	10
4.2	GROUNDWATER SAMPLES	10
5.0	DISCUSSION OF RESULTS	10
5.1	GEOLOGY	10
5.2	HYDROGEOLOGY	15
5.3	ARSENIC CONCENTRATIONS IN SOIL	19
5.4	ARSENIC CONCENTRATIONS IN GROUNDWATER	21
5.5	VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER	21
5.6	ARSENIC ANOMALY AT MONITORING WELL MW-5	24
6.0	SUMMARY	24
7.0	CONCLUSIONS	26
8.0	RECOMMENDATIONS	26

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

LIST OF FIGURES

Figure 1: Vicinity Map 2
Figure 2: Facility Map 4
Figure 3: Geologic Cross-Section 14
Figure 4: Hydrologic Cross Section - Gage Aquifer, August 26, 1993 16
Figure 5: Water Table Contour Map - Old Dune Sand Aquifer, August 26, 1993 17
Figure 6: Potentiometric Surface Contour Map - Gage Aquifer, August 26, 1993 18
Figure 7: Arsenic Concentrations in Soil 20
Figure 8: Arsenic Concentrations in Groundwater 22
Figure 9: Arsenic Concentration Contour Map - Gage Aquifer 23

LIST OF TABLES

PAGE

Table 1: Well Construction 8
Table 2: Results for Arsenic in Soil 11
Table 3: Results for Arsenic in Groundwater 12
Table 4: Results for VOCs in Groundwater 13

APPENDICES

Appendix A: Historic Aerial Photograph
Appendix B: Lithologic and Well Construction Logs
Appendix C: Development/Sampling Logs
Appendix D: Laboratory Reports

H. KRAMER & CO. SITE
EL SEGUNDO, CALIFORNIA

PHASE II
SUPPLEMENTAL SITE INVESTIGATION
AUGUST 1993

1.0 INTRODUCTION

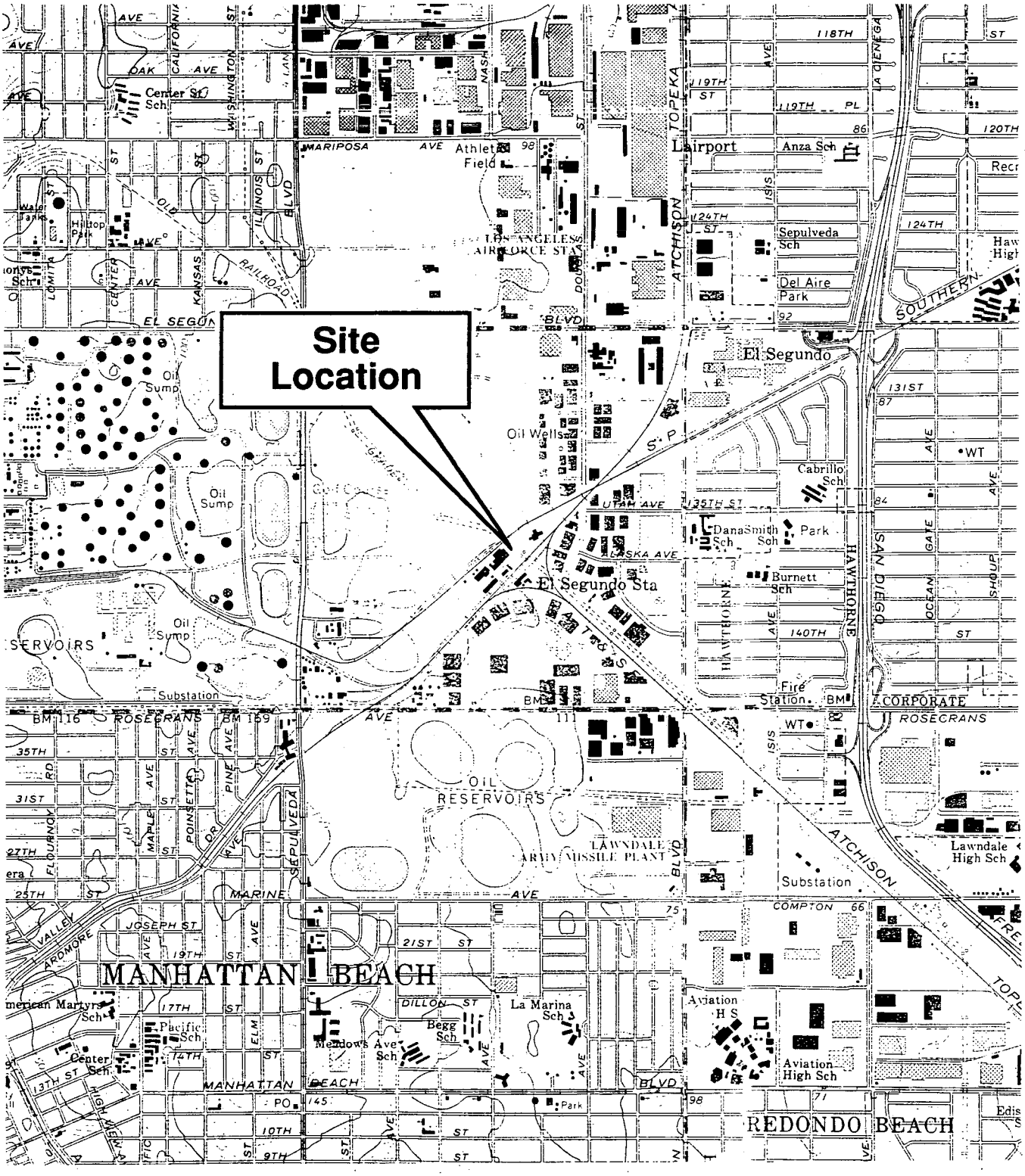
Presented in this report are the results of a supplemental site investigation performed by Ebasco Environmental (Ebasco) at the H. Kramer & Company (H. Kramer) site located at One Chapman Way, El Segundo, California (Figure 1). The Phase II supplemental site investigation was performed at the request of the Los Angeles Regional Water Quality Control Board (Board) pursuant to Cleanup and Abatement Order N° 92-094 (dated December 28, 1992) to assess arsenic concentrations in groundwater beneath the facility. Results of this Phase II investigation will be used to support a remedial action plan being developed consistent with results of these studies, and a health risk assessment published in February, 1993, in which it was concluded, among other things, that risks associated with groundwater contamination were marginal and controllable since the affected aquifers are not used as a water supply within a 1-mile radius of the facility.

1.1 PURPOSE AND OBJECTIVES

The purpose of this supplemental site investigation was to resolve issues identified in the Phase I study published in January, 1993. The main objectives of Phase II were to (1) research the extent of the former lagoon operated by Harshaw Chemical Company through the review of historical aerial photographs; (2) further assess the competency of the Bellflower Aquiclude beneath and west of the former lagoon; (3) establish the lateral (off-site) and vertical (beneath site) extent of elevated dissolved arsenic concentrations, within the regional volatile organic compound (VOC) contaminant plume in the Gage Aquifer; (4) investigate the anomalous arsenic concentrations detected in previous investigations within monitoring well MW-5.

1.2 SITE BACKGROUND

The H. Kramer site is located on industrially zoned property in the city of El Segundo, California. Industrial activity ceased here in 1985. Currently, new construction has restricted further use of the site (overhead electrical transmission lines and a Los Angeles light rail spur). H. Kramer operated a brass foundry at the site from 1951 through mid-1985. Slag generated from site operations was disposed in a waste pile, filling and now extending beyond a waste lagoon used by Kramer's site predecessor, Harshaw Chemical Company. Harshaw generated, in the process of smelting antimony, wastes which contained heavy metals (in particular, arsenic).



Source: USGS, 7.5 Min. Topographic Map, Venice, CA - 1964, Revised 1981.

Figure No. 1

Vicinity Map
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

Arsenic and other metals, as well as volatile organics, were detected in previous investigations conducted for H. Kramer by IT Corporation in 1985 and ENSR Consulting and Engineering in 1989. Three groundwater monitoring wells were installed around the slag pile by IT; five more were completed by ENSR, providing coverage of the entire site. In November/December, 1992, Ebasco performed a Phase I supplemental site investigation, installing two more wells screened in the deeper (Gage) aquifer at the slag pile. Following development of two new wells (MW-9 and MW-10), all monitoring wells (MW-1 through MW-10; see Figure 2) were sampled for analysis of general minerals and dissolved arsenic. Depth to water table were also measured to determine groundwater gradients. Samples from wells MW-5, MW-6, MW-8, MW-9, and MW-10 were also analyzed for volatile organic compounds.

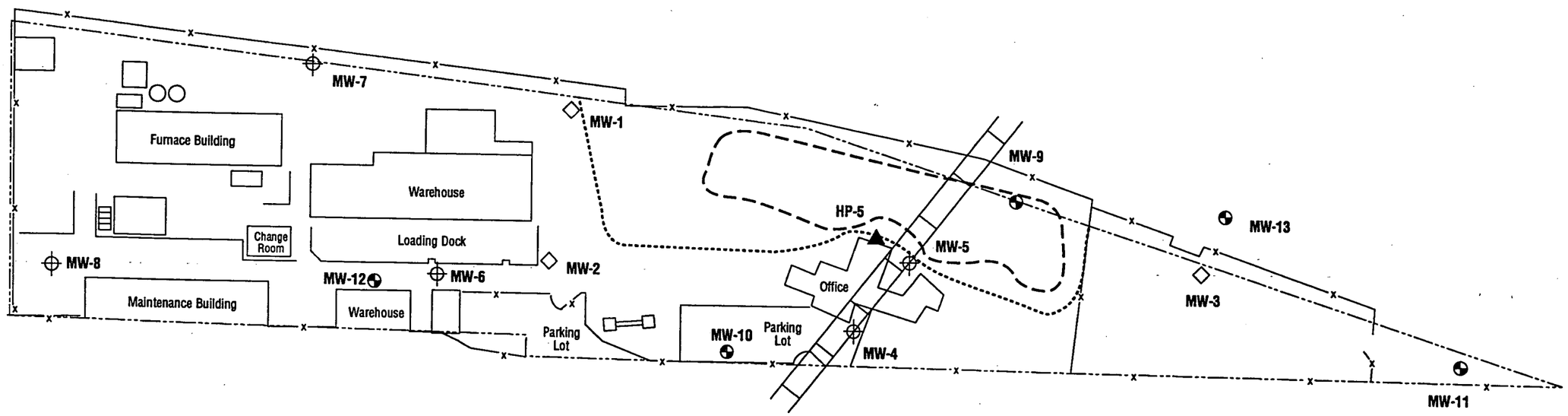
Results of the Phase I study confirmed the presence of two aquifers (Old Dune Sand and Gage) beneath the site, presence of a competent Bellflower Aquiclude in MW-9 and -10 locations, and the presence of arsenic in eight of ten wells. Results of VOC sample analyses in monitoring wells MW-5, MW-6, MW-8, and MW-10 confirmed regional contamination (including Gage Aquifer) by various VOCs.

Analysis of boring logs for MW-6 and MW-8 indicated that the screened interval for these wells bracketed both aquifers, apparently creating hydraulic connections. The log for MW-6 did not reveal presence of the Bellflower Aquiclude, but the logging-observation intervals were surmised to have bracketed, and therefore missed, a clay layer.

The single most important issue, aside from potential off-site migration of arsenic, which remained poorly understood following the Phase I study, was that of the high arsenic concentrations noted in MW-5 in both ENSR's and Ebasco's work. These values (> 100 mg/l) were anomalous and extremely difficult to reconcile with the rest of the values, be they representative of the Old Dune Sand *or* Gage Aquifers. Otherwise, results showed an area of groundwater beneath the site which contained from 0.017 to 8.7 mg/l arsenic. Resolution of the incongruous result from MW-5 remained to be determined, as did accuracy and precision of plume maps derived from Phase I results.

2.0 HISTORIC AERIAL PHOTOGRAPHY RESEARCH

Aerial photographs were reviewed at the Fairchild Collection, Department of Geology, Whittier College, Whittier, California. The aerial photographs indicate that the former lagoon existed at the subject property as early as August, 1941. Appendix A contains a 1955 aerial of the site, clearly showing the lagoon during the early years of H. Kramer's use of the site. The dashed line in Figure 2 represents the known extent of the former lagoon on the basis of the historic aerial photograph presented in Appendix A.



EXPLANATION

- Property Boundary
- Fence
- Excavation Limits of Former Wastewater Pond
- Limits of Slag Pile
- Metro Light-Rail
- Base for Overhead High-Voltage Power Lines
- MW-3 ◇ Monitoring Well Installed by I.T. Corp (1985)
- MW-8 ⊕ Monitoring Well Installed by ENSR (1989)
- MW-13 [HP-4] Monitoring Well Installed by Ebasco Environmental (1992, 1993) with Corresponding Hydropunch Boring Location
- HP-5 ▲ Hydropunch Boring Location

Scale
1" = 150'

Drawing References: Modified from Original Map Provided in ENSR (1990) "Site Characterization Report for the H. Kramer & Company Facility, El Segundo, California". and Air Photo, August 1955; Fairchild Aerial Photography Collection, Department of Geology, Whittier College, Whittier, California.

Figure 2

Facility Map
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

11

3.0 FIELD METHODS AND MATERIALS

Field activities consisting of drilling, soil sampling, groundwater sampling, well installation, well development, and surveying were initiated on August 4, 1993. All field activities were performed according to a work plan prepared in March 1993 and approved by the Board in its letter dated April 12, 1993. The work plan was designed to efficiently evaluate the extent (if any) of downgradient arsenic contamination in the Gage Aquifer and to install a monitoring well at such location(s) to facilitate long-term monitoring as part of the remedial action plan. A total of nine tentative locations were ultimately identified for this purpose. One was located on the site; eight just downgradient of the slag pile on off the site streets and railroad right-of-ways. The work was to proceed from proximal (on-site) locations, outward and downgradient (off the site), with total numbers/terminus to be a function of arsenic screening and analytical results (where arsenic concentrations were $\leq$ 0.05 mg/l). Two other drilling locations (HP-4 and HP-5) were included in the program to further evaluate anomalies at MW-5 and MW-6.

3.1 DRILLING ACTIVITIES

The drilling program was conducted from August 4 through August 20, 1993. Four soil borings (HP-2, HP-3, HP-4, and HP-5) were drilled at those locations illustrated in Figure 2 (HP-1, to the east of the slag pile, was deleted from the program with on-site approval from the Board). [There was no need to perform drilling/sampling at any additional downgradient locations, because arsenic concentrations were found to be below detection (and, therefore, action) levels at HP-2 and HP-3.] Each soil boring was drilled with a dual-wall percussion drilling rig using reverse-air circulation to remove the soil cuttings from the borehole. Soil cuttings generated during drilling operations were placed in roll-off bins and stored on the site for later disposal. Prior to drilling each boring, all dual-wall drive pipe and ancillary down-hole drilling equipment were steam cleaned. The small quantity of decontamination water generated by steam cleaning was collected within the bermed wash area and allowed to evaporate.

The drilling operations were supervised by an Ebasco Environmental geologist who maintained the logs of borings; collected the soil samples; and visually classified the soils encountered following the Unified Soil Classification System (USCS). Notations regarding other drilling and soil characteristics (e.g., color changes, odor, etc.) were also recorded on the field boring logs. Lithologic logs for the soil borings are presented in Appendix B.

3.2 SOIL SAMPLING

Relatively undisturbed soil samples were collected for laboratory analysis at the lithologic contact between the Old Dune Sand Aquifer and the Bellflower Aquiclude, and between the Bellflower Aquiclude and the Gage Aquifer. Additional soil samples were collected for analysis at HP-2 from a sand layer within the Bellflower Aquiclude and at the base of the Gage Aquifer. Soil samples were also collected while drilling through the Bellflower Aquiclude to assist the geologist in identifying the thickness and the homogeneity of the lithology within the unit.

Soil samples were collected using a split-spoon sampler according to the following procedures.

- Drilling was completed to the desired sampling depth.

- A split-spoon sampler containing four brass sample tubes (6.0 inches long by 2.5 inches in diameter) was lowered by steel rods through the middle of the dual-wall drive pipe to the sampling depth. The sampler was driven into the soil 24 inches beyond the drill bit unless refusal was encountered. Refusal was identified as taking greater than 50 blows to drive the sampler six inches. A 140-pound sliding hammer with a 30-inch vertical stroke was used to drive the sampler into the soil.

- After retrieving the sampler, both ends and one-half of the split-spoon sampler were removed to access the four brass sample tubes. The two uppermost sample tubes were used for lithologic description purposes, the next for laboratory analysis (if required), and the lowermost tube for quality-control purposes (if required). The ends of the soil sample designated for laboratory analysis were trimmed, covered with Teflon® sheets, and capped with tightly fitting plastic end caps. After the sample was labeled, it was sealed in a plastic bag and placed on ice in a cooler prior to transporting to the laboratory. Samples used for lithologic descriptions were monitored for the presence of organic vapors with a flame ionization detector (FID) for data acquisition purposes as well as for health and safety monitoring. Measured FID values were recorded on the field boring logs.

At the completion of each boring, all sample information was entered onto a chain-of-custody form. The form accompanied the samples to the laboratory following chain-of-custody protocols.

3.3 GROUNDWATER SAMPLING

Discrete samples were collected from the Gage Aquifer for field screening and laboratory analysis using a Hydropunch HP-II groundwater sampling tool. One sample per boring was collected within the top 10 feet of the Gage Aquifer. Two samples were collected at HP-5; one sample at the top of the Gage Aquifer, and one at the bottom of that aquifer.

Discrete water samples were collected by driving the Hydropunch 24 inches into the aquifer beyond the drill bit. Groundwater from the surrounding formation entered the Hydropunch through the intake screen. The intake screen became exposed when the main body of the Hydropunch was retracted. A check valve at the top and bottom of the sampling chamber within the intake screen retained the groundwater sample as the Hydropunch was retrieved. At the surface, the Hydropunch was turned upside-down and the water sample was discharged through a top discharge valve and tubing into sample bottles.

A portion of each water sample was analyzed for arsenic in the field using EM Quant Test Strips©. The test involved acidification of 5 milliliters (ml) of water in the presence of the

arsenic analyte-target reagent, immersing a test strip into the head space above the water sample, and comparing the change in color on the test strip against a color chart which corresponds to arsenic concentrations. The EM Quant Test Strip© has an arsenic concentration detection range of 0.1 mg/l to 3.0 mg/l. The concept underlying this approach was that if a sample registered at the high end of this range, the boring would be abandoned and backfilled (not outside 0.05 mg/l plume definition action level). If not, the boring would be considered a candidate for monitoring well installation, subject to lab verification of screening results.

The remaining portion of each water sample was submitted to the analytical laboratory for verification of field screening results and for VOC analysis. Samples to be analyzed for arsenic were placed into 500-ml plastic containers with no preservatives. Samples to be analyzed for VOCs were collected in 40-ml glass vials preserved with hydrochloric acid. All samples were placed in a cooler containing ice, to keep them at $\leq$ 4°C until reaching the laboratory. Split samples were taken by the Board from borings HP-2 and HP-4. The split water samples were submitted by the Board to its own approved laboratory for identical analyses.

3.4 MONITORING WELL INSTALLATION

Based upon results of screening/lab verification of arsenic results, three monitoring wells (MW-11, MW-12, and MW-13) were installed within the Gage Aquifer at the locations presented in Figure 2. Monitoring well MW-11 was constructed within the boring for HP-2, monitoring well MW-12 was constructed within the boring for HP-4, and monitoring well MW-13 was constructed within the boring for HP-3. Each well was constructed with either 20 feet (MW-11 and MW-12) or 15 feet (MW-13) of screen, depending on the thickness of the Gage Aquifer at the respective location. Construction details for each monitoring well are summarized in Table 1 and presented graphically in Appendix B. The general procedures followed during the installation of the monitoring wells are described below.

- Well depths were selected by the field geologist based on the depth and the effective thickness of the Gage Aquifer at each location.

- Four-inch-diameter, schedule 40 polyvinyl chloride (PVC) well screen with 0.020-inch slots and a bottom cap was lowered into each boring through the center of the dual-wall drive pipe. The slot size was selected on the basis of the coarseness of the material encountered within the Gage Aquifer while drilling. Four-inch-diameter, schedule 40 PVC blank casing was utilized from the top of the screen to ground surface. Immediately prior to construction of each well, each section of screen and casing was steam cleaned and inspected for structural flaws.

- The annular space between the well screen and the boring wall was backfilled with clean, kiln-dried RMC Lonestar N° 3 sand. Sand was brought up to roughly 3 feet above the top of each screen. In situations where water was present in the annulus after the placement of the N° 3 sand, approximately 4 feet of N° 30 sand was placed on top of the N° 3 sand prior to placing a minimum 5-foot-thick bentonite gel seal. The N° 30 sand

TABLE 1
WELL CONSTRUCTION

Monitoring Well	Date Drilled	Total Depth (ft)	Monitoring Well Diameter (in.)	Screened Aquifer	Screened Interval	Screen Slot Size	Well Material	Top of Casing Reference Elevation (ft above msl)
MW-1	12/02/85	95	4	Old Sand Dune	75-95	NA	PVC	101.91
MW-2	12/04/85	95	4	Old Sand Dune	74-95	NA	PVC	98.90
MW-3	12/06/85	80	4	Old Sand Dune	60-80	NA	PVC	94.22
MW-4	11/20/89	75	4	Old Sand Dune	45-75	0.020	PVC	92.44
MW-5	11/17/89	110	4	Gage	80-110	0.020	PVC	93.00
MW-6	11/16/89	115	4	Old Sand Dune/Gage	84-115	0.020	PVC	98.26
MW-7	11/16/89	95	4	Old Sand Dune	65-95	0.020	PVC	108.15
MW-8	11/14/89	110	4	Old Sand Dune/Gage	80-110	0.020	PVC	102.64
MW-9	11/16/92	114	4	Gage	94-114	0.020	PVC	102.80
MW-10	11/12/92	111	4	Gage	91-111	0.020	PVC	93.70
MW-11	08/09/93	105	4	Gage	85-105	0.020	PVC	89.56
MW-12	08/13/93	128	4	Gage	108-128	0.020	PVC	98.80
MW-13	08/19/93	110	4	Gage	95-110	0.020	PVC	92.71

was added to stop the infiltration of the bentonite gel into the N° 3 sand filter pack. The bentonite gel was substituted for bentonite pellets to ensure a proper seal in the presence of standing water in the annulus. The remaining annular space was filled with cement grout containing 5 percent bentonite by weight. The dual-wall drive pipe was used as a tremie pipe during well construction and was removed one section at a time as construction continued. Volume calculations and frequent depth measurements were taken for determining proper placement of the filter pack and seals. Volume calculations and depth measurements also provided confidence that the upper Old Dune Sand Aquifer was properly sealed off from the deeper Gage Aquifer.

- A locking monument cover and a steel and concrete traffic box were installed at each monitoring well. Each traffic box was installed slightly above grade to direct surface water runoff away from the monitoring well.

3.5 MONITORING WELL DEVELOPMENT

Each monitoring well was initially developed using a 2.5-gallon stainless steel bailer to remove sediment that had accumulated at the bottom of each well during installation. Following bailing, a stainless steel submersible pump was lowered to the bottom of the well and pumping was performed until the purged water became clear. The pump intake was raised and pumping continued. The operation continued upwards through the water column until the entire submerged portion of the screened section had been pumped, and the purged water was relatively clean.

Each well screen was subsequently swabbed with a rubber-disk swab tool to flush fine materials from the sand pack so as to increase the efficiency of the well and to restore the natural hydraulic conductivity of the surrounding formation modified during drilling and well-construction activities. Swabbing was accomplished by repeatedly working the swab tool between the bottom and top of the well screen in single continuous motions.

Following swabbing, pumping resumed using the same initial procedures. Pumping continued until the physical (temperature and turbidity) and chemical (specific conductance and pH) parameters of the purge water had stabilized and at least five well volumes of water had been produced. Well development logs are presented in Appendix C.

3.6 BORING ABANDONMENT

Boring HP-5, near MW-5, was not designated to be converted into a monitoring well and was backfilled with cement grout containing 5 percent bentonite by weight. The backfilling procedure involved the grout being tremmied into place from the bottom to the top of the boring in one continuous operation. The dual-walled drive pipe served as the tremie pipe during the backfilling procedure and was removed as the grout was added. The grout level was kept up within the drive pipe at all times during backfilling to ensure a competent seal.

4.0 LABORATORY ANALYSIS

All soil and groundwater samples were delivered to Del Mar Analytical (Del Mar), located in Irvine, California, for analysis. Del Mar is a laboratory certified by the California Department of Health Services (CDHS Certification No. 1197) for the analyses described in the subsections below.

4.1 SOIL SAMPLES

Soil samples were analyzed for arsenic using EPA Method 6010/7000 series. Results of the analyses are presented in Table 2 and discussed in Section 5.3. Laboratory reports are presented in Appendix D.

4.2 GROUNDWATER SAMPLES

Groundwater samples were analyzed for dissolved arsenic using EPA Method 6010/7000 series and for volatile organics using EPA Method 8240. Results of the arsenic analyses are presented in Table 3. Results of the VOC analyses are presented in Table 4 and discussed in Section 5.4. Laboratory reports are presented in Appendix D.

5.0 DISCUSSION OF RESULTS

5.1 GEOLOGY

The subsurface geology of the site has been established by literature research for the region, and from lithologic logs compiled during on-site drilling programs by International Technology Corporation (IT), ENSR Consulting and Engineering, and Ebasco Environmental. A geologic cross-section illustrating the subsurface lithology is presented in Figure 3. The line of cross-section A - A′, starts southwest of monitoring well MW-8 and ends northeast of monitoring well MW-13. As defined in Department of Water Resources (DWR) Bulletin 104 (1961), the uppermost lithologic unit, the Old Dune Sand Formation (also known in literature as the Older Dune Sand Formation),

> "...consists of fine- to medium-grained sand with minor sandy silt, clay, and gravel lenses. Within the weathered zone the materials are yellow to brown in color although the unweathered formation in place is white gray and black in color. The Old Dune Sand generally consists of three divisions: a deeply weathered surface, an intermediate horizon of clean sands and basal beach sands and gravels, and a lowermost horizon which apparently includes a zone of transition to the underlying Bellflower Aquiclude."

Beneath the site, the Old Sand Dune Formation ranges from 60 to 90 feet in thickness. The zone of transition, otherwise referred to as the transition zone, is discontinuous along the line

TABLE 2
RESULTS FOR ARSENIC IN SOIL

Sample Location	Sample Name	Sample Depth (Feet Below Grade)	Corresponding Geologic Unit	Arsenic Concentration (mg/kg)	Method Detection Limit (mg/kg)	Average Arsenic Concentration in Soil[1] (mg/kg)
MW-11	HP2-1	65.0 - 65.5	Old Dune Sand/ Bellflower contact	5.2	1.0	7.2
MW-11	HP2-2	80.5 - 81.0	sand layer within Bellflower	3.6	1.0	7.2
MW-11	HP2-3	87.0 - 87.5	upper Gage Aquifer	11	1.0	7.2
MW-11	HP2-6	105.0 - 105.5	lower Gage Aquifer	2.9	1.0	7.2
MW-12	HP4-1	91.5 - 92.0	Old Dune Sand/ Bellflower contact	130	1.0	7.2
MW-12	HP4-7	104.0 - 104.5	lower Bellflower	ND	1.0	7.2
MW-13	HP3-1	68.5 - 69	Old Dune Sand/ Bellflower contact	29	1.0	7.2
MW-13	HP3-3	76.5 - 77.0	sand layer within Bellflower	81	1.0	7.2
HP-5	HP5-1	76.0 - 76.5	Old Dune Sand/ Bellflower contact	360 (51 mg/l)[2]	1.0	7.2
HP-5	HP5-3	86.0 - 86.5	Bellflower/ Gage Aquifer contact	12	1.0	7.2

ND = Not Detected

1) Shacklette, Hansford T., and Boerngen, Josephine G., 1984, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States: U.S. Geological Survey Professional Paper 1270, p 4-6.

2) Waste Extraction Test method analytical result

TABLE 3
RESULTS FOR ARSENIC IN GROUNDWATER

Sample Location	Sample Name	Sample Depth (Feet Below Grade)	Corresponding Geologic Unit	Arsenic Concentration (mg/l)	Method Detection Limit (mg/l)	California Maximum Contaminant Level (mg/l)
MW-11	HP2-5	90 - 92	upper Gage Aquifer	ND	0.010	0.05
MW-12	HP4-6	110 - 112	upper Gage Aquifer	ND	0.010	0.05
MW-13	HP3-6	95 - 97	upper Gage Aquifer	ND	0.010	0.05
HP-5	HP5-6	90 - 92	upper Gage Aquifer	6.0	0.010	0.05
HP-5	HP5-8	100 - 102	lower Gage Aquifer	0.029	0.010	0.05

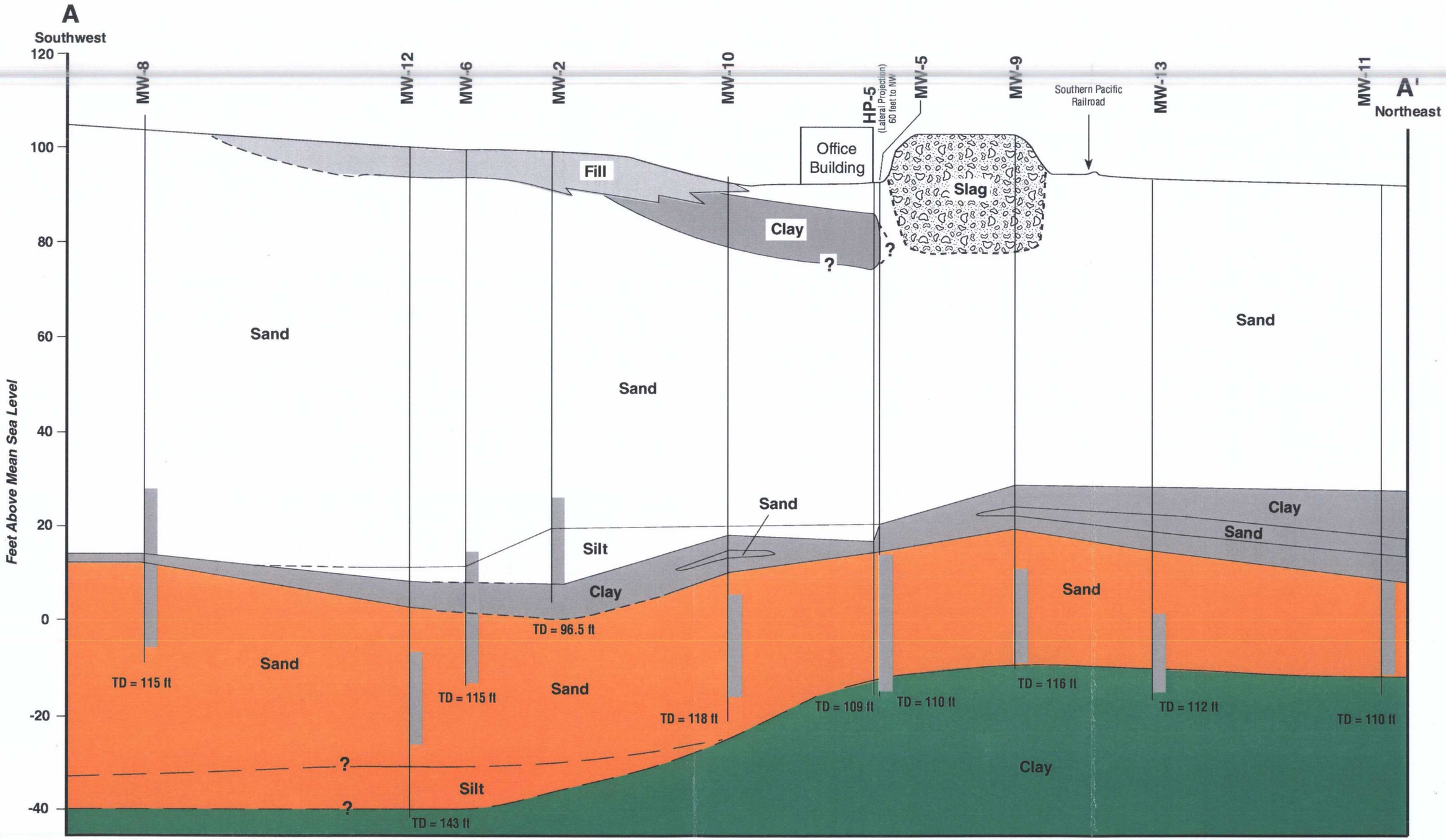
ND = Not Detected

TABLE 4
RESULTS FOR VOCs IN GROUNDWATER

Sample Location	Sample Name	Sample Depth (Feet Below Grade)	Corresponding Geologic Unit	VOC Compound and Concentration (μg/l)		Method Detection Limit (μg/l)	California Maximum Contaminant Level (μg/l)
MW-11	HP2-4	90 - 92	upper Gage Aquifer	Chloroform	4.0	2.0	100[1]
				cis-1,2-DCE	7.0	2.0	6.0
				1,1,2,2-PCA	2.0	2.0	1.0
				PCE	29	2.0	5.0
				TCE	230	2.0	5.0
MW-12	HP4-5	110 - 112	upper Gage Aquifer	Chloroform	230	2.0	100[1]
				1,2-DCA	4.0	2.0	0.5
				1,1,2,2-PCA	220	2.0	1.0
				PCE	2.0	2.0	5.0
				TCE	17	2.0	5.0
				Freon 11	210	5.0	150
MW-13	HP3-5	95 - 97	upper Gage Aquifer	cis-1,2-DCE	3.0	2.0	6.0
				PCE	52	2.0	5.0
				TCE	140	2.0	5.0
HP-5	HP5-5	90 - 92	upper Gage Aquifer	CCl_4	12	5.0	0.5
				Chloroform	22	2.0	100[1]
				PCE	4.0	2.0	5.0
				TCE	76	2.0	5.0
HP-5	HP5-7	100 - 102	lower Gage Aquifer	CCl_4	16	5.0	0.5
				Chloroform	23	2.0	100[1]
				cis-1,2-DCE	20	2.0	6.0
				TCE	230	2.0	5.0
				Freon 11	7.0	5.0	150

Water samples were collected using the Hydropunch HP-II sampling system during drilling activities.

1) = EPA Maximum Contaminant Level drinking water standard
cis-1,2-DCE = cis-1,2-Dichloroethene
1,1,2,2-PCA = 1,1,2,2-Tetrachloroethane
PCE = Tetrachloroethene
TCE = Trichloroethene
Freon 11 = Trichlorofluoromethane
CCl_4 = Carbon Tetrachloride



EXPLANATION

- Old Dune Sand Formation
- Bellflower Aquiclude (Manhattan Beach Formation)
- Gage Aquifer (Lakewood Formation)
- El Segundo Aquiclude (San Pedro Formation)
- Approximate Geologic Contact, Dashed where Inferred
- Monitoring Well Screened Interval with Total Depth of Boring — TD = 115 ft

SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Figure 3

Geologic Cross-Section
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

E-21

of cross-section. When the zone of transition is present, such as between monitoring wells MW-8 and MW-5, it consists of sandy silt to silty sand.

Underlying the Old Dune Sand Formation is the Bellflower Aquiclude (also known as the Manhattan Beach Formation). The aquiclude consists of silty clay to clayey silt and silt with clay. Beneath the site, the upper surface of the Bellflower Aquiclude dips gently to the west to southwest. The vertical thickness varies along the line of cross-section with the aquiclude being thickest in the northwest, and decreasing in thickness to the southwest. The fine sediments of the Bellflower Aquiclude act as a competent barrier by restricting the vertical movement of groundwater from above.

The Gage Aquifer underlies the Bellflower Aquiclude beneath the site. The aquifer is the basal or lowermost unit of the Lakewood Formation, upper Pleistocene in age. The thickness of the aquifer beneath the site ranges from roughly 18 feet in the northeast to greater than 30 feet in the southwest. The aquifer tends to grade vertically downward into medium to coarse sand and fine to coarse gravel and may contain thin (1 foot thick or less) discontinuous clay lenses.

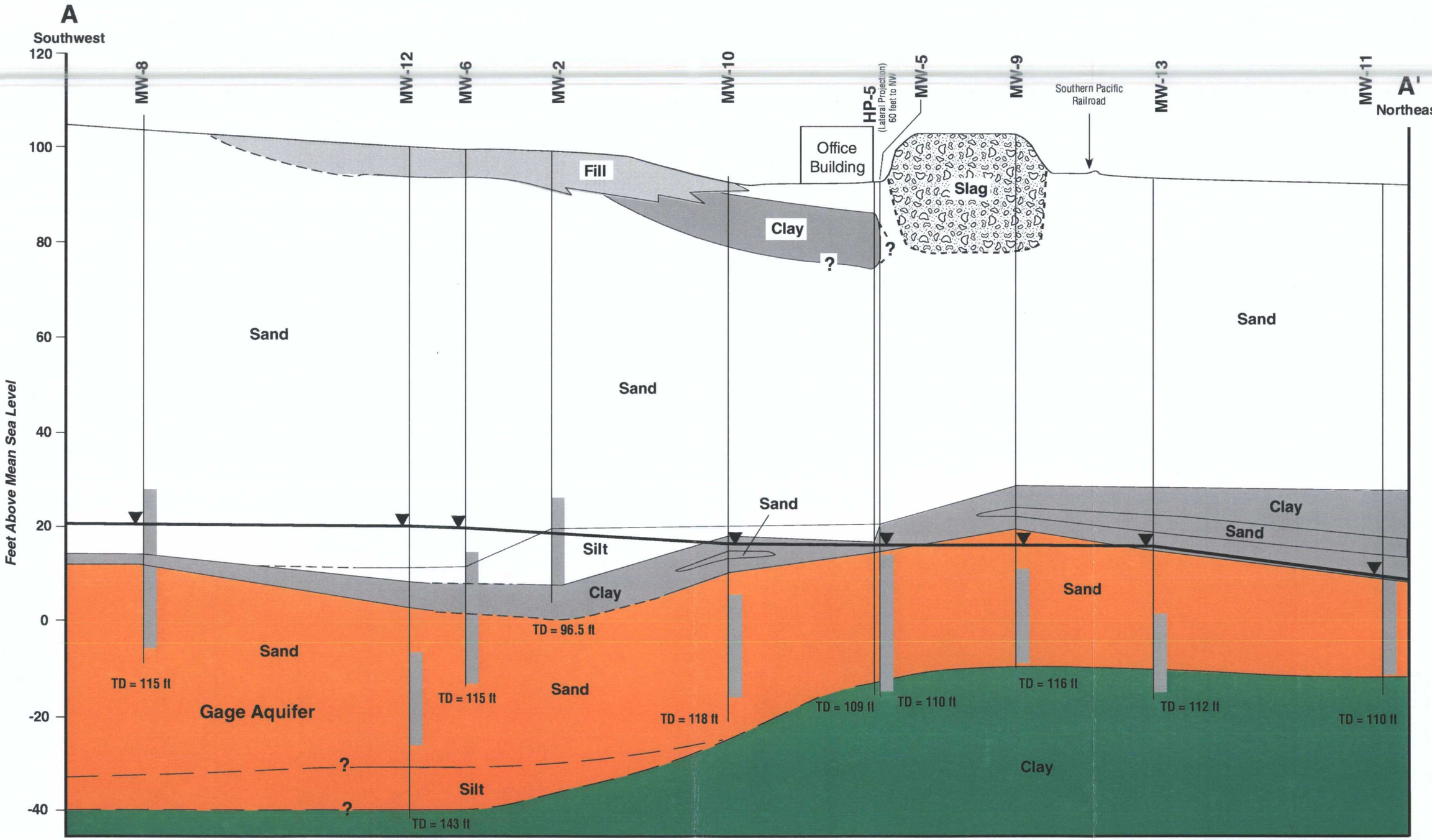
Beneath the Gage Aquifer are greenish-gray to yellowish-brown silts and clays belonging to the El Segundo Aquitard of the San Pedro Formation, lower Pleistocene in age. The aquitard is laterally extensive beneath the site and separates the upper Gage Aquifer from the deeper Silverado Aquifer. The elevation of the upper contact of the El Segundo Aquitard ranges from 105 feet below ground surface (bgs) in the northeast to 140 feet bgs in the southwest.

5.2 HYDROGEOLOGY

A hydrogeologic cross-section of the H. Kramer site is shown in Figure 4. Two aquifers are illustrated in the cross-section. The uppermost aquifer is the unconfined Old Dune Sand Aquifer. The deeper, confined aquifer is the Gage Aquifer. The two aquifers are separated by the Bellflower Aquiclude. Groundwater elevations of the potentiometric surface for the Gage Aquifer indicate that the aquifer has artesian properties.

A water table contour map in the Old Dune Sand Aquifer, as measured August 26, 1993, is presented in Figure 5. The contour gradients indicate that groundwater flows to the south-southwest across the site. The hydraulic gradient across the property is approximately 0.012 ft/ft. The saturated thickness of the Old Dune Sand Aquifer has been assessed to range from approximately 1 foot within the northeastern portion of the site to approximately 10 feet in the southwestern portion of the site.

A groundwater contour map of the Gage Aquifer's potentiometric surface, as measured August 26, 1993, is shown in Figure 6. Contour gradients for the potentiometric surface of the aquifer indicate that groundwater flows to the northeast. The hydraulic gradient across the majority of the site (between monitoring wells MW-8 and MW-13) has been calculated to be 0.002 ft/ft. The gradient of the potentiometric surface steepens between monitoring wells MW-13 and -11 and has a calculated hydraulic gradient of 0.024 ft/ft.



EXPLANATION

- Old Dune Sand Formation
- Bellflower Aquiclude (Manhattan Beach Formation)
- Gage Aquifer (Lakewood Formation)
- El Segundo Aquiclude (San Pedro Formation)
- Approximate Geologic Contact, Dashed where Inferred
- Potentiometric Groundwater Surface
- Monitoring Well Screened Interval with Total Depth of Boring (TD = 115 ft)

SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Figure 4

Hydrologic Cross-Section
Gage Aquifer, August 26, 1993
Phase II Supplemental Geologic Investigation

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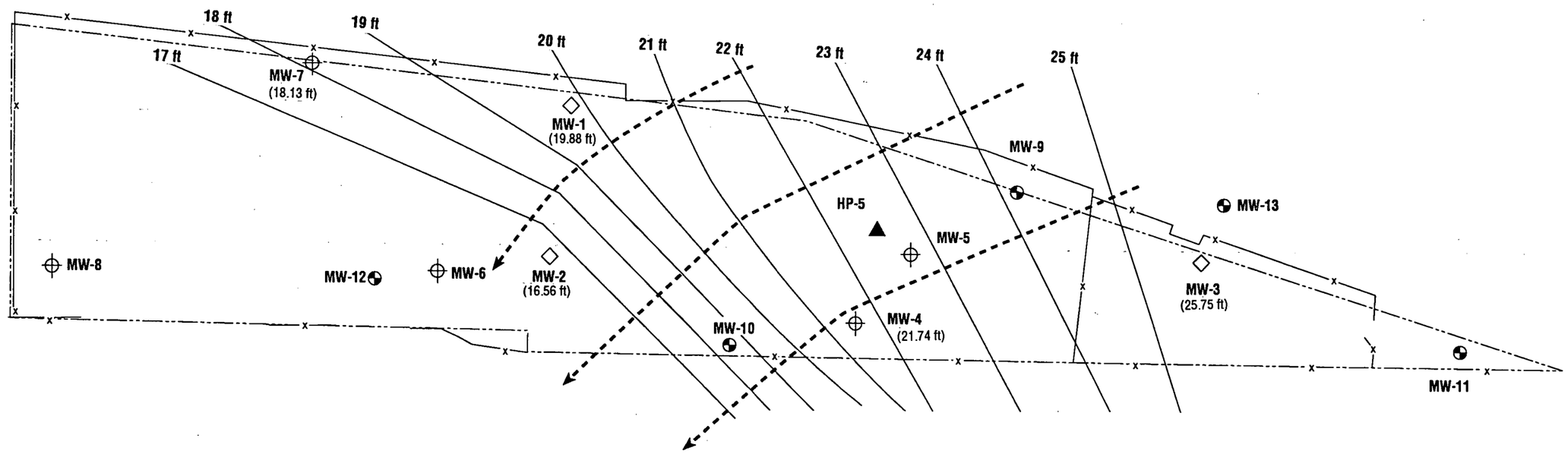
El Segundo, California



EXPLANATION

- Property Boundary
- Fence
- MW-3 (25.75 ft) — Monitoring Well Installed by I.T. Corp (1985) with Water Elevation (ft above mean sea level)
- MW-8 (18.13 ft) — Monitoring Well Installed by ENSR (1989) with Water Elevation (ft above mean sea level)
- MW-13 — Monitoring Well Installed by Ebasco Environmental (1992, 1993)
- HP-5 — Hydropunch Boring Location by Ebasco Environmental (1993)
- Groundwater Flow Lines

Scale
1" = 150'

Note: Groundwater Elevations Provided for Monitoring Wells Screened Exclusively within the Old Dune Sand Aquifer

Figure 5

Water Table Contour Map
Old Dune Sand Aquifer
August 26, 1993
Phase II Supplemental Geologic Investigation

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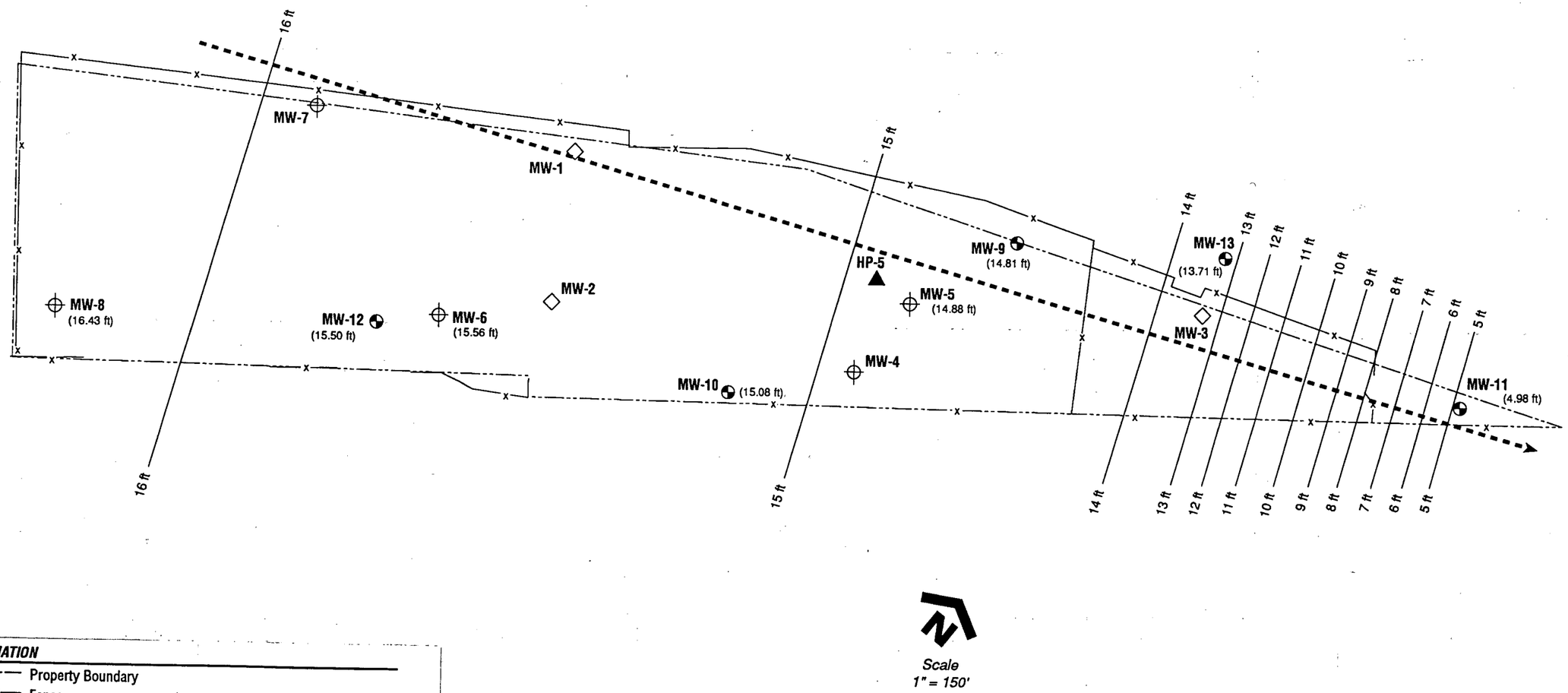

EXPLANATION

- Property Boundary
- Fence
- MW-3 ◇ Monitoring Well Installed by I.T. Corp (1985)
- MW-8 ⊕ Monitoring Well Installed by ENSR (1989) with Water Elevation (ft above mean sea level)
- MW-13 (13.71 ft) Monitoring Well Installed by Ebasco Environmental (1992, 1993) (ft above mean sea level)
- HP-5 ▲ Hydropunch Boring Location by Ebasco Environmental (1993)
- Groundwater Flow Lines

Note: Grounwater Elevations Provided for Monitoring Wells Screened Wholly or Partially within the Gage Aquifer.

Figure 6

Potentiometric Surface Contour Map
Gage Aquifer
August 26, 1993
Phase II Supplemental Geologic Investigation

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El Segundo, California

The artesian properties of the Gage Aquifer, combined with the groundwater gradient maps and the known lithology of the Bellflower Aquiclude derived from both supplemental geologic investigations, indicate that the Bellflower Aquiclude is a competent barrier to the vertical migration of groundwater. A review of Figures 3 and 4 may suggest that monitoring wells MW-6 and MW-8 have been constructed so as to allow the two aquifers to be hydrogeologically interconnected at these two locations.

5.3 ARSENIC CONCENTRATIONS IN SOIL

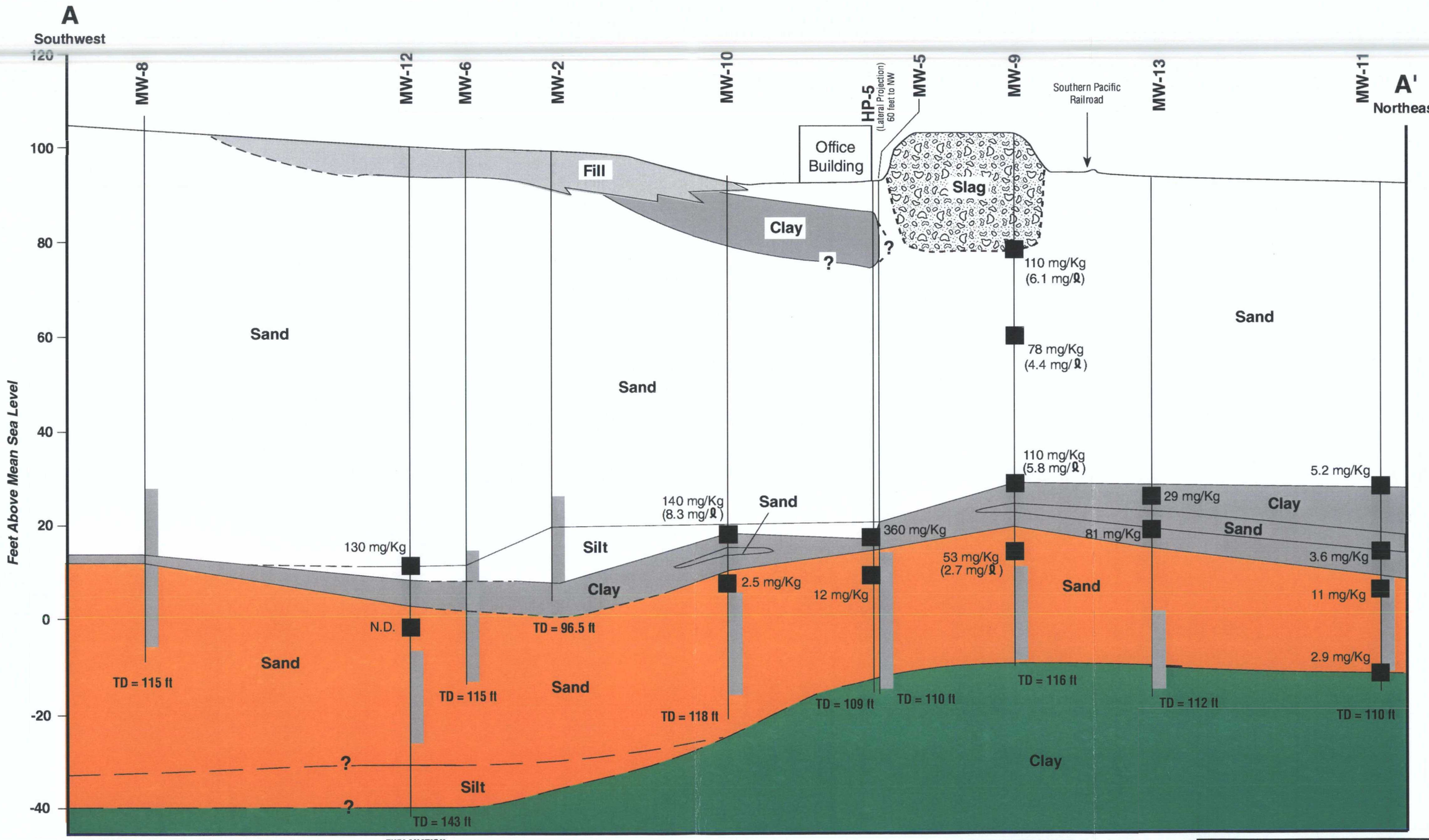
Locations of soil samples submitted for arsenic analysis, along with analytical results of Phase I and II investigations, are presented in Figure 7. Soil samples were analyzed for the Total Threshold Limit Concentrations (TTLC), a measure of the total amount of arsenic present, using EPA Method 6010/7000 series. Depending on results of the TTLC analytical results, certain soil samples were also analyzed for the Soluble Threshold Limit Concentrations (STLC) using the Waste Extraction Test (WET) method. The WET method is used to assess the extractable concentration of an element or compound in a soil or waste by acid digestion with sodium citrate at a pH of 5.

The arsenic concentration at monitoring well MW-11 is representative of background conditions at the lithologic contact between the Old Dune Sand Formation and the Bellflower Aquiclude. The arsenic concentration detected within the soil at this location was 5.2 mg/kg (TTLC).

A vertical profile illustrating arsenic concentrations beneath the former lagoon is illustrated in monitoring well MW-9. The arsenic concentration beneath the floor of the former lagoon was 110 mg/kg (TTLC). The WET concentration was 6.1 mg/l. The arsenic concentration decreases to 78 mg/kg (TTLC) and 4.4 mg/l (WET) moving vertically downwards. At the Old Dune Sand Formation and Bellflower Aquiclude lithologic contact, arsenic concentrations increase to 110 mg/kg (TTLC) and 5.8 mg/l (STLC).

Hydrogeologically downgradient (Old Dune Sand Aquifer) of the former lagoon, the soil arsenic concentration increases to 360 mg/kg (TTLC) and 51 mg/l (STLC) at hydropunch location HP-5. The soil arsenic concentration decreases to 140 mg/kg (TTLC) and 8.3 mg/l (STLC) at monitoring well MW-10. The soil arsenic concentration at monitoring well MW-12, the most downgradient location for which data are available, is 130 mg/kg (TTLC).

Soil arsenic concentrations are known at five locations within the Gage Aquifer. Upgradient conditions are represented by monitoring well MW-12. At this location, arsenic was not detected in the Gage Aquifer. An arsenic concentration of 2.5 mg/kg (TTLC) was detected at monitoring well MW-10. A soil sample collected at hydropunch location HP-5 had an arsenic concentration of 12 mg/kg (TTLC). The arsenic concentration at monitoring well MW-9 was 53 mg/kg (TTLC) and 2.7 mg/l (STLC). Monitoring well MW-11 is located downgradient within the Gage Aquifer. At the top of the aquifer, arsenic was detected at 11 mg/kg (TTLC). At the base of the aquifer, the arsenic concentration was 2.9 mg/kg.



Old Dune Sand Formation
Bellflower Aquiclude (Manhattan Beach Formation)
Gage Aquifer (Lakewood Formation)
El Segundo Aquiclude (San Pedro Formation)

EXPLANATION

Approximate Geologic Contact, Dashed where Inferred
140 mg/Kg (8.3 mg/ℓ) — Soil Sample Location with Arsenic Concentrations; W.E.T. result in brackets
N.D. — Not Detected
TD = 115 ft — Monitoring Well Screened Interval with Total Depth of Boring

SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Figure 7

Arsenic Concentrations in Soil
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

E-21

A discontinuous thin sand lens was identified within the Bellflower Aquiclude in monitoring wells MW-9, MW-10, MW-11, and MW-13. It was not present at monitoring well MW-12 or hydropunch location HP-5. However, within the lens, soil arsenic concentrations were 81 mg/kg (TTLC) at monitoring well MW-13 and 3.6 mg/kg (TTLC) at MW-11.

5.4 ARSENIC CONCENTRATIONS IN GROUNDWATER

Arsenic concentrations in groundwater along geologic cross-section A - A′ are illustrated in Figure 8, and the estimated lateral extents of the arsenic concentrations are shown in Figure 9. These drawings combine results of Phase I and II investigations, given inclusion of data for MW-8, MW-6, MW-2, MW-10, and MW-9 (south to north). The important aspects to note from these drawings are as follows:

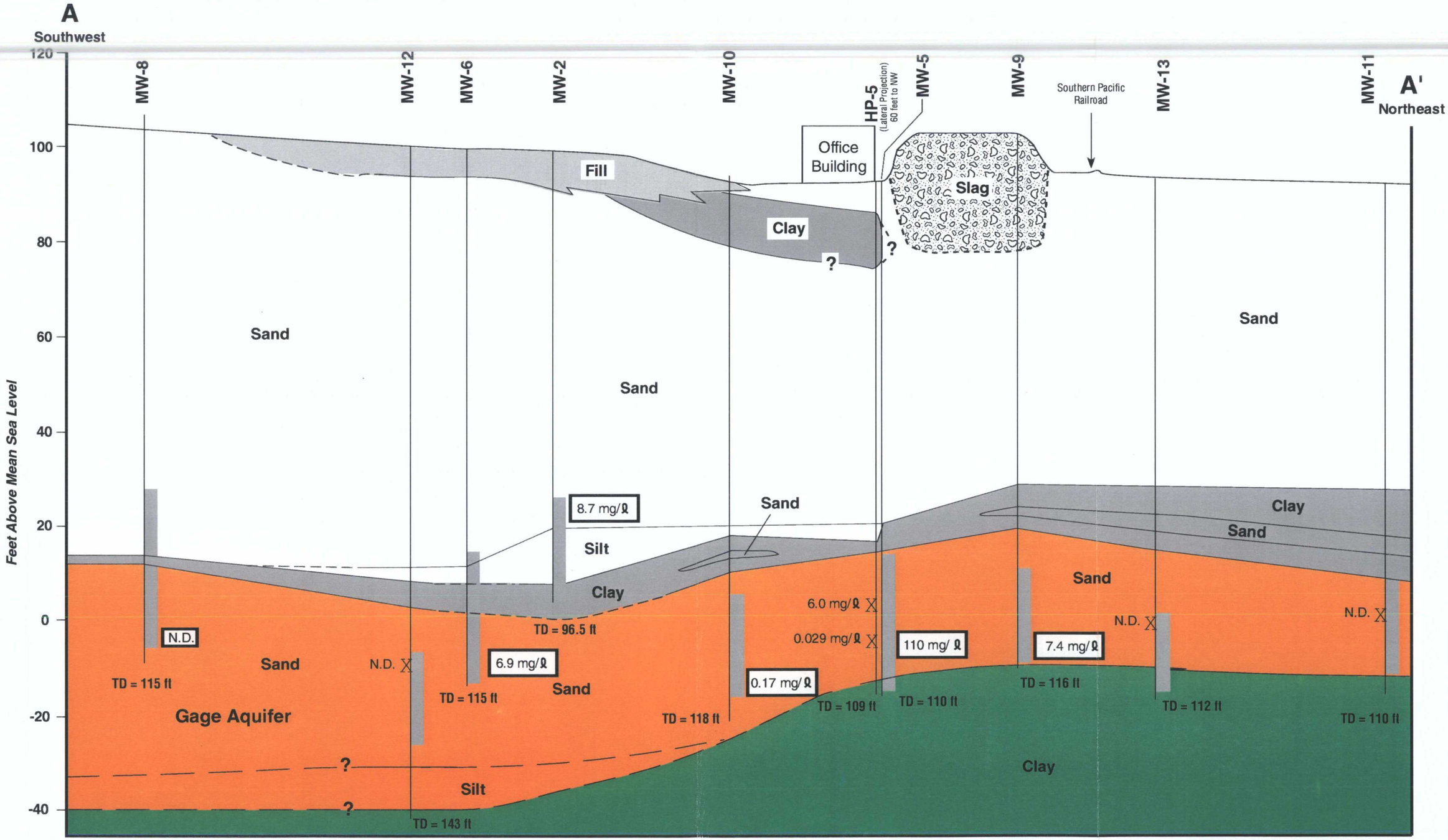
- No arsenic was detected in MW-8 (Phase I), even though it may be screened across both Old Dune Sand and Gage Aquifers.
- No arsenic was detected in the Hydropunch sample taken in the Gage Aquifer at MW-12, adjacent to MW-6 which appears to be screened across both aquifers.
- HP-5 Hydropunch samples had arsenic concentrations of 6.0 mg/l at the top of the Gage Aquifer, and less than 0.05 mg/l at the bottom of the aquifer. This location was proximal and upgradient to monitoring well (MW-5) which has consistently produced anomalously high arsenic concentrations in previous studies.
- Arsenic was not detected in groundwater samples taken within the Gage Aquifer at downgradient wells MW-11 and MW-13, indicating that arsenic contamination in the Gage Aquifer is largely confined to that detected beneath the site.

Given results for HP-3 (MW-13) and HP-2 (MW-11), with on-site approval by the Board's representative, no additional borings/samples were made further off the site, and the arsenic plume is considered to have been defined as per conditions of Cleanup and Abatement Order N^0 92-094.

5.5 VOLATILE ORGANIC COMPOUND CONCENTRATIONS IN GROUNDWATER

Groundwater samples collected with the Hydropunch were analyzed for VOCs using EPA Method 8240. VOCs were detected in all water samples at concentrations which exceeded corresponding State of California Maximum Contaminant Levels (MCLs) for drinking water (Table 4). VOCs (that exceeded MCLs) included chloroform; cis-1,2-dichloroethene (cis-1,2-DCE); 1,1,2,2-tetrachloroethane (1,1,2,2-PCA); tetrachloroethene (PCE); trichloroethene (TCE); trichlorofluromethane (Freon 11); and carbon tetrachloride (CCl_4).

TCE was the only VOC to be detected in all five water samples. PCE was detected in monitoring wells MW-11, MW-12, MW-13, and within the upper Gage Aquifer at Hydropunch



EXPLANATION

- Old Dune Sand Formation
- Bellflower Aquiclude (Manhattan Beach Formation)
- Gage Aquifer (Lakewood Formation)
- El Segundo Aquiclude (San Pedro Formation)

- Approximate Geologic Contact, Dashed where Inferred
- 6.0 mg/ℓ — Hydropunch Location with Arsenic Concentration in Groundwater
- 110 mg/ℓ — Arsenic Concentration in Groundwater (Nov. 1992)
- N.D. — Not Detected
- TD = 115 ft — Monitoring Well Screened Interval with Total Depth of Boring

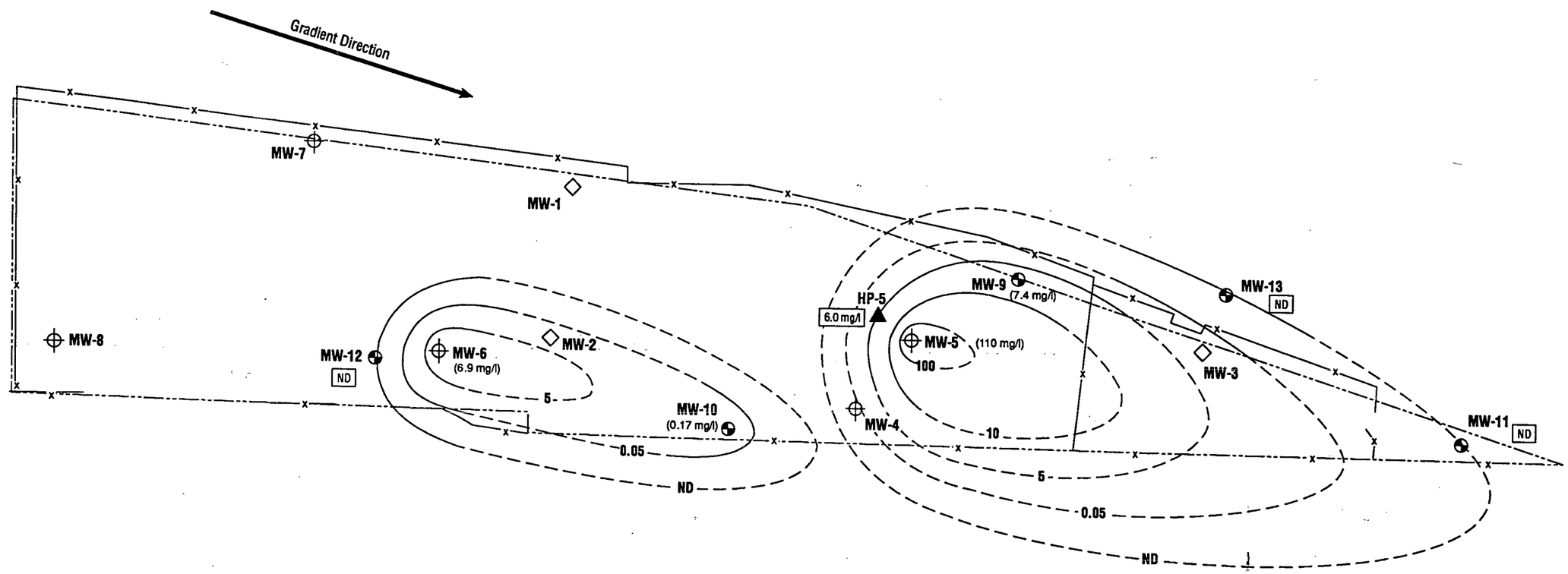
SCALE:
Horizontal - 1 inch = 150 ft
Vertical - 1 inch = 20 ft

This geologic cross-section is an interpretation of subsurface conditions based on boring logs and literature research. Actual conditions may differ from those presented above. Only at boring locations should profiles be considered to be reasonably accurate.

Figure 8

Arsenic Concentrations in Groundwater
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California



EXPLANATION

- Contour of Equal Concentration (mg/l) Dashed Where Inferred
- Property Boundary
- Fence
- MW-3 ◇ Monitoring Well Installed by I.T. Corp (1985)
- MW-8 ⊕ Monitoring Well Installed by ENSR (1989)
- MW-13 ◐ Monitoring Well Installed by Ebasco Environmental (1992, 1993)
- HP-5 ▲ Hydropunch Boring Location by Ebasco Environmental (1993)
- ND Not Detected
- (110 mg/l) Arsenic Concentration Detected in the Phase 1 Supplemental Site Investigation (Nov. 1992)
- 6.0 mg/l Arsenic Concentration Detected in the Phase 2 Supplemental Site Investigation (Aug. 1993)

N

Scale
1" = 150'

Note: This arsenic concentration contour map has been compiled using the analytical results of groundwater samples collected during the Phase 1 and Phase 2 Supplemental Site Investigations.

Figure 9

Arsenic Concentration Contour Map
Gage Aquifer
Phase II Supplemental Geologic Investigation

H. Kramer & Co. Facility
El Segundo, California

location HP-5. Chloroform was detected at all locations except monitoring well MW-13. Cis-1,2-DCE was detected in monitoring wells MW-11, MW-13, and the lower Gage Aquifer at HP-5. 1,1,2,2-PCA was detected in monitoring wells MW-11 and MW-12. Freon 11 was detected in monitoring well MW-12 and the lower Gage Aquifer at HP-5. CCl_4 was detected in both the upper and lower Gage Aquifer at HP-5. The presence of VOC contamination in both upgradient and downgradient wells within the Gage Aquifer certainly indicates an off-site source.

5.6 ARSENIC ANOMALY AT MONITORING WELL MW-5

During Phase I of the supplemental site investigation, arsenic was detected in monitoring well MW-5 at a concentration of 110 mg/l. Literature research about monitoring well MW-5 indicated that 30 feet of hollow-stem augers were left within the boring while that well was being constructed (ENSR, 1990). Therefore, to further assess whether the elevated arsenic concentration in MW-5 was an anomaly, Hydropunch HP-5 was drilled immediately upgradient.

Soil samples were collected at the lithologic contact between the Old Dune Sand Formation and the Bellflower Aquiclude and from beneath the Bellflower Aquiclude. Both soil samples were analyzed for arsenic using EPA Method 6010/7000 series to assess the ability of the Bellflower Aquiclude to inhibit the vertical migration of arsenic. Both the lithological and the analytical results indicate that the Bellflower Aquiclude presents a competent barrier to vertical migration of arsenic within that vicinity. The soil sample at the Old Dune Sand Formation and Bellflower Aquiclude lithologic contact had an arsenic concentration of 360 mg/kg. The soil sample collected beneath the Bellflower Aquiclude (at the base of the tight silty sand unit) had an arsenic concentration of 12 mg/kg. This arsenic concentration of 12 mg/kg appears to be the result of the location of HP-5 within the zone of influence from MW-5 and not the result of migration through the Bellflower Aquiclude.

Two Hydropunch samples were collected from the Gage Aquifer at Hydropunch location HP-5 to assess actual arsenic concentrations in groundwater immediately upgradient of monitoring well MW-5. If the high arsenic concentrations detected in MW-5 were indicative of conditions in the Gage Aquifer, such elevated concentrations should be expected to be detected immediately upgradient. Instead, the first water sample collected within the upper portion of the Gage Aquifer had an arsenic concentration of 6.0 mg/l. The second water sample, collected 10 feet deeper, had an arsenic concentration of 0.029 mg/l (vs. the 110 mg/l found in MW-10).

An analysis of the lithology and arsenic concentrations within the soil and groundwater indicate that the elevated arsenic concentrations detected at monitoring well MW-5 are due to construction of that well, and that it should be properly destroyed.

6.0 SUMMARY

Results of the Phase II supplemental site investigation of the H. Kramer site can be summarized as follows:

GEOHYDROLOGY

- The geological profile beneath the site consists of the Old Dune Sand Formation, the Bellflower Aquiclude, the Gage Aquifer (belonging to the Lynwood Formation), and the El Segundo Aquitard. The Old Dune Sand Formation consists primarily of sand and ranges from 60 to 90 feet in thickness.

- The Bellflower Aquiclude, a clay unit, separates the Old Dune Sand from the Gage Aquifer. It ranges in thickness from approximately 22 feet in the northeast portion of the site to at least 2 to 3 feet thick in the southwest portion of the site. [Boring records for MW-8, upon which this is based, may have underestimated the thickness here due to the interval between observations.] The Bellflower Aquiclude is competent and about 10 feet in thickness beneath the slag pile.

- The Gage Aquifer is approximately 20 feet thick in the northeast portion of the site and approximately 42 feet thick in the southwest portion of the site. The vertical thickness of the El Segundo Aquitard was not established; however, it is known to be at least 5 feet thick in the southwest portion of the site.

- The Old Dune Sand Aquifer is an unconfined aquifer that flows south to southwest across the site. The hydraulic gradient across the property is approximately 0.012 ft/ft. Its saturated thickness increases from approximately 1 foot in the northeastern portion of the site to approximately 10 feet in the southwestern portion of the site.

- The Gage Aquifer is a confined aquifer that flows east-northeast across the site. The hydraulic gradient for the aquifer is approximately 0.002 ft/ft.

PLUME DEFINITION AND GEOCHEMISTRY

- Arsenic concentrations in the soil beneath the former lagoon down to the lithologic contact between the Old Dune Sand Aquifer and the Bellflower Aquiclude range from 78 mg/kg to 110 mg/kg. Arsenic concentrations in the soil continue to be elevated towards the south to southwest (near MW-6) along the lithologic contact (360 mg/kg to 130 mg/kg).

- Arsenic concentrations within the Gage Aquifer, with the exception of the MW-5 area and one soil sample (at 53 mg/kg) collected from MW-9, are below established background concentrations for the Western United States (7 mg/kg).

- In Phase I (December, 1992), elevated arsenic concentrations above drinking water standards (0.05 mg/l) were detected within both the Old Dune Sand Aquifer (0.12 mg/l to 8.70 mg/l) and the Gage Aquifer (0.1 mg/l to 110 mg/l).

- The arsenic impacted area within the Gage Aquifer, based on Phase II results, is largely confined to beneath the central and northeastern portion of the site.

- Volatile organic compound concentrations (chloroform, cis-1,2-DCE, 1,1,2,2-PCA, PCE, TCE, Freon 11, and CCl_4) have been detected above drinking water standards within both the Old Dune Sand Aquifer and the Gage Aquifer. Evidence indicates that the volatile organic compound contamination in both aquifers is widespread in this region and is not related to prior operations at the H. Kramer site.

MW-5 ANOMALY

- Arsenic concentrations in the groundwater at MW-5 represent conditions specific to that location. Results of this study indicate that MW-5 well construction is allowing vertical migration of arsenic from the Old Dune Sand Aquifer down to the Gage Aquifer.

7.0 CONCLUSIONS

Based on the results of Phase I and Phase II supplemental site investigations, along with information provided by previous investigations, the following conclusions have been drawn:

- The Bellflower Aquiclude is a competent barrier that effectively separates the Old Dune Sand Aquifer from the underlying Gage Aquifer both hydrogeologically and with respect to vertical migration of arsenic.

- Elevated arsenic concentrations within the Gage Aquifer are largely confined to the area beneath the slag pile. Based on Phase II results, such contamination is not due to any natural incompetence in the Bellflower Aquiclude.

- Monitoring wells MW-6 and -8 have been constructed such that each well has been screened across the Bellflower Aquiclude, thus allowing the Old Dune Sand Aquifer to be hydrogeologically connected with the Gage Aquifer.

- Evidence indicates that MW-5 is allowing the Old Dune Sand Aquifer to be hydrogeologically connected with the Gage Aquifer. As such, arsenic has migrated vertically downward, causing the locally anomalous (high) arsenic concentration detected there.

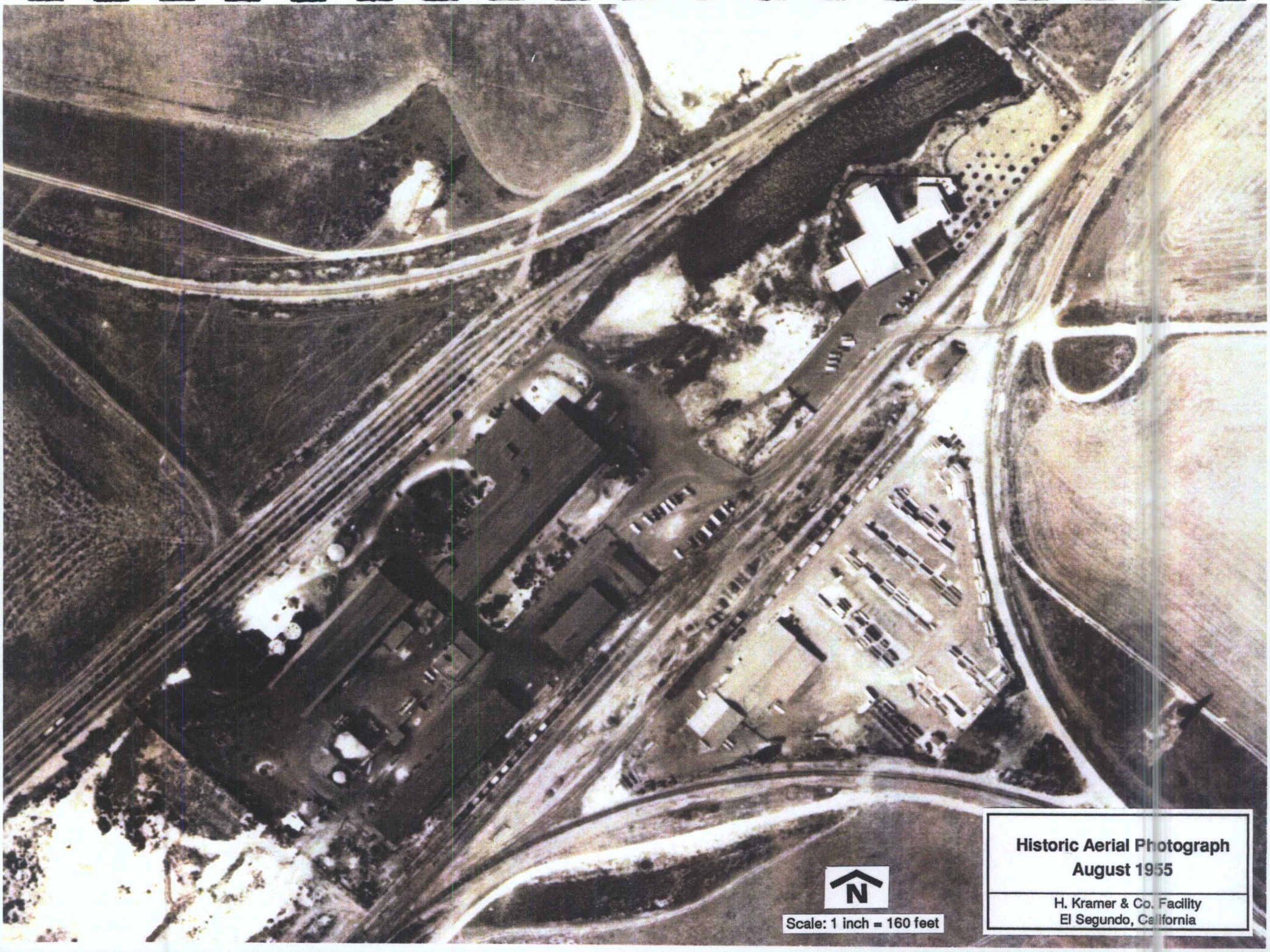
8.0 RECOMMENDATIONS

To eliminate any additional vertical migration of arsenic into the Gage Aquifer, it is strongly recommended that MW-5 and -6 be properly destroyed following the State of California, Department of Water Resources protocols listed in Bulletin 74-90 ("California Well Standards").

Given that MW-8 appears to be screened across the Bellflower, this monitoring well might also be considered a candidate for destruction.

APPENDIX A

HISTORIC AERIAL PHOTOGRAPH



Historic Aerial Photograph
August 1955

H. Kramer & Co. Facility
El Segundo, California

APPENDIX B

LITHOLOGIC AND WELL CONSTRUCTION LOGS

EBASCO ENVIRONMENTAL

MW-11/HP-2

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/04/93 to 08/09/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 90.1
TOTAL DEPTH (ft) 110
DEPTH TO WATER (ft) 84.58

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Locking well cover; Concrete									ASPHALT
1										Fill; gravel, sand, silt mixture. Hand auger to 5.0 ft.
2						SM				
3									SM	SILTY SAND, reddish brown (2.5YR3/6), moist, no odor, low dry strength, no to low plasticity, slow to rapid dilatency, low toughness, 75% fine grained sand, 25% fines, micaceous.
4										
5										
6										
7										
8										
9										
10	4-inch Schedule 40 PVC Casing; Bentonite/Cement Slurry				0					
11										
12										
13										
14										
15										
16										
17										
18										
19										
20					0					
21										Color change to light yellow brown (2.5Y6/4).
22										
23										
24										
25										

EBASCO ENVIRONMENTAL

MW-11/HP-2

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/04/93 to 08/09/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 90.1
TOTAL DEPTH (ft) 110
DEPTH TO WATER (ft) 84.58

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
25									SM	
26										
27										
28										
29										
30	4-inch Schedule 40 PVC Casing				0				SP	POORLY GRADED SAND, light reddish brown (2.5YR6/4), fine grained, slightly moist, no odor, trace coarse subangular sand, no dry strength, rapid dilatency, no toughness, non-plastic, 90% sand, 10% fines, micaceous.
31										
32										
33						SM				
34										Reduction of fines and appearance of trace fine subrounded gravel.
35										
36										
37										
38										
39										
40	Bentonite/Cement Slurry				0					
41										
42										
43										
44										
45										
46										
47										
48										
49										
50					0					

EBASCO ENVIRONMENTAL

MW-11/HP-2

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *C. Kreller*
DRILLING CO *Layne Environmental*
DATE (start/finish) *08/04/93 to 08/09/93*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Hydropunch/split spoon*
GROUND SURFACE ELEVATION (ft MSL) *90.1*
TOTAL DEPTH (ft) *110*
DEPTH TO WATER (ft) *84.58*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50									SP	
51	4-inch Schedule 40 PVC Casing									POORLY GRADED SAND WITH GRAVEL, light orange brown (2.5YR5/2), fine grained sand, trace subrounded fine gravel, trace coarse subangular sand, slightly moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 85% sand, 15% fine gravel, max. particle size .75 in., micaceous.
52										
53										
54										
55										
56						SM				
57										
58										
59										
60					0					
61										Appearance of very coarse gravel.
62										
63										
64										
65		HP2-1		6	0	SM	SO		CL	LEAN CLAY, greenish gray (5Y6/1), slightly moist, no odor, medium dry strength, medium toughness, no to slow dilatency, medium plasticity, 95% clayey fines, <5% fine grained sand, minor iron staining, micaceous.
66				6						
67				9						
68				9						
69										
70										
71										
72										
73	4-inch Schedule 40 PVC Casing									
74										
75										

Bentonite/Cement Slurry

3/8-inch Bentonite Pellets

EBASCO ENVIRONMENTAL

MW-11/HP-2

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/04/93 to 08/09/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 90.1
TOTAL DEPTH (ft) 110
DEPTH TO WATER (ft) 84.58

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
75									CL	Color change to dark greenish gray (5BG4/1).
76										
77										
78									SP	
79										POORLY GRADED SAND, light gray (2.5Y6/2), fine sand, slightly moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 95% sand, 5% fines, micaceous.
80				9						
81		HP2-2		17	0	SM	MD		CL	Saturated conditions at 80.0 ft.
82				21 30						LEAN CLAY, dark greenish gray (5BG4/1) slightly moist, no odor, medium dry strength, medium toughness, no dilatency, low to medium plasticity, 90% clayey fines, 10% non-plastic fines, micaceous, minor iron staining.
83										
84										
85										
86									SP	
87	0.020-inch Slot, 4-inch Schedule 40 PVC Screen	HP2-3		21 38	0	WT	MD			POORLY GRADED SAND, yellowish red (5YR4/6), wet, no odor, fine grained sand to medium grained subrounded sand, trace subrounded to subangular gravel, no dry strength, no toughness, rapid dilatency, non-plastic, 90% fine sand, 10% non-plastic fines, max. particle size .5 in., micaceous.
88				53						
89										
90		HP2-4,5								
91										Resume drilling after collecting hydropunch sample at 90.0 ft.
92										
93										
94										
95										
96										
97										
98										
99										
100						ST				

3/8-inch Bentonite Pellets

No. 3 Lonestar Sand

EBASCO ENVIRONMENTAL

MW-11/HP-2

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/04/93 to 08/09/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 90.1
TOTAL DEPTH (ft) 110
DEPTH TO WATER (ft) 84.58

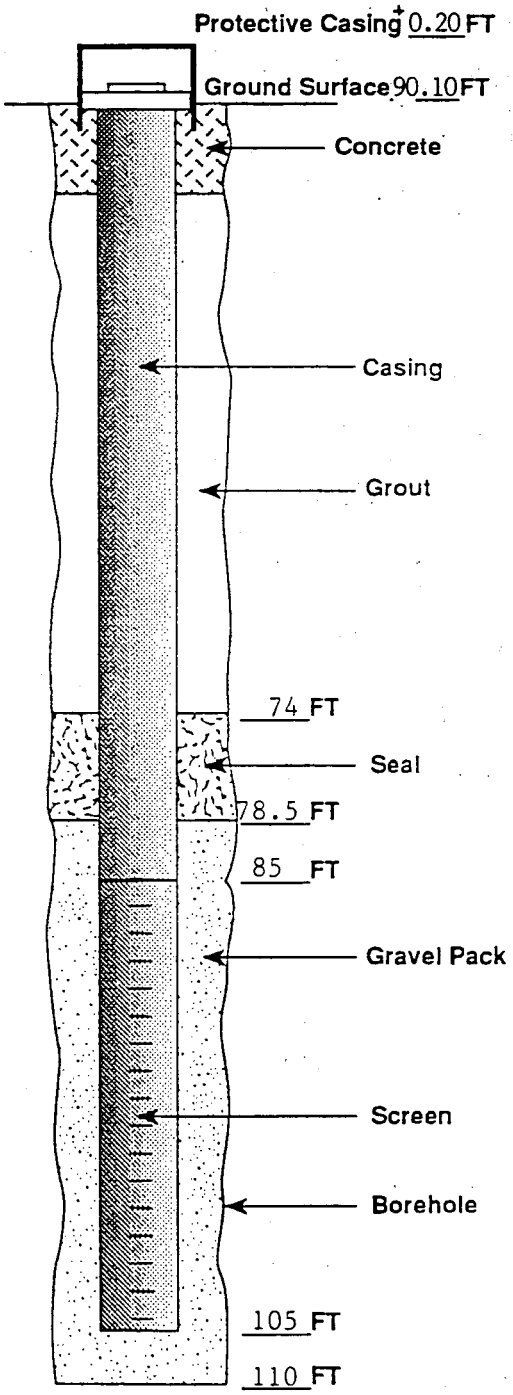
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100	0.020-inch Slot, 4-inch Schedule 40 PVC Screen; No. 3 Lonestar Sand; Bentonite Plug								SP	POORLY GRADED SAND WITH SILT, reddish brown (7.5YR5/6), saturated, no odor, fine sand, no dry strength, no toughness, rapid dilatency, non-plastic, 85% sand, 15% non-plastic fines, micaceous.
101										
102										
103										
104										
105		HP2-6	■	7	0	SM	D			
106			⊠	22					CL	SILTY LEAN CLAY, light greenish gray (5Y6/2), slightly moist, no odor, medium dry strength, medium toughness, no dilatency, low to medium plasticity, 85% clayey fines, 15% non-plastic fines, trace fine grained sand, micaceous.
107			⊠	46						
108										
109										
110										TD of well - 110.0 ft. Water level measured at 84.89 ft bgl 08/09/93
111										
112										
113										
114										
115										
116										
117										
118										
119										
120										
121										
122										
123										
124										
125										

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4050

WELL CONSTRUCTION LOG

PROJECT NAME: H. Kramer & Co.
PROJECT OFS: CHEC 3135.008
LOCATION: One Chapman Way
El Segundo, CA
EBASCO PERSONNEL: R. Tweidt/Colin Kreller

WELL NUMBER: MW-11
WELL LOCATION: Next to Douglas St.
SURFACE ELEV (ft. above MSL): 90.10
CASING ELEV (ft. above MSL): 89.56



E-12

DRILLING SUMMARY

DATE: 08/09/93
DRILLING COMPANY: Layne Environmental, Inc.
DRILLING FOREMAN: Louis L.
RIG TYPE: AP 1000 Drill Systems
TOTAL DEPTH OF BORING: 110 feet
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

WELL TYPE: Monitoring Well
BORING DIAMETER: 9 3/4 inches
TOTAL WELL DEPTH: 105 feet
CASING TYPE: PVC
CASING DIAMETER: 4-inch
CASING LENGTH: 85 feet
SCREEN TYPE: PVC
SCREEN SIZE: 0.020
SCREEN LENGTH: 20 feet
TAILPIPE LENGTH: None
CASING STICKUP: - 0.54 feet
PROTECTIVE CASING TYPE: Steel & Plastic Traffic Box
PROTECTIVE CASING STICKUP: + 0.20 feet
CENTRALIZERS: None
GROUT MATERIAL: Cement/bentonite mix
GROUT VOLUME: 22 cu. ft.
SEAL MATERIAL: 3/8 inch bentonite pellets
SEAL VOLUME: 2 - 50 lb. buckets
FILTER MATERIAL: No. 3 Lonestar sand
FILTER VOLUME: 12 cu. ft.
COMMENTS: 107 - 110 feet backfilled with 3/8 inch bentonite pellets

EBASCO ENVIRONMENTAL

MW-12/HP-4

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/5/93 to 08/13/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 99.40
TOTAL DEPTH (ft) 147.0
DEPTH TO WATER (ft) 83.30

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Locking well cover; Concrete									Asphalt and road base to 3.5 ft. Hand auger to 5.0 ft.
1										
2										
3									SP	
4					0	SM				POORLY GRADED SAND, yellowish brown, (10YR5/6), slightly moist, no odor, low dry strength, low toughness, rapid dilatency, non-plastic, 95% fine to medium grained sand, 5% fines.
5										
6										
7										
8										
9										
10	4-inch Schedule 40 PVC Casing; Bentonite/Cement Slurry				0					
11										
12										
13										
14										
15										
16										
17										
18										
19										
20					0					
21										
22										
23										
24										
25										

EBASCO ENVIRONMENTAL

MW-12/HP-4

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/5/93 to 08/13/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 99.40
TOTAL DEPTH (ft) 147.0
DEPTH TO WATER (ft) 83.30

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
25									SP	Fine grained, color change to light yellow brown (10YR7/6).
26										
27										
28										
29										
30	4-inch Schedule 40 PVC Casing				0					
31										
32										
33										
34										
35										
36										
37										Fine to medium grained.
38										
39										
40	Bentonite/Cement Slurry				0					
41										
42										
43										
44										
45										
46										
47										
48										
49										
50					0					

EBASCO ENVIRONMENTAL

MW-12/HP-4

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/5/93 to 08/13/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 99.40
TOTAL DEPTH (ft) 147.0
DEPTH TO WATER (ft) 83.30

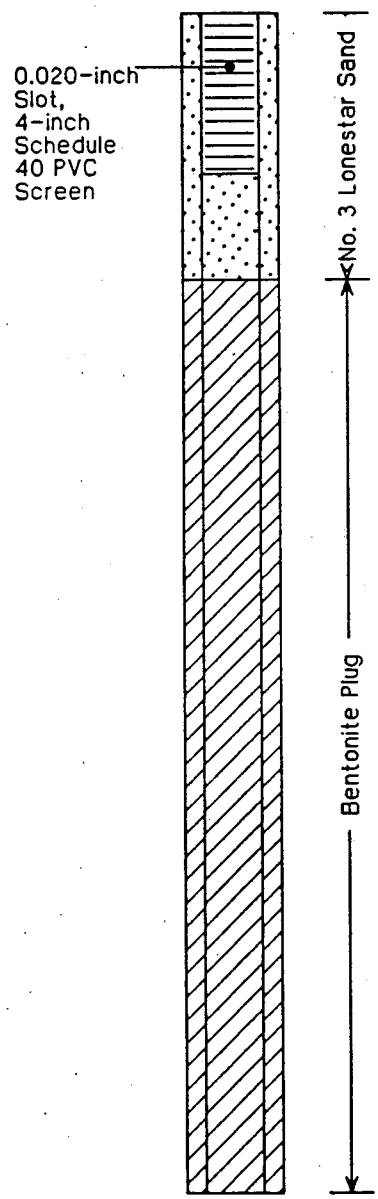
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50	4-inch Schedule 40 PVC Casing; Bentonite/Cement Slurry								SP	
51										
52										
53										
54										
55										
56										
57										
58										Appearance of trace subrounded pebbles.
59										
60					0					
61										
62										
63										
64										Appearance of fine sand with an increase in rounded gravel, max. particle size 1.5 in.
65										
66										Fine to medium sand, gravel no longer present.
67										
68										
69										
70					0					POORLY GRADED SAND, yellowish brown (10YR5/6), slightly moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 95% fine to medium grained sand, trace silt, micaceous.
71										
72										
73										
74										
75										

EBASCO ENVIRONMENTAL

MW-12/HP-4

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/5/93 to 08/13/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 99.40
TOTAL DEPTH (ft) 147.0
DEPTH TO WATER (ft) 83.30

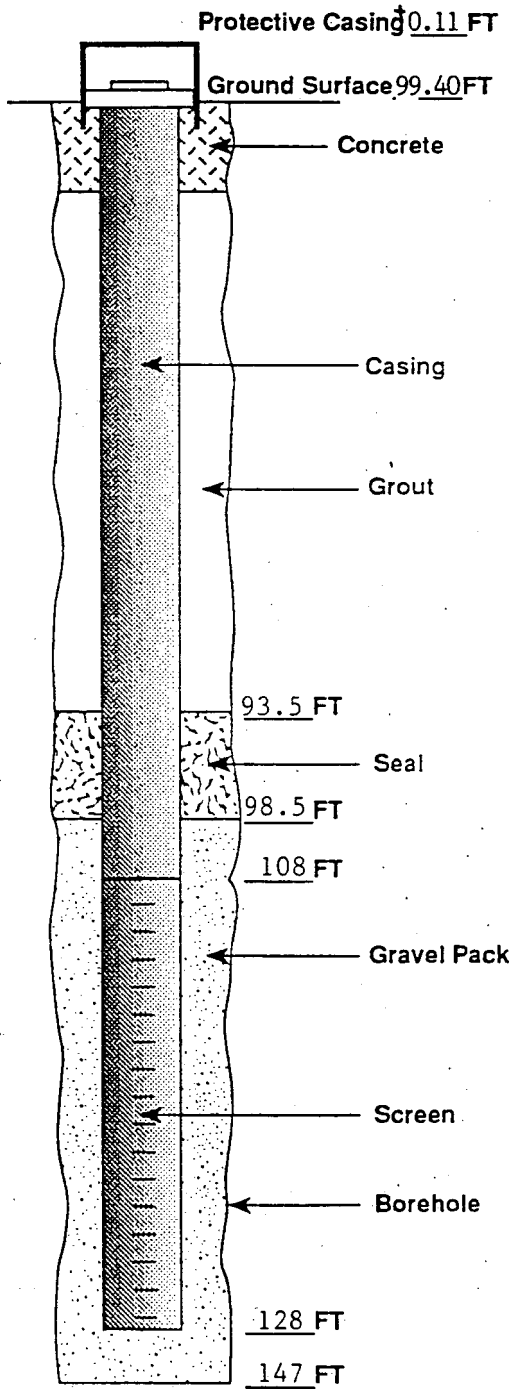
Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
125									SP	
126										
127									SM	
128										SILTY SAND, dark yellowish brown (10YR4/6), very moist, no odor, no dry strength, no toughness, slow to rapid dilatency, non-plastic, 65% fine to medium grained rounded sand, 35% non-plastic fines, micaceous.
129										
130										
131										Increase in fine grained sand and appearance of trace medium grained sand.
132										
133									ML	SILT WITH CLAY, dark greenish gray (5BG4/1), slightly moist, no odor, medium dry strength, medium toughness, slow dilatency, low plasticity, 85% non-plastic fines, 15% plastic fines, trace fine grained sand, iron staining present, micaceous.
134										
135										
136										
137										
138										Increase in fine grained sand (30%), and clay component disappears.
139										
140										
141									CL	SILTY CLAY, dark greenish gray (5GY4/1), slightly moist, no odor, medium dry strength, medium toughness, slow dilatency, medium plasticity, 75% plastic fines, 25% non-plastic fines, trace fine grained sand, micaceous.
142										
143										
144										
145										
146										
147										Total Depth of Boring - 147.0 ft.
148										
149										
150										

EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
3000 W. MacArthur Blvd., Santa Ana, CA 92704, (714) 662-4050

WELL CONSTRUCTION LOG

PROJECT NAME: H. Kramer & Co.
PROJECT OFS: CHEC 3135.008
LOCATION: One Chapman Way
El Segundo, CA
EBASCO PERSONNEL: R. Tweidt/Colin Kreller

WELL NUMBER: MW-12
WELL LOCATION: Adjacent to MW-6
SURFACE ELEV (ft. above MSL): 99.40
CASING ELEV (ft. above MSL): 98.80



DRILLING SUMMARY

DATE: 08/13/93
DRILLING COMPANY: Layne Environmental, Inc.
DRILLING FOREMAN: Louis L.
RIG TYPE: AP 1000 Drill Systems
TOTAL DEPTH OF BORING: 147 feet
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

WELL TYPE: Monitoring Well
BORING DIAMETER: 9 3/4 inches
TOTAL WELL DEPTH: 128 feet
CASING TYPE: PVC
CASING DIAMETER: 4-inch
CASING LENGTH: 108 feet
SCREEN TYPE: PVC
SCREEN SIZE: 0.020
SCREEN LENGTH: 20 feet
TAILPIPE LENGTH: None
CASING STICKUP: - 0.60 feet
PROTECTIVE CASING TYPE: Steel & Plastic Traffic Box
PROTECTIVE CASING STICKUP: + 0.11 feet
CENTRALIZERS: None
GROUT MATERIAL: Cement/bentonite mix
GROUT VOLUME: 30 cu. ft.
SEAL MATERIAL: Bentonite gel
SEAL VOLUME: 2 cu. ft.
FILTER MATERIAL: No. 3 Lonestar sand
FILTER VOLUME: 9 cu. ft.
COMMENTS: No. 30 sand from 98.5 to 103.5 feet.

E-12

EBASCO ENVIRONMENTAL

MW-13/HP-3

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/16/93 to 08/19/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.24
TOTAL DEPTH (ft) 112
DEPTH TO WATER (ft) 79.00

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Locking well cover; Concrete									Asphalt and road base to 2.5 ft. Hand auger to 5.0 ft.
1					0					
2										
3						MO			SP	
4										
5										POORLY GRADED SAND, orange brown, (10YR4/6), moist, no odor, no dry strength, no toughness, rapid dilatency, no plasticity, 90% fine grained sand, 10% non-plastic fines, micaceous.
6					0					
7										
8										
9										
10	4-inch Schedule 40 PVC Casing; Bentonite/Cement Slurry				0					
11										
12										
13										
14										
15										
16										
17										
18										
19										
20					0					
21										
22										
23										
24										
25										

EBASCO ENVIRONMENTAL

MW-13/HP-3

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/16/93 to 08/19/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.24
TOTAL DEPTH (ft) 112
DEPTH TO WATER (ft) 79.00

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
25									SP	
26										
27										
28										
29										
30	4-inch Schedule 40 PVC Casing				0					
31										
32										
33										
34										
35										Color change to light orange brown (10YR6/8).
36										
37										
38										
39										
40	Bentonite/Cement Slurry				0					POORLY GRADED SAND, orange brown (10YR5/8), very fine grained, trace medium grained subangular sand, no dry strength, no toughness, rapid dilatency, non-plastic, micaceous.
41										
42										
43										Appearance of trace medium to coarse rounded sand.
44										
45										
46										
47										
48										
49										
50					0					

EBASCO ENVIRONMENTAL

MW-13/HP-3

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/16/93 to 08/19/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.24
TOTAL DEPTH (ft) 112
DEPTH TO WATER (ft) 79.00

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50									SP	
51										
52										
53										
54										
55	4-inch Schedule 40 PVC Casing									
56										
57										
58										
59										
60	Bentonite/Cement Slurry				0					
61										
62										
63										Color change to dark grayish brown (10YR4/3).
64										
65									SW	WELL GRADED SAND, light orange brown, (2.5YR5/2), fine grained and coarse grained rounded to subrounded sand, fine subrounded gravel, moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 95% sand, 5% fines, max. particle size .5 in., micaceous.
66				65		MO				
67				10						
68				21 24						
69		HP3-1		32	0	SM	MD		CL	Trace cobbles at 68.0 ft.
70										
71										SILTY CLAY, greenish gray (5YR4/6), trace fine grained sand, medium dry strength, medium toughness, none to slow dilatency, low to medium plasticity, slightly moist, no odor, 95% fines, micaceous, predominant iron oxide staining.
72										
73	4-inch Schedule 40 PVC Casing									
74										
75									SP	

EBASCO ENVIRONMENTAL

MW-13/HP-3

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/16/93 to 08/19/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.24
TOTAL DEPTH (ft) 112
DEPTH TO WATER (ft) 79.00

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
75	Bentonite/Cement Slurry			15					SP	
76				14						
77		HP3-2 HP3-3		28 28	0	ST	MD			POORLY GRADED SAND, light greenish gray (5Y5/2), saturated, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, micaceous, 95% fine grained sand, 5% fines.
78										
79									ML	
80				7						
81				13	0	SM	MS			CLAYEY SILT, dark greenish gray (5BG4/1), slightly moist, no odor, low dry strength, low toughness, no dilatency, no plasticity, 90% non-plastic fines, 10% clayey fines,micaceous, clay content increases slightly towards contact.
82				13 12						
83	Bentonite Gel								SP	
84										POORLY GRADED SAND, orange brown (5YR4/6), fine to medium subrounded to rounded sand, no dry strength, no toughness, rapid dilatency, non-plastic, moist, no odor, 95% sand, 5% non-plastic fines, micaceous.
85										
86										
87										
88	NO. 30 Lonestar Sand									
89										
90				8	0	SM	VS		CL	LEAN CLAY, dark greenish gray (5BG4/1), medium dry strength, medium toughness, no dilatency, medium plasticity, slightly moist, no odor, 90% clayey fines, 10% non-plastic fines, micaceous.
91				21 36						
92				37						
93									SP	
94	No. 3 Lonestar Sand									POORLY GRADED SAND, light brown (7.5YR5/4), fine grained and medium grained subangular to subrounded sand, saturated, no odor, no dry strength, no toughness, rapid daliatency non-plastic, trace medium to coarse gravel, 95% sand, micaceous.
95		HP3-4,5,6								
96										
97										
98										First hydropunch - 100ml recovered. Second hydropunch - 50ml recovered. Third hydropunch - 50ml recovered.
99										
100										

EBASCO ENVIRONMENTAL

MW-13/HP-3

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/16/93 to 08/19/93

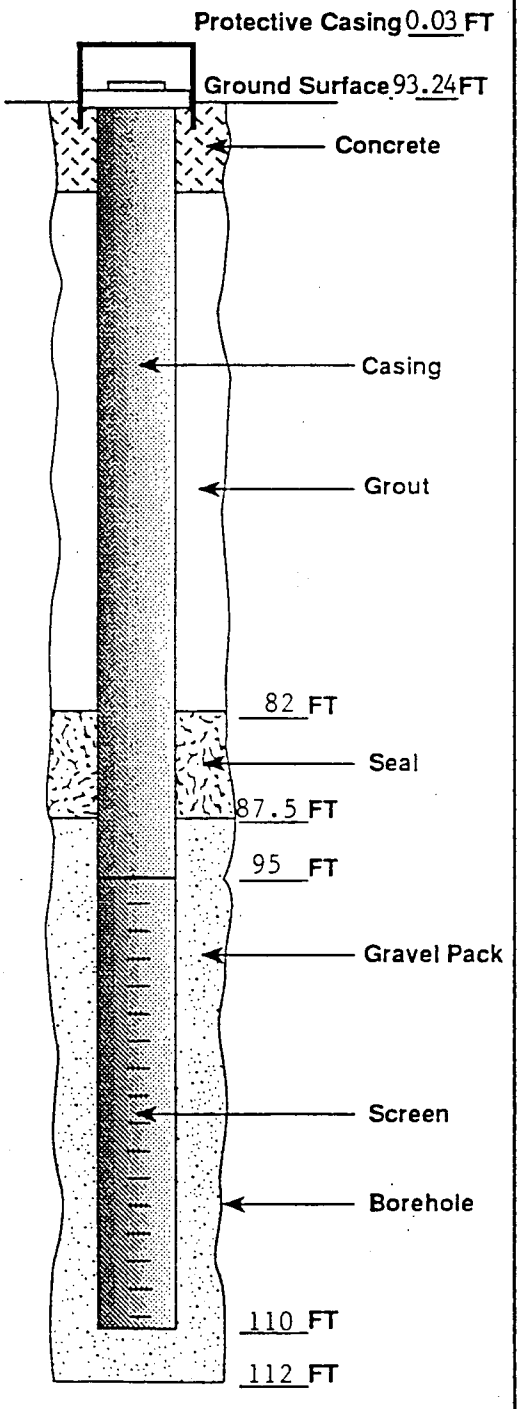
DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.24
TOTAL DEPTH (ft) 112
DEPTH TO WATER (ft) 79.00

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100	0.020-inch Slot, 4-inch Schedule 40 PVC Screen; No. 3 Lonestar Sand								SP	
101										
102										
103										
104										
105										
106										
107										
108									ML	
109										CLAYEY SILT, light yellowish brown (2.5Y/4), moist, no odor, minor fine grained sand, medium dry strength, medium toughness, slow dilatency, low to medium plasticity, 85% non-plastic fines, 15% clayey fines.
110										
111		HP3-7		10 29						
112		HP3-8		70	0	MO	H			
113										Boring terminated at 112.0 ft. (8/16/93) Groundwater (Old Dune Sand), encountered at approx. 65.0 ft bgl (8/16/93). Groundwater (Gage) encountered at approx. 93 ft. bgl (8/16/93).
114										
115										
116										
117										
118										
119										
120										
121										
122										
123										
124										
125										

WELL CONSTRUCTION LOG

PROJECT NAME: H. Kramer & Co.
PROJECT OFS: CHEC 3135.008
LOCATION: One Chapman Way
El Segundo, CA
EBASCO PERSONNEL: R. Tweidt/Colin Kreller

WELL NUMBER: MW-13
WELL LOCATION: North of Southern Pacific R.R.
SURFACE ELEV (ft. above MSL): 93.24
CASING ELEV (ft. above MSL): 92.71



DRILLING SUMMARY

DATE: 08/19/93
DRILLING COMPANY: Layne Environmental, Inc.
DRILLING FOREMAN: Louis L.
RIG TYPE: AP 1000 Drill Systems
TOTAL DEPTH OF BORING: 112 feet
SURFACE CONDUCTOR CASING (length, diameter): None
DRILLING FLUID: Air

CONSTRUCTION LOG

WELL TYPE: Monitoring Well
BORING DIAMETER: 9 3/4 inches
TOTAL WELL DEPTH: 110 feet
CASING TYPE: PVC
CASING DIAMETER: 4-inch
CASING LENGTH: 95 feet
SCREEN TYPE: PVC
SCREEN SIZE: 0.020
SCREEN LENGTH: 15 feet
TAILPIPE LENGTH: None
CASING STICKUP: - 0.53
PROTECTIVE CASING TYPE: Steel & Plastic Traffic Box
PROTECTIVE CASING STICKUP: + 0.03
CENTRALIZERS: None
GROUT MATERIAL: Cement/bentonite mix
GROUT VOLUME: 35 cu. ft.
SEAL MATERIAL: Bentonite gel
SEAL VOLUME: 2 cu. ft.
FILTER MATERIAL: No. 3 Lonestar sand
FILTER VOLUME: 11 cu. ft.
COMMENTS: No. 30 sand from 87.5 feet to 92 feet

E-12

EBASCO ENVIRONMENTAL

HP-5

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kneller
DRILLING CO Layne Environmental
DATE (start/finish) 08/17/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.00
TOTAL DEPTH (ft) 109
DEPTH TO WATER (ft) N/A

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
0	Bentonite/Cement Slurry									Grass, topsoil to 0.5 ft. Hand auger to 5.0 ft.
1						MO			SP	POORLY GRADED SAND, orange brown, (5YR4/6), moist, musty odor, no dry strength, no toughness, rapid dilatency, no plasticity, 90% fine grained sand, 10% non-plastic fines, micaceous.
2										
3										
4										
5										
6										
7									CL	
8						MO				SILTY CLAY, dark grayish brown (10YR4/2), moist, no odor, low dry strength, medium plasticity, medium toughness, dilatency, 75% clayey fines, 25% non-plastic fines, trace fine sand, micaceous.
9										
10					0					
11										
12										
13										
14										Increase in clay content, silts comprise 5-10%.
15										
16										
17										
18										
19										
20					0	SM			SM	
21										SILTY SAND, light orange brown (10YR5/6), no dry strength, no toughness, rapid dilatency, non-plastic, slightly moist, no odor, 80% fine grained sand, 20% non-plastic fines, micaceous.
22										
23										
24										
25									SP	

EBASCO ENVIRONMENTAL

HP-5

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/17/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.00
TOTAL DEPTH (ft) 109
DEPTH TO WATER (ft) N/A

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
25	Bentonite/Cement Slurry								SP	
26						MO				POORLY GRADED SAND, light orange brown (10YR5/8), slightly moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 95% fine grained sand, 5% non-plastic fines, micaceous.
27										
28										
29										
30					0					
31										
32										
33										
34										
35										
36						SM				100% fine grained sand, color change to pale orange brown (10YR6/8).
37										
38										
39										
40					0					
41										
42										Appearance of trace medium to coarse subrounded to rounded sand and fine gravel.
43										
44										
45						SM				
46										
47										
48										
49										
50					0					

EBASCO ENVIRONMENTAL

HP-5

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/17/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.00
TOTAL DEPTH (ft) 109
DEPTH TO WATER (ft) N/A

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
50	Bentonite/Cement Slurry								SP	
51										
52										
53										
54										
55										
56										
57										
58										
59										
60					0					
61										
62										
63										
64										
65										
66										
67										
68										
69										
70					0					Increase in silt content (20%), medium to coarse sand and fine gravel disappear.
71										
72						MO				SANDY SILT, orange brown (10YR4/6), moist, no odor, low dry strength, medium toughness, slow dilatency, no to low plasticity, 85% non-plastic fines, 15% fine grained sand, occasional subrounded pebbles, micaceous, mottled iron staining.
73										
74									SM	
75										

EBASCO ENVIRONMENTAL

HP-5

PROJECT H. Kramer & Co.
LOCATION El Segundo, CA
GEOLOGIST C. Kreller
DRILLING CO Layne Environmental
DATE (start/finish) 08/17/93

DRILLING METHOD Dual-wall air percussion
SAMPLING METHOD Hydropunch/split spoon
GROUND SURFACE ELEVATION (ft MSL) 93.00
TOTAL DEPTH (ft) 109
DEPTH TO WATER (ft) N/A

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
75	Bentonite/Cement Slurry			15					SM	
76		HP5-1		44						
		HP5-2		50	0	MO	D			SILTY CLAY, greenish gray (2.5Y5/2), medium dry strength, medium toughness, no dilatency, medium plasticity, slightly moist, no odor, 80% clayey fines, 20% non-plastic fines, micaceous.
77				42					CL	
78										
79									SM	
80				26						
81				22		MO	MD			Increase in fine grained sand (3-5%).
				20						
82				17						SILTY SAND, dark orange brown (10YR4/6), slightly moist, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 70% fine grained sand, 30% non-plastic fines, micaceous.
83										
84										
85				14	0	ST	MD			Soil becomes saturated at 84.0 ft., decrease in silt content.
86				23					SP	
		HP5-3		37						POORLY GRADED SAND WITH SILT, dark yellowish brown (10YR3/3), saturated, no odor, no dry strength, no toughness, rapid dilatency, non-plastic, 75% fine grained sand and medium grained subrounded sand, 25% non-plastic fines, micaceous.
87		HP5-4		50						
88										
89										
90		HP5-5								
91		HP5-6								
92										Increase in grain size to medium to coarse subrounded to rounded sand, 5% fines, occasional cobbles and pebbles. Color change to light brown (2.5YR3/4).
93										
94										
95										
96										
97										
98										Slight increase in silt content.
99										
100										

EBASCO ENVIRONMENTAL

HP-5

PROJECT *H. Kramer & Co.*
LOCATION *El Segundo, CA*
GEOLOGIST *C. Kreller*
DRILLING CO *Layne Environmental*
DATE (start/finish) *08/17/93*

DRILLING METHOD *Dual-wall air percussion*
SAMPLING METHOD *Hydropunch/split spoon*
GROUND SURFACE ELEVATION (ft MSL) *93.00*
TOTAL DEPTH (ft) *109*
DEPTH TO WATER (ft) *N/A*

Depth (ft)	Well Completion	Sample No.	Samples	Blows/6-in.	OVA (ppm)	Moisture	Consistency	Lithology	USCS Symbol	Lithologic Description and Notes
100	Bentonite/Cement Slurry	HP5-7							SP	
101		HP5-8								
102										
103										
104										
105										
106									CL	SILTY CLAY, greenish gray (2.5Y5/4), slightly moist, no odor, no dry strength, medium toughness, no to slow dilatency, medium plasticity, 75% clayey fines, 25% non-plastic fines, trace fine grained sand, slight iron staining, micaceous.
107										
108										
109									ML	SILTY SAND, greenish gray (2.5Y5/4), moist, no odor, no dry strength, low toughness, slow to rapid dilatency, no plasticity, 60% fine grained sand, 40% non-plastic fines, trace clayey fines, abundant iron staining, micaceous.
110										Total Depth of HP-5 - 109.0 ft.
111										
112										
113										
114										
115										
116										
117										
118										
119										
120										
121										
122										
123										
124										
125										

APPENDIX C

DEVELOPMENT/SAMPLING LOGS

EBASCO ENVIRONMENTAL

Field Water Level Measurements

DATE: 8/26/93

PERSONNEL: C. KRELLER

WEATHER: COOL, CLEAR

PROJECT NAME: H. KRAMER + Co

PROJECT OFS: CHSC 3135.003

MEASUREMENT DEVICE: SOLINST W/L METER

COMMENTS:

Time	Well I.D.	Top of Casing Elev. Measuring Point (feet above MSL)	Depth to Water from Measuring Point (feet)	Elevation of Groundwater (feet above MSL)
0730	MW-12	98.80	83.21'	15.79
0740	MW-13	92.71	79.00'	13.71
0750	MW-11	89.56	84.58'	4.98
8/27/93 0733	MW-13	92.71	79.00'	13.71
0741	MW-10	93.70	78.62'	15.08
0748	MW-4	92.44	70.70'	21.74
0753	MW-2	98.90	82.34'	16.56
0759	MW-12	98.80	83.30'	15.50
0812	MW-6	98.26	82.70'	15.56
0816	MW-8	102.64	86.21'	16.43
0825	MW-7	108.15	90.02'	18.13
0832	MW-1	101.91	82.03'	19.88
0839	MW-5	93.00	78.12'	14.88
0851	MW-9	102.80	87.99'	14.81
1129	MW-3	94.22	68.47'	25.75
1005	MW-11	89.56	84.58'	4.98

E-12

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. KRAMER
Project Number : CHEC 3135.008
Date : 8/26/93
Site Engineer : C. KRELLER

Well Number : MW-13
Equipment : SI 700 Development rig; 2" round top pump
Contractor : Layne Environmental

	Before	Reference Point	After
Depth to Water (ft)	79.00'	Top 4" casing	79.16'
Depth to Sediment (ft)	109.90'	Top 4" casing	109.90'
Thickness of Sediment (ft)	.10'		.10

Depth of Well (ft) 110.0'
Water Column Height (ft) 31.0'
Diameter of Casing (ft) .333
Diameter of Boring (ft) .8125
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 20.18
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 120.16
Total Volume Purged (gals) 1518
Casing/Well Volumes Purged 75.2 / 12.6

Time	pH	Turbidity (NTU)	Temp. (°C)	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1425						Pump bailing
1447			Pump at 109'			
1452	6.78	95	23	180	13.8	murky
1459			Pump off			Pump to pull out of hole
1542			Pump on		"	
1545	6.94	35	23	182	"	cloudy
1552	6.97	13	22	180	"	cloudy
1557	6.97	6.4	22	180	"	clear
1602	6.98	4.5	22	180	"	W/L 80.25'
1609	6.99	5.5	22	180	"	"
1606	6.98	4.0	22	180	"	"
1608	6.95	3.5	22	180	"	"
1610	6.93	3.5	22	180	"	clear
1611		Pump off				
08/27/93						
0908						START PUMPING @ 100'
0916	7.00	4.0	22	175	13.8	clear
0920	7.05	3.7	22	175	"	
0922	7.07	2.3	22	175	"	
0924	7.08	2.0	22	175	"	
0926	7.08	1.8	21.5	175	"	
0928	7.08	1.8	21.5	175		STOP PUMPING

Notes Sampling Procedures:

F4

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. KRAMER
Project Number : CHEC 3135.008
Date : 8/26/93
Site Engineer : C. KRELLER

Well Number : MW-12
Equipment : 317.00 Development Rig; 2" Grundfos Pump
Contractor : Layne Environmental

	Before	Reference Point	After
Depth to Water (ft)	83.21'	Top 4" casing	83.32
Depth to Sediment (ft)	126.82'	Top 4" casing	127.23
Thickness of Sediment (ft)	1.18'		0.77

Depth of Well (ft) 128.0'
Diameter of Casing (ft) .333
Water Column Height (ft) 43.61'
Diameter of Boring (ft) .8125
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 25.39
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 169.04
Total Volume Purged (gals) 1656
Casing/Well Volumes Purged 58.3 / 9.79

Time	pH	Turbidity (NTU)	Temp. (°C)	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1022			Pump on		13.1	Pump on @ 127'
1025					"	Pump set @ 117'
1028					"	Pump set @ 107' w/L 85.25
1038			Pump off			
1050						
1059						
1102						
1117			Pump on			Pump on @ 127'
1119					21.3 gpm	
1121	5.84	>100	23	310	"	dirty
1124	6.04	>100	23	308	"	murky
1129	6.03	41	23	310	"	cloudy
1136	6.03	23	23	312	18.8	slightly cloudy w/L 86.62'
1141	6.03	20	23	312		
1146	6.05	15	23	310	"	clear
1151	6.03	15	23	310	"	"
1156	6.05	13	23	312	"	clear
1201	6.06	8.5	23	310	"	" w/L 86.72'
1206	6.05	8.5	23	312	"	
1211	6.06	5.6	23	310	"	"
1216	6.04	4.5	23	310	"	"
1218	6.04	3.7	23	312	"	"

Notes Sampling Procedures: 2 bailers taken out of well prior to pumping

1220	3.3	23	312	"	v. clear
1222		STOP PUMPING			

F4

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. KRAMER
Project Number : CHEC 2125.008
Date : 8/26/93
Site Engineer : C. KRELLER

Well Number : MW-12
Equipment : [illegible] Development [illegible]
7" [illegible] pump
Contractor : Lane Environmental

	Before	Reference Point	After
Depth to Water (ft)	83.21'	Top 4" casing	83.21'
Depth to Sediment (ft)	126.82'	Top 4" casing	126.82'
Thickness of Sediment (ft)	1.18'		1.18'

Depth of Well (ft) 128.0'
Diameter of Casing (ft) .333
Water Column Height (ft) 43.61
Diameter of Boring (ft) .2125
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 28.29
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 19.04
Total Volume Purged (gals) 165
Casing/Well Volumes Purged 5.8 / 9.79

Time	pH	Turbidity (NTU)	Temp. (°C)	Conductivity (µmhos)	Pump Rate (gpm)	Comments
[illegible]						Pump [illegible] 128'
1243					13.5	
1245	6.07	15	23	321	"	clear
1251	6.08	2.0	23	319		"
1253	6.06	2.1	23	319	"	
1255	6.05	2.1	23	319	"	"
1259	6.05	2.0	23	319		
1301	6.04	1.5	23	320	"	"
1302						Move pump to 107' w/ 83.60'
1305					13.5	Start pump
1309	6.01	65	24	330	"	instruments in sun
1315	6.05	35	23	321	"	
1320	6.05	2.2	23	319	"	
1322	6.05	2.1	23	319	"	
1324	6.04	1.5	23	319	"	
1326	6.02	1.5	23	319	"	

Notes Sampling Procedures:

F4

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : U KRAMER
Project Number : CHFC 3135.003
Date : 8/27/93
Site Engineer : C. KRELLER

Well Number : MW-11
Equipment : S1700 Development Pump
2" Grundfos Pump
Contractor : Layne Environmental

	Before	Reference Point	After
Depth to Water (ft)	84.58'	Top 4" casing	85.25'
Depth to Sediment (ft)	103.98'	Top 4" casing	104.10'
Thickness of Sediment (ft)	1.02'		.90'

Depth of Well (ft) 105.0' — Water Column Height (ft) 19.4'
Diameter of Casing (ft) .333 — Diameter of Boring (ft) .5125
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 12.63
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 75.20
Total Volume Purged (gals) 1573 — Casing/Well Volumes Purged 124.56 / 20.91

Time	pH	Turbidity (NTU)	Temp. (°C)	Conductivity (µmhos)	Pump Rate (gpm)	Comments
~~1029~~ 1026			Pump on			No water
						w/c 84.68' w pump off
						Pump on
1034						w/c ~~[illegible]~~ 57.6' w pump on
1047						Move pump to 100.0'
1049						87.8'
1053						
1108			Pump off			w/c 55.47 w pump off
1143			Begin Swabbing			
1220			Finish Swabbing			
1230			Pump at 104'		13.3 gpm	brown
1234	7.23	>100	22.5	300	"	murky
1242	7.29	24.5	22.3	290	"	cloudy
1247	7.28	25.0	22.3	293	"	v. cloudy
1253	7.29	13	22	290	"	clear
1255	7.29	18	22	289	"	clear
1303	7.30	8.3	22	288	"	"
1308	7.29	9.5	22	287	"	"
1312		TANK FULL SHUT OFF PUMP.				w/c 85.02
1340			Pump ON			
1349	7.35	18	22	285	13.8	clear
1355	7.33	8.9	22	290	13.8	"
1402	7.33	5.5	22	290	"	"

Notes Sampling Procedures:

F4

WELL DEVELOPMENT LOG / WELL SAMPLING LOG

Project Name : H. KRAMER
Project Number : CHEC 3135.003
Date : 8/27/93
Site Engineer : C. KRELLER

Well Number : MW-11
Equipment : S1700 Development Rig
2" Grundfos Pump
Contractor : Layne Environmental

	Before	Reference Point	After
Depth to Water (ft)	84.58'	Top 4" casing	85.25
Depth to Sediment (ft)	103.93'	Top 4" casing	104.10
Thickness of Sediment (ft)	1.02'		.90'

Depth of Well (ft) 105.0'
Water Column Height (ft) 19.4'
Diameter of Casing (ft) .333
Diameter of Boring (ft) .8125
Casing Volume (gals) = π(Diam. of Casing (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 12.63
Well Volume (gals) = π(Diam. of Boring (ft)/2)²(Water Column Height (ft))(7.48 gals/ft³) = 77.20
Total Volume Purged (gals) 1573
Casing/Well Volumes Purged 124.56 / 20.91

Time	pH	Turbidity (NTU)	Temp. (°C)	Conductivity (µmhos)	Pump Rate (gpm)	Comments
1404	7.37	6.8	22	288	13.8	clear
1406	7.35	6.8	22	285	13.8	w/l 87.30
1411	7.33	5.5	22	286	13.8	
1416	7.33	4.8	22	281	"	
1418	7.33	4.8	22	280	"	
1420	7.33	4.6	22	281	"	
	MOVE PUMP TO			94'		
1424	7.31	12	22	271	"	"
1425	Pump off					
1450		Pump on			13.8	
1453	7.38	9.6	22	270	"	clear w/l 87.5
1505	7.36	6.2	22	270	"	clear
1510	7.31	5.3	22	266	"	clear
1515	7.31	4.8	22	266	"	
1517	7.30	4.9	22	265	"	
1519	7.30	4.0	22	265	"	
1522	7.30	3.5	22	263	"	
1524	7.30	4.0	22	263	"	
1525		Pump off				

Notes Sampling Procedures:

F4

APPENDIX D

LABORATORY REPORTS

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261-1022 FAX (714) 261-1228
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370-4667 FAX (909) 370-1046
16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled:	Aug 5, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received:	Aug 5, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water	Analyzed:	Aug 6, 1993
Attention: Rob Tweidt	First Sample #: CH00489	Reported:	Aug 6, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
CH00489	HP2-5	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Rob Tweidt

Method Blank

Analyzed: Aug 6, 1993
Reported: Aug 6, 1993
Matrix: Water

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
Method Blank	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

CH00489.EEE <2 of 2>

Del Mar Analytical

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QC DATA REPORT

METHOD Metals
Instrument: AA
Matrix: water

DATE: 8/6/93

SAMPLE # CH00489

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	0	25	22	21	88%	84%	4.7%	86%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; (MS-R1) / SP X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 16, 1993
3000 W. MacArthur Blvd.	Kramer	Received: Aug 16, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water	Analyzed: Aug 17, 1993
Attention: Robert Tweidt	First Sample #: CH01563	Reported: Aug 17, 1993

LABORATORY ANALYSIS FOR: DISSOLVED ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
CH01563	HP3-6	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 17, 1993
Reported: Aug 17, 1993
Matrix: Water

LABORATORY ANALYSIS FOR: DISSOLVED ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
Method Blank	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

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16525 Sherman Way, Suite C 11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

METHOD Metals
Instrument: AA
Matrix: water

DATE: 8/17/93

SAMPLE # Blank

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	0	25	25	24	100%	96%	4.1%	98%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; (MS-R1) / SP X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled:	Aug 6, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received:	Aug 6, 1993
Santa Ana, CA 92704	Sample Descript Water	Analyzed:	Aug 9, 1993
Attention: Rob Tweidt	First Sample #: CH00712	Reported:	Aug 9, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
CH00712	HP4-6	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704
Attention: Rob Tweidt

Method Blank

Analyzed: Aug 9, 1993
Reported: Aug 9, 1993
Matrix: Water

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
Method Blank	0.010	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

CH00712.EEE <2 of 2>

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 17, 1993
3000 W. MacArthur Blvd.	Kramer & Co.-El Segundo	Received: Aug 17, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water	Analyzed: Aug 18, 1993
Attention: Robert Tweidt	First Sample #: CH01647	Reported: Aug 18, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
CH01647	HP5-6	0.010	6.0
CH01648	HP5-8	0.010	0.029

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 18, 1993
Reported: Aug 18, 1993
Matrix: Water

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/L (ppm)	Sample Result mg/L (ppm)
Method Blank	0.01	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

METHOD Metals
Instrument: AA
Matrix: water

DATE: 8/18/93

SAMPLE # Blank

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	0	25	25	26	100%	104%	3.9%	102%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; (MS-R1) / SP X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

Del Mar Analytical
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 5, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received: Aug 5, 1993
Santa Ana, CA 92704-6993	Sample Descript: Soil	Analyzed: Aug 13, 1993
Attention: Rob Tweidt	First Sample #: CH00490	Reported: Aug 16, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
CH00490	HP2-1	1.0	5.2
CH00491	HP2-2	1.0	3.6
CH00492	HP2-3	1.0	11
CH00494	HP2-6	1.0	2.9

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical
2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779-1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Rob Tweidt

Method Blank

Analyzed: Aug 13, 1993
Reported: Aug 16, 1993
Matrix: Soil

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
Method Blank	1.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

METHOD Metals
Instrument: AA
Matrix: water

DATE: 8/13/93

SAMPLE # CH00821

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	0	25	21	21	84%	84%	0.0%	84%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; (MS-R1) / SP X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

Del Mar Analytical
2857 Alton Ave., Irvine, CA 92714 (714) 261-1022 FAX (714) 261-1228
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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 16, 1993
3000 W. MacArthur Blvd.	Kramer	Received: Aug 16, 1993
Santa Ana, CA 92704-6993	Sample Descript: Soil	Analyzed: Aug 27, 1993
Attention: Robert Tweidt	First Sample #: CH01564	Reported: Aug 27, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 6010)

Laboratory Number	Sample Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
CH01564	HP3-1	1.0	29
CH01565	HP3-3	1.0	81

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbie Ranck for

Gary Steube
Laboratory Director

Del Mar Analytical
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370 4667 FAX (909) 370 1046
16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 27, 1993
Reported: Aug 27, 1993
Matrix: Soil

LABORATORY ANALYSIS FOR: ARSENIC (EPA 6010)

Laboratory Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
Method Blank	1.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbie Ranck for

Gary Steube
Laboratory Director

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C 11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

METHOD Metals
Instrument: ICP
Matrix: SOIL

Date: 8/27/93

SAMPLE # CH01650

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	1227	1000	2155	2000	93%	77%	7.5%	85%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; ((MS-R1) / SP) X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP) X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779 1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 5, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received: Aug 6, 1993
Santa Ana, CA 92704	Sample Descript: Soil	Analyzed: Aug 13, 1993
Attention: Rob Tweidt	First Sample #: CH00713	Reported: Aug 16, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
CH00713	HP4-1	1.0	130

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

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Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 6, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received: Aug 6, 1993
Santa Ana, CA 92704	Sample Descript: Soil	Analyzed: Aug 13, 1993
Attention: Rob Tweidt	First Sample #: CH00715	Reported: Aug 16, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Number	Sample Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
CH00715	HP4-7	1.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704
Attention: Rob Tweidt

Method Blank

Analyzed: Jun 13, 1993
Reported: Aug 16, 1993
Matrix: Soil

LABORATORY ANALYSIS FOR: ARSENIC (EPA 7060)

Laboratory Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
Method Blank	1.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

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QC DATA REPORT

METHOD Metals
Instrument: AA
Matrix: soil

DATE: 8/13/93

SAMPLE # Blank

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	0	25	22	23	88%	92%	4.4%	90%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; (MS-R1) / SP X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

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Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 17, 1993
3000 W. MacArthur Blvd.	Kramer & Co.-El Segundo	Received: Aug 17, 1993
Santa Ana, CA 92704-6993	Sample Descript: Soil	Analyzed: Aug 27, 1993
Attention: Robert Tweidt	First Sample #: CH01649	Reported: Aug 30, 1993

LABORATORY ANALYSIS FOR: ARSENIC (EPA 6010)

Laboratory Number	Sample Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
CH01649	HP5-1	1.0	360
CH01650	HP5-3	1.0	12

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbie Ranck for
Gary Steube
Laboratory Director

Del Mar Analytical

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Client Project ID: CHEC 3135.008
Kramer & Co.-El Segundo
Sample Descript: STLC Extract of a Soil, HP 5-1
Lab Number: CH02727

Sampled: Aug 17, 1993
Received: Aug 17, 1993
Analyzed: Sep 7, 1993
Reported: Sep 7, 1993

Analyte	EPA Method	STLC Max. Limit mg/L (ppm)	TTLC Max. Limit mg/Kg (ppm)	Detection Limit mg/L (ppm)	STLC Sample Result mg/L (ppm)
Arsenic	6010	5.0	500	0.050	51

Prior to analysis, the sample was extracted using the WET method as described in California Title 22, Section 66261, Appendix II.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 27, 1993
Reported: Aug 30, 1993
Matrix: Soil

LABORATORY ANALYSIS FOR: ARSENIC (EPA 6010)

Laboratory Description	Detection Limit mg/Kg (ppm)	Sample Result mg/Kg (ppm)
Method Blank	1.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbie Ranck for
Gary Steube
Laboratory Director

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

METHOD Metals
Instrument: ICP
Matrix: SOIL

Date: 8/27/93

SAMPLE # CH01650

Analyte	R1	SP	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
Arsenic	1227	1000	2155	2000	93%	77%	7.5%	85%

R1..... Result of Sample Analysis
Sp..... Spike Concentration Added to Sample
MS..... Matrix Spike Result
MSD..... Matrix Spike Duplicate Result
PR1..... Percent Recovery of MS; ((MS-R1) / SP) X 100
PR2..... Percent Recovery of MSD; ((MSD-R1) / SP) X 100
RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

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Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled:	Aug 5, 1993
3000 W. MacArthur Blvd.	H. Kramer & Co., El Segundo	Received:	Aug 5, 1993
Santa Ana, CA 92704-6993	Sample Descript Water, HP2-4	Analyzed:	Aug 10, 1993
Attention: Rob Tweidt	Lab Number: CH00493	Reported:	Aug 16, 1993

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	**2.0**	**4.0**
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	**2.0**	**7.0**
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	**2.0**	**2.0**
Tetrachloroethene	**2.0**	**29**
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	**2.0**	**230**
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	87%
Toluene-d8	96%
4-Bromofluorobenzene	104%

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Rob Tweidt

Method Blank

Analyzed: Aug 10, 1993
Reported: Aug 16, 1993
Matrix: Water

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	92%
Toluene-d8	93%
4-Bromofluorobenzene	101%

CH00489.EEE <6 of 6>

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

EPA METHOD 624
Matrix: water

DATE: 8/10/93

SAMPLE # Blank

Analyte	R1	Sp	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
1,1-Dichloroethene	0	50	47	49	94%	98%	4.2%	96%
Trichloroethene	0	50	48	52	96%	104%	8.0%	100%
Chlorobenzene	0	50	49	51	98%	102%	4.0%	100%
Benzene	0	50	50	55	100%	110%	9.5%	105%
Toluene	0	50	49	54	98%	108%	9.7%	103%

Definition of Terms:

R1..... Result of Sample Analysis

Sp..... Spike Concentration Added to Sample

MS..... Matrix Spike Result

MSD..... Matrix Spike Duplicate Result

PR1..... Percent Recovery of MS; ((MS-R1) / SP) X 100

PR2..... Percent Recovery of MSD; ((MSD-R1) / SP) X 100

RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

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Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 16, 1993
3000 W. MacArthur Blvd.	Kramer	Received: Aug 16, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water, HP3-5	Analyzed: Aug 18, 1993
Attention: Robert Tweidt	Lab Number: CH01566	Reported: Aug 27, 1993

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	**2.0**	**3.0**
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	**2.0**	**52**
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	**2.0**	**140**
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbi Rand for
Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	88%
Toluene-d8	98%
4-Bromofluorobenzene	97%

CH01563.EEE <4 of 6>

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 18, 1993
Reported: Aug 27, 1993
Matrix: Water

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbie Ranck for
Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	93%
Toluene-d8	100%
4-Bromofluorobenzene	94%

CH01563.EEE <6 of 6>

Del Mar Analytical

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Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704
Attention: Rob Tweidt

Client Project ID: CHEC 3135.008
H. Kramer & Co., El Segundo
Sample Descript: Water, HP4-5
Lab Number: CH00714

Sampled: Aug 6, 1993
Received: Aug 6, 1993
Analyzed: Aug 10, 1993
Reported: Aug 16, 1993

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	**2.0**	**230**
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	**2.0**	**4.0**
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	**2.0**	**220**
Tetrachloroethene	**2.0**	**2.0**
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	**2.0**	**17**
Trichlorofluoromethane	**5.0**	**210**
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	91%
Toluene-d8	97%
4-Bromofluorobenzene	105%

CH00712.EEE <5 of 7>

Del Mar Analytical
2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370 4667 FAX (909) 370 1046
16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704
Attention: Rob Tweidt

Method Blank

Analyzed: Aug 10, 1993
Reported: Aug 16, 1993
Matrix: Water

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Gary Stebbe
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	92%
Toluene-d8	93%
4-Bromofluorobenzene	101%

CH00712.EEE <7 of 7>

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
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16525 Sherman Way, Suite C 11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

EPA METHOD 624

Matrix: water

DATE: 8/10/93

SAMPLE # Blank

Analyte	R1	Sp	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
1,1-Dichloroethene	0	50	47	49	94%	98%	4.2%	96%
Trichloroethene	0	50	48	52	96%	104%	8.0%	100%
Chlorobenzene	0	50	49	51	98%	102%	4.0%	100%
Benzene	0	50	50	55	100%	110%	9.5%	105%
Toluene	0	50	49	54	98%	108%	9.7%	103%

Definition of Terms:

R1..... Result of Sample Analysis

Sp..... Spike Concentration Added to Sample

MS..... Matrix Spike Result

MSD..... Matrix Spike Duplicate Result

PR1..... Percent Recovery of MS; ((MS-R1) / SP) X 100

PR2..... Percent Recovery of MSD; ((MSD-R1) / SP) X 100

RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled:	Aug 17, 1993
3000 W. MacArthur Blvd.	Kramer & Co.-El Segundo	Received:	Aug 17, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water, HP5-5	Analyzed:	Aug 18, 1993
Attention: Robert Tweidt	Lab Number: CH01651	Reported:	Aug 26, 1993

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	**5.0**	**12**
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	**2.0**	**22**
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	**2.0**	**4.0**
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	**2.0**	**76**
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbi Ranck for
Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	90%
Toluene-d8	96%
4-Bromofluorobenzene	95%

CH01647.EEE <4 of 7>

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370 4667 FAX (909) 370 1046
16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779-1843

Ebasco Environmental	Client Project ID: CHEC 3135.008	Sampled: Aug 17, 1993
3000 W. MacArthur Blvd.	Kramer & Co.-El Segundo	Received: Aug 17, 1993
Santa Ana, CA 92704-6993	Sample Descript: Water, HP5-7	Analyzed: Aug 18, 1993
Attention: Robert Tweidt	Lab Number: CH01652	Reported: Aug 26, 1993

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	**5.0**	**16**
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	**2.0**	**23**
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	**2.0**	**20**
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	**2.0**	**230**
Trichlorofluoromethane	**5.0**	**7.0**
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbi Ranck for
Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	92%
Toluene-d8	96%
4-Bromofluorobenzene	94%

CH01647.EEE <5 of 7>

Del Mar Analytical

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16525 Sherman Way, Suite C-11, Van Nuys, CA 91406 (818) 779-1844 FAX (818) 779 1843

Ebasco Environmental
3000 W. MacArthur Blvd.
Santa Ana, CA 92704-6993
Attention: Robert Tweidt

Method Blank

Analyzed: Aug 18, 1993
Reported: Aug 26, 1993
Matrix: Water

VOLATILE ORGANICS by GC/MS (EPA 8240)

Analyte	Detection Limit µg/L (ppb)	Sample Result µg/L (ppb)
Acetone	10	N.D.
Benzene	2.0	N.D.
Bromodichloromethane	2.0	N.D.
Bromoform	2.0	N.D.
Bromomethane	5.0	N.D.
2-Butanone	10	N.D.
Carbon disulfide	5.0	N.D.
Carbon tetrachloride	5.0	N.D.
Chlorobenzene	2.0	N.D.
Chlorodibromomethane	2.0	N.D.
Chloroethane	5.0	N.D.
2-Chloroethyl vinyl ether	2.0	N.D.
Chloroform	2.0	N.D.
Chloromethane	5.0	N.D.
1,1-Dichloroethane	2.0	N.D.
1,2-Dichloroethane	2.0	N.D.
1,1-Dichloroethene	5.0	N.D.
cis-1,2-Dichloroethene	2.0	N.D.
trans-1,2-Dichloroethene	2.0	N.D.
1,2-Dichloropropane	2.0	N.D.
cis-1,3-Dichloropropene	2.0	N.D.
trans-1,3-Dichloropropene	2.0	N.D.
Ethylbenzene	2.0	N.D.
2-Hexanone	10	N.D.
Methylene chloride	10	N.D.
4-Methyl-2-pentanone	5.0	N.D.
Styrene	2.0	N.D.
1,1,2,2-Tetrachloroethane	2.0	N.D.
Tetrachloroethene	2.0	N.D.
Toluene	2.0	N.D.
1,1,1-Trichloroethane	2.0	N.D.
1,1,2-Trichloroethane	2.0	N.D.
Trichloroethene	2.0	N.D.
Trichlorofluoromethane	5.0	N.D.
Vinyl acetate	5.0	N.D.
Vinyl chloride	5.0	N.D.
Total Xylenes	2.0	N.D.

Analytes reported as N.D. were not present above the stated limit of detection.

DEL MAR ANALYTICAL, IRVINE (ELAP #1197)

Debbi Ranck for
Gary Steube
Laboratory Director

Surrogate Standard Recoveries:	
1,2-Dichloroethane-d4	93%
Toluene-d8	100%
4-Bromofluorobenzene	94%

CH01647.EEE <7 of 7>

Del Mar Analytical

2852 Alton Ave., Irvine, CA 92714 (714) 261 1022 FAX (714) 261 1228
1014 E. Cooley Dr., Suite A, Colton, CA 92324 (909) 370 4667 FAX (909) 370 1046
16525 Sherman Way, Suite C 11, Van Nuys, CA 91406 (818) 779 1844 FAX (818) 779 1843

QC DATA REPORT

EPA METHOD 624
Matrix: Water

DATE: 8/18/93

SAMPLE # CH01541

Analyte	R1	Sp	MS	MSD	PR1	PR2	RPD	MEAN PR
	ppb	ppb	ppb	ppb	%	%	%	%
1,1-Dichloroethene	0	50	47	47	94%	94%	0.0%	94%
Trichloroethene	0	50	51	51	102%	102%	0.0%	102%
Chlorobenzene	0	50	52	50	104%	100%	3.9%	102%
Benzene	0	50	54	51	108%	102%	5.7%	105%
Toluene	0	50	52	50	104%	100%	3.9%	102%

Definition of Terms:

R1..... Result of Sample Analysis

Sp..... Spike Concentration Added to Sample

MS..... Matrix Spike Result

MSD..... Matrix Spike Duplicate Result

PR1..... Percent Recovery of MS; ((MS-R1) / SP) X 100

PR2..... Percent Recovery of MSD; ((MSD-R1) / SP) X 100

RPD..... Relative Percent Difference; ((MS-MSD)/(MS+MSD)/2)) X 100

Del Mar Analytical

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10524

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Page 1 of 1

Project Name: H. Kramer & Co.

OFS No.: CHEC 3135.008

Sampling Date: 8/5/93

Shipment Date: 8/5/93

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☒ ___ DAYS; RUSH ☐ ___ DAYS

Project Address: One Chapman Way, El Segundo, CA.

Sampler (Name): Colin Kreller / Rob Tweidt

Sampler: (Signature): Rob K. Tweidt

Laboratory/DHS No.: DEL MAR ANALYTICAL

Reports to Be Sent to: ROB TWEIDT

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	EPA METHOD 6010/7000 SERIES Dissolved Arsenic & Selenium	EPA METHOD 6010/7000 SERIES Arsenic						
HP2-1	0920	ice	2.5" x 6" brass sleeve		X													X						
HP2-2	0950		"		X													X						
HP2-3	1020		"		X													X						
HP2-4	1200	+HCl	40 ml VOA	X							X													
* HP2-5	1200		500 ml plastic bottle	X													X							
HP2-6	1240	ice	2.5" x 6" brass sleeve		X													X						

LABORATORY INSTRUCTIONS/COMMENTS: Report results as Dissolved Arsenic concentration
Method Detection Limit for dissolved arsenic 0.01 mg/l (in water sample).
(*) Turnaround Time for dissolved arsenic water sample next day at 10:00 AM (*) Needs to be entered in LIMS
Phone (714) 349-1229 or (714) 662-4050 and ask for Rob Tweidt if any questions

Standard turnaround time for 8240 & soil samples

Samples intact / cool

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
Rob K. Tweidt	8/5/93	[signature]	[signature]	8/5/93	[signature] 8/5/93 4:15 pm
Company: Ebasco Environmental	Time: 1435	Company: DEL MAR	Company: DEL MAR	Time: 4:15	Company: Del Mar Analytical

F-2

Shipping Copy (White) File Copy (Yellow) Field Copy (Pink)

107

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10531

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Project Name: KRAMER

OFS No.: CHEC 3135.008

Sampling Date: 08/16/93

Shipment Date: 08/16/93

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☐ ____ DAYS; RUSH ☒ ____ DAYS

Project Address: #1 Chapman Way, El Segundo, CA

Sampler (Name): Rob. K. Tweidt / Colin G. Kreller

Sampler (Signature): [signature]

Laboratory/DHS No.: DEL MAR ANALYTICAL

Reports to Be Sent to: ROBERT K. TWEIDT

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	EPA METHOD: Arsenic 6010/7060 Series	Dissolved EPA Method Arsenic 6010/7060 Series						
HP3-1	1130	ICE	2.5"x6" BRASS SLEEVE		X												X							
~~HP3-2~~ EX																								
HP3-3	1200	ICE	2.5"x6" BRASS SLEEVE		X												X							
HP3-5	1420	ICE+HCl	1x40mL GLASS	X							X													
HP3-6 *		ICE	1x500mL PLASTIC	X														X						

LABORATORY INSTRUCTIONS/COMMENTS: Report results for arsenic water sample as "dissolved arsenic" concentration
Method detection limit for dissolved arsenic water sample is 0.01 mg/l
Turnaround time for dissolved arsenic is 10:00 AM Tuesday morning (8/17/93)
* Dissolved arsenic sample must be filtered in the lab.
Standard turnaround time for 8240 & soil samples.

Phone (714) 662-4050 or (714) 349-1220 and ask for Rob if you have any questions.

Archive soil samples after analyses.

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)	Date:
[signature]	8-16-93	[signature]	[signature]	8/16/93	[signature]	8/16/93
Company: EBASCO	Time: 1249	Company: DHL	Company: DHL	Time: 7:22	Company: Del Mar Analytical	Time: 6:20pm

F-2

Shipping Copy (White) File Copy (Yellow) Field Copy (Pink)

Samples received intact/cool.

108

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10640

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Project Name: H. Kramer & Co.

OFS No.: CHEC 3135.008

Sampling Date: 8/5/93 8/6/93

Shipment Date: 8/6/93

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☒ ____ DAYS; RUSH ☒ ____ DAYS

Project Address: One Chapman Way, El Segundo, CA.

Sampler (Name): Colin Kreller / Rob Tweidt

Sampler: (Signature): Rob K. Tweidt

Laboratory/DHS No.: DEL MAR ANALYTICAL

Reports to Be Sent to: Rob Tweidt

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	EPA method Arsenic 6010/7000 Series	Dissolved Arsenic 6010/7000 Series
HP4-1	8/5/93 1620	ice	2.5" x 6" brass sleeve		X												X	
~~HP4-2~~ RKT																		
~~HP4-4~~ RKT																		
HP4-5	1250	ice + HCl	40 ml VOA	X							X							
HP4-6 *	1250	ice	500 ml plastic bottle	X														X
HP4-7	1100	ice	2.5" x 6" brass sleeve		X												X	
~~HP4-8~~ RKT																		

8/6/93

LABORATORY INSTRUCTIONS/COMMENTS: Report results for arsenic water sample as "Dissolved Arsenic" concentration

Method Detection Limit for dissolved arsenic water sample is 0.01 mg/l

Turnaround time for dissolved arsenic is @ 10:00 AM Monday morning (8/9/93)

* Dissolved arsenic sample has been filtered in the field.

Standard turnaround time for 8240 & soil samples.

phone (714) 662-4050 or (714) 349-122 and ask for Rob if you have questions.

Archive ~~Hold~~ soil samples after analyses.

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
Rob K. Tweidt	8/6/93	[signature]	[signature]	8/6/93	[signature] 8/6/93
Company: Ebasco Environmental	Time: 1300	Company: DMA	Company: DMA	Time: 1845	Company: Del Mar Analytical

1.4°C

Shipping Copy (White) File Copy (Yellow) Field Copy (Pink)

F-2

Samples intact/cool.

109

CHAIN OF CUSTODY FORM REQUEST FOR ANALYSIS

№ 10630

EBASCO ENVIRONMENTAL

A Division of Ebasco Services Incorporated

3000 W. MacArthur Boulevard, Santa Ana, California 92704-6993 • (714) 662-4050 • Fax (714) 662-4049

Project Name: KRAMER & Co.

OFS No.: CHEC 3135.008

Sampling Date: 8/17/93

Shipment Date: 8/17/93

HAZARD IDENTIFICATION: Nonhazard ☒ Flammable ☐ Skin Irritant ☐ Reactive ☐ Toxic ☐ Infectious ☐

Time Required: NORMAL ☒ ____ DAYS; RUSH ☒ ____ DAYS

Project Address: ONE CHAPMAN WAY, El Segundo, CA.

Sampler (Name): Colin Kreller / Rob Tweidt

Sampler (Signature): Rob K. Tweidt

Laboratory/DHS No.: DEL MAR ANALYTICAL

Reports to Be Sent to: ROB TWEIDT

ANALYSES REQUIRED

SAMPLE NUMBER	TIME COLLECTED	SAMPLE PRESERVATIVE(S)	CONTAINER SIZE AND TYPE	SAMPLE MATERIAL: WATER	SOIL	OTHER (Describe)	Halogenated Volatile Organics (8010/601)	Mod. 8015 (Gas Range)/(Diesel Range)	Aromatic Volatile Organics (8020/602)	Pesticides (8080/608)	Volatile Organics (8240/624)	Semi-Volatile Organics (8270/625)	TRPH (418.1)	Title 22 Metals	Waste Extraction Test (WET)	TCLP for Metals	EPA Method Arsenic 6010/7060 Series	Dissolved Arsenic EPA Method 6010/7060 Series						
HPS-1	1005	ice	2.5" x 6" brass sleeve		X												X							
HPS-3	1045	↓	"		X												X							
~~HPS-4~~ RKT																								
HPS-5	1230	+ HCl	40ml VOA	X							X													
HPS-6	1230		500ml plastic bottle	X														X						
HPS-7	1420	+ HCl	40ml VOA	X							X													
HPS-8	1420		500ml plastic bottle	X														X						

LABORATORY INSTRUCTIONS/COMMENTS: Water samples for arsenic have been filtered in the field. Report these results as "Dissolved Arsenic" concentration. Method Detection Limit is 0.01 mg/l for arsenic in water. Turnaround time for dissolved arsenic water samples is 10:00 AM Wed. morning (8/18/93). Standard Turnaround time for 8240 & soil samples. Phone (714) 662-4050 or (714) 349-1229 and ask for Rob Tweidt if there are any questions.

INTACT / COOL

Relinquished by: (Signature)	Date:	Received by: (Signature)	Relinquished by: (Signature)	Date:	Received by: (Signature)
[signature]	8/17/93	[signature]	[signature]	8/17/93	[signature] 8/17/93
Company: EBASCO	Time: 3:30	Company: DEL MAR	Company: DELMAR	Time: 4:50	Company: DEL MAR Time: 4.50

F-2

Shipping Copy (White) File Copy (Yellow) Field Copy (Pink)

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EBASCO

An ENSERCH Engineering & Construction Company

3000 West MacArthur Boulevard • Santa Ana, California 92704-7998 • (714) 662-4000

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EBASCO
ENVIRONMENTAL

WORK PLAN FOR SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS AT THE H. KRAMER & COMPANY SITE EL SEGUNDO, CALIFORNIA

September 1992

A Division of Ebasco Services Incorporated
120 MONTGOMERY STREET • SUITE 715
SAN FRANCISCO, CA • 94104-4310
(415) 249-0831 • (415) 249-0931 FAX

EBASCO

September 25, 1992

URS Consultants
ATTN: Mr. Kurt Carlson
100 California St.
Suite 500
San Francisco, CA 94111

RE: H. KRAMER & COMPANY SITE (EL SEGUNDO, CA):
PUBLIC HEALTH RISK ASSESSMENT REPORT AND DRAFT WORK PLAN FOR SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS

Dear Mr. Carlson:

Per my discussion with Mr. William Potter (Chevron), and at the request of Mr. Jim Ross (RWQCB, Los Angeles Region), enclosed are the subject reports developed for the H. Kramer & Company site.

Should you have any questions, feel free to call me at 415/ 249-0831 (ex. 202).

Yours truly,

Susan Kamp
Senior Scientist

cc: W. Potter (Chevron Chemical Co.)
L. Sutton (Alschuler, Grossman & Pines)
G. Piehler (EBASCO)

SK:sdk 25sep01

WORK PLAN FOR SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS AT THE H. KRAMER & COMPANY SITE EL SEGUNDO, CALIFORNIA

Prepared by
EBASCO ENVIRONMENTAL
A Division of Ebasco Services Incorporated
San Francisco, California

September 1992

DRAFT WORK PLAN
H. KRAMER & COMPANY SITE, EL SEGUNDO, CALIFORNIA
SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS

CONTENTS

Page

1.0 INTRODUCTION AND STATEMENT OF PURPOSE 1

1.1 BACKGROUND 1

1.2 SUMMARY OF ANALYTICAL RESULTS 4

1.2.1 Soils 4

1.2.2 Groundwater 6

1.3 LOCAL AND REGIONAL GEOLOGY/HYDROLOGY 6

2.0 PROPOSED METHODS FOR SUPPLEMENTAL INVESTIGATION 10

2.1 METHODS CONSIDERED 10

2.2 DESCRIPTION OF PROGRAM CHOSEN 11

2.2.1 Drilling Activities 11

2.2.2 Drilling and Sampling Methods 11

2.2.3 Field Observations 11

2.2.4 Boring Abandonment 15

2.2.5 Equipment Decontamination 15

2.2.6 Data and Reports 15

2.3 WASTE HANDLING/DISPOSAL 15

3.0 HEALTH AND SAFETY 16

4.0 REFERENCES 16

DRAFT WORK PLAN
H. KRAMER & COMPANY SITE, EL SEGUNDO, CALIFORNIA
SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS

FIGURES

		Page
1	Site Location Map	2
2	Site and Sample Location Map	3
3	Generalized Regional Geographic Cross Section	8
4	Boring Locations	12
5	Boring Log Form	14

TABLES

1	Summary of Subsurface Soil Analytical Results	5
2	Summary of Groundwater Analytical Results	7

DRAFT WORK PLAN
H. KRAMER & COMPANY SITE, EL SEGUNDO, CALIFORNIA
SUPPLEMENTAL GEOLOGICAL INVESTIGATIONS

1.0 INTRODUCTION AND STATEMENT OF PURPOSE

In early 1992, a public health risk assessment was performed for the H. Kramer & Company (Kramer) site in El Segundo, California (Figure 1). The risk assessment focused on a slag pile from Kramer's former brass foundry operation; elements of site geology and chemistry were also addressed. The risk assessment was issued to the Los Angeles Regional Water Quality Control Board (LARWQCB) in May 1992 for review and comment.

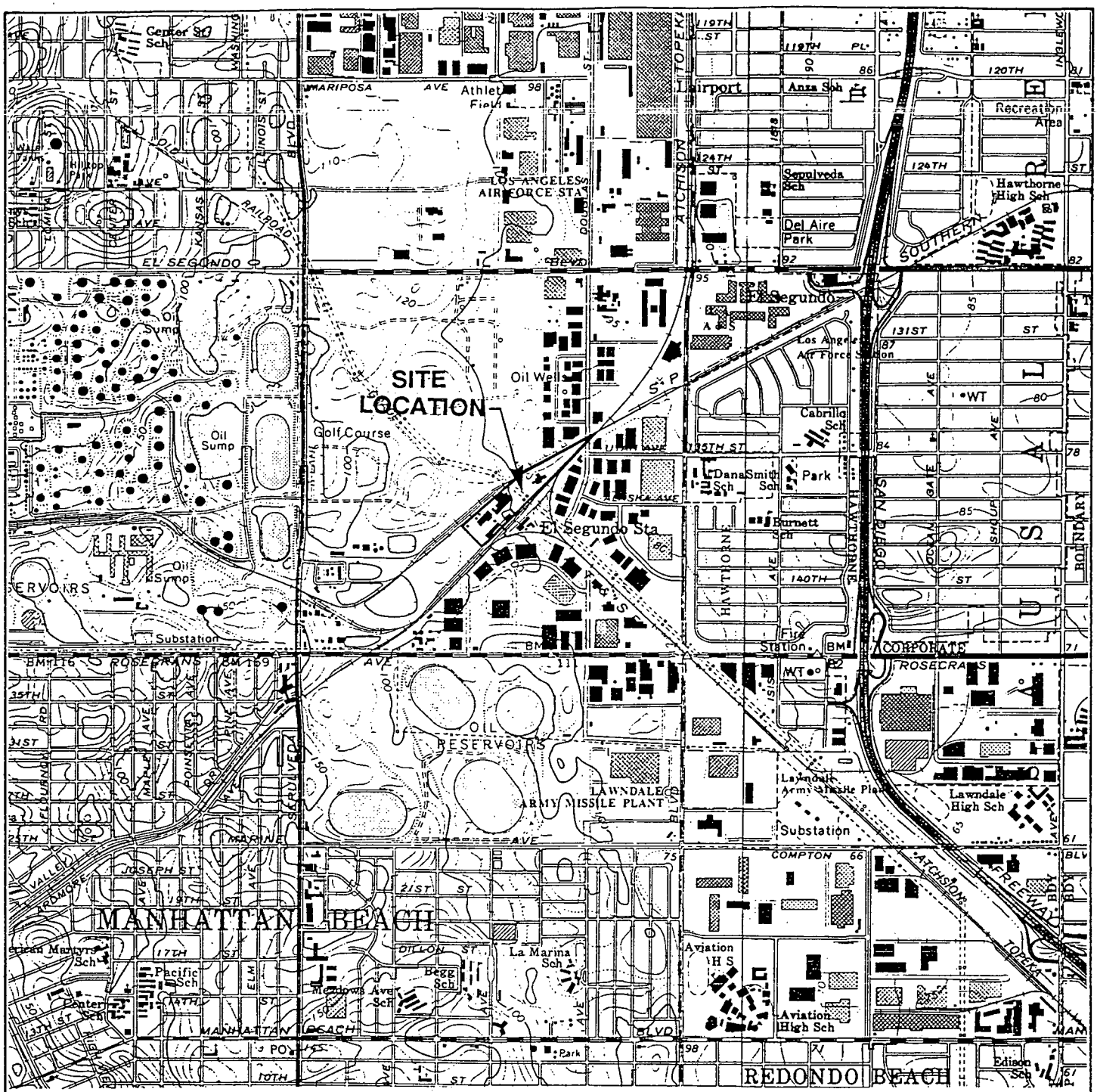
Subsequent to its review, the LARWQCB has requested that an investigation be performed to confirm the presence of a confining aquitard posited in the risk assessment to exist beneath the site. More specifically, the purpose of this investigation is to evaluate continuity of potential aquitards/aquicludes beneath the site which would prevent vertical migration through the Gage aquifer. Objectives of the study are to complete the preliminary picture of subsurface geology beneath the site; strengthen the risk assessment conclusions relative to hypothetical groundwater exposure pathways; and contribute toward slag pile remedial action planning which currently is focused on capping the pile to prevent human exposure to surface slags and prevent leaching of slag pile constituents to groundwater during rainfall.

1.1 BACKGROUND

Kramer operated a brass foundry at the subject site from 1951 through mid-1985. The layout of the site, showing present features, is shown in Figure 2. The slag pile, located in the northeast segment, is roughly 50 acre-feet in volume, with a maximum depth of approximately 20 feet (± 10' above grade). The slag pile occupies a former surface lagoon which was used by the previous owner and occupant of the site (Harshaw Chemical Company) in its manufacture of ammunition casings. Use of the site by Harshaw apparently resulted in deposition of arsenic-containing materials, on top of which slags containing other materials were deposited by Kramer.

The Kramer site has not been used since mid-1985, when the company ceased operations in California. Recently, however, construction of a high voltage transmission line and an extension of the LA light rail system across the northeast portion of the site was completed. Presence of these two features will further restrict opportunities for future site use.

In 1989, ENSR Corporation performed a characterization of the Kramer site, following a work plan (WP) which was approved by the U.S. Environmental Protection Agency (USEPA). A combination of hand and power augers was used to collect soil samples throughout the site, with emphasis on the slag pile; five new wells (i.e., MW 4-8) were constructed in borings which extended some 100 feet below ground



0 1/2 1

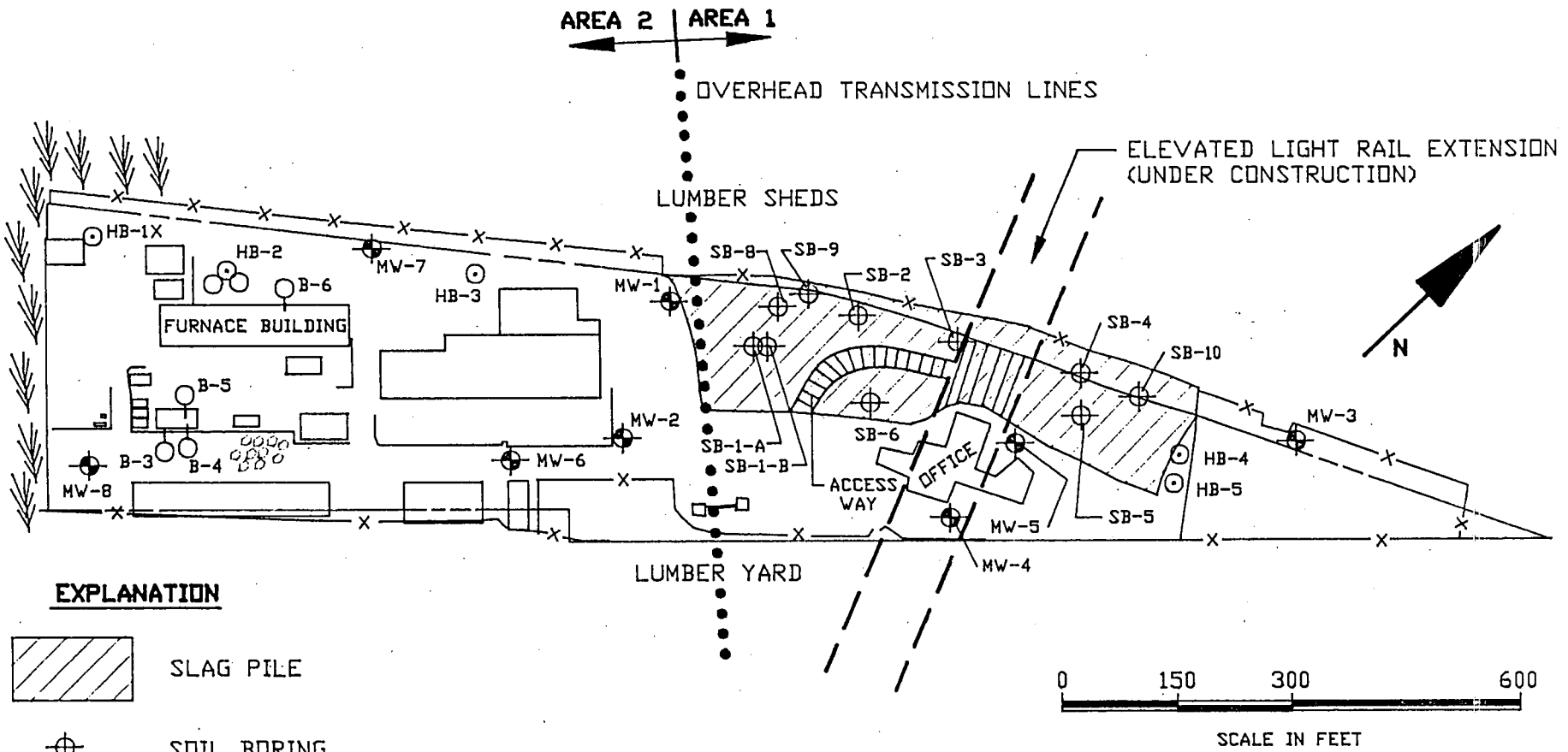
SCALE IN MILES

FIGURE 1

SITE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

Source: USGS, 7.5 Min. Topographic Map, Inglewood, CA - 1964, Revised 1981



EXPLANATION

SLAG PILE

SOIL BORING

SOIL BORING/MONITORING WELL

SLANT BORING (SHOWING DIRECTION OF SLANT)

HAND BORING

PHRAGMITES (vegetation)

55 GALLON DRUMS

TARP AND PLANK COVERED ACCESS WAY
(UNDERLAIN WITH IMPORTED FILL)

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

FIGURE 2

SITE AND SAMPLE LOCATION MAP
H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

EBASCO ENVIRONMENTAL

AK, 4-30-92

PLSC: 1.4=300, CHEV-3

surface (bgs); and slag pile, soil, and groundwater samples were taken and analyzed according to methods presented in the EPA-approved WP. All borings were logged by the field geologist.

A total of 50-61 soil samples (the exact number depending on analyte) was collected from 23 locations (including 9 borings in and through the slag pile). Soil samples were collected at five-foot intervals, starting at a depth of 3 to 5 feet and extending to depths of approximately 20-30 feet below the surface.

These samples were analyzed for total metals (the 17 CAM metals plus iron, aluminum, and manganese). Subsets of these samples were analyzed for volatile organic compounds (VOCs) and California Waste Extraction Test (WET) metals. ENSR utilized a decision tree, based on the Total Threshold Limits Concentration (TTLC) and the Soluble Threshold Limits Concentration (STLC), to select additional soil samples for analysis. VOCs were analyzed only for those soil samples with organic vapor readings exceeding 25 parts per million (ppm) using a Photo-ionization Detector (PID) organic vapor meter.

Groundwater samples from eight on-site monitoring wells were analyzed for VOCs and metals. The total and screening depths of wells 1 to 3, installed prior to ENSR's investigation, are not known. Wells MW 5, 6 and 8 were screened between 115 and 80 feet bgs; wells MW 4 and 7 were screened between 75 and 45 feet, and 95 and 65 feet, respectively.

1.2 SUMMARY OF ANALYTICAL RESULTS

1.2.1 Soils

Table 1 presents ranges and means of metals detected in the subsurface soil/slag samples. In lieu of site-specific background data, metal concentrations were compared with background levels reported in literature. These comparisons indicate that soil/slag concentrations of antimony, arsenic, beryllium, cadmium, copper, lead, manganese, mercury, nickel, selenium and zinc exceed national background levels. [Note: Site-specific background data were not available.] Sample locations in the slag pile, particularly SB-1A and SB-3, contained the highest concentrations of metals. In addition, the majority of the slag pile samples containing the maximum metal concentrations were collected five feet below the surface of the slag pile (this was the shallowest depth sampled). The only exception was the maximum concentration of arsenic, 2,800 mg/kg, detected in a slag pile sample collected at a depth of 20 feet, in soils at the slag/soil interface.

Based on results of the initial organic vapor screening, and using the sampling criteria described above, seven soil samples were analyzed for VOCs (three in the slag pile and four underlying pavement). As shown in Table 1, acetone was detected in 4/7 samples at concentrations ranging from 15 to 30 ug/kg (ppb). Methylene chloride was detected in 2/7 samples at the detection limit of 5 ug/kg. Results for acetone and methylene chloride are both considered suspect given possible cross-contamination reported

TABLE 1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	SUBSURFACE SOIL SAMPLE RESULTS Frequency	Mean	Minimum	Maximum	Location of Maximum	BACKGROUND LEVELS CITED IN LITERATURE Reported Range	Mean
METALS (mg/kg)							
Aluminum	49/50	4,276	690	18,000	SB1A-5'	--	--
Antimony	20/54	87.9	2.8	1,780	MW5-5'	0.05 - 4.0	--
Arsenic	61/61	185.7	0.6	2,800	SB3-20'	0.1 - 30	5.1
Barium	50/50	53.7	6.1	501	SB3-5'	20 - 1,500	400
Beryllium	39/50	12.5	0.06	230	SB1A-5'	3 - 200	40
Cadmium	30/50	1.48	0.05	29.5	SB3-5'	0.07 - 1.1	0.5
Chromium	50/50	9.39	1.5	74.60	SB4-10'	3 - 200	40
Chromium (VI)	1/50	1.21	1.21	1.21	SB2-5'	--	--
Cobalt	49/50	4.14	0.5	28	SB1A-5'	0.4 - 20	3.5
Copper	50/50	1,826	2.6	53,800	SB6-5'	1 - 70	14
Iron	50/50	8,252	1,800	31,000	SB1A-5'	--	--
Lead	43/50	242.1	1	2,500	SB1A-5'	10 - 70	17
Manganese	50/50	1,188	16.2	41,000	SB1A-5'	7 - 2,000	345
Mercury	37/50	0.19	0.02	5.80	MW5-5'	0.01 - 0.54	0.08
Molybdenum	34/50	4.45	0.1	33	SB1A-5'	0.05 - 2.0	--
Nickel	46/50	29.1	2.0	310	SB1A-5'	5 - 70	13
Selenium	22/52	10.6	0.09	300	MW5-5'	0.05 - 4.0	--
Silver	15/50	1.35	0.1	3.7	SB8-10'	0.1 - 5.0	--
Vanadium	50/50	9.42	2.3	27	SB1A-5'	7 - 150	47
Zinc	50/50	7,757	5.2	76,000	SB3-5'	15 - 164	40
VOLATILE ORGANIC COMPOUNDS (ug/kg)							
Acetone	4/7	14.0	15.0	30.0	SB4-30'	--	--
Methylene chloride	2/7	3.21	5.0	5.0	B4, MW-8	--	--
Toluene	3/7	4.86	6.0	12.0	B4-X-10	--	--

: Indicates constituents selected as Chemicals of Potential Concern (COPC) used in the risk assessment.

by the laboratory. Toluene was detected in 3/7 samples at concentrations ranging from 6 ug/kg (in 30' and 70' samples) to 12 ug/kg (10' sample).

1.2.2 Groundwater

Table 2 summarizes ENSR's groundwater sampling results. Metals detected in these groundwater samples included: antimony (ND-0.84 mg/l); arsenic (ND-140 mg/l); barium (ND-0.49 mg/l); trivalent chromium (ND-0.21 mg/l); hexavalent chromium (ND-0.23 mg/l); manganese (ND-3.3 mg/l); nickel (ND-0.07 mg/l); selenium (ND-0.19 mg/l) and zinc (ND-0.11 mg/l).

VOCs detected in site groundwater samples included carbon tetrachloride (ND-43.0 ug/l); 1,1-dichloroethane (ND-19 ug/l); ethylbenzene (ND-39 ug/l); tetrachloroethane or PCE (ND-200 ug/l); toluene (ND-270 ug/l); 1,1,1-trichloroethane (ND-12 ug/l); trichloroethane or TCE (18-370 ug/L); trichlorofluoromethane (ND-73 ug/l); and xylenes (ND-300 ug/l).

1.3 LOCAL AND REGIONAL GEOLOGY/HYDROGEOLOGY

Figure 3, adapted from a 1987 report by Radian Corporation, illustrates the general stratigraphy of the area of concern. Past drilling work in this area shows that the stratigraphy includes the uppermost Old Dune Sand Aquifer; the Manhattan Beach Formation (synonymous with and hereafter referred to as the "Bellflower Aquiclude"); the Gage Aquifer; the El Segundo Aquitard; and the Silverado Aquifer.

The Kramer site is located on the eastern fringe of the El Segundo Sand Hills (see Figure 3). These hills are comprised of a narrow strip of active wind-blown dunes along the coast, and older more stabilized sand dunes inland. The Kramer site is situated within the area of stabilized sand dunes. The 7.5 Minute Quadrangle (Venice, CA., 1981) shows the topography for the area and indicates that the site is situated in a relatively flatter, low-lying area. Surface elevation for the site is approximately 100 feet above mean sea level (MSL), and topography generally slopes gently to the east-southeast. Overall, the original surface topography has been greatly modified by human activity.

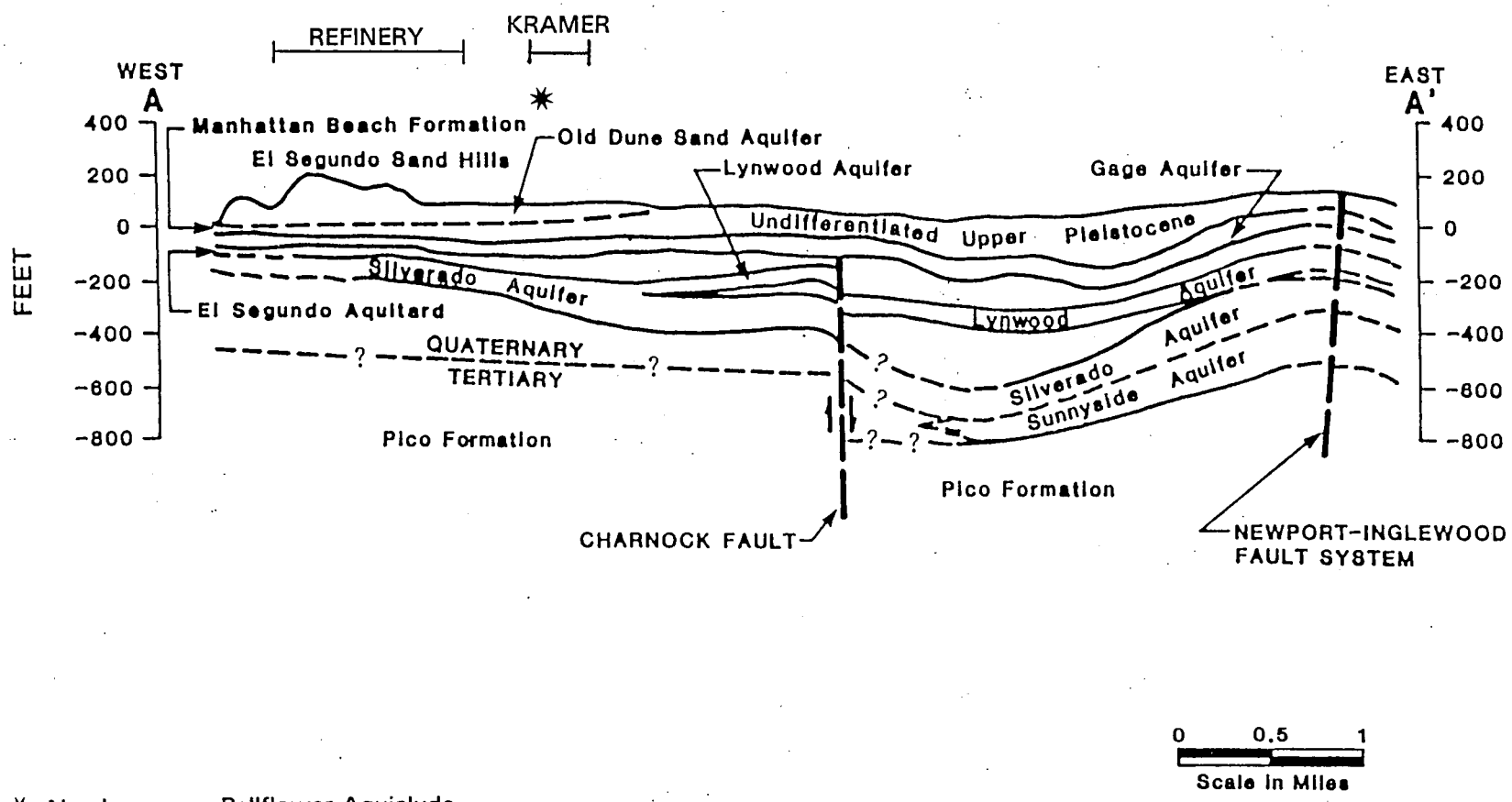
The lower section of the El Segundo Sand Hills is comprised of wind-blown materials late Pleistocene in age. These collectively comprise the Old Dune Sand Aquifer. Lithologically, the formation is composed of unconsolidated yellow to light brown, well sorted, fine to medium grained sand with discontinuous lenses of silt, clay, coarse sand and gravel (Radian, 1986). Internally, the Old Dune Sand Aquifer has been divided into three sections: a deeply weathered surface, an intermediate horizon of clean sands and gravels, and a lower transition zone of fine sand and silts that lie conformably upon the Bellflower Aquiclude (CDWR, 1961). Based on ENSR's boring logs from Kramer and from others within the area (Chevron, Hughes), it is difficult to distinguish these various sections within the old Dune Sand Aquifer and its exact juxtaposition to the Bellflower.

TABLE 2
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
H. KRAMER AND COMPANY SITE

PARAMETER (units)	MONITORING WELL LOCATION MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	Range of Sample QLs	Drinking Water Guidelines Value	Source
Screen Depth (bgs):	--	--	--	(45-75')	(80-110')	(85-115')	(65-95')	(80-110')			
Screen Elevation (amsl):	--	--	--	(17.2 - 47.2')	(-17.2 - 12.8')	(-16.8 - 13.2')	(12.9 - 42.9')	(-7.6-22.4')			
METALS (mg/l)											
Antimony	<0.1	<0.1	0.84	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	----	
Arsenic	3.2	12	9.8	0.005	140	25	0.011	<0.005	0.005 - 50	0.05 mg/l	EPA/CA MCL
Barium	<0.02	<0.02	0.07	0.49	0.03	0.03	0.04	0.03	0.02	1.0 mg/l	CA MCL
Chromium III	<0.02	0.21	<0.02	0.1	<0.02	0.23	<0.02	0.02	0.02	0.05 mg/l	CA MCL
Chromium VI	<0.05	0.17	<0.05	0.09	<0.05	0.23	NA	<0.05	0.05 - 0.1	----	
Manganese	0.06	3.3	<0.02	<0.02	0.08	1.9	0.5	0.42	0.02	0.05 mg/l	CA MCL
Nickel	0.02	0.06	<0.02	<0.02	0.03	0.07	<0.02	0.06	0.02	----	
Selenium	0.02	0.24	0.19	<0.01	0.02	0.03	<0.01	0.01	0.01- 0.03	0.01 mg/l	CA MCL
Zinc	<0.05	0.04	0.03	<0.02	0.02	0.11	<0.02	0.04	0.02	5.0 mg/l	CA MCL
VOLATILE ORGANIC COMPOUNDS (ug/l)											
Carbon Tetrachloride	<5	<5	<5	<5	<5	43	NA	<5	5	0.5 ug/l	CA MCL
1,1-Dichloroethene	19	<5	<5	<5	<5	8	NA	5	5	6.0 ug/l	CA MCL
Ethylbenzene	<5	<5	<5	6	39	<5	NA	<5	5	680 ug/l	CA MCL
Tetrachloroethene (PCE)	200	16	160	<5	<5	<5	NA	25	5	5 ug/l	EPA/CA MCL
Toluene	<5	18	6	39	270	<5	NA	<5	5	100 ug/l	CA Action Level (AL)
1,1,1-Trichloroethane	12	<5	<5	<5	<5	10	NA	<5	5	200 ug/l	CA MCL
Trichloroethene (TCE)	370	40	120	190	18	110	NA	88	5	5 ug/l	EPA/CA MCL
Trichlorofluoromethane (Freon-11)	<5	<5	<5	<5	<5	73	NA	<5	5	150 ug/l	CA MCL
Xylenes	<5	<5	<5	40	300	<5	NA	<5	5	1750 ug/l	CA MCL

: Shaded chemicals were selected as Chemicals of Potential Concern (COPC). Shaded values indicate sample in which drinking water guidelines were exceeded for a given parameter.

NA: Not Analyzed
QL: Quantitation Limit
---: No data/criteria available.



✷ Also known as Bellflower Aquiclude

Source: Hydrogeological Assessment Report - Radian Corporation, 1987.

FIGURE 3
GENERALIZED REGIONAL GEOLOGIC CROSS SECTION

The Bellflower Aquiclude is an assemblage of very fine sand, silt, and clay. Locally, the color of the aquiclude is gray to dark-gray, to blue. Presence of the Bellflower Aquiclude beneath the Kramer site has been confirmed in several of ENSR's borings. Specifically, borings for MW-4 and MW-5 near the slag pile revealed a clay layer at least five feet thick at a depth of approximately seventy-four (74) feet below ground surface. The MW-8 boring log revealed presence of the aquiclude (at least 1.5 feet thick) at depths of 90-91 feet bgs. The exact thickness of the aquiclude under the site, and/or the fact that it was not reported in logs for MW-6 and MW-7, may be a function of the interval between samples in those borings (i.e., 10 feet in some cases; potentially eclipsing the Bellflower Aquiclude).

About one thousand (1000) feet northwest of the Kramer site, on the Hughes Aircraft Company property, borings clearly indicate presence of the Bellflower within a zone 40 feet thick, lying between mean sea level and 65 feet of the ground surface (i.e., 60-100 feet bgs). The Bellflower has been found to be as thick as 15 feet on the eastern side of the Chevron refinery (about 90-100 feet bgs), and, as reported by Radian, appears to dip shallowly to the west, varying in thickness before merging with the El Segundo Aquitard about 2,300 feet west of the refinery.

Immediately below the Bellflower Aquiclude is the Gage Aquifer. The Gage Aquifer consists mainly of medium to coarse grained yellow-brown sand with localized layers of clay. Although the thickness of the Gage Aquifer is not known underneath the Kramer site, it is thought to have a vertical thickness between forty (40) and sixty (60) feet (CDWR, 1961).

The Gage Aquifer is separated from the El Segundo Aquitard by an erosional unconformity, represented as being the contact between the Upper and Lower Pleistocene sediments. The El Segundo Aquitard represents the uppermost unit of the San Pedro Formation, separating the Gage Aquifer from the Silverado Aquifer. The El Segundo Aquitard is comprised of a blue-gray, dense, silty clay. Borings at the Kramer site and in the east-central portions of the Chevron refinery have apparently not gone deep enough to encounter the El Segundo Aquitard, but borings for wells constructed at the Hughes Aircraft Company depict the aquitard as being approximately seventy (70) feet below sea level (Hargis & Associates, 1990).

The Silverado Aquifer consists of fine to coarse grained sand and gravel with pebble lenses. Locally, beds of silt and clay up to ten (10) feet thick may be present. These fine-grained deposits are generally described as gray, silty (highly plastic) clay and as brown silt and/or gray silt. According to Radian (1986), the elevation of the Silverado Aquifer ranges from sixty-five (65) feet below mean sea level at the center of the Chevron refinery to twenty-three (23) feet blow mean sea level to the north of the refinery. The variation in elevation is most likely due to local erosional influences and results. The depth of the Silverado Aquifer increases substantially with distance inland.

Groundwater was encountered in onsite wells between depths of seventy (70) to ninety (90) feet bgs, or sixteen (16) to twenty-two (22) feet above mean sea level. At present, it is believed that this is the water

table for the Old Dune Sand Aquifer, but water levels within monitoring wells MW-5 and MW-6 may possibly be representative of the Gage Aquifer.

The direction of groundwater flow underneath the Kramer site was reported by ENSR (1990) to flow south, southwest, or southeast, depending on location within the property. This apparent flow direction may, however, have been an anomaly, influenced by the presence of groundwater injection wells located one-half mile west of the facility along Sepulveda Boulevard. Fresh water is presently being injected into the Gage and Silverado Aquifers through these wells be the County of Los Angeles to curtail saltwater intrusion into these aquifers. Historically, these wells were leaking at higher elevations (i.e. Old Dune Sand Aquifer) causing a reversal in the groundwater gradient east of the injection wells. The leaks have been reported to have been corrected by the County of Los Angeles, and it is suspected that the groundwater gradient will mimic the groundwater gradient at the Chevron refinery where groundwater has been shown to flow to the west.

2.0 PROPOSED METHODS FOR SUPPLEMENTAL INVESTIGATION

To resolve uncertainties about the lateral continuity of the Bellflower Aquiclude underlying the Kramer site, the LARWQCB has requested that a supplemental subsurface investigation be performed. This section discusses investigative methods that have been considered and selected. Further described are data, logs, and reports to be generated, and a plan for handling and disposing waste generated be the investigation.

2.1 METHODS CONSIDERED

Two methods were considered to meet the study objectives: surface geophysics and subsurface soil boring logging. Surface geophysics has been demonstrated elsewhere to achieve the objectives in a cost-effective and non-intrusive manner. These geophysical methods include ground penetrating radar (GPR); seismic reflection or refraction; and Time Domain Electro-Magnetic (TDEM) techniques. GPR and seismic refraction were quickly dismissed by Ebasco on the basis of depth of potential penetration and/or resolution given site characteristics.

Based on review of reports and preliminary plot plans, however, seismic reflection and TDEM were judged to have success probabilities of 10-20 and 40-50 percent, respectively. Further discussion with geological experts concerning the amount of "noise" and spatial-constraints characterizing the site suggested that even these methods might not offer high resolution of clay aquicludes such as the Bellflower Aquiclude. Therefore, Ebasco performed a site reconnaissance and obtained photographic documentation of transmission lines, railroad tracks, chain link fences, light rail structures, and other buildings and appurtenances for review by geophysical experts. Their conclusion based on these observations was that TDEM would not work, and seismic reflection had a 10-20 percent chance of delimiting geological strata beneath the site (perhaps only in Area 2, as defined in Figure 2). Based on

this conclusion, with the exception of using simple surface magnetometry to ensure buried line clearance, the only alternative is to perform subsurface boring and borehole logging to delineate the subsurface stratigraphy.

2.2 DESCRIPTION OF PROGRAM CHOSEN

2.2.1 Drilling Activities

To establish the lateral continuity and the vertical thickness of the Bellflower Aquiclude beneath the Kramer site, Ebasco proposes to drill seven (7) borings at those locations shown in Figure 4. All borings have been selected to establish whether the aquiclude exists within the central and western regions of the property. Borings around the periphery of the slag pile will be used to further assess the lateral extension and integrity of the Bellflower Aquiclude.

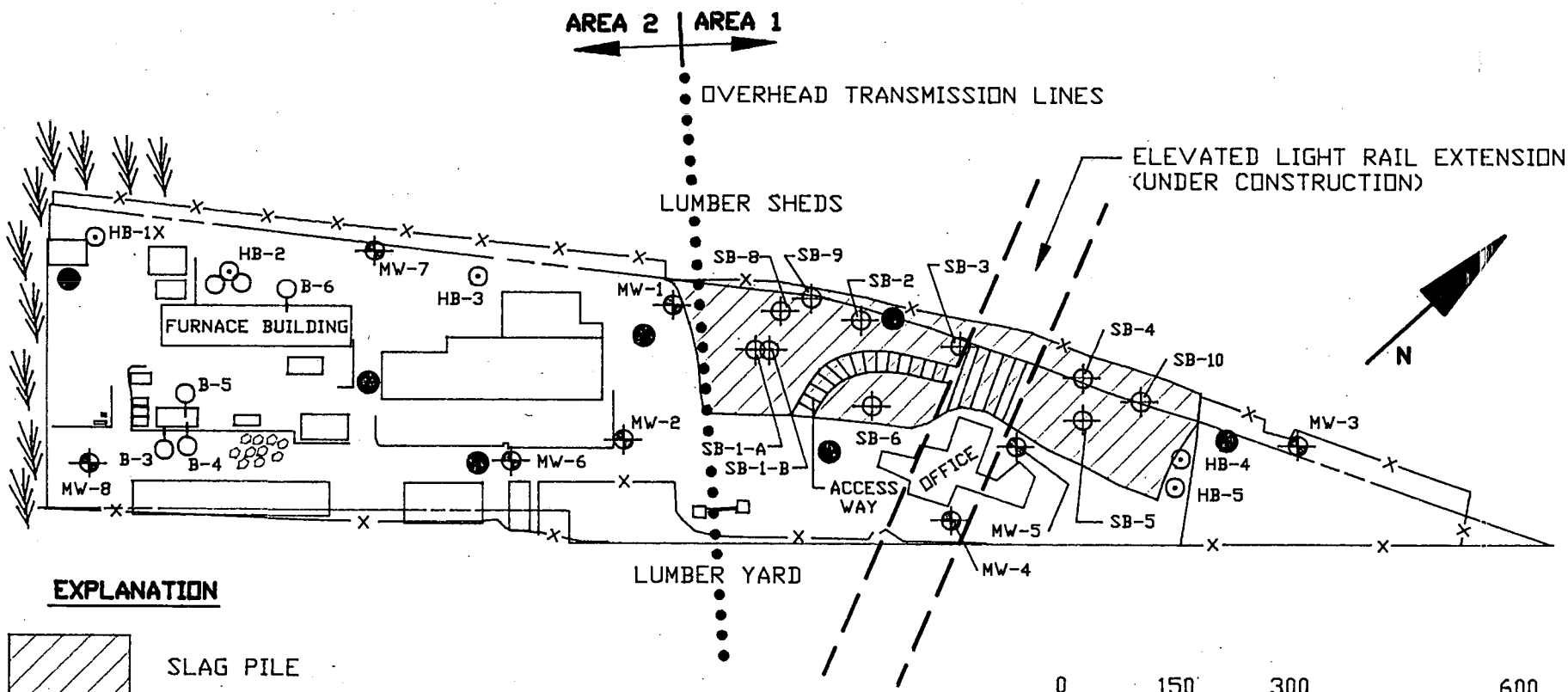
2.2.2 Drilling and Sampling Methods

A truck-mounted drilling rig with 4- to 8-inch O.D. hollow-stem auger will be used to drill the soil borings. Soil samples will be collected in 6-inch long and 1.5-inch to 2.5-inch diameter stainless steel or brass sleeves at those depths specified below. Three sample tubes will be placed in an 18-inch long split-spoon sampler and driven into the soil using a 140-pound hammer dropped 30 inches. The uppermost of these sample sleeves will be used for lithologic observations and for field screening using an organic vapor analyzer. The remaining two (2) sleeves will be used for lithologic interpretation and possible archiving.

It is expected that the Bellflower Aquiclude should be encountered between roughly twenty (20) to ten (10) feet above msl. Therefore, sampling intervals will be more closely spaced in that region than they will be in the upper strata (top 70 feet). Soil samples will be collected at ten (10) foot intervals through the Old Dune Sand Aquifer. At approximately twenty (20) feet above msl, undisturbed soil samples will be collected at five (5)-foot intervals. Zones between sampling intervals will be continuously cored and logged using a five (5)-foot unlined core barrel. Sampling and coring will continue using this process until either the presence and thickness of the Bellflower Aquiclude has been confirmed; another deeper layer of competant clay is defined; and/or refusal of the auger.

2.2.3 Field Observations

A permanently bound log book will be maintained by the filed sampling team to provide a daily record of significant events, observations, and measurements taken during field investigations. It will include persons present on site during work hours, phone numbers of key personnel, descriptions of deviations from this Work Plan, and a sample register. All log book entries will be dated, legible, and contain accurate and inclusive documentation of field activities.



EXPLANATION

SLAG PILE

SOIL BORING

SOIL BORING/MONITORING WELL

SLANT BORING (SHOWING DIRECTION OF SLANT)

HAND BORING

PHRAGMITES (vegetation)

55 GALLON DRUMS

TARP AND PLANK COVERED ACCESS WAY (UNDERLAIN WITH IMPORTED FILL)

APPROXIMATE LOCATIONS OF NEW (proposed) BORINGS

SOURCE:
JENNINGS ENGINEERING COMPANY, A.L.T.A. SURVEY, SEPTEMBER 13, 1984
ENSR, DWG NO. FIGURE 4-1, PROJECT NO. 9500-089

FIGURE 4

SITE AND SAMPLE LOCATION MAP
WITH NEW (PROPOSED) BORINGS

H. KRAMER & COMPANY FACILITY
EL SEGUNDO, CALIFORNIA

AK, 9-15-92

PLSC: 1.4=300, CHEV-5

All observations and measurements made while a boring is being drilled and sampled will be noted on a Field Boring Log Form (Figure 5). Observations and measurements which may be placed on the Boring Log Form include:

- Physical characteristics of the soil (e.g., grain size distribution, angularity, and composition)
- Stratigraphic boundaries
- Presence of any inferred or visible contaminants
- Soil color
- Soil moisture content
- Thickness or individual units
- Samples taken
- Odor
- Organic vapor analyzer readings
- Blow counts per distance penetrated during sampling with the Split Spoon sampler

Soil sample descriptions will be based on the Unified Soil Classification system. Any other pertinent information will be noted on the Soil Boring Log Forms. Each soil boring log will be reviewed by the California Registered Geologist and used to characterize the surface soil profile of the site.

Organic vapor measurements will be made using a portable flame ionization detector (FID) or a photo-ionization detector (PID). These measurements will be made on one of the sample tubes collected at each sampling location, on drilling cuttings, and at the mouth of the boring. Field measurements of organic vapors in the soil samples will be made after the sample has been placed in a glass jar, or self sealing plastic bag, and allowed to sit for a short period of time. The end of the FID or PID will then be slipped under the lid of the jar or in a corner of the plastic bag (so the vapors which have accumulated do not escape) and the reading recorded.

OFS No.	BORING LOG	SHEET _____ of _____

PROJECT NAME: _____
LOCATION: _____
CLIENT NAME: _____
SITE MANAGER: _____
LOGGED BY: _____

BORING NUMBER: _____
DRILLING CONTRACTOR: _____
DRILLING METHOD: _____
BIT SIZE: _____

DATE STARTED: _____
DATE COMPLETED: _____
TOTAL DEPTH: _____
WATER DEPTH: _____

DEPTH (Feet)	GRAPHIC LOG											SAMPLE DATA					DESCRIPTION
			Boulders	Cobbles	Pebbles	Gravel	Crs. Sand	Med. Sand	Fine Sand	Silt	Clay	OVA (ppm)	% LEL	Moisture	Odor	USCS Symbols	EXAMPLE: SEDIMENT TYPE, COLOR, HARDNESS, GRAIN SIZE, GRAIN SHAPE, SORTING, CEMENTATION, STRUCTURE; ACCESSORIES.

FIELD BORING LOG

EBASCO ENVIRONMENTAL
A Division of EBASCO SERVICES INCORPORATED

FIGURE 5
Sample Soil Boring Log

2.2.4 Boring Abandonment

All soil borings will be backfilled with Volclay grout. The upper 1 foot of each boring will then be filled with ready mix concrete or asphalt patch in areas where it is required to restore the site to its original condition. This will form an impermeable seal which will prevent the boring from serving as a conduit to the subsurface for potentially contaminated surface waters.

2.2.5 Equipment Decontamination

Equipment and material directly involved in drilling and soil sampling will be decontaminated prior to use. Decontamination of heavy equipment used in drilling, such as augers, will include brushing to remove solids, and steam cleaning. Soil sampling equipment will be decontaminated as follows:

- Brush off any solids from split spoons and other equipment
- Wash in trisodium phosphate detergent and distilled water solution
- Rinse in distilled water
- Rinse a second time in distilled water
- Air dry
- Wrap or cover until used

An adequate amount of equipment and material will be decontaminated for the day's work at the beginning of the day so that drilling and sampling activities are not interrupted. All wastes produced during decontamination activities will be captured and stored appropriately for proper disposal at the completion of the project. (See Section 2.3)

2.2.6 Data and Reports

The geologic information developed during the drilling and borehole logging activities in addition to the existing information will be assembled into a report for the LARWQCB. The data collected in the field will be assembled into boring logs to enable Ebasco geologists to construct isopach maps of the Bellflower Aquiclude and Old Dune Sand Aquifer and geologic cross-sections of the site. These new data will be merged with both existing site information and information from nearby sites to develop this multi-dimensional picture of the subsurface. The isopach maps and cross-sections will be included in a written report, reviewed by a registered geologist, that satisfies the study objectives.

2.3 WASTE HANDLING AND DISPOSAL

All soil cutting waste generated during drilling and sampling will be initially screened in the field first by visual inspection and by portable instruments prior to deciding on its final disposition. Soil which does not appear to be visually contaminated will be placed on plastic on the ground and covered with

additional plastic. Material that appears to be visually contaminated will be placed in 55-gallon steel drums and covered pending laboratory test results. During the decontamination process, all fluids and solids generated will be stored in 55-gallon drums pending laboratory test results. Final disposition of all solids and fluids generated during drilling will be consistent with all applicable laws and regulations in California.

3.0 HEALTH AND SAFETY

Prior to the initiation of this study, Ebasco will prepare a detailed Health & Safety Plan (HASP) which will govern conduct of the drilling and protection of site personnel and the public. The HASP will be approved by a Certified Industrial Hygienist (CIH) and implemented by a trained Health & Safety Officer (HSO). The level of personal protection is anticipated to be a modified C (i.e., Tyvek, boots, gloves), with respirators on hand if needed. All Ebasco personnel and drillers will be certified to have had medical clearance and completion of the 40-hour H&S course and refreshers, as required under OSHA 1910.120.

4.0 REFERENCES

1) California Department of Water Resources (CDWR), Planned Utilization of the Groundwater Basins of the Coastal Plain of Los Angeles County, Appendix A, Ground Water Geology, Bulletin No. 104, June 1961.

2) Radian Corporation, Report on Remedial Investigation, Chevron El Segundo Refinery, Category A Site Assessment, Radian Corporation, El Segundo, California, September 4, 1986.

3) Hargis and Associates, Results of Subsurface Soil Investigation, Hughes Aircraft Company, Electro-Optical Data Systems Group, El Segundo, California (1990).