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TRANSMITTAL

Date: November 30, 2000
Project: 2002-0945-01

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ENVIRONMENTAL PROTECTION

To:
Ms. Susan Hugo
Alameda County Health Care Service Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Re: International Brands Corporation, Oakland, CA

Item	Description
1	Human Health Risk Analysis To Support A Risk-Based Corrective Action and Site Closure regarding Interstate Brands Corporation, 945 53rd Street, Oakland, California

Comments:

If you have any questions or concerns regarding the attached document, please contact me at (530) 676-6000.

Sincerely,

Jay R. Johnson, R.G.
Project Manager

cc: Larry Brown, Interstate Brands Corporation
Travis Bryant, Interstate Brands Corporation

HUMAN HEALTH RISK ANALYSIS TO SUPPORT A RISK-BASED CORRECTIVE ACTION AND SITE CLOSURE

INTERSTATE BRANDS CORPORATION
945 53rd STREET
OAKLAND, CALIFORNIA

Prepared for
INTERSTATE BRANDS CORPORATION

December 01, 2000

Prepared by
STRATUS ENVIRONMENTAL, INC.
3330 Cameron Park Drive, Suite 550
Cameron Park, California 95682

Project 2002-0945-01

Human Health Risk Analysis
To Support a Risk-Based Corrective Action And Site Closure

Interstate Brands Corporation
945 53rd Street
Oakland, California

The data and information presented in this report were prepared under the supervision of the undersigned.

Stratus Environmental, Inc.

for Michael S. Blankinship
Senior Toxicologist

Jay R. Johnson, R.G.
Principal Geologist

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Executive Summary

Stratus Environmental, Inc. (Stratus) performed a human health risk analysis that estimated site-specific target levels (SSTLs) for chemicals of concern in groundwater that can remain in place on the site without posing a potential adverse impact to human health. Calculations assumed that the current commercial land use is also the most-likely future land use. At this time, no chemicals of concern in groundwater pose a potential for adverse impacts to human health. Therefore, we request no further action and closure for this site.

1. BACKGROUND

Several documents describe assessment work performed on the site (EMCON, 1998; URS Greiner, 1999). A brief summary of this work is presented below and a site plan is presented in Figure 1.

In December 1992, one 10,000 gallon fiberglass gasoline tank, one 8,000 gallon diesel fuel tank; which was used as standby fuel for the building, one 5,000 gallon diesel fuel tank, and one 200 gallon waste-oil tank were removed from the site. After the underground storage tank (UST) removal, the excavation was filled with gravel.

During UST removal activities, there was no indication of a leak near the 8,000 gallon diesel UST, which was in an excavation by itself. There was visual staining and a petroleum odor observed in the other UST excavation, which formerly contained the other three tanks. Holes were observed in the waste oil tank; there were no holes observed in any of the other tanks.

In 1994, three groundwater monitoring wells (MW-1, MW-2 and MW-3) were installed on site. Boring logs for the monitoring wells are included in Appendix A. During installation of these borings, silt, silty clay and clayey silt, and sands were encountered.

From 1994 through 1995, quarterly groundwater monitoring was performed. From 1996 through 1998, semi-annual groundwater sampling was performed. One groundwater monitoring event occurred in March 1999 and no monitoring has occurred since that time. The groundwater flow direction is generally toward the southwest with a hydraulic gradient of approximately 0.05 feet/feet (ft/ft). Approximate depths to groundwater range between 9 and 13 feet below ground surface (bgs).

Groundwater samples collected after September 1998 have not exhibited floating product in any of the monitoring wells. Total petroleum hydrocarbons (TPH) and xylenes have been sporadically detected in MW-2 and MW-3 through March 1998. Since March 1998, neither TPH nor xylenes have been detected in MW-2 or MW-3. Since sampling began in 1994, no benzene, toluene, or ethyl benzene have ever been detected in MW-2 and MW-3.

Compared to MW-1 and MW-2, TPH constituents have been more consistently detected in MW-1. Since 1996, and when correlated to depth to groundwater and season, the concentrations of both TPH and benzene, toluene, ethyl benzene and xylenes (BTEX) in MW-1 have decreased with time.

Two upgradient borings (A and B) were drilled at the site upgradient of the former UST excavation area as shown on Figure 1. These borings were drilled to assess the upgradient soil and groundwater conditions. Boring A encountered clayey gravelly sand from the surface to a depth of about 12 feet where a one foot layer of greenish gravelly clayey sand was encountered. Silty sand extended from about 16 feet to 24 feet, where clayey sand with gravel was encountered. Boring B encountered a similar gravelly clayey sand to the total depth of 31 feet. Both borings were filled with cement/bentonite grout after completion of sampling.

Neither boring encountered TPH or BTEX in soil. Neither TPH nor BTEX was detected in groundwater collected from Boring B. Only trace concentrations of TPH-gasoline (TPHG), toluene, and xylenes were detected in groundwater collected from Boring A.

A summary of data from the analysis of soil and groundwater from borings A and B and from the three monitoring wells is presented in Table 1 and Appendix A.

2. INTRODUCTION AND OBJECTIVE

A letter from Susan Hugo of the Alameda County Health Care Services Agency (ACHCSA) dated October 28, 1999 indicated that the site may be considered a low risk soil and groundwater case and that a Risk-based Corrective Action (RBCA) for the site should be conducted. The letter further states that the use of American Society for Testing and Materials (ASTM) Standard Guide for RBCA Applied at Petroleum Release Sites (E1739-95) is acceptable.

In lieu of using the Risk-Based Screening Level (RBSL) Look-Up Table X2.1 in ASTM E1939-95, but consistent with Section 6.8.1 of the same ASTM document, the human health risk analysis described herein uses a Tier 2 RBCA approach. This Tier II approach is described in both ASTM E1939-95 and ASTM PS-104, Standard Provisional Guide for RBCA (ASTM, 1998).

Site-specific assessment data and reasonably likely future land use information were used. Tier II RBCA calculations were done using the RBCA Tool Kit for Chemical Releases (GSI, 1999). This analysis tool was used to estimate SSTLs for chemicals of concern (COC) using techniques consistent with ASTM E1939-95 and ASTM PS-104 and with current U.S. Environmental Protection Agency (USEPA, 1996, 1989) and California Environmental Protection Agency (CalEPA, 1994) guidelines.

Consistent with the mid-point of USEPA's established risk range as described in the National Contingency Plan (NCP), SSTLs for carcinogens were derived using an acceptable excess cancer risk value of $1x10^{-5}$. A hazard index (HI) of 1 was used to calculate SSTLs for non-carcinogens.

The objective of this human health risk analysis was to estimate concentrations of COCs that can remain on the site without likely posing adverse health effects to human health given the current and future land uses evaluated.

3. IDENTIFICATION OF CHEMICALS OF CONCERN

Summary tables from previous work (EMCON, 1998) describing chemicals detected on the site are presented in Appendix B. Review of data in these tables was accomplished to determine potential COC.

Evaluate TPH using fractionation in MADEP

TPH has been sporadically detected in MW-2, and MW-3 and more consistently detected in MW-1. TPH is a complex mix of both long and short chain aliphatic hydrocarbons, and branched and unbranched aromatic hydrocarbons. Identification and quantification of TPH, while useful in assessing impact to the site, is not necessarily useful in assessing the level of risk, since the composition of TPH can vary significantly, and TPH is generally considered to have low toxicity. Further, no toxicity criteria have been established for TPH. To assess the risk associated with TPH, constituents of TPH were selected and identified as COC. These COC are BTEX constituents.

BTEX was selected as the COC because it is generally both more mobile and more toxic than other TPH constituents. The selection of BTEX as the COC is consistent with several risk assessment guidance documents (USEPA, 1989; ASTM, 1995). Further, CalEPA (CalEPA, 1994) and ASTM (ASTM, 1995) provide guidance for conducting risk assessment for petroleum hydrocarbons. Specifically, BTEX is considered the most mobile and toxic of gasoline constituents and therefore their consideration provides an upper-bound, conservative representation of petroleum hydrocarbons and their additives. Of the compounds that comprise BTEX, benzene is generally the most mobile of the four, and is the only carcinogen. Therefore, benzene has the lowest SSTL value of the COCs considered in this analysis.

Model inputs for COCs is presented in Appendix B, pages B-1 through B-2.1.

4. TOXICITY ASSESSMENT

The probability of developing cancer is the measure used for quantitating the toxicity of carcinogens. These probabilities identify the likelihood of a carcinogenic response in an individual that receives a given dose of a particular chemical based on mathematical modeling of the animal or human data plus safety factors. These probabilities are expressed in terms of the chemical-specific slope factor (SF) or Unit Risk Factor (URF). The SF and the URF represent the probability of a carcinogenic response per unit dose and is usually expressed as 1/milligram/kilogram-day (mg/kg-day) for SF and 1/milligram per meter cubed (mg/m^3) for URF. The SF or the URF multiplied by the predicted chemical dose provides an estimate of the incremental upperbound cancer risk. Benzene is the only COC that is classified by the USEPA as a carcinogen.

Quantitation of non-cancer toxicity is accomplished with the use of the Reference Dose (RfD) or the Reference Concentration (RfC). The RfD and the RfC are derived from the No Observable Adverse Effect Level (NOAEL) and the application of an uncertainty factor (UF). The UF considers the various types of data used to estimate RfDs and RfCs along with a modifying factor (MF). The MF is based on professional judgments regarding scientific uncertainties not covered under the standard UF, such as the completeness of the overall database and the number of animals in the study.

The RfD and the RfC are very conservative estimates of daily exposure to the human population that is unlikely to have appreciable risk or adverse effects. Doses less than the RfD or RfC are not likely to be associated with any health risks, even to sensitive individuals (USEPA, 1989).

A summary of select chemical, physical, and cancer and non-cancer toxicological characteristics of COCs is presented in Table 2.

The use of the toxicity data summarized in Table 2 combined with site-specific exposure data presented below and in Appendix B allow for the estimation of SSTLs.

Model input for Toxicity data in presented in Appendix B, pages B-2.1 and B-3.

5. EXPOSURE ASSESSMENT

Benzene, because it has a relatively high vapor pressure and Henry's Law constant, can volatilize from the liquid phase into the gas phase and is subsequently able to migrate through the subsurface by a combination of molecular diffusion and advective dispersion. The rate and degree of benzene migration is determined in part by the physical and chemical properties of the subsurface. The transport of benzene is most effective in unconsolidated, gravelly or sandy soils that provide a relatively uninhibited migration pathway. In fine-grained soils, which may have high porosity, but a low degree of permeability because the pores are not connected, volatile transport may be slower.

Because benzene contamination on the site is overlain by predominantly clayey silt, vapor migration is anticipated to occur, but only to a limited extent. Vapor migration is further limited by the presence of asphalt on the site. Although vapor migration may occur through the soil profile, further migration through the asphalt is considered unlikely.

During the most recent groundwater sampling event in March 1999, benzene was detected in groundwater in MW-1 at a concentration of 58 micrograms per liter (ug/L). Benzene has never been detected in any other well. Benzene in groundwater may result in volatilization of benzene into both outdoor and indoor air. Inhalation of this air by current and future on-site commercial workers constitutes the only complete exposure pathway evaluated in this analysis. Refer to Figure 2.

As groundwater on the site is not used currently or reasonably anticipated for irrigation use or consumptive purposes, it is not part of a complete ingestion or dermal contact exposure pathway. Refer to Figure 2.

To determine the dose or amount of a COC a commercial land use occupant may be exposed to, the Johnson-Ettinger volatilization model was used. This model estimates vapor concentrations resulting from soils beneath the surface, and did not account for the presence of the asphalt on the site. USEPA Reasonable Maximum Exposure (RME) values were then used to estimate dose.

The COCs and TPH are subject to continual biotic processes that result in varying rates and degrees of degradation (Lawrence Livermore National Laboratory, 1995). Although the extent to which they are occurring is unclear, these degradative processes are occurring on the site. As a result, both TPH and BTEX concentrations will attenuate over time. This is significant because long-term (i.e., chronic) risk estimations made herein use the conservative assumption that no BTEX degradation occurs over time.

The source of contamination on the site has been removed and the most recent analysis of ground water on the site was almost 2 years ago. Review of historic groundwater analytical data (refer to Appendix A and Table 1) demonstrate that attenuation of both BTEX and TPH is occurring.

Although not defined in the past 2 years, it is highly anticipated that COC attenuation in groundwater has and will continue to occur. Thus, actual COC concentrations are very likely significantly less than the values reported in March 1999.

Site geology appears variable in nature with a combination of silt, silty clay, and clayey silt, and sands. In general, silty clay and clayey silt predominate in the subsurface above the water table. Of these two, clayey silt exhibits a greater tendency to allow for vapors to migrate through it as evidenced by its greater vapor permeability relative to silty clay. To be conservative, clayey silt was selected as one of the subsurface conditions that were evaluated.

The other subsurface condition considered was the gravel-filled former UST excavation. This gravel material is expected to be more porous and permeable, and consequently more able to allow for the migration of vapors than compared to clayey silt. To evaluate this gravel backfill, sand with 0% organic content was selected as the predominant subsurface material.

Model input for Exposure estimations are presented in Appendix B, pages B-3 through B-9.

6. RISK CHARACTERIZATION

The SSTL for the one carcinogenic COC, benzene, was derived using an acceptable excess cancer risk value of 1×10^{-5}. An HI of 1 was used to calculate SSTLs for the remaining non-carcinogenic COCs.

A summary of the physical properties of clayey silt, sand and their corresponding SSTLs are presented in Table 3. The lowest SSTL values for benzene under a clayey silt or sand scenario are presented as ***bold italic.*** These bold italic values are the concentrations that, if not exceeded, do not create the potential for an adverse health affect.

The last detected benzene concentration in March 1999 was less than the bold italic SSTL values in Table 3. In addition, the last detected concentrations of all COCs are below their respective SSTLs. This indicates that no adverse health effects will result from COCs in groundwater during commercial land use or construction worker activity.

7. CONCLUSIONS AND RECOMMENDATIONS

A site-specific, risk-based derivation of clean-up goals (i.e., SSTLs) was estimated using information from site assessment data, current and anticipated commercial land use, and toxicological data. Several conservative assumptions were used in the estimation of SSTLs. These assumptions most likely result in an over-estimation of the likelihood of the potential of adverse health effects.

The presence of COCs in groundwater do not pose a potential for adverse health effects to commercial site workers. Data presented in this report indicated that the site meets the ACHCSA's definition of a "low risk soil and groundwater case". Consequently, we request closure and no further action. Please forward all documentation to that effect to Interstate Brands Corporation.

8. LIMITATIONS

This analysis did not include the estimation of risk under a residential land use scenario. If future site use includes residential land use, then an estimation of exposure and subsequent risk under this scenario will be required. Further, if additional subsurface site assessment data becomes available, risk estimations should be re-evaluated.

This work was performed in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances at the same time the services are performed. No warranty, express or implied, is made. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

9. REFERENCES

American Society for Testing and Materials, 1995. Standard Guide for Risk-based Corrective Action Applied at Petroleum Release Sites, ASTM-E1739-95, Philadelphia, PA

California Environmental Protection Agency (CalEPA), 1994. Preliminary Endangerment Assessment Manual, January 1994.

EMCON, 1998. Quarterly Groundwater Monitoring Report, Third Quarter 1998 dated December 17, 1998.

Groundwater Services, Inc., 1999. RBCA Tool Kit for Chemical Releases, Groundwater Services, Inc., Houston, TX.

Lawrence Livermore National Laboratory, Environmental Protection Department, Environmental Restoration Division, 1995. Recommendations to Improve the Cleanup Process for California's Leaking Underground Fuel Tanks (LUFTs), October 16, 1995. Submitted to the California State Water Resource Control Board and the Senate Bill 1764 LUST Advisory Committee. UCRL-AR-121762.

URS Greiner Woodward Clyde, 1999. Soil and Groundwater Sampling and Semi-annual Groundwater Monitoring Report, 1st Quarter 1999. Report dated April 20, 1999.

USEPA, 1996. Technical Background Document for Soil Screening Guidance, Review Draft, EPA/540/R-94/106.

USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A, EPA/600/3-89/013.

Table 1. Supplement to EMCON Groundwater Monitoring and Soil Analytical Data

IBC Oakland, CA

Well	Matrix Type	Sample Date	TPH Diesel ug/L	TPH Gas ug/L	Benzene ug/L	Toluene ug/L	Ethyl Benzene ug/L	Xylenes ug/L	MTBE ug/L
MW1	Water	3/23/99	<50	9800	58	130	810	2900	<250
MW2	Water	3/23/99	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5
MW3	Water	3/23/99	<50	<50	<0.5	<0.5	<0.5	<0.5	<0.5
Boring A	Water	3/9/99	<50	74	<0.5	1	<0.5	0.98	<0.5
Boring B	Water	3/9/99	<50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boring A	Soil	3/9/99	<1	<1	<0.005	<0.005	<0.005	<0.005	<0.005
Boring B	Soil	3/9/99	<1	<1	<0.005	<0.005	<0.005	<0.005	<0.005

Notes:
Source: URS/Greiner Woodward Clyde Report dated April 20, 1999
Samples collected from Borings A and B at a depth of approximately 12 feet bgs.
Soil values in mg/Kg.

Table 2. Summary of Select Chemical, Physical, and Toxicological Characteristics for BTEX and MTBE

IBC Oakland, CA

	Chemical/Physical Constants						Diffusion Coefficients	
Chemical	Solubility (mg/L)	Vap. Pres. (mm Hg)	Soil 1/2 Live (days)	Log Koc (L/Kg)	Henry's (unitless)	BCF (L/Kg)	Air (cm^2/s)	Water (cm^2/s)
Benzene	2.E+03	1.E+02	7.E+02	2.E+00	2.E-01	1.E+01	9.E-02	1.E-05
Toluene	5.E+02	3.E+01	3.E+01	2.E+00	3.E-01	7.E+01	9.E-02	9.E-06
Ethylbenzene	2.E+02	1.E+01	2.E+02	3.E+00	3.E-01	1.E+00	8.E-02	8.E-06
Xylene (mixed isomers)	2.E+02	7.E+00	4.E+02	2.E+00	3.E-01	1.E+00	7.E-02	9.E-06
Methyl t-Butyl ether	5.E+04	2.E+02	2.E+02	1.E+00	2.E-02	1.E+00	8.E-02	9.E-05

	Cancer Data				Non-Cancer Data			Other Data	
		Cancer Slope Factors		Unit Risk Factor	Reference Doses & Concentrations				
Chemical	Carcinogen ? Wgt. Of Evid.	Oral 1/(mg/Kg-d)[1]	Dermal 1/(mg/Kg-d)[1]	Inhalation 1/(ug/m^3)[1]	Oral RfD (mg/Kg-d)	Dermal RfD (mg/Kg-d)	Inhal. RfC (mg/m^3)	MCL (mg/L)	TWA (mg/m^3)
Benzene	Y, A	1.E-01	1.E-01	2.90E-05	3.E-03	-	6.E-03	1.0E+00	3.3E+00
Toluene	N, D	-	-	-	2.E-01	2.E-01	4.E-01	1.0E+00	1.5E+02
Ethylbenzene	N, D	-	-	-	1.E-01	1.E-01	1.E+00	7.0E-01	4.4E+02
Xylene (mixed isomers)	N, D	-	-	-	2.E+00	2.E+00	7.E+00	1.0E+01	4.3E+02
Methyl t-Butyl ether	N, -	-	-	-	1.E-02	8.E-03	3.E+00	1.3E+01	6.0E+01

Notes:

(1) California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database. www.oehha.ca.gopv/risk/ChemicalDB.

Table 3. Soil Physical Property and Site Specific Target Level (SSTL) Summary

RBCA Tier 2 Analysis
IBC Oakland, CA

Clayey Silt

***Clayey Silt** Physical Properties*

Physical Property	Vadose Zone	Capillary Zone
Total porosity (unitless)	0.36	
Volumetric water content (unitless)	0.24	0.324
Volumetric air content (unitless)	0.12	0.036
Dry bulk density (Kg/L)	1.7	
Vertical hydraulic conductivity (ft/day)	2.8E-2	
Vapor permeability (ft^2)	1.1E-14	
Capillary zone thickness (ft)	8.9E-1	

Note: Values from Appendix B, Page B-7.

***Clayey Silt** Groundwater SSTLs (mg/L)*

PATHWAY	Groundwater Volatilization to Indoor Air	Groundwater Volatilization to Outdoor Air
LOCATION (Distance from Source, ft.)	0	
LAND USE	Commercial	Commercial
CHEMICAL		
Benzene	***8.9E-1***	1.7E+2
Toluene	3.6E+2	>5.2E+2
Ethylbenzene	>1.7E+2	>1.7E+2
Xylene (mixed isomers)	>2.0E+2	>2.0E+2
Methyl t-Butyl ether	7.9E+3	>4.8E+4

Sand

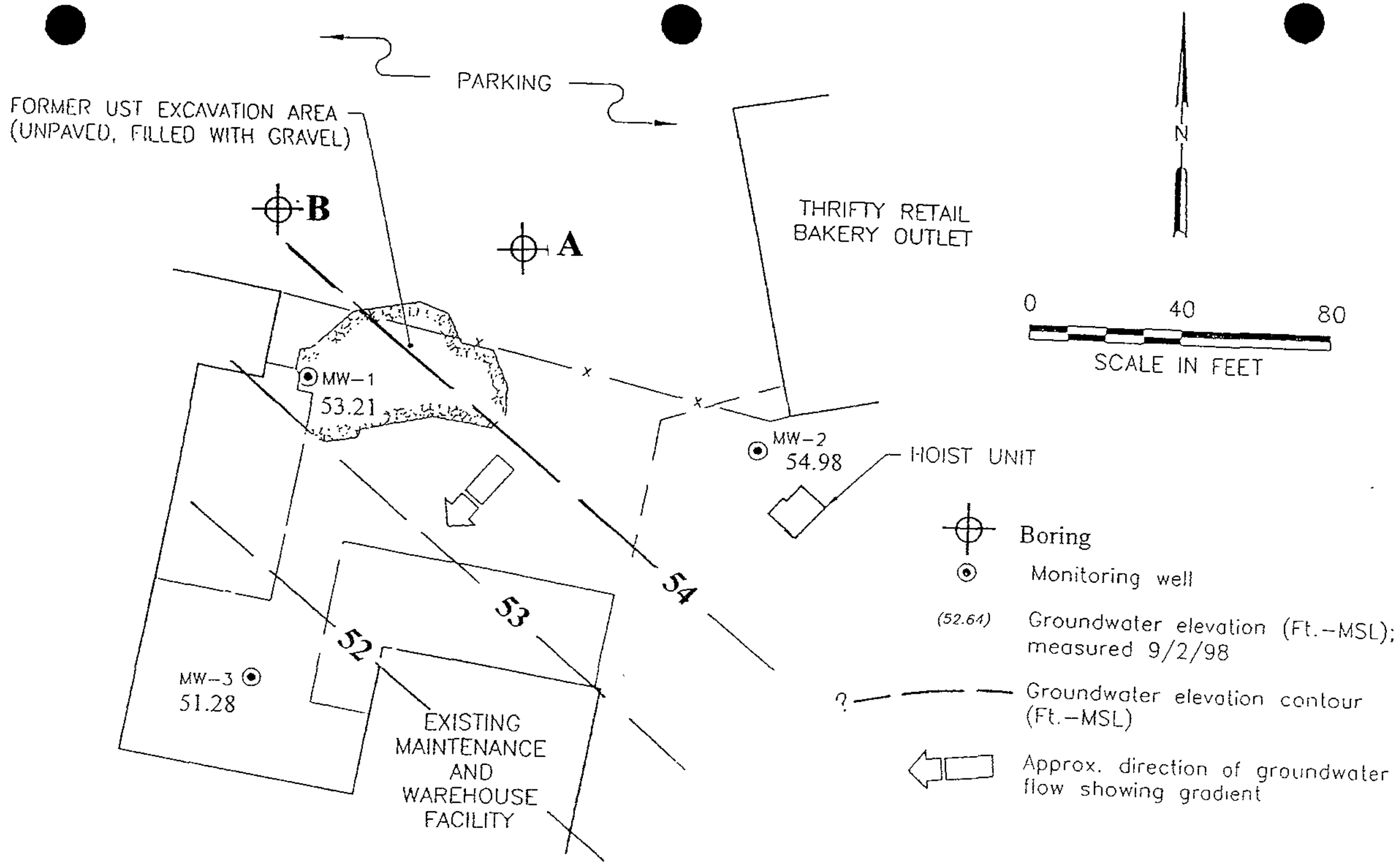
***Sand** Physical Properties*

Physical Property	Vadose Zone	Capillary Zone
Total porosity (unitless)	0.41	
Volumetric water content (unitless)	0.08	0.369
Volumetric air content (unitless)	0.33	0.041
Dry bulk density (Kg/L)	1.7	
Vertical hydraulic conductivity (ft/day)	2.8E+1	
Vapor permeability (ft^2)	1.1E-11	
Capillary zone thickness (ft)	1.6E-1	

Note: Values from Appendix B, Page B-7. 0% Organic Carbon value used.

***Sand** Groundwater SSTLs (mg/L)*

PATHWAY	Groundwater Volatilization to Indoor Air	Groundwater Volatilization to Outdoor Air
LOCATION (Distance from Source, ft.)	0	
LAND USE	Commercial	Commercial
CHEMICAL		
Benzene	***1.9E-1***	2.2E+1
Toluene	7.8E+1	>5.2E+2
Ethylbenzene	>1.7E+2	>1.7E+2
Xylene (mixed isomers)	>2.0E+2	>2.0E+2
Methyl t-Butyl ether	3.5E+3	>4.8E+4

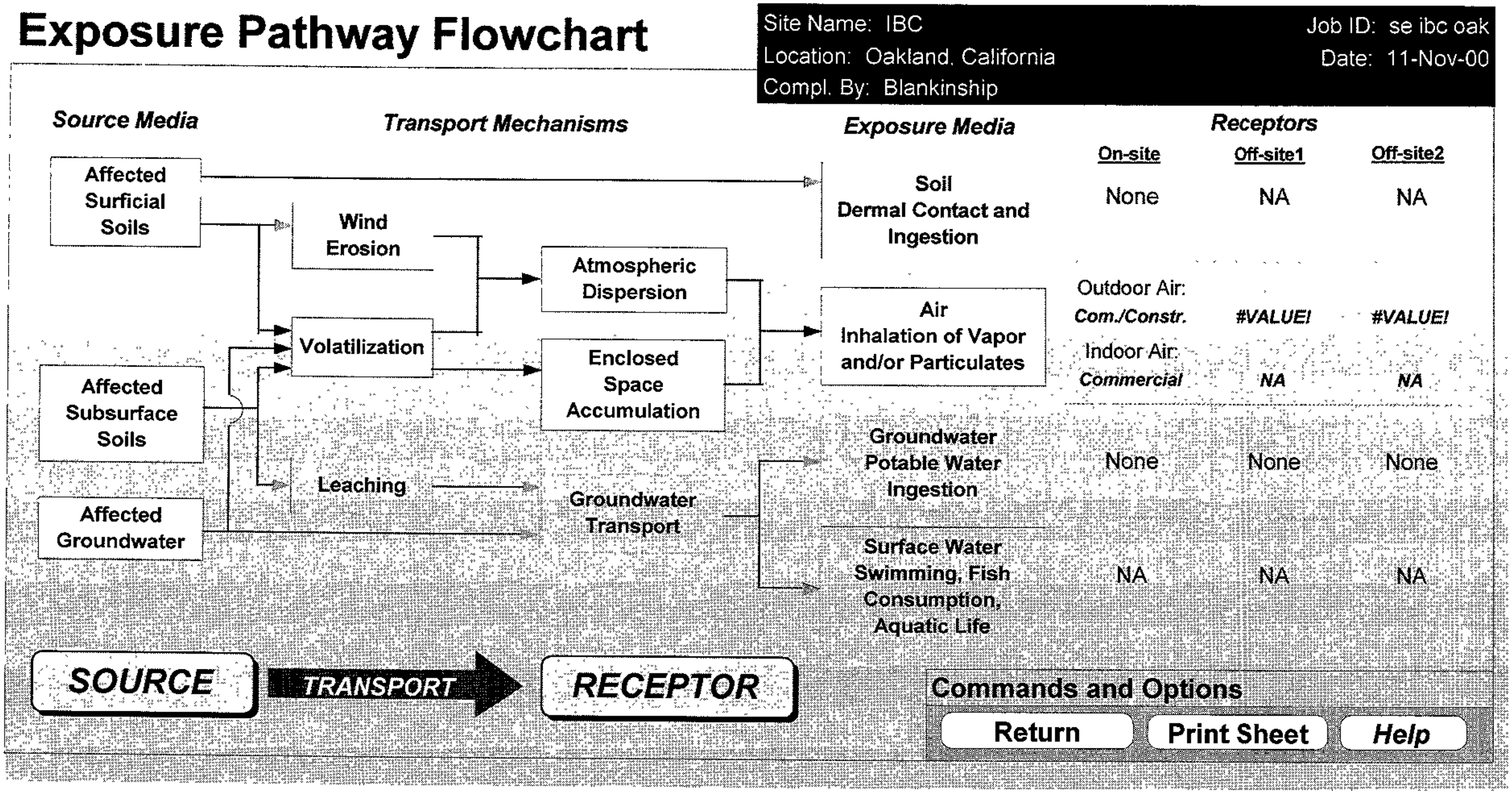


Project No. 41-07099010.00	IBC 945 53rd Street, Oakland California	GROUNDWATER ELEVATION CONTOURS	Figure 1
URS GREINER WOODWARD-CLYDE			

(Source: URS/Greiner Woodward Clyde Report dated April 20, 1999)

Figure 2. Site Conceptual Model/Exposure Pathway Flowchart

IBC Oakland, CA



APPENDIX A

Table 1 from EMCON Report dated December 17, 1998

and

Boring Logs for MW-1, MW-2, and MW-3
(Source: Woodward Clyde, May 1994)

Table 1

Groundwater Monitoring Data
Interstate Brands Corporation
1010 46th Street
Oakland, California

Well	Date	Top of Casing Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet MSL*)	TPH Diesel (µg/L)	TPH Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total Oil & Grease (mg/L)	MTBE (µg/L)
MW-1	05/26/94	61.84	9.27	52.57	1,300	12,000	57	340	370	3,100	<5.0	NA
MW-1	07/29/94	61.84	9.81	52.03	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	08/26/94	61.84	9.87	51.97	510/650 [1]	6,700/8,400	22/35	71/97	310/410	1,000/1,400	<5.0/<5.0	NA
MW-1	10/04/94	61.84	9.89	51.95	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	10/27/94	61.84	9.94	51.90	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	11/30/94	61.84	8.92	52.92	1,300	29,000	480	1,100	1,200	5,300	<5.0	NA
MW-1	01/03/95	61.84	8.79	53.05	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	01/31/95	61.84	8.33	53.51	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	03/16/95	61.84	8.07	53.77	1,900	29,000	140	1,400	1,800	9,700	<5.0	NA
MW-1	06/12/95	61.84	9.02	52.82	810/540 [1]	3,900/11,000	23/280	57/610	200/400	680/2,000	<5.0/<5.0	NA
MW-1	08/30/95	61.84	9.44	52.40	350 [1]	3,300	26	36	250	490	<5.0	NA
MW-1	11/29/95	61.84	9.93	51.91	270	1,700	20	21	110	210	<5.0	NA
MW-1	03/06/96	61.84	8.37	53.47	2,500/2,400 [1]	39,000/38,000	690/1,000	1,800/2,000	2,300/2,300	14,000/15,000	5.9	NA
MW-1	07/08/96	61.84	9.10	52.74	670/580 [1]	3,000/2,600	89/9.5	79/85	140/120	350/270	NA	NA
MW-1	04/04/97	61.84	9.14	52.70	1,400	3,500	13	27	190	410	NA	<30 [5]
MW-1	09/23/97	61.84	9.15	52.69	260	2,100	13	11	200	220	NA	<5
MW-1	03/30/98	61.84	8.73	53.11		----------Well inaccessible for sampling----------						
MW-1	09/02/98	61.84	9.20	52.64	280	1,400	7	7	90	120	NA	<12
MW-2	05/26/94	63.10	9.30	53.80	<50/<50	<50/<50	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<5.0	NA
MW-2	07/29/94	63.10	9.70	53.40	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	08/26/94	63.10	9.89	53.21	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	10/04/94	63.10	9.86	53.24	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	10/27/94	63.10	9.96	53.14	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	11/30/94	63.10	8.95	54.15	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	01/03/95	63.10	8.15	54.95	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	01/31/95	63.10	6.96*	56.14	NA	NA	NA	NA	NA	NA	NA	NA
MW-2	03/16/95	63.10	6.37*	56.73	<50/<50	<50/<50	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<5.0	NA
MW-2	06/12/95	63.10	9.07	54.03	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	08/30/95	63.10	9.53	53.57	52 [3]	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	11/29/95	63.10	9.74	53.36	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	03/06/96	63.10	7.23	55.87	68 [4]	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-2	07/08/96	63.10	8.84	54.26	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-2	04/04/97	63.10	8.70	54.40	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<3

Table

Groundwater Monitoring Data
Interstate Brands Corporation
1010 46th Street
Oakland, California

Well	Date	Top of Casing Elevation (feet)	Depth to Water (feet)	Groundwater Elevation (feet MSL*)	TPH Diesel (µg/L)	TPH Gasoline (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Total Oil & Grease (mg/L)	MTBE (µg/L)
MW-2	09/23/97	63.10	9.18	53.92	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<5
MW-2	03/30/98	63.10	7.14	55.96	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<5
MW-2	09/02/98	63.10	9.37	53.73	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<3
MW-3	05/26/94	62.51	12.88	49.63	99	<50	<0.5	<0.5	<0.5	1.7	<5.0	NA
MW-3	07/29/94	62.51	13.61	48.90	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	08/26/94	62.51	13.71	48.80	66 [2]	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-3	10/04/94	62.51	13.74	48.77	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	10/27/94	62.51	13.77	48.74	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	11/30/94	62.51	11.85	50.66	78/85	100/100	<0.5/1.9	<0.5/<0.5	<0.5/1.0	2.1/4.3	<5.0	NA
MW-3	01/03/95	62.51	12.09	50.42	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	01/31/95	62.51	10.64	51.87	NA	NA	NA	NA	NA	NA	NA	NA
MW-3	03/16/95	62.51	10.79	51.72	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-3	06/12/95	62.51	12.05	50.46	120 [2]	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-3	08/30/95	62.51	13.54	48.97	88/57 [3]	<50/<50	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<0.5/<0.5	<5.0/<5.0	NA
MW-3	11/29/95	62.51	13.72	48.79	<50	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-3	03/06/96	62.51	10.78	51.73	140 [3]	<50	<0.5	<0.5	<0.5	<0.5	<5.0	NA
MW-3	07/08/96	62.51	13.39	49.12	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	NA
MW-3	04/04/97	62.51	13.23	49.28	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<3
MW-3	09/23/97	62.51	13.35	49.16	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<5
MW-3	03/30/98	62.51	12.16	50.35	75	<50	<0.5	<0.5	<0.5	0.64	NA	<5
MW-3	09/02/98	62.51	13.19	49.32	<50	<50	<0.5	<0.5	<0.5	<0.5	NA	<3

Project: CBC - Oakland
Project Location: Oakland, California
Project Number: 92CB040

Log of Boring MW-1

Sheet 1 of 1

Date(s) Drilled: 5/16/94	Total Depth Drilled (feet): 21.5	Top of Casing Elevation (feet): 61.84 MSL	Groundwater Level (feet)	First: 11	Completion:	24 Hours: 9.27
Logged by: L. Autle'	Checked by:	Diameter of Hole (inches): 7 1/8	Diameter of Well (inches): 4	Number of Samples	Disturbed: 0	Undisturbed: 5
Drilling Company: Kvilhaug Drilling		Drilling Method: Hollow Stem Auger		Drill Rig Type: B-53		
Sampler Type: Mod. CA - Split Spoon		Drill Bit Size/Type:		Type of Well Casing: 4-inch PVC Schedule 40		
Screen Perforation: 0.020" Slot (5' - 20')			Type of Sand Pack: #2/12 Sand (4' - 20')			
Type of Seals: Bentonite (3'- 4')			Grout (0'- 3')			
Comments: Located in former tank area next to bldg.						

Depth, feet	Elevation, feet	SAMPLES Type	Number	Blows/foot	USCS Classification	Graphic Log	MATERIAL DESCRIPTION	Well Completion Log	OVA (ppm)	REMARKS
0					FILL		SILT (FILL MATERIAL) Dark brown, damp, soft			
	60									
							Gravels to 1" in diameter			
5				6 9 15						Rock in Shoe No Recovery
	55			5 9 10	ML		CLAYEY SILT Blue green mottled, slightly moist to moist, some coarse sand		110	50% Recovery
							more sand, slightly moist			
10				3 11 15					870	
	50									
15				4 4 5	SM-ML		SANDY CLAYEY SILT Light yellow brown, coarse to very coarse sand, 6" at top, grades to more silty		>1000	
	45									
20				3 4 5						
	40									

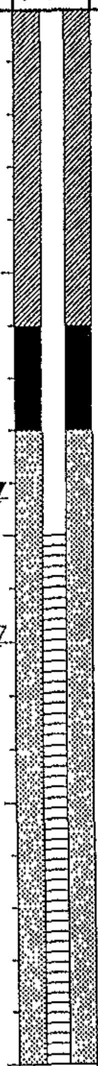
Woodward-Clyde Consultants

Project: CBC - Oakland	Log of Boring MW-2
Project Location: Oakland, California	Sheet 1 of 1
Project Number: 92CB040	

Date(s) Drilled: 5/11/94	Total Depth Drilled (feet): 21.5	Top of Casing Elevation (feet): 63.10 MSL	Groundwater Level (feet)	First: 12	Completion: — ; 24 Hours: 9.30
Logged by: L. Autie'	Checked by:	Diameter of Hole (inches): 7 1/8	Diameter of Well (inches): 4	Number of Samples	Disturbed: 0 ; Undisturbed: 6
Drilling Company: Kvilhaug Drilling		Drilling Method: Hollow Stem Auger		Drill Rig Type: B-53	
Sampler Type: Mod. CA - Split Spoon		Drill Bit Size/Type:		Type of Well Casing: 4-inch PVC Schedule 40	
Screen Perforation: 0.020" Slot (10' - 20')			Type of Sand Pack: #2/12 Sand (8' - 20')		
Type of Seals: Bentonite (6' - 8')			Grout (0' - 6')		
Comments: Located upgradient from the former tank form					

Depth, feet	Elevation, feet	Samples: Type	Number	Blows/foot	USCS Classification	MATERIAL DESCRIPTION	OVA (ppm)	REMARKS
0					ML	SILTY CLAY / CLAYEY SILT Brown		
	60							
5				4 7 10	ML	CLAYEY SILT Mottled tan and yellow, slightly moist, moderately dense, some coarse to fine sand	2	50% Recovery
	55							Final Water Before Developement 5/12/94
10				3 6 12			~2	
				3 4 5		grades to moist	2	
	50							
15				2 3 5			1	
						very wet		
	45							
20				3 4 5				

Well Completion Log:



Woodward-Clyde Consultants

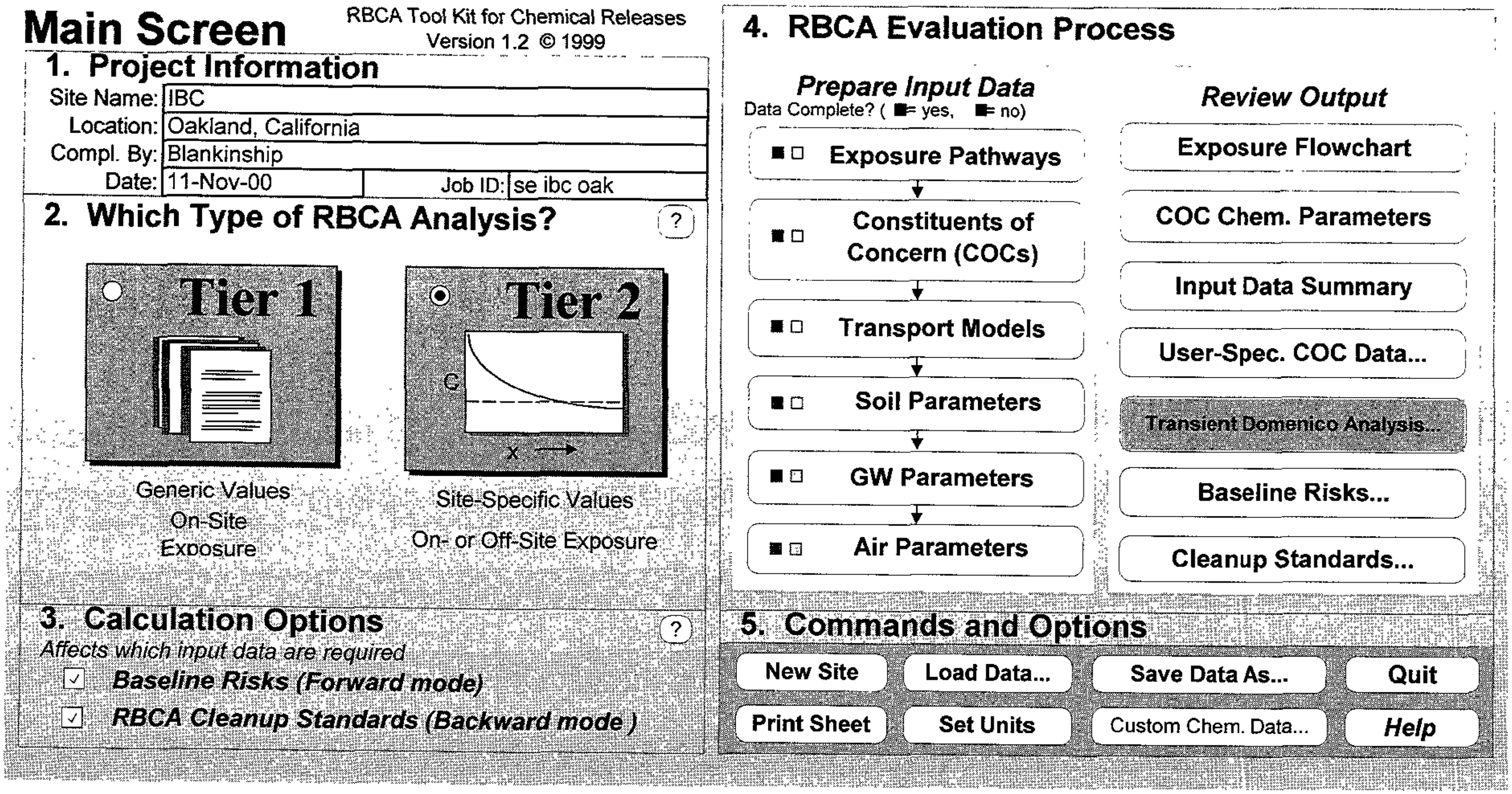
Project: CBC - Oakland	Log of Boring MW-3
Project Location: Oakland, California	
Project Number: 92CB040	Sheet 1 of 1

Date(s) Drilled: 5/11/94	Total Depth Drilled (feet): 22.0	Top of Casing Elevation (feet): 62.51 MSL	Groundwater Level (feet)	First 13.5	Completion / 24 Hours 12.88
Logged by: L. Autle'	Checked by:	Diameter of Hole (inches): 7 1/8	Diameter of Well (inches): 4	Number of Samples: Disturbed 0	Undisturbed 5
Drilling Company: Kvilhaug Drilling		Drilling Method: Hollow Stem Auger		Drill Rig Type: B-53	
Sampler Type: Mod. CA - Split Spoon		Drill Bit Size/Type:		Type of Well Casing: 4-inch PVC Schedule 40	
Screen Perforation: 0.020" Slot (10' - 20')			Type of Sand Pack: #2/12 Sand (8' - 21')		
Type of Seals: Bentonite (6' - 8')			Grout (0' - 6')		
Comments: Located in the corner of the bldg.					

Depth, feet	Elevation, feet	Blows/foot	USCS Classification	MATERIAL DESCRIPTION	OVA (ppm)	REMARKS
0			CL	**SILTY CLAY** Brown with some yellow, some sand, moist		
	60					
5		3 4 4		**CLAY** (organic) Black blue, some pebbles, moist, soft		No Sample, 2" of Soil in Plug 1-1/2 Tubes Recovered with fill material only
	55	6 6 7	SM-ML	**SILTY SAND / SANDY SILT and CLAY** Yellow brown, fine sand, very moist	3	
			CL	**SILTY CLAY** Blue mottled, very soft, moist		
10		2 2 3		Grades to black, very moist	6	
	50					
		1 1 1		Some pebbles up to 1/4" in diameter, some coarse sand, high organic particles	86	Hydrocarbon Odor Present
15		2 1 1	SM	**SILTY CLAYEY SAND** Black-green, gravels up to 1/2" in diameter, very wet, soft	48	
	45					
20		3 5 11	ML	**CLAYEY SILT** Yellow brown, medium dense, some sand, moist	38	

Appendix B

Model Input Summary Sheets


Main Screen
RBCA Tool Kit for Chemical Releases
Version 1.2 © 1999
1. Project Information
Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Date: 11-Nov-00
Job ID: se ibc oak
2. Which Type of RBCA Analysis?
?
Tier 1
Generic Values
On-Site
Exposure
Tier 2
C
x
Site-Specific Values
On- or Off-Site Exposure
3. Calculation Options
?
Affects which input data are required
Baseline Risks (Forward mode)
RBCA Cleanup Standards (Backward mode)
4. RBCA Evaluation Process
Prepare Input Data
Data Complete? (■= yes, ■= no)
Exposure Pathways
Constituents of Concern (COCs)
Transport Models
Soil Parameters
GW Parameters
Air Parameters
Review Output
Exposure Flowchart
COC Chem. Parameters
Input Data Summary
User-Spec. COC Data...
Transient Domenico Analysis...
Baseline Risks...
Cleanup Standards...
5. Commands and Options
New Site
Load Data...
Save Data As...
Quit
Print Sheet
Set Units
Custom Chem. Data...
Help

RBCA Tool Kit for Chemical Releases, Version 1.2

Site Name: IBC	Job ID: se ibc oak
Location: Oakland, California	Date: 11-Nov-00
Compl. By: Blankinship	

Commands and Options

Main Screen | Print Sheet | *Help*

Source Media Constituents of Concern (COCs)

Apply Raoult's Law ?

Selected COCs	Groundwater Source Zone (mg/L)	note	Soil Source Zone (mg/kg)	note	Mole Fraction in Source Material (-)
Benzene*	2.5E-1	95%UCL High Val All Wells	3.9E+0	E of Pump Island	
Toluene	9.3E-2	"	7.8E+2	"	
Ethylbenzene	1.5E-1	"	6.4E+2	"	
Xylene (mixed isomers)	3.9E-1	"	5.1E+2	"	
Methyl t-Butyl ether	4.9E-2	"	1.3E+3	"	

COC Select: Add/Insert, Delete. Sort List: Top, Bottom, MoveUp, MoveDown ?

Representative COC Concentration ? — Groundwater Source Zone: Enter Directly, Enter Site Data. Soil Source Zone: Calculate, Enter Site Data.

* = Chemical with user-specified data

User-Specified Custom Chemical Database

Chemical Name Benzene

CAS No. 71-43-2 Type A

Physical Properties

	Value	Reference
Molecular weight (g/mol)	78.1	PS
Solubility @ 20-25°C (mg/L)	1750	PS
Vapor pressure @ 20-25°C (mmHg)	95.2	PS
Henry's Law constant @ 20°C ( ) *(atm-m³/mol)* (•) unitless (-)	0.22888633	PS
	2	
Ionization/dissociation constants (pH units): acid pKa -		
base pKb	-	
Sorption coefficient (log L/kg) (•) log Koc ( ) log Kd	1.77	PS
	1	
Diffusion coefficient in air (cm^2/s)	0.088	PS
Diffusion coefficient in water (cm^2/s)	0.0000098	PS

Miscellaneous Parameters

Analytical Detection Limits: 6

	Value	Reference
Groundwater (mg/L)	0.002	S
Soil (mg/kg)	0.005	S
First-Order Decay Half Lives (days): Saturated	720	
Unsaturated	720	H
Bioconcentration Factor (-)	12.6	

Toxicity Data

	Value	Reference
EPA weight of evidence ☑ Carcinogen	A	
Oral slope factor (1/[mg/kg/day])	0.1	CA
Dermal slope factor (1/[mg/kg/day])	0.1	CA
Inhalation unit risk factor (1/[µg/m³])	0.00003	CA
Oral reference dose (mg/kg/day)	0.003	R
Dermal reference dose (mg/kg/day)	-	
Inhalation reference conc. (mg/m³)	0.00595	R

Dermal Exposure

	Value	Reference
Dermal relative adsorption factor (-)	0.5	D
Dermal permeability coefficient (cm/hr)	0.021	
Lag time for dermal exposure (hr)	0.26	
Critical dermal exposure time (hr)	0.63	
Relative contribution of perm. coeff. (-)	0.013	

Regulatory Standards

	Value	Reference
Groundwater MCL (mg/L)	0.001	EPA, SWRCB
Air PEL/TWA (mg/m³)	3.25	
Aquatic life prot. criterion (mg/L)	-	

Commands and Options

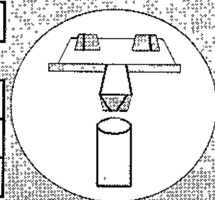
Update Database | Close | Refs. | Restore Values | Print Sheet | *Help*

Exposure Factors and Target Risk Limits

Site Name:	IBC
Location:	Oakland, California
Compl. By:	Blankinship
Job ID:	se ibc oak
Date:	11-Nov-00

1. Exposure Parameters

Exposure Parameters	Age Adjustment?	Residential: Adult	Residential: (Age 0-6)	Residential: (Age 0-16)	Commercial: Chronic	Commercial: Construc.
Averaging time, carcinogens (yr)		70				
Averaging time, non-carcinogens (yr)		30			25	1
Body weight (kg)		70	15	35	70	
Exposure duration (yr)		30	6	16	25	1
Exposure frequency (days/yr)		350			250	180
Dermal exposure frequency (days/yr)		350			250	
Skin surface area, soil contact (cm^2)	☐	5800		2023	5800	5800
Soil dermal adherence factor ($mg/cm^2/day$)		1				
Water ingestion rate (L/day)		2			1	
Soil ingestion rate (mg/day)	☐	100	200		50	100
Swimming exposure time (hr/event)		3				
Swimming event frequency (events/yr)		12	12	12		
Swimming water ingestion rate (L/hr)	☐	0.05	0.5			
Skin surface area, swimming (cm^2)	☐	23000		8100		
Fish consumption rate (kg/day)		0.025				
Contaminated fish fraction (unitless)		1				



2. Risk Goal Calculation Options

- ○ Individual Constitiuent Risk Goals Only
- ◉ Individual and Cumulative Risk Goals

3. Target Health Risk Limits

	Individual	Cumulative
Target Risk (Class A/B carcins.)	1.0E-5	1.0E-5
Target Risk (Class C carcinogens)	1.0E-5	
Target Hazard Quotient	1.0E+0	
Target Hazard Index		1.0E+0

4. Commands and Options

Return to Exposure Pathways

Use Default Values

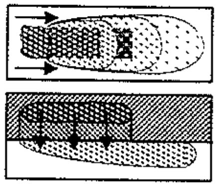
Print Sheet

Help

Exposure Pathway Identification

Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Job ID: se ibc oak
Date: 11-Nov-00

1. Groundwater Exposure ?



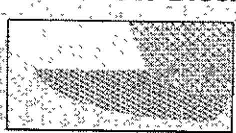
Groundwater Ingestion/ Surface Water Impact

Receptor	None		
Type:	On-site	Off-site1	Off-site2

Source Media: Distance to GW receptors

	On-site	Off-site1	Off-site2	
☐ Affected Groundwater	0	0	0	(ft)
☐ Affected Soils Leaching to Groundwater	0	0	0	(ft)

GW Discharge to Surface Water Exposure

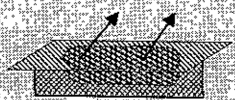


☐ Swimming
☐ Fish Consumption
☐ Aquatic Life Protection

Enter ALP Criteria

2. Surface Soil Exposure ?

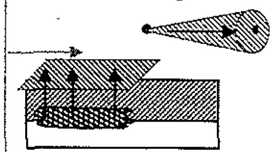
Direct Ingestion and Dermal Contact



Receptor: None
Type: On-site
No off-site receptors
Construction Worker ☐

3. Air Exposure ?

Volatilization and Particulates to Outdoor Air Inhalation



Receptor	Com.			
Type:	On-site	Off-site1	Off-site2	
	0	0	0	(ft)

Construction worker ☑

☑ Affected Soils--Volatilization to Ambient Outdoor Air
☑ Affected Groundwater--Volatilization to Ambient Outdoor Air
☐ Affected Surface Soils--Particulates to Ambient Outdoor Air

Volatilization to Indoor Air Inhalation

Receptor: Com.
Type: On-site
No off-site receptors

☑ Affected Soils--Volatilization to Enclosed Space
☑ Affected Groundwater--Volatilization to Enclosed Space

4. Commands and Options

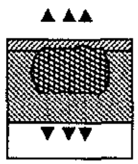
Main Screen **Print Sheet** **Set Units** ***Help***

Exposure Factors & Target Risks | Exposure Flowchart

Transport Modeling Options

Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Job ID: se ibc oak
Date: 11-Nov-00

1. Vertical Transport, Surface Soil Column



Outdoor Air Volatilization Factors ?

- ○ Surface soil volatilization model only
- ◉ Combination surface soil/Johnson & Ettinger models
  - Thickness of surface soil zone: 10 *(ft)*
- ○ User-specified VF from other model — [Enter VF Values]

Indoor Air Volatilization Factors ?

- ◉ Johnson & Ettinger model
- ○ User-specified VF from other model — [Enter VF Values]

Soil-to-Groundwater Leaching Factor ?

- ○ ASTM Model
  - ☐ Apply Soil Attenuation Model (SAM)
  - ☐ Allow first-order biodecay — [Enter Decay Rates]
- ○ User-specified LF from other model — [Enter LF Values]

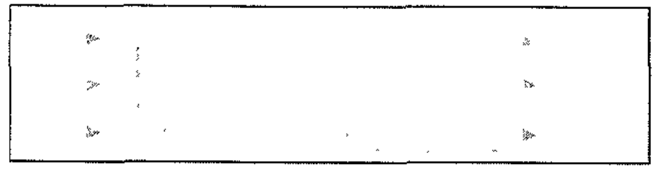
2. Lateral Air Dispersion Factor

?

- ○ 3-D Gaussian dispersion model
- ○ User-Specified ADF

	Off-site 1	Off-site 2	
	1.00E+0	1.00E+0	(-)

3. Groundwater Dilution Attenuation Factor



Calculate DAF using Domenico Model ?

- ○ Domenico equation with dispersion only (no biodegradation)
- ○ Domenico equation first-order decay — [Enter Decay Rates]
- ○ Modified Domenico equation using electron acceptor superposition — [Enter Site Data]

[Enter Directly] Biodegradation Capacity: NC *(mg/L)*

— or —

User-Specified DAF Values

- ○ DAF values from other model or site data — [Enter DAF Values]

n o

4. Commands and Options

[Main Screen] [Print Sheet] [*Help*]

Site-Specific Groundwater Parameters

Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Job ID: se ibc oak
Date: 11-Nov-00

1. Water-Bearing Unit

Hydrogeology

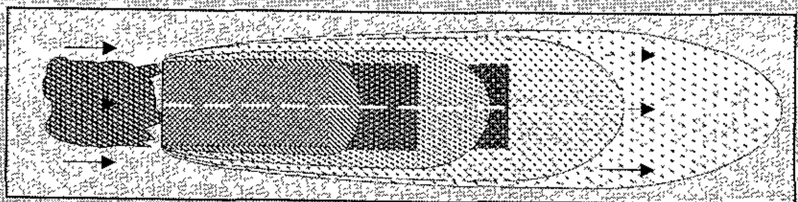
Groundwater Darcy velocity		(ft/d)
Groundwater seepage velocity		(ft/d)
or NA	or	
Hydraulic conductivity		(ft/d)
Hydraulic gradient		(-)
Effective porosity		(-)

Sorption

Fraction organic carbon--saturated zone		(-)
Groundwater pH		(-)

2. Groundwater Source Zone

Groundwater plume width at source	100	(ft)
Plume (mixing zone) thickness at source		(ft)
or NA	or	
Saturated thickness		(ft)
Length of source zone		(ft)



3. Groundwater Dispersion

Model:

	GW Ingestion Off-site 1	GW Ingestion Off-site 2	Soil Leaching to GW Off-site 1	Soil Leaching to GW Off-site 2	
Distance to GW receptors	0	0	0	0	(ft)
or NA		or		or	
Longitudinal dispersivity					(ft)
Transverse dispersivity					(ft)
Vertical dispersivity					(ft)

4. Groundwater Discharge to Surface Water

	Off-site 2	
Distance to GW/SW disharge point	NA	(ft)
Plume width at GW/SW discharge	0	(ft)
Plume thickness at GW/SW discharge	0	(ft)
Surface water flowrate at GW/SW discharge	0.0E+0	(ft^3/d)

5. Commands and Options

Main Screen

Set Units

Use Default Values

Print Sheet

Help

Site-Specific Soil Parameters

Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Job ID: se ibc oak
Date: 11-Nov-00

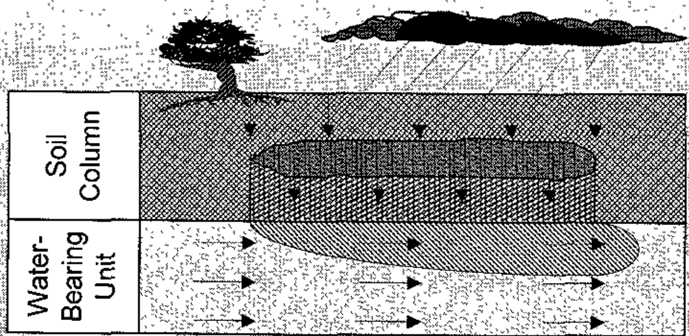
1. Soil Source Zone Characteristics (?)

Hydrogeology

	General Case	Construction	
Depth to water-bearing unit	9.842519685		(ft)
Capillary zone thickness	0.164041995		(ft)
Soil column thickness	9.67847769		(ft)

Affected Soil Zone

	General Case	Construction	
Depth to top of affected soils	0		(ft)
Depth to base of affected soils	9.842519685		(ft)
Affected soil area	21797	21797	(ft^2)
Length of affected soil parallel to assumed wind direction	147.64	147.64	(ft)
Length of affected soil parallel to assumed GW flow direction			(ft)



2. Surface Soil Column

Predominant USCS Soil Type

SW/SP: Sand (?)

or [Enter Directly] or

	Vadose Zone	Capillary Fringe	
Total porosity	0.41		(-)
Volumetric water content	0.08	0.369	(-)
Volumetric air content	0.33	0.041	(-)
Dry bulk density	1.7		(kg/L)
Vertical hydraulic conductivity	2.8E+1		(ft/d)
Vapor permeability	1.1E-11		(ft^2)
Capillary zone thickness	1.6E-1		(ft)

Net Rainfall Infiltration

Net infiltration estimate ______ (mm/yr)

or [NA] or

Average annual precipitation ______ (mm/yr)

Partitioning Parameters

Fraction organic carbon	0	(-)
Soil/water pH	6.8	(-)

3. Commands and Options

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Site-Specific Soil Parameters

Site Name: IBC
Location: Oakland, California
Compl. By: Blankinship
Job ID: se ibc oak
Date: 11-Nov-00

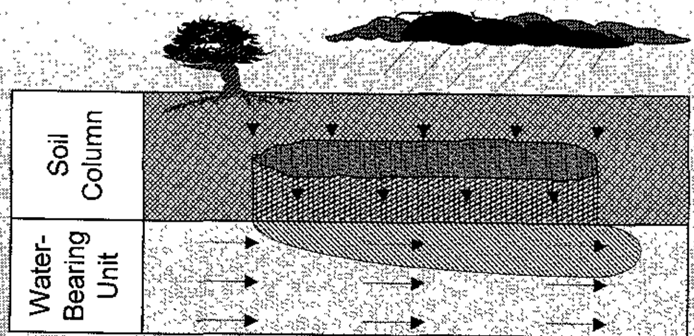
1. Soil Source Zone Characteristics (?)

Hydrogeology

	General Case	Construction	
Depth to water-bearing unit	9.842519685		(ft)
Capillary zone thickness	0.885826772		(ft)
Soil column thickness	8.956692913		(ft)

Affected Soil Zone

	General Case	Construction	
Depth to top of affected soils	0		(ft)
Depth to base of affected soils	9.842519685		(ft)
Affected soil area	21797	21797	(ft^2)
Length of affected soil parallel to assumed wind direction	147.64	147.64	(ft)
Length of affected soil parallel to assumed GW flow direction			(ft)



2. Surface Soil Column

Predominant USCS Soil Type (?)

MH: Clayey Silt

or Enter Directly

	Vadose Zone	Capillary Fringe	
Total porosity	0.36		(-)
Volumetric water content	0.24	0.324	(-)
Volumetric air content	0.12	0.036	(-)
Dry bulk density	1.7		(kg/L)
Vertical hydraulic conductivity	2.8E-2		(ft/d)
Vapor permeability	1.1E-14		(ft^2)
Capillary zone thickness	8.9E-1		(ft)

Net Rainfall Infiltration

Net infiltration estimate		(mm/yr)
or NA	or	
Average annual precipitation		(mm/yr)

Partitioning Parameters

Fraction organic carbon	0.01	(-)
Soil/water pH	6.8	(-)

3. Commands and Options

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Site-Specific Air Parameters

Site Name: IBC | Job ID: se ibc oak
Location: Oakland, California | Date: 11-Nov-00
Compl. By: Blankinship

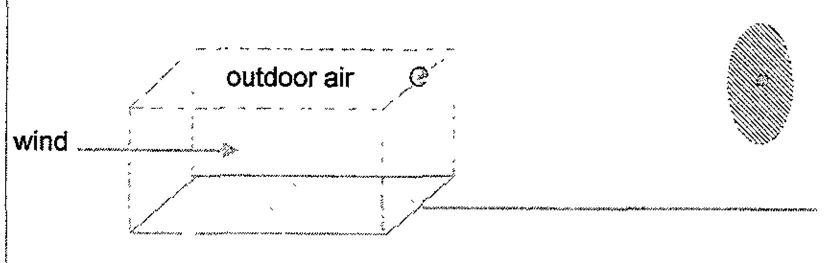
1. Outdoor Air Pathway

Dispersion in Air

	Off-site 1	Off-site 2	
Distance to offsite air receptor			*(ft)*
or NA		*or*	
Horizontal dispersivity			*(ft)*
Vertical dispersivity			*(ft)*

Air Source Zone

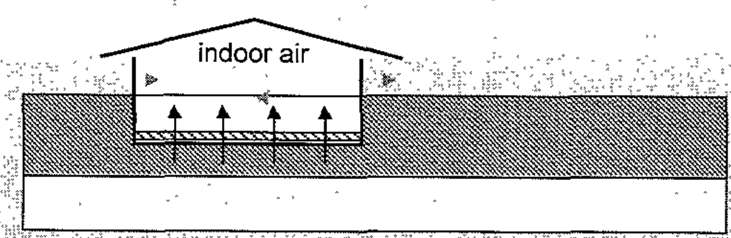
Air mixing zone height	6.56167979	*(ft)*
Ambient air velocity in mixing zone	637795.2756	*(ft/d)*
Areal particulate emission flux	6.9E-14	*(g/cm^2/s)*



2. Indoor Air Pathway

Building Parameters

	Residential	Commercial	
Building volume/area ratio	6.56168	9.84252	*(ft)*
Foundation area	1000	753.474	*(ft^2)*
Foundation perimeter	400	111.549	*(ft)*
Building air exchange rate	1.2E+1	2.0E+1	*(1/d)*
Depth to bottom of foundation slab	0.49213	0.49213	*(ft)*
Convective air flow through cracks	0.0E+0	0.0E+0	*(ft^3/d)*
Foundation thickness	0.492125984		*(ft)*
Foundation crack fraction	0.01		*(-)*
Volumetric water content of cracks	0.12		*(-)*
Volumetric air content of cracks	0.26		*(-)*
Indoor/Outdoor differential pressure	0		*(psi)*



3. Commands and Options

Main Screen | Use Default Values | Print Sheet
Set Units | | *Help*

RBCA SITE ASSESSMENT

Input Parameter Summary

Site Name IBC
Site Location Oakland, California

Completed By Blankinship
Date Completed: 11-Nov-00

Job ID se ibc oak

Exposure Parameters		Residential: Adult	Residential: (1-6yrs)	Residential: (1-16 yrs)	Commercial/Industrial: Chronic	Commercial/Industrial: Construc.
AT_c	Averaging time for carcinogens (yr)	70				
AT_n	Averaging time for non-carcinogens (yr)	30			25	1
BW	Body weight (kg)	70	15	35	70	
ED	Exposure duration (yr)	30	6	16	25	1
τ	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure frequency (days/yr)	350			250	180
EF_D	Exposure frequency for dermal exposure	350			250	
IR_w	Ingestion rate of water (L/day)	2			1	
IR_s	Ingestion rate of soil (mg/day)	100	200		50	100
SA	Skin surface area (dermal) (cm^2)	5800		2023	5800	5800
M	Soil to skin adherence factor	1				
ET_{swim}	Swimming exposure time (hr/event)	3				
EV_{swim}	Swimming event frequency (events/yr)	12	12	12		
IR_{swim}	Water ingestion while swimming (L/hr)	0 05	0 5			
SA_{swim}	Skin surface area for swimming (cm^2)	23000		8100		
IR_{fish}	Ingestion rate of fish (kg/yr)	0 025				
FI_{fish}	Contaminated fish fraction (unitless)	1				

Complete Exposure Pathways and Receptors	On-site	Off-site 1	Off-site 2
Groundwater.			
Groundwater Ingestion	None	None	None
Soil Leaching to Groundwater Ingestion	None	None	None
Applicable Surface Water Exposure Routes:			
Swimming			NA
Fish Consumption			NA
Aquatic Life Protection			NA
Soil:			
Direct Ingestion and Dermal Contact	None		
Outdoor Air			
Particulates from Surface Soils	None	None	None
Volatilization from Soils	Com /Constr	#VALUE!	#VALUE!
Volatilization from Groundwater	Commercial	#VALUE!	#VALUE!
Indoor Air:			
Volatilization from Subsurface Soils	Commercial	NA	NA
Volatilization from Groundwater	Commercial	NA	NA

Receptor Distance from Source Media	On-site	Off-site 1	Off-site 2	(Units)
Groundwater receptor	NA	NA	NA	(ft)
Soil leaching to groundwater receptor	NA	NA	NA	(ft)
Outdoor air inhalation receptor	0	NA	NA	(ft)

Target Health Risk Values		Individual	Cumulative
TR_{ab}	Target Risk (class A&B carcinogens)	1 0E-5	1 0E-5
TR_c	Target Risk (class C carcinogens)	1 0E-5	
THQ	Target Hazard Quotient (non-carcinogenic risk)	1 0E+0	1 0E+0

Modeling Options	
RBCA tier	Tier 2
Outdoor air volatilization model	Surface & subsurface models
Indoor air volatilization model	Johnson & Ettinger model
Soil leaching model	NA
Use soil attenuation model (SAM) for leachate?	NA
Air dilution factor	NA
Groundwater dilution-attenuation factor	NA

NOTE NA = Not applicable

Surface Parameters		General	Construction	(Units)
A	Source zone area	2 2E+4	2 2E+4	(ft^2)
W	Length of source-zone area parallel to wind	1 5E+2	1.5E+2	(ft)
W_{gw}	Length of source-zone area parallel to GW flow	NA		(ft)
U_{air}	Ambient air velocity in mixing zone	6 4E+5		(ft/d)
δ_{air}	Air mixing zone height	6 6E+0		(ft)
P_e	Areal particulate emission rate	NA		(g/cm^2/s)
L_{ss}	Thickness of affected surface soils	1.0E+1		(ft)

Surface Soil Column Parameters		Value			(Units)
h_{cap}	Capillary zone thickness	1 6E-1			(ft)
h_v	Vadose zone thickness	9 7E+0			(ft)
ρ_s	Soil bulk density	1 7E+0			(g/cm^3)
f_{oc}	Fraction organic carbon	0 0E+0			(-)
θ_T	Soil total porosity	4 1E-1			(-)
K_{vs}	Vertical hydraulic conductivity	2 8E+1			(ft/d)
k_v	Vapor permeability	1 1E-11			(ft^2)
L_{gw}	Depth to groundwater	9.8E+0			(ft)
L_s	Depth to top of affected soils	0 0E+0			(ft)
L_{base}	Depth to base of affected soils	9 8E+0			(ft)
L_{subs}	Thickness of affected soils	9 8E+0			(ft)
pH	Soil/groundwater pH	6 8E+0			(-)
		capillary	vadose	foundation	
θ_w	Volumetric water content	0 369	0 08	0 12	(-)
θ_a	Volumetric air content	0 041	0 33	0 26	(-)

Building Parameters		Residential	Commercial	(Units)
L_b	Building volume/area ratio	NA	9 84E+0	(ft)
A_b	Foundation area	NA	7 53E+2	(cm^2)
X_{crk}	Foundation perimeter	NA	1 12E+2	(ft)
ER	Building air exchange rate	NA	1 99E+1	(1/d)
L_{crk}	Foundation thickness	NA	4 92E-1	(ft)
Z_{crk}	Depth to bottom of foundation slab	NA	4 92E-1	(ft)
η	Foundation crack fraction	NA	1 00E-2	(-)
dP	Indoor/outdoor differential pressure	NA	0 00E+0	(psi)
Q_s	Convective air flow through slab	NA	0 00E+0	(ft^3/d)

Groundwater Parameters		Value	(Units)
δ_{gw}	Groundwater mixing zone depth	NA	(ft)
I_f	Net groundwater infiltration rate	NA	(mm/yr)
U_{gw}	Groundwater Darcy velocity	NA	(ft/d)
V_{gw}	Groundwater seepage velocity	NA	(ft/d)
K_s	Saturated hydraulic conductivity	NA	(ft/d)
i	Groundwater gradient	NA	(-)
S_w	Width of groundwater source zone	NA	(ft)
S_d	Depth of groundwater source zone	NA	(ft)
θ_{eff}	Effective porosity in water-bearing unit	NA	(-)
f_{oc-sat}	Fraction organic carbon in water-bearing unit	NA	(-)
pH_{sat}	Groundwater pH	NA	(-)
	Biodegradation considered?	NA	

Transport Parameters		Off-site 1	Off-site 2	Off-site 1	Off-site 2	(Units)
Lateral Groundwater Transport		Groundwater Ingestion		Soil Leaching to GW		
α_x	Longitudinal dispersivity	NA	NA	NA	NA	(ft)
α_y	Transverse dispersivity	NA	NA	NA	NA	(ft)
α_z	Vertical dispersivity	NA	NA	NA	NA	(ft)
Lateral Outdoor Air Transport		Soil to Outdoor Air Inhal		GW to Outdoor Air Inhal		
σ_y	Transverse dispersion coefficient	NA	NA	NA	NA	(ft)
σ_z	Vertical dispersion coefficient	NA	NA	NA	NA	(ft)
ADF	Air dispersion factor	NA	NA	NA	NA	(-)

Surface Water Parameters		Off-site 2	(Units)
Q_{sw}	Surface water flowrate	NA	(ft^3/d)
W_{pl}	Width of GW plume at SW discharge	NA	(ft)
δ_{pl}	Thickness of GW plume at SW discharge	NA	(ft)
DF_{sw}	Groundwater-to-surface water dilution factor	NA	(-)

HUMAN HEALTH RISK ANALYSIS TO SUPPORT A RISK-BASED CORRECTIVE ACTION AND SITE CLOSURE

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