

*1st Risk Assessment  
before 2 revisions*

April 19, 1999

**DRAFT**

Ms. Juliet Shin  
Alameda County Health Services Agency  
Division of Environmental Protection  
1131 Harbor Bay Parkway, 2<sup>nd</sup> Floor  
Alameda, California 94502

Subject: Additional Risk Based Corrective Action Evaluations Set No.2  
Former Tosco Service Station No. 1871  
96 MacArthur Boulevard, Oakland, California

Ms. Shin:

At the request of the Alameda County Health Services Agency (ACHSA), Gettler-Ryan Inc. (GR) has prepared this letter and attachments to document latest additional Risk-Based Corrective Action (RBCA) evaluations. During our telephone conversation on April 15, 1999, Ms. Madhulla Logan and you requested that the revised RBCA evaluation dated April 6, 1999 be modified, and the Risk Based Screening Levels (RBSLs) recalculated. At the request of ACHSA and per their guidance, all of the chemicals of concern (COC) were averaged using the arithmetic mean average method rather than the publish averaging contained in the ASTM E-1739 RBCA program.

The first recalculation was to use the soil data, although located in the subsurface (>3 feet below grade), in the surface soils evaluation for the construction worker RBSLs. The selected soil data used in this evaluation was specified by ACHSA and included analytical data from the waste oil and ground storage tank (WOST) excavations, and product piping trenches, soil borings EB-1, EB-2 and EB-3, and from monitoring wells MW-1 through MW-5. These samples were collected between 5 and 10 feet below ground surface (bgs). Soil sample WOSW2 at 9 feet was the only sample used from the waste oil excavation. The other samples were removed during over excavation that extended to groundwater. These data were used to construct a new table and each COC was averaged by the arithmetic mean average method. The mean average was then inputted into the RBCA program and the evaluation was performed. The RBCA evaluation Output Worksheets; Output Table1, and 6.1, 6.2 and 6.3, and associated analytical concentrations (hand drafted table) used in the evaluation are attached in Attachment 1.

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The second request was to re-evaluate the air inhalation potential using soil analytical data from the waste oil excavation, soil borings EB-1 through EB-3 and monitoring well MW-4; and groundwater (grab samples) analytical data from the waste oil excavation soil borings EB-1 through EB-3, and MW-4 (average concentrations from the last year of data), also using an arithmetic mean average method. The RBCA evaluation Output Worksheets; Table 1, 6.1, 6.2 and 6.3 and associated hand drafted data tables with analytical concentrations used in the evaluation are attached in Attachment 2.

## RBCA Findings

### RBSL's for Construction Worker: Modified Evaluation

GR applied the requested soil analytical data for a modified RBCA evaluation in order to establish RBSLs for construction workers. One Chemicals of Concern (COC) was identified, benzene at a RBSL concentration of  $7.1E-2$  parts per million (ppm) for the associated pathway of groundwater volatilization to indoor air. One grab groundwater sample from boring EB-2 contained 0.69 ppm benzene while EB-1, EB-3 and MW-4 were all non detect. Given this data, the impact to groundwater in the specified area is limited and since the primary and secondary sources have been removed, it is likely that the actual benzene concentration in the area of EB-2 has attenuated to some degree. Attached in Attachment 1A, GR reevaluated the data set with only a one magnitude of order reduction in the benzene concentration from EB-2 (from 0.69 ppm to 0.069 ppm). The results indicated that the calculated RBSLs for the construction worker at the site was not exceeded.

### RBSL's for Air Inhalation (indoor/enclosed space) Modified Data Set

GR applied the requested modified soil and groundwater analytical data set for the RBCA evaluation regarding the air inhalation potential. This data set was also averaged by the arithmetic mean method. One exposure pathway, ~~volatilization of groundwater to indoor air was exceeded. Benzene was identified as the COC and a RBSL of  $7.2E-2$  ppm was calculated.~~ Once again, with the concentration of the grab sample from the boring EB-2 at 0.69 ppm and the other specified groundwater concentrations in the data set (all non detect), and given a attenuation factor of one magnitude of this benzene concentration to 0.069 ppm, the recalculated RBSLs for the site have not been exceeded. These worksheets are attached in Attachment 2A.

## Summary

Based on these RBCA modified evaluations, the potential risk at the site is primarily air volatilization from groundwater to indoor air. For the construction worker (Attachment 1), these results should be used for the preparation of any site health and safety plan for construction activities that include excavation of soils below 3 feet. The site will be developed into another petroleum fuel storage and dispensing facility as we understand. The potential exposure to a construction worker will be minimal and limited to the time

that the underground construction is conducted. The construction workers that will be employed should be properly trained and familiar with the exposure to petroleum hydrocarbons and implement appropriate precautionary measures.

The second evaluation was prepared was specific data selected by the ACHSA for the purposes of evaluating the potential health risks associated with the site and the planned uses. As seen in the worksheets in Attachment 2, one exposure pathway, groundwater volatilization to indoor air has been identified. The calculated RSBL for the COC, benzene is  $7.1E-2$  ppm. As discussed, the benzene result in the grab groundwater sample from EB-2 (0.69 ppm) was the only detected COC in the data set. The impacted area is limited and given a attenuation factor of one magnitude for the grab groundwater concentration (from 0.69 ppm to 0.069 ppm), the recalculated site RBSLs have not been exceeded.

The primary and secondary sources of petroleum hydrocarbons have been removed from the site. After three plus years since the groundwater grab sample was collected from boring EB-2, natural biodegradation and attenuation process has most likely occurred. An estimated one magnitude of order is well with in reason and is an conservative value. With the removal of the source of hydrocarbons, the residual concentrations should naturally attenuate and continue to decrease any potential risk to the property occupant.

If you have any questions or comments regarding this document, please me at (415) 893-1515.

Sincerely  
**Gettler-Ryan Inc.**

David J. Vossler  
Project Manager

Attachments:	Attachment 1:	RBCA Output/Worksheets-Construction Worker
	Attachment 1A:	RBCA Output/Worksheets-Construction Worker (COC attenuation data set)
	Attachment 2:	RBCA Output/Worksheets-Potential Air Inhalation
	Attachment 2A:	RBCA Output/Worksheets-Potential Air Inhalation (COC attenuation data set)

Cc: Mr. David B. DeWitt, Tosco Marketing Company  
Ms. Barbara Bee, Property Owner

# **ATTACHMENT 1**

**Construction Worker: Modified Output files  
with Associated Analytical Tables**

## Groundwater

ppm

Sample-	Benzene	Toluene	Ethyl-Benzene	Xylenes	M+BE
EB1	0.0005	0.0005	0.0005	0.0013	0.0005
EB2	0.069	0.041	0.025	0.064	0.0005
EB3	0.0005	0.0005	0.0005	0.0005	0.0036
MW-4	0.0005	0.0005	0.0005	0.0005	2.92
Average	0.17	0.010	0.0066	0.017	0.73

Average - 1-order  
of magnitude Reduction  
Attachment 2A

Benzene (only)	0.069 ppm	0.018	0.010	0.0066	0.017	0.73
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Non Detected - DL used  
All concentrations in ppm

## Subsurface Soils

## Sample

SW3-5'	0.049	0.051	0.05	0.2	6.6
SW4-5'	0.08	0.01	0.01	0.039	12
SW-1	0.01	0.01	0.01	0.01	1.9
SW-2	0.031	0.01	0.01	0.015	3.8
MW-4-5'	0.005	0.005	0.0052	0.019	—
MW-4-9.5'	0.005	0.74	0.15	0.48	—
EB-1-5'	0.005	0.005	0.005	0.005	—
EB-1-10'	0.005	0.005	0.005	0.005	—
EB-2-10'	0.005	0.005	0.0094	0.035	—
EB-2-5'	0.005	0.005	0.005	0.005	—
EB-3-9.5'	0.005	0.005	0.005	0.005	0.025
WOSW2	2.2	2.6	9.5	22	—

Average — 2 ppm

Non Detected - DL used  
All concentrations in ppm

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# RBCA TIER 1/TIER 2 EVALUATION

# Output Table 1

Site Name: Former Tosco (former Unocal) Site Identification: 140165.05  
 Site Location: 96 MacArthur Blvd., Oakland, CA Date Completed: 4/19/99  
 Completed By: David J. Vossler

Software: GSI RBCA Spreadsheet  
 Version: 1.0.1

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

Exposure Parameter	Definition (Units)	Residential		Commercial/Industrial		Surface Parameters		Residential	Constrctn
		Adult	(1-6yrs)	(1-16 yrs)	Chronic	Constrctn	Definition (Units)		
ATc	Averaging time for carcinogens (yr)	70						<u>2.8E+05</u>	
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1		<u>6.1E+02</u>	
BW	Body Weight (kg)	70	15	35	70			<u>6.1E+02</u>	
ED	Exposure Duration (yr)	30	6	16	25	1		2.3E+02	
t	Averaging time for vapor flux (yr)	30			25	1		2.0E+02	
EF	Exposure Frequency (days/yr)	350			250	180		1.0E+02	
EF_Derm	Exposure Frequency for dermal exposure	350			250			6.9E-14	
IRgw	Ingestion Rate of Water (L/day)	2			1				
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100			
IRAdj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01				
IRa.in	Inhalation rate indoor (m³/day)	15			20				
IRa.out	Inhalation rate outdoor (m³/day)	20			20	10			
SA	Skin surface area (dermal) (cm²)	5.8E+03		2.0E+03	5.8E+03	5.8E+03			
SAadj	Adjusted dermal area (cm²-yr/kg)	2.1E+03			1.7E+03				
M	Soil to Skin adherence factor	1							
AAFs	Age adjustment on soil ingestion	FALSE			FALSE				
AAFd	Age adjustment on skin surface area	FALSE			FALSE				
tox	Use EPA tox data for air (or PEL based)?	TRUE							
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE							

  

Matrix of Exposed Persons to Complete Exposure Pathways	Residential		Commercial/Industrial		Soil	Definition (Units)	Value			
	Chronic	Constrctn	Chronic	Constrctn			capillary	vadose	foundation	
<b>Outdoor Air Pathways:</b>										
SS.v	Volatiles and Particulates from Surface Soils	FALSE		TRUE	TRUE	hc	Capillary zone thickness (cm)	5.0E+00		
S.v	Volatilization from Subsurface Soils	FALSE		TRUE		hv	Vadose zone thickness (cm)	<u>3.4E+02</u>		
GW.v	Volatilization from Groundwater	FALSE		TRUE		rho	Soil density (g/cm³)	1.7		
<b>Indoor Air Pathways:</b>										
S.b	Vapors from Subsurface Soils	FALSE		TRUE		foc	Fraction of organic carbon in vadose zone	0.01		
GW.b	Vapors from Groundwater	FALSE		TRUE		phi	Soil porosity in vadose zone	<u>0.41</u>		
<b>Soil Pathways:</b>										
SS.d	Direct Ingestion and Dermal Contact	FALSE		FALSE	TRUE	Lgw	Depth to groundwater (cm)	<u>3.4E+02</u>		
<b>Groundwater Pathways:</b>										
GW.i	Groundwater Ingestion	FALSE		FALSE		Ls	Depth to top of affected subsurface soil (cm)	<u>2.7E+02</u>		
S.l	Leaching to Groundwater from all Soils	FALSE		FALSE		Lsubs	Thickness of affected subsurface soils (cm)	<u>6.9E+01</u>		
						pH	Soil/groundwater pH	<u>6.93</u>		
						phi.w	Volumetric water content	<u>0.369</u>	0.13	0.12
						phi.a	Volumetric air content	<u>0.041</u>	<u>0.28</u>	0.26

  

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

  

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

  

Building Parameters	Definition (Units)	Residential	Commercial
		Lb	Building volume/area ratio (cm)
ER	Building air exchange rate (s⁻¹)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

  

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

**RBCA SITE ASSESSMENT**

**Tier 1 Worksheet 6.1**

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SURFACE SOIL RBSL VALUES  
( < 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			X	Inhalation of Volatiles and Particulates		X	Construction Worker	Applicable RBSL	RBSL Exceeded ?	Required CRF
CAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)	(mg/kg)	* If yes	Only if "yes" left		
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	1.7E+2	1.1E+2	1.1E+2	<input type="checkbox"/>	<1		
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1		
1634-04-4	Methyl t-Butyl Ether	0.0E+0	NA	NA	NA	NA	>Res	2.4E+2	2.4E+2	<input type="checkbox"/>	<1		
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1		
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1		

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.2

Site Name: Former Tosco (former Unocal) SS # 1871  
 Site Location: 96 MacArthur Blvd., Oakland, Ca.

Completed By: David J. Vossler  
 Date Completed: 4/19/1999

1 OF 1

**SUBSURFACE SOIL RBSL VALUES  
 (> 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6  MCL exposure limit?  
 Target Risk (Class C) 1.0E-5  PEL exposure limit?  
 Target Hazard Quotient 1.0E+0

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration	Soil Leaching to Groundwater			X	Soil Volatilization to Indoor Air		X	Soil Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CRF
GAS No.	Name	(mg/kg)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/kg)	* If yes	Only if "yes" left
71-43-2	Benzene	2.0E-1	NA	NA	NA	NA	2.3E-1	NA	2.5E+2	2.3E-1			<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	8.1E-1	NA	NA	NA	NA	>Res	NA	>Res	>Res			<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	4.9E+0	NA	NA	NA	NA	2.0E+3	NA	>Res	2.0E+3			<input type="checkbox"/>	<1
108-88-3	Toluene	2.9E-1	NA	NA	NA	NA	2.7E+2	NA	>Res	2.7E+2			<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.9E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res			<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.3

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**GROUNDWATER RBSL VALUES**

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

MCL exposure limit?  
 PEL exposure limit?

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable RBSL	RBSL Exceeded ?	Required CAF
CAS No.	Name	(mg/L)	Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)	(mg/L)	<input type="checkbox"/> If yes	Only if "yes" left
71-43-2	Benzene	7.1E-1	NA	NA	NA	NA	7.1E-2	NA	4.1E+1	7.1E-2	<input checked="" type="checkbox"/>	2.0E+00
100-41-4	Ethylbenzene	6.6E-3	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	7.3E-1	NA	NA	NA	NA	3.7E+3	NA	>Sol	3.7E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	1.0E-2	NA	NA	NA	NA	8.1E+1	NA	>Sol	8.1E+1	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.7E-2	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1

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

107 = 70 ppb

**ATTACHMENT 1A**

**DRAFT**

**Construction Worker: Modified Output files  
with Associated Analytical Tables**

# RBCA TIER 1/TIER 2 EVALUATION

# Output Table 1

Site Name: Former Tosco (former Unocal) Site Identification: 140165.05  
 Site Location: 96 MacArthur Blvd., Oakland, CA Date Completed: 4/19/99  
 Completed By: David J. Vossler

Software: GSI RBCA Spreadsheet  
 Version: 1.0.1

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

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

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm <sup>2</sup> )	<u>9.3E+04</u>	
W	Length of affect. soil parallel to wind (cm)	<u>3.0E+02</u>	
W.gw	Length of affect. soil parallel to groundwater (cm)	<u>3.0E+02</u>	
Uair	Ambient air velocity in mixing zone (cm/s)	<u>2.3E+02</u>	
delta	Air mixing zone height (cm)	<u>2.0E+02</u>	
Lss	Thickness of affected surface soils (cm)	<u>1.0E+02</u>	
Pe	Particulate areal emission rate (g/cm <sup>2</sup> /s)	<u>6.9E-14</u>	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>5.8E-01</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>1.5E+00</u>
Ks	Saturated hydraulic conductivity (cm/s)	6.1E-07
grad	Groundwater gradient (cm/cm)	3.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
loc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is biotenuation considered?	TRUE
BC	Biodegradation Capacity (mg/L)	

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

Soil Parameters	Definition (Units)	Value
hc	Capillary zone thickness (cm)	5.0E+00
hv	Vadose zone thickness (cm)	<u>3.4E+02</u>
rho	Soil density (g/cm <sup>3</sup> )	1.7
loc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	<u>0.41</u>
Lgw	Depth to groundwater (cm)	<u>3.4E+02</u>
Ls	Depth to top of affected subsurface soil (cm)	<u>2.7E+02</u>
Lsubs	Thickness of affected subsurface soils (cm)	<u>6.9E+01</u>
pH	Soil/groundwater pH	<u>6.83</u>
		<u>capillary</u> <u>vadose</u> <u>foundation</u>
phi.w	Volumetric water content	<u>0.369</u> 0.13      0.12
phi.a	Volumetric air content	<u>0.041</u> <u>0.28</u> 0.26

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

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s <sup>-1</sup> )	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.1

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SURFACE SOIL RBSL VALUES  
( < 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

**RBSL Results For Complete Exposure Pathways ("X" if Complete)**

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Inhalation of Volatiles and Particulates		Construction Worker	Applicable RBSL (mg/kg)	RBSL Exceeded ? * If yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.1E-1	NA	NA	NA	NA	3.4E+2	1.1E+2	1.1E+2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	4.5E-1	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	3.6E+0	NA	NA	NA	NA	>Res	2.4E+2	2.4E+2	<input type="checkbox"/>	<1
108-88-3	Toluene	1.8E-1	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

**Tier 1 Worksheet 6.2**

Site Name: Former Tosco (former Unocal) SS # 1871  
 Site Location: 96 MacArthur Blvd., Oakland, Ca.

Completed By: David J. Vossler  
 Date Completed: 4/19/1999

1 OF 1

**SUBSURFACE SOIL RBSL VALUES  
 (> 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6  MCL exposure limit?  
 Target Risk (Class C) 1.0E-5  PEL exposure limit?  
 Target Hazard Quotient 1.0E+0

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		Soil Volatilization to Outdoor Air		Applicable RBSL (mg/kg)	RBSL Exceeded ? *■* if yes	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	2.0E-1	NA	NA	NA	NA	2.3E-1	NA	4.9E+2	2.3E-1	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	8.1E-1	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	4.9E+0	NA	NA	NA	NA	2.0E+3	NA	>Res	2.0E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	2.8E-1	NA	NA	NA	NA	2.7E+2	NA	>Res	2.7E+2	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.9E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

**Tier 1 Worksheet 6.3**

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**GROUNDWATER RBSL VALUES**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

**RBSL Results For Complete Exposure Pathways ("X" if Complete)**

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable RBSL (mg/L)	RBSL Exceeded ? * If yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.5E-2	NA	NA	NA	NA	7.1E-2	NA	8.3E+1	7.1E-2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	6.3E-3	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	5.9E-1	NA	NA	NA	NA	3.7E+3	NA	>Sol	3.7E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	9.2E-3	NA	NA	NA	NA	8.1E+1	NA	>Sol	8.1E+1	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	2.6E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1

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

## ATTACHMENT 2

~~Air Inhalation~~: Modified Data Set

Construction  
Work







# RBCA TIER 1/TIER 2 EVALUATION

# Output Table 1

Site Name: Former Tosco (former Unocal), Site Identification: 140165.05  
 Site Location: 96 MacArthur Blvd., Oakland, CA Date Completed: 11/23/98  
 Completed By: David J. Vossler

Software: GSI RBCA Spreadsheet  
 Version: 1.0.1

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

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

Surface Parameters	Definition (Units)	Residential	Constrctn
A	Contaminated soil area (cm <sup>2</sup> )	<u>9.3E+04</u>	
W	Length of affect. soil parallel to wind (cm)	<u>3.0E+02</u>	
W.gw	Length of affect. soil parallel to groundwater (cm)	<u>3.0E+02</u>	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm <sup>2</sup> /s)	6.9E-14	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>5.8E-01</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>1.5E+00</u>
Ks	Saturated hydraulic conductivity (cm/s)	6.1E-07
grad	Groundwater gradient (cm/cm)	3.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	TRUE
BC	Biodegradation Capacity (mg/L)	

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

Soil Parameters	Definition (Units)	Value
hc	Capillary zone thickness (cm)	5.0E+00
hv	Vadose zone thickness (cm)	<u>3.4E+02</u>
rho	Soil density (g/cm <sup>3</sup> )	1.7
foc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	<u>0.41</u>
Lgw	Depth to groundwater (cm)	<u>3.4E+02</u>
Ls	Depth to top of affected subsurface soil (cm)	<u>2.7E+02</u>
Lsubs	Thickness of affected subsurface soils (cm)	<u>6.9E+01</u>
pH	Soil/groundwater pH	<u>6.93</u>
		<u>capillary</u> <u>vadose</u> <u>foundation</u>
phi.w	Volumetric water content	<u>0.369</u> 0.13      0.12
phi.a	Volumetric air content	<u>0.041</u> <u>0.28</u> 0.26

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

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s <sup>-1</sup> )	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

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

**RBCA SITE ASSESSMENT**

**Tier 1 Worksheet 6.1**

Site Name: Former Tosco (former Unocal) SS # 1871  
 Site Location: 96 MacArthur Blvd., Oakland, Ca.

Completed By: David J. Vossler  
 Date Completed: 11/23/1998

1 OF 1

**SURFACE SOIL RBSL VALUES  
 (< 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6       MCL exposure limit?      Calculation Option: 1  
 Target Risk (Class C) 1.0E-5       PEL exposure limit?  
 Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Inhalation of Volatiles and Particulates		Construction Worker	Applicable RBSL (mg/kg)	RBSL Exceeded ? * If yes	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.1E-1	NA	NA	NA	NA	3.4E+2	1.1E+2	1.1E+2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	4.5E-1	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	3.6E+0	NA	NA	NA	NA	>Res	2.4E+2	2.4E+2	<input type="checkbox"/>	<1
108-88-3	Toluene	1.8E-1	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.2

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 11/23/1998

1 OF 1

**SUBSURFACE SOIL RBSL VALUES  
(> 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Soil Volatilization to Indoor Air		Soil Volatilization to Outdoor Air		Applicable RBSL (mg/kg)	RBSL Exceeded ? *■* If yes	Required CRF Only if "yes" left
CAS No.	Name		Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	2.0E-1	NA	NA	NA	NA	2.3E-1	NA	4.9E+2	2.3E-1	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	8.1E-1	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	4.9E+0	NA	NA	NA	NA	2.0E+3	NA	>Res	2.0E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	2.8E-1	NA	NA	NA	NA	2.7E+2	NA	>Res	2.7E+2	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.9E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.3

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 11/23/1998

1 OF 1

**GROUNDWATER RBSL VALUES**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

**RBSL Results For Complete Exposure Pathways ("X" if Complete)**

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable RBSL (mg/L)	RBSL Exceeded ? ■ If yes	Required CRF Only if "yes" left
CAS No.	Name		Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.4E-1	NA	NA	NA	NA	7.1E-2	NA	8.3E+1	7.1E-2	■	2.0E+00
100-41-4	Ethylbenzene	6.3E-3	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	5.9E-1	NA	NA	NA	NA	3.7E+3	NA	>Sol	3.7E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	9.2E-3	NA	NA	NA	NA	8.1E+1	NA	>Sol	8.1E+1	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	2.6E-1	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1

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

# RBCA TIER 1/TIER 2 EVALUATION

# Output Table 1

Site Name: Former Tosco (former Unocal) Site Identification: 140165.05  
 Site Location: 96 MacArthur Blvd., Oakland, CA Date Completed: 4/19/99  
 Completed By: David J. Vossler

Software: GSI RBCA Spreadsheet  
 Version: 1.0.1

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

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

Surface Parameters	Definition (Units)	Residential	Constructn
		A	Contaminated soil area (cm <sup>2</sup> )
W	Length of affect. soil parallel to wind (cm)	<u>6.1E+02</u>	
W.gw	Length of affect. soil parallel to groundwater (cm)	<u>6.1E+02</u>	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lss	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm <sup>2</sup> /s)	6.9E-14	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>9.8E-01</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>1.5E+00</u>
Ks	Saturated hydraulic conductivity (cm/s)	6.1E-07
grad	Groundwater gradient (cm/cm)	3.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	TRUE
BC	Biodegradation Capacity (mg/L)	

Soil Parameters	Definition (Units)	Value
hc	Capillary zone thickness (cm)	5.0E+00
hv	Vadose zone thickness (cm)	<u>3.4E+02</u>
rho	Soil density (g/cm <sup>3</sup> )	1.7
foc	Fraction of organic carbon in vadose zone	0.01
phi	Soil porosity in vadose zone	<u>0.41</u>
Lgw	Depth to groundwater (cm)	<u>3.4E+02</u>
Ls	Depth to top of affected subsurface soil (cm)	<u>2.7E+02</u>
Lsubs	Thickness of affected subsurface soils (cm)	<u>6.8E+01</u>
pH	Soil/groundwater pH	<u>6.93</u>
		<b>capillary</b> <b>vadose</b> <b>foundation</b>
phi.w	Volumetric water content	<u>0.269</u> 0.13      0.12
phi.a	Volumetric air content	<u>0.041</u> <u>0.28</u> 0.26

Building Parameters	Definition (Units)	Residential	Commercial
Lb	Building volume/area ratio (cm)	2.0E+02	3.0E+02
ER	Building air exchange rate (s <sup>-1</sup> )	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

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

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

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.1

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SURFACE SOIL RBSL VALUES  
( < 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Inhalation of Volatiles and Particulates		Construction Worker	Applicable RBSL (mg/kg)	RBSL Exceeded ? * If yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	1.7E+2	1.1E+2	1.1E+2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	0.0E+0	NA	NA	NA	NA	>Res	2.4E+2	2.4E+2	<input type="checkbox"/>	<1
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.2

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SUBSURFACE SOIL RBSL VALUES  
(> 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			X	Soil Volatilization to Indoor Air		X	Soil Volatilization to Outdoor Air		Applicable RBSL (mg/kg)	RBSL Exceeded ? <input type="checkbox"/> if yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)					
CAS No.	Name													
71-43-2	Benzene	2.0E-1	NA	NA	NA	NA	2.3E-1	NA	2.5E+2	2.3E-1	<input type="checkbox"/>	<1		
100-41-4	Ethylbenzene	8.1E-1	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1		
1634-04-4	Methyl t-Butyl Ether	4.9E+0	NA	NA	NA	NA	2.0E+3	NA	>Res	2.0E+3	<input type="checkbox"/>	<1		
108-88-3	Toluene	2.9E-1	NA	NA	NA	NA	2.7E+2	NA	>Res	2.7E+2	<input type="checkbox"/>	<1		
1330-20-7	Xylene (mixed isomers)	1.9E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1		

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.3

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**GROUNDWATER RBSL VALUES**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable RBSL (mg/L)	RBSL Exceeded ? * If yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.8E-2	NA	NA	NA	NA	7.1E-2	NA	4.1E+1	7.1E-2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	6.6E-3	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	7.3E-1	NA	NA	NA	NA	3.7E+3	NA	>Sol	3.7E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	1.0E-2	NA	NA	NA	NA	8.1E+1	NA	>Sol	8.1E+1	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.7E-2	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1

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

**ATTACHMENT 2A**

**Air Inhalation: Modified Data Set**

# RBCA TIER 1/TIER 2 EVALUATION

# Output Table 1

Site Name: Former Tosco (former Unocal) Site Identification: 140165.05  
 Site Location: 96 MacArthur Blvd., Oakland, CA Date Completed: 4/19/99  
 Completed By: David J. Vossler

Software: GSI RBCA Spreadsheet  
 Version: 1.0.1

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

Exposure Parameter	Definition (Units)	Residential			Commercial/Industrial	
		Adult	(1-5yrs)	(1-15 yrs)	Chronic	Constrctn
ATc	Averaging time for carcinogens (yr)	70				
ATn	Averaging time for non-carcinogens (yr)	30	6	16	25	1
BW	Body Weight (kg)	70	15	35	70	
ED	Exposure Duration (yr)	30	6	16	25	1
t	Averaging time for vapor flux (yr)	30			25	1
EF	Exposure Frequency (days/yr)	350			250	180
EF.Derm	Exposure Frequency for dermal exposure	350			250	
IRgw	Ingestion Rate of Water (L/day)	2			1	
IRs	Ingestion Rate of Soil (mg/day)	100	200		50	100
IRadj	Adjusted soil ing. rate (mg-yr/kg-d)	1.1E+02			9.4E+01	
IRa.in	Inhalation rate indoor (m³/day)	15			20	
IRa.out	Inhalation rate outdoor (m³/day)	20			20	10
SA	Skin surface area (dermal) (cm²)	5.8E+03		2.0E+03	5.8E+03	5.8E+03
SAadj	Adjusted dermal area (cm²-yr/kg)	2.1E+03			1.7E+03	
M	Soil to Skin adherence factor	1				
AAFs	Age adjustment on soil ingestion	FALSE			FALSE	
AAFd	Age adjustment on skin surface area	FALSE			FALSE	
tox	Use EPA tox data for air (or PEL based)?	TRUE				
gwMCL?	Use MCL as exposure limit in groundwater?	FALSE				

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

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

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

Surface Parameters	Definition (Units)	Residential	Constrctn
		A	Contaminated soil area (cm²)
W	Length of affect. soil parallel to wind (cm)	<u>6.1E+02</u>	
W.gw	Length of affect. soil parallel to groundwater (cm)	<u>6.1E+02</u>	
Uair	Ambient air velocity in mixing zone (cm/s)	2.3E+02	
delta	Air mixing zone height (cm)	2.0E+02	
Lsa	Thickness of affected surface soils (cm)	1.0E+02	
Pe	Particulate areal emission rate (g/cm²/s)	6.9E-14	

Groundwater Parameters	Definition (Units)	Value
delta.gw	Groundwater mixing zone depth (cm)	2.0E+02
I	Groundwater infiltration rate (cm/yr)	3.0E+01
Ugw	Groundwater Darcy velocity (cm/yr)	<u>5.8E-01</u>
Ugw.tr	Groundwater seepage velocity (cm/yr)	<u>1.5E+00</u>
Ks	Saturated hydraulic conductivity (cm/s)	6.1E-07
grad	Groundwater gradient (cm/cm)	3.0E-02
Sw	Width of groundwater source zone (cm)	
Sd	Depth of groundwater source zone (cm)	
phi.eff	Effective porosity in water-bearing unit	3.8E-01
foc.sat	Fraction organic carbon in water-bearing unit	1.0E-03
BIO?	Is bioattenuation considered?	TRUE
BC	Biodegradation Capacity (mg/L)	

Soil Parameters	Definition (Units)	Value		
		capillary	vadose	foundation
hc	Capillary zone thickness (cm)	5.0E+00		
hv	Vadose zone thickness (cm)	<u>3.4E+02</u>		
rho	Soil density (g/cm³)	1.7		
foc	Fraction of organic carbon in vadose zone	0.01		
phi	Soil porosity in vadose zone	<u>0.41</u>		
Lgw	Depth to groundwater (cm)	<u>3.4E+02</u>		
Ls	Depth to top of affected subsurface soil (cm)	<u>2.7E+02</u>		
Lsubs	Thickness of affected subsurface soils (cm)	<u>6.9E+01</u>		
pH	Soil/groundwater pH	<u>6.93</u>		
phi.w	Volumetric water content	<u>0.369</u>	0.13	0.12
phi.a	Volumetric air content	<u>0.041</u>	<u>0.28</u>	0.26

Building Parameters	Definition (Units)	Residential	Commercial
		Lb	Building volume/area ratio (cm)
ER	Building air exchange rate (s⁻¹)	1.4E-04	2.3E-04
Lcrk	Foundation crack thickness (cm)	1.5E+01	
eta	Foundation crack fraction	0.01	

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

**RBCA SITE ASSESSMENT**

**Tier 1 Worksheet 6.1**

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SURFACE SOIL RBSL VALUES  
( < 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			Inhalation of Volatiles and Particulates		Construction Worker	Applicable RBSL (mg/kg)	RBSL Exceeded ? * If yes	Required CRF
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Commercial: (on-site)			
71-43-2	Benzene	0.0E+0	NA	NA	NA	NA	1.7E+2	1.1E+2	1.1E+2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	0.0E+0	NA	NA	NA	NA	>Res	2.4E+2	2.4E+2	<input type="checkbox"/>	<1
108-88-3	Toluene	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	0.0E+0	NA	NA	NA	NA	>Res	>Res	>Res	<input type="checkbox"/>	<1

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.2

Site Name: Former Tosco (former Unocal) SS # 1871

Completed By: David J. Vossler

Site Location: 96 MacArthur Blvd., Oakland, Ca.

Date Completed: 4/19/1999

1 OF 1

**SUBSURFACE SOIL RBSL VALUES  
(> 3.3 FT BGS)**

Target Risk (Class A & B) 1.0E-6

MCL exposure limit?

Calculation Option: 1

Target Risk (Class C) 1.0E-5

PEL exposure limit?

Target Hazard Quotient 1.0E+0

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/kg)	Soil Leaching to Groundwater			X	Soil Volatilization to Indoor Air		X	Soil Volatilization to Outdoor Air		Applicable RBSL (mg/kg)	RBSL Exceeded ? * If yes	Required CRF Only if "yes" left
			Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential: (on-site)	Commercial: (on-site)					
71-43-2	Benzene	2.0E-1	NA	NA	NA	NA	2.3E-1	NA	2.5E+2	2.3E-1	<input type="checkbox"/>	<1		
100-41-4	Ethylbenzene	8.1E-1	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1		
1634-04-4	Methyl t-Butyl Ether	4.9E+0	NA	NA	NA	NA	2.0E+3	NA	>Res	2.0E+3	<input type="checkbox"/>	<1		
108-88-3	Toluene	2.9E-1	NA	NA	NA	NA	2.7E+2	NA	>Res	2.7E+2	<input type="checkbox"/>	<1		
1330-20-7	Xylene (mixed isomers)	1.9E+0	NA	NA	NA	NA	>Res	NA	>Res	>Res	<input type="checkbox"/>	<1		

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

**RBCA SITE ASSESSMENT**

Tier 1 Worksheet 6.3

Site Name: Former Tosco (former Unocal) SS # 1871  
 Site Location: 96 MacArthur Blvd., Oakland, Ca.

Completed By: David J. Vossler  
 Date Completed: 4/19/1999

1 OF 1

**GROUNDWATER RBSL VALUES**

Target Risk (Class A & B) 1.0E-6  MCL exposure limit?  
 Target Risk (Class C) 1.0E-5  PEL exposure limit?  
 Target Hazard Quotient 1.0E+0

Calculation Option: 1

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

CONSTITUENTS OF CONCERN		Representative Concentration (mg/L)	Groundwater Ingestion			Groundwater Volatilization to Indoor Air		Groundwater Volatilization to Outdoor Air		Applicable RBSL (mg/L)	RBSL Exceeded ? <input type="checkbox"/> If yes	Required CRF Only if "yes" left
CAS No.	Name		Residential: (on-site)	Commercial: (on-site)	Regulatory(MCL): (on-site)	Residential: (on-site)	Commercial: (on-site)	Residential (on-site)	Commercial: (on-site)			
71-43-2	Benzene	1.8E-2	NA	NA	NA	NA	7.1E-2	NA	4.1E+1	7.1E-2	<input type="checkbox"/>	<1
100-41-4	Ethylbenzene	6.6E-3	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1
1634-04-4	Methyl t-Butyl Ether	7.3E-1	NA	NA	NA	NA	3.7E+3	NA	>Sol	3.7E+3	<input type="checkbox"/>	<1
108-88-3	Toluene	1.0E-2	NA	NA	NA	NA	8.1E+1	NA	>Sol	8.1E+1	<input type="checkbox"/>	<1
1330-20-7	Xylene (mixed isomers)	1.7E-2	NA	NA	NA	NA	>Sol	NA	>Sol	>Sol	<input type="checkbox"/>	<1

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