

REPORT  
SUBSURFACE INVESTIGATION  
GOOD CHEVROLET  
1630 PARK STREET  
ALAMEDA, CALIFORNIA  
April 29, 1987

INTRODUCTION

This report presents the results of Groundwater Technology, Inc.'s Subsurface Investigation at Good Chevrolet, located at 1630 Park Street, Alameda, California (See Figure 1, Site Location Map). Groundwater Technology, Inc. (GTI) was retained in December 1986 to conduct an investigation of the Good Chevrolet property which, consisted of the installation of three monitoring wells, a review of regional hydrogeologic conditions and collection and laboratory analysis of soil and groundwater samples.

BACKGROUND

Subsurface hydrocarbon contamination was initially detected at this site during removal of two underground storage tanks by Petroleum Engineering, Inc. in October 1986. One 300 gallon waste oil tank and one 500 gallon gasoline tank were removed after on-site storage was discontinued. On October 22, 1986, Blaine Technical Services collected three soil samples from the two adjacent tank pits. The gasoline tank pit was initially sampled at ten feet below surface, then excavated to a depth of 14 feet, and re-sampled. These samples were analyzed for total

Tank Removal into.

**Risk-Based Screening Levels for Soil Gas**  
 This table shows the actual RBSL calculated, it  
 does not show "SAT"

Media	Exposure Pathway	Land Use	Type of Risk	Acenaph-thene	Acenaph-ethylene	Acetone	Anthra-cene	Arsenic	Barium	Benz(a)-anthracene	Benzene	Benz(a)-pyrene	Benz(b)-fluoranthene	Benz(g,h,i)-perylene	Benz(k)-fluoranthene	Beryllium	Bi(2-ethylhexyl)-phthalate	Butyl benzyl phthalate	Cadmium	Carbon Disulfide	
AIR	Indoor Air Inhalation (ug/m <sup>3</sup> )	Residential	Carcinogenic					6.7E-03		2.0E-02	2.0E-01	2.0E-02	2.0E-01		2.0E-01	1.1E-02	9.5E+00		5.3E-03		
			Hazard	9.4E+01	9.4E+01	1.6E+02	4.7E+02			2.2E-01		2.7E+00				6.3E+00		3.4E+01		7.8E-01	4.5E+00
		Commercial/Industrial	Carcinogenic					3.2E-02		9.8E-02	9.8E-01	9.8E-02	9.8E-01		9.8E-01	5.5E-02	4.6E+01		2.5E-02		
	Outdoor Air Inhalation (ug/m <sup>3</sup> )	Residential	Carcinogenic						8.4E-03		2.6E-02	1.0E+00	2.6E-02	2.6E-01		2.6E-01	1.4E-02	1.2E+01		6.7E-03	
			Hazard	1.4E+02	1.4E+02	2.3E+02	7.0E+02			3.3E-01		4.0E+00				9.4E+00		5.2E+01		1.2E+00	6.8E+00
		Commercial/Industrial	Carcinogenic					3.2E-02		9.8E-02	3.8E+00	9.8E-02	9.8E-01		9.8E-01	5.5E-02	4.5E+01		2.5E-02		
		Industrial	Hazard	8.2E+02	8.2E+02	1.4E+03	4.1E+03		1.9E+00		2.3E+01			5.5E+01		3.0E+02		6.8E+00	4.0E+01		
		Industrial	Hazard	8.2E+02	8.2E+02	1.4E+03	4.1E+03		1.9E+00		2.3E+01			5.5E+01		3.0E+02		6.8E+00	4.0E+01		
Soil Gas in Subsurface Soil	Vapor Intrusion to Buildings (ug/m <sup>3</sup> )	Residential	Carcinogenic							9.1E+03	3.3E+03	8.8E+03	2.3E+05		1.4E+05		2.3E+06				
			Hazard	5.6E+07	4.3E+07	3.1E+07	3.6E+08			1.4E+05		7.5E+05			2.1E+06		8.4E+06				1.1E+06
		Commercial/Industrial	Carcinogenic								1.4E+05	3.3E+05	1.4E+05	3.6E+06		2.3E+06		2.4E+06			3.2E+07
		Industrial	Hazard	1.6E+09	1.3E+09	8.1E+08	1.0E+10			2.2E+07			6.0E+07								
J&E Attenuation Coefficient	C <sub>soil</sub> C <sub>source</sub>	Residential	-	1.7E-06	2.2E-06	5.0E-06	1.3E-06	0.0E+00	0.0E+00	2.2E-06	3.5E-06	2.3E-06	9.1E-07	3.0E-06	1.4E-06	0.0E+00	4.1E-06	2.0E-06	0.0E+00	4.2E-06	
			-	5.1E-07	6.5E-07	1.5E-06	3.9E-07	0.0E+00	0.0E+00	6.8E-07	1.1E-06	7.0E-07	2.7E-07	9.1E-07	4.2E-07	0.0E+00	1.2E-06	6.0E-07	0.0E+00	1.3E-06	
		Commercial/Industrial	-	5.1E-07	6.5E-07	1.5E-06	3.9E-07	0.0E+00	0.0E+00	6.8E-07	1.1E-06	7.0E-07	2.7E-07	9.1E-07	4.2E-07	0.0E+00	1.2E-06	6.0E-07	0.0E+00	1.3E-06	

Good Chevrolet  
April 29, 1987

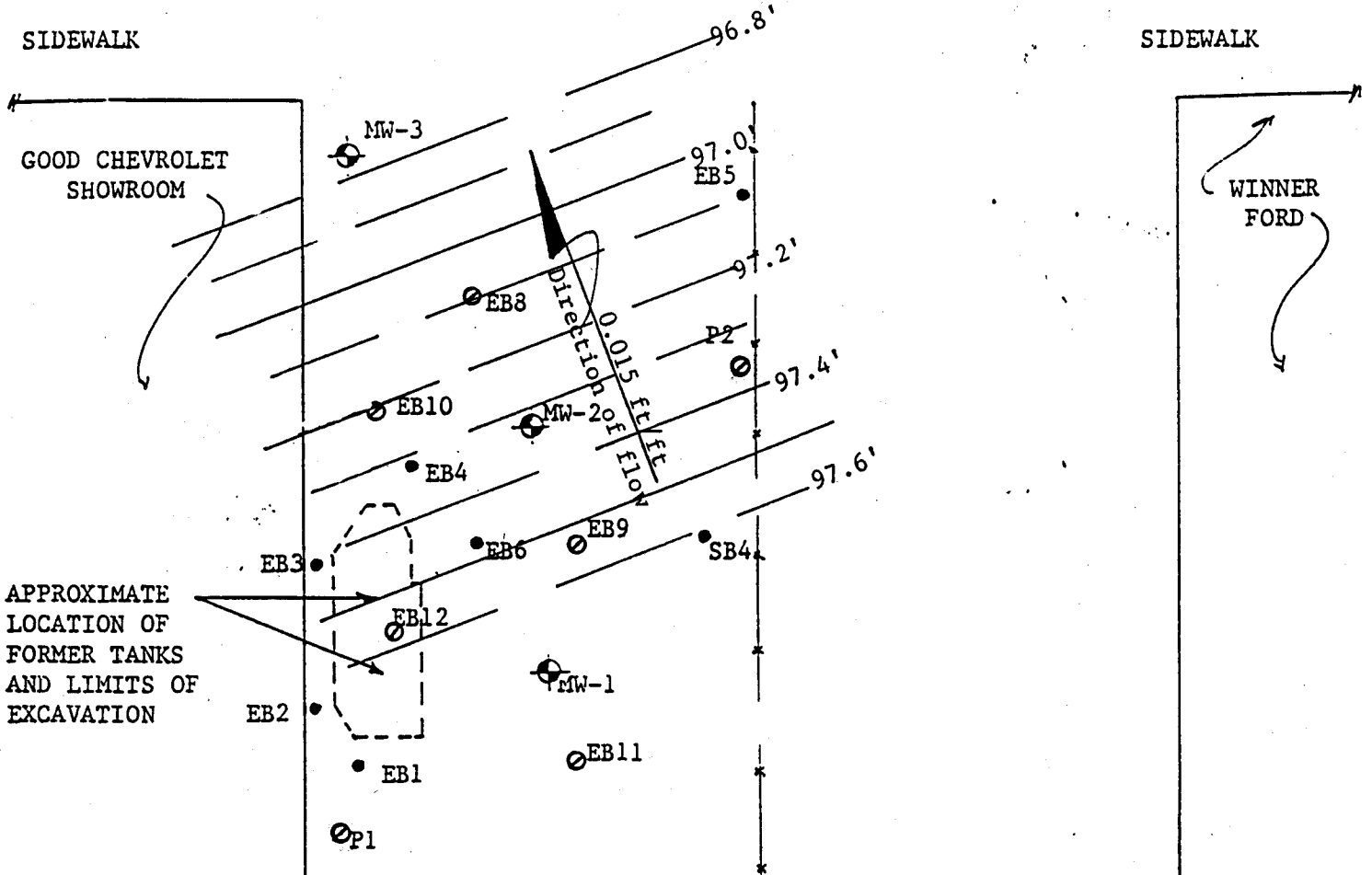
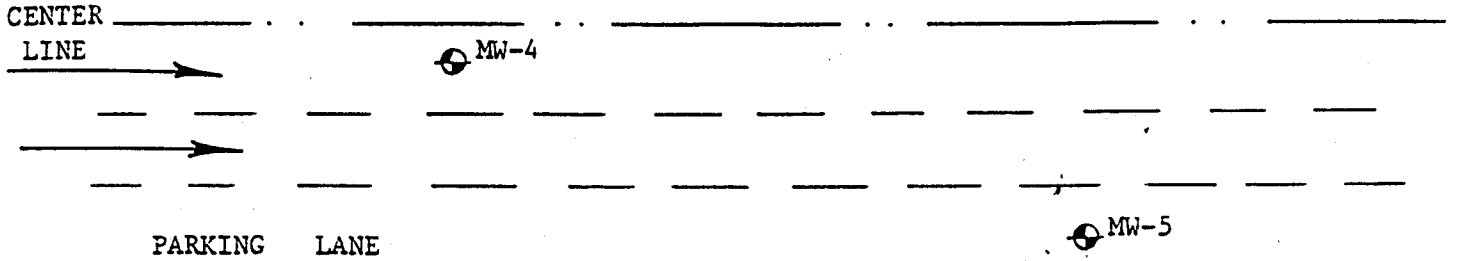
hydrocarbons as gasoline, and found to contain 2509 parts per million (ppm) and 1441 ppm, respectively. The waste oil tank pit was sampled at a depth of eight feet below grade, and was analyzed for total hydrocarbons as waste oil. The hydrocarbons concentration from this sample measured 57 ppm. Excavated soils were placed on site for aeration under the supervision of GTI.

#### SCOPE OF WORK

The purpose of this investigation was to provide a general assessment of potential hydrocarbon contamination and hydrogeologic conditions at the site. Specifically, our scope of services was as follows:

- ° Explore the subsurface by drilling five soil borings in the vicinity of the tank pit area; three to 20 feet below surface and two to 10 feet below surface.
- ° Collect soil samples at 5 foot intervals while drilling. Select soil samples for analyses of concentrations of benzene, toluene, xylene (BTX), total hydrocarbons (THC), lead, and polychlorinated biphenyls (PCB's).
- ° Convert three soil borings into monitoring wells to assess the extent of any groundwater contamination.
- ° Monitor groundwater levels in the wells to determine local groundwater gradient.

ARROW INDICATES DIRECTION OF TRAFFIC FLOW



JANUARY, 1997

	<u>CASING ELEVATION</u>	<u>DEPTH TO WATER</u>	<u>WATER ELEVATION</u>
MW-1	104.76	7.03	97.73
MW-2	104.86	7.55	97.31
MW-3	104.52	7.75	96.77
MW-4	104.86	----	----
MW-5	103.62	6.79	96.83

Note: Casing and ground water elevations based on Temporary Bench Mark (TBM) with an assumed elevation of 100.00 feet.

- ⊕ Monitoring Wells
- Borings Previous Studies
- ⊙ Borings Current Study

**GeoPlexus, Inc.**

GOOD CHEVROLET		
DATE 1/21/97	SCALE 1"=20'	DRAWN BY dgc
JAN, 97 GRADIENT PLAN		
		Figure 4

Good Chevrolet  
April 29, 1987

for PCB analysis. The results of the analyses are summarized in Table 1 below and the laboratory reports are presented in Appendix II.

TABLE I  
SOIL ANALYSIS

(ppm)

Sample I.D.	Benzene	Toluene	Xylene	Total Hydrocarbons	Lead	PCB
MW - 1 10'	2.9	3.6	1.8	24	1.3	ND
MW - 1 15'	ND	ND	ND	ND	1.3	ND
MW - 2 5'	ND	ND	ND	ND	.92	ND
MW - 2 10'	14	22	23	350	1.1	ND
MW - 3 10'	9.8	16	16	200	1.1	ND
MW - 3 15'	ND	ND	ND	ND	.74	°
SB - 5 10'	ND	.22	ND	6.5	47	ND

All analyses performed by Sequoia Laboratories, Redwood City, California. For method detection limits, See Appendix II.

\* - Analysis not performed  
ND - Not Detected

1630 Park

**SAMPLE SPREADSHEET FOR CALCULATION OF BENZENE RBSLs BASED ON ASTM RBCA GUIDANCE**  
**Leaking Underground Storage Tank Oversight Program**  
**Santa Clara Valley Water District**

INPUT PARAMETERS			SITE SPECIFIC		DEFAULT	
			Residential	Commercial	Residential	Commercial
Exposure	Target excess individual cancer risk [unitless]	TR	1.00E-05	<del>1.00E-05</del>	1.00E-06	1.00E-06
	Adult body weight [kg]	BW	70	70	70	70
	Averaging time for carcinogens [years]	AT_c	70	70	70	70
	Daily indoor inhalation rate [m3/day]	IR_air_ind	15	20	15	20
	Daily outdoor inhalation rate [m3/day]	IR_air_out	20	20	20	20
	Soil ingestion rate, mg/day	IR_soil	100	50	100	50
	Exposure frequency [days/year]	EF	350	250	350	250
	Exposure duration [years]	ED	30	25	30	25
	Oral relative absorption factor	RAF_o	1	1	1	1
	Skin surface area [cm2/day]	SA	3160	3160	3160	3160
	Soil to skin adherence factor [mg/cm2]	M	0.5	0.5	0.5	0.5
	Dermal relative absorption factor, volatiles/PAHs	RAF_d	0.5	0.5	0.5	0.5
	Averaging time for vapor flux [s]	tau	9.46E+08	7.88E+08	9.46E+08	7.88E+08
	Building	Enclosed space air exchange rate [L/s]	ER	0.00014	0.00023	0.00014
Enclosed space volume/infiltration area ratio [cm]		L_b	200	300	200	300
Enclosed space foundation or wall thickness [cm]		L_crack	15	15	15	15
Aerial fraction of cracks in foundations/walls [cm2 cracks/cm2 total area]		nju	0.01	0.01	0.01	0.01
Volumetric air content in in foundation/wall cracks [cm3 air/cm3 total volume]		Phi_acrack	0.26	0.26	0.26	0.26
Volumetric water content in foundation/wall cracks [cm3 water/cm3 total volume]		Phi_wcrack	0.12	0.12	0.12	0.12
Surface		Wind speed in ambient mixing zone [cm/s]	U_air	225	225	225
	Ambient air mixing zone height [cm]	delta_air	200	200	200	200
	Width of source area parallel to wind or groundwater flow direction [cm]	W	2400	2400	1500	1500
	Particulate emission rate [g/cm2-s]	P_o	6.9E-14	6.9E-14	6.90E-14	6.90E-14

INPUT PARAMETERS			SITE SPECIFIC		DEFAULT	
			Residential	Commercial	Residential	Commercial
Subsurface	Groundwater Darcy velocity [cm/year]	U_gw	1500	1500	2500	2500
	Infiltration rate of water through soil [cm/year]	I	15	15	30	30
	Groundwater mixing zone thickness [cm]	delta_gw	260	260	200	200
	Thickness of capillary fringe [cm]	h_cap	4.6	4.6	5	5
	Thickness of vadose zone [cm]	h_v	235.4	235.4	295	295
	Depth to subsurface soil sources [cm]	L_s	213	213	100	100
	Depth to groundwater [cm]	L_gw	240	240	300	300
	Lower depth of surficial soil zone [cm]	d	396	396	100	100
Soil	Total soil porosity [cm3/cm3 soil]	Phi_t	0.38	0.38	0.38	0.38
	Volumetric air content in vadose zone [cm3 air/cm3 soil]	Phi_as	0.26	0.26	0.26	0.26
	Volumetric water content in vadose zone [cm3 H2O/cm3 soil]	Phi_ws	0.12	0.12	0.12	0.12
	Volumetric air content in capillary fringe [cm3 air/cm3 soil]	Phi_acap	0.038	0.038	0.038	0.038
	Volumetric water content in capillary fringe [cm3 H2O/cm3 soil]	Phi_wcap	0.342	0.342	0.342	0.342
	Soil bulk density [g/cm3]	Ro_s	1.7	1.7	1.7	1.7
	Fraction of organic carbon in soil [unitless]	f_oc	0.01	0.01	0.01	0.01
Chemical	Inhalation slope factor [(mg/kg-day)-1]	SF_i	0.029	0.029	0.029	0.029
	Oral slope factor [(mg/kg-day)-1]	SF_o	0.1	0.1	0.1	0.1
	Henry's constant [cm3 H2O/cm3 air]	H	0.22	0.22	0.22	0.22
	Pure component solubility in water [mg/L]	S	1780	1780	1780	1780
	Carbon-water sorption coefficient [cm3 H2O/g C]	k_oc	38.02	38.02	38.02	38.02
	Soil-water sorption coefficient [cm3 H2O/g soil]	k_s	0.380	0.380	0.380	0.380
	Diffusion coeff. In air [cm2/s]	D_air	0.093	0.093	0.093	0.093
	Diffusion coeff. In water [cm2/s]	D_wat	0.000011	0.000011	0.000011	0.000011

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**Santa Clara Valley Water District**

CALCULATED TRANSPORT COEFFICIENTS		SITE SPECIFIC		DEFAULT	
		Residential	Commercial	Residential	Commercial
Effective diffusion coeff in soil based on vapor conc [cm2/s]	Deff_s	0.00722511	0.007225113	0.00722511	0.007225113
Effective diffusion coeff. Through capillary fringe [cm2/s]	Deff_cap	2.1732E-05	2.17324E-05	2.1732E-05	2.17324E-05
Effective diffusion coeff. From groundwater to surface [cm2/s]	Deff_ws	0.00098262	0.000982615	0.00110742	0.001107416
Effective diffusion coeff. Through foundation cracks [cm2/s]	Deff_crack	0.00725763	0.007257629	0.00725763	0.007257629
Volatilization factor from subsurface soil to enclosed space [mg/m3 air/mg/kg soil]	VF_s_esp	0.06867002	0.0278686	0.07353951	0.02964499
Volatilization factor from subsurface soil to ambient air [mg/m3 air/mg/kg soil]	VF_s_amb	0.0008216	0.0008216	0.00109375	0.00109375
Volatilization factor from surficial soil to ambient air (vapor) [mg/m3 air/mg/kg soil]	VF_ss	0.00014613	0.00016012	9.1334E-05	0.00010007
Volatilization factor from surficial soil to ambient air (particulates) [mg/m3 air/mg/kg soil]	VF_ss1	3.7953E-05	4.5563E-05	5.9901E-06	7.1912E-06
	VF_p	3.68E-12	3.68E-12	2.3E-12	2.3E-12
Volatilization factor from groundwater to enclosed space [mg/m3 air/mg/L H2O]	VF_w_esp	0.01742311	0.00707058	0.01645076	0.00667697
Volatilization factor from groundwater to ambient air [mg/m3 air/mg/L H2O]	VF_w_amb	4.8039E-05	4.8039E-05	2.707E-05	2.707E-05
Leaching factor from subsurface soils to groundwater [mg/L H2O/mg/kg soil]	LF_s_w	0.17444826	0.17444826	0.17044715	0.17044715

CALCULATED TARGET LEVELS		SITE SPECIFIC		DEFAULT		
		Residential	Commercial	Residential	Commercial	
AIR	RBSL for enclosed space air [ug/m3]	RBSL_air_esp	3.92E+00	4.93E+00	3.92E-01	4.93E-01
	RBSL for ambient air [ug/m3]	RBSL_air_amb	2.94E+00	4.93E+00	2.94E-01	4.93E-01
SOIL	Surficial soil - ingestion, inhalation of vapors and dust, dermal contact [mg/kg]	RBSL_s_surf	1.53E+01	2.59E+01	1.84E+00	3.25E+00
	Subsurface soil RBSL - Enclosed space vapor inhalation from subsurface soil [mg/kg]	RBSL_s_esp	5.70E-02	1.77E-01	5.32E-03	1.65E-02
	Subsurface soil RBSL - Ambient air vapor inhalation from subsurface soil [mg/kg]	RBSL_s_amb	3.57E+00		2.69E-01	4.51E-01
	Soil RBSL to protect groundwater MCL	RBSL_s_w_MCL	2.87E-02	2.87E-02	2.93E-02	2.93E-02
	Soil RBSL to protect groundwater RBSL enclosed space vapor inh. [mg/kg]	RBSL_s_w_esp	1.29E+00	4.00E+00	1.40E-01	4.34E-01
	Soil RBSL to protect groundwater RBSL ambient air vapor inh. [mg/kg]	RBSL_s_w_amb	3.50E+02	5.89E+02	6.36E+01	1.07E+02
	Concentration in soil at which pore-water and vapor become saturated [mg/kg]	C_s_sat	8.62E+02		8.62E+02	
GROUND- WATER	Groundwater RBSL - Enclosed space vapor inhalation from groundwater [mg/L]	RBSL_w_esp	2.25E-01	6.98E-01	2.38E-02	7.39E-02
	Groundwater RBSL - Ambient air vapor inhalation from groundwater [mg/L]	RBSL_w_amb	6.11E+01		1.08E+01	1.82E+01
	MCL	MCL	5.00E-03	5.00E-03	5.00E-03	5.00E-03

1630 Park

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**Leaking Underground Storage Tank Oversight Program**  
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INPUT PARAMETERS			SITE SPECIFIC		DEFAULT		
			Residential	Commercial	Residential	Commercial	
Exposure	Target excess individual cancer risk [unitless]	TR	1.00E-06	<del>1.00E-06</del>	1.00E-06	1.00E-06	
	Adult body weight [kg]	BW	70	70	70	70	
	Averaging time for carcinogens [years]	AT_c	70	70	70	70	
	Daily indoor inhalation rate [m3/day]	IR_air_ind	15	20	15	20	
	Daily outdoor inhalation rate [m3/day]	IR_air_out	20	20	20	20	
	Soil ingestion rate, mg/day	IR_soil	100	50	100	50	
	Exposure frequency [days/year]	EF	350	250	350	250	
	Exposure duration [years]	ED	30	25	30	25	
	Oral relative absorption factor	RAF_o	1	1	1	1	
	Skin surface area [cm2/day]	SA	3160	3160	3160	3160	
	Soil to skin adherence factor [mg/cm2]	M	0.5	0.5	0.5	0.5	
	Dermal relative absorption factor, volatiles/PAHs	RAF_d	0.5	0.5	0.5	0.5	
	Averaging time for vapor flux [s]	tau	9.46E+08	7.88E+08	9.46E+08	7.88E+08	
	Building	Enclosed space air exchange rate [L/s]	ER	0.00014	0.00023	0.00014	0.00023
		Enclosed space volume/infiltration area ratio [cm]	L_b	200	300	200	300
Enclosed space foundation or wall thickness [cm]		L_crack	15	15	15	15	
Aerial fraction of cracks in foundations/walls [cm2 cracks/cm2 total area]		nju	0.01	0.01	0.01	0.01	
Volumetric air content in in foundation/wall cracks [cm3 air/cm3 total volume]		Phi_acrack	0.26	0.26	0.26	0.26	
Volumetric water content in foundation/wall cracks [cm3 wate/cm3 total volume]		Phi_wcrack	0.12	0.12	0.12	0.12	
Surface		Wind speed in ambient mixing zone [cm/s]	U_air	225	225	225	225
	Ambient air mixing zone height [cm]	delta_air	200	200	200	200	
	Width of source area parallel to wind or groundwater flow direction [cm]	W	2400	2400	1500	1500	
	Particulate emission rate [g/cm2-s]	P_o	6.9E-14	6.9E-14	6.90E-14	6.90E-14	

INPUT PARAMETERS			SITE SPECIFIC		DEFAULT	
			Residential	Commercial	Residential	Commercial
Subsurface	Groundwater Darcy velocity [cm/year]	U_gw	1500	1500	2500	2500
	Infiltration rate of water through soil [cm/year]	I	15	15	30	30
	Groundwater mixing zone thickness [cm]	delta_gw	260	260	200	200
	Thickness of capillary fringe [cm]	h_cap	4.6	4.6	5	5
	Thickness of vadose zone [cm]	h_v	235.4	235.4	295	295
	Depth to subsurface soil sources [cm]	L_s	213	213	100	100
	Depth to groundwater [cm]	L_gw	240	240	300	300
	Lower depth of surficial soil zone [cm]	d	396	396	100	100
Soil	Total soil porosity [cm3/cm3 soil]	Phi_t	0.38	0.38	0.38	0.38
	Volumetric air content in vadose zone [cm3 air/cm3 soil]	Phi_as	0.26	0.26	0.26	0.26
	Volumetric water content in vadose zone [cm3 H2O/cm3 soil]	Phi_ws	0.12	0.12	0.12	0.12
	Volumetric air content in capillary fringe [cm3 air/cm3 soil]	Phi_acap	0.038	0.038	0.038	0.038
	Volumetric water content in capillary fringe [cm3 H2O/cm3 soil]	Phi_wcap	0.342	0.342	0.342	0.342
	Soil bulk density [g/cm3]	Ro_s	1.7	1.7	1.7	1.7
	Fraction of organic carbon in soil [unitless]	f_oc	0.01	0.01	0.01	0.01
Chemical	Inhalation slope factor [(mg/kg-day)-1]	SF_i	0.029	0.029	0.029	0.029
	Oral slope factor [(mg/kg-day)-1]	SF_o	0.1	0.1	0.1	0.1
	Henry's constant [cm3 H2O/cm3 air]	H	0.22	0.22	0.22	0.22
	Pure component solubility in water [mg/L]	S	1780	1780	1780	1780
	Carbon-water sorption coefficient [cm3 H2O/g C]	k_oc	38.02	38.02	38.02	38.02
	Soil-water sorption coefficient [cm3 H2O/g soil]	k_s	0.380	0.380	0.380	0.380
	Diffusion coeff. In air [cm2/s]	D_air	0.093	0.093	0.093	0.093
	Diffusion coeff. In water [cm2/s]	D_wat	0.000011	0.000011	0.000011	0.000011



SAMPLE SPREADSHEET FOR CALCULATION OF BENZENE RBSLs BASED ON ASTM RBCA GUIDANCE  
Leaking Underground Storage Tank Oversight Program  
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CALCULATED TRANSPORT COEFFICIENTS		SITE SPECIFIC		DEFAULT	
		Residential	Commercial	Residential	Commercial
Effective diffusion coeff in soil based on vapor conc [cm2/s]	Deff_s	0.00722511	0.007225113	0.00722511	0.007225113
Effective diffusion coeff. Through capillary fringe [cm2/s]	Deff_cap	2.1732E-05	2.17324E-05	2.1732E-05	2.17324E-05
Effective diffusion coeff. From groundwater to surface [cm2/s]	Deff_ws	0.00098262	0.000982615	0.00110742	0.001107416
Effective diffusion coeff. Through foundation cracks [cm2/s]	Deff_crack	0.00725763	0.007257629	0.00725763	0.007257629
Volatilization factor from subsurface soil to enclosed space [mg/m3 air/mg/kg soil]	VF_s_esp	0.06867002	0.0278686	0.07353951	0.02984499
Volatilization factor from subsurface soil to ambient air [mg/m3 air/mg/kg soil]	VF_s_amb	0.0008216	0.0008216	0.00109375	0.00109375
Volatilization factor from surficial soil to ambient air (vapor) [mg/m3 air/mg/kg soil]	VF_ss	0.00014613	0.00016012	9.1334E-05	0.00010007
Volatilization factor from surficial soil to ambient air (particulates) [mg/m3 air/mg/kg soil]	VF_ss1	3.7953E-05	4.5563E-05	5.9901E-06	7.1912E-06
	VF_p	3.68E-12	3.68E-12	2.3E-12	2.3E-12
Volatilization factor from groundwater to enclosed space [mg/m3 air/mg/L H2O]	VF_w_esp	0.01742311	0.00707058	0.01645076	0.00667597
Volatilization factor from groundwater to ambient air [mg/m3 air/mg/L H2O]	VF_w_amb	4.8039E-05	4.8039E-05	2.707E-05	2.707E-05
Leaching factor from subsurface soils to groundwater [mg/L H2O/mg/kg soil]	LF_s_w	0.17444826	0.17444826	0.17044715	0.17044715

CALCULATED TARGET LEVELS		SITE SPECIFIC		DEFAULT		
		Residential	Commercial	Residential	Commercial	
AIR	RBSL for enclosed space air [ug/m3]	RBSL_air_esp	3.92E-01	4.93E-01	3.92E-01	4.93E-01
	RBSL for ambient air [ug/m3]	RBSL_air_amb	2.94E-01	4.93E-01	2.94E-01	4.93E-01
SOIL	Surficial soil - ingestion, inhalation of vapors and dust, dermal contact [mg/kg]	RBSL_s_surf	1.53E+00	2.59E+00	1.84E+00	3.25E+00
	Subsurface soil RBSL - Enclosed space vapor inhalation from subsurface soil [mg/kg]	RBSL_s_esp	5.70E-03	1.77E-02	5.32E-03	1.65E-02
	Subsurface soil RBSL - Ambient air vapor inhalation from subsurface soil [mg/kg]	RBSL_s_amb	3.57E-01	4.93E-01	2.69E-01	4.51E-01
	Soil RBSL to protect groundwater MCL	RBSL_s_w_MCL	2.87E-02	2.87E-02	2.93E-02	2.93E-02
	Soil RBSL to protect groundwater RBSL enclosed space vapor inh. [mg/kg]	RBSL_s_w_esp	1.29E-01	4.00E-01	1.40E-01	4.34E-01
	Soil RBSL to protect groundwater RBSL ambient air vapor inh. [mg/kg]	RBSL_s_w_amb	3.50E+01	5.89E+01	6.36E+01	1.07E+02
	Concentration in soil at which pore-water and vapor become saturated [mg/kg]	C_s_sat	8.62E+02		8.62E+02	
GROUND- WATER	Groundwater RBSL - Enclosed space vapor inhalation from groundwater [mg/L]	RBSL_w_esp	2.25E-02	6.98E-02	2.38E-02	7.39E-02
	Groundwater RBSL - Ambient air vapor inhalation from groundwater [mg/L]	RBSL_w_amb	6.11E+00	1.03E+01	1.08E+01	1.82E+01
	MCL	MCL	5.00E-03	5.00E-03	5.00E-03	5.00E-03

1630 Park

**SAMPLE SPREADSHEET FOR CALCULATION OF BENZENE RBSLs BASED ON ASTM RBCA GUIDANCE**  
**Leaking Underground Storage Tank Oversight Program**  
**Santa Clara Valley Water District**

INPUT PARAMETERS			SITE SPECIFIC		DEFAULT	
			Residential	Commercial	Residential	Commercial
Exposure	Target excess individual cancer risk [unitless]	TR	1.00E-06	<b>1.00E-05</b>	1.00E-06	1.00E-06
	Adult body weight [kg]	BW	70	70	70	70
	Averaging time for carcinogens [years]	AT_c	70	70	70	70
	Daily indoor inhalation rate [m3/day]	IR_air_ind	15	20	15	20
	Daily outdoor inhalation rate [m3/day]	IR_air_out	20	20	20	20
	Soil ingestion rate, mg/day	IR_soil	100	50	100	50
	Exposure frequency [days/year]	EF	350	250	350	250
	Exposure duration [years]	ED	30	25	30	25
	Oral relative absorption factor	RAF_o	1	1	1	1
	Skin surface area [cm2/day]	SA	3160	3160	3160	3160
	Soil to skin adherence factor [mg/cm2]	M	0.5	0.5	0.5	0.5
	Dermal relative absorption factor, volatiles/PAHs	RAF_d	0.5	0.5	0.5	0.5
	Averaging time for vapor flux [s]	tau	9.46E+08	7.88E+08	9.46E+08	7.88E+08
	Building	Enclosed space air exchange rate [L/s]	ER	0.00014	0.00023	0.00014
Enclosed space volume/infiltration area ratio [cm]		L_b	200	300	200	300
Enclosed space foundation or wall thickness [cm]		L_crack	15	15	15	15
Aerial fraction of cracks in foundations/walls [cm2 cracks/cm2 total area]		nju	0.01	0.01	0.01	0.01
Volumetric air content in in foundation/wall cracks [cm3 air/cm3 total volume]		Phi_acrack	0.26	0.26	0.26	0.26
Volumetric water content in foundation/wall cracks [cm3 wate/cm3 total volume]		Phi_wcrack	0.12	0.12	0.12	0.12
Surface		Wind speed in ambient mixing zone [cm/s]	U_air	225	225	225
	Ambient air mixing zone height [cm]	delta_air	200	200	200	200
	Width of source area parallel to wind or groundwater flow direction [cm]	W	<b>2400</b>	2400	1500	1500
	Particulate emission rate [g/cm2-s]	P_o	6.9E-14	6.9E-14	6.90E-14	6.90E-14

INPUT PARAMETERS			SITE SPECIFIC		DEFAULT		
			Residential	Commercial	Residential	Commercial	
Subsurface	Groundwater Darcy velocity [cm/year]	U_gw	<b>1500</b>	1500	2500	2500	
	Infiltration rate of water through soil [cm/year]	I	<b>15</b>	15	30	30	
	Groundwater mixing zone thickness [cm]	delta_gw	<b>260</b>	260	200	200	
	Thickness of capillary fringe [cm]	h_cap	<b>4.6</b>	4.6	5	5	
	Thickness of vadose zone [cm]	h_v	<b>235.4</b>	235.4	295	295	
	Depth to subsurface soil sources [cm]	L_s	<b>91</b>	91	100	100	
	Depth to groundwater [cm]	L_gw	<b>240</b>	240	300	300	
	Lower depth of surficial soil zone [cm]	d	<b>279</b>	279	100	100	
	Soil	Total soil porosity [cm3/cm3 soil]	Phi_t	0.38	0.38	0.38	0.38
		Volumetric air content in vadose zone [cm3 air/cm3 soil]	Phi_as	0.26	0.26	0.26	0.26
Volumetric water content in vadose zone [cm3 H2O/cm3 soil]		Phi_ws	0.12	0.12	0.12	0.12	
Volumetric air content in capillary fringe [cm3 air/cm3 soil]		Phi_acap	0.038	0.038	0.038	0.038	
Volumetric water content in capillary fringe [cm3 H2O/cm3 soil]		Phi_wcap	0.342	0.342	0.342	0.342	
Soil bulk density [g/cm3]		Ro_s	1.7	1.7	1.7	1.7	
Fraction of organic carbon in soil [unitless]		f_oc	0.01	0.01	0.01	0.01	
Chemical		Inhalation slope factor [(mg/kg-day)-1]	SF_i	0.029	0.029	0.029	0.029
	Oral slope factor [(mg/kg-day)-1]	SF_o	0.1	0.1	0.1	0.1	
	Henry's constant [cm3 H2O/cm3 air]	H	0.22	0.22	0.22	0.22	
	Pure component solubility in water [mg/L]	S	1780	1780	1780	1780	
	Carbon-water sorption coefficient [cm3 H2O/g C]	k_oc	38.02	38.02	38.02	38.02	
	Soil-water sorption coefficient [cm3 H2O/g soil]	k_s	0.380	0.380	0.380	0.380	
	Diffusion coeff. In air [cm2/s]	D_air	0.093	0.093	0.093	0.093	
	Diffusion coeff. In water [cm2/s]	D_wat	0.000011	0.000011	0.000011	0.000011	

240 cm  
2.54 m

2.54 m  
2.95 m  
240 - 7.9  
279

*Geoplexus' site specific values, except benzene slope factor at 0.1 10<sup>-5</sup> risk*

SAMPLE SPREADSHEET FOR CALCULATION OF BENZENE RBSLs BASED ON ASTM RBCA GUIDANCE  
Leaking Underground Storage Tank Oversight Program  
Santa Clara Valley Water District

CALCULATED TRANSPORT COEFFICIENTS		SITE SPECIFIC		DEFAULT	
		Residential	Commercial	Residential	Commercial
Effective diffusion coeff in soil based on vapor conc [cm2/s]	Deff_s	0.00722511	0.007225113	0.00722511	0.007225113
Effective diffusion coeff. Through capillary fringe [cm2/s]	Deff_cap	2.1732E-05	2.17324E-05	2.1732E-05	2.17324E-05
Effective diffusion coeff. From groundwater to surface [cm2/s]	Deff_ws	0.00098262	0.000982615	0.00110742	0.001107416
Effective diffusion coeff. Through foundation cracks [cm2/s]	Deff_crack	0.00725763	0.007257629	0.00725763	0.007257629
Volatilization factor from subsurface soil to enclosed space [mg/m3 air/mg/kg soil]	VF_s_esp	0.0739572	0.03001452	0.07353951	0.02984499
Volatilization factor from subsurface soil to ambient air [mg/m3 air/mg/kg soil]	VF_s_amb	0.00192308	0.00192308	0.00109375	0.00109375
Volatilization factor from surficial soil to ambient air (vapor) [mg/m3 air/mg/kg soil]	VF_ss	0.00014613	0.00016012	9.1334E-05	0.00010007
Volatilization factor from surficial soil to ambient air (particulates) [mg/m3 air/mg/kg soil]	VF_ss1	2.674E-05	3.2102E-05	5.9901E-06	7.1912E-06
	VF_p	3.68E-12	3.68E-12	2.3E-12	2.3E-12
Volatilization factor from groundwater to enclosed space [mg/m3 air/mg/L H2O]	VF_w_esp	0.01742311	0.00707058	0.01645076	0.00667597
Volatilization factor from groundwater to ambient air [mg/m3 air/mg/L H2O]	VF_w_amb	4.8039E-05	4.8039E-05	2.707E-05	2.707E-05
Leaching factor from subsurface soils to groundwater [mg/L H2O/mg/kg soil]	LF_s_w	0.17444826	0.17444826	0.17044715	0.17044715

CALCULATED TARGET LEVELS		SITE SPECIFIC		DEFAULT		
		Residential	Commercial	Residential	Commercial	
AIR	RBSL for enclosed space air [ug/m3]	RBSL_air_esp	3.92E-01	4.93E+00	3.92E-01	4.93E-01
	RBSL for ambient air [ug/m3]	RBSL_air_amb	2.94E-01	4.93E+00	2.94E-01	4.93E-01
SOIL	Surficial soil - ingestion, inhalation of vapors and dust, dermal contact [mg/kg]	RBSL_s_surf	1.63E+00	2.79E+01	1.84E+00	3.25E+00
	Subsurface soil RBSL - Enclosed space vapor inhalation from subsurface soil [mg/kg]	RBSL_s_esp	5.29E-03	1.64E-01	5.32E-03	1.65E-02
	Subsurface soil RBSL - Ambient air vapor inhalation from subsurface soil [mg/kg]	RBSL_s_amb	1.53E-01	4.93E+00	2.69E-01	4.51E-01
	Soil RBSL to protect groundwater MCL	RBSL_s_w_MCL	2.87E-02	2.87E-02	2.93E-02	2.93E-02
	Soil RBSL to protect groundwater RBSL enclosed space vapor inh. [mg/kg]	RBSL_s_w_esp	1.29E-01	4.00E+00	1.40E-01	4.34E-01
	Soil RBSL to protect groundwater RBSL ambient air vapor inh. [mg/kg]	RBSL_s_w_amb	3.50E+01	5.89E+02	6.36E+01	1.07E+02
	Concentration in soil at which pore-water and vapor become saturated [mg/kg]	C_s_sat	8.62E+02		8.62E+02	
GROUND-	Groundwater RBSL - Enclosed space vapor inhalation from groundwater [mg/L]	RBSL_w_esp	2.25E-02	6.98E-01	2.38E-02	7.39E-02
	Groundwater RBSL - Ambient air vapor inhalation from groundwater [mg/L]	RBSL_w_amb	6.11E+00	1.08E+01	1.08E+01	1.82E+01
WATER	MCL	MCL	5.00E-03	5.00E-03	5.00E-03	5.00E-03