ALAMEDA COUNTY
HEALTH CARE SERVICES
AGENCY
DAVID J. KEARS, Agency Director

RAFAT A. SHAHID, Director

DEPARTMENT OF ENVIRONMENTAL HEALTH
Environmental Protection Division
1131 Harbor Bay Parkway, #250
Alameda, CA 94502-6577
(510) 567-6700

August 15, 1995
StID # 1486

REMEDIAL ACTION COMPLETION CERTIFICATION

Mr. Vince Tong
P.O. Box 13190
Oakland CA 94661

RE: On Time Towing, 3800 Wattling St., Oakland CA 94601

Dear Mr. Tong:

This letter confirms the completion of site investigation and remedial action for the one 6,000 gallon underground leaded gasoline tank at the above described location. Enclosed is the Case Closure Summary for the referenced site for your records.

Based upon the available information, including current land use, and with provision that the information provided to this agency was accurate and representative of site conditions, no further action related to the underground tank release is required.

This notice is issued pursuant to the regulation contained in Title 23, Division 3, Chapter 16, Section 2721 (e) of the California Code of Regulations. (If a change in land use is proposed, the owner must promptly notify this agency.)

Please contact Barney Chan at (510) 567-6765 if you have any questions regarding this matter.

Sincerely,

Jun Makishima

Jun Makishima
Acting Director of Environmental Health

c: Tom Peacock, Acting Chief, Hazardous Materials Division-files
Kevin Graves, RWQCB
Mike Harper, SWRCB

RACC3800

~~Site Summary for 400 Lancaster St., Oakland 94601~~

CASE CLOSURE SUMMARY
Leaking Underground Fuel Storage Tank Program

I. AGENCY INFORMATION

Date: 08/03/95

Agency name: **Alameda County-HazMat**   Address: **1131 Harbor Bay Parkway Rm 250, Alameda CA 94502**

City/State/Zip: **Alameda**   Phone: **(510) 567-6700**

Responsible staff person: Barney Chan   Title: **Hazardous Materials Spec.**

II. CASE INFORMATION

Site facility name: On Time Towing

Site facility address: 3800 Wattling St., Oakland CA 94601

RB LUSTIS Case No: **N/A**   Local Case No./LOP Case No.: 1486

ULR filing date: 7/26/95   SWEEPS No: **N/A**

Responsible Parties:	Addresses:	Phone Numbers:
Mr. Vince Tong	P.O. Box 13190 Oakland CA 94661	(510) 532-6200

Tank No:	Size in gal.:	Contents:	Closed in-place or removed?:	Date:
1	6,000	leaded gas	Removed	9/13/93

III RELEASE AND SITE CHARACTERIZATION INFORMATION

Cause and type of release: unknown

Site characterization complete?   Yes

Date approved by oversight agency: 7/26/95

Monitoring Wells installed?   No   Number:

Proper screened interval?   NA

Highest GW depth: Lowest depth:
Groundwater encountered at 10'bgs in borings
Flow direction: assumed north northwesterly, regional gradient

Leaking Underground Fuel Storage Program

Most sensitive current use: unknown

Are drinking water wells affected? No   Aquifer name:

Is surface water affected? No Nearest affected SW name: NA

Off-site beneficial use impacts (addresses/locations):

Report(s) on file? **Yes** Where is report(s)? Alameda County
                                    1131 Harbor Bay Parkway,
                                    Room 250, Alameda CA 94502-6577

Treatment and Disposal of Affected Material:

Material	Amount (include units)	Action (Treatment of Disposal w/destination)	Date
Tanks & Piping	1-6000 gallon gas	Disposed @ H&H Shipping San Francisco 94107	9/13/93
Soil	30 cubic yards	Disposed at Forward LF Manteca, 95336	4/29/94
	20 cubic yards	Reused "clean" as analyzed	9/13/93

Maximum Documented Contaminant Concentrations - - Before and After Cleanup

Contaminant	Soil (ppm)		* Water (ppb)	
	* *Before	After	Before	After
TPH (Gas)	2800	17	ND	
TPH (Diesel)	400	ND	ND	
Benzene	8.4	ND	ND	
Toluene	26	0.052	ND	
Ethylbenzene	13	0.02	ND	
Xylenes	86	0.25	ND	
Other Org Lead	ND	---	* hydropunch sample	
Semivolatiles:				
bis(2-ethylhexyl phthalate)	9.1	NA	common lab contaminant	
VOCs: 1,1,2-TCA	3.9	ND	0.8 (1,1,1TCA)	
cis-1,2-DCE	2.2	ND	0.7	
TCE	5.7	0.007	23	
TOG	6200	300		

** soil sample from near dispenser

Comments (Depth of Remediation, etc.): see site summary

IV.   CLOSURE
Does completed corrective action protect existing beneficial uses per the Regional Board Basin Plan?   YES

Leaking Underground Fuel Storage Tank Program

Does completed corrective action protect potential beneficial uses per the Regional Board Basin Plan?   YES

Does corrective action protect public health for current land use?   YES

Site management requirements: NA

Should corrective action be reviewed if land use changes?   Yes

Monitoring wells Decommisioned: NA

Number Decommisioned: NA   Number Retained:

List enforcement actions taken: None

List enforcement actions rescinded:None

V.   LOCAL AGENCY REPRESENTATIVE DATA

Name: Barney M. Chan   Title: Hazardous Materials Specialist

Signature: *Barney M Chan*   Date: 8/3/95

Reviewed by

Name: Madhulla Logan   Title: Hazardous Materials Specialist

Signature: *Madhulla Logan*   Date: 8/1/95

Name: Eva Chu   Title: Haz. Mat. Specialist

Signature: *Eva Chu*   Date: 7/26/95

VI.   RWQCB NOTIFICATION

Date Submitted to RB: RB Response: *Approved*

RWQCB Staff Name: K. Graves   Title: AWRCE   Date: 8/11/95

VII. ADDITIONAL COMMENTS, DATA, ETC.

Site Summary for 3800 Wattling St., Oakland 94601,
On Time Towing

September 13, 1993- One approximately 6000 gallon gasoline tank
was removed from site. Tank was located outside of building
which was being used as an auto service shop. Tank was observed
to have had several small holes on its bottom. The dispenser was
located adjacent to the tank. Two soil samples were taken
approx. 1-2' beneath the ends of the tank. One soil sample was
taken beneath the dispenser at approx. 3' depth. The soil
samples beneath the tank did not detect gasoline, BTEX or organic
lead. The soil sample 3' bgs beneath the dispenser detected 2800
ppm gasoline and 8.4,26,86 and 13 ppm BTEX respectively. A sink
was observed to be next to the dispenser. (P~1-3)

October 5, 1993- Based on the initial results, overexcavation of
the dispenser was performed and another soil sample taken at 4' (5-1)
bgs. This area appeared to be contaminated with oil therefore
all the waste oil parameters were run on this sample. The
laboratory stated that this overexcavation sample detected a
hydrocarbon mixture lighter than diesel and it "seems to be paint
thinner". The overexcavation sample contained: 66 ppm gasoline
(thinner), 400 ppm diesel, 6200 ppm petroleum oil and grease,
3900 ppb 1,1,2 TCA, 2200 ppb 1,2-DCE, 710 ppb ethylbenzene, 8200
ppb total xylenes and 5700 ppb TCE. No benzene or toluene was
detected. The chlorinated solvents are atypical of a gasoline
release and support the possibility of another source.

November 29,1993- Additional overexcavation was performed in the
dispenser area. 15-20 cubic yards of soil was excavated and five
confirmatory soil samples were taken, four from the sidewalls at
4' depth and one from the pit bottom at 5' depth. Results
indicate that the excavation was successful with only slight
amounts of TOG, gasoline and TEX remaining. No VOCs were
detected in these samples.

August 4, 1994- Based on the above results, a request for a work
plan for soil and groundwater investigation was written to Mr.
Vince Tong, the property owner.

September 7, 1994- Received correspondence from Mr. Harold
Smith, attorney for Mr. Tong, stating that he questioned the
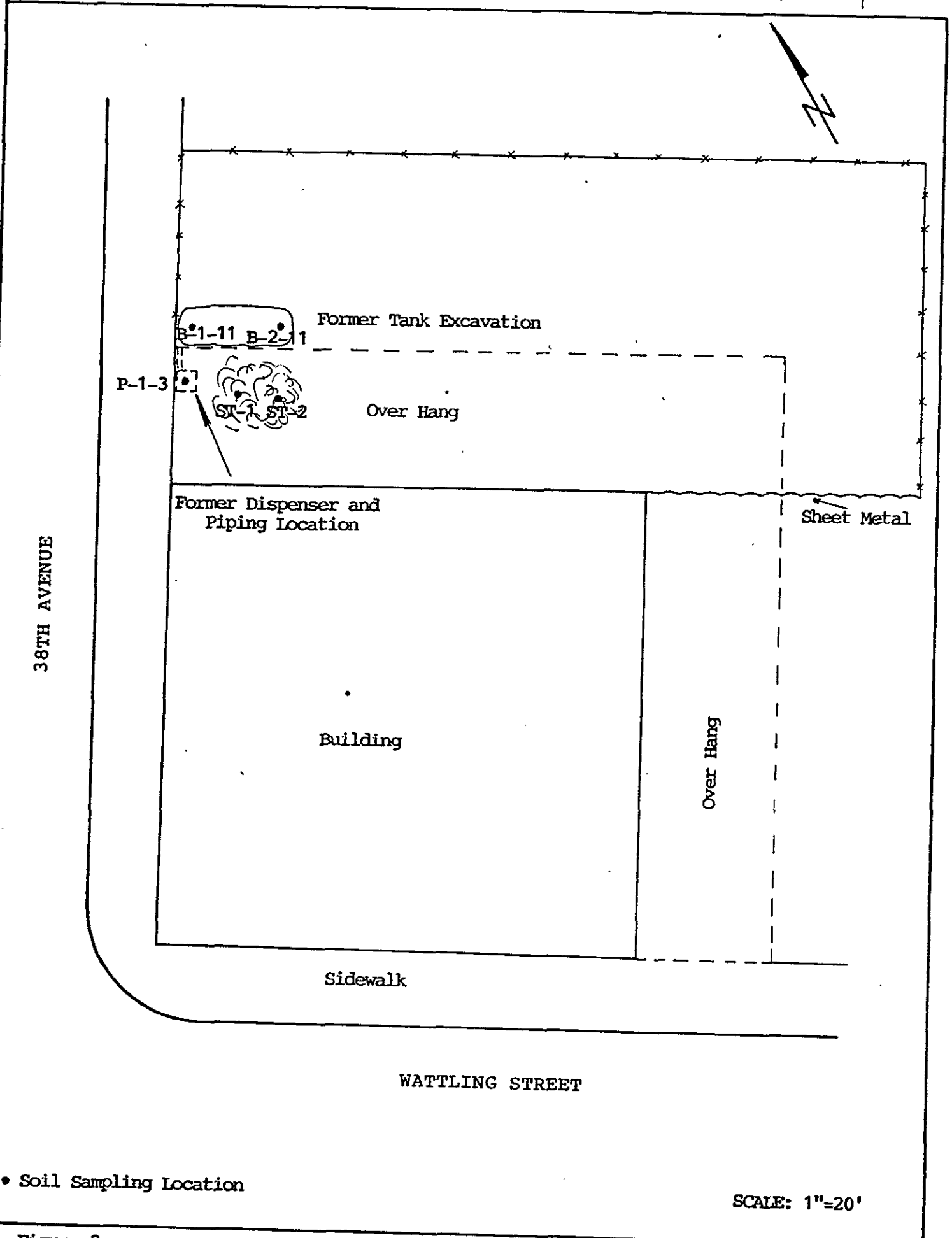County's need for a work plan.

November 22, 1994- First pre-enforcement meeting with County, D.
A. Office, RWQCB, Mr. Tong and Mr. Smith. Information was
provided that the current tenant may be an additional responsible
party. Reset pre-enforcement hearing for January 24, 1995.

April 4, 1995- Subsequent to the reset pre-enforcement hearing, a request for technical report pursuant to 13267 of the Water Code was issued to Mr. Tong and Mr. Dubberly. A June 20, 1995 work plan for soil borings and grab groundwater sampling was submitted and performed on June 30, 1995. Four borings, BH-A,B,C and D, were advanced, one within the former dispenser excavation and three in the assumed downgradient direction to the former tank dispenser. Boring D was advanced because Boring A did not yeild any water. Soil samples from just above groundwater and grab groundwater samples were taken from each boring. Results indicate little to no gasoline, diesel, TOG, BTEX or VOCs (including chlorinated solvents) in the soil. The grab groundwater samples were ND for gasoline, diesel, TOG and BTEX and detected up to 2.8 mg/l TPHo, 0.8 ppb 1,1,1 TCA, 0.7 ppb cis-1,2-DCE and 23 ppb TCE. The concentrations of TCA and cis-DCE are below their respective MCLs while the MCL for TCE is 5 ppb.

Based on these results, no further work is recommended for this site. This decision is based on:

1. The fairly complete excavation of contaminated soils;

2. The only VOC detected above MCL was TCE at 23 ppb. This was found in a grab groundwater sample. If we assume that this concentration is representative of groundwater conditions, a Health Risk Assessment conducted at a nearby site, the former Del Monte Plant at 3100 E. 9th St., asserted that up to 17,000 ppb TCE would be required in water to present a 10-6 risk. (see attachment).

3. The low concentrations of TCE indicate a plume of limited area.

ssum3800

Former Tank Excavation

B-1-11 B-2-11

P-1-3

ST-1 ST-2

Over Hang

Former Dispenser and
Piping Location

Sheet Metal

38TH AVENUE

Building

Over Hang

Sidewalk

WATTLING STREET

• Soil Sampling Location

SCALE: 1"=20'

Figure 2

TABLE 1 CONT'D
SUMMARY OF SOIL ANALYSIS RESULTS
FROM OCTOBER 5, 1993
IN
PARTS PER MILLION (ppm)

1st sple taken beneath initial piping / dispenser

2. TOG AND SEMI-VOLATILE ORGANICS COMPOUNDS (EPA METHOD 8270) RESULTS

Date	Sample No.	TOG	Semi-Volatile Organics	Detected
10/05/93	S-1	6,200	bis(2-Ethylhexyl) Phthalate	9.1
	P-1-4	NA	Not Analyzed	
	P-1-5	NA	Not Analyzed	
	P-1-6	NA	Not Analyzed	

3. TOG AND VOLATILE ORGANICS COMPOUNDS (EPA METHOD 8240) RESULTS *ppm*

Date	Sample Number	Volatile Organics Compounds	Detected
10/05/93	S-1	1,1,2-Trichloroethane 1,2-Dichloroethene Trichloroethene	3.9 2.2 5.7
	P-1-4	Not Analyzed	
	P-1-5	Not Analyzed	
	P-1-6	Not Analyzed	

TOG - Total Oil & Grease
ND - Not Detected (Below Laboratory Detection Limit)

SOIL TECH ENGINEERING, INC.   T2

TABLE 1
SUMMARY OF SOIL ANALYSIS RESULTS
FROM OCTOBER 5, 1993
IN
PARTS PER MILLION (ppm)

1. TPHD, TPHG AND BTEX RESULTS

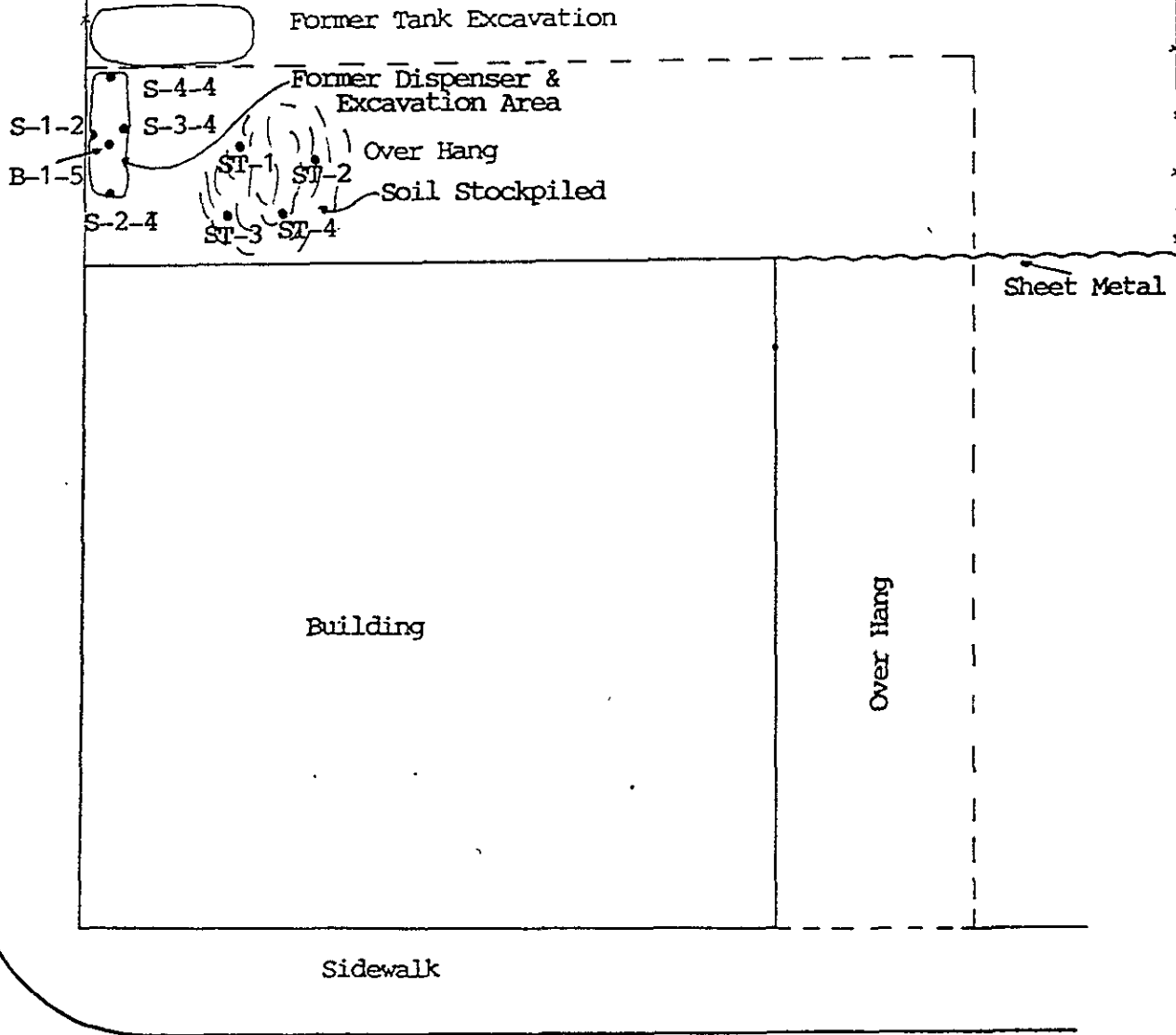| Date	Sample Number	Depth feet	TPHd	TPHg	B	T	E	X
10/05/93	S-1	1	400	66	ND	ND	0.71	8.2
	P-1-4	4	NA	NA	NA	NA	NA	NA
	P-1-5	5	NA	NA	NA	NA	NA	NA
	P-1-6	.6	NA	NA	NA	NA	NA	NA

what were these Samples (handwritten)

TPHd - Total Petroleum Hydrocarbons as diesel
TPHg - Total Petroleum hydrocarbons as gasoline
BTEX - Benzene, Toluene, Ethylbenzene, Total Xylenes
  NA - Not Analyzed
  ND - Not Detected (Below Laboratory Detection Limit)

SOIL TECH ENGINEERING, INC.   T1

11/29/93
Additional over excavation samples N

Former Tank Excavation

S-4-4

Former Dispenser &
Excavation Area

S-1-2   S-3-4

B-1-5   Over Hang

ST-1   ST-2

Soil Stockpiled

S-2-4

ST-3   ST-4

Sheet Metal

38TH AVENUE

Building

Over Hang

Sidewalk

WATTLING STREET

• Soil Sampling Location

SCALE: 1"=20'

Figure 2   SOIL TECH ENGINEERING, INC.   M2

TABLE 2 CONT'D
SUMMARY OF SOIL ANALYSIS RESULTS
FROM NOVEMBER 29, 1993
IN
PARTS PER MILLION (ppm)

2. TOG AND HALOGENATED VOLATILE ORGANICS (PER EPA METHODS 8010) RESULTS

Date	Sample Number	Depth (ft.)	TOG	VOC's Detected
11/29/93	S-1-2	2	300	Not Detected
	S-2-4	4	ND	Not Detected
	S-3-4	4	·80	Not Detected
	S-4-4	4	ND	Not Detected
	B-1-5	5	ND	Not Detected

TOG - Total Oil & Grease
ND - Not Detected (Below Laboratory Detection Limit)

SOIL TECH ENGINEERING, INC.   T4

TABLE 2
SUMMARY OF SOIL ANALYSIS RESULTS
FROM NOVEMBER 29, 1993
IN
PARTS PER MILLION (ppm)

1. TPHD, TPHG AND BTEX RESULTS

Date	Sample Number	Depth feet	TPHd	TPHg	B	T	E	X
11/29/93	S-1-2	2	ND	2.3	ND	0.01	ND	0.027
	S-2-4	4	ND	ND	ND	ND	ND	ND
	S-3-4	4	ND	ND	ND	ND	ND	ND
	S-4-4	4	ND	17	ND	0.052	0.02	0.25
	B-1-5	• 5	ND	ND	ND	ND	ND	ND

TPHd - Total Petroleum Hydrocarbons as diesel
TPHg - Total Petroleum hydrocarbons as gasoline
BTEX - Benzene, Toluene, Ethylbenzene, Total Xylenes
  ND - Not Detected (Below Laboratory Detection Limit)

June 30, 1995 Borings

FENCE

ASSUMED GROUNDWATER
FLOW DIRECTION

BH-A
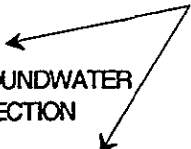
FORMER PUMP DISPENSER
AND UST EXCAVATION

BH-D

BH-C

OVERHANG

BH-B

3
8
T
H

A
V
E
N
U
E

S
I
D
E
W
A
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K

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V
E
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A
N
G

BUILDING

SIDEWALK

WATTLING STREET

LEGEND

● BORING LOCATION

SCALE
1" = 20'

BORING LOCATION MAP

Tong Property
3800 Wattling Street
Oakland, California

AQUA SCIENCE ENGINEERS, INC. | Figure 2

TABLE ONE
Summary of Analytical Results of SOIL Samples
Total Petroleum Hydrocarbons and BTEX
All results are in parts per million

Boring Location	Sample Depth	TPH Gasoline	TPH Diesel	Oil & Grease (Hydro-carbon)	Benzene	Toluene	Ethyl Benzene	Total Xylenes
BH-A	10.0'	<1	20	180	<0.005	<0.005	<0.005	<0.005
BH-B	10.0'	<1	<10	<10	<0.005	<0.005	<0.005	<0.005
BH-C	9.0'	3	<10	40	<0.005	<0.005	<0.005	0.009
EPA METHOD		5030/ 8015	3550/ 8015		8020	8020	8020	8020

Note:
Total oil and grease concentrations contain the hydrocarbon oil and grease portions noted above plus an additional 10 parts per million background.

TABLE TWO
Summary of Analytical Results of SOIL Samples
Volatile Organic Compounds by EPA Method 8010
All results are in parts per million

Boring Location	Sample Depth	TCE	Other VOCs
BH-A	10.0'	0.007	N.D.
BH-B	10.0'	<0.005	N.D.
BH-C	9.0'	<0.005	N.D.

Notes:
TCE = Trichloroethene
VOCs = Volatile organic compounds by EPA Method 8010
N.D. = Not detected at detection limits between 0.005 and 0.02 parts per million

TABLE THREE
Summary of Analytical Results of GROUNDWATER Samples
Total Petroleum Hydrocarbons and BTEX
All results are in parts per billion

Boring Location	TPH Gasoline	TPH Diesel	TPH Oil	Oil & Grease	Benzene	Toluene	Ethyl Benzene	Total Xylenes
BH-B	<50	<50	---	<500	<0.5	<0.5	<0.5	<2
BH-C	<50	<50	---	<500	<0.5	<0.5	<0.5	<2
BH-D	<50	<90	2,800	---	<0.5	<0.5	<0.5	<2
EPA METHOD	5030/ 8015	3550/ 8015	3510/ 8015	5520 C&F	8020	8020	8020	8020

TABLE FOUR
Summary of Analytical Results of GROUNDWATER Samples
Volatile Organic Compounds by EPA Method 8010
All results are in parts per billion

Boring Location	TCE	Cis-1,2-DCE	1,1,1-TCA	Other VOCs
BH-B	17	0.7	<0.5	N.D.
BH-C	1·1	<0.5	<0.5	N.D.
BH-D	23	<0.5	0.8	N.D.
DTSC MCL	5	6	200	

Notes:
TCE = Trichloroethene
Cis-1,2-DCE = Cis-1,2-Dichloroethene
1,1,1-TCA = 1,1,1-Trichloroethane
VOCs = Volatile organic compounds by EPA Method 8010
N.D. = Not detected at detection limits between 0.5 and 2 parts per billion
DTSC MCL = California Department of Toxic Substances Control maximum contaminant
level for drinking water

4.1 Potentially Exposed Populations

Under the future land use scenario, the site will be developed into a retail shopping center. The redeveloped site will include commercial/retail buildings, paved parking areas, and limited landscaped areas. Individuals present at the site would likely include commercial workers, maintenance workers and the public.

4.2 Potential Exposure Pathways

see note Potential pathways of exposure to VOCs in groundwater would include direct contact with groundwater and transport of VOCs from groundwater through soil and through the foundation of a building or into ambient air. Shallow groundwater at the site is not currently used as a drinking water supply source nor is it expected to be in the future due to the aquifer's discontinuous structure, limited thickness, and limited areal distribution. Currently, the water supply source for the area is municipal. Therefore, this is not a complete pathway and is not further evaluated in this HRA.

Future onsite workers/public could be exposed to VOCs in groundwater through the migration of VOCs from groundwater through soil and into the foundation of a building. Air migration of VOCs can occur following volatilization of chemicals from groundwater. Volatilization of chemicals from water is calculated using the Henry's law constant for a given chemical. Henry's law constant is a measure of the chemical partitioning between air and water at equilibrium. The higher the constant, the more likely a chemical is to volatilize than remain in water. Depth to groundwater in the area ranges from 12 to 25 feet bgs.

Since most of the redeveloped site will be covered with buildings and paved parking, volatilization into ambient air is not likely to be a significant exposure pathway. Even if the parking area was not completely paved, emissions into ambient air would be expected to be less than those in a building due to dilution and mixing.

Based on potential air concentrations, exposure duration and frequency, future onsite commercial workers are expected to be the maximally exposed population and are quantitatively addressed in the HRA.

4.3 Quantification of Exposure

The following equation is used for calculating chemical intake from inhalation of volatile chemicals in air:

$$I = (CA \times BR \times EF \times ED)/(BW \times AT)$$

where:

I	=	chemical intake (mg/kg body weight/day)
CA	=	chemical concentration in air (mg/m^3)
BR	=	breathing rate (m^3/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

To evaluate worker exposure, this HRA uses an inhalation rate of 20 m^3/day, an exposure frequency of 250 days/year, an exposure duration of 25 years, and a lifetime average body weight of 70 kg (CAL-EPA, 1992).

4.4 Estimated Air Concentrations

Concentrations of VOCs that may diffuse into a building built above groundwater have been estimated based on existing groundwater concentration data. Estimation of the flux of VOCs from groundwater to the soil surface was calculated using existing data in conjunction with Fick's first law of diffusion. The concentration of VOCs inside a commercial building were then calculated based on these flux estimates.

Potential gas concentrations within a future onsite building were estimated by incorporating calculated soil-gas concentrations into equations that calculate the flux through unsaturated soil and into a building foundation. Soil-gas concentrations were estimated using the maximum chemical concentrations detected in groundwater. The methodology for estimating air concentrations inside a building are presented in Attachment I. Estimated air concentrations are shown in Table 2.

Table 2 Chemical Concentrations in Air Inside a Building		
Chemical	**Maximum Groundwater Concentration (μg/l)**	**Air Concentration (mg/m^3)**
1,1-DCE	1.0	0.3
cis-1,2-DCE	3.3	0.1
trans-1,2-DCE	1.7	0.1
PCE	2.1	0.2
TCE	280	23.3

5.0 Toxicity Assessment

Human health effects are divided into two broad categories; noncancer and cancer effects. This division is based on different mechanisms of action associated with each category. Chemicals posing noncancer risks may have cancer effects, also.

Toxicity values, which are a quantitative expression of the dose-response relationship for a chemical, take the form of reference doses (RfDs) for noncarcinogenic effects and cancer slope factors (CSFs) for carcinogenic effects. Both RfDs and CSFs are specific to the exposure route.

The RfD is generally expressed in units of milligram per kilogram body weight per day (mg/kg-day). Inhalation RfDs may be expressed as either mg/kg-day or mg/m^3 air. Chronic RfDs are an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure to the human population, including sensitive populations, that is likely to be without appreciable risk of deleterious effects during a lifetime (EPA, 1989).

Generally, the CSF is a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The approach used to estimate the CSF from animal studies or human data assumes a dose-response relationship with no threshold. There is uncertainty and conservatism built into the risk extrapolation approach. Cancer risks estimated by this method produce an estimate that provides a rough but plausible upper limit of risk: i.e., it is not likely that the true risk would be much more than the estimated risk, but could be considerably lower (EPA, 1989).

The priority for sources of toxicity values used in this HRA was as follows:

- CAL-EPA compilation of cancer potency factors (CAL-EPA, 1994a).

- US EPA Integrated Risk Information System (IRIS) database (US EPA, 1995a).

- Health Effects Assessment Summary Tables (HEAST) issued by US EPA's Office of Research and Development (US EPA, 1994)

- Provisional toxicity values developed by the US EPA Environmental Criteria and Assessment Office (ECAO) (US EPA, 1995b).

The RfDs and CSFs used in this HRA are presented in Table 3.

Table 3 Toxicity Values					
Chemical	RfD (mg/kg-day)	Source	CSF (mg/kg-day)$^{-1}$	Source	Weight of Evidence (a)
1,1-DCE	0.009	IRIS (a)	0.175	IRIS	C
cis-1,2-DCE	0.01	HEAST (a)	--	--	D
trans-1,2-DCE	0.02	IRIS (a)	--	--	D
PCE	0.01	IRIS (a)	0.021	CAL-EPA	C-B2
TCE	0.006	ECAO (a)	0.01	CAL-EPA	B2

(a) The oral RfD has been used for chemicals with no inhalation RfD.
(b) US EPA Weight of Evidence Classification:
    A = Human carcinogen
    B = Probable human carcinogen
        B1 = Limited evidence of carcinogenicity in humans.
        B2 = Sufficient evidence of carcinogenicity in animals with inadequate or lack of
        evidence in humans.
    C = Possible human carcinogen.
    D = Not classified as to human carcinogenicity.

6.0 Risk Characterization

The risk characterization integrates the toxicity and exposure assessments to estimate the potential risks to workers from exposure to site chemicals. The exposure scenarios are evaluated by estimating the noncarcinogenic and carcinogenic risks associated with them. The estimation of risk assumes that exposure remains constant over the exposure periods assessed (i.e., contaminant concentrations and intake levels are constant).

6.1 Noncarcinogenic Risks

Noncarcinogenic risk is assessed by comparing the estimated daily intake of a chemical to its RfD. The estimated intake of each chemical through an individual route of exposure is divided by its RfD. The resulting quotients are termed noncancer hazard quotients. When the hazard quotient exceeds one (i.e., intake exceeds RfD), there is potential for health concern (CAL-EPA, 1994b).

To assess the potential for noncarcinogenic effects posed by multiple chemicals, a "hazard index" approach is used. The method assumes dose additivity. Hazard quotients are summed to provide a hazard index. When the hazard index exceeds one, there is potential for health risk.

6.2 Carcinogenic Risks

The potential for carcinogenic effects is evaluated by estimating the excess lifetime cancer risk, which is the probability of developing cancer during one's lifetime over the background probability of developing cancer (i.e., if no exposure to site contaminants occurred). For example, a 1×10^{-6} excess lifetime cancer risk means that for every 1 million people exposed to the carcinogen throughout their lifetime (which is typically assumed to be 70 years) at the defined exposure conditions, the average incidence of cancer is increased by one extra case of cancer. According to the CAL-EPA, an estimated cancer risk of greater than 10^{-6} indicates the presence of contamination which may pose a significant threat to human health (CAL-EPA, 1994b).

Because of the methods used to estimate CSFs, the excess lifetime cancer risks estimated in this HRA should be regarded as upper bounds on the potential cancer risks rather than an accurate representation of true cancer risk. The actual risk could be as low as zero.

Although synergistic or antagonistic interactions might occur among chemicals at the site, at this time there is insufficient information in the toxicological literature to predict quantitatively the effects of such interactions. Carcinogenic risks are treated in this HRA as additive within the route of exposure.

6.3 Estimated Risks - Transport of VOCs into a Building

The exposure scenario for the Del Monte Plant assumes a commercial worker could be exposed to VOCs present in groundwater through volatilization and transport through soil into air inside a future onsite building. The estimated hazard quotients and excess lifetime cancer risks for this exposure scenario are summarized in Table 4.

Table 4 Estimated Excess Lifetime Cancer Risks and Noncancer Hazard Quotients (a)		
Chemicals	**Excess Lifetime Cancer Risk**	**Noncancer Hazard Quotient**
1,1-DCE	3×10^{-9}	0.000006
cis-1,2-DCE	--(b)	0.000002
trans-1,2-DCE	--(b)	0.000001
PCE	3×10^{-10}	0.000004
TCE *for 280 μg/ℓ*	2×10^{-8}	0.0008
(a) Based on worker inhalation exposure to VOCs inside a building. (b) Cis- and trans-1,2-DCE have no cancer slope factors.		

The estimated hazard quotient was less than one for all five chemicals evaluated. The estimated hazard index, or sum of all hazard quotients, is also less than one. The estimated excess lifetime cancer risk for each of the chemicals evaluated is below 10^{-6}, a risk level considered acceptable by CAL-EPA. The sum of the individual chemical risk is also below 10^{-6}.

7.0 Summary

The property containing Del Monte Plants 37 and 237 is expected to be redeveloped into a retail shopping center. During investigations of groundwater beneath the property, VOCs were detected. These chemicals present in groundwater beneath the site could volatilize and migrate through soil into ambient air or air inside a future onsite building. However, due to planned paving of the area, volatilization into ambient air is not likely to be a significant exposure pathway. In addition, groundwater is not expected to be used as a municipal source of water. Therefore, the purpose of this HRA was to quantitatively evaluate potential health risks to future onsite workers (the potentially maximally exposed population) due to volatilization of chemicals from groundwater and transport through soil to air inside of a future onsite building.

The results of the HRA show that the estimated noncancer hazard index is less than one, the level considered by CAL-EPA to be the noncancer level of concern. In addition, the estimated excess lifetime cancer risk is below 10^{-6}, a risk level considered acceptable by CAL-EPA.

For comparison purposes, groundwater concentrations corresponding to a hazard quotient of one or a cancer risk of 10^{-6} (whichever is lower) were calculated for the five VOCs of concern. These risk-based concentrations are presented in Table 5 along with the maximum concentrations detected onsite. As shown in this table, detected concentrations are at least 60 times lower than the calculated values.

Table 5		
Risk-Based Concentrations for Groundwater		
Chemical	Risk-Based Groundwater Concentration (µg/l) (a)	Maximum Groundwater Concentration Detected (µg/l)
1,1-DCE	310	1.0
cis-1,2-DCE	1,355,000 (b)	3.3
trans-1,2-DCE	1,352,000 (b)	1.7
PCE	6,200	2.1
TCE	17,000	280
(a) Based on an excess lifetime cancer risk of 10^{-6}, unless otherwise noted. (b) Based on a noncancer hazard quotient of one.		

8.0 References

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US EPA. 1994. Health Effects Assessment Summary Tables. EPA540/R-94/020. March.

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Attachment I
Transport of Chemicals From Groundwater to Air

Concentrations of volatile organic compounds (VOCs) that may diffuse into a building built above groundwater which contains VOCs have been estimated based on existing groundwater concentration data. Estimation of the flux of VOCs from groundwater to the soil surface was calculated using existing data in conjunction with Fick's first law of diffusion. The concentration of VOCs inside a building such as a shopping complex or commercial building were then calculated based on these flux estimates.

Five VOCs were detected in groundwater at the Del Monte site; 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, tetrachloroethene, and trichloroethene. For this assessment, the indoor concentrations of VOCs inside a structure built above the groundwater were estimated based on the measured groundwater concentrations.

Potential gas concentrations within an onsite building were estimated by incorporating calculated soil-gas concentrations into equations that calculate the flux through unsaturated soil and into a building foundation. This method of chemical partitioning and subsequent simulation of soil-gas flux using Fick's Law has been verified with a one-dimensional finite difference vadose zone leaching model entitled VLEACH (CH2M HILL, 1990). Soil-gas concentrations were estimated from groundwater sampling results. Methodology for estimating concentrations in soil-gas from concentrations measured in groundwater is described below.

Estimating Soil-Gas Concentrations from Groundwater Samples

For each of the chemicals detected in groundwater, equilibrium soil-gas concentrations at the water table were estimated using the Henry's Law constant, H (atm • m^3/mole). The Henry's Law constant is a measure of the chemical partitioning between air and water at equilibrium. A unitless form of the Henry's Law constant, H_1, is equal to H at standard temperature and pressure and is empirically related to the ratio of the concentration in the gas phase (e.g., concentration of chemical in soil gas at the water table), C_{sg}, over the concentration in the liquid phase (e.g., concentration in groundwater), C_{sl}, at the liquid/air interface.

$$H_1 \quad = \quad H/RT = C_{sg}/C_{sl} \tag{1}$$

where:

R	=	Universal gas constant
T	=	temperature

The higher the constant, the more likely a chemical is to volatilize than remain in water.

Estimating the Chemical Concentration in a Building

The chemical concentration in a building was estimated using two equations which relate chemical concentrations in the gas phase to the flux of a chemical (rate of movement per unit area). The first equation, Fick's First Law, states that the flux to the soil surface, J, is due to the concentration gradient between the chemical concentration in the soil gas at the water table and the concentration of the chemical just below the foundation of the building:

$$J = D\frac{(C_2 - C_1)}{L} \qquad (2)$$

where:

D = rate of movement of gas-phase chemicals in the vadose zone (soil gas diffusion coefficient)

C_2 = chemical concentration in the soil-gas at depth L

C_1 = chemical concentration in the soil-gas at the surface

L = depth for which the soil-gas concentration, C_2, is estimated (depth of the water table)

The diffusion coefficient used in Equation 2 represents the rate at which a gas-phase chemical moves upward through the soil from the water table to ground level. This vadose zone diffusion coefficient (D), was approximated by using the Millington Quirk (1961) formula, which accounts for the effect of soil particles on air diffusion rates:

$$D = D_0\left(\frac{a^{10/3}}{\Phi^2}\right) \qquad (3)$$

where:

D_0 = gas phase diffusion rate through air (air diffusion coefficient)

a = air filled soil porosity

Φ = total soil porosity

Equation 2 estimates the flux of chemical in the vapor phase which diffuses to the soil surface below the building. To relate this flux to the flux of chemical into the building it was assumed that the flux into the building is some percentage of the flux to the soil surface, due to cracks in the foundation. Air concentrations in a building were estimated from flux using the following equation:

$$C_b = \frac{(J)(A)(\%)(R)}{V} \tag{4}$$

where:

C_b	=	concentration of the chemical in the air in the building
J	=	flux of chemical at the ground surface
A	=	area of the building foundation
%	=	proportion of vapors that enter the building
R	=	residence time of air in the building
V	=	volume of air in the building

Calculating the concentration of air inside a building requires solving Equation 2 for the chemical flux to the surface. This may not be calculated directly because C_1, the concentration below the building, is not known. To obtain a solution, the concentration just below the foundation was assumed to be equal to the concentration in the air inside of the building. Equation 4 was substituted for C_1 in Equation 2, and flux was calculated. The flux was then substituted back into Equation 4 to obtain a building air concentration.

The method described here is accurate over the short term (eg., less than 1 year), and would be applicable for small time frames such as the 1-hour residence time in the commercial building. For much larger time periods (eg., greater than one year) this method will overpredict the average exposure concentration in the building since it is based on present day field measurements and does not consider attenuation of chemical concentrations over time. Hence this method provides a conservative estimate of exposure concentrations of chemicals in air.

Input Parameters

Table A-1 lists the compound-specific input parameters for each of the five chemicals which were modeled. Henry's Law constants and air diffusion coefficients were obtained from published values (Howard, 1989 and Lugg, 1978). Where published air diffusion coefficients were not available, they were estimated using the method of Fuller, Schettler, and Giddings as described in the Handbook of Chemical Property Estimation Methods (Lyman et al., 1991).

Table A-2 lists the values which were selected for the soil, groundwater, and building input parameters. The depth to groundwater at the Del Monte site is approximately 8 feet. The soil type is silty sand to sandy silt, and the area is moist. Since measured values for total porosity and air-filled porosity were not available, a total porosity and air-filled porosity of 0.40 and 0.15 were assumed.

Equation 5 requires input parameters which describe the structure built above the groundwater containing VOCs. It was assumed that a commercial building will be constructed at this site. Two of the input parameters which are required are the building foundation area and volume of air in

the building. Note that, for a rectangular structure, the area divided by volume is equal to 1 divided by the ceiling height. A twelve-foot ceiling was selected to be representative of a typical commercial building.

Air residence time was calculated from a ventilation rate. For malls and arcades, the 1994 Uniform Building Code requires a ventilation rate of 0.2 cubic feet per minute (cfm) per square foot of area. For a 12-foot ceiling height, this is equal to an air residence time of 1 hour. Equation 4 also includes a factor for the percentage of upward flux of chemicals which penetrate the building foundation. A value of 0.5 percent was selected, based on the percentage of the foundation which is assumed to be cracked.

The estimated air concentrations in a building are shown on Table A-3.

References

Howard, P.H. 1989. Handbook of Environmental Fate and Exposure Data for Organic Chemicals. Volumes I and II. Lewis Publishers.

Lugg, G.A. 1968. Diffusion Coefficients of Some Organic and Other Vapors in Air. Analytical Chemistry, Vol. 40, No. 7. June. pp 1072-1077.

Lyman, W.J. 1991. Handbook of Chemical Property Estimation Methods. American Chemical Society.

Millington, R.J., and P. Quirk. 1961. Permeability of Porous Solids. Transactions of the Faraday Society, Vol. 57, pp 1200-1207.

Table A-1 Transport of Chemicals from Groundwater to Building Chemical-Specific Input Parameters		
Chemical name	Henry's Law Constant (atm-m3/mol)	Air Diffusion Coefficient (cm2/s)
1,1-Dichloroethene	0.0301	0.0939
cis-1,2-Dichloroethene	0.00337	0.1209
trans-1,2-Dichloroethen	0.00672	0.1209
Tetrachloroethene	0.0149	0,0797
Trichloroethene	0.0103	0.0875
References: Howard, 1989; Lugg, 1968; Lyman, 1991.		

Table A-2
Transport of Chemicals from Groundwater to Building Soil and Building Input Parameters

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.15

Structure Data Input

Ceiling Height	=	12 ft
Air residence time	=	1 hr
Flux % through foundation	=	0.5 %

Chemical Concentrations in Indoor Air - Groundwater
Del Monte Site

Table A-3
Calculation of Contaminant Concentrations Inside a Structure Above Contaminated Groundwater
Dissolved contaminants (no separate organic phase)

Version 2.0

Scenario description: Commercial building with 11,000 sq. ft. area

DATA INPUT SECTION

Soil Data Input

				Chemical name	Henry's Constant (atm-m3/mol)	Air Diffusion Coeff. (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in House (ug/m^3)
				1,1-Dichloroethene	0.0301	0.0939	1	2.61E-04
Depth of Water Table	=	8	ft	cis-1,2-Dichloroethylene	0.00337	0.1209	3.3	1.24E-04
Total porosity	=	0.4		trans-1,2-Dichloroethylene	0.00672	0.1209	1.7	1.28E-04
Air-filled porosity	=	0.15		Tetrachloroethylene	0.0149	0.0797	2.1	2.31E-04
				Trichloroethylene	0.0103	0.0875	280	2.33E-02

Structure Data Input

Foundation area	=	11000	ft^2
Structure volume	=	3738	m^3
Air residence time	=	1	hr
Flux % through foundation	=	0.5	%

Note: Parameter Henry's Law constants are from Howard Volumes I and II.
  Diffusion coefficients are estimated using method in Lyman for 1,1-DCE and 1,2-DCE
  Diffusion coefficients are from Lugg, ES&T, June 1968 for PCE and TCE.