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August 8, 1996

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Subject: Recommendation for Completion of Remedial Activities
Del Monte Plant 35, Emeryville, CA

Enclosed is the document, *Recommendation for Completion of Remedial Activities at Del Monte Plant 35 Property in Emeryville, California* which we submit on Del Monte's behalf. This final document revises the draft document submitted to you in April 1996, by responding to RWQCB verbal comments and by updating the groundwater monitoring data to reflect the results of the most recent monitoring event.

As you are aware, Del Monte is negotiating for the sale and development of this property with prospective buyers. Because a closure letter is essential to the sale and development of the property, Del Monte requests that the RWQCB issue a closure letter for the Plant 35 property by August 23, 1996.

Del Monte does not see a benefit to any continued groundwater monitoring at the site. As you know, Del Monte has been monitoring groundwater at the site since 1989, covering periods of time before, during, and after remedial activities. Concentrations of chlorinated hydrocarbons at the site have dramatically decreased due to groundwater remediation activities, and concentrations have not shown a significant increase since the West Parcel groundwater remediation system ceased operating over one year ago. Chlorinated hydrocarbon concentrations currently detected in groundwater are below levels that pose a threat to human health, as indicated in the risk assessment presented in the enclosed report. Furthermore, because the sources of the chlorinated solvents in groundwater have been remediated through removal of underground tanks and extensive amounts of soil, concentrations in groundwater are expected to decrease further over time. We conclude

that continued groundwater monitoring would result in additional costs to Del Monte while not providing any benefit to human health or the environment.

As always, feel free to contact me with any questions or comments at (510) 251-2888 ext. 2189.

Sincerely,

CH2M HILL

Madeline Wall

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Enclosure
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Recommendation for Completion of Remedial Activities at Del Monte Plant 35 Property in Emeryville, California

Prepared for

Del Monte Foods

AUGUST 1996

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1. Introduction

1.1 Purpose and Scope

The purpose of this document is to present and support recommendations for the completion of remedial actions at Del Monte's Plant 35 property in Emeryville, California. The document includes a summary of remedial activities performed at the site, a description of the nature and extent of chemical constituents remaining in onsite soil and groundwater, and an evaluation of associated human health and environmental risks.

1.2 Background

Del Monte Plant 35, located in an industrial area of Emeryville, was operated as a fruit and vegetable processing facility from the late 1920s through 1989. Plant 35 is located on approximately 13 acres; the West Parcel, located at 4204 Hollis Street, is approximately 2 acres in size and the East Parcel, located at 1250 Park Avenue, is approximately 11 acres in size. The site layout is shown on Figure 1.

Plant 35 is underlain by approximately 5 to 8 feet of fill, composed primarily of clay containing gravel. Native silty clay extends from beneath the fill to a depth of approximately 15 to 20 feet below ground surface (bgs). Discontinuous lenses of sand and gravels have also been encountered within the native silty clay. This silty clay zone is underlain with silty sand. Shallow groundwater exists beneath the property at a depth of approximately 7 to 10 feet bgs and flows in a southwesterly direction.

Since 1989, Del Monte has conducted extensive soil and groundwater investigations and completed remedial activities to address known and potential releases of petroleum and chlorinated hydrocarbons at Plant 35. The activities were conducted with the oversight of the Alameda County Environmental Health Department (ACDEH) and the San Francisco Bay Regional Water Quality Control Board (RWQCB). Chlorinated hydrocarbon compounds were found in soil and groundwater beneath the West Parcel in 1989. The source on the West Parcel was identified as four 50-gallon fuel oil storage tanks used by former Del Monte tenants. Chlorinated hydrocarbon and petroleum hydrocarbons were also found in soil and groundwater on the East Parcel. The source on the East Parcel was identified as an area of soil to the east of the main cannery building and an underground fuel oil storage tank adjacent to the boiler house. Contaminant source removal and groundwater remediation is described in the next section.

source of the chlorinated hydrocarbon compounds in the East Parcel groundwater. In November 1994 and June and July 1995, Del Monte removed affected soil on the East Parcel. An underground fuel oil storage tank and surrounding affected soil were also removed at that time and a groundwater monitoring well (MW-13) was installed downgradient of the tank excavation. The total volume of soil removed from the East Parcel was approximately 5,300 cubic yards.

Target soil cleanup levels were 1 mg/kg total volatile organic compounds (VOCs) and 100 mg/kg total petroleum hydrocarbons (TPH). Soil excavation depths ranged from 8 to 17 feet bgs and were dictated by the depth of affected soil and the groundwater table. Groundwater was encountered at about 7 to 10 feet bgs and rose to within 4 to 5 feet of the ground surface in the open pit. Results of 55 confirmation samples indicated that target soil cleanup levels were met in all but four bottom samples. In one of these samples, the concentration of total chlorinated hydrocarbons was only slightly above the target cleanup level (1.2 compared with 1.0 mg/kg). In another sample, the total petroleum hydrocarbon concentration was 104 mg/kg, only slightly above the target of 100 mg/kg. In the other two samples, total petroleum hydrocarbon concentrations of 200 and 180 mg/kg were detected. The hydrocarbons identified, however, were diesel and motor oil. The mobilities of diesel and motor oil are significantly less than that of gasoline which is typically the basis for a 100 mg/kg cleanup target. Their low mobility is evidenced by the fact that groundwater downgradient of the excavation, as indicated from samples collected from MW-13, is not affected by petroleum hydrocarbons.

Approximately 1,228 tons of the excavated soil were transported offsite for disposal at BFI's Vasco Road Landfill. Approximately 2,300 cubic yards of soil remain stockpiled onsite. The soil contains low levels of petroleum and chlorinated hydrocarbons. The RWQCB has approved the use of this soil in backfilling onsite excavations (RWQCB, 1996).

Following removal of the soil source, remediation of East Parcel groundwater was initiated. A groundwater extraction system was installed in the excavated pit on the East Parcel and the existing West Parcel treatment system was modified to accommodate East Parcel groundwater. From October 1995, when it began operating, to June 24, 1996, the East Parcel extraction system has removed approximately 1,178,000 gallons of East Parcel groundwater.

3. Residual Chemical Constituents in Soil and Groundwater

Because the levels are below cleanup criteria and pose little or no risk to the environment or human health (see Sections 4 and 5), low levels of residual chlorinated and petroleum hydrocarbons will remain in subsurface soil and groundwater at the Plant 35 property. This section describes the locations and concentrations of residual chemicals at the property.

3.1 West Parcel

All known soil affected by the release of chlorinated hydrocarbons from the four 50-gallon tanks was removed. During soil investigations, chlorinated hydrocarbon compounds were identified in soil at one location in the northern part of the West Parcel. At this location, the following chemicals were detected: at 2.5 feet bgs, 1,1,1-trichloroethane at 0.022 mg/kg and 1,1-dichloroethane at 0.03 mg/kg; and at 6 feet bgs, 1,1,1-trichloroethane at 0.01 mg/kg (CH2M HILL, 1993). At another location in the northern part of the West Parcel, motor oil was detected in the soil at 6 feet bgs at a concentration of 260 mg/kg (CH2M HILL, 1993). This level is below the proposed target cleanup level (see Section 6). Locations of these detections are shown on Figure 4. Chemical constituents present in West Parcel soil are summarized in Table 3.

West Parcel groundwater is currently monitored quarterly by collecting and analyzing samples from four wells: MW-7, MW-9, MW-10, and MW-12. Chemicals detected during past monitoring events and their respective concentrations are shown on Table 2. Table 4 summarizes the results of groundwater monitoring on the West Parcel since the GET system was shut down in June 1995. The concentration of total chlorinated hydrocarbons in the West Parcel wells for the five events since shut down ranged from below the detection limits to 90 µg/l, with an average of 31 µg/l. The most recent sampling event was conducted on June 18, 1996. The data are summarized in Table 4. Chemicals present in West Parcel groundwater are TCE, PCE, and cis- and trans-1,2-dichloroethene (DCE). In the June 18, 1996 sampling event, total chlorinated hydrocarbon concentrations ranged from 6.7 to 44 µg/l in the four wells sampled. The maximum concentrations were detected in MW-10. The average concentration of total chlorinated hydrocarbons in the four West Parcel wells in the June 18, 1996 event was 29.5µg/l.

3.2 East Parcel

Residual concentrations of chemicals present in soil on the East Parcel are summarized in Table 5. The data are from confirmation samples collected from soil left in place after the soil removal activities. Thirty four (34) confirmation samples were collected from the excavation of soil containing chlorinated and petroleum hydrocarbons east of the former Label Room and 21 samples were collected from the excavation at the former underground tank

location. Table 5 provides the range of concentrations detected in confirmation samples as well as the mean concentration. Sample depths ranged from 6 to 17 feet bgs.

As documented in previous reports, petroleum hydrocarbons are also present beneath structures or pavement at various isolated locations on the East Parcel (CH2M HILL, 1993 and CH2M HILL, 1994d). Soil with concentrations above agency approved cleanup levels will be removed after existing site structures are demolished. Cleanup levels are discussed in Section 6.

East Parcel groundwater is monitored by sampling groundwater from MW-13. To date, four sampling events have occurred. Chemicals detected on the East Parcel are the same as those detected on the West Parcel with the addition of vinyl chloride and 1,1,1,-trichloroethane. Chemicals detected and their respective concentrations are provided in Table 2 and summarized in Table 4. In the June 18, 1996 sampling event, 56 µg/l of total chlorinated hydrocarbons and 30 mg/l of total fuel hydrocarbons (TFH) as gasoline were detected.

4. Human Health Risks

A screening Health Risk Assessment (HRA) was conducted for the former Plant 35 property. The HRA addresses potential future exposure to the volatile organic compounds present in soil and groundwater and was conducted in accordance with California Environmental Protection Agency (CAL-EPA) risk assessment guidance, as appropriate.

Del Monte Plant 35 is located in an industrial area of Emeryville. Currently, the only structure remaining on the property is the main cannery building. Although no specific redevelopment plans are currently proposed, likely future uses of the property are industrial, commercial, and/or multi-family residential.

Chemicals present in groundwater and subsurface soil beneath the site could volatilize and migrate through soil into ambient air or air inside a future onsite building. The groundwater is not currently used as a domestic source of water and is not expected to be used as such in the future.

The purpose of this HRA is to quantitatively evaluate potential health risks to the public and onsite workers due to volatilization of chemicals from groundwater and subsurface soil, and transport through soil to air inside of a future onsite building. This screening HRA assumes that the only additional remedial actions taken at the site are the removal of "hot spots" of petroleum contamination that may be encountered during demolition of the remaining onsite structures.

4.1 Chemicals of Concern

All chemicals detected in groundwater monitoring wells (located in the East and West Parcels) during the June 18, 1996 sampling event are considered chemicals of concern for purposes of the screening HRA. The groundwater chemicals of concern include five VOCs: PCE; TCE; cis-1,2,-dichloroethene; trans-1,2,-dichloroethene; vinyl chloride, and 1,1,1,-trichloroethane.

Likewise, all chemicals detected in soil in the confirmation samples (collected from the East and West Parcels) are considered chemicals of concern. The soil chemicals of concern for the West Parcel include two VOCs: 1,1-dichloroethane and 1,1,1-trichloroethane. The soil chemicals of concern for the East Parcel include seven VOCs: PCE; TCE; cis-1,2-dichloroethene; trans-1,2-dichloroethene; acetone; vinyl chloride; and methylene chloride.

4.2 Exposure Assessment

The exposure assessment characterizes the potentially exposed populations and identifies the potential pathways by which exposure may occur. The magnitude, frequency, and duration of exposure are then estimated.

4.2.1 Potentially Exposed Populations

No specific redevelopment plans are currently proposed for the Plant 35 property. However, possible future uses for the property include commercial/industrial and/or residential. Individuals that could be exposed to VOCs in groundwater and soil include commercial/industrial workers and residents.

4.2.2 Potential Exposure Pathways

Potential pathways of exposure to VOCs in groundwater and soil include direct contact with groundwater and subsurface soil, and transport of VOCs from groundwater and subsurface soil through the foundation of a building or into ambient air. Groundwater in the vicinity of the site is not currently used for drinking water and is not expected to be used as such in the future. Therefore, direct contact with groundwater is not considered a complete pathway and is not further evaluated in this HRA. Since residual VOCs in soil were found in the subsurface depth intervals only (i.e., not in surface or near-surface soils), soil exposure through direct contact is also considered unlikely and, therefore, is not further evaluated in this HRA.

Future onsite commercial/industrial workers or residents could be exposed to VOCs in groundwater and subsurface soil through migration of VOC vapors into ambient air, commercial/industrial buildings, or residences. Exposures to VOCs in ambient air are expected to be less than those in a building or residence due to dilution and mixing. Therefore, workers inside buildings and residents inside their homes are expected to be the maximally exposed populations and are quantitatively addressed in the HRA.

4.2.3 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 the 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). To evaluate the resident's exposure, an exposure frequency of 350 days/year and an exposure duration of 30 years are used; all other exposure parameters are the same as those used for workers.

4.2.4 Estimated Air Concentrations

Concentrations of VOCs that may diffuse into a building or residence built above groundwater were estimated based on groundwater data collected since the GET system shutdown

for the West Parcel and since well installation for the East Parcel. Estimation of the flux of VOCs from groundwater to the soil surface was calculated using the 95 percent upper confidence limit of the mean concentrations of groundwater chemicals of concern from the West Parcel samples in conjunction with Fick's first law of diffusion. For the East Parcel, only four samples were available, so the maximum detected concentration of each chemical of concern was used to calculate flux. The concentrations of VOCs inside a building or residence were then calculated based on these flux estimates.

Concentrations of VOCs that may diffuse into a building or residence from subsurface soil were estimated based on analytical results from samples collected after soil removal activities were completed. The 95 percent upper confidence limits of the mean concentrations of chemicals of concern in confirmation subsurface soil samples from the East and West Parcels were used in conjunction with the Freundlich constant and Henry's Law constant to estimate soil-gas concentrations. The modeled soil-gas concentrations are used with Fick's first law of diffusion to estimate flux; the flux is used to calculate concentrations of VOCs in a building or residence.

The methodologies for estimating air concentrations in a building or residence resulting from migration of VOCs from groundwater and subsurface soil are presented in Appendix A. Estimated air concentrations are shown in Table 6. Soil and groundwater concentrations used in the risk assessment are shown on Tables 3, 4, and 5.

4.3 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 routes.

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 (US 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 (US 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 7.

4.4 Risk Characterization

The risk characterization integrates the toxicity and exposure assessments to estimate the potential risk to workers and residents 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).

4.4.1 Noncarcinogenic Risk

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 a 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 a potential for health risk.

4.4.2 Carcinogenic Risk

The potential for carcinogenic effect 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 $x10^{-6}$ 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. The acceptable risk range specified by the US EPA in the National Contingency Plan is 1×10^{-6} to 1×10^{-4} (US EPA, 1990).

Because of the methods used to estimate CSFs, the excess lifetime cancer risk estimated in this HRA should be regarded as upper bounds on the potential cancer risk 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 quanti-

tatively the effects of such interactions. Carcinogenic risk is treated in this HRA as additive within the route of exposure.

4.4.3 Estimated Risks—Transport of VOCs into a Building or Residence

The exposure scenarios for the Del Monte Plant assume a commercial/industrial worker or future resident could be exposed to VOCs present in groundwater or subsurface soil through volatilization and transport through soil into air inside a future onsite building or residence. The estimated hazard quotients and excess lifetime cancer risks for these expo sure scenarios are summarized in Table 8. Risk calculation spreadsheets are provided in Appendix B.

The estimated hazard quotients were less than one for all of the groundwater and soil chemicals evaluated. The estimated hazard indices, or sum of all hazard quotients, for both the commercial and residential scenarios involving groundwater and soil are also less than one. For the East Parcel, the hazard indices for soil and groundwater combined are 0.002 for the commercial scenario and 0.002 for the residential scenario. For the West Parcel, the hazard indices for soil and groundwater combined are 0.0004 for the commercial scenario and 0.001 for the residential scenario. These values are well below one, the level where there is a concern for adverse health effects.

The estimated excess lifetime cancer risks for each of the groundwater and soil chemicals evaluated are below 10^{-4}. For the East Parcel, total risks from exposure to groundwater and soil are 5×10^{-6} for the commercial scenario and 3×10^{-5} for the residential scenario. For the West Parcel, total risks from exposure to groundwater and soil are 2×10^{-6} for the commercial scenario and 1×10^{-7} for the residential scenario. These risks are within the acceptable risk range specified by the U.S. EPA (10^{-6} to 10^{-4}).

4.5 Summary of Human Health Risks

The former Del Monte Plant 35 property is expected to be redeveloped for industrial, commercial, or multi-family residential use. Soil and groundwater conditions beneath the property have been investigated and remediated. Remaining chemicals present in subsurface soil and groundwater beneath the site could volatilize and migrate through soil into ambient air or inside a future onsite building or residence. However, direct contact with groundwater is not considered a complete exposure pathway because groundwater is not expected to be used as a domestic source of water. Likewise, incidental ingestion and dermal contact with soil are not considered complete exposure pathways because direct contact with subsurface soil is unlikely. Therefore, this HRA quantitatively evaluates potential health risks to future onsite workers and residents due to volatilization of chemicals from groundwater and subsurface soil.

The results of the HRA show that the estimated noncancer hazard indices for both the East and West Parcels are less than one (the level considered by the State of California to be the noncancer level of concern) for both the commercial and the residential scenarios for combined groundwater and soil exposure. In addition, the estimated excess lifetime cancer risks are below 1×10^{-4} for combined groundwater and soil exposure in both the East and West Parcels for all chemicals.. These risks are within the acceptable risk range specified by the US EPA in the National Contingency Plan ($1X10^{-6}$ to $1X10^{-4}$).

5. Environmental Risk and Contaminant Transport Analysis

Concentrations of chlorinated and petroleum hydrocarbons in soil and groundwater at this site have been significantly reduced through the soil source removal and groundwater extraction and treatment described in Section 2. The chlorinated and petroleum hydrocarbons remaining in site soil (see Section 3) do not pose a significant threat to underlying groundwater because of their low concentrations and the presence of clayey soils throughout much of the site that retards migration of chemicals from soil to groundwater. In groundwater beneath the West Parcel, current levels of chlorinated hydrocarbons are significantly less than before soil sources were removed and groundwater was remediated. The concentrations are expected to be further reduced over time due to the continuing beneficial effect of the remedial activities that were conducted on the West and East Parcels. In groundwater beneath the East Parcel, the highest levels of chlorinated hydrocarbons measured in the 1994 investigations were at the location of the soil excavation east of the Label Room. As described in Section 2, soil was excavated to depths below the groundwater table. East Parcel groundwater quality is currently monitored at MW-13.

No potential environmental receptors to chemical constituents remaining in soil and groundwater at the Del Monte Plant 35 property have been identified. First, current and expected future site uses involve pavement over most, if not all, of the site. Direct exposure of environmental receptors to the low levels of remaining soil contaminants in any future unpaved areas is unlikely due to the location of the chemicals below the ground surface. In addition, redevelopment projects typically cover the ground surface with imported top soil for landscaping. Second, the nearest groundwater discharge point is San Francisco Bay, located about 1/2 mile west of Plant 35. As indicated by the contaminant transport modeling of East Parcel groundwater described below, over that distance chemical concentrations are expected to be essentially reduced to levels below detection limits through various physical and chemical processes.

To evaluate the effect of East Parcel groundwater migrating downgradient toward the West Parcel, a contaminant transport analysis was conducted. The analysis model AT123D (Yeh, 1981) was used in two dimensions to predict the transport and migration of VOCs in groundwater. The model simulates the processes of advection, hydraulic dispersion, molecular diffusion, and adsorption under a simplified idealization of the field to give qualitative estimates of the extent of contaminant transport. The chemical concentrations used in the model were taken from the sample with the maximum values measured in a groundwater grab sample collected downgradient of the East Parcel source area in 1994 (source area concentrations were not used because they do not represent current conditions due to soil and groundwater remediation conducted in 1994 and 1995).

Figure 5 shows the model area superimposed upon the groundwater surface elevations. The initial conditions and input parameters, including aquifer and chemical properties, are summarized in Table 9. The plume was modeled as an instantaneous slug of contaminant introduced at the location and concentrations exhibited by the groundwater grab sample at

WH-5 (Figure 5) A contaminant slug rather than a continuous source was modeled because a continuous source is not present at the site. The total VOC concentration of the source plume was 270.7 µg/l, and contains PCE (120 µg/l), TCE (50 µg/l), vinyl chloride (84 µg/l), and trans-1,2-dichloroethene (16 µg/l. These levels are significantly higher than total VOCs currently measured in MW-13 on the East Parcel (See Table 2).

The instantaneous slug of contamination was modeled for time periods of 1, 5, 10, 20, and 50 years. As shown in Figures 6 and 7, the plume migrates longitudinally and laterally and total VOC concentrations are reduced by an order of magnitude in 5 years and two orders of magnitude in 20 years. The model estimates that after 20 years, the leading edge of the plume will have traveled approximately 800 feet (still within the property boundary) and will have total VOC concentrations less than 10 µg/l. The transport modeling results indicate that further groundwater extraction at Plant 35 is unnecessary to control migrating contaminants from the East Parcel.

6. Conclusions and Recommendations

Since 1989 when a release to soil and groundwater at the Plant 35 property was discovered, Del Monte has pro-actively undertaken extensive investigation and remediation activities. Del Monte has completed the following significant activities:

- Thoroughly investigated soil and groundwater conditions at the property
- Removed sources of chemical constituents detected in groundwater (four 50-gallon underground tanks and affected soil on the West Parcel; 20,000-gallon underground tank and affected soil on the East Parcel; and soil containing chlorinated and petroleum hydrocarbons on the East Parcel)
- Extracted and treated groundwater beneath the West Parcel until asymptotic levels were reached
- Extracted and treated groundwater beneath the East Parcel during soil remediation activities in June and July 1995, and from October 1995 to the present

The remediation efforts have resulted in chlorinated hydrocarbon concentrations stabilizing at greatly reduced levels in groundwater beneath the West Parcel. Groundwater monitoring results have not shown a significant rebound since the West Parcel GET system was shut off in June 1995. Potential risks to human health posed by the low levels of chlorinated and petroleum hydrocarbons remaining in soil and groundwater are well below standard acceptable threshold levels. Potential risks to environmental receptors are low to non-existent.

Based on the completion of source removal and groundwater monitoring results, the following measures are recommended:

- After the existing structures and pavement are demolished, screen and sample surface soil and excavate soil if petroleum hydrocarbon levels exceed cleanup criteria. Cleanup criteria will be 100 mg/kg for TPH-gasoline, 200 mg/kg for TPH-diesel, and 300 mg/kg for TPH-motor oil.
- Use excavated soil remaining onsite from the 1994 and 1995 East Parcel remediation activities to backfill pits, or grade into the subsurface as approved by the RWQCB.
- Discontinue groundwater extraction from the East Parcel and dismantle the GET systems on the East and West Parcels.
- Discontinue groundwater monitoring and abandon monitoring wells and piezometers in accordance with applicable Alameda County Flood Control and Water Conservation District, Zone 7 requirements.
- Receive "No Further Action" letters from the RWQCB and ACDEH.

7. References

CAL-EPA, 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities. Department of Toxic Substances Control. July.

CAL-EPA, 1994a. California Cancer Potency Factors: Update. Office of Environmental Health Hazard Assessment. November 1.

CAL-EPA, 1994b. Preliminary Endangerment Assessment Guidance Manual. Department of Toxic Substances Control. January.

California Administrative Code, Title 22, Division 21.5, Section 12703(b).

CH2M HILL, 1989. Property Assessment and Tank Removal Report, Del Monte Plant No. 35, Southwest Corner. September 1989.

CH2M HILL, 1993. Investigation Report for Del Monte Plant 35. December 1993.

CH2M HILL, 1994a. Supplemental Onsite Investigation Report for Del Monte Plant 35. May 1994.

CH2M HILL, 1994b. Technical Memorandum: Soil and Groundwater Investigation East of Boiler House on East Parcel, Del Monte Plant 35. August 12, 1994.

CH2M HILL, 1994c. Report on Focused Soil Removal, East Parcel Del Monte Plant 35. December 1994.

CH2M HILL, 1994d. Draft Remediation Plan, Del Monte Plant 35. April 1994.

CH2M HILL, 1995a. Proposal to Shut Off West Parcel GET System, Del Monte Plant 35. March 24, 1995.

CH2M HILL, 1995b. Letter to B. Oliva/ACDEH and S. Arigala/RWQCB from M. Wall/CH2M HILL regarding Results of Past Shut Off/Start Ups oaf West Parcel GET System. April 12, 1995.

CH2M HILL, 1995c. Quarterly Groundwater Monitoring and Groundwater Extraction and Treatment Systems Status Report for Del Monte Plant 35 - West Parcel. October 31, 1995.

CH2M HILL, 1996a. Remedial Activities Conducted on the East Parcel, Del Monte Plant 35. February 1996.

CH2M HILL, 1996b. Quarterly Groundwater Monitoring and Groundwater Extraction and Treatment Systems Status Report for Del Monte Plant 35. January 31, 1996.

RWQCB, 1996. Letter from S. Morse/RWQCB to S. Ronzone/Del Monte. March 25, 1996.

US EPA, 1989. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A. Interim Final. OSWER Directive 9285.701a. September.

US EPA, 1990. National Oil and Hazardous Substances Pollution Contingency Plan. 40 CFR 300.

US EPA, 1994. Health Effects Assessment Summary Tables. EPA 540/R-94/020. March.

US EPA, 1995a. Integrated Risk Information System. Chemical Files. US EPA Information System Database. Office of Research and Development. Cincinnati, OH.

US EPA, 1995b. Region IX Preliminary Remediation Goals (PRGs), First Half 1995. February 1.

Yeh, 1981. Yeh, G.T., AT 123D: Analytical Transient One-, Two-, and Three-Dimensional Simulation of Waste Transport in the Aquifer System. Oak Ridge National Laboratory, Environmental Sciences Division Publication No. 1439. March 1981.

Tables

TABLE 1
Summary of Remediation Activities and Results, Del Monte Plant 35

Activity	Date	Purpose of Activity	Summary of Remediation Results	Summary of Confirmation Sampling	Reference
West Parcel					
Underground tank removal	March 1989	Source removal	Four 50-gallon tanks removed (contained fuel oil contaminated with chlorinated hydrocarbons)	Chlorinated hydrocarbon levels in soil samples were well below 1 mg/kg	CH2M HILL, 1989.
Soil removal from location of four 50-gallon former underground tanks	December 1992	Construction of groundwater extraction pit and remaining soil source removal	Excavated soil containing low levels of chlorinated hydrocarbons and aerated onsite	No chlorinated hydrocarbons were detected in remaining soil.	
Groundwater extraction and treatment	Constructed in January 1993; extraction system expanded in August 1994; operated from January 1993 through June 1995	Groundwater remediation	Extracted and treated 4,381,361 gallons of groundwater; total chlorinated hydrocarbons reduced from 666 mg/L (1/93) to 14.3 mg/L (6/95)	Since shut down of extraction system (June 1995), quarterly verification monitoring has indicated that groundwater quality has stabilized at reduced levels	CH2M HILL, 1995a, 1995b, 1995c, and 1996a
East Parcel					
Soil removal from east of label room	November 1994	Source removal	600 cubic yards of soil containing chlorinated and petroleum hydrocarbons removed and stockpiled onsite	Soil remaining beneath adjacent structures contained contaminants above cleanup criteria	CH2M HILL, 1994c
Soil removal from east of label room	June 1995	Source removal	2,700 cubic yards of additional soil removed	Chlorinated hydrocarbons in confirmation samples were < 1 mg/kg except in one sample (of 34) at 1.2 mg/kg at 14 feet bgs.	CH2M HILL, 1996b
Underground tank and soil removal	July 1995	Source removal	20,000 gallon closed-in-place tank and 2,000 cubic yard of affected soil removed	Petroleum hydrocarbons exceeded 100 mg/kg in three of 21 samples: at 104, 200, and 180 mg/kg. In all cases, the hydrocarbons were predominantly diesel and motor oil	CH2M HILL, 1996b
Soil offhaul	November 1995	Soil disposal	1,228 tons of excavated soil were transported to BFI's Vasco Road Class III landfill for disposal	Not applicable	CH2M HILL, 1996b
Groundwater extraction and treatment	October 1995 to present	Groundwater remediation	554,000 gallons of East Parcel groundwater extracted between October 1995 to March 1995.	Not applicable	CH2M HILL, 1996a, 1996b. and 1995c.

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA
QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TPH gasoline (i)
MW7	17-Apr-91	85.0	<0.5	<0.5	23.0	14.0	5.1	<0.5	<0.5	400.0
MW7	31-Jul-91	100.0	<0.5	<0.5	29.0	19.0	5.1	<0.5	<0.5	70.0
MW7	22-Oct-91	130.0	<1.0	<1.0	30.0	20.0	3.0	<1.0	<1.0	100.0
MW7	23-Jan-92	100.0	<0.5	<0.5	29.0	17.0	3.1	<0.5	<0.5	<50
MW7	23-Apr-92	92.0	<0.5	<0.5	46.0	28.0	<0.5	<0.5	<0.5	not tested
MW7	17-Jul-92	93.0	<0.5	<0.5	51.0	30.0	1.8	<0.5	<0.5	not tested
MW7	12-Oct-92	71.0	<0.5	<0.5	39.0	28.0	2.8	<0.5	<0.5	not tested
MW7	13-Jan-93	54.0	<0.5	<0.5	25.0	16.0	2.1	<0.5	<0.5	not tested
MW7	30-Mar-93	65.0	<0.5	<0.5	31.0	22.0	2.5	<0.5	<0.5	not tested
MW7	16-Jun-93	45.0	<2.0	<2.0	25.0	19.0	2.7	<2.0	<2.0	250
MW7	17-Sep-93	1.6 (t)	<1.0	<1.0	17.0	12.0	<1.0	<1.0	<1.0	not tested
MW7	21-Dec-93	20.3	<0.5	<0.5	17.0	20.0	1.9	<0.5	<0.5	not tested
MW7	14-Feb-94	18.0	<0.5	<0.5	13.0	11.0	0.7	<0.5	<0.5	not tested
MW7	11-Apr-94	13.0	<0.5	<0.5	12.0	10.0	<1.0	<0.5	<0.5	not tested
MW7	15-Jul-94	18.8	<0.5	<0.5	13.0	11.0	<0.50	<0.5	<0.5	not tested
MW7	17-Oct-94	18.2	<0.5	<0.5	11.0	10.0	<0.50	<0.5	<0.5	not tested
MW7	29-Dec-94	<1.0 (t)	<1.0	<1.0	4.4	3.8	<1.0	<1.0	<1.0	not tested
MW7	09-Mar-95	<1.0 (t)	<1.0	<1.0	8.4	6.8	<1.0	<1.0	<1.0	190
MW7	21-Jun-95	2.0 (t)	<1.0	<1.0	10.0	8.5	<1.0	<1.0	<1.0	not tested
MW7	15-Aug-95	<1.0 (t)	<1.0	<1.0	7.8	6.6	<1.0	<1.0	<1.0	not tested
MW7	25-Sep-95	<1.0 (t)	<1.0	<1.0	8.5	7.1	<1.0	<1.0	<1.0	not tested
MW7	26-Dec-95	15(cis) <0.5(t)	<1.0	<1.0	17	9.0	<1.0	<1.0	<1.0	not tested
MW7	27-Mar-96	19(cis) 1.9(t)	<0.5	<0.5	16.0	9.4	<0.5	<0.5	<0.5	not tested
MW7	18-Jun-96	17(cis) 1.5(t)	<1.0	<1.0	13.0	7.1	<1.0	<1.0	<1.0	not tested
MW8	12-May-89	290.0	<10.0	<10.0	1400.0	20.0	78.0	<10.0	<10.0	not tested
MW8	10-Jul-89	140.0	<2.5	<2.5	330.0	14.0	17.0	<2.5	<2.5	not tested
MW8-dup	10-Jul-89	130.0	<2.5	<2.5	310.0	12.0	16.0	<2.5	<2.5	not tested
MW8	24-Oct-89	100.0	<2.0	<2.0	330.0	24.0	4.0	<2.0	<2.0	not tested
MW8	07-Feb-90	100.0	<2.0	<2.0	520.0	18.0	12.0	<2.0	<2.0	not tested
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene
(b) 1,1-Dichloroethene
(c) 1,2-Dichloroethane
(d) Trichloroethene
(e) Tetrachloroethene
(f) Vinyl chloride
(g) 1,2-Dichloropropane
(h) 1,1,1-Trichloroethane
(i) Total fuel hydrocarbons as gasoline
(t) trans

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA
QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TPH-gasoline (i)
MW8	10-Jul-90	5.0	<0.2	<0.5	91.0	36.0	3.0	<0.5	<0.5	not tested
MW8	17-Oct-90	59.0	<1.0	<1.0	160.0	21.0	2.0	<1.0	<1.0	not tested
MW8	24-Jan-91	160.0	<2.0	<5.0	450.0	13.0	9.0	27.0	<2.0	not tested
MW8	17-Apr-91	210.0	<5.0	<5.0	830.0	16.0	<5.0	<5.0	<5.0	not tested
MW8	31-Jul-91	85.0	<2.0	<2.0	350.0	30.0	<2.0	<2.0	<2.0	not tested
MW8	22-Oct-91	40.0	<5.0	<5.0	630.0	20.0	<5.0	<5.0	<5.0	not tested
MW8	23-Jan-92	160.0	<5.0	<5.0	690.0	29.0	<5.0	<5.0	<5.0	not tested
MW8	23-Apr-92	130.0	<10.0	<10.0	1600.0	30.0	<10.0	<10.0	<10.0	not tested
MW8	17-Jul-92	35.0	<2.0	<2.0	490.0	11.0	<2.0	<2.0	<2.0	not tested
MW8	12-Oct-92	22.0	<1.0	<1.0	110.0	24.0	1.3	<1.0	<1.0	not tested
MW8 (SP-D)	19-Jan-93	37.0	<0.5	<0.5	620.0	4.9	3.0	<0.5	<0.5	not tested
MW8 (SP-D)	26-Feb-93	50.0	<0.5	<0.5	350.0	14.0	<0.5	<0.5	<0.5	not tested
MW8 (SP-D)	11-Mar-93	44.9	<0.5	<0.5	130.0	25.0	<0.5	<0.5	<0.5	not tested
MW8 (SP-D)	06-Apr-93	48.0	<1.0	<1.0	160.0	21.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	04-May-93	29.0	<0.5	<0.5	89.0	14.0	<0.5	<0.5	<0.5	not tested
MW8 (SP-D)	02-Jun-93	1.2 (t)	<1.0	<1.0	120.0	8.5	<1.0	<1.0	<1.0	not tested
MW8 (Extr. Well)	16-Jun-93	66.8	<2.0	<2.0	86.0	31.0	1.4	<2.0	<2.0	not tested
MW8 (SP-D)	16-Jun-93	62.0	<2.0	<2.0	102.0	24.0	<2.0	<2.0	<2.0	not tested
MW8 (SP-D)	02-Sep-93	<1.0 (t)	<1.0	<1.0	83.0	11.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	01-Oct-93	<1.0 (t)	<1.0	<1.0	41.0	10.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	05-Nov-93	<1.0 (t)	<1.0	<1.0	56.0	11.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	02-Dec-93	<1.0 (t)	<1.0	<1.0	68.0	11.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	09-Mar-94	<1.0 (t)	<1.0	<1.0	130.0	4.4	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	16-Jun-94	<1.0 (t)	<1.0	<1.0	37.0	13.0	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	17-Oct-94	<1.0 (t)	<1.0	<1.0	2.5	2.5	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	06-Dec-94	<1.0 (t)	<1.0	<1.0	5.5	1.4	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	09-Mar-95	<1.0 (t)	<1.0	<1.0	16.0	3.4	<1.0	<1.0	<1.0	not tested
MW8 (SP-D)	22-Jun-95	<1.0 (t)	<1.0	<1.0	9.1	5.2	<1.0	<1.0	<1.0	not tested
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene
(b) 1,1-Dichloroethene
(c) 1,2-Dichloroethane
(d) Trichloroethene
(e) Tetrachloroethene
(f) Vinyl chloride
(g) 1,2-Dichloropropane
(h) 1;1,1-Trichloroethane
(i) Total fuel hydrocarbons as gasoline
(t) trans

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA

QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TEH-gasoline (i)
MW9	10-Jul-89	63.0	<0.5	<0.5	13.0	38.0	16.0	<0.5	<0.5	not tested
MW9	24-Oct-89	6.4	<0.5	<0.5	29.0	48.0	23.0	<0.5	<0.5	not tested
MW9	07-Feb-90	55.0	<0.5	<0.5	15.0	30.0	7.1	<0.5	<0.5	not tested
MW9	10-Jul-90	3.0	<0.2	<0.5	9.0	43.0	10.0	<0.5	<0.5	not tested
MW9	17-Oct-90	70.0	<0.5	<0.5	14.0	32.0	4.6	<0.5	<0.5	not tested
MW9	24-Jan-91	70.0	<2.0	<2.0	220.0	23.0	<2.0	<2.0	<2.0	not tested
MW9	17-Apr-91	44.0	<0.5	<0.5	12.0	26.0	<0.5	<0.5	<0.5	not tested
MW9	31-Jul-91	55.0	<0.5	<0.5	14.0	32.0	2.3	<0.5	<0.5	not tested
MW9	22-Oct-91	71.0	<0.5	<0.5	15.0	33.0	2.8	<0.5	<0.5	not tested
MW9	23-Jan-92	64.0	<0.5	<0.5	10.0	27.0	2.1	<0.5	<0.5	not tested
MW9	23-Apr-92	22.0	<0.5	<0.5	11.0	29.0	<0.5	<0.5	<0.5	not tested
MW9	17-Jul-92	26.0	<0.5	<0.5	13.0	32.0	<0.5	<0.5	<0.5	not tested
MW9	12-Oct-92	41.0	<0.5	<0.5	17.0	36.0	3.0	<0.5	<0.5	not tested
MW9	13-Jan-93	22.0	<0.5	<0.5	7.9	17.0	1.4	<0.5	<0.5	not tested
MW9	30-Mar-93	26.0	<0.5	<0.5	9.6	22.0	2.1	<0.5	<0.5	not tested
MW9	16-Jun-93	41.5	<2.0	<2.0	12.0	27.0	6.8	<2.0	<2.0	not tested
MW9	17-Sep-93	1.6 (t)	<1.0	<1.0	11.0	21.0	3.5	<1.0	<1.0	not tested
MW9	21-Dec-93	34.5	<0.5	<0.5	16.0	34.0	5.9	<0.5	<0.5	not tested
MW9	14-Feb-94	30.8	<0.5	<0.5	11.0	25.0	4.2	<0.5	<0.5	not tested
MW9	11-Apr-94	18.0	<0.5	<0.5	9.0	18.0	1.6	<0.5	<0.5	not tested
MW9	15-Jul-94	42.4	<0.5	<0.5	15.0	24.0	7.1	<0.5	<0.5	not tested
MW9	17-Oct-94	35.6	<0.5	<0.5	14.0	24.0	2.2	<0.5	<0.5	not tested
MW9	29-Dec-94	<1.0 (t)	<1.0	<1.0	3.5	8.5	<1.0	<1.0	<1.0	not tested
MW9	09-Mar-95	<1.0 (t)	<1.0	<1.0	3.4	8.4	<1.0	<1.0	<1.0	<50
MW9	21-Jun-95	<1.0 (t)	<1.0	<1.0	4.8	9.7	<1.0	<1.0	<1.0	not tested
MW9	15-Aug-95	<1.0 (t)	<1.0	<1.0	2.5	7.0	<1.0	<1.0	<1.0	not tested
MW9	25-Sep-95	<1.0 (t)	<1.0	<1.0	2.5	7.2	<1.0	<1.0	<1.0	not tested
MW9	26-Dec-95	7.9(cis) <0.5(t)	<1.0	<1.0	4.7	9.8	<1.0	<1.0	<1.0	not tested
MW9	27-Mar-96	2.5(cis) <0.5(t)	<0.5	<0.5	4.0	6.6	<0.5	<0.5	<0.5	not tested
MW9	18-Jun-96	1.3 (cis) <1.0(t)	<1.0	<1.0	1.2	3.7	<1.0	<1.0	<1.0	not tested
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene (c) 1,2-Dichloroethane (e) Tetrachloroethene (g) 1,2-Dichloropropane (i) Total fuel hydrocarbons as gasoline

(b) 1,1-Dichloroethene (d) Trichloroethene (f) Vinyl chloride (h) 1,1,1-Trichloroethane (t) trans

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA

QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TFH-gasoline (i)
MW10	10-Jul-89	85.0	0.8	<0.5	27.0	42.0	28.0	<0.5	<0.5	not tested
MW10	24-Oct-89	104.8	<0.5	<0.5	37.0	28.0	6.9	<0.5	<0.5	not tested
MW10	07-Feb-90	50.0	<0.5	<0.5	11.0	8.0	5.3	<0.5	<0.5	not tested
MW10	10-Jul-90	9.0	<0.2	<0.5	30.0	76.0	54.0	<0.5	<0.5	not tested
MW10-dup	10-Jul-90	10.0	5.0	<0.5	28.0	69.0	17.0	<0.5	<0.5	not tested
MW10	17-Oct-90	140.0	<0.5	<0.5	35.0	37.0	13.0	<0.5	<0.5	not tested
MW10	24-Jan-91	65.0	<0.5	<0.5	14.0	31.0	3.3	<0.5	<0.5	not tested
MW10	17-Apr-91	210.0	<2.0	<2.0	48.0	52.0	10.0	<2.0	<2.0	not tested
MW10	31-Jul-91	280.0	<2.0	<2.0	66.0	14.0	2.0	<2.0	<2.0	not tested
MW10	22-Oct-91	160.0	<1.0	<1.0	40.0	40.0	5.0	<1.0	<1.0	not tested
MW10	23-Jan-92	240.0	<2.0	<2.0	46.0	54.0	10.0	<2.0	<2.0	not tested
MW10	23-Apr-92	210.0	<2.0	<2.0	89.0	110.0	<2.0	<2.0	<2.0	not tested
MW10	17-Jul-92	180.0	<1.0	<1.0	78.0	82.0	15.0	<1.0	<1.0	not tested
MW10	12-Oct-92	110.0	<1.0	<1.0	45.0	46.0	11.0	<1.0	<1.0	not tested
MW10	13-Jan-93	190.0	<1.0	<1.0	78.0	110.0	19.0	<1.0	<1.0	not tested
MW10	30-Mar-93	26.0	<0.5	<0.5	15.0	18.0	0.7	<0.5	<0.5	not tested
MW10	16-Jun-93	3.2	<2.0	<2.0	2.7	4.7	<2.0	<2.0	<2.0	not tested
MW10	17-Sep-93	<1.0 (t)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	not tested
MW10	21-Dec-93	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	<0.5	not tested
MW10	14-Feb-94	9.9	<0.5	<0.5	5.4	4.4	<0.5	<0.5	<0.5	not tested
MW10	11-Apr-94	3.7	<0.5	<0.5	2.2	1.5	<1.0	<0.5	<0.5	not tested
MW10	15-Jul-94	<0.5	<0.5	<0.5	1.0	1.0	<0.5	<0.5	<0.5	not tested
MW10	17-Oct-94	20.6	<0.5	<0.5	37.0	19.0	<0.5	<0.5	<0.5	not tested
MW10	29-Dec-94	<1.0 (t)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	not tested
MW10	09-Mar-95	1.7 (t)	<1.0	<1.0	13.0	9.8	<1.0	<1.0	<1.0	<50
MW10	21-Jun-95	<1.0 (t)	<1.0	<1.0	2.1	2.1	<1.0	<1.0	<1.0	not tested
MW10	15-Aug-95	<1.0 (t)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	not tested
MW10	25-Sep-95	<1.0 (t)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	not tested
MW10	26-Dec-95	41(cis) 4(t)	<1.0	<1.0	25	20	<1.0	<1.0	<1.0	not tested
MW10	27-Mar-96	26(cis) 2(t)	<0.5	<0.5	20	26	<0.5	<0.5	<0.5	not tested
MW10	18-Jun-96	13(cis) <1.0(t)	<1.0	<1.0	10	20	<1.0	<1.0	<1.0	not tested
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene (c) 1,2-Dichloroethane (e) Tetrachloroethene (g) 1,2-Dichloropropane (i) Total fuel hydrocarbons as gasoline

(b) 1,1-Dichloroethene (d) Trichloroethene (f) Vinyl chloride (h) 1,1,1-Trichloroethane (t) trans

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA
QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TPH-gasoline (i)
MW11	10-Jul-89	73.0	<1.0	4.0	160.0	12.0	16.0	5.7	<1.0	not tested
MW11	24-Oct-89	188.0	<2.0	10.0	410.0	15.0	22.0	20.0	<2.0	not tested
MW11	07-Feb-90	105.0	<2.0	2.0	270.0	8.0	11.0	13.0	<2.0	not tested
MW11	10-Jul-90	4.0	<2.0	23.0	46.0	18.0	15.0	<0.5	<2.0	not tested
MW11	17-Oct-90	150.0	<2.0	11.0	300.0	8.0	<2.0	31.0	<2.0	not tested
MW11	24-Jan-91	120.0	<1.0	<1.0	29.0	29.0	3.0	<1.0	<1.0	not tested
MW11	17-Apr-91	100.0	<1.0	14.0	160.0	12.0	5.0	29.0	<1.0	not tested
MW11	31-Jul-91	250.0	<2.0	<2.0	61.0	65.0	12.0	2.0	<2.0	not tested
MW11	22-Oct-91	180.0	<2.0	5.0	560.0	20.0	5.0	30.0	<2.0	not tested
MW11	23-Jan-92	160.0	<2.0	13.0	290.0	19.0	<2.0	21.0	<2.0	not tested
MW11	23-Apr-92	30.0	<1.0	9.0	120.0	13.0	<1.0	14.0	<1.0	not tested
MW11	17-Jul-92	26.0	<0.5	1.4	81.0	<0.5	<0.5	3.5	<0.5	not tested
MW11	12-Oct-92	63.0	<3.0	4.4	450.0	16.0	5.2	17.0	<3.0	not tested
MW11	13-Jan-93	29.0	<1.0	2.2	140.0	13.0	3.2	6.4	<1.0	not tested
MW11	30-Mar-93	17.0	<0.5	<0.5	55.0	10.0	1.6	5.1	<0.5	not tested
MW11	16-Jun-93	41.5	<2.0	6.3	230.0	20.0	7.0	7.2	<2.0	not tested
MW11	17-Sep-93	<5.0 (t)	<5.0	<5.0	230.0	<5.0	<5.0	<5.0	<5.0	not tested
MW11	21-Dec-93	32.2	<0.5	2.8	220.0	14.0	6.1	<0.5	<0.5	not tested
MW11	14-Feb-94	11.8	<0.5	2.0	52.0	5.6	1.5	2.6	<0.5	not tested
MW11	11-Apr-94	10.0	<0.5	<0.5	57.0	4.9	<1.0	2.7	<0.5	not tested
MW11	27-Jun-94	<0.5	<0.5	<0.5	110.0	12.0	<0.5	<0.5	<0.5	not tested
MW-11 (SP-E)	30-Sep-94	<1.0 (t)	<1.0	<1.0	2.6	2.8	<1.0	<1.0	<1.0	not tested
MW-11 (SP-E)	06-Dec-94	<1.0 (t)	<1.0	<1.0	4.2	1.8	<1.0	<1.0	<1.0	not tested
MW-11 (SP-E)	09-Mar-95	<1.0 (t)	<1.0	<1.0	2.3	1.1	<1.0	<1.0	<1.0	not tested
MW-11 (SP-E)	22-Jun-95	<1.0 (t)	<1.0	<1.0	6.9	4.6	<1.0	<1.0	<1.0	not tested
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene
(b) 1,1-Dichloroethene
(c) 1,2-Dichloroethane
(d) Trichloroethene
(e) Tetrachloroethene
(f) Vinyl chloride
(g) 1,2-Dichloropropane
(h) 1,1,1-Trichloroethane
(i) Total fuel hydrocarbons as gasoline
(t) trans

TABLE 2

DEL MONTE PLANT NO. 35 EMERYVILLE, CA

QUARTERLY GROUNDWATER MONITORING RESLUTS

Monitoring Well	Sampling Date	Concentration (ug/L) 1,2-DCE(a)	1,1-DCE(b)	1,2-DCA(c)	TCE(d)	PCE(e)	VC(f)	1,2-DP(g)	1,1,1-TCA (h)	TFH-gasoline (i)
MW12	02-Mar-94	35.3	<0.5	<0.5	170.0	16.0	6.8	<0.5	<0.5	not tested
MW12	11-Apr-94	25.0	<0.5	<0.5	100.0	13.0	<1.0	<0.5	<0.5	not tested
MW12	15-Jul-94	31.9	<0.5	<0.5	82.0	19.0	4.2	<0.5	<0.5	not tested
MW12	17-Oct-94	<0.5	<0.5	<0.5	1.1	0.9	<0.5	<0.5	<0.5	not tested
MW12	29-Dec-94	<1.0 (t)	<1.0	<1.0	28.0	11.0	<1.0	<1.0	<1.0	not tested
MW12	09-Mar-95	<1.0 (t)	<1.0	<1.0	64.0	16.0	<1.0	<1.0	<1.0	<50
MW12	21-Jun-95	1.1 (t)	<1.0	<1.0	32.0	15.0	<1.0	<1.0	<1.0	not tested
MW12	15-Aug-95	<1.0 (t)	<1.0	<1.0	18.0	11.0	<1.0	<1.0	<1.0	not tested
MW12	25-Sep-95	<1.0 (t)	<1.0	<1.0	20.0	9.9	<1.0	<1.0	<1.0	not tested
MW12	26-Dec-95	15(cis) 5(t)	<1.0	<1.0	34	14	<1.0	<1.0	<1.0	not tested
MW12	27-Mar-96	11(cis) <0.5(t)	<0.5	<0.5	15	11	<0.5	<0.5	<0.5	not tested
MW12	18-Jun-96	5.7(cis) <1.0(t)	<1.0	<1.0	15	7.4	<1.0	<1.0	<1.0	not tested
MW13	13-Oct-95	2.6 (t)	<1.0	<1.0	9.6	28	20	<1.0	<1.0	<50
MW13	26-Dec-95	38(cis) 13(t)	<1.0	<1.0	13	29	17	<1.0	<1.0	<50
MW13	27-Mar-96	27(cis) 2.2(t)	<0.5	<0.5	8.0	18.0	6.7	<0.5	<0.5	<50
MW13	18-Jun-96	20(cis) 1.0(t)	<1.0	<1.0	4.1	12.0	8.7	<1.0	10	30
	Primary MCL	cis=6; trans=10	6	0.5	5	5	0.5	5	200	

(a) 1,2-Dichloroethene (b) 1,1-Dichloroethene (c) 1,2-Dichloroethane (d) Trichloroethene (e) Tetrachloroethene (f) Vinyl chloride (g) 1,2-Dichloropropane (h) 1,1,1-Trichloroethane (i) Total fuel hydrocarbons as gasoline (t) trans

TABLE 3
Chemicals Present in West Parcel Soil

Sample Location Number	Depth (bgs)	Chemical Constituent	Concentration (mg/kg)	Concentration Used in Risk Assessment[a] (mg/kg)
A10-SB-04	2.5 ft.	1,1,1-trichloroethane	0.022	0.0066
		1,1-dichloroethane	0.03	0.0114
	6.0 ft.	1,1,1-trichloroethane	0.01	0.0066
A10-SB-07	6.0 ft.	Motor oil	260	NA

[a] UCL_{95}; one-half the detection limit was substituted for nondetects when calculating UCL_{95}.

TABLE 4
Summary of Chlorinated Hydrocarbons in Groundwater (µg/l)[a]

West Parcel[b]	6/18/96		5 Events Since GET System Shut Down		Concentration Used In Risk Assessments[g]
	Range	Average	Range	Average	
PCE	3.7 – 20	9.6	<1.0 – 26	9.7	12.1
TCE	1.2 – 15	9.8	<1.0 – 34	11.8	15.3
cis-1,2-DCE	1.3 – 17	9.3	1.3-41[d]	14.5	20.2
trans-1,2-DCE	<1.0 – 1.5	0.75	<0.5 – 5	1.0	1.55

East Parcel[e]	6/18/96	4 Events Since Well Installation		Concentration Used in Risk Assessments[h]
		Range	Average	
PCE	12	12.0 – 29	21.8	29.0
TCE	4.1	4.1 – 13	8.7	13.0
cis-1,2-DCE	20	20 – 38[d]	28.3	38
trans-1,2-DCE	1.0	1.0 – 13	4.7	13
Vinyl Chloride	8.7	6.7 – 20	13.1	20.0
1,1,1-TCA	10	<0.5 – 10	2.8	10.0

[a] Based on results of EPA Method 8010 analysis
[b] Wells monitored are MW-7, MW-9, MW-10, MW-12.
[c] Events since GET system turned off: August 15, September 25, December 26, 1995, March 27 and June 18, 1996.
[d] cis-1,2-DCE was not analyzed for in the August 15, September 25, or October 13, 1995 sampling events.
[e] Well monitored is MW-13.
[f] October 13 and December 26, 1995, March 27 and June 8, 1996.
[g] UCL_{95}; one-half the detection limit was substituted for nondetects when calculating UCL_{95}.
[h] maximum detected value.
PCE = Perchloroethene or tetrachloroethene
TCE = Trichloroethene
DCE = Dichloroethene
TCA = Trichloroethane

TABLE 5
Concentrations of Chlorinated and Petroleum Hydrocarbons Remaining in East Parcel Soil (mg/kg)

	Range	No. Of Detects	Concentration Used in Risk Assessment [a]
Source Area East of Label Room			
Kerosene	<1 to 4.5	1 of 34	NA
Diesel	<1 to 9.6	1 of 34	NA
Motor Oil	<1 to 19	3 of 34	NA
PCE[b]	<0.005 to 0.960	15 of 34	0.0069
TCE[c]	<0.005 to 0.230	11 of 34	0.022
cis 1,2-DCE[d]	<0.005 to 0.200	12 of 34	0.026
trans 1,2-DCE	<0.005 to 0.050	5 of 34	0.0054
Vinyl Chloride	<0.005 to 0.081	6 of 34	0.012
Acetone	<0.005 to 0.047	2 of 34	0.0054
Former Underground Tank Area			
Diesel	<1 to 60	5 of 21	NA
Motor Oil	<1 to 150	4 of 21	NA
Gasoline	<1 to 1.4	1 of 21	NA
TCE	<0.005 to 0.009	1 of 21	0.022
Methylene Chloride	<0.005 to 0.039	1 of 21	0.0043
cis 1,2-DCE	<0.005 to 0.011	6 of 21	0.026

[a] UCL_{95}: one-half the detection limit was substituted for nondetects when calculating the UCL_{95}.
[b]PCE = perchloroethene or tetrachloroethene
[c]TCE = trichloroethene
[d]DCE = dichloroethene

Table 6
Chemical Concentrations in Air Inside Residential and Commercial Buildings

Chemical	Concentration	Air Concentration	
		Commercial (ug/m^3)	Residential (ug/m^3)
Groundwater (West Parcel)	**UCL95 (UG/l)**		
cis-1,2-Dichloroethylene	20.2	3.20E-03	1.05E-02
Tetrachloroethylene	12.1	5.59E-03	1.84E-02
trans-1,2-Dichloroethylene	1.55	4.90E-04	1.61E-03
Trichloroethylene	15.3	5.36E-03	1.76E-02
Groundwater (East Parcel)	**Max. (ug/L)**		
cis-1,2-Dichloroethylene	3.80E+01	6.02E-03	1.98E-02
Tetrachloroethylene	2.90E+01	1.34E-02	4.40E-02
trans-1,2-Dichloroethylene	1.30E+01	4.11E-03	1.35E-02
Trichloroethylene	1.30E+01	4.56E-03	1.50E-02
Vinyl chloride	2.00E+01	7.07E-02	2.32E-01
1,1,1-Trichloroethane	1.00E+01	2.47E-03	8.12E-03
Soil (West Parcel)	**UCL_{95} (ug/kg)**		
1,1,1-Trichloroethane	6.61	2.68E-03	8.83E-03
1,1-Dichloroethane	11.35	1.98E-02	6.62E-02
Soil (East Parcel)	**UCL_{95} (ug/kg)**		
Acetone	5.36	7.29E-04	2.40E-03
cis-1,2-Dichloroethylene	26.35	2.13E-02	7.00E-02
Methylene chloride	4.28	2.41E-03	7.92E-03
Tetrachloroethylene	68.8	2.18E-02	7.17E-02
trans-1,2-Dichloroethylene	5.38	1.18E-02	3.88E-02
Trichloroethylene	21.81	1.52E-02	4.98E-02
Vinyl chloride	11.94	1.85E-01	6.08E-01

Table 7
Toxicity Values

Chemical	RfD (mg/kg-day)	Source (a)	CSF $(mg/kg\text{-}day)^{-1}$	Source (a)	Weight of Evidence (b)
Methylene Chloride	0.86	IRIS	0.0035	CalEPA	B2
cis-1,2-Dichloroethene	0.01	IRIS	--		D
trans-1,2-Dichloroethene	0.02	IRIS	--		D
Vinyl Chloride	--	IRIS	0.3	HEAST	A
Tetrachloroethene	0.01	IRIS	0.021	CalEPA	C-B2
Trichloroethene	0.006	ECAO	0.01	CalEPA	B2
1,1,1-Trichloroethane	0.29	IRIS	--	HEAST	B2
1,1-Dichloroethane	0.14	IRIS	0.0057	CalEPA	C
Acetone	0.1	IRIS	--	HEAST	D

NOTES :
(a) Sources :
IRIS - Integrated Risk Information System
HEAST - Healt Effects Assessment Summary Tables
ECAO - Environmental Criteria and Asessment Office
CalEPA - California Environmental Protection Agency
(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 carcinogenecity

Table 8
Estimated Excess Lifetime Cancer Risks and Noncancer Hazard Quotients (a)

Chemical	Commercial		Residential	
	Excess Lifetime Cancer Risk	Noncancer Hazard Quotient	Excess Lifetime Cancer Risk	Noncancer Hazard Quotient
Groundwater (West Parcel)				
cis-1,2-Dichloroethylene	(b)	6E-05	(b)	3E-04
trans-1,2-Dichloroethylene	(b)	5E-06	(b)	2E-05
Tetrachloroethylene	8E-09	1E-04	5E-08	5E-04
Trichloroethylene	4E-09	2E-04	2E-08	8E-04
Pathway TOTAL	1E-08	4E-04	7E-08	2E-03
Soil (West Parcel) ug/kg				
1,1,1-Trichloroethane	(b)	2E-06	(b)	6E-06
1,1-Dichloroethane	8E-09	3E-05	4E-08	9E-05
Pathway TOTAL	8E-09	3E-05	4E-08	1E-04
West Parcel TOTAL	2E-08	4E-04	1E-07	2E-03
Groundwater (East Parcel)				
cis-1,2-Dichloroethylene	(b)	1E-04	(b)	5E-04
trans-1,2-Dichloroethylene	(b)	4E-05	(b)	2E-04
Vinyl chloride	1E-06	--	8E-06	--
Tetrachloroethylene	2E-08	3E-04	1E-07	1E-03
Trichloroethylene	3E-09	1E-04	2E-08	7E-04
1,1,1-Trichloroethane	(b)	2E-06	(b)	8E-06
Pathway TOTAL	2E-06	6E-04	8E-06	3E-03
Soil (East Parcel) ug/kg				
Methylene chloride	6E-10	6E-07	3E-09	2E-06
cis-1,2-Dichloroethylene	(b)	4E-04	(b)	1E-03
trans-1,2-Dichloroethylene	(b)	1E-04	(b)	4E-04
Vinyl chloride	4E-06	--	2E-05	--
Tetrachloroethylene	3E-08	4E-04	2E-07	1E-03
Trichloroethene	1E-08	5E-04	6E-08	2E-03
Acetone	(b)	1E-06	(b)	5E-06
Pathway TOTAL	4E-06	1E-03	2E-05	5E-03
East Parcel TOTAL	5E-06	2E-03	3E-05	7E-03

(a) Based on worker or resident inhalation exposure to VOCs inside a building or residence
(b) Cis- and trans-1,2-DCE; 1,1,1-TCA; and acetone have no slope factors

TABLE 9
Transport Model Parameter Summary

Model Parameters	Transport Model AT123D
Initial Conditions	instantaneous slug with total VOC = 207.7 ppb source configuration = 30 ft x 30 ft (based on portion of plume not entrained by capture zone analysis (Fig 3-3)) gradient = 0.013 ft/ft
Aquifer Properties	width = assumed infinite (only 165 ft plotted) depth = 35 ft effective porosity = 0.3 (estimate for a sand, based on Yeh, 1981) K = 3 ft/day (based on site specific data, see CH2M HILL, 1994c)
Transport Parameters	longitudinal dispersivity = 10 ft (Yeh, 1981) lateral dispersivity = 0.5 ft (Yeh, 1981) molecular diffusion = 3.28E-07 ft/hr (Yeh, 1981) bulk density = 42.48 kg/ft^3
Chemical Properties	Foc (organic carbon fraction in soil) = 0.005 (value between Bay Alluvium and Bay Mud field measurements) Koc (organic carbon partitioning coefficient): vinyl chloride /trans-1,2-dichloroethene = 57 ml/g; TCE = 126 ml/g; and PCE = 364 ml/g (EPA 540/1-86/060)

Figures

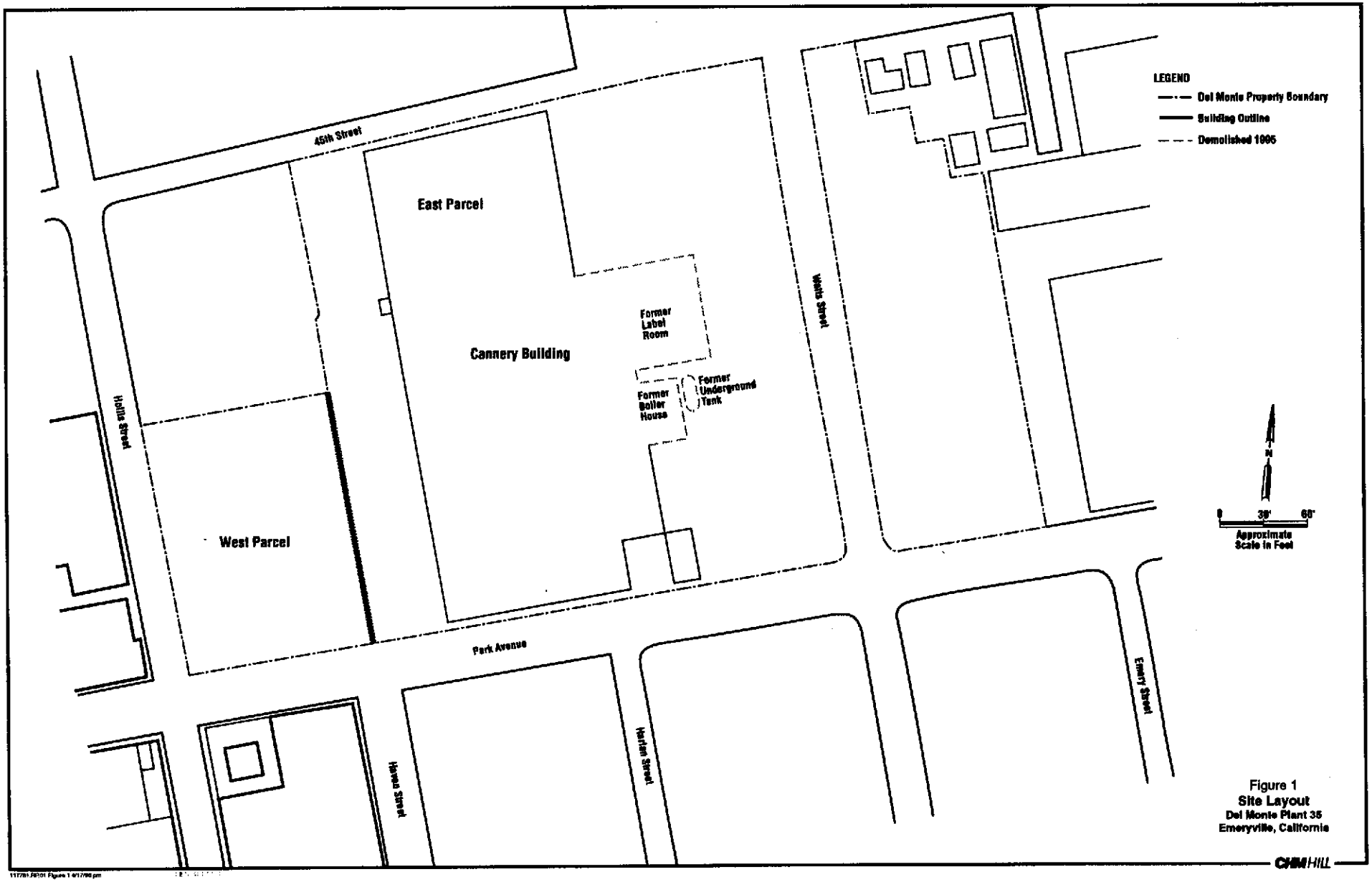


Figure 1
Site Layout
Del Monte Plant 35
Emeryville, California

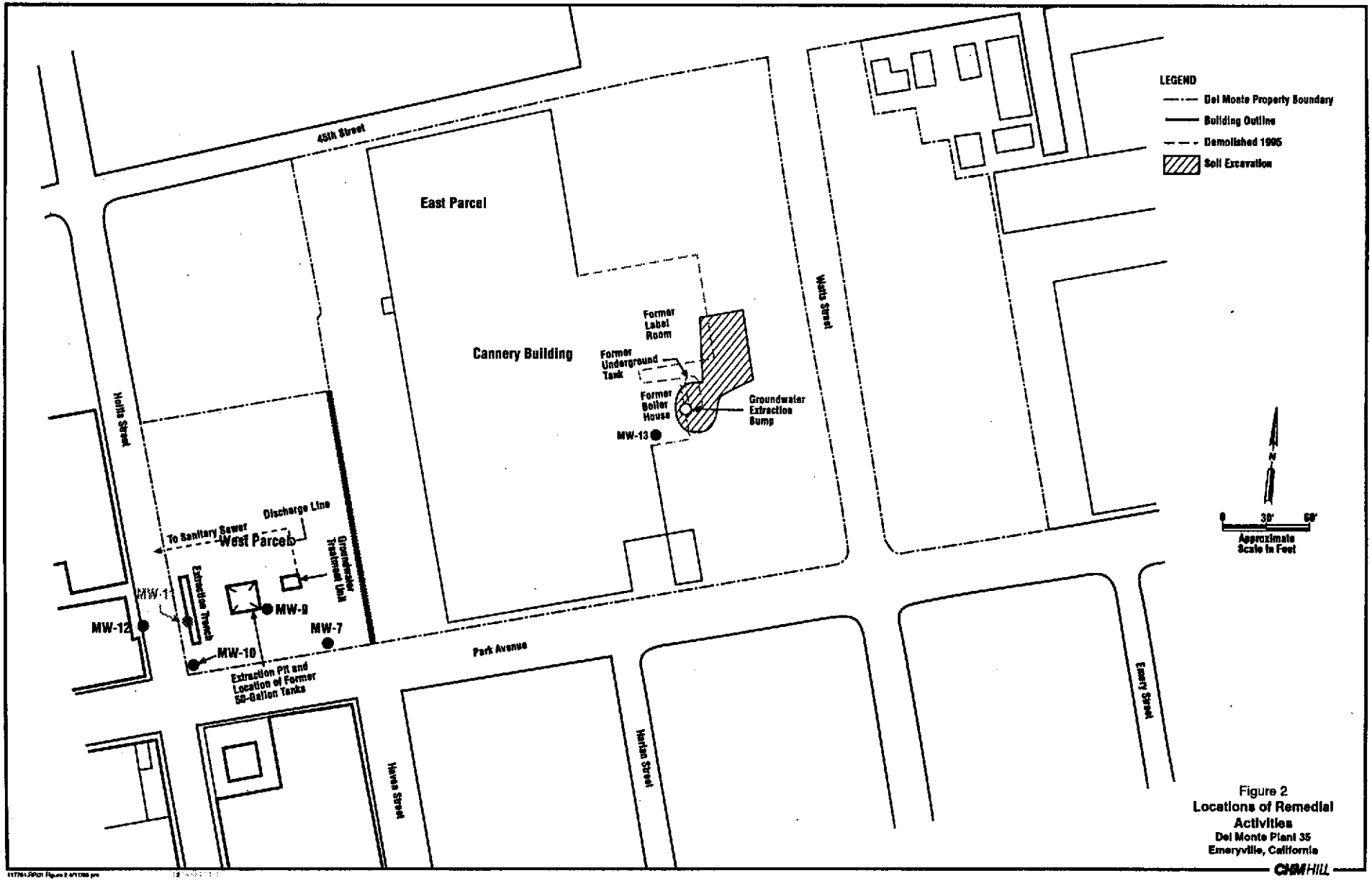
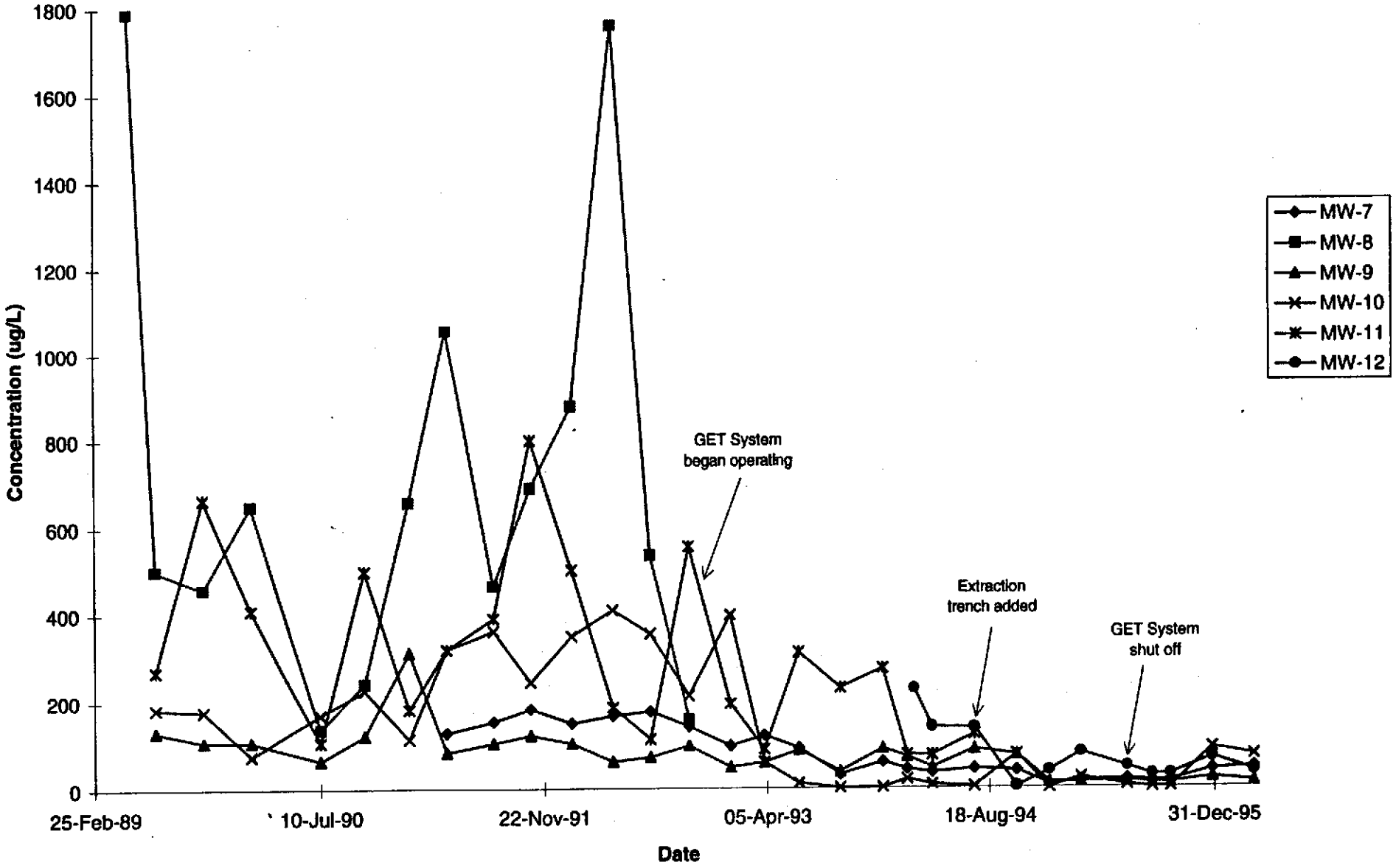


Figure 2
Locations of Remedial Activities
Del Monte Plant 35
Emeryville, California

CH2MHILL

Figure 3
Total Chlorinated Hydrocarbon Concentration in Monitoring Wells



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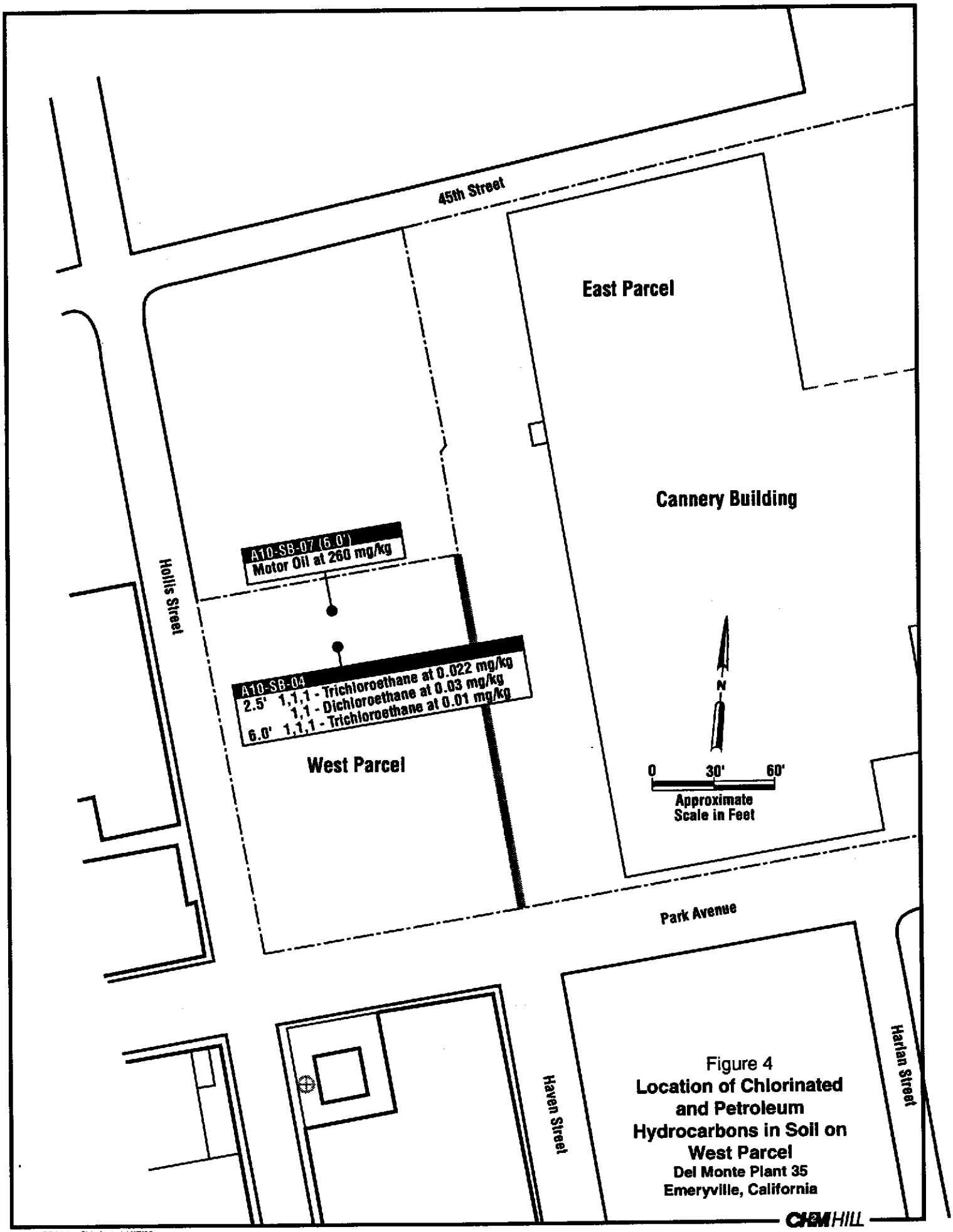

Figure 4
Location of Chlorinated and Petroleum Hydrocarbons in Soil on West Parcel
Del Monte Plant 35
Emeryville, California

CH2MHILL

117761.RR01 LocChlorinated 4/17/96 pm

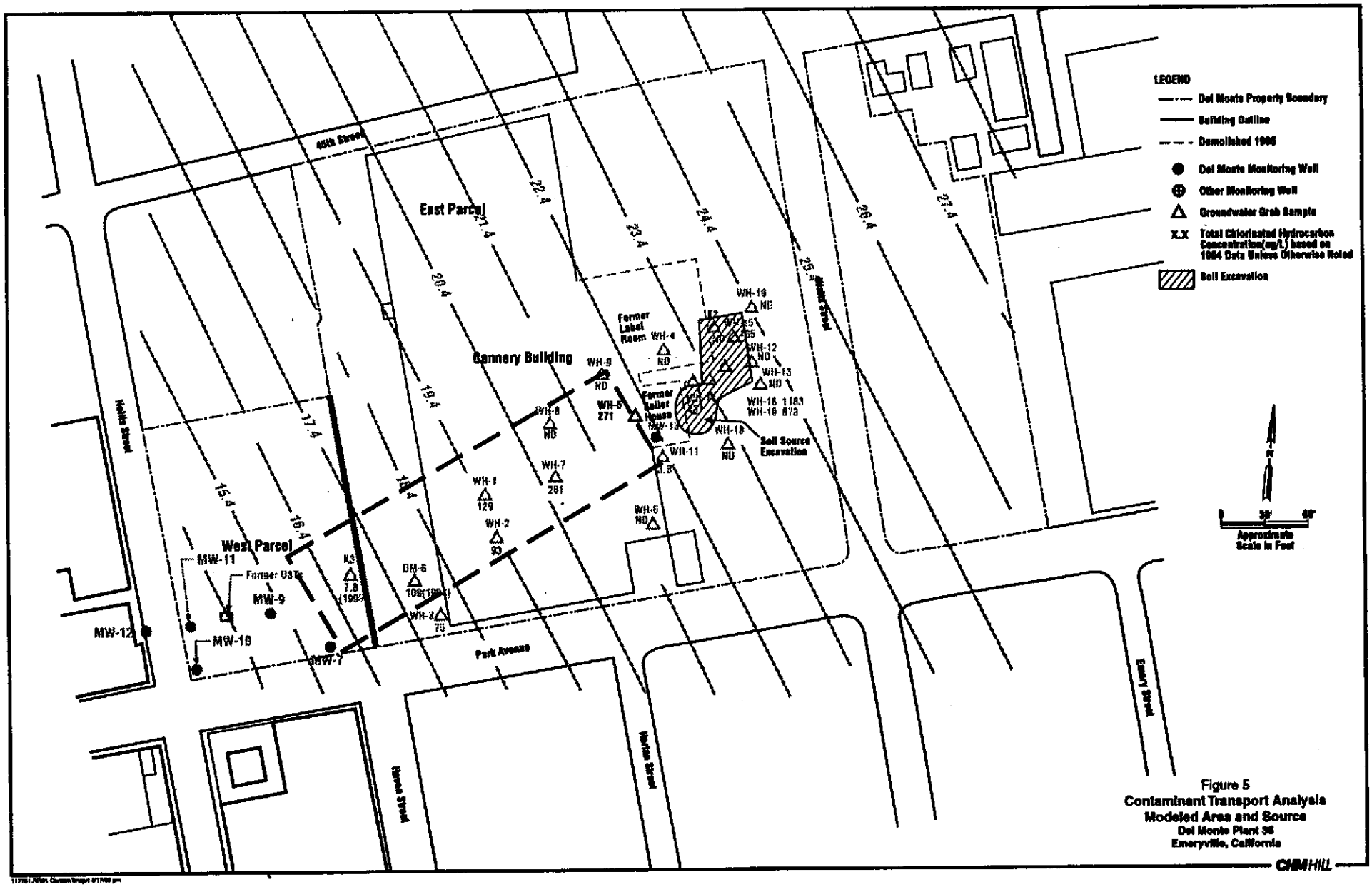

Figure 5
Contaminant Transport Analysis
Modeled Area and Source
Del Monte Plant 35
Emeryville, California

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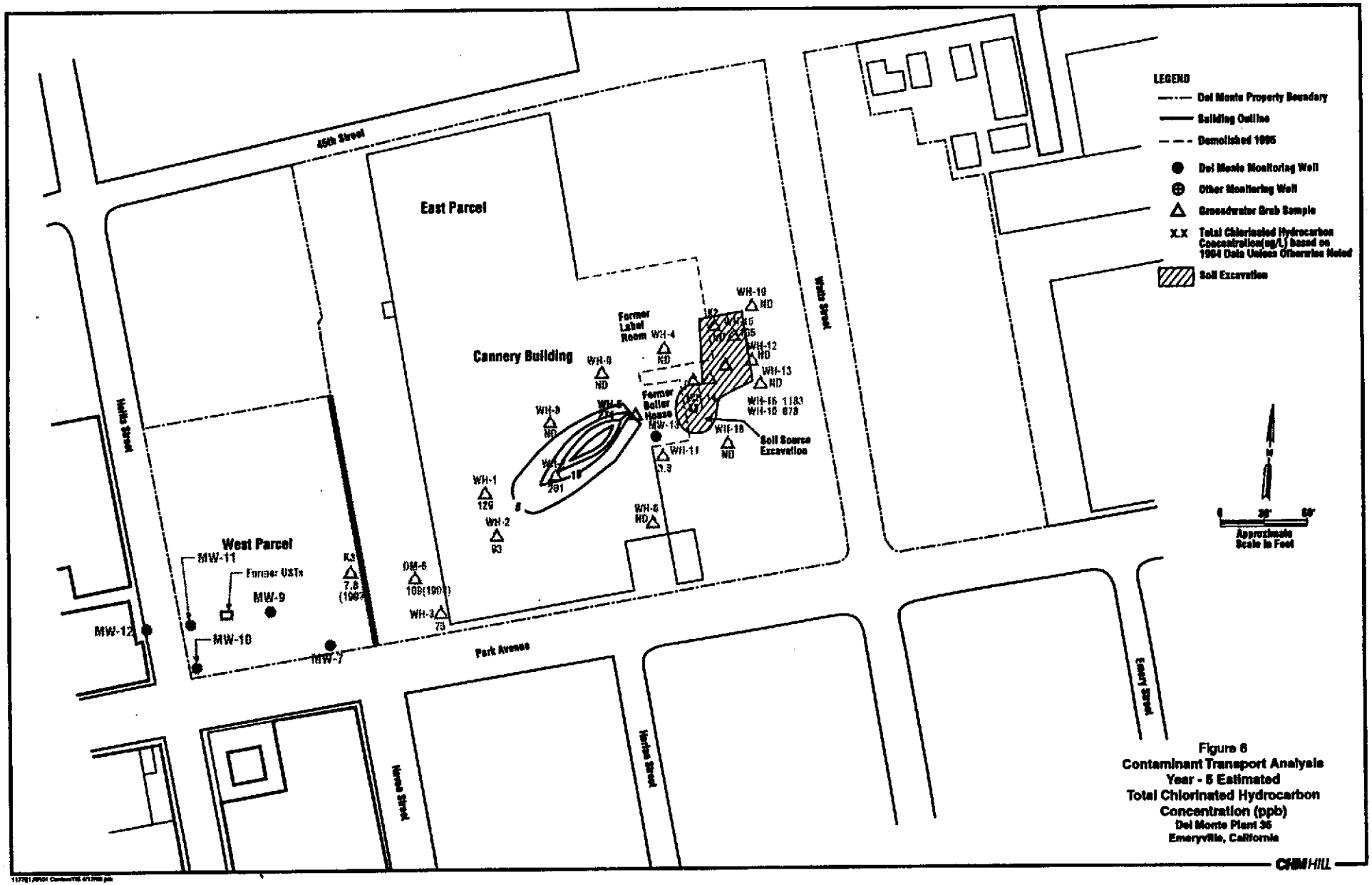

Figure 6
Contaminant Transport Analysis
Year - 5 Estimated
Total Chlorinated Hydrocarbon
Concentration (ppb)
Del Monte Plant 35
Emeryville, California

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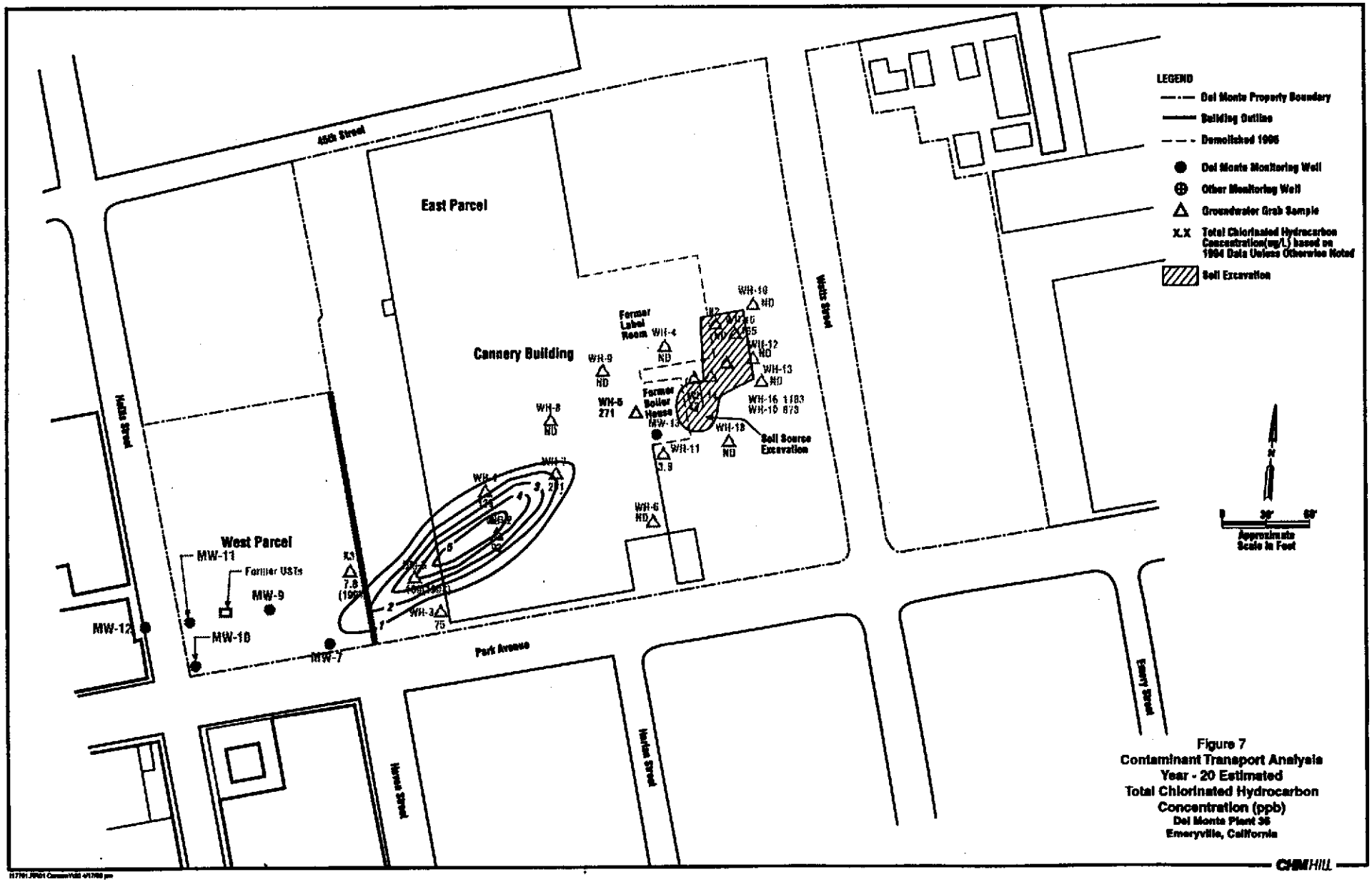

Figure 7
Contaminant Transport Analysis
Year - 20 Estimated
Total Chlorinated Hydrocarbon
Concentration (ppb)
Del Monte Plant 36
Emeryville, California

CH2MHILL

Appendix A
Transport of Chemicals for Groundwater and Soil to Air

Appendix A

Transport of Chemicals From Groundwater and Soil to Air

Concentrations of volatile organic compounds (VOCs) that may diffuse into a residential or a commercial building from contaminated soil or groundwater have been estimated based on existing soil/groundwater analytical data. Estimation of the flux of VOCs from groundwater or soil at a specific depth to the soil surface was calculated using existing data in conjunction with Fick's first law of diffusion or chemical partitioning according to the Fruendlich constant. The concentration of VOCs inside a residential and commercial building were then calculated on the basis of the flux estimates.

For this preliminary risk assessment, five VOCs for groundwater and nine for soil were evaluated. The five groundwater chemicals are cis-1,2-dichloroethene, trans-1,2-dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride. All five VOCs were detected in groundwater at the Del Monte site. The nine compounds detected in soil are 1,1,1-trichloroethane, 1,1-dichloroethane, cis-1,2-dichloroethene, trans-1,2-dichloroethene, tetrachloroethene, vinyl chloride, acetone, methylene chloride and trichloroethene. For the screening level risk assessment, the indoor concentrations of VOCs at a structure built on the ground surface, directly above the contaminated soil or groundwater were estimated utilizing the measured contaminant concentration in soil or groundwater.

Soil gas contaminant concentration may be estimated from measured soil or groundwater contaminant concentration. In case of known soil contamination, equilibrium soil water concentration is estimated from the soil contaminant concentration. The calculated or measured soil water concentration is then utilized to estimate the soil gas concentration. 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). Formulation to estimate soil water concentration from measured soil concentration and subsequently soil gas flus from measured or calculated groundwater concentration is described below.

Estimating Soil Water Concentration From Soil Samples

To convert the soil concentration of a contaminant to the soil water concentration, the Fruendlich constant K_f was used. The Fruendlich constant is a measure of the chemical partitioning between soil and soil water.

$$K_f = \frac{Amount\ Absorbed\ to\ Soil}{Soil\ Water\ Concentration} \qquad 1$$

This chemical partitioning is affected by the organic content of the soil, therefore K_f can also be defined as the product of the organic carbon partitioning coefficient (K_{oc}) and the fraction of organic carbon in the soil, the concentration in the soil water can be determined by :

$$K_f = (K_{oc})(f_{oc}) \qquad 2$$

The fraction of organic carbon (f_{oc}) for soil at the Del Monte site is assumed to be 0.5 percent.

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_l, 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.

$$H_l = \frac{H}{RT} = \frac{C_{sg}}{C_{sl}} \qquad 3$$

where:

R = the Universal gas constant; and
T = the temperature

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

Estimate of Chemical Concentration in Building

The concentration of a chemical in a building which is built above contaminated groundwater 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:

$$J = D \frac{(C_2 - C_1)}{L} \quad (4)$$

where:

D = the rate of movement of gas-phase chemicals in the vadose zone (soil gas diffusion coefficient);
C_2 = the chemical concentration in the soil gas at depth L;
C_1 = the chemical concentration in the soil gas at the surface; and
L = the depth for which the soil gas concentration, C_2, is estimated (depth of the water table)

The diffusion coefficient used in Equation 4 represents the rate at which a gas-phase contaminant 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:

$$D = D_0 \left(\frac{a^{10/3}}{\Phi^2} \right) \quad (5)$$

where:

D_0 = the gas phase diffusion rate through air (air diffusion coefficient)
a = the air filled soil porosity
Φ = the total soil porosity

Equation 4 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:

$$C_h = \frac{(J)(A)(\%)(R)}{V} \quad (6)$$

where:

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

Calculating the concentration of air inside a building requires solving Equation 4 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 6 was substituted for C_1 in Equation 4, and flux was calculated. The flux was then substituted back into Equation 6 to obtain building air concentration.

The method described here is accurate over the short term (e.g., less than 1 year), and would be applicable for short time frames such as the 2-hour residence time in the home. For much longer time periods (e.g., 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 concentration of chemicals in air, appropriate for this risk analysis.

Input Parameters

Table A-1 lists the compound-specific input parameters for each of the chemicals in soil and groundwater that 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). Organic carbon partitioning coefficients were obtained from *Superfund Public Health Evaluation Manual* (USEPA, 1987).

Table A-2 lists the values that 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 0.26 were assumed.

Equation 6 requires input parameters that describe the structure built above the groundwater containing VOCs. It was assumed that the site has potential for both commercial and residential building development. Two of the input parameters which are required are the building foundation area and volume of air in the buildings.

Air residence time was assumed to be 2 hour for residential buildings and 0.56 hour for commercial buildings. 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.

References

ASTM. 1995 American Society for Testing and Materials. "Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. November.

CH2M HILL. 1990. User Documentation for VLEACH, A One-Dimensional Finite Difference Vadose Zone Leaching Model. August.

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.

USPEA, 1987, Superfund Public Health Evaluation Manual. EPA 540/1-86/060. US Environmental Protection Agency, Washington DC

Table A-1
Transport of Chemicals from Groundwater and Soil to Building
Chemical-Specific Input Parameters

Chemical name	Henry's Law Constant (atm-m3/mol)	Air Diffusion Coefficient (cm2/s)	Organic Carbon Partitioning Coeff. K_{oc} (ml/g)
1,1,1-Trichloroethane	8.00E-03	7.94E-02	152
1,1-Dichloroethane	4.31E-03	9.19E-02	30
Acetone	3.67E-05	8.39E-02	2.2
cis-1,2-Dichloroethene	3.37E-03	1.21E-01	49
Methylene Chloride	2.68E-03	1.04E-01	48
Tetrachloroethene	1.49E-02	7.97E-02	364
Trichloroethene	1.03E-02	8.75E-02	126
trans-1,2-Dichloroethen	6.72E-03	1.21E-01	36
Vinyl Chloride	8.19E-02	1.11E-01	57

References:
Howard, 1989; Lugg, 1968; Lyman, 1991; USEPA, 1987.

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

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26 [(a)]
Depth to contaminated soil	=	8 ft

Structure Data Input

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

(a) Reference: ASTM 1995.

Appendix B
Risk Calculation Spread Sheets

Residential

Chemical Concentrations in Soil to Indoor Air
Del Monte Site

Calculation of Contaminant Concentrations Inside a Structure Above Contaminated Soil
Dissolved contaminants (no separate organic phase)

Scenario description: Residential building with 1,500 sq. ft. area

DATA INPUT SECTION

Soil Data Input

Depth of Soil Contam'n	=	6 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26
Fraction organic carbon	=	0.005

Structure Data Input

Foundation area	=	1500 ft^2
Structure volume	=	461.5 m^3
Air residence time	=	2 hr
Flux % through foundation	=	0.5 %

Chemical name	Henry's Constant (atm-m3/mol)	Org.Carb. Partition Coeff. (ml/g)	Air Diffusion Coeff. (cm2/s)	Chemical Conc. Soil (ug/kg)	Conc'n in House (mg/m^3)	Conc'n in House (ug/m^3)	Target mg/m^3	Diffusion Coeff. in Soil (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n in House (ug/l)
1,1,1-Trichloroethane	0.008	152	0.0794	6.61	7.06E-06	7.06E-03	4.60E-01	0.005567	8.6973684	2.84531	0.00302	2.48E-06	7.06E-06
1,1-Dichloroethane	0.00587	30	0.0919	11.35	5.22E-05	5.22E-02	2.51E-03	0.006443	75.666667	18.1633	0.00302	2.87E-06	5.22E-05
Acetone	3.67E-05	2.2	0.0839	5.36	1.92E-06	1.92E-03	2.60E-04	0.005882	487.27273	0.73129	0.00302	2.62E-06	1.92E-06
cis-1,2-Dichloroethylene	0.00397	49	0.1209	26.35	5.60E-05	5.60E-02	5.11E-02	0.008476	107.55102	14.8217	0.00302	3.78E-06	5.6E-05
Methylene chloride	0.00268	48	0.1037	4.28	6.33E-06	6.33E-03	4.09E-03	0.007271	17.833333	1.95443	0.00302	3.24E-06	6.33E-06
Tetrachloroethylene	0.0149	364	0.0797	68.8	5.74E-05	5.74E-02	6.81E-04	0.005588	37.802198	23.0333	0.00302	2.49E-06	5.74E-05
trans-1,2-Dichloroethylene	0.00672	36	0.1209	5.38	3.10E-05	3.10E-02	1.02E-01	0.008476	29.888889	8.21356	0.00302	3.78E-06	3.1E-05
Trichloroethylene	0.0103	126	0.0875	21.61	3.99E-05	3.99E-02	1.43E-03	0.006135	94.619048	14.5816	0.00302	2.73E-06	3.99E-05
Vinyl chloride	0.0819	57	0.1110	11.94	4.87E-04	4.87E-01	5.30E-05	0.007782	41.894737	140.312	0.00302	3.47E-06	0.000487

Notes:

Diffusion coefficients are estimated using method in Lyman
- or - diffusion coefficients are from Lugg, ES&T, June 1968.
Parameter Henry's Law constants are from Howard Volumes I and II and HSDB

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

EXCESS LIFETIME CANCER RISK
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Soil to Air)
Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. in Air mg/m3 (b)	Conc. in Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc in Air mg/m3 (b)	Conc in Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
Methylene Chloride	B2	0.0035	CalEPA	6.33E-06	6.33E-03	2.22E-07	8.E-10	6.33E-06	6.33E-03	7.44E-07	2.60E-09
cis-1,2-Dichloroethene	D	--		5.60E-05	5.60E-02	1.96E-06		5.60E-05	5.60E-02	6.58E-06	
trans-1,2-Dichloroethene	D	--		3.10E-05	3.10E-02	1.09E-06		3.10E-05	3.10E-02	3.64E-06	
Vinyl Chloride	A	0.3	HEAST	4.87E-04	4.87E-01	1.71E-05	5.E-06	4.87E-04	4.87E-01	5.72E-05	1.71E-05
Tetrachloroethene	C-B2	0.021	CalEPA	5.74E-05	5.74E-02	2.01E-06	4.E-08	5.74E-05	5.74E-02	6.74E-06	1.41E-07
Trichloroethene	B2	0.01	CalEPA	3.99E-05	3.99E-02	1.40E-06	1.E-08	3.99E-05	3.99E-02	4.68E-06	4.68E-08
1,1,1-Trichloroethane	B2	--	HEAST	7.06E-06	7.06E-03	2.48E-07		7.06E-06	7.06E-03	8.29E-07	
1,1-Dichloroethane	C	0.0057	CalEPA	5.22E-05	5.22E-02	1.83E-06	1.E-08	5.22E-05	5.22E-02	6.13E-06	3.49E-08
Acetone	D	--	HEAST	1.92E-06	1.92E-03	6.73E-08		1.92E-06	1.92E-03	2.25E-07	

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	350	350
Exposure Duration (years)	9	30
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

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NONCARCINOGENIC HEALTH RISK EVALUATION
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Soil to Air)
Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
Methylene Chloride	0.86	IRIS	6.33E-06	6.33E-03	1.74E-06	2.02E-06	NO	6.33E-06	6.33E-03	1.24E-06	1.45E-06	NO
cis-1,2-Dichloroethene	0.01	IRIS c	5.60E-05	5.60E-02	1.53E-05	1.53E-03	NO	5.60E-05	5.60E-02	1.10E-05	1.10E-03	NO
trans-1,2-Dichloroethene	0.02	IRIS c	3.10E-05	3.10E-02	8.50E-06	4.25E-04	NO	3.10E-05	3.10E-02	6.07E-06	3.04E-04	NO
Vinyl Chloride	--	IRIS	4.87E-04	4.87E-01	1.33E-04	--	--	4.87E-04	4.87E-01	9.53E-05	--	--
Tetrachloroethene	0.01	IRIS c	5.74E-05	5.74E-02	1.57E-05	1.57E-03	NO	5.74E-05	5.74E-02	1.12E-05	1.12E-03	NO
Trichloroethene	0.006	ECAO c	3.99E-05	3.99E-02	1.09E-05	1.82E-03	NO	3.99E-05	3.99E-02	7.80E-06	1.30E-03	NO
1,1,1-Trichloroethane	0.29	IRIS	7.06E-06	7.06E-03	1.93E-06	6.77E-06	NO	7.06E-06	7.06E-03	1.38E-06	4.84E-06	NO
1,1-Dichloroethane	0.14	IRIS	5.22E-05	5.22E-02	1.43E-05	1.00E-04	NO	5.22E-05	5.22E-02	1.02E-05	7.15E-05	NO
Acetone	0.1	IRIS c	1.92E-06	1.92E-03	5.25E-07	5.25E-06	NO	1.92E-06	1.92E-03	3.75E-07	3.75E-06	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONAI	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20	20
Exposure Frequency (days/year)	350	250	350
Body Weight (kilogram)	70	70	70
Conversion Factor 1 (year to day)	365	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 18.
(c) Oral RfD has been used for chemicals with no inhalation RfD.

Chemical Concentrations in Indoor Air - Groundwater
West Parcel, Del Monte Site

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

Scenario description: Residential building with 1,500 sq. ft. area

DATA INPUT SECTION

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26

Chemical name	Henry's Constant (atm-m3/mol)	Air Diffusion Coeff. (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in House (mg/m^3)	Conc'n in House (ug/m^3)	Target mg/m^3
cis-1,2-Dichloroethylene	0.00337	0.1209	2.02E+01	1.05E-05	1.05E-02	5.11E-02
Tetrachloroethylene	0.0149	0.0797	1.21E+01	1.84E-05	1.84E-02	6.81E-04
trans-1,2-Dichloroethylene	0.00672	0.1209	1.55E+00	1.61E-06	1.61E-03	1.02E-01
Trichloroethylene	0.0103	0.0875	1.53E+01	1.76E-05	1.76E-02	1.43E-03

Diffusion Coeff. in Soil (cm2/s)	Conc'n in Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n in House (ug/l)
0.008476	2.78377	0.00302	3.78E-06	1.05E-05
0.005588	7.37265	0.00302	2.49E-06	1.84E-05
0.008476	0.42594	0.00302	3.78E-06	1.61E-06
0.006135	6.44438	0.00302	2.73E-06	1.76E-05

Structure Data Input

Foundation area	=	1500 ft^2
Structure volume	=	461.5 m^3
Air residence time	=	2 hr
Flux % through foundation	=	0.5 %

Notes:

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

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

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EXCESS LIFETIME CANCER RISK
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
West Parcel, Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc In Air mg/m3 (b)	Conc In Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
cis-1,2-Dichloroethene	D	--		1.1E-05	1.05E-02	3.69E-07		1.05E-05	1.05E-02	1.23E-06	
trans-1,2-Dichloroethene	D	--		1.61E-06	1.61E-03	5.65E-08		1.61E-06	1.61E-03	1.89E-07	
Tetrachloroethene	C-B2	0.021	CalEPA	1.84E-05	1.84E-02	6.44E-07	1.E-08	1.84E-05	1.84E-02	2.16E-06	4.53E-08
Trichloroethene	B2	0.01	CalEPA	1.76E-05	1.76E-02	6.18E-07	6.E-09	1.76E-05	1.76E-02	2.07E-06	2.07E-08

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	350	350
Exposure Duration (years)	9	30
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

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NONCARCINOGENIC HEALTH RISK EVALUATION
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
West Parcel, Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. in Air mg/m3 (b)	Conc. in Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc. in Air mg/m3 (b)	Conc. in Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
cis-1,2-Dichloroethene	0.01	IRIS c	1.05E-05	1.05E-02	2.88E-06	2.88E-04	NO	1.05E-05	1.05E-02	2.88E-06	2.88E-04	NO
trans-1,2-Dichloroethene	0.02	IRIS c	1.61E-06	1.61E-03	4.41E-07	2.20E-05	NO	1.61E-06	1.61E-03	4.41E-07	2.20E-05	NO
Tetrachloroethene	0.01	IRIS c	1.84E-05	1.84E-02	5.03E-06	5.03E-04	NO	1.84E-05	1.84E-02	5.03E-06	5.03E-04	NO
Trichloroethene	0.006	ECAO c	1.76E-05	1.76E-02	4.83E-06	8.05E-04	NO	1.76E-05	1.76E-02	4.83E-06	8.05E-04	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	350	350
Body Weight (kilogram)	70	70
Conversion Factor 1 (year to day)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 6.
(c) Oral RfD has been used for chemicals with no inhalation RfD.

Chemical Concentrations in Indoor Air - Groundwater
East Parcel, Del Monte Site

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

Scenario description: Residential building with 1,500 sq. ft. area

DATA INPUT SECTION

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26

Structure Data Input

Foundation area	=	1500 ft^2
Structure volume	=	461.5 m^3
Air residence time	=	2 hr
Flux % through foundation	=	0.5 %

Chemical name	Henry's Constant (atm-m3/mol)	Air Diffusion Coeff. (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in House (mg/m^3)	Conc'n in House (ug/m^3)	Target mg/m^3
1,1,1-Trichloroethane	0.008	0.0794	1.00E+01	8.12E-06	8.12E-03	4.60E-01
cis-1,2-Dichloroethylene	0.00337	0.1209	3.80E+01	1.98E-05	1.98E-02	5.11E-02
Tetrachloroethylene	0.0149	0.0797	2.90E+01	4.40E-05	4.40E-02	6.81E-04
trans-1,2-Dichloroethylene	0.00672	0.1209	1.30E+01	1.35E-05	1.35E-02	1.02E-01
Trichloroethylene	0.0103	0.0875	1.30E+01	1.50E-05	1.50E-02	1.43E-03
Vinyl chloride	0.0819	0.1110	2.00E+01	2.32E-04	2.32E-01	5.30E-05

Diffusion Coeff. in Soil (cm2/s)	Conc'n in Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n in House (ug/l)
0.005567	3.27146	0.00302	2.48E-06	8.12E-06
0.008476	5.2368	0.00302	3.78E-06	1.98E-05
0.005588	17.67	0.00302	2.49E-06	4.4E-05
0.008476	3.57244	0.00302	3.78E-06	1.35E-05
0.006135	5.47561	0.00302	2.73E-06	1.5E-05
0.007782	66.9832	0.00302	3.47E-06	0.000232

Notes:

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

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

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EXCESS LIFETIME CANCER RISK
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
East Parcel, Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc In Air mg/m3 (b)	Conc In Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
cis-1,2-Dichloroethene	D	--		1.98E-05	1.98E-02	6.94E-07		1.98E-05	1.98E-02	2.32E-06	
trans-1,2-Dichloroethene	D	--		1.35E-05	1.35E-02	4.74E-07		1.35E-05	1.35E-02	1.58E-06	
Vinyl Chloride	A	0.3	HEAST	2.32E-04	2.32E-01	8.15E-06	2.E-06	2.32E-04	2.32E-01	2.73E-05	8.19E-06
Tetrachloroethene	C-B2	0.021	CalEPA	4.40E-05	4.40E-02	1.54E-06	3.E-08	4.40E-05	4.40E-02	5.17E-06	1.09E-07
Trichloroethene	B2	0.01	CalEPA	1.50E-05	1.50E-02	5.25E-07	5.E-09	1.50E-05	1.50E-02	1.76E-06	1.76E-08
1,1,1-Trichloroethane	B2	--	HEAST	8.12E-06	8.12E-03	2.85E-07		8.12E-06	8.12E-03	9.53E-07	

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	350	350
Exposure Duration (years)	9	30
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

File nc_res.xls Revised 3/21/96

NONCARCINOGENIC HEALTH RISK EVALUATION
RESIDENT ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
East Parcel, Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS: Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS: Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
cis-1,2-Dichloroethene	0.01	IRIS c	1.98E-05	1.98E-02	5.42E-06	5.42E-04	NO	1.98E-05	1.98E-02	5.42E-06	5.42E-04	NO
trans-1,2-Dichloroethene	0.02	IRIS c	1.35E-05	1.35E-02	3.70E-06	1.85E-04	NO	1.35E-05	1.35E-02	3.70E-06	1.85E-04	NO
Vinyl Chloride	--	IRIS	2.32E-04	2.32E-01	6.37E-05	--	--	2.32E-04	2.32E-01	6.37E-05	--	--
Tetrachloroethene	0.01	IRIS c	4.40E-05	4.40E-02	1.21E-05	1.21E-03	NO	4.40E-05	4.40E-02	1.21E-05	1.21E-03	NO
Trichloroethene	0.006	ECAO c	1.50E-05	1.50E-02	4.10E-06	6.84E-04	NO	1.50E-05	1.50E-02	4.10E-06	6.84E-04	NO
1,1,1-Trichloroethane	0.29	IRIS	8.12E-06	8.12E-03	2.22E-06	7.78E-06	NO	8.12E-06	8.12E-03	2.22E-06	7.78E-06	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	350	350
Body Weight (kilogram)	70	70
Conversion Factor 1 (year to day)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 6.
(c) Oral RfD has been used for chemicals with no inhalation RfD.

Commercial

Chemical Concentrations in Soil to Indoor Air
Del Monte Site

Calculation of Contaminant Concentrations Inside a Structure Above Contaminated Soil
Dissolved contaminants (no separate organic phase)

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

DATA INPUT SECTION

Soil Data Input

Depth of Soil Contam'n	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26
Fraction organic carbon	=	0.005

Structure Data Input

Foundation area	=	11000 ft^2
Structure volume	=	3115 m^3
Air residence time	=	0.56 hr
Flux % through foundation	=	0.5 %

Chemical name	Henry's Constant (atm-m3/mol)	Org.Carb. Partition Coeff. (ml/g)	Air Diffusion Coeff. (cm2/s)	Chemical Conc. Soil (ug/kg)	Conc'n In Bldg. (mg/m^3)	Conc'n in Bldg. (ug/m^3)	Target mg/m^3	Diffusion Coeff. In Soil (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n In Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n In Building (ug/l)
1,1,1-Trichloroethane	0.008	152	0.0794	6.61	2.15E-06	2.15E-03	4.60E-01	0.005567	8.6973684	2.84531	0.000919	7.55E-07	2.15E-06
1,1-Dichloroethane	0.00587	30	0.0919	11.35	1.59E-05	1.59E-02	2.51E-03	0.006443	75.666667	18.1633	0.000919	8.74E-07	1.59E-05
Acetone	3.67E-05	2.2	0.0839	5.36	5.83E-07	5.83E-04	2.60E-04	0.005882	487.27273	0.73129	0.000919	7.98E-07	5.83E-07
cis-1,2-Dichloroethylene	0.00337	49	0.1209	26.35	1.70E-05	1.70E-02	5.11E-02	0.008476	107.55102	14.8217	0.000919	1.15E-06	1.7E-05
Methylene chloride	0.00268	48	0.1037	4.28	1.93E-06	1.93E-03	4.09E-03	0.007271	17.833333	1.95443	0.000919	9.86E-07	1.93E-06
Tetrachloroethylene	0.0149	364	0.0797	68.8	1.75E-05	1.75E-02	6.81E-04	0.005588	37.802198	23.0333	0.000919	7.58E-07	1.75E-05
trans-1,2-Dichloroethylene	0.00672	36	0.1209	5.38	9.44E-06	9.44E-03	1.02E-01	0.008476	29.888889	8.21356	0.000919	1.15E-06	9.44E-06
Trichloroethylene	0.0103	126	0.0875	21.81	1.21E-05	1.21E-02	1.43E-03	0.006135	34.619048	14.5816	0.000919	8.32E-07	1.21E-05
Vinyl chloride	0.0819	57	0.1110	11.94	1.48E-04	1.48E-01	5.30E-05	0.007782	41.894737	140.312	0.000919	1.06E-06	0.000148

Notes:

Diffusion coefficients are estimated using method in Lyman
- or - diffusion coefficients are from Lugg, ES&T, June 1968.
Parameter Henry's Law constants are from Howard Volumes I and II and HSDB

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

EXCESS LIFETIME CANCER RISK
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Soil to Air)
Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc In Air mg/m3 (b)	Conc In Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
Methylene Chloride	B2	0.0035	CalEPA	1.93E-06	1.93E-03	4.83E-08	2.E-10	1.93E-06	1.93E-03	1.35E-07	4.71E-10
cis-1,2-Dichloroethene	D	--		1.70E-05	1.70E-02	4.27E-07		1.70E-05	1.70E-02	1.19E-06	
trans-1,2-Dichloroethene	D	--		9.44E-06	9.44E-03	2.37E-07		9.44E-06	9.44E-03	6.60E-07	
Vinyl Chloride	A	0.3	HEAST	1.48E-04	1.48E-01	3.71E-06	1.E-06	1.48E-04	1.48E-01	1.03E-05	3.10E-06
Tetrachloroethene	C-B2	0.021	CalEPA	1.75E-05	1.75E-02	4.37E-07	9.E-09	1.75E-05	1.75E-02	1.22E-06	2.56E-08
Trichloroethene	B2	0.01	CalEPA	1.21E-05	1.21E-02	3.04E-07	3.E-09	1.21E-05	1.21E-02	8.48E-07	8.48E-09
1,1,1-Trichloroethane	B2	--	HEAST	2.15E-06	2.15E-03	5.38E-08		2.15E-06	2.15E-03	1.50E-07	
1,1-Dichloroethane	C	0.0057	CalEPA	1.59E-05	1.59E-02	3.98E-07	2.E-09	1.59E-05	1.59E-02	1.11E-06	6.32E-09
Acetone	D	--	HEAST	5.83E-07	5.83E-04	1.46E-08		5.83E-07	5.83E-04	4.08E-08	

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	250	250
Exposure Duration (years)	9	25
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

NONCARCINOGENIC HEALTH RISK EVALUATION
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Soil to Air)
Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
Methylene Chloride	0.86	IRIS	1.93E-06	1.93E-03	3.77E-07	4.40E-07	NO	1.93E-06	1.93E-03	3.77E-07	4.40E-07	NO
cis-1,2-Dichloroethene	0.01	IRIS c	1.70E-05	1.70E-02	3.33E-06	3.33E-04	NO	1.70E-05	1.70E-02	3.33E-06	3.33E-04	NO
trans-1,2-Dichloroethene	0.02	IRIS c	9.44E-06	9.44E-03	1.85E-06	9.24E-05	NO	9.44E-06	9.44E-03	1.85E-06	9.24E-05	NO
Vinyl Chloride	--	IRIS	1.48E-04	1.48E-01	2.90E-05	--	--	1.48E-04	1.48E-01	2.90E-05	--	--
Tetrachloroethene	0.01	IRIS c	1.75E-05	1.75E-02	3.42E-06	3.42E-04	NO	1.75E-05	1.75E-02	3.42E-06	3.42E-04	NO
Trichloroethene	0.006	ECAO c	1.21E-05	1.21E-02	2.37E-06	3.96E-04	NO	1.21E-05	1.21E-02	2.37E-06	3.96E-04	NO
1,1,1-Trichloroethane	0.29	IRIS	2.15E-06	2.15E-03	4.20E-07	1.47E-06	NO	2.15E-06	2.15E-03	4.20E-07	1.47E-06	NO
1,1-Dichloroethane	0.14	IRIS	1.59E-05	1.59E-02	3.11E-06	2.17E-05	NO	1.59E-05	1.59E-02	3.11E-06	2.17E-05	NO
Acetone	0.1	IRIS c	5.83E-07	5.83E-04	1.14E-07	1.14E-06	NO	5.83E-07	5.83E-04	1.14E-07	1.14E-06	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONAI	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20	20
Exposure Frequency (days/year)	250	250	250
Body Weight (kilogram)	70	70	70
Conversion Factor 1 (year to day)	365	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 18.
(c) Oral RfD has been used for chemicals with no inhalation RfD.

Chemical Concentrations in Indoor Air - Groundwater
West Parcel, Del Monte Site

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

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

DATA INPUT SECTION

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26

Chemical name	Henry's Constant (atm-m3/mol)	Air Diffusion Coeff. (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in Bldg. (mg/m^3)	Conc'n in Bldg. (ug/m^3)	Target mg/m^3
cis-1,2-Dichloroethylene	0.00337	0.1209	2.02E+01	3.20E-06	3.20E-03	5.11E-02
Tetrachloroethylene	0.0149	0.0797	1.21E+01	5.59E-06	5.59E-03	6.81E-04
trans-1,2-Dichloroethylene	0.00672	0.1209	1.55E+00	4.90E-07	4.90E-04	1.02E-01
Trichloroethylene	0.0103	0.0675	1.53E+01	5.36E-06	5.36E-03	1.43E-03

Diffusion Coeff. in Soil (cm2/s)	Conc'n in Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n in Building (ug/l)
0.008476	2.78377	0.000919	1.15E-06	3.2E-06
0.005588	7.37265	0.000919	7.58E-07	5.59E-06
0.008476	0.42594	0.000919	1.15E-06	4.9E-07
0.006135	6.44438	0.000919	8.32E-07	5.36E-06

Structure Data Input

Foundation area	=	11000 ft^2
Structure volume	=	3115 m^3
Air residence time	=	0.56 hr
Flux % through foundation	=	0.5 %

Notes:

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

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

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EXCESS LIFETIME CANCER RISK
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
West Parcel, Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc In Air mg/m3 (b)	Conc In Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
cis-1,2-Dichloroethene	D	--		3.20E-06	3.20E-03	8.02E-08		3.20E-06	3.20E-03	2.24E-07	
trans-1,2-Dichloroethene	D	--		4.90E-07	4.90E-04	1.23E-08		4.90E-07	4.90E-04	3.42E-08	
Tetrachloroethene	C-B2	0.021	CalEPA	5.59E-06	5.59E-03	1.40E-07	3.E-09	5.59E-06	5.59E-03	3.90E-07	8.20E-09
Trichloroethene	B2	0.01	CalEPA	5.36E-06	5.36E-03	1.34E-07	1.E-09	5.36E-06	5.36E-03	3.75E-07	3.75E-09

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	250	250
Exposure Duration (years)	9	25
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

File nc_wrk.xls Revised 3/21/96

NONCARCINOGENIC HEALTH RISK EVALUATION
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
West Parcel, Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. in Air mg/m3 (b)	Conc. in Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc. in Air mg/m3 (b)	Conc. in Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
cis-1,2-Dichloroethene	0.01	IRIS c	3.20E-06	3.20E-03	6.26E-07	6.26E-05	NO	3.20E-06	3.20E-03	6.26E-07	6.26E-05	NO
trans-1,2-Dichloroethene	0.02	IRIS c	4.90E-07	4.90E-04	9.58E-08	4.79E-06	NO	4.90E-07	4.90E-04	9.58E-08	4.79E-06	NO
Tetrachloroethene	0.01	IRIS c	5.59E-06	5.59E-03	1.09E-06	1.09E-04	NO	5.59E-06	5.59E-03	1.09E-06	1.09E-04	NO
Trichloroethene	0.006	ECAO c	5.36E-06	5.36E-03	1.05E-06	1.75E-04	NO	5.36E-06	5.36E-03	1.05E-06	1.75E-04	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	250	250
Body Weight (kilogram)	70	70
Conversion Factor 1 (year to day)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 6.
(c) Oral RfD has been used for chemicals with no inhalation RfD.

Chemical Concentrations in Indoor Air - Groundwater
East Parcel, Del Monte Site

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

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

DATA INPUT SECTION

Soil Data Input

Depth of Water Table	=	8 ft
Total porosity	=	0.4
Air-filled porosity	=	0.26

Structure Data Input

Foundation area	=	11000 ft^2
Structure volume	=	3115 m^3
Air residence time	=	0.56 hr
Flux % through foundation	=	0.5 %

Chemical name	Henry's Constant (atm-m3/mol)	Air Diffusion Coeff. (cm2/s)	Conc'n in Ground-Water (ug/l)	Conc'n in Bldg. (mg/m^3)	Conc'n in Bldg. (ug/m^3)	Target mg/m^3	Diffusion Coeff. in Soil (cm2/s)	Conc'n in Soil Gas (ug/l)	Factor K1 (hr/min)	Factor K2	Conc'n in Building (ug/l)
1,1,1-Trichloroethane	0.008	0.0794	1.00E+01	2.47E-06	2.47E-03	4.60E-01	0.005567	3.27146	0.000919	7.55E-07	2.47E-06
cis-1,2-Dichloroethylene	0.00337	0.1209	3.80E+01	6.02E-06	6.02E-03	5.11E-02	0.008476	5.2368	0.000919	1.15E-06	6.02E-06
Tetrachloroethylene	0.0149	0.0797	2.90E+01	1.34E-05	1.34E-02	6.81E-04	0.005588	17.67	0.000919	7.58E-07	1.34E-05
trans-1,2-Dichloroethylene	0.00672	0.1209	1.30E+01	4.11E-06	4.11E-03	1.02E-01	0.008476	3.57244	0.000919	1.15E-06	4.11E-06
Trichloroethylene	0.0103	0.0875	1.30E+01	4.56E-06	4.56E-03	1.43E-03	0.006135	5.47561	0.000919	8.32E-07	4.56E-06
Vinyl chloride	0.0819	0.1110	2.00E+01	7.07E-05	7.07E-02	5.30E-05	0.007782	66.9832	0.000919	1.06E-06	7.07E-05

Notes:

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

Groundwater concentrations which have been calculated are based on the assumption of a dilute solution (Henry's Law).
At high concentrations, a second phase may form and Henry's Law is no longer valid. Groundwater concentrations also may exceed soil saturation values: therefore, air concentrations may be lower than indicated here.

EXCESS LIFETIME CANCER RISK
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
East Parcel, Del Monte

CHEMICAL	U.S.EPA Carcinogen Classification	Slope Factor kg-day/mg	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc In Air mg/m3 (b)	Conc In Air ug/m3	Lifetime Maximum Chemical Intake mg/kg-day	Excess Lifetime Cancer Risk
cis-1,2-Dichloroethene	D	--		6.02E-06	6.02E-03	1.51E-07		6.02E-06	6.02E-03	4.21E-07	
trans-1,2-Dichloroethene	D	--		4.11E-06	4.11E-03	1.03E-07		4.11E-06	4.11E-03	2.87E-07	
Vinyl Chloride	A	0.3	HEAST	7.07E-05	7.07E-02	1.77E-06	5.E-07	7.07E-05	7.07E-02	4.94E-06	1.48E-06
Tetrachloroethene	C-B2	0.021	CalEPA	1.34E-05	1.34E-02	3.36E-07	7.E-09	1.34E-05	1.34E-02	9.36E-07	1.97E-08
Trichloroethene	B2	0.01	CalEPA	4.56E-06	4.56E-03	1.14E-07	1.E-09	4.56E-06	4.56E-03	3.18E-07	3.18E-09
1,1,1-Trichloroethane	B2	--	HEAST	2.47E-06	2.47E-03	6.19E-08		2.47E-06	2.47E-03	1.73E-07	

EXPOSURE ASSUMPTIONS	Average	Reasonable Maximum
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	250	250
Exposure Duration (years)	9	25
Body Weight (kilogram)	70	70
Averaging Time (years)	70	70
Conversion Factor 1 (days per year)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of Slope Factors:
IRIS - Integrated Risk Information System.
HEAST - Health Effects Assessment Summary Tables.
ECAO - Environmental Criteria and Assessment Office.
CalEPA - California Environmental Protection Agency
(b) Chemical concentrations taken from Table 6.

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NONCARCINOGENIC HEALTH RISK EVALUATION
WORKER ASSUMPTIONS - ADULT
Inhalation of Organic Vapor (Groundwater to Air)
East Parcel, Del Monte

CHEMICAL	Reference Dose (RfD) mg/kg-day	Source (a)	AVERAGE EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Average Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD	REASONABLE MAXIMUM EXPOSURE ASSUMPTIONS Conc. In Air mg/m3 (b)	Conc. In Air ug/m3	Maximum Daily Intake (DI) mg/kg-day	Hazard Quotient DI/RfD	Does Intake Exceed RfD
ORGANICS												
cis-1,2-Dichloroethene	0.01	IRIS c	6.02E-06	6.02E-03	1.18E-06	1.18E-04	NO	6.02E-06	6.02E-03	1.18E-06	1.18E-04	NO
trans-1,2-Dichloroethene	0.02	IRIS c	4.11E-06	4.11E-03	8.04E-07	4.02E-05	NO	4.11E-06	4.11E-03	8.04E-07	4.02E-05	NO
Vinyl Chloride	--	IRIS	7.07E-05	7.07E-02	1.38E-05	--	--	7.07E-05	7.07E-02	1.38E-05	--	--
Tetrachloroethene	0.01	IRIS c	1.34E-05	1.34E-02	2.62E-06	2.62E-04	NO	1.34E-05	1.34E-02	2.62E-06	2.62E-04	NO
Trichloroethene	0.006	ECAO c	4.56E-06	4.56E-03	8.91E-07	1.49E-04	NO	4.56E-06	4.56E-03	8.91E-07	1.49E-04	NO
1,1,1-Trichloroethane	0.29	IRIS	2.47E-06	2.47E-03	4.83E-07	1.69E-06	NO	2.47E-06	2.47E-03	4.83E-07	1.69E-06	NO

EXPOSURE ASSUMPTIONS	AVERAGE	REASONABLE MAXIMUM
Inhalation Rate (m3/day)	20	20
Exposure Frequency (days/year)	250	250
Body Weight (kilogram)	70	70
Conversion Factor 1 (year to day)	365	365
Conversion Factor 2 (micrograms to milligrams)	0.001	0.001

NOTES:
(a) Sources of RfDs:
IRIS - Integrated Risk Information System.
ECAO - Environmental Criteria and Assessment Office.
(b) Chemical concentrations taken from Table 6.
(c) Oral RfD has been used for chemicals with no inhalation RfD.