Appendix B—Tables

Table 1. Exposure Pathways at the AMCO Chemical Site, Oakland, California.

Pathway	Media	Exposure Point	Exposure Route	Receptor	Time	Pathway Status	Health Hazard
Skin contact and incidental ingestion of contaminated soils	Soils	On-site surface soils	Skin absorption and incidental ingestion	On-site workers	Past	**Completed**	No apparent public health hazard
Breathing contaminated soil gas	Soil gas	Indoor air in off-site buildings (residences abutting site)	Breathing	Abutting residents	Past	**Completed**	No apparent public health hazard
Skin contact and incidental ingestion of contaminated soils	Soils	Utility excavations on or near the site	Skin absorption and incidental ingestion	Utility workers on or near the site	Past and future	**Completed**	No apparent public health hazard
Breathing vapors from soil excavations	Outdoor air	Utility excavations on or near the site	Breathing	Utility workers on or near the site	Past and future	**Completed**	**Public health hazard**
Breathing contaminated soil gas	Soil gas	Indoor air in on-site building (office) and off-site buildings (residences abutting site)	Breathing	Abutting residents and workers at the site	Present and future	Potentially completed	**Indeterminate public health hazard**
Skin contact and incidental ingestion of contaminated soils	Soils	On-site subsurface soils	Skin absorption and incidental ingestion	On-site workers	Future	Potentially completed	**Indeterminate public health hazard**
Skin contact and incidental ingestion of contaminated soils	Soils	On-site subsurface soils	Skin absorption and incidental ingestion	On-site workers	Present	Eliminated	No apparent public health hazard
Skin contact and incidental ingestion of contaminated soils	Soils	Utility excavations on or near the site	Skin absorption and incidental ingestion	Utility workers on or near the site	Present	Eliminated	No apparent public health hazard
Breathing vapors from soil excavations	Outdoor air	Utility excavations on or near the site	Breathing	Utility workers on or near the site	Present	Eliminated	No apparent public health hazard
Drinking contaminated groundwater	Ground-water	Drinking, showering, and bathing	Ingestion, skin absorption, and breathing	Water consumers	Past, present, and future	Eliminated	No apparent public health hazard

Table 2. Vinyl Chloride Breathing Dose for Children and Adults and Cancer Risk Estimation for Adult Residents Abutting AMCO Chemical Site, Oakland, California.

	Chemical Concen-tration ($\mu g/m^3$)	Breathing Rate (m^3/day)	Exposure Factor	Body Weight (kg)	Noncancer Breathing Dose (mg/kg/day)	RfDi (mg/kg-day)	Exceeds RfDi?	Cancer Breathing Dose (mg/kg/day)	Breathing Cancer Slope 1/(mg/kg/day)	Cancer Risk
Noncancer Dose for Resident Adult Exposed to Maximum Concentration	0.117	15.2	1.0	70	0.00003	0.0286	**NO**			
Noncancer Dose for Resident Children Exposed to Maximum Concentration	0.117	10.6	1.0	26.3	0.00005	0.0286	**NO**			
Cancer Dose for Resident Adult Exposed to Maximum Concentration	0.117	15.2	0.4	70				0.00001	0.03	3.4 E-07

ID = CA x BR x EF/BW
Where ID = Inhalation Dose in milligrams per kilogram per day (mg/kg/day)
CA = Concentration in Air in micrograms per cubic meter ($\mu g/m^3$)
BR = Breathing Rate in cubic meters per day (m^3/day)
EF = Exposure Factor (unitless)
BW = Body Weight in kilogram (kg)

A conversion factor of 0.001 is included in this calculation to convert $\mu g/m^3$ to mg/m^3

This model assumes 100% of the volatile organic compound of concern is absorbed.
CDHS assumes that residents spend all their time in their homes (24 hours/day, 365 days/year).
Adult BR is based on average adult male inhalation rate as presented in the U.S. Environmental Protection Agency's Exposure Factors Handbook, Table 5-23.
Child BR is based on average inhalation rate for 3-11 year olds as presented in the U.S. Environmental Protection Agency's Exposure Factors Handbook, Table 5-23.

EF-cancer = (365 days/year x 30 years)/(365 days/year x 70 years) = **0.428**
EF-noncancer = (365 days/year x 9 years)/(365 days/year x 9 years) = **1.0**
RfDi = Reference Dose-inhalation (mg/kg/day)

Table 3. Noncancer Incidental Soil Ingestion Dose for Subsurface Utility Workers Using Maximum Subsurface Soil Concentrations at the AMCO Chemical Site, Oakland, California.

Chemical	C	IR	EF	BW	Noncancer Dose (ID)	MRL	RfD	Dose Exceeds MRL?	Dose Exceeds RfD?
1,2,4-Trimethylbenzene	270	100	0.001	70	0.0000005	NA	0.05	NA	**NO**
1,3,5-Trimethylbenzene	94	100	0.001	70	0.0000002	NA	0.03	NA	**NO**
Trichloroethene (TCE)	350	100	0.001	70	0.0000007	0.2*	0.0003	**NO**	**NO**
Vinyl chloride	34	100	0.001	70	0.00000007	0.00002**	0.003	**NO**	**NO**

$ID = C \times IR \times EF\ 10^{-6})/(BW)$
Where ID = Soil Ingestion Exposure Dose in milligrams per kilogram per day (mg/kg/day)
C = Contaminant Concentration (mg/kg); a conversion factor of 10^{-6} is used to convert from mg/kg to mg/mg soil
IR = Ingestion Rate in milligrams soil per day (mg/day)
EF = Exposure Factor (unitless)
BW = Body Weight in kilogram (kg)

EF = exposure frequency x exposure duration/exposure time. For a utility worker: 8 hours/24 hours per day x 5 days/year x 9 years of work/365 days/year x 30 years = **0.0014**

For this estimation, CDHS used maximum soil values detected; the maximum concentration of TCE was detected in 1999 at soil boring 63 (SB-63); the maximum concentrations of 1,2,3-trimethylbenzene and 1,2,4-trimethylbenzene were detected at S-113 in 2000; the maximum concentration of vinyl chloride was detected in 2000 at S-112**.**

Units for doses, MRL (ATSDR's Minimal Risk Level) and RfD (USEPA's reference dose) = mg/kg/day
*MRL used for TCE is the acute oral MRL
** MRL used for vinyl chloride is the chronic oral MRL
NA = not available

Table 4. Evaluation of Utility Workers Breathing Air from Excavations at the AMCO Chemical Site, Oakland, California.

Chemical	Air Concentration ($\mu g/m^3$)	Acute Breathing MRL ($\mu g/m^3$)	Exceeds Acute MRL?	Air Concentration (mg/m^3)	Breathing Rate (m^3/day)	Exposure Factor Cancer	Body Weight (kg)	Cancer Breathing Dose (ID)	Inhalation Slope Factor $(mg/kg/day)^{-1}$	Cancer Risk
GRAB SAMPLES										
Vinyl Chloride	312	1,278	NO							
Trichloroethene	24,960	10,747	**YES**							
Tetrachloroethene	1,092	1,356	NO							
6-HOUR TIME-WEIGHTED SAMPLES										
Vinyl Chloride	49	1,278	NO	0.049	12	0.002	70	0.00001	0.03	4.55E-07
Trichloroethene	4,160	10,747	NO	4.16	12	0.002	70	0.001	0.4	**5.02E-04**
Tetrachloroethene	125	1,356	NO	0.125	12	0.002	70	0.00004	0.002	7.66E-08
							COMBINED CANCER RISK			**5.03 E-04**

ID = CA x BR x EF/BW
Where ID = Soil Inhalation Exposure Dose in milligrams per kilogram per day (mg/kg/day)
CA = Concentration in Air in milligrams per cubic meter (mg/m^3)
BR = Breathing Rate in cubic meters per day (m^3/day)
EF = Exposure Factor (unitless)
BW = Body Weight in kilogram (kg)

MRL = ATSDR's Minimal Risk Level
$\mu g/m^3$ = micrograms per cubic meter
EF-cancer = (5 days/year x 9 years)/(365 days/year x 70 years) = **0.00176**

This model assumes 100% of the volatile organic compound of concern is absorbed and workers are not using any personal protective equipment.
Breathing rates for outdoor workers under moderate activity = 1.5 m^3/hour (U.S. Environmental Protection Agency's Exposure Factors Handbook, Table 5-23).
CDHS estimated an average daily breathing rate for workers to be **8 hours x 1.5 m^3/hour = 12 m^3/day**
This estimate assumes the utility worker spends **5 days/year for 9 years** working in excavations.

Table 5. Noncancer Soil Exposure Dose Calculations for On-Site Workers Using Maximum Subsurface Soil Concentrations at the AMCO Chemical Site, Oakland, California.

Chemical	C	IR	EF	BW	Noncancer Dose	MRL	RfD	Dose Exceeds MRL?	Dose Exceeds RfD?
1,2,4-Trimethylbenzene	270	50	0.7	70	0.0001	NA	0.05	NA	NO
1,3,5-Trimethylbenzene	94	50	0.7	70	0.00005	NA	0.03	NA	NO
Trichloroethene (TCE)	350	50	0.7	70	0.0002	0.2*	0.0003	NO	NO
Vinyl chloride	34	50	0.7	70	0.00002	0.00002***	0.003	NO	NO

ID = (C x IR x EF x 10-6)/(BW)
Where ID = Soil Ingestion Exposure Dose in milligrams per kilogram per day (mg/kg/day)
C = Contaminant Concentration (mg/kg: ppm) a conversion factor of 10^{-6} is used to convert from mg/kg to mg/mg soil
IR = Ingestion Rate in milligrams soil per day (mg/day)
EF = Exposure Factor (unitless)
BW = Body Weight in kilogram (kg)

EF = exposure frequency x exposure duration/exposure time. For a worker: 250 days/year x 30 years of work/365 days/year x 30 years = **0.68**

For this estimation, CDHS used maximum soil values detected; the maximum concentration of TCE, 1,2,3-trimethylbenzene and 1,2,4-trimethylbenzene were detected in 1999 at soil boring 63 (SB-63). The maximum concentration of vinyl chloride was detected in 2000 at S-112.

Units for doses, MRL (ATSDR's Minimal Risk Level) and RfD (USEPA's reference dose) = mg/kg/day

*MRL used for TCE is the acute oral MRL
** MRL used for vinyl chloride is the chronic oral MRL
NA = not available

Table 6. Crawlspace Sampling for Vinyl Chloride at Residences Near the AMCO Chemical Site, Oakland, California.

Location	Date	Sample Number	Detection Limit (ppbv)	Result (ppbv)	Result ($\mu g/m^3$)
Residence A, located on Third Street	09/13/99	CA-50	0.019	0.020	0.052
	09/13/99	CA-51	0.019	0.020	0.052
	4/24/00	CA-100	0.014	nd	nd
	4/24/00	CA-101	0.014	nd	nd
	2002	*Crawlspace not accessible*			
Residence B, located on Third Street	09/13/99	CA-52	Not available	**0.045***	**0.117***
	4/24/00	CA-102	0.020	nd	nd
	08/27/02	1432-CA	0.013	nd	nd
Residence C, located on Center Street	9/13/99	CA-55	0.013	nd	nd
	9/13/99	CA-552	Not available	0.026	0.068
	4/24/00	CA-104	0.013	nd	nd
	8/27/02	326-CA	0.018	nd	nd
	8/27/02	343-CA (duplicate)	0.018	nd	nd

ppbv = parts per billion volume; $\mu g/m^3$ = micrograms per cubic meter
Cancer Risk Evaluation Guide (CREG) for vinyl chloride in air = 0.10 $\mu g/m^3$
A microgram (µg) is one-millionth of a gram, or 0.000001 grams.
Reference concentration for vinyl chloride in air = 100 $\mu g/m^3$
Intermediate Environmental Media Evaluation Guide for vinyl chloride in air = 30 $\mu g/m^3$
U.S. Environmental Protection Agency (USEPA) Region IX Ambient Air Preliminary Remediation Goal (PRG) for vinyl chloride in air = 0.11 $\mu g/m^3$
***The 1999 detection at this Third Street residence exceeds the CREG and the USEPA Region IX PRG.**

Table 7. Subsurface Soil Data Collected in April 2000 at the AMCO Chemical Site, Oakland, California (mg/kg = ppm)**.**

Chemical	Soil Boring Number					Health Comparison Value
	S-110	**S-111**	**S-112**	**S-113**	**S-114**	
Acetone	0.034	0.057	nd	nd	nd	RMEG 200,000
Benzene	nd	nd	nd	nd	nd	CREG 10
2-Butanone	nd	nd	nd	nd	nd	RMEG 400,000
n-Butylbenzene	nd	nd	14	67	1.6	iPRG 2,200
sec-Butylbenzene	nd	nd	3.8	21	nd	iPRG 1,600
Carbon disulfide	nd	nd	nd	nd	nd	RMEG 70,000
Chlorobenzene	nd	nd	nd	nd	nd	RMEG 10,000
1,2-Dichlorobenzene	nd	nd	45	21	40	RMEG 60,000
1,3-Dichlorobenzene	nd	nd	nd	nd	2.5	iPRG 63
1,4-Dichlorobenzene	nd	nd	8	nd	11	EMEG 300,000
1,1-Dichloroethene	nd	nd	nd	nd	nd	RMEG 40,000
cis-1,2-Dichloroethene	nd	nd	5.1	170	nd	EMEG 200,000
Ethylbenzene	nd	nd	9.7	100	nd	RMEG 70,000
Methylene chloride	nd	nd	nd	nd	nd	CREG 90
MTBE (methyl tertiary butyl ether)	0.004	0.006	nd	nd	nd	EMEG 200,000
Napthalene	nd	nd	69	64	1.3	RMEG 10,000
n-Propylbenzene	nd	nd	9.2	38	nd	iPRG 2,200
Tetrachloroethene	nd	nd	nd	nd	nd	RMEG 7,000
Toluene	nd	nd	33	930	nd	iPRG 2,200
1,2,4-Trichlorobenzene	nd	nd	3.3	nd	3	iPRG 5,600
1,1,1-Trichloroethane	nd	nd	nd	nd	nd	iPRG 6,900
Trichloroethene	nd	nd	nd	nd	nd	iPRG 110
1,2,4-Trimethylbenzene	nd	nd	53	**270**	1.9	iPRG 170
1,3,5-Trimethylbenzene	nd	nd	22	**94**	nd	iPRG 70
Vinyl chloride	nd	nd	**34**	nd	nd	CREG 0.5
Xylene, m, p-	nd	nd	34	340	0.62	EMEG 400,000

All soil data presented in this table were collected at 5 feet below ground surface (bgs), except S-111, which was collected at 15 feet bgs. They were collected at the 15 foot interval (no data collected from 5 foot interval).
RMEG = Reference Dose Media Evaluation Guide
EMEG = Environmental Media Evaluation Guide
iPRG = industrial Preliminary Remediation Goal
CREG = Cancer Risk Evaluation Guide
All RMEG and EMEG values represent adult values.
All PRG values represent U.S. Environmental Protection Agency Region IX industrial soil PRGs.
Bolded values exceed comparison values
mg/kg = milligrams per kilogram
ppm = parts per million
nd = non detect

Table 8. Shallow Groundwater Data Collected in April 2000 at the AMCO Chemical Site, Oakland, California
(ug/L = ppb).

	GW-110	GW-111	GW-112	GW-113	GW-114	GW-115	GW-116	MCL	Comparison Value
Sample Depth	**20 feet**	**20 feet**	**20 feet**	**5 feet**	**20 feet**	**30 feet**	**20 feet**		
Butylbenzene	ND	ND	ND	1,100	ND	ND	ND	NA	240 tap water PRG
Chlorobenzene	ND	ND	ND	ND	**270**	ND	ND	100	200 Child RMEG
1,2-Dichlorobenzene	5.5	5.4	**1,800**	**1,000**	220	ND	ND	600	900 child RMEG
1,3-Dichlorobenzene	ND	ND	ND	ND	7.9	ND	ND	NA	300 Int. Child EMEG
1,4-Dichlorobenzene	ND	ND	ND	ND	**99**	ND	ND	75	700 Int. Child EMEG
1,1-Dichloroethane	ND	ND	3700	2,200	ND	ND	ND	NA	810 tap water PRG
cis-1,2-Dichloroethene	2.8	2.7	**60,000**	**62,000**	20	ND	ND	70	3,000 Int. Child EMEG
Ethyl Benzene	ND	ND	ND	**4,200**	ND	ND	ND	700	1,000 Int. Child EMEG
4-Methyl-2-pentanone	ND	ND	ND	**15,000**	ND	ND	ND	NA	1,900 PRG
Naphthalene	ND	ND	ND	3,200	ND	ND	ND	NA	6,000 Int. Child EMEG
Para-isopropyl toluene	ND	ND	ND	2,500	ND	ND	ND	NA	NA
Propylbenzene	ND	ND	ND	1,200	ND	ND	ND	NA	240 tap water PRG
PCE	ND	ND	ND	ND	ND	ND	ND	5	100 Child RMEG
Toluene	ND	ND	ND	**58,000**	ND	ND	ND	1,000	200 Int. Child EMEG
1,1,1-Trichloroethane	ND	ND	ND	1,100	ND	ND	ND	200	200,000 Int. Child EMEG
TCE	ND	ND	ND	**8,400**	ND	ND	ND	5	NA
1,2,4-Trimethylbenzene	ND	ND	ND	**12,000**	ND	ND	ND	70	100 Child RMEG
1,3,5-Trimethylbenzene	ND	ND	ND	**4,100**	ND	ND	ND	NA	12 tap water PRG
Vinyl chloride	ND	ND	**27,000**	**2,500**	ND	ND	ND	2	30 RMEG
m, p-Xylene	ND	ND	ND	17,000	ND	ND	ND	NA	NA
o-Xylene	ND	ND	ND	**6,800**	ND	ND	ND	NA	30 RMEG

PRG = Preliminary Remedial Goal for USEPA Region IX
Bolded values exceed comparison values.
This data was presented in Tables 6-13 of the Preliminary Assessment/Site Investigation Report dated August 2001.
MCL = Maximum Contaminant Level in drinking water (USEPA)
The data in this table is from the shallowest well sample for each location. The wells in this table are shown in Figure 7 of this report.
RMEG = Reference Dose Media Evaluation Guide, EMEG = Environmental Media Evaluation Guide

Appendix C—Glossary

Adverse Health Effect
A change in body function or the structures of cells that can lead to disease or health problems.

ATSDR
The Agency for Toxic Substances and Disease Registry. ATSDR is a federal health agency in Atlanta, Georgia, that deals with hazardous substance and waste site issues. ATSDR gives people information about harmful chemicals in their environment and tells people how to protect themselves from coming into contact with chemicals.

Background Concentration
An average or expected amount of a chemical in a specific environment. Or, amounts of chemicals that occur naturally in a specific environment.

Cancer Risk
The potential for exposure to a contaminant to cause cancer in an individual or population is evaluated by estimating the probability of an individual developing cancer over a lifetime as the result of the exposure. This approach is based on the assumption that there are no absolutely "safe" toxicity values for carcinogens. USEPA has developed cancer slope factors for many carcinogens. A slope factor is an estimate of a chemical's carcinogenic potency, or potential, for causing cancer.

If adequate information about the level of exposure, frequency of exposure, and length of exposure to a particular carcinogen is available, an estimate of excess cancer risk associated with the exposure can be calculated using the slope factor for that carcinogen. Specifically, to obtain risk estimates, the estimated, chronic exposure dose (which is averaged over a lifetime or 70 years) is multiplied by the slope factor for that carcinogen.

Cancer risk is the likelihood, or chance, of getting cancer. The term "excess cancer risk" means a "background risk" of about one-in-four chances of getting cancer. In other words, in a million people it is expected that 250,000 individuals would get cancer from a variety of causes. A "one-in-a-million" excess cancer risk from a given exposure to a contaminant means that if one million people are exposed to a carcinogen at a certain concentration over their lifetime, then one cancer above the background chance, or the $250{,}000^{th}$ cancer, may appear in those million persons from that particular exposure. In order to take into account the uncertainties in the science, the risk numbers used are plausible upper limits of the actual risk based on conservative assumptions. In actuality, the risk is probably somewhat lower than calculated, and, in fact, may be zero.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
CERCLA was put into place in 1980. It is also known as Superfund. This act concerns releases of hazardous substances into the environment, and the cleanup of these substances and hazardous waste sites. ATSDR was created by this act and is responsible for looking into the health issues related to hazardous waste sites.

Concern
A belief or worry that chemicals in the environment might cause harm to people.

Concentration
How much or the amount of a substance present in a certain amount of soil, water, air, or food.

Contaminant
See Environmental Contaminant.

Dermal Contact
A chemical getting onto your skin. (See Route of Exposure.)

Dose
The amount of a substance to which a person may be exposed, usually on a daily basis. Dose is often explained as the amount of substance(s) per body weight per day.

Dose/Response
The relationship between the amount of exposure (dose) and the change in body function or health that result.

Duration
The amount of time (days, months, years) that a person is exposed to a chemical.

Environmental Contaminant
A substance (chemical) that gets into a system (person, animal, or the environment) in amounts higher than that found in Background Concentration, or what would be expected.

Environmental Media
Usually refers to the air, water, and soil in which chemicals of interest are found. Sometimes refers to the plants and animals that are eaten by humans. Environmental Media is the second part of an Exposure Pathway.

Environmental Media Evaluation Guide (EMEG)
EMEGs are media specific values developed by ATSDR to serve as an aid in selecting environmental contaminants that need to be further evaluated for potential health impacts. EMEGs are based on non-carcinogenic endpoints and do not consider carcinogenic effects. EMEGs are based on the MRLs.

Exposure
Coming into contact with a chemical substance. (For the three ways people can come in contact with substances, see Route of Exposure.)

Exposure Assessment
The process of finding the ways people come in contact with chemicals, how often and how long they come in contact with chemicals, and the amounts of chemicals with which they come in contact.

Exposure Pathway
A description of the way that a chemical moves from its source (where it began) to where and

how people can come into contact with (or get exposed to) the chemical. ATSDR defines an exposure pathway as having five parts:
1. A Source of Contamination
2. Environmental Media and Transport Mechanism
3. Point of Exposure
4. Route of Exposure
5. Receptor Population

When all five parts of an exposure pathway are present, it is called a Completed Exposure Pathway.

Groundwater
Water beneath the earth's surface that flows through soil and rock openings, and often serves as a source of drinking water.

Hazardous Waste
Substances that have been released or thrown away into the environment and, under certain conditions, could be harmful to people who come into contact with them.

Maximum Contaminant Level (MCL)
The USEPA has issued drinking water standards, or MCLs, for more than 80 contaminants in drinking water. The MCLs are set based on known or anticipated adverse human health effects (which also account for sensitive subgroups, such as, children, pregnant women, the elderly, etc.), the ability of various technologies to remove the contaminant, their effectiveness, and cost of treatment. For cancer risk, USEPA generally sets the MCLs at concentrations that will limit an individual risk of cancer from a contaminant to between 1 in 10,000 (low increased excess risk) to 1 in 1,000,000 (no apparent increased excess risk) over a lifetime. As for noncancer effects, USEPA estimates an exposure concentration below which no adverse health effects are expected to occur.

Noncancer Evaluation, ATSDR's Minimal Risk Level (MRL), and USEPA's Reference Dose (RfD) and Reference Concentration (RfC)
The MRL, RfD, and RfC are estimates of daily exposure to the human population (including sensitive subgroups), below which noncancer adverse health effects are unlikely to occur. The MRL, RfD, and RfC only consider noncancer effects. Because they are based only on information currently available, some uncertainty is always associated with the MRL, RfD, and RfC. "Safety" factors are used to account for the uncertainty in our knowledge about their danger. The greater the uncertainty, the greater the "safety" factor and the lower the MRL, RfD, or RfC.

When there is adequate information from animal or human studies, MRLs and RfDs are developed for the ingestion exposure pathway, whereas RfCs are developed for the inhalation exposure pathway. A MRL, RfD, or RfC is an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse (non-carcinogenic) health effects over a specified duration of exposure. No toxicity values exist for exposure by skin contact. Separate noncancer toxicity values are also developed for different durations of exposure. ATSDR

develops MRLs for acute exposures (less than 14 days), intermediate exposures (from 15 to 364 days), and for chronic exposures (greater than one year). USEPA develops RfDs and RfCs for acute exposures (less than 14 days), subchronic exposures (from two weeks to seven years), and chronic exposures (greater than seven years). Both the MRL and RfD for ingestion are expressed in units of milligrams of contaminant per kilograms body weight per day (mg/kg/day). The RfC for inhalation is expressed in units of mg/m^3.

Noncancer and Cancer Evaluations USEPA's Preliminary Remediation Goals (PRGs)
PRGs are developed by the USEPA to estimate contaminant concentrations in the environmental media (soil, air, and water), both in residential and industrial settings, that are protective of humans, including sensitive groups, over a lifetime. PRGs were developed for both industrial and residential settings because of the different exposure parameters, such as different exposure time frames (e.g., industrial setting: workers are exposed for 8 hours/day, 5 days/week vs. residential setting: families are exposed 24 hours/day, 7 days/week; and different "human" exposure points such as industrial setting: healthy adult males vs. residential setting: males, females, young children, and infants), etc. Media concentrations less than the PRGs are unlikely to pose a health threat; whereas concentrations exceeding a PRG do not automatically determine that a health threat exists, but suggest that further evaluation is necessary.

NPL
The National Priorities List (which is part of Superfund). A list kept by the U.S. Environmental Protection Agency (EPA) of the most serious, uncontrolled, or abandoned hazardous waste sites in the country. An NPL site needs to be cleaned up or is being looked at to see if people can be exposed to chemicals from the site.

Point of Exposure
The place where someone can come into contact with a contaminated environmental medium (air, water, food, or soil). Examples: the area of a playground that has contaminated dirt, a contaminated spring used for drinking water, the location where fruits or vegetables are grown in contaminated soil, or the backyard area where someone might breathe contaminated air.

Population
A group of people living in a certain area; or the number of people in a certain area.

PRP
Potentially Responsible Party. A company, government, or person that is responsible for causing the pollution at a hazardous waste site. PRP's are expected to help pay for the clean up of a site.

Public Health Assessment (PHA)
A report or document that looks at chemicals at a hazardous waste site and tells if people could be harmed from coming into contact with those chemicals. The PHA also tells if possible further public health actions are needed.

Public Health Hazard
The category is used in PHAs for sites that have certain physical features or evidence of chronic, site-related chemical exposure that could result in adverse health effects.

Public Health Hazard Criteria
PHA categories given to a site which tell whether people could be harmed by conditions present at the site. Each is defined in the *Glossary*. The categories are:
1. Urgent Public Health Hazard
2. Public Health Hazard
3. Indeterminate Public Health Hazard
4. No Apparent Public Health Hazard
5. No Public Health Hazard

Reference Dose Media Evaluation Guide (RMEG)
RMEGs are media specific values developed by USEPA to serve as an aid in selecting environmental contaminants that need to be further evaluated for potential health impacts. RMEGs are based on non-carcinogenic end-points and do not consider carcinogenic effects. RMEGs are based on the USEPA RfDs.

Route of Exposure
The way a chemical can get into a person's body. There are three exposure routes:
1. Breathing (also called inhalation);
2. Eating or drinking (also called ingestion); and
3. Getting something on the skin (also called dermal contact).

Semi-Volatile Organic Compound (SVOC)
A chemical compound that partially evaporates or changes from liquid to gas readily at room temperature.

Source (of Contamination)
The place where a chemical comes from, such as a landfill, pond, creek, incinerator, tank, or drum. Contaminant source is the first part of an Exposure Pathway.

Special Populations
People who may be more sensitive to chemical exposures because of certain factors such as age, a disease they already have, occupation, sex, or certain behaviors (like cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Superfund Site
See NPL.

Toxic
Harmful. Any substance or chemical can be toxic at a certain dose (amount). The dose is what determines the potential harm of a chemical and whether it would cause someone to get sick.

Toxicology
The study of the harmful effects of chemicals on humans or animals.

Urgent Public Health Hazard
This category is used in ATSDR's PHA documents for sites that have certain physical features or evidence of short-term (less than 1 year) site-related chemical exposure that could result in adverse health effects and require quick intervention to stop people from being exposed.

Volatile Organic Compound (VOC)
A chemical compound that evaporates (volatilizes) or changes from liquid to gas readily at room temperature.

Appendix D—Toxicological Summaries

Please see glossary and/or list of acronyms for abbreviations and acronyms through out this section.

Arsenic (32)

- Naturally-occurring chemical commonly found in surface soil and surface water.
- Long-term exposures of lower levels of arsenic through drinking water (170-800 ppb) can lead to a condition known as "blackfoot disease."
- Other effects include gastrointestinal irritation, and contact with skin can cause discoloration (hypo-or hyper-pigmentation), wart-like growths, and skin cancer.
- Acute oral MRL = 0.005 mg/kg/day (gastrointestinal effects in humans).
- Chronic oral MRL = 0.0003 mg/kg/day (dermal effects in humans).
- RfD = 0.0003 mg/kg/day (dermal effects in humans).
- EPA's cancer slope factor = 1.5 $(mg/kg/day)^{-1}$.
- Carcinogenicity: U.S. Environmental Protection Agency (USEPA)—human carcinogen (due to its ability to cause skin cancer); U.S. Department of Health and Human Services (DHHS)—known human carcinogen; International Agency for Research on Cancer (IARC)—human carcinogen (sufficient human evidence).

Lead (33)

- Naturally occurring metal found in small amounts in the earth's crust, most of the high levels of lead found in the environment are from human activities.
- People may be exposed to lead by eating foods or drinking water that contains lead, spending time in areas where leaded paints have been used or are deteriorating, lead pipes, drinking from leaded-crystal glassware.
- People who live near hazardous waste sites may be exposed to lead and chemicals containing lead by breathing the air, swallowing dust and dirt containing lead, or drinking lead –contaminated water.
- Lead affects the nervous system, the blood system, the kidneys and the reproductive system.
- Low blood levels (30 µg/dL) may contribute to behavioral disorders; lead levels in young children have been consistently associated with deficits in reaction time and with reaction behavior. These effects on attention occur at blood lead levels extending below 30 µg/dL, and possibly as low as 15-20 µg/dL.
- Health effects associated with lead are not based on an external dose, but on internal dose that takes into account total exposure.
- Federal agencies and advisory groups have redefined childhood lead poisoning as a blood lead level of 10 µg/dL.
- OSHA requires workers with a blood lead level >50 µg/dL be removed from the workroom where lead exposure is occurring.
- Carcinogenicity: USEPA—probable human carcinogen.

Tetrachloroethene (PCE) (28)

- Synthetic chemical used as a dry cleaning fluid, a degreaser, and as a starting material for other products.

- Evaporates quickly; breaks down very slowly.
- Can travel easily through soils to reach groundwater.
- Most common way to enter body is inhalation, also ingestion if drinking water is contaminated.
- Adverse health effects due to chronic inhalation exposure possibly include reproductive effects in women.
- Chronic inhalation MRL = 40 ppb (270 $\mu g/m^3$) (neurological effects in humans).
- RfD = 0.01 mg/kg/day (liver effects in mice).
- High levels of exposure in animals may cause liver, kidney damage.
- OEHHA oral slope factor = 0.54 $(mg/kg/day)^{-1}$.
- OEHHA inhalation slope factor = 0.021 $(mg/kg/day)^{-1}$.
- OEHHA inhalation unit risk = 5.9 x 10^{-6} $(\mu g/m^3)^{-1}$.
- Carcinogenicity: USEPA—carcinogenicity currently under review; DHHS—may reasonably be anticipated to be a human carcinogen; IARC—probable human carcinogen (limited human, sufficient animal evidence).

Trichloroethene (TCE) (27)

- Synthetic chemical, liquid at room temperature; most commonly used as a degreaser, also used in some household products.
- Evaporates readily from surface soil, water; breaks down in air to form phosgene, a lung irritant; breaks down more slowly from deep soils, groundwater.
- Can enter body through inhalation, ingestion, or dermal absorption.
- Adverse health effects due to chronic exposure possibly include childhood leukemia, heart defects, and other birth defects.
- Acute inhalation MRL = 2,000 ppb (10,700 $\mu g/m^3$) (neurological effects in humans).
- Intermediate inhalation MRL = 100 ppb (540 $\mu g/m^3$) (neurological effects in rats).
- Chronic REL= 600 $\mu g/m^3$ (effects on the nervous system and eyes).
- Acute oral MRL = 0.2 mg/kg/day (developmental effects in mice).
- OEHHA oral slope factor = 0.013 $(mg/kg/day)^{-1}$.
- OEHHA inhalation slope factor = 0.007 $(mg/kg/day)^{-1}$.
- OEHHA inhalation unit risk = 2 x 10^{-6} $(\mu g/m^3)^{-1}$.
- Carcinogenicity: USEPA—probable human carcinogen (inadequate human, sufficient animal evidence); DHHS—may reasonably be anticipated to be a human carcinogen; IARC—probable human carcinogen (limited human, sufficient animal evidence).

1,2,4-Trimethylbenzene (1,2,4-TMB) (34)

- Colorless, flammable liquid with a unique odor.
- Occurs naturally in coal tar and petroleum crude oil.
- Used in the manufacture of trimellitic anhydride (used in the production of poly-vinyl chloride plastics), dyes, perfumes, resins, and pharmaceuticals.
- Will not dissolve appreciably in water; does not tend to adhere to soil.
- Is soluble in alcohol, ether, and benzene and tends to be stored in fatty tissue.
- Evaporates readily when exposed to air.

- Bioconcentration factor values suggest that bioconcentration in aquatic organisms ranges from moderate to high.
- OSHA states that workers may not be exposed to average levels of 1,2,4-TMB greater than 25 ppm in air during an 8-hour workday.
- Inhaling 1,2,4-TMB can irritate the eyes, nose and throat.
- Inhaling large amounts of 1,2,4-TMB can effect the nervous system and cause headaches, fatigue and drowsiness.

1,3,5 -Trimethylbenzene (1,3,5-TMB) (35)

- A colorless, flammable liquid with a unique odor; also called mesitylene.
- Occurs naturally in coal tar and petroleum crude oil.
- Used as a laboratory reagent.
- Will not dissolve appreciably in water; does not tend to adhere to soil.
- Is soluble in alcohol, ether, and benzene and tends to be stored in fatty tissue.
- Evaporates readily when exposed to air.
- Bioconcentration factor values suggest that bioconcentration in aquatic organisms ranges from moderate to high.
- Inhaling 1,3,5-TMB can irritate the eyes, nose, and throat.
- OSHA states that workers may not be exposed to average levels of 1,2,4-TMB greater than 25 ppm in air during an 8-hour workday.
- Inhaling large amounts of 1,3,5-TMB can cause dizziness, drowsiness, headache, sore throat, and vomiting.

Vinyl Chloride (29)

- Colorless, flammable gas at normal temperatures with a mild, sweet odor.
- It is used to make poly-vinyl chloride or PVC.
- Vinyl chloride is a breakdown product of other chlorinated compounds such as trichloroethene.
- Evaporates easily into the air.
- Breathing high levels of vinyl chloride can cause dizziness or sleepiness.
- Long term exposure via inhalation can cause changes to liver structure.
- Exposure to the skin can cause numbness, redness, and blisters.
- Animal studies have shown that long-term exposure to vinyl chloride can damage sperm and testes.
- Vinyl chloride exposure can result in liver cancer (hepatic angiosarcoma) in humans.
- USEPA MCL for vinyl chloride in drinking water is 0.002 ppm.
- ATSDR chronic oral MRL is 0.00002 mg/kg/day (hepatic cysts).
- USEPA oral slope factor = 1.4 mg/kg/day.
- USEPA chronic oral RfD = 0.003 mg/kd/day^{-1} (liver cell polymorphism).
- Carcinogenicity: DHHS—known human carcinogen.

Appendix E—Comments Received from the Public Comment Draft with CDHS's Responses

On September 14, 2004, the English version of the public health assessment (PHA) for the AMCO site was released in draft form for public comment. The comment period remained open for several weeks until CDHS could release a Spanish version of the PHA, prepared with the assistance of U.S. Environmental Protection Agency (USEPA). CDHS released the Spanish version of the PHA on November 9, 2004, and distributed it to residents who expressed an interest to CDHS during our visits to the neighborhood in September 2004.

As part of the release, CDHS spent several days going door-to-door in the Fall of 2004 to discuss issues and concerns of residents living near the AMCO site. During these visits, CDHS provided a letter in English and Spanish and offered copies of the English version of the PHA. CDHS compiled a list of residents interested in receiving the Spanish version of the PHA and informed community members about the PHA process. CDHS also mailed a copy of our cover letter in English and Spanish that describes the PHA process and our interest to receive comments. CDHS mailed letters to over 100 addresses that are a part of the South Prescott Neighborhood. The English and Spanish versions of the PHA are available on the CDHS web site: http://www.ehib.org.

CDHS received over 20 comments from a variety of individuals and community organizations. Comments can be found below. When appropriate, a response from CDHS is provided (responses are in bold).

Summary

A PHA has been prepared for the AMCO Chemical site in West Oakland. The Draft Report, which was released for review and comment on September 14, 2004, was received by us on November 9, 2004. The Draft Report was prepared by the California Department of Health Services (DHS) under cooperative agreement with the Agency for Toxic Substance and Disease Registry ATSDR. The report appears to be totally inadequate because the most likely route of exposure to the public is completely ignored. DHS and ATSDR have failed to account for, or even mention, the effects of contact by the public with contaminated groundwater flowing from the site. The groundwater at the site is known to be contaminated with vinyl chloride and other contaminants that can become vinyl chloride as time passes. Groundwater is known to be flowing away from the site. Vinyl chloride is known to cause cancer in humans. Because the groundwater is very near the surface at certain times of year, it is easy for people who live in the path of the groundwater flow to come in contact with groundwater. This can happen by digging in their yards, by groundwater seeping into basements, by using shallow wells for watering their yards, and by breathing vapors that rise from the shallow groundwater.

The depth and extent of groundwater contamination has not even been investigated, much less cleaned up. Groundwater is known to be flowing away from the AMCO site. The path that it takes has not been determined. No survey has been done to find out if there are unregistered wells in the houses, or their yards, that are in the path of the groundwater flow. Except for houses right next to the site, nothing has been done to find out if the crawl spaces or basements under houses in the path of the groundwater flow are contaminated by vapors. Because of these unknowns, we are particularly concerned that children in West Oakland may have been exposed to vinyl chloride in the past, and may be exposed to vinyl chloride now and in the future. The health effects of such exposures may never be known because it may take 30 years or more for

cancer caused by today's exposure to show up. By then, the children will be grown up, probably moved away, and no one will be able to say whether their cancer was caused by exposure to vinyl chloride in West Oakland or not.

By dismissing potential exposures to contaminated groundwater because "no one is drinking it", the PHA violates principles of environmental justice. The PHA points out that the residents of West Oakland are predominantly minorities. The PHA does not, however, compare the actions being taken at the AMCO site with actions taken in other non-minority Bay Area communities with similar groundwater problems. For example at the COE site in Palo Alto, the MEW Superfund site in Mountain View, and the South San Jose Superfund site, complete investigation and cleanup of the groundwater was required, even though no one was drinking it. Environmental justice demands that public health in West Oakland be equally protected.

CDHS agrees that further analysis of groundwater contamination is warranted at the site and vicinity. While CDHS did not specifically recommend groundwater remediation, we understood USEPA to be planning to do groundwater remediation as a part of the source area cleanup (recommendation #1 in PHA). CDHS will amend the PHA to include a specific recommendation to clean up groundwater contaminants from the AMCO site. Additional groundwater data will be collected by USEPA in the Fall of 2005. This data will be included in the Remedial Investigation document.

In the case of the AMCO Chemical site, the most likely pathway of exposure for people that live near the site is soil gas/vapor intrusion from contaminated groundwater and soil getting into homes near the facility. This pathway was addressed in the PHA.

In the PHA, CDHS described what was known about the contaminated groundwater at the site, including the presence of vinyl chloride. However, it is not "easy" for people to come into contact with contaminated groundwater because the AMCO site and Third Street are paved and the depth to groundwater in the area generally ranges from 4 to 6 feet below ground surface (bgs). While CDHS agrees that residents in the area could potentially hit water if they dug a pit in their back yard, such a pit would need to be several feet deep. Currently, the City of Oakland will not grant permits for excavations in the vicinity of the AMCO site due to concerns of exposure to contaminants. Even if someone dug a deep hole without a permit it appears unlikely that upon reaching the groundwater that residents would then proceed to wade, splash or otherwise spend time in these waters to any significant degree. The residences closest to the AMCO contamination have crawlspaces, not basements. Therefore, migration of contaminated groundwater into basements is not an issue.

General Comments

This paragraph eliminates the "groundwater consumption pathway" because "nobody is drinking this water and because the groundwater has high levels of total dissolved solids, future use as a potable water source is highly unlikely." Potential routes of exposure to contaminated groundwater through incidental ingestion, skin contact, or by breathing vapors are ignored. These potential routes of exposure are almost certain to have been completed because

groundwater is shallow and can potentially seep into shallow depressions, holes, excavations, trenches, basements, and unregistered irrigation wells, which some residents have reported at public meetings. In addition, the most toxic chemicals used at AMCO Chemical, the ones that degrade to vinyl chloride, are heavier than water. They sink in the groundwater; they do not float on it. At the MEW and other sites similar to AMCO, contaminated groundwater was found depths of hundreds of feet. The deeper aquifers beneath the AMCO site, which may be usable in the future, may have also been contaminated by these heavy solvents. Future use of groundwater should not be ruled out. In fact, until recently, a food-grade yeast manufacturer located a block from the site was using water from an aquifer approximately 200 feet below ground surface.

It is true that we did not evaluate the incidental ingestion or skin contact with groundwater because it is unlikely that groundwater would ever be used as a drinking water source. CDHS assessed the potential exposure of residents near the AMCO site to vapors from the groundwater, referred to in the PHA as soil gas. It is CDHS' contention that exposure to soil gas contaminants from the AMCO site is the pathway that is most likely to be completed for residents in the area.

CDHS is aware that the groundwater on the AMCO site and vicinity is relatively shallow (4 to 6 feet bgs). While residents may occasionally dig holes on their property, excavations greater than 3 feet bgs are considered not likely and such an excavation is less likely to occur during the wet season (when water levels are highest), due to wet conditions and rain potentially filling the excavation. While CDHS cannot be certain there will be no future use of groundwater in the area, this scenario is highly unlikely. However, in light of the comments about unregistered wells reported as in use, CDHS will recommend that a well survey be conducted in the area.

Detailed Comments

1) Page 2, 1st Paragraph

It is our understanding that the utility workers that were previously exposed to vapors were digging a trench in 3rd Street at some distance from the source area on the AMCO site centered near the former railroad spur. It is likely that these workers were in the path of contaminated groundwater, and smelled the vapors coming from the contaminated groundwater, the same way that one smells the aroma in a cup of coffee. Therefore, utility workers could be exposed not only if future subsurface activity takes place at the site, or if pavement is removed at the site, but also anywhere in the path of the groundwater flowing away from the site. Other sites in the Bay Area where impacts to groundwater have been thoroughly investigated have shown that the contaminated groundwater can be found thousands of feet and even miles from the source area. This is true not only for utility workers, but for the general public as well because of the shallowness of groundwater in the area. We think the DHS and ATSDR should "wake up and smell the coffee on this issue.

The utility trench on Third Street was located about 50 feet from the source area. Figure 3 of the PHA shows the approximate center of the source area (B-63). The utility trench was to the south on Third Street. However, the former Third Street trench is approximately as close to the source area as the nearest residence. While CDHS agrees

that groundwater contaminant plumes can travel miles from source areas, CDHS determines that unless excavations of greater than 3 feet bgs occur in the vicinity of the AMCO site, people are not likely to be exposed to AMCO VOC contaminants in the groundwater. Generally speaking, any vapors that might make their way to the surface would dissipate rapidly in ambient air due to winds and mixing with surrounding air. CDHS does not focus on downgradient groundwater exposure issues because we believe the likelihood of exposure is minimal. However, this opinion does not exempt the plume from being assessed and remediated by USEPA or responsible parties.

2) Page 2, 3rd Paragraph

The residences where vapors have been detected are 50 feet or more to the west (toward the bay) of the source area at the AMCO site. Vapors detected in the crawl spaces under these homes are probably caused by the presence of contaminated groundwater under these homes. The path of groundwater migration from the AMCO site should be determined, and every basement, crawl space, irrigation well, etc. in the path that groundwater takes should be further tested, not just the houses that abut the site.

CDHS generally agrees with this position. USEPA conducted additional field sampling on the site and immediate area around the site in the Fall of 2004. Data results from this round of sampling should provide a clearer picture of the contaminants in various media. While CDHS agrees that further characterization of the groundwater plume is needed for remedial purposes, we contend that for the purposes of assessing human health exposure risks, inhalation of soil gases from AMCO contaminants is the pathway of greatest concern, and therefore has received a large portion of our attention in the PHA.

3) Page 2, 6th Paragraph through Page 3, 1st Paragraph

Potential exposures are understated or ignored because exposures of the general public to groundwater flowing from the site and to vapors emanating from the groundwater are ignored.

As stated previously, the soil gas (vapors) emanating from the groundwater have been addressed within the PHA.

4) Page 3, 5th Paragraph through Page 4, 1st Paragraph

The last sentence of this paragraph states, "Groundwater flow direction at the site generally travels toward the southwest with seasonal variations." No reference is given for this statement. Groundwater maps prepared for the nearby Bobo's Junkyard site (former SPRR Transportation Yard) indicate that local groundwater flow is generally to the west some seasonal variation to the northwest, which is toward the Prescott Elementary School.

CDHS is familiar with reports that indicate groundwater flow on the former Bobo's Junkyard is flowing west to west-southwest (Terranext Second Quarter 1996 Groundwater Monitoring Report). However, the majority of data for groundwater flow

direction on the AMCO site indicates groundwater flows southwest with some seasonal variation towards Oakland Inner Harbor. CDHS has amended the PHA to reflect this information (page 4 of the final PHA).

5) Pages 4 and 5

The entire discussion on these pages supports our position that the health risks associated with the movement of contaminated groundwater are not adequately accounted for in this PHA.

The *Site Description* section is intended to provide an overview of the available information for the site. Information and analysis of health risks are addressed in the *Environmental Contamination/Pathways Analyses/Toxicological Implications* section.

6) Pages 7 and 8

The discussion of demographics on these pages points out that the residents of the area are predominantly minorities (86%), poor, not property owners, and young. We think that the lack of discussion, much less investigation, of the health effects of contaminated groundwater in this community is a classic environmental justice issue. Any risk of health effects of contaminated groundwater has apparently been deemed unacceptable in more affluent communities such as Palo Alto (COE site), Mountain View (MEW Superfund site) and San Jose (South San Jose Superfund site) where hundreds of millions of dollars have been spent to investigate and remediate contaminated groundwater. The residents of West Oakland deserve no less, and should not become guinea pigs to determine what happens if nothing is done to remediate groundwater contaminated by vinyl chloride, a known, powerful, cancer-causing toxic chemical.

Again, the intent of the PHA is to identify exposed populations and make recommendations to eliminate or reduce exposure to hazardous materials. It is not a remedial document. USEPA is in the process of characterizing the site and will decide on a clean-up method. One of the factors that affect USEPA's choice of remediation is community acceptability. CDHS encourages you to be involved in the USEPA remedial process.

7) Page 8, 5th Paragraph

This paragraph states that the City of Oakland has placed permit restrictions on excavations at the AMCO site. We believe that these restrictions extend some distance from the site, and that utility workers and city workers refuse to excavate in the vicinity of the site. We support these workers in their refusal to excavate in the area, because of the potential for these workers to come in contact with contaminated groundwater or its vapors. What happens if a sewer line breaks near the AMCO site? Who will fix it? Will the sewage just run forever? What are the health effects of such a scenario?

In general, when a utility such as a sewer line breaks, it is the responsibility of that utility provider to fix the problem. This situation is a bit more complex in the vicinity of AMCO because of the limitations on excavations in the area. If an incident occurs that requires excavation in the area, such as a sewer main break, the City of Oakland would

be notified and the restriction in the area would be imposed on work in the area. In addition, because AMCO is a Superfund site, USEPA would be notified of any work in the area. This may require that utility workers do work in health and safety equipment to prevent exposures to hazardous materials.

8) Page 8

The discussion of land uses in the area points out that the highest standards of cleanup should be applied to the AMCO Chemical site. There are residences, parks, and schools nearby where children are present.

CDHS agrees that areas zoned for residential purposes should be held to the highest clean- up standards.

9) Pages 9 and 10

The discussion about the incinerator points out why the community is mistrustful of the agencies. It also shows why environmental justice has become one of the most important issues of concern to the community. Incineration was never used at similarly contaminated sites in the Bay Area because of public perceptions and real health concerns. Feasibility Studies at the COE site in Palo Alto, which was regulated by the DHS, and the MEW and South San Jose Superfund sites, which were regulated by the EPA, ruled out incineration. Yet when it came to West Oakland, incineration was approved over other technologies that had been proven to be effective and safe at these other sites. It appeared to us that we were being used as guinea pigs to try out a technology that more affluent communities would not accept.

Comment noted.

10) Page 12 Question: Is there the possibility of inhaling of getting exposed to vapors from groundwater that could lead to health problems?

This community health concern is not adequately addressed by the response presented in the PHA. DHS has not evaluated potential routes of exposure from groundwater seeping into basements, sumps, wells, depressions, excavations and other places that could trap vapors coming from the groundwater. Because contaminated groundwater can migrate substantial distances from the site, the evaluations of crawl spaces under buildings near the site are not enough to put this issue to rest. Precisely because it is difficult to establish whether a particular individual's illness/symptoms were caused by a specific exposure, any uncontrolled exposure to these highly toxic materials is not acceptable. A Preliminary Endangerment Assessment (PEA) using California Department of Toxic Substances Control (DTSC) methodology prepared for the 7th St.-McClymonds Corridor Neighborhood Improvement Initiative showed that the excess cancer risk associated with the AMCO site was nearly three cancers per 10 exposures, and that most of this risk came from potential contact with vinyl chloride-contaminated groundwater and/or its vapors. Downplaying or ignoring this risk is like asking every person that comes in contact with groundwater or its vapors from the AMCO site to put three rounds in a ten-chamber revolver, spin the chamber, pull the trigger, and wait thirty years to see if the gun goes off.

Please see previous comments (#2 & #3) pertaining to the soil gas/vapor intrusion pathway.

11) Page 13, 1st Paragraph

Workers at the site, and offsite workers that potentially come in contact with groundwater flowing from the site, should be 40-hour trained in accordance with 40CFR1910.120.

Workers that may come into contact with hazardous chemicals should be 40-hour trained to prevent exposures to hazardous materials. As long as the pavement remains on the site, on-site workers are not expected to be at risk from exposure to AMCO contaminants. Off-site workers that work in subsurface soils should have O.S.H.A. 40-hour training. Any permitted work that takes place in the subsurface soils would trigger the City of Oakland excavation restrictions.

12) Page 13 Question: How does the government decide if there is or isn't risk from the vinyl chloride that was found in the community?

The DHS discusses how the risk from vapors detected in crawl spaces of residences abutting the facility. There is no discussion of how the risks of inadvertent ingestion of groundwater, skin contact with groundwater, and/or breathing vapors emanating from groundwater were evaluated. It appears that DHS did not evaluate these risks.

The breathing of vapors emanating from groundwater has been addressed in the soil gas/vapor intrusion pathway. CDHS has not calculated risks for inadvertent exposure to groundwater via ingestion and skin contact because we do not believe this to be a likely pathway.

13) Pages 14 through 26

This entire section on exposure pathways totally disregards the very real potential exposures of the public to vinyl chloride through contact with contaminated groundwater and/or its vapors. This deficiency is so glaring as to appear at best to be minimization of the actual situation, and at worst a deliberate attempt to obscure the actual situation from the public to avoid what will undoubtedly be a costly investigation and remediation at the site.

CDHS focused on the soil gas/vapor intrusion pathway because in our opinion this is a realistic exposure scenario. CDHS does not consider that direct exposure to subsurface groundwater contamination in the area is likely. While the PHA does make some recommendations for remedial action, it does not exempt additional remediation should it be deemed necessary in the future.

14) Pages 26 and 27

The entire discussion of potential future exposure to contaminated groundwater is condescending, misleading, and just plain wrong. We know that our drinking water comes from the city water supply inside pipes, and is clean. This is not our concern. Our concern is with the

contaminated groundwater that can seep into basements and holes dug in yards, come in contact with children, and have long-term health effects on our children.

CDHS is unaware of any residents that have basements in the area downgradient of the site or in the area near the AMCO site. Groundwater contaminants from the AMCO site appear to be headed towards the southwest, towards Oakland Inner Harbor. With the exception of the residences on Third Street, all the areas in the likely pathway of groundwater contaminants are zoned for industrial or light industrial operations. These areas are very unlikely to be converted to residential areas and are even less likely to have basements because of tidal influence in the area and shallow groundwater. CDHS did not assess the potential risks from contaminated groundwater getting into basements because to our knowledge there are no basements near the AMCO site.

15) Page 28 Child Health Considerations

We suggest the following additions be made: Children play outdoors close to the ground which also increases their exposure to near-surface groundwater and vapors from contaminated groundwater. Children have a tendency to put their hands in their mouths while playing, thereby exposing them to soil soaked in contaminated groundwater that has flowed from contaminated sites. Some children ingest non-food items such as soil soaked in contaminated groundwater, a behavior known as “pica”.

CDHS agrees that children play on the ground and have a tendency to put their hands in their mouth while playing. However, the average depth to groundwater in the area is over 3 feet bgs. CDHS is unaware of any areas on or near the site where soils are “soaked” with contaminated water from the AMCO site and is interested to learn more specifics about these areas, if available. CDHS contends that children are not digging 3 to 4 foot ditches in the area. Further, CDHS contends that any vapors that might make their way to the soil surface from contaminated groundwater would quickly dissipate in ambient air to background levels.

Table T-2 of the August 2002 Data Evaluation Report for the AMCO site shows the range of groundwater depth in six wells and one peizometer in the vicinity of the AMCO site. This data set ranges from 1997 to 2001. The depth to groundwater in this set of wells ranges from as shallow as 3.4 feet bgs in MW-12 to 8.9 feet bgs in BMW-8 (Table 6a). The average depth of these wells range from 4.9 to 8.3 feet bgs. CDHS concludes it is highly unlikely that people would dig to these depths and be exposed to contaminated groundwater.

16) Pages 28 and 29 Limitations with the Investigations Described in this Public Health Assessment

It is our position that the limitations and data gaps have severely compromised the conclusions of this PHA.

Comment noted.

17) Pages 29 and 30 Conclusions

The absurd and erroneous proposition that groundwater is not a problem because no one is drinking it is repeated in the conclusions section of the PHA. We do not accept the conclusions presented in this PHA because of the lack of data on groundwater.
The conclusions we have come to are the same conclusions that were arrived at for other similar sites in the Bay Area such as the COE site in Palo Alto, the MEW Superfund site in Mountain View, and the South San Jose Superfund site. These conclusions are:
The solvents that were spilled at the AMCO site have been known to sink hundreds of feet into the earth, even when groundwater is present, because they do not float on the groundwater like gasoline or oil. They have been known to create a deep "column" of contaminated soil that groundwater passes through, which causes the groundwater to become contaminated. The contaminated soil can bleed solvents into the groundwater for decades, the same way it takes a long time to rinse soap out of a sponge. Contaminated water can reach great distances during these decades, and when it is near the ground surface as is the case in West Oakland, public health impacts can be severe even though no one is drinking the water. The residents of West Oakland demand environmental justice and equal protection of the laws such as the Clean Water Act.

Comment noted.

18) Page 31 Recommendations to USEPA for Further Actions

The absence of a recommendation for complete investigation and cleanup of the contaminated groundwater plume flowing under West Oakland caused by the AMCO site is unconscionable. It continues a pattern of the regulatory agencies ignoring the real problems at this site, and asks the West Oakland community to accept conditions that other communities are unwilling to accept. Other communities in the Bay Area had the good fortune that the electronics companies and defense agencies that caused the problems paid for the investigations and cleanups. In these cases, the regulatory agencies required strict compliance with laws regulating discharge of toxic chemicals to the groundwater. Complete investigation of the groundwater contamination, and cleanup of the groundwater was required. In the case of AMCO, AMCO is long gone, and there is nothing left but the Superfund to pay for the cleanup. But this is what the Superfund is for: to clean up sites where the responsible parties are no longer financially viable. The fact that the site cleanup is publicly funded should not change the level of cleanup, or the level of environmental protection provided to the public.

As stated previously, the PHA is not a remedial document and although groundwater assessment and containment/remediation are not explicitly mentioned in the report, it is CDHS' understanding that these activities are underway. In an effort to clarify CDHS' position on this matter, we will amend the PHA to include recommendations to thoroughly assess and remediate contaminated groundwater.

19) Page 40 Figure 2

This map shows several monitoring wells from which data could have been obtained. There is no data shown. The elevations of groundwater in the wells would show the slope of the groundwater

table and therefore the direction groundwater is flowing. Concentrations of contaminants in the wells would help to map the groundwater contamination plume and would indicate where additional wells should be installed to completely map the plume and monitor the cleanup when the cleanup begins.

The PHA does not usually include tables of all the available data because this would make the document cumbersome. However, in light of your comment that groundwater data would be useful, CDHS has included a table summarizing groundwater data collected on the AMCO site in 2000 (Table 8).

20) Page 48 Table 1

Pathways for inadvertent ingestion, skin contact, and breathing vapors of un-potable (non-drinking) groundwater are not mentioned. For some reason drinking contaminated groundwater, which is not an issue at the AMCO site, is discussed.

These issues are not addressed in Table 1 because there is no completed or potentially completed exposure related to groundwater that occurred in the past, are occurring now, or are likely to occur in the future. If you have evidence to the contrary, CDHS encourages you to share that information/data with us as soon as possible.

21) Additional General Comments

The Draft Public Health Report prepared by the California Department of Health Services (DHS) under cooperative agreement with the Agency for Toxic Substance and Disease Registry (ATSDR) for the AMCO Chemical site in West Oakland appears to inadequately assess the public health concerns by ignoring groundwater contamination, one of the most likely human exposure routes.

The most concerning of all the chemicals found at the site, vinyl chloride, is known to have contaminated the groundwater at the site, and is estimated to be flowing away from the site. Specifically, vinyl chloride has been classified as a human carcinogen by the United States EPA, by the International Agency for Research on Cancer, by the National Institutes of Occupational Safety and Health, buy the American Conference of Governmental Industrial Hygienists. A causal relationship between exposure to the agent and human cancer has been proven in human studies. It appears erroneous for a Public Health Assessment to completely fail to consider all possible exposure routes to this chemical, among others, two of which are additionally classified carcinogens.

While the groundwater in this community is not currently used for drinking by the population as a whole, there are other avenues of potential exposure to groundwater. EPA has found vinyl chloride in the soil and nearby monitoring wells in the West Oakland neighborhood, as well as in the crawlspace air and soil gas at residences on the same block as the site in September 1999. No thorough study conducted on the number of unregistered personal wells along the entire flow

path of the groundwater which is common for residents to use for irrigation. The irrigation of contaminated water can surface the gas, increasing risk of inhalation, and create the likelihood for dermal exposure, as well as residual ingestion from vegetable and herb gardens.

Additionally, the water table during the rainy season has the potential to reach very near the surface, and possibly seep into crawl spaces or basements of homes in the groundwater flow path, creating once again potential for exposure. The groundwater migration is also of substantial environmental concern with the potential for contamination migrating to the Oakland Estuary where large bird and fish populations, among others will be impacted. Furthermore with California's growing population the future scarcity of fresh clean water must be considered a public health impact. The groundwater should be viewed as a future commodity for the community, and state, which the contamination has impacted significantly. Vinyl chloride has been detected at levels over the Federal Maximum Contaminant Levels for drinking water in offsite groundwater. Clean up of the groundwater must to be addressed in the recommendations for future action.

This, in large, is an environmental justice issue. As West Oakland has a predominately minority population, the responsible parties have neglected to account for the full extent of the contamination, and potential public health concerns the community faces. It has been researched that the race of the affected community is a particularly accurate indicator of enforcement failure by Byrne, Martinez, and Glover in 2002. Disproportionate environmental and health hazards are faced by minority communities as bourgeoning research has shown. So much evidence in fact has mounted that reduction of socioeconomic status and racial disparities in health has been identified by the United States Health Services and the National Institute of Health as a majority priority for public health practice and research for the 21st century. This Public Health Assessment from the CA DHS is once again evidence of how such disparities develop. It is crucial for a public health assessment to take into account all viable exposure pathways for all populations.

CDHS agrees that a study of private wells in the area is warranted to ensure that people are not using the groundwater for irrigation or other purposes. While the public comment draft PHA did not explicitly recommend remediation of groundwater in the area, it is CDHS' understanding that the groundwater in the area will be remediated as a part of cleaning up the source area. Groundwater remediation and private well survey recommendations have been added to the PHA.