Health Consultation

Technical Review of the Risk Assessment for Gas Vent Volatile Organic Compound Data

AT

OLD SOUTHINGTON LANDFILL SITE
SOUTHINGTON, HARTFORD COUNTY, CONNECTICUT

EPA FACILITY ID: CTD980670806

SEPTEMBER 30, 2006

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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Prepared by:

The Connecticut Department of Public Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health (CTDPH) and the Agency for Toxic Substances and Disease Registry (ATDSR). CTDPH and ATSDR will review additional information when received. The review of additional data could change the conclusions and recommendations listed in this document.

A. BACKGROUND AND STATEMENT OF ISSUE

The United States Environmental Protection Agency (US EPA) requested that the Connecticut Department of Public Health (CTDPH) review and comment on the Risk Assessment for Gas Vent Data Volatile Organic Compound (VOC) Data-Revision 1.1 dated June 2006, for the Old Southington Landfill Superfund (OSL) Site in Southington, Connecticut. Kleinfelter performed the risk assessment for the Performing Settling Defendants (PSDs). The risk assessment uses measured concentrations of landfill gases from gas vents on the landfill cap and models the concentrations in ambient air on the cap and at nearby residences offsite (Kleinfelter, 2006).

In the fall of 2005, CTDPH prepared a Health Consultation for the US EPA which reviewed and commented on the Gas Vent Sampling Data Reports dated December, April, and July of 2002 from OSL (ATSDR 2005a). The gas vent sampling was performed by MACTEC Engineering and Consulting for the PSDs. In the 2005 health consultation, CTDPH requested that gas vent modeling for onsite workers for the Old Southington Landfill site be performed in order to determine whether workers on the landfill cap were receiving exposures to landfill gases that could pose a health threat. The risk assessment report reviewed in this health consultation is the result of this request.

The Old Southington Landfill Superfund Site (OSL) is located in Southington, Connecticut. The landfill operated from approximately 1920 until 1967. The 13-acre site is located adjacent to Old Turnpike Road in the Plantsville section of town. The site is bordered by Old Turnpike Road to the west, Rejean Road to the north, and Black Pond to the east. The surrounding neighboring properties include town production well number five, the land occupied by the Lori Corporation, a radio station, and Chuck and Eddie's Used Auto Parts Yard. A map of the site can be found in Appendix A. Open dumping of liquid, solid, and hazardous wastes began in 1950. Open burning of wastes and spontaneous chemical fires occurred for an unknown period of time. Various contaminants of concern, including volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), metals, and pesticides have been found in groundwater and soil (ATSDR 1995).

A Public Health Assessment prepared in 1995 concluded that the site was a public health hazard based on the physical hazards associated with the methane contamination of indoor air in commercial facilities (ATSDR 1995). Since that time, structures at risk from methane have been relocated and the landfill has been capped. Following completion of the landfill cap in 2001, a gas vent sampling program was initiated. The purpose of this program was to provide data to support whether or not active gas treatment would be necessary at the landfill. The specific question posed to CTDPH by the US EPA was

whether onsite landfill workers were exposed to unacceptable levels of contaminants from the landfill gas. CTDPH focused on the risk assessment of onsite workers and not of residents living in nearby neighborhoods because this group was the main focus of our concern in the earlier health consultation. CTDPH does not believe that the VOC levels from OSL gas vents that the residents nearby neighborhoods are exposed to are elevated enough to indicate the existence of a significant health risk

B. DISCUSSION

1. Summary of Kleinfelter's Risk Assessment

Kleinfelter used the 2002 OSL gas vent data in a US EPA ISC3 dispersion model in order to determine the maximum total emissions from the landfill. The 2002 gas vent data was collected from 13 vents each with a 4 inch inside diameter.

ISC3 is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. The modeling for the landfill was performed with the short-term ISCST3 model for two different averaging periods: 1-hour and annual.

Using the model, Kleinfelter estimated the maximum and average 1-hour concentrations for the 6 contaminants that are either known or are likely to be carcinogenic to humans (benzene, chloroform, methylene chloride, tetrachloroethylene, trichloroethylene, and vinyl chloride) of the 24 analytes detected in the gas vent data and make up 75.2 % of the emission rate. Trichloroethylene is the main risk driver based on two key factors: total emissions (69%) and cancer potency. Kleinfelter evaluated cancer risk from long-term exposure to these 6 carcinogens by onsite maintenance workers.

Kleinfelter used the maximum 1-hour concentration measured in any of the three sampling events as a conservative estimate of daily exposure a person might be exposed to 8 times a year for 30 years. They assumed that the maintenance on the landfill which is mainly grass mowing, would be done twice a month for 4 months and it would take 2 hours. All of these cancer risk calculations indicated that long-term exposure to these contaminants did not pose a significant excess risk. Cancer risk calculations showed that the total theoretical excess lifetime cancer risk is 2.5 cancer cases in a population of 100 million. This risk is extremely low and presents very minimal risk to onsite maintenance workers who are exposed to landfill gases coming out of the gas vents at OSL. CTDPH concurs with Kleinfelter's conclusions that no significant cancer risk exists for onsite maintenance workers exposed to the landfill gas at OSL.

In assessing noncancer chronic and acute risk, CTDPH assumed that a maintenance worker would be exposed to the landfill gas 16 times a year (as later described) instead of eight. Even if this assumption would be made in assessing cancer risk, the excess lifetime cancer risk would only be 5 excess cancers out of 100 million. This risk is still extremely low and represents very minimal risk to onsite maintenance workers who are exposed to landfill gases at OSL.

2. Comments on the Risk Assessment

a. CTDPH believes that the model used, the US EPA ISC3 dispersion model, is appropriate for the OSL landfill gas vent exposure scenario for onsite workers.

b. Kleinfelter focused its gas modeling vent efforts on 6 analytes that were known carcinogens. There were other contaminants detected in the gas vents (chlorobenzene, xylene, chloroethane, and ethylbenzene), whose concentrations were elevated above comparison levels. However, these contaminants are not considered to be carcinogens and therefore, are not considered when evaluating cancer risk from exposure to the landfill gas from OSL.

c. Kleinfelter did not evaluate noncancer risk from long-term exposure or risk from short-term (acute) exposure. CTDPH believes that it is important to evaluate these risks and will do so in the following section.

3. CTDPH Evaluation of Noncancer Risks

CTDPH calculated long-term (chronic) noncancer risk and short-term (acute) risk for onsite maintenance workers from exposure to the 6 above mentioned contaminants at OSL. CTDPH believes that the inclusion of these risk evaluations are important in evaluating overall public health risk to the onsite maintenance worker. Using the same exposure scenario assumptions (with one exception which is mentioned below) and the same contaminants used by Kleinfelter in the cancer risk evaluation, CTDPH calculated both chronic noncancer risk and acute risk for all 6 of these contaminants. However, CTDPH assumed that the grass was cut 16 times a year. CTDPH believes that this is a more appropriate assumption for the onsite worker mowing grass on the landfill than 8 times per year (Kleinfelter's assumption). CTDPH calculated a hazard index (HI) for chronic and acute risk for persons exposed to each of 6 above mentioned contaminants. A HI is the ratio between a person's estimated site exposure and the "safe" level (minimal risk level or reference dose (MRL or RfD)). MRLs and RfDs are estimates of daily exposure to humans that are likely to be without harmful noncancer effects. MRL s and RfDs used to calculate HIs for the onsite maintenance worker scenario are shown in Table 1. A HI less than 1 means that a person's exposure is lower than the safe level and health effects can be ruled out. A HI greater than 1 means that a person's exposure is greater than the safe level and health effects cannot be ruled out.

Table 1. Chronic and Acute Reference Doses for Contaminants found in Landfill Vent Modeling Volatile Organic Compound Data for Onsite Maintenance Workers at Old Southington Landfill.

Contaminant	Maximum 1-Hour Concentration ($\mu g/m^3$)^@	Comparison Value (Chronic)* ($\mu g/m^3$)	ATSDR Acute MRL ($\mu g/m^3$)
Benzene	0.010	30 (EPA RfC) (IRIS 2006)	29 (ATSDR 2005b)
Chloroform	0.007	99 (ATSDR MRL) (ATSDR 1997a)	496 (ATSDR 1997a)
Methylene Chloride	0.473	1,059 (ATSDR MRL) (ATSDR 2000)	2118 (ATSDR 2000)
Tetrachloroethylene	0.218	270 (ATSDR MRL) (ASTDR 1997b)	1356 (ATSDR1997b)
Trichloroethylene	10.530	40 (EPA DRAFT RfC) (EPA 2001)	10,920 (ATSDR 1997c)
Vinyl Chloride	0.113	11 (ATSDR MRL) (ATSDR 2004)	1,300 (ATSDR 2004)

^Estimated by the US EPA using plume model
@ micrograms per cubic meter
* Comparison levels are estimates of daily exposure to humans that are likely to be without harmful noncancer effects. Minimal risk level (MRLs) and reference concentrations (RfCs) are comparison values.

Table 2 lists CTDPH's calculations for chronic and acute HI for the 6 above mentioned contaminants found in the landfill vents. Please see Appendix B for risk calculations listed in Table 2. All of the chronic and acute HI's for the 6 contaminants sampled in the landfill vents are well below 1. Therefore, we can conclude that noncancer health effects from acute and chronic exposure to gas vent contaminants from OSL by an onsite landfill worker are very unlikely. As stated previously, Kleinfelter modeled only the 6 analytes that are carcinogens. Although, there are additional contaminants present in the landfill gas, CTDPH did not include them because modeled concentrations were not available. However, their concentrations and toxicity are relatively low compared to the 6 listed analytes. Because of this, their inclusion would not change the conclusions about noncancer risk.

Table 2. CTDPH's Calculations of Chronic and Acute Risk for Onsite Workers from Exposure to Volatile Organic Compounds from Gas Vents from the Old Southington Landfill Site.

Contaminant	Chronic Hazard Index*	Acute Hazard Index
Benzene	1.2E-6	1.6 E-4
Chloroform	2.7E-7	7.1E-6
Methylene Chloride	2.0E-5	1.1E-4
Tetrachloroethylene	3.0E-6	6.0E-4
Trichloroethylene	1.0E-3	5.0E-4
Vinyl Chloride	3.9E-5	4.2E-5

- A Hazard Index (HI) is the ratio between a person's exposure and the "safe" level. An HI less than 1 means that a person's exposure is lower than the safe level and health effects can be ruled out. An HI greater than 1 means that a person's exposure is greater than the safe level and health effects cannot be ruled out.

4. Uncertainty

When evaluating risk from exposure to contaminants, one must keep in mind that there is a great deal of uncertainty that must be considered. The actual concentration that a maintenance worker is exposed to at the landfill over a specific length of time is unknown. In the presence of uncertainty, a very conservative estimate of that concentration can be estimated using a maximum 1-hour concentration. However, it is unlikely that a maintenance worker was exposed to this concentration the entire time he or she was working on the landfill. Consequently, the risk calculations from exposure to vent gas contaminants which are already very minimal, may be even less than what CTDPH has estimated.

C. CONCLUSIONS

Gas vent modeling for onsite maintenance workers at OSL was performed by Kleinfelter as requested by CTDPH. Kleinfelter did a risk assessment on the gas vent modeling data for onsite maintenance workers and the US EPA requested that CTDPH review and comment on Kleinfelter's report. However, Kleinfelter only calculated cancer risk for maintenance workers mowing the grass on the Landfill. Noncancer and acute health risk were not evaluated for the maintenance work exposure scenario. CTDPH believes that it is prudent to evaluate long-term noncancer and acute risk for onsite maintenance workers exposed to landfill gases coming out of the vents of OSL. Using the gas vent modeling data, CTDPH evaluated long-term noncancer and acute risk for onsite maintenance workers at the OSL. CTDPH concludes that both chronic and acute exposure to the landfill gas does not result in any significant health risk to onsite maintenance workers. In addition, CTDPH concurs with Kleinfelter's conclusion concerning cancer risk. Their conclusion stated that long-term exposure to the landfill gases by an onsite maintenance worker on the landfill does not present a significant risk for cancer.

ATSDR has a characterization scheme whereby the level of public health hazard at a site is assigned to one of five conclusion categories (Appendix C). CTDPH has concluded that exposure to contaminants from landfill gas vent on the Old Southington Landfill site presents no apparent public health hazard to onsite maintenance workers

RECOMMENDATIONS

1. CTDPH recommends that the US EPA and CTDEP continue to work with CTDPH on the long-term monitoring plans and 5-year review for old Southington Landfill.

2. CTDPH recommends that the US EPA and CTDEP continue to work with CTDPH in educating the public about the long-term monitoring plans for Old Southington Landfill.

PUBLIC HEALTH PLAN

Actions Taken

1. As requested by the US EPA, CTDPH has reviewed and commented on the risk assessment of landfill gas vent contaminants.

Actions Planned

1. CTDPH will make this health consultation available to the US EPA, Southington Health Department, CT DEP, and town maintenance worker.

2. CTDPH will continue to work with the US EPA to respond to health questions and concerns regarding cleanup of hazardous contaminants at the Old Southington Landfill site.

3. CTDPH will review any additional data for this site and update this health consultation, if necessary.

REFERENCES

[ATSDR 1995] Agency for Toxic Substances and Disease Registry. 1995. Public Health Assessment for Old Southington Landfill. Atlanta: US Department of Health and Human Services.

[ATSDR 1997a] Agency for Toxic Substances and Disease Registry. 1997. Toxicological Profile for Chloroform. Atlanta: US Department of Health and Human Services.

[ATSDR 1997b] Agency for Toxic Substances and Disease Registry. 1997. Toxicological Profile for Tetrachloroethylene. Atlanta: US Department of Health and Human Services.

[ATSDR 1997c] Agency for Toxic Substances and Disease Registry. 1997. Toxicological Profile for Trichloroethylene. Atlanta: US Department of Health and Human Services.

[ATSDR 2000] Agency for Toxic Substances and Disease Registry. 2000. Toxicological Profile for Methylene Chloride. Atlanta: US Department of Health and Human Services.

[ATSDR 2004] Agency for Toxic Substances and Disease Registry. 2004. Toxicological Profile for Vinyl Chloride. Atlanta: US Department of Health and Human Services.

[ATSDR 2005a] Agency for Toxic Substances and Disease Registry. 2005. Health Consultation: Public Health Evaluation of Gas Vent Sampling Reports at Old Southington Landfill. Atlanta: US Department of Health and Human Services, September 13, 2005.

[ATSDR 2005b] Agency for Toxic Substances and Disease Registry. 2005. Toxicological Profile for Benzene. Atlanta: US Department of Health and Human Services

[EPA] United States Environmental Protection Agency. 1997. Risk Factors Handbook.

[EPA 2001] Unites State Environmental Protection Agency. 2001 Trichloroethylene Health Risk Assessment: Synthesis and Characterization; EPA/600/P-01/002A-External Review Draft; August 2001.

[IRIS 2006] United States Environmental Protection Agency. 2006. Integrated Risk Information System. Available at: http://www.epa.gov/iris.

[Kleinfelter 2006]. Kleinfelter Engineering and Consulting. 2006. Risk Assessment for Gas Vent VOC Data- Revision 1.1. Old Southington Landfill Superfund Project. Kleinfelter Project Number 0060201EA, Task 3.0., June 14, 2006.

CERTIFICATION

The Health Consultation for the Technical Review of the Risk Assessment for Gas Vent Volatile Organic Compound Data-Revision I at Old Southington Landfill Site in Southington, Connecticut was prepared by the Connecticut Department of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the ATSDR Cooperative Agreement Partner.

Greg Ulirsch
Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
Agency for Toxic Substances and Disease Registry (ATSDR)

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Team Leader-Coop Agreement Program
CAT, DHAC, ATSDR

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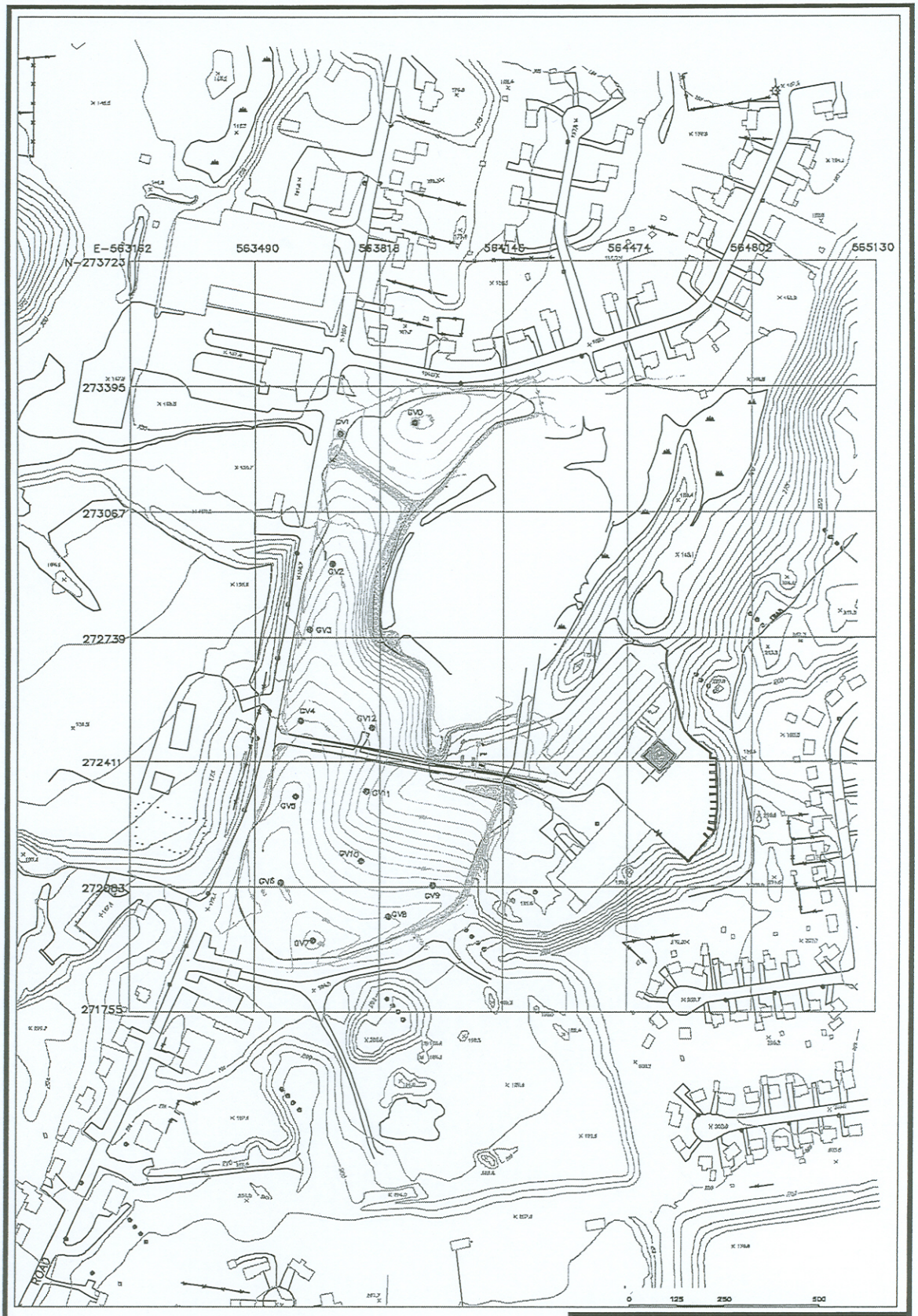
Appendix A
Map of the Old Southington Landfill Site



LEGEND:

- EXTENT OF STUDY SITE
- GV10 GAS VENT LOCATION
- CARTESIAN GRID

N

FIGURE 1
GRID BOUNDARY, GAS VENT LOCATIONS AND MAXIMUM CONCENTRATION LOCATIONS
OLD SOUTHINGTON LANDFILL SUPERFUND PROJECT
SOUTHINGTON, CONNECICUT
SUPPLEMENTAL GROUNDWATER INVESTIGATION

GSC REF.: 060201.02GAS	CHECKED BY:
DRAFTED BY: ANG	DATE: 4/24/06
REVISED BY:	DATE:
SOURCE: MACTEC FILE# 719-75614	

KLEINFELDER
30 Porter Road • Littleton, MA 01460 • (978) 486-0060

Appendix B
Risk Calculations

Average Daily Exposure

Average Daily $Dose_{chronic}$: [Air] x EF_1 (events/year) x ED (hours/event) x EP (years) x 1/AP (years) x C1 x C2 x 1/BW x1/IR

Acute Daily Dose =IR x [Air] x EF_1 x EF_2 x 1/BW x 1/AT x ED x EF_3

HI= Average Daily Dose/RfD or MRL

1. Benzene

1a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of benzene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

Conversion Factor 1ppm=3.24 mg/m^3
EPA RfD (IRIS 2006): 0.03 mg/m^3 x 20 m^3/day x 1/70kg= 8.57E-3 mg/kg/day
Average Daily $Dose_{chronic}$=(9.66E-3 µg/m^3) x (16 ev/yr) x (2 hr/ev) x (30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 1/70kg x 20 mg^3/day
Average Daily Dose= 0.00001 ug/kg/day or 1.00 E-8 mg/kg/day
HI=1.00 E-8 mg/kg/day /(8.57 E-3 mg/kg/day
HI= 1.2 E-6

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for benzene is below 1. This indicates that noncancer health impacts from benzene are unlikely.

1b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of benzene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Acute MRL (ATSDR 2005b) =0.009 ppm or 0.029 mg/m^3
=0.029 x 20 m^3/ day 1/70 kg=0.0083 mg/kg/day
Acute Daily Dose =(4.8m^3/ hr) x [9.66 E-3 µg/m^3] x 7 days/wk x 1 wk x 1/70 kg x 1/7 days x (2hr/ev) x (1 ev/day)
Acute Daily Dose=1.32E-3 µg/kg/ day or 1.32E-6 mg/kg/day
HI= 1.32E-6 mg/kg/day) /(0.00828 mg/kg/day)=
HI=1.6E-4

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for benzene is below 1. This indicates that noncancer health impacts from benzene are unlikely.

2. Chloroform

2a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of chloroform an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Chronic MRL (ATSDR 1997a) =20 ppb or 99µg/m^3
Conversion Factor: 1ppm=4.96 mg/m^3
ATSDR MRL=0.099mg/m^3 x 20m^3/day x 1/70 kg=0.028 mg/kg/day
Average Daily $Dose_{chronic}$: 7.3E-3µg/m^3 x 16 ev/yr x (2 hr/ev) x(30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 20 m^3/day x 1/70 kg= 7.6E-6 µg/kg/day or 7.6 E-9 mg/kg/day
HI=7.6 E-9 mg/kg/day/0.028 mg/kg/day=**2.7 E-7**

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for chloroform is below 1. This indicates that noncancer health impacts from chloroform are unlikely.

2b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of chloroform an onsite maintenance worker would receive from chloroform via inhalation of vent gas from OSL.

Acute MRL (ATSDR 1997a)=0.1 ppm or 0.496 mg/m^3
=0.496 mg/m^3 x 20 m^3/day x 1/70 kg=0.14 mg/kg/day
Acute Daily Dose=(4.8m^3/ hr) x [0.0073 µg/m^3] x 7 day/wk x 1 wk x 1/70 kg x 1/7 day x (2hr/ev) x (1 ev/day)
=0.001 µg/kg/day or 1.0 E-6 mg/kg/day
HI=(1.0E-6 mg/kg/ day)/ 0.14 mg/kg/day
HI=7.1E-6

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for chloroform is below 1. This indicates that noncancer health impacts from chloroform are unlikely.

3. Methylene Chloride

3a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of methylene chloride an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Chronic MRL (ATSDR 2000): 0.3ppm=1.059 mg/m^3
= 1.059 mg/m^3 x 20 m^3/day x 1/70 kg =0.303 mg/kg/day
Conversion factor: 1ppm=3.53 mg/m^3
Average Daily $Dose_{chronic}$: 0.47255µg/m^3 x 16 ev/yr x (2 hr/ev) x (30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 20 m^3/day x 1/70 kg= 0.00049 µg/kg/day or 4.93 E-7 mg/kg/day
HI= 4.93 E-7 mg/kg/day /0.303 mg/kg/day
HI=1.6E-6

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for methylene chloride is below 1. This indicates that noncancer health impacts from methylene chloride are unlikely.

3b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of methylene chloride an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

Acute Inhalation Dose
ATSDR Acute MRL (ATSDR 2000)=0.6 ppm or 2.118 mg/m^3
Acute MRL=2.118 mg/m^3 x 20 m^3/ day x 1/70 kg =0.605 mg/kg/day
Acute Daily Dose=(4.8m^3/ hr) x [0.47255 µg/m^3] x 7 day/wk x 1 wk x 1/70 kg x 1/7 day x (2hr/ev) x (1 ev/day)
=0.065 µg/kg/day or .000065 mg/kg/day
HI=(0.000065 mg/kg/day)/(0.605 mg/kg/day**)**
HI= 1.1E-4

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for methylene chloride is below 1. This indicates that noncancer health impacts from methylene chloride are unlikely.

4. Tetrachloroethylene

4a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of tetrachloroethylene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Chronic MRL (ATSDR 1997b): 40 ppb or 0.040 ppm or 0.27 mg/m^3 or 270$\mu g/m^3$
=0.27 mg/m^3 x 20 mg/m^3 x 1/70 kg = 0.077 mg/kg/day
Conversion Factor: 1ppm=6.78mg/m^3
Average Daily $Dose_{chronic}$ = 0.21804$\mu g/m^3$ x 16 ev/yr x (2 hr/ev) (30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 20 m^3/day x 1/70 kg= 0.00023 µg/kg/day or 2.28 E-7 mg/kg/day
HI= 2.28 E-7 mg/kg/day) /0.077 mg/kg/day
HI =3.0 E-6

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for tetrachloroethylene is below 1. This indicates that noncancer health impacts from tetrachloroethylene are unlikely.

4b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of tetrachloroethylene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Acute MRL (ATSDR 1997b)= 0.2 ppm or 1.356 mg/m^3
1.356mg/m^3 x 20m^3/day x 1/70 kg=0.387mg/kg/day
Acute Daily Dose=(4.8m^3/ hr) x [0.21804$\mu g/m^3$] x 7 day/wk x 1 wk x 1/70 kg x 1/7 day x (2hr/ev) x (1 ev/day)
=0.030 µg/kg/day or 0.000030 mg/kg/day
HI=(0.000030 mg/kg/day)/(0.387mg/kg/day)
HI= 7.8E-5

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for tetrachloroethylene is below 1. This indicates that noncancer health impacts from tetrachloroethylene are unlikely.

5. Trichloroethylene

5a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of trichloroethylene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

EPA draft RfC (EPA 2001): 0.04 mg/m^3 or 40 $\mu g/m^3$
EPA RfD=0.04 mg/m^3 x 20 m^3/day x 1/70kg =0.01 mg/kg/day
Average Daily $Dose_{chronic}$: 10.53$\mu g/m^3$ x 16 ev/yr x (2 hr/ev) x (30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 20 m^3/day x 1/70 kg= 0.01099 µg/kg/day or 1.099 E-5 mg/kg/day
HI=1.099 E-5 mg/kg/day)/0.01 mg/kg/day
HI=0.001 or 1E-3

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for trichloroethylene is below 1. This indicates that noncancer health impacts from trichloroethylene are unlikely.

5b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of trichloroethylene an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

Conversion Factor=1 mg/m^3=0.18 ppm
ATSDR MRL (ATSDR 1997c)=2 ppm or 10.92 mg/m^3
10.92 mg/m^3 x 20 m^3/day x 1/70 kg=3.12 mg/kg/day
Acute Daily Dose=(4.8m^3/ hr) x [10.53 $\mu g/m^3$] x 7 day/wk x 1 wk x 1/70 kg x 1/7 day x (2hr/ev) x (1 ev/day)
= 1.44 µg/kg/day or .0014 mg/kg/day
HI=(0.0014 mg/kg/day)/3.12 mg/kg/day
HI=0.0005 or 5E-4

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for trichloroethylene is below 1. This indicates that noncancer health impacts from trichloroethylene are unlikely.

6. Vinyl Chloride

6a. Chronic Inhalation Dose
In this calculation, we are estimating the average daily dose of vinyl chloride an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

ATSDR Chronic MRL (ATSDR 2004): 0.003 mg/kg/day
Average Daily $Dose_{chronic}$: 0.11274 ug/m^3 x 16 ev/yr x (2 hr/ev) x (30 yr) x (1/30 yr) x 1day/24 hr x 1 yr/365 day x 20 m^3/day x 1/70 kg=
=1.18 E-4 µg/kg/day or 1.18 E-7 mg/kg/day
HI=1.18E-7 mg/kg/day)/0.003 mg/kg/day
HI=3.9E-5

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for vinyl chloride is below 1. This indicates that noncancer health impacts from vinyl chloride are unlikely.

6b. Acute Inhalation Dose
In this calculation, we are estimating the average acute daily dose of vinyl chloride an onsite maintenance worker would receive from via inhalation of vent gas from OSL.

Conversion Factor: 1 ppm=2.6 mg/m^3
ATSDR Acute MRL (ATSDR 2004) =0.5 ppm or 1.3 mg/m^3
=1.3 mg/m^3 x 20 m^3/ day x 1/70 kg =0.37 mg/kg/day
=(4.8m^3/ hr) x [0.11274 µg/m^3] x 7 day/wk x 1 wk x 1/70 kg x 1/7 day x (2hr/ev) x (1 ev/day)
= 0.015 µg/kg/day or .000015 mg/kg/day
HI=(0.000015 mg/kg/day)/0.37 mg/kg/day
HI= 4.1E-5

A Hazard Index of 1 means that the estimated dose is equal to the safe dose. A Hazard Index less than 1 indicated that the estimated dose is below the safe dose and noncancer health effects are unlikely. A Hazard Index (HI) greater than 1 indicates that the estimated dose is above the safe dose and noncancer health impacts cannot be ruled out. In this case, the HI for vinyl chloride is below 1. This indicates that noncancer health impacts from vinyl chloride are unlikely.

Where:

[Air]	Maximum 1-Hour Concentration in Air
AP=	Averaging period, Chronic: 30 years (noncancer), Acute: 7 days
BW=	Body Weight: 70 kg
C1	Conversion: 1 day/24 hours
C2	Conversion: 1year/365 days
EF1=	Event Frequency: (Events per year), Chronic:16 events per year Acute: 7 events/week
EF2=	Event Frequency: Acute: 1 week
EF3:=	Event Frequency: Acute:1 event/day
ED=	Exposure duration , 2 hours/event)
EP=	Exposure period, 30 years
HI=	Hazard Index
IR=	Inhalation Rate: Chronic: $20m^3$/day; Acute: Assume heavy activity-4.8 m^3/hr, every day for 2 hours for 1 week (EPA 1997)
MRL	Minimal Risk Level
RfC	Reference Concentration
RfD	Reference Dose

Appendix C. ATSDR Interim Public Health Categories

Category/Definition	Criteria	ASTDR Actions
1. Urgent Public Health Hazard This category is used for sites where short-term exposures (< 1 year) to hazardous substances or conditions could result in adverse health effects that require rapid intervention. This determination represents a professional judgment based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information indicates that the site-specific conditions or likely exposures have had, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.	ATSDR will expeditiously issue a health advisory that includes strong recommendations to immediately stop or reduce exposure to mitigate the health risks posed by the site.
2. Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 year) to hazardous substance or conditions that could result in adverse health effects. This determination represents a professional judgment based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.	ATSDR will make recommendations to stop or reduce exposure in a timely manner to mitigate the health risks posed by the site.

Appendix C. ATSDR Interim Public Health Categories, Continued

Category/Definition	Criteria	ASTDR Actions
3. Indeterminate Public Health Hazard This category is used for sites in which "critical" data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels. This determination represents a professional judgment that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	This category is used for sites in which "critical" data are insufficient with regard to extent of exposure and/or toxicologic properties at estimated exposure levels. The health assessor must determine, using professional judgement, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible, to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.	ATSDR will make recommendations in the public health assessment to identify the data or information needed to adequately assess the public health risks posed by the site.
4. No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects. This determination represents a professional judgment based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.	Recommendations made to reduce exposure are not needed to reduce risk but may be considered prudent public health practice.
5. No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminated media may have occurred, no exposures are currently occurring, and exposures are not likely to occur in the future.	ATSDR may make no recommendations or may recommend community health education.