Health Consultation

ISS OXFORD BUILDING SERVICES SITE

(CURRENTLY OCCUPIED BY TASTE MAKER FOODS, LLC)

MEMPHIS, SHELBY COUNTY, TENNESSEE

Prepared by the
Tennessee Department of Health

MARCH 18, 2010

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner 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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Foreword

This document summarizes an environmental public health investigation performed by Environmental Epidemiology of the State of Tennessee Department of Health. Our work is conducted under a Cooperative Agreement with the federal Agency for Toxic Substances and Disease Registry. In order for the Health Department to answer an environmental public health question, several actions are performed:

Evaluate Exposure: Tennessee health assessors begin by reviewing available information about environmental conditions at a site. We interpret environmental data, review site reports, and talk with environmental officials. Usually, we do not collect our own environmental sampling data. We rely on information provided by the Tennessee Department of Environment and Conservation, U.S. Environmental Protection Agency, and other government agencies, businesses, or the general public. We work to understand how much contamination may be present, where it is located on a site, and how people might be exposed to it. We look for evidence that people may have been exposed to, are being exposed to, or in the future could be exposed to harmful substances.

Evaluate Health Effects: If people have the potential to be exposed to contamination, then health assessors take steps to determine if it could be harmful to human health. We base our health conclusions on exposure pathways, risk assessment, toxicology, cleanup actions, and the scientific literature.

Make Recommendations: Based on our conclusions, we will recommend that any potential health hazard posed by a site be reduced or eliminated. These actions will prevent possible harmful health effects. The role of Environmental Epidemiology in dealing with hazardous waste sites is to be an advisor. Often, our recommendations will be actions items for other agencies. However, if there is an urgent public health hazard, the Tennessee Department of Health can issue a public health advisory warning people of the danger, and will work with other agencies to resolve the problem.

If you have questions or comments about this report, we encourage you to contact us.

Please write to: Environmental Epidemiology Program
Tennessee Department of Health
1st Floor, Cordell Hull Building
425 5th Avenue North
Nashville TN 37243

Or call us at: 615-741-7247 or toll-free 1-800-404-3006 during normal business hours

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SUMMARY

INTRODUCTION

The Tennessee Department of Health's (TDH) Environmental Epidemiology Program (EEP) wrote this health consultation in response to a request by the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's State Remediation Program (SRP). This health consultation was prepared to evaluate the results of passive soil-gas sampling completed outside a commercial building. The soil-gas survey was conducted because groundwater containing chemicals is migrating beneath the building. TDEC SRP asked EEP to evaluate the potential exposures to vapor intrusion at the site and any public health implications to the exposures. The building is currently occupied by a food manufacturing company called Taste Maker Foods, LLC (Taste Maker Foods) and is located at 1415/1425 East McLemore Avenue in Memphis, Shelby County, Tennessee. Taste Maker Foods produces prepared flour mixes and doughs at their facility. The purpose of this health consultation is to document our review of soil-gas data collected and to evaluate the potential for soil vapor intrusion and any public health implications of these exposures, as requested by TDEC SRP.

All data supplied for this health consultation were compared to residential health screening values provided by the Agency for Toxic Substance and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA). Screening values are chemical concentrations based on toxicology below which no adverse health effects are likely to occur. When a screening value is exceeded, it does not necessarily mean that people would be expected to develop adverse health effects. Instead, it simply means that the potential for harm requires further investigation.

Ensuring the wellbeing of those living in, working in, or visiting the City of Memphis is a priority of the Tennessee Department of Health's, Environmental Epidemiology Program.

CONCLUSIONS

The Environmental Epidemiology Program reached three important conclusions in this health consultation:

Conclusion 1

EEP concludes that concentrations of tetrachloroethylene and 1,2-dichloroethane in soil-gas at the site should not pose a health risk to adults who work at Taste Maker Foods.

Basis for Conclusion

Chemicals previously identified in the groundwater beneath the Taste Maker Foods site were detected in soil-gas in very low concentrations and only in certain portions of the site. Many testing locations did not show

any detections of these chemicals. The soil-gas analyses had appropriate detection limits.

Next Steps No additional future work is planned at this site.

Conclusion 2 EEP concludes that the vapors from groundwater concentrations of chemicals at the site should not pose a health risk to adults who breathe the indoor air at the site.

Basis for Conclusion Modeling of previously collected groundwater chemical concentrations using the U.S. Environmental Protection Agency's simplified Johnson and Ettinger vapor intrusion model showed calculated indoor air concentrations to be below health screening values.

Next Steps No additional future work is planned.

Conclusion 3 EEP concludes that it would be prudent to re-evaluate the potential for vapor intrusion if the use of the site or other site conditions change in the future.

Basis for Conclusion Chemical plumes are not always stable, and changes in how the site is used in the future could have an impact on the potential for exposure from vapor intrusion to site occupants.

Next Steps TDH EEP will review additional environmental data as requested.

FOR MORE INFORMATION If you have any questions or concerns about your health, you should contact your healthcare provider. For more information on this site and others, call 615-741-7247 or toll-free 1-800-404-3006 during normal business hours.

Introduction

The ISS Building Services Site is currently leased by Taste Maker Foods. Taste Maker Foods produces prepared flour mixes and doughs at their facility, located at 1415/1425 East McLemore Avenue in Memphis, Tennessee (Figures 1 and 2). The purpose of this health consultation is to document our review of soil-gas data collected and to evaluate the potential for vapors from contaminated groundwater beneath the site to migrate upwards into the indoor air of the facility. The Tennessee Department of Health's (TDH) Environmental Epidemiology Program (EEP) was asked by the Tennessee Department of Environment and Conservation's (TDEC) Division of Solid Waste Management, State Remediation Program (SRP) to evaluate the potential exposures to vapor intrusion at the site and any public health implications from these exposures. Based on communication with TDEC SRP, the property owner is not considered responsible for a release of chlorinated solvents in groundwater beneath the site. Groundwater samples from 2 of 3 on-site monitoring wells indicated that tetrachloroethylene (PCE) and trichloroethylene (TCE) concentrations were above U.S. Environmental Protection Agency's (EPA) Maximum Contaminant Levels (MCLs) for public drinking water supplies (Fisher & Arnold 2009). MCLs are typically used as comparison values for concentrations of site-related chemicals in groundwater.

TDEC SRP required a soil-gas investigation to be conducted to evaluate whether the groundwater contaminant plume migrating beneath the Taste Maker Foods buildings could affect the indoor air and thus the health of workers in the facility. There are approximately 27 workers on-site. Thus, the soil-gas investigation is one step in a process to make sure that the indoor air the workers breathe is not a chemical exposure pathway.

The soil-gas investigation was conducted by the Memphis, Tennessee office of Fisher & Arnold Inc. A report outlining results of the soil-gas investigation was submitted to the TDEC SRP in August 2009 (Fisher & Arnold 2009). Based on the results from this report, EEP issued a technical memorandum on November 18, 2009, to TDEC SRP evaluating soil-gas concentrations at the site. This health consultation summarizes many of the findings of that memorandum.

Background

Environmental site investigations have been conducted on the ISS Building Services Site since June 2007. Previous investigations conducted indicated groundwater contamination due to chlorinated solvents. According to TDEC SRP, the investigations revealed that the groundwater contamination was migrating onto the site from an unknown source. The chemicals identified in groundwater were not used by Taste Maker Foods nor were they used by the property owner for any purpose at the site. Upon entering into a Brownfield agreement with TDEC, Taste Maker Foods will purchase the property from the current site owner.

Site groundwater data indicated the concentrations of chemicals are highest in the northwestern corner of the property. Groundwater flows from the northwest to the southeast across the site. Chemical concentrations decrease to levels near the MCLs at the eastern property boundary. Groundwater is found at 46 feet below the ground surface (Fisher & Arnold 2009).

Fisher & Arnold conducted a Gore passive soil-gas survey at the property from July 9 to July 17, 2009. Eight soil-gas samples and one trip blank were collected and analyzed for PCE, TCE, cis-1,2-dichloroethylene (cis-1,2-DCE), and 1,2-dichloroethane (1,2-DCA) as shown in Figure 2. Previous groundwater sampling at the site did not identify other breakdown products of PCE. Therefore they were not tested for as part of the soil-gas survey.

The soil-gas survey was conducted around buildings present at the site. The majority of the soil-gas locations were around the main site building where most of the approximately 27 site workers spend most of their time.

TDEC SRP contacted the TDH EEP on October 20, 2009. TDEC SRP wanted EEP to evaluate the results of the soil-gas survey. The evaluation of the soil-gas data was done to understand if the chemicals in the groundwater at the site could have the potential to expose workers in the main Taste Maker Foods building and to assess any public health implications from these potential exposures.

Discussion

Introduction to Chemical Exposure

To determine whether persons have been or are likely to be exposed to chemicals, TDH EEP evaluates mechanisms that could lead to human exposure. An exposure pathway contains five parts:

- A source of contamination,
- contaminant transport through an environmental medium,
- a point of exposure,
- a route of human exposure, and
- a receptor population.

An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present at the site. A pathway is considered potential if there is a lower probability of exposure (that is, information on one of the elements is missing). If there is no evidence that at least one of the five elements listed is, has been, or will be present at the site, then it is considered an incomplete exposure pathway.

Physical contact alone with a potentially harmful chemical in the environment by itself does not necessarily mean that a person will develop adverse health effects. A chemical's ability to affect public health is controlled by a number of other factors, including:

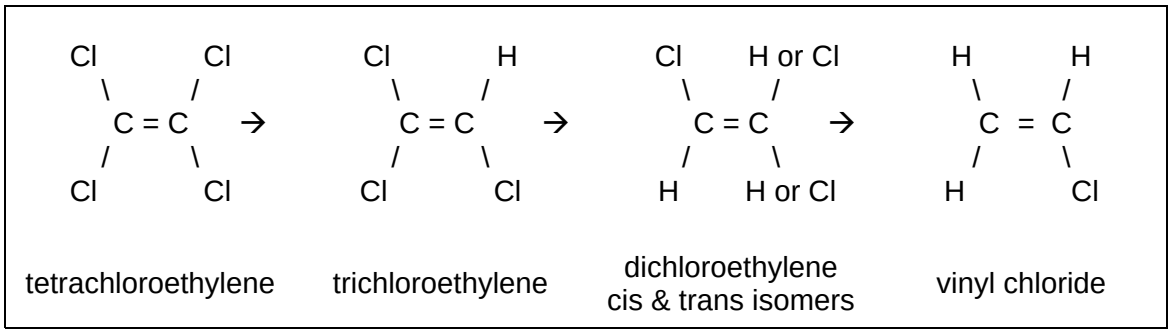
- The amount of the chemical that a person is exposed to (dose),
- the length of time that a person is exposed to the chemical (duration),
- the number of times a person is exposed to the chemical (frequency),
- the person's age and health status, and
- the person's diet and nutritional habits.

The purpose of this health consultation is to identify if there is a pathway for vapors from chemicals in the groundwater beneath the site to migrate into the indoor air of the main building. The potentially exposed population is the workers at Taste Maker Foods who work and breathe the indoor air in the main building. There are no children present at this manufacturing facility.

Solvent Explanation

The most commonly identified solvent in the site groundwater plume was tetrachloroethylene (perc or PCE) (Fisher & Arnold 2009. PCE is a colorless liquid and has sweet smell (ATSDR 1997). PCE is a volatile organic compound. It will quickly evaporate into a gas at room temperature.

As its name implies, tetrachloroethylene has four chlorine anions on a two-carbon molecule. As these chlorine anions react, the molecule breaks down into other chlorinated volatile organics. Each of these breakdown products has slightly different chemical properties and toxicities. The following diagram is an example of how one chemical can breakdown to form another.



For example, PCE can breakdown to trichloroethene (TCE), then to dichloroethylene (DCE), and then to vinyl chloride (VC). Each of these breakdown products can act independently. The only way to truly know the ratio of these breakdown products is to collect environmental samples. PCE, TCE, cis-1,2-DCE, and 1,2-DCA, all chemicals identified in previously collected groundwater samples, were carefully considered in developing this report.

Health Guidance Values

To evaluate exposure to a hazardous substance, health assessors often use health screening values. If the chemical concentrations are below the screening value, then health assessors can be reasonably certain that no adverse health effects will occur in people who are exposed. If concentrations are above the screening values (ATSDR 2009) for a particular chemical, then further evaluation is needed to determine if exposures would be likely to cause harm.

ATSDR environmental media evaluation guidelines (EMEGs) and minimum risk levels (MRLs) are based on conservative assumptions about chemical exposure. EMEGs and MRLs consider non-cancer adverse health effects. Exposure durations are defined as acute (14 days or less), intermediate (15–365 days), and chronic (365 days or more) exposures. For cancer effects,

ATDSR uses EPA information to set their cancer risk evaluation guidelines (CREGs) for lifetime exposure.

There are no health screening values established by ATSDR for soil-gas results. This is because there are many factors that can influence the ability of chemicals in the gaseous phase found in the pore spaces of soil to migrate into the indoor air of a building. Typically a more direct exposure sampling method, such as testing the indoor air of a building, is done. In this case TDEC SRP opted to allow the consultant to sample soil-gas to assess the potential for indoor air migration. The sampling methods have merit and are prudent as they identified site-specific soil-gas characteristics. EEP tried to compare the soil-gas results from this investigation to screening values established by the U.S. Environmental Protection Agency (EPA) in its *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (EPA 2002). This guidance has screening values that were established through modeling and the application of attenuation factors for migration of the chemicals. However, reporting methods of the analysis did not allow a direct comparison.

Environmental Sampling and Chemicals Detected

Fisher & Arnold conducted a Gore passive soil-gas survey at the property from July 9 to July 17, 2009. Eight soil-gas samples and one trip blank were collected and analyzed for PCE, TCE, cis-1,2-dichloroethylene (cis-1,2-DCE), and 1,2-dichloroethane (1,2-DCA), which were the chemicals of concern in groundwater at the site (Figure 2) (Fisher & Arnold 2009). A method blank was also run for the analysis of these samples. Results of the soil-gas sampling are shown in Table 1.

Evaluation

Given that results are reported in micrograms per sorber (mass), only a qualitative assessment of the soil-gas results can be completed. As mentioned above, the results could not be compared to any of the concentrations outlined in Table 2c: Question 4 Generic Screening Levels and Summary Sheet of the *Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (EPA 2002). This is because of the unit's discrepancy due to the data collection method. Additionally, both the PCE and 1,2-DCA concentrations detected in soil-gas were very low. Because the concentrations of PCE and 1,2-DCA in soil-gas at the site are very low and there were limited detections (Table 1), it is unlikely that concentrations of PCE and 1,2-DCA in soil-gas would lead to soil-gas migration (vapor intrusion) into the indoor air of the site buildings.

To be complete, EEP wanted to further evaluate the potential for vapor intrusion to be a pathway of exposure at the site. Because the soil-gas data could not be readily compared to established ATSDR or EPA soil-gas screening values, the TDEC-supplied groundwater data was put into the EPAs simple Johnson & Ettinger (EPA 2009) model. Briefly, the model is a one-dimensional analytical solution, which incorporates both advection and diffusion transport mechanisms to produce a unit-less "attenuation factor". This attenuation factor is a measure of how soil and building properties limit the intrusion of organic vapors into overlying buildings and is defined

TABLE 1. Gore method soil-gas sampling results for the ISS Oxford Building Services Site, Memphis, Shelby County, TN (Fisher & Arnold 2009). Event samples were collected from July 7 to 17, 2009. Values reported in micrograms per sorber (µg). Sample locations are shown in Figure 2. Results below detection limits are indicated by a less than sign (<) and the detection limit for the analysis.

Sample Location	tetrachloroethylene (PCE)	trichloroethene (TCE)	cis-1,2-dichloroethylene (cis-1,2-DCE)	1,2-dichloroethane (1,2-DCA)
606489	0.03	<0.01	<0.01	<0.01
606490	<0.01	<0.01	<0.01	<0.01
606491	0.03	<0.01	<0.01	<0.01
606492	<0.01	<0.01	<0.01	<0.01
606493	<0.01	<0.01	<0.01	<0.01
606494	<0.01	<0.01	<0.01	<0.01
606495	<0.01	<0.01	<0.01	0.06
606496	<0.01	<0.01	<0.01	<0.01
606497	<0.01	<0.01	<0.01	<0.01
Method Blank	<0.01	<0.01	<0.01	<0.01

as the concentration of the compound in indoor air divided by the concentration of the compound in soil-gas or groundwater. Chemical concentrations in groundwater will attenuate more than chemicals in soil-gas because of certain limitations in the transfer of mass across the area immediately above the water table. The larger the attenuation factor produced by the model, the greater the intrusion of vapors into indoor air.

Health comparison values used in the evaluation included EPA's screening values for cancer risk for PCE and TCE. The PCE screening value used was 0.06 parts per billion (ppb) for one excess cancer in one million. For TCE, the screening value used was 0.22 ppb for one excess cancer in one million.

The highest concentration of PCE in groundwater was used in the model to determine if vapor intrusion would be an issue. The concentration of 210 parts per billion (ppb), the highest concentration identified in site wells, was used as a worst-case scenario. Using this PCE concentration, the J&E model indicated a best estimate calculated indoor air concentration of 0.6 ppb. This concentration is equal to the 1 in 100,000 excess cancer risk, using EPA's unit risk and subsequent screening values (EPA 2008). This risk value is considered acceptable (EPA 1991) for a facility in which no one is living and the overall time at the site is limited. The output of the J&E modeling of the PCE groundwater concentration is in the Appendix.

The highest concentration of TCE in groundwater was 16 ppb. Again, this concentration was used as a worst-case scenario. This TCE concentration was put into the J&E model to estimate the indoor air concentration. A best estimate indoor air concentration was calculated to be 0.02 ppb. This is equivalent to the one excess cancer in one billion, using EPA's unit risk and subsequent screening values (EPA 2008), which is certainly acceptable in an industrial facility (EPA 1991). The output of the J&E modeling of the TCE groundwater concentration is also in the Appendix.

The other two chemicals identified in site groundwater, cis-1,2-DCE and 1,2-DCA were also evaluated. The best estimate J&E model calculated indoor air concentrations are below their respective indoor air concentration screening values for one excess cancer in one million. The output of the J&E modeling of the cis-1,2-DCE and 1,2-DCA groundwater concentrations are also in the Appendix.

It is the opinion of EEP that, based on the data obtained from the soil-gas investigation, and through modeling using the J&E model, that there is a low potential for indoor air to contain vapors containing the chemicals found in the subsurface groundwater contaminant plume that lies beneath the site. Therefore, based on the soil-gas and groundwater data collected, it appears that the chemical concentrations are too low to cause vapor intrusion to be a significant pathway for exposure to workers at the site. Because the concentrations of PCE and 1,2-DCA were very low in the soil-gas samples collected and tested, indoor air sampling is not necessary at this time.

Future Considerations

As part of a preventative maintenance plan that could be established at the property, an interior building survey could be conducted to identify any fractures (cracks) or unsealed joints within the concrete floor slab. Any cracks or unsealed joints within the concrete floor slab could be filled with some type of VOC-free material and the fracture or joint sealed. This interior survey could be conducted once per year as part of routine maintenance. Since vapors migrate and subsurface site conditions change over time, this survey and any follow up could mitigate potential exposure from unforeseen future conditions.

If the activities within the building change, such as the use of lift trucks or other vehicles traveling over the floor, additional investigation activities could be suggested. These activities would be to evaluate the effect of changing activities on the potential exposure for any workers within the building.

If in the future the concrete floor slab is compromised or excavation of the floor is undertaken, then additional potential investigation activities may have to be completed to further evaluate the potential of vapor intrusion.

Child Health Considerations

Children are typically a sensitive, exposed population when it comes to evaluating exposure at hazardous waste sites. Since no children live or work in the ISS Building Services site facility, any effects that the chemicals in the indoor air of the facility would have on children were not considered in this Health Consultation.

Conclusions

The Tennessee Department of Health's Environmental Epidemiology Program (EEP) reached three important conclusions in this health consultation:

EEP concludes that concentrations of tetrachloroethylene and 1,2-dichloroethane in soil-gas at the site should not pose a health risk to adults who work at Taste Maker Foods. This is because concentrations of chemicals previously identified in the groundwater beneath the Taste Maker Foods site were detected in soil-gas in very low concentrations and only in certain portions of the site. Many testing locations did not show any detections of these chemicals. The soil-gas analyses had appropriate detection limits.

EEP concludes that the vapors from groundwater concentrations of chemicals at the site should not pose a health risk to adults who breathe the indoor air at the site. Modeling of previously collected groundwater chemical concentrations using the U.S. Environmental Protection Agency's Johnson and Ettinger vapor intrusion model showed calculated indoor air concentrations to be below health screening values.

EEP concludes that it would be prudent to re-evaluate the potential for vapor intrusion if the use of the site or other site conditions change in the future. Chemical plumes are not always stable and changes in how the site is used in the future could have an impact on the potential for exposure from vapor intrusion to site occupants.

Recommendations

There are no recommendations at this time. If the use of the site changes or the site is redeveloped then it would be prudent to re-evaluate site soil-gas and/or groundwater conditions to identify if concentrations of chemicals would pose a risk to those using the site.

Public Health Action Plan

The public health action plan for the ISS Oxford Building Services Site contains a list of actions that have been or will be taken by EEP and other agencies. The purpose of the public health action plan is to ensure that this health consultation identifies public health hazards and offers a plan of action designed to mitigate and prevent harmful health effects that result from breathing, eating, drinking, or touching hazardous substances in the environment. Included is a

commitment on the part of EEP to follow up on this plan to ensure that it is implemented.

Public health actions that have been taken include:

- Initial soil-gas sampling conducted by Fisher & Arnold in July 2009 at the request of TDEC SRP
- TDH EEP November 18, 2009 technical memorandum to DCERP evaluating soil-gas concentrations at the site.
- TDH EEP Health Consultation

Public health actions that may be taken include:

- Any additional sampling at the site will be the responsibility of Fisher & Arnold with direction and oversight by TDEC SRP.
- TDH EEP will provide copies of this health consultation to state, federal, and local government, academia, environmental groups, community groups, owners of businesses, and others interested in the ISS Oxford Building Services Site.
- Maintaining a dialogue with ATSDR, EPA, TDEC SRP, and other interested stakeholders to safeguard public health and to prevent people from future exposure to chemicals at the ISS Oxford Building Services Site.
- Reviewing additional environmental data, as requested.

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References

[ATSDR] Agency for Toxic Substances and Disease Registry. 1997. Toxicological profile for Tetrachloroethylene (Update). U.S. Department of Health and Human Services. September 1997.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1997. Toxicological profile for Tetrachloroethylene (Update). U.S. Department of Health and Human Services. September 1997.

[ATSDR] Agency for Toxic Substances and Disease Registry. 1998. Promoting children's health, progress report of the Child Health Workgroup, Board of Scientific Counselors. Atlanta, GA: US Department of Health and Human Services.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2001. Toxicological profile for 1,2-dichloroethane. Atlanta, GA. US Department of Health and Human Services. accessed October 8, 2008. Available at: www.atsdr.cdc.gov/toxprofiles/tp38.html

[ATSDR] Agency for Toxic Substances and Disease Registry. 2009. Air comparison values. U.S. Department of Health and Human Services. June 16, 2009.

[EPA] U.S. Environmental Protection Agency. 1991. Role of the baseline risk assessment in superfund remedy selection determination. OSWER Directive 9355.0-30. Washington, D.C.

[EPA] OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). 2002. Publication No. EPA530-D-02-004. Office of Solid Waste and Emergency Response. Washington, D.C. November 2002.

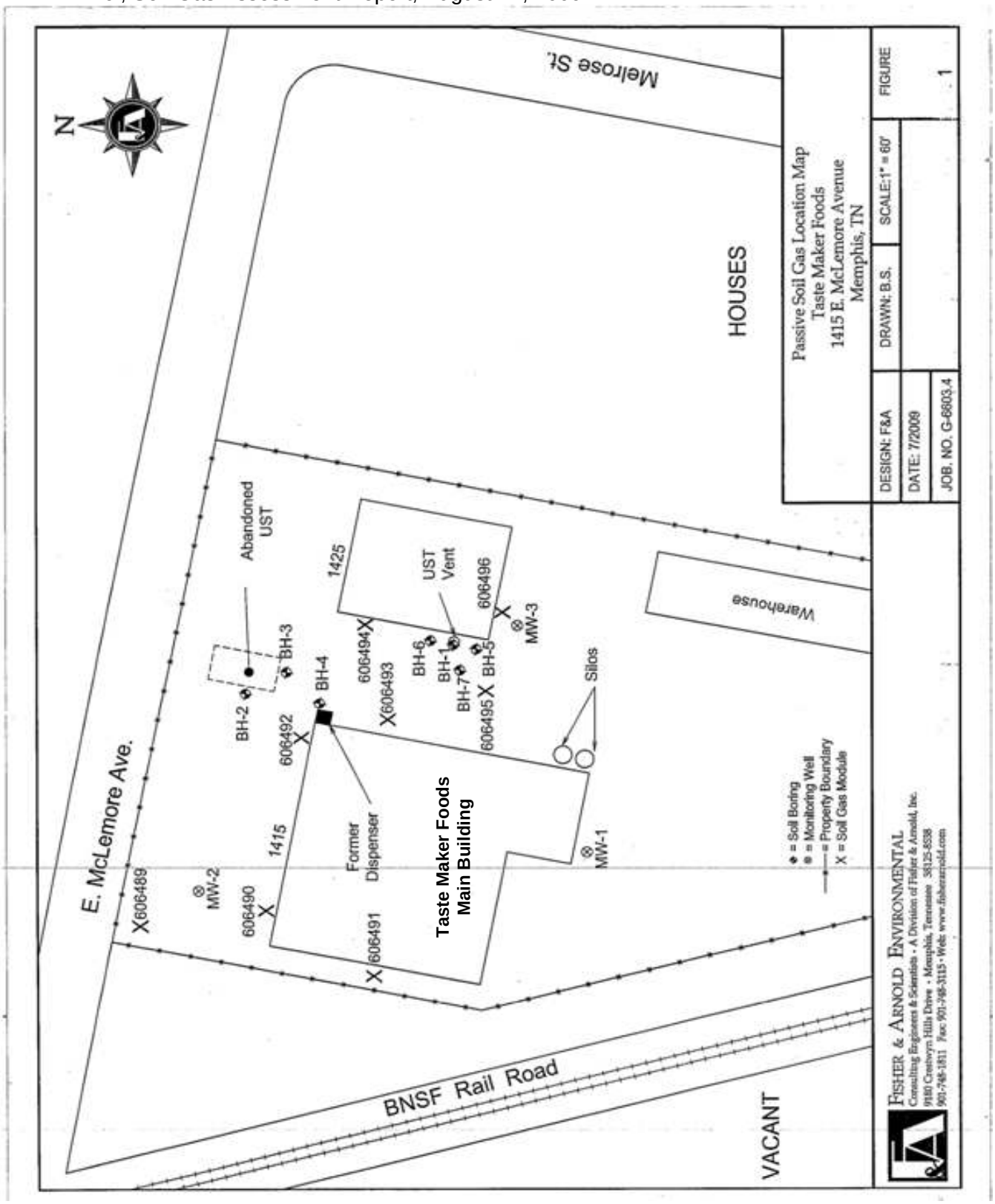
[EPA] U.S. Environmental Protection Agency. 2008. Regional screening levels (RSL) for chemical contaminants at superfund sites. Oak Ridge, TN: Oak Ridge National Laboratory. Last accessed: June 3, 2009. Available from: http://epa.gov/region09/superfund/prg/index.html

[EPA] Online tools for site assessment calculation; screening level implementation of the Johnson & Ettinger vapor intrusion model. August 2009. accessed December 8, 2009. Available at: http://www.epa.gov/Athens/learn2model/part-two/onsite/JnE_lite.html

[F&A] Fisher & Arnold. 2009. Soil-Gas Assessment Using Gore Modules (Passive Soil-Gas Samplers) for the ISS Oxford Building Services Site, 1415/1425 East McLemore Avenue, Memphis, Tennessee. Memphis, TN. August 27, 2009.

FIGURE 1. Location of the ISS Oxford Building Services at 1415/1425 East McLemore Ave in Memphis, Shelby County, TN, occupied by Taste Maker Foods. Figure Credit: Google Earth 2009

FIGURE 2. Site Map of the ISS Oxford Building Services site at 1415/1425 East McLemore Avenue in Memphis, Shelby County, TN, occupied by Taste Maker Foods. Figure Credit: Fisher & Arnold Inc., Soil-Gas Assessment Report, August 27, 2009.



Appendix

Johnson & Ettinger Vapor Intrusion Model Results for Previous Groundwater Sampling Results for the ISS Building Services Site

INDOOR AIR SIMULATION RESULTS

Screening-Level Johnson and Ettinger Model

Site Name: ISS Oxford Building Services Site
Report Date: Tue Dec 8 12:51:26 CST 2009
Report Generated From: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.htm
Type of sample: GROUND WATER Concentration = 210[ppb-water]
Depth to ground water table: 45ft +/- 2ft
Average soil/ground water temperature: 10C

CHEMICAL PROPERTIES
Chemical of Concern: Tetrachloroethylene CAS Number: 127184
Molecular Weight: 165.83 [g/mole] Henrys Constant: 0.3362604 [unitless]
Diffusivity in Air: 7.200e-2 [cm^2/sec] Diffusivity in Water: 8.200e-6 [cm^2/sec]
Unit Risk Factor: 0.000003 [$(\mu g/m^3)^{-1}$] Reference Concentration: 0 [mg/m^3]

SOIL PROPERTIES
Soil Type: Loam Total Porosity: 0.33
Unsaturated Zone Moisture Content:
low= 0.061 best estimate= 0.148 high= 0.24
Capillary Zone Moisture Content: 0.29 Height of Capillary Rise: 0.375 [m]
Soil-Gas Flow Rate into Building: 5 [L/min]

BUILDING PROPERTIES
Building Type: Slab-on-Grade Air Exchange Rate: 0.25[hr^{-1}]
Building Mixing Height: 2.44[m] Building Footprint Area: 100[m^2]
Subsurface Foundation Area: 106[m^2] Building Crack Ratio: 0.00038[unitless]
Foundation Slab Thickness: 0.1[m]

EXPOSURE PARAMETERS
Exposure Duration: carcinogens 25 [years] non-carcinogens: 25 [years]
Exposure Frequency: carcinogens 250 [days/year] non-carcinogens: 250 [days/year]
Averaging Time: carcinogens 25 [years] non-carcinogens: 25 [years]

JOHNSON & ETTINGER SIMULATION RESULTS
Effective Diffusion Coefficient (D^T_{eff}): 0.0005193[cm^2/s]
Ground Water to Indoor Air Attenuation Factor (α_{GW}) = 0.00002357

[1]Low Indoor Air Prediction: 0.5248 [$\mu g/m^3$] or 0.07743 [ppbv]
Cancer Risk of this concentration: 1.078e-6 Hazard Risk of this concentration: 0.

Best Estimate Indoor Air Prediction: 1.665[$\mu g/m^3$] or 0.2456 [ppbv]
Cancer Risk of this concentration: 3.420e-6 Hazard Risk of this concentration: 0.

[2]High Indoor Air Prediction: 1.990[$\mu g/m^3$] or 0.2937 [ppbv]
Cancer Risk of this concentration: 4.090e-6 Hazard Risk of this concentration: 0.

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

[1]"Low Prediction" concentrations produced with HIGHEST moisture content and DEEPEST depth to contamination.
[2]"High Prediction" concentrations produced with LOWEST moisture content and SHALLOWEST depth to contamination.

Averaging Time for carcinogens has been changed from default value of 70 years.
Exposure Frequency for carcinogens has been changed from default value of 350 days/year.
Exposure Duration for carcinogens has been changed from default value of 30 years.
Exposure Frequency for non-carcinogens has been changed from default value of 365 days/year.

INDOOR AIR SIMULATION RESULTS

Screening-Level Johnson and Ettinger Model

Site Name: ISS Oxford Building Services Site
Report Date: Tue Dec 8 13:42:44 CST 2009
Report Generated From: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.htm
Type of sample: GROUND WATER Concentration = 16[ppb-water]
Depth to ground water table: 45ft +/- 2ft
Average soil/ground water temperature: 10C

CHEMICAL PROPERTIES
Chemical of Concern: Trichloroethylene CAS Number: 79016
Molecular Weight: 131.39 [g/mole] Henrys Constant: 0.2057688 [unitless]
Diffusivity in Air: 7.900e-2 [cm^2/sec] Diffusivity in Water: 9.100e-6 [cm^2/sec]
Unit Risk Factor: 0.00011 [$(\mu g/m^3)^{-1}$] Reference Concentration: 0.04 [mg/m^3]

SOIL PROPERTIES
Soil Type: Loam Total Porosity: 0.33
Unsaturated Zone Moisture Content:
low= 0.061 best estimate= 0.148 high= 0.24
Capillary Zone Moisture Content: 0.29 Height of Capillary Rise: 0.375 [m]
Soil-Gas Flow Rate into Building: 5 [L/min]

BUILDING PROPERTIES
Building Type: Slab-on-Grade Air Exchange Rate: 0.25[hr^{-1}]
Building Mixing Height: 2.44[m] Building Footprint Area: 100[m^2]
Subsurface Foundation Area: 106[m^2] Building Crack Ratio: 0.00038[unitless]
Foundation Slab Thickness: 0.1[m]

EXPOSURE PARAMETERS
Exposure Duration: carcinogens 25 [years] non-carcinogens: 25 [years]
Exposure Frequency: carcinogens 250 [days/year] non-carcinogens: 250 [days/year]
Averaging Time: carcinogens 25 [years] non-carcinogens: 25 [years]

JOHNSON & ETTINGER SIMULATION RESULTS
Effective Diffusion Coefficient (D^T_{eff}): 0.0006257[cm^2/s]
Ground Water to Indoor Air Attenuation Factor (α_{GW}) = 0.00002837

[1]Low Indoor Air Prediction: 0.02774 [$\mu g/m^3$] or 0.005165 [ppbv]
Cancer Risk of this concentration: 2.090e-6 Hazard Risk of this concentration: 4.750e-4

Best Estimate Indoor Air Prediction: 0.09342[$\mu g/m^3$] or 0.01739 [ppbv]
Cancer Risk of this concentration: 7.038e-6 Hazard Risk of this concentration: 0.001600

[2]High Indoor Air Prediction: 0.1139[$\mu g/m^3$] or 0.02120 [ppbv]
Cancer Risk of this concentration: 8.579e-6 Hazard Risk of this concentration:

0.001950

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

[1]"Low Prediction" concentrations produced with HIGHEST moisture content and DEEPEST depth to contamination.
[2]"High Prediction" concentrations produced with LOWEST moisture content and SHALLOWEST depth to contamination.

Averaging Time for carcinogens has been changed from default value of 70 years.
Exposure Frequency for carcinogens has been changed from default value of 350 days/year.
Exposure Duration for carcinogens has been changed from default value of 30 years.
Exposure Frequency for non-carcinogens has been changed from default value of 365 days/year.

INDOOR AIR SIMULATION RESULTS

Screening-Level Johnson and Ettinger Model

Site Name: ISS Oxford Building Services Site
Report Date: Tue Dec 8 13:55:09 CST 2009
Report Generated From: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.htm
Type of sample: GROUND WATER Concentration = 16[ppb-water]
Depth to ground water table: 45ft +/- 2ft
Average soil/ground water temperature: 10C

CHEMICAL PROPERTIES
Chemical of Concern: cis-1,2-Dichloroethylene CAS Number: 156592
Molecular Weight: 96.94 [g/mole] Henrys Constant: 0.08772779 [unitless]
Diffusivity in Air: 7.360e-2 [cm^2/sec] Diffusivity in Water: 1.130e-5 [cm^2/sec]
Unit Risk Factor: 0 [$(\mu g/m^3)^{-1}$] Reference Concentration: 0.035 [mg/m^3]

SOIL PROPERTIES
Soil Type: Loam Total Porosity: 0.33
Unsaturated Zone Moisture Content:
low= 0.061 best estimate= 0.148 high= 0.24
Capillary Zone Moisture Content: 0.29 Height of Capillary Rise: 0.375 [m]
Soil-Gas Flow Rate into Building: 5 [L/min]

BUILDING PROPERTIES
Building Type: Slab-on-Grade Air Exchange Rate: 0.25[hr^{-1}]
Building Mixing Height: 2.44[m] Building Footprint Area: 100[m^2]
Subsurface Foundation Area: 106[m^2] Building Crack Ratio: 0.00038[unitless]
Foundation Slab Thickness: 0.1[m]

EXPOSURE PARAMETERS
Exposure Duration: carcinogens 25 [years] non-carcinogens: 25 [years]
Exposure Frequency: carcinogens 250 [days/year] non-carcinogens: 250 [days/year]
Averaging Time: carcinogens 25 [years] non-carcinogens: 25 [years]

JOHNSON & ETTINGER SIMULATION RESULTS
Effective Diffusion Coefficient (D^T_{eff}): 0.0008199[cm^2/s]
Ground Water to Indoor Air Attenuation Factor (α_{GW}) = 0.00003711

[1]Low Indoor Air Prediction: 0.01236 [$\mu g/m^3$] or 0.003119 [ppbv]
Cancer Risk of this concentration: 0. Hazard Risk of this concentration: 2.419e-4

Best Estimate Indoor Air Prediction: 0.05209[$\mu g/m^3$] or 0.01315 [ppbv]
Cancer Risk of this concentration: 0. Hazard Risk of this concentration: 0.001019

[2]High Indoor Air Prediction: 0.06964[$\mu g/m^3$] or 0.01758 [ppbv]
Cancer Risk of this concentration: 0. Hazard Risk of this concentration: 0.001363

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

[1]"Low Prediction" concentrations produced with HIGHEST moisture content and DEEPEST depth to contamination.
[2]"High Prediction" concentrations produced with LOWEST moisture content and SHALLOWEST depth to contamination.

Averaging Time for carcinogens has been changed from default value of 70 years.
Exposure Frequency for carcinogens has been changed from default value of 350 days/year.
Exposure Duration for carcinogens has been changed from default value of 30 years.
Exposure Frequency for non-carcinogens has been changed from default value of 365 days/year.

INDOOR AIR SIMULATION RESULTS

Screening-Level Johnson and Ettinger Model

Site Name: ISS Oxford Building Services Site
Report Date: Tue Dec 8 13:53:08 CST 2009
Report Generated From: http://www.epa.gov/athens/learn2model/part-two/onsite/JnE_lite_forward.htm
Type of sample: GROUND WATER Concentration = 4[ppb-water]
Depth to ground water table: 45ft +/- 2ft
Average soil/ground water temperature: 10C

CHEMICAL PROPERTIES
Chemical of Concern: 1,2-Dichloroethane CAS Number: 107062
Molecular Weight: 98.96 [g/mole] Henrys Constant: 0.0196182 [unitless]
Diffusivity in Air: 0.1040 [cm^2/sec] Diffusivity in Water: 9.900e-6 [cm^2/sec]
Unit Risk Factor: 0.000026 [$(\mu g/m^3)^{-1}$] Reference Concentration: 0 [mg/m^3]

SOIL PROPERTIES
Soil Type: Loam Total Porosity: 0.33
Unsaturated Zone Moisture Content:
low= 0.061 best estimate= 0.148 high= 0.24
Capillary Zone Moisture Content: 0.29 Height of Capillary Rise: 0.375 [m]
Soil-Gas Flow Rate into Building: 5 [L/min]

BUILDING PROPERTIES
Building Type: Slab-on-Grade Air Exchange Rate: 0.25[hr^{-1}]
Building Mixing Height: 2.44[m] Building Footprint Area: 100[m^2]
Subsurface Foundation Area: 106[m^2] Building Crack Ratio: 0.00038[unitless]
Foundation Slab Thickness: 0.1[m]

EXPOSURE PARAMETERS
Exposure Duration: carcinogens 25 [years] non-carcinogens: 25 [years]
Exposure Frequency: carcinogens 250 [days/year] non-carcinogens: 250 [days/year]
Averaging Time: carcinogens 25 [years] non-carcinogens: 25 [years]

JOHNSON & ETTINGER SIMULATION RESULTS
Effective Diffusion Coefficient (D^T_{eff}): 0.001725[cm^2/s]
Ground Water to Indoor Air Attenuation Factor (α_{GW}) = 0.00007743

[1]Low Indoor Air Prediction: 0.001132 [$\mu g/m^3$] or 2.798e-4 [ppbv]
Cancer Risk of this concentration: 2.015e-8 Hazard Risk of this concentration: 0.

Best Estimate Indoor Air Prediction: 0.006076[$\mu g/m^3$] or 0.001502 [ppbv]
Cancer Risk of this concentration: 1.082e-7 Hazard Risk of this concentration: 0.

[2]High Indoor Air Prediction: 0.009664[$\mu g/m^3$] or 0.002389 [ppbv]
Cancer Risk of this concentration: 1.721e-7 Hazard Risk of this concentration: 0.

Based on parameter analysis: Advection is the dominant mechanism across foundation. Diffusion through soil is the overall rate-limiting process for the subsurface to indoor-air pathway.

[1]"Low Prediction" concentrations produced with HIGHEST moisture content and DEEPEST depth to contamination.
[2]"High Prediction" concentrations produced with LOWEST moisture content and SHALLOWEST depth to contamination.

Averaging Time for carcinogens has been changed from default value of 70 years.
Exposure Frequency for carcinogens has been changed from default value of 350 days/year.
Exposure Duration for carcinogens has been changed from default value of 30 years.
Exposure Frequency for non-carcinogens has been changed from default value of 365 days/year.

Certification

This Public Health Consultation: *ISS Oxford Building Services Site, Memphis, Shelby County, Tennessee*, was prepared by the Tennessee Department of Health's Environmental Epidemiology Program under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun.

Technical Project Officer, CAT, SPAB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with the findings.

Team Leader, CAT, SPAB, DHAC, ATSDR