Health Consultation

LAUGH AND LEARN DAYCARE

ASHVILLE, PICKAWAY COUNTY, OHIO

JUNE 18, 2007

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.

You May Contact ATSDR TOLL FREE at
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

LAUGH AND LEARN DAYCARE

ASHVILLE, PICKAWAY COUNTY, OHIO

Prepared By:

Ohio Department of Health
Health Assessment Section
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

BACKGROUND AND STATEMENT OF ISSUES

Site History

The Laugh and Learn Daycare center in Ashville, Ohio is located on a site previously occupied by an old gas station, the former Ashville Oil Company. The site had operated as a service station from 1928 until 1991, and at one time had contained five underground storage tank (UST) systems, regulated by the State Fire Marshal, Bureau of Underground Storage Tank Regulations (BUSTR). In addition, there were four above ground storage tanks (AST) systems (not regulated by BUSTR) that were added after the service station burned down and was rebuilt in 1956.

The five USTs along with the four fuel oil ASTs were removed from the site in 1993. About 500 cubic yards of petroleum-contaminated soil were excavated during tank removal but remained on the site until approximately 1998. Proper site remediation was not completed, and data produced at the time indicated that contamination remained at the site.

Since 1999, the site had several owners. The property was remodeled and occupied in 2000 as an electrical contractor's office. The property was resold in 2003 and converted to a day care facility. The Ohio Environmental Protection Agency (Ohio EPA) relayed concerns about potential contamination at the daycare site to the Pickaway County General Health District and the Ohio Department of Health (ODH) in 2005. BUSTR also sought the assistance of the Ohio EPA in performing additional sampling at the site to determine whether BUSTR's regulatory requirements had been met. ODH convened a multi-agency meeting with Ohio EPA, BUSTR, Pickaway County General Health District and the Ohio Department of Job and Family Services (ODJFS) to discuss these concerns in October, 2005. The main potential health threat identified by the agencies was for vapor-phase gasoline components to migrate up through soils under the daycare and find their way into indoor air in the daycare building where children and teachers could breathe them in. This process, called "vapor intrusion," can occur when leaked or spilled gasoline migrates through the soil as a vapor and enters the indoor air in a building through cracks in the foundation or basement.

Fifteen soil samples and four ground water samples were collected by the Ohio EPA and BUSTR in March, 2006. The results indicated soil contamination around the building, and one monitoring well, MW-02, located about 10 feet from the building, contained residual gasoline floating on top of the ground water. OEPA vapor intrusion modeling indicated a possible risk to building occupants if vapor intrusion was indeed occurring.

Sub-slab and indoor air samples were collected by the Ohio EPA to determine if there was a completed exposure pathway. Two sub-slab gas, two indoor air and two ambient air samples were taken on May 27 and 28, 2006. Steps were taken to ensure the worst possible indoor air conditions: the building sat unopened for about 20 hours, all windows

and doors were closed, and the heating and cooling systems were turned off. Products, such as cleaning chemicals, which may contain volatile organic compounds (VOCs), were removed prior to sampling.

Sub-slab gas samples were taken using two gas probes inserted into the concrete floor at either end of the building over a 24-hour period. Two indoor air samples were taken in the same locations. Two outdoor air samples were collected for comparison to the indoor air concentrations.

DISCUSSION

Environmental Data

The data provided by Ohio EPA for the sub-slab are listed in Table 1. The table compares the results for samples collected on May 27 and 28, 2006, with the results taken on January 19, 2007, before and after the installation of a sub-slab vapor mitigation system, respectively. The May, 2006 sub-slab sample results showed significant levels of several VOCs, which were identified and quantified. However, the concentrations for some of the compounds exceeded analytical instrument capabilities. These samples were diluted and re-analyzed by the laboratory. Other tentatively identified compounds (TICs), primarily petroleum constituents, were also detected; however, these TIC concentrations could only be estimated and are not listed in the table. In general, the results indicated a considerable amount of contamination under the building.

Several chemicals were also detected in both indoor air samples. The indoor air results are listed in Table 2, and the ambient air sample results are listed in Table 3. The May, 2006 sample results showed that all compounds detected in the indoor air were below levels of concern with the exception of benzene and naphthalene measured within the toddler room. The level of benzene found in the toddler room did not pose an immediate health risk; however, it was near a level at which the Ohio EPA suggests action to protect the health of the occupants. The level of naphthalene in the toddler room was above the level at which action would be suggested; however, naphthalene was not detected in the sub-slab sample taken in the same area. This indicated that the naphthalene in the indoor air may have been the result of a household product used in the toddler room.

Exposure Pathway

For the public to be exposed to elevated levels of contaminants from the former Ashville Oil site, they must first come into physical contact with contaminated soil, sediment, groundwater, or air. The likely route of exposure for the Laugh and Learn Daycare center occupants is from breathing site-related chemicals in indoor and/or ambient air. The indoor air may have been contaminated from the vapors coming from the contaminated subsoil and groundwater. A **completed exposure pathway** consists of five main parts:

1. **A source of contamination**;
2. **Environmental transport**, which is a way for the chemical to move away from its source (soil, air, groundwater, surface water);
3. **A point of exposure**, which is a place where people come into physical contact with the chemical (on-site, off-site);
4. **A route of exposure**, which is how people come into physical contact with the chemical (breathing, drinking, eating, touching); and
5. **People who could be exposed**, which are people likely to come into physical contact with site-related chemicals.

Physical contact with a chemical contaminant, in and by itself, does not necessarily result in adverse health effects. A chemical's ability to affect a resident's health is also controlled by a number of factors including:

- How much of the chemical a person is exposed to (the dose).
- How long a person is exposed to the chemical (the duration).
- How often a person is exposed to the chemical (the frequency).
- The toxicity of the chemical of concern (how a chemical affects the body).

Other factors affecting a chemical's likelihood of causing adverse health effects upon contact include the resident's:

1. Past exposure
2. Smoking, drinking alcohol, or taking certain medications
3. Current health status, sensitivity to certain substances
4. Age
5. Family medical history

Vapor Intrusion

The primary public health concern presented by the former gas station in Ashville, Ohio was the possibility that volatile chemicals associated with the underlying soil and groundwater contamination were vaporizing up through the building's concrete subslab. In these confined indoor air environments, residents could be exposed to these chemicals through inhalation of these gases in the air within the daycare center. This potential exposure pathway is termed the *Vapor Intrusion Pathway* (see Appendix A, *Vapor Intrusion; Answers to Frequently Asked Health Questions,* Fact Sheet).

Gasoline is a mixture of refined hydrocarbon compounds, 150 simple to complex organic chemical compounds associated with crude oil. The "lighter" compounds in gasoline include a number of VOCs; chemicals that are normally liquids that can readily vaporize into a gas when exposed to air. These include chemicals like benzene, toluene, ethylbenzene, xylenes (so-called BTEX compounds) plus heptane, hexane, naphthalene, and trimethylbenzenes. Upon being released as a gas to soils, these chemicals can migrate through the enclosing soils from areas of high pressure at depth below the ground surface to areas of low pressure on top of the ground surface. Vapor-phase hydrocarbons

will tend to follow the path of the least resistance, seeking out soils that are porous and permeable, allowing for the easy movement of the gases up through the soils to the surface. Upon reaching the surface, these gases discharge to the atmosphere, mixing with the air which effectively dilutes the concentrations of these chemicals and leading to their breakdown from complex to simpler compounds due to exposure to oxygen and sunlight.

However, if these gases migrate into homes and businesses, they undergo less mixing and dilution. Concentrations may remain high enough indoors to pose a health threat to residents and workers if these trapped gases are inhaled in by these individuals. This is particularly true in the winter months when homes are typically closed up tight, trapping the air inside and allowing for little or no free exchange with the outside air.

Health Evaluation

If indoor air concentrations are high enough and/or if people are exposed to these chemicals for a long enough period of time, these vapor-phase hydrocarbons can pose a health threat to residents. Benzene is a known human cancer-causing chemical through the inhalation route in occupational settings where workers were exposed to the chemical at high concentrations (parts per million range) in the indoor air for a number of years (ATSDR, 1997). These exposures have been associated with the development of excess incidence of leukemia and other blood disorders in these workers (ATSDR, 2000). The other compounds pose primarily non-cancer health threats, usually targeting the central nervous system. Exposure to high concentrations in the air (several 10's of parts per million range) can result in dizziness, fatigue, sleepiness, headaches, and nausea (ATSDR, 1993). Prolonged exposures to these same high levels can lead to liver and kidney damage and anemia as well.

Indoor vapor levels associated with the gasoline contamination beneath the daycare center were not high enough to result in acute adverse health effects. Levels of benzene in the indoor air were below ATSDR's Minimal Risk Levels (MRLs) for acute, intermediate and chronic-duration inhalation exposures to benzene. MRLs are based on non-carcinogenic effects and are screening values only. The 2002 US EPA vapor intrusion screening value for benzene in indoor air is 0.98 parts per billion (ppb), and is a guideline based on a 1×10^{-5} cancer risk. The United States Environmental Protection Agency (US EPA) estimates that exposure to 0.4 ppb benzene in air over a lifetime could cause a risk of one additional cancer case for every 100,000 exposed persons. It should be noted that benzene can be found in outdoor air and can range from 0.02 to 34 ppb; and in this case, ambient air samples collected around the daycare center measured from 0.19 to 0.28 ppb. The level of benzene found in the toddler room did not pose an immediate health risk; however, it was near the 0.4 ppb level at which the Ohio EPA suggested action to protect the health of the occupants.

Using the US EPA vapor intrusion screening table (US EPA, 2002), the guideline for naphthalene is 0.57 ppb for indoor air, based on a non cancer risk. Naphthalene was initially measured in the in the indoor air above this value, but it was not found in the

sub-slab sample, indicating that it may have been the result of a consumer product used in the toddler room.

Child Health Issues

Because children were the primary population that could be potentially exposed at this site, a public health concern was raised and recommendations were provided for the highest level of protection for children. Children can be at a greater risk of developing illness due to exposure to hazardous chemicals because of their smaller stature and developing body systems. Children are likely to breathe more air and consume more food and water per body weight than are adults. Children are also likely to have more opportunity to come into contact with environmental pollutants due to being closer to the ground surface and taking part in activities on the ground such as, crawling, sitting, and lying down on the ground. In the case of benzene exposure, it is not known if children are more susceptible to benzene poisoning than adults. ODH, in coordination with local health officials, Ohio EPA, and ODJFS, which licenses daycares in Ohio, attempted to make sure that the most vulnerable population was not at risk from exposure to hazardous chemicals associated with this former gas station site.

Ohio EPA Public Meeting

Ohio EPA held a public meeting at the Teays Valley High School in Ashville the evening of June 7, 2006 to present results of their investigation to property owners, parents of children at the daycare and the community. Only 10 residents attended. After discussion between the daycare operator and representatives from OEPA, ODH and ODJFS, the owners and operators agreed to install a sub-slab vapor mitigation system at the facility as soon as possible. The sub-slab mitigation system was installed at the daycare on June 29, 2006.

Table 1
Ohio EPA Sub-Slab Sampling Results
Laugh and Learn Daycare
Ashville, Ohio

Sub-Slab Sample Location Date	Infant Room 5/27-28/2006	Infant Room 1/19/2007	Preschool Room 5/27-28/2006	Preschool Room 1/19/2007	Sub-slab Comparison Value
Compound	Result, ppb	Result, ppb	Result, ppb	Result, ppb	Value, ppb
Acetone		2.2		3.5	1500
Acetonitrile					360
Acrylonitrile					1.7
Benzene	6200	0.19	290	0.43	9.8
n-Butane	6200	0.97	1500	1	
2-Butanone					3400
Carbon tetrachloride					2.6
Cumene	10+		3.3		810
Chlorodifluoromethane		0.26		0.23	140000
Chloromethane		0.45		0.41	120
Cyclohexane	7100		580		
Dichlorodifluoromethane		0.47		0.49	400
Ethylbenzene	6.2		6.5	0.41	51
4-Ethyltoluene			0.75	0.12	
n-Heptane	6100	0.11	420		
Hexane	11000		2900	0.34	570
Naphthalene	0.1				5.7
n-Nonane	2.7		7.7	0.67	
n-Octane	2000		43	0.43	
n-Pentane	9300	0.24	4000	0.51	
Propylene	220	0.6	400+	0.57	
n-Propylbenzene	400+		2.7		280
Toluene		0.24			1100
Trichlorofluoromethane		0.17		0.18	1200
1, 2, 4-Trimethylbenzene	1.5		1.5	0.61	12
1, 3, 5-Trimethylbenzene	4.2		0.74	0.24	12
1, 1, 2-Trichloroethane	10				2.8
n-Undecane		0.23		0.84	
Vinyl acetate					
Vinyl chloride			0.12		11
Total m&p xylenes	7.3			0.8	

ppb = parts per billion
+ = likely higher than the amount listed
Note: The values presented for comparison are from the US EPA OSWER Draft Guidance document for Vapor Intrusion (2002), using a calculated risk of 1×10^{-5}.

Table 2
Ohio EPA Indoor Air Sampling Results
Laugh and Learn Daycare
Ashville, Ohio

Air Sample Location Date	Toddler Room 5/27-28/2006	Toddler Room 1/19/2007	Preschool Room 5/27-28/2006	Preschool Room 1/19/2007 (90766)	Preschool Room 1/19/2007 (90761)	Indoor Air Comparison Value
Compound	Result, ppb	Result, ppb	Result, ppb	Result, ppb	Result, ppb	Value, ppb
Acetone	9.3	3.1	10	2.6	2.7	150
Acetonitrile						36
Acrylonitrile						0.17
Benzene	0.38	0.23	0.27	0.18	0.21	0.4
n-Butane	1.3	1.2	0.96		1.2	
2-Butanone	1.6		2	1.1		340
Carbon tetrachloride						0.26
Cumene						81
Chlorodifluoromethane	0.15					14000
Chloromethane		0.46		0.55	0.44	12
Cyclohexane						
Dichlorodifluoromethane		0.47		0.46	0.46	40
Ethylbenzene						5.1
4-Ethyltoluene	0.13		0.12			
n-Heptane		0.12		0.11	0.12	
Hexane	0.92		0.91			57
Naphthalene	9.3		0.5			0.57
n-Nonane						
n-Octane						
n-Pentane	1.1	0.28	0.94	0.26	0.28	
Propylene	0.51	0.66	0.23	0.61	0.69	
n-Propylbenzene						28
Toluene	0.85	0.31	0.76	0.22	0.27	110
Trichlorofluoromethane		0.17		0.17	0.18	120
1, 2, 4-Trimethylbenzene	0.38		0.37			1.2
1, 3, 5-Trimethylbenzene						1.2
1, 1, 2-Trichloroethane						0.28
n-Undecane		0.26		0.2	0.26	
Vinyl acetate						
Vinyl chloride						1.1
Total m&p xylenes						

ppb = parts per billion
Note: The values presented for comparison are from the US EPA OSWER Draft Guidance document for Vapor Intrusion (2002), using a risk of 1×10^{-5}; with the exception of benzene, where EPA's Integrated Risk Information System (IRIS) air concentration at a 1 in 100,000 carcinogenic risk level was applied.

Table 3
Ohio EPA Outdoor Air Sampling Results
Laugh and Learn Daycare
Ashville, Ohio

Air Sample Location Date	Ambient Air Play Yard 5/27-28/2006	Ambient Air Play Yard 1/19/2007	Ambient Air AC 5/27-28/2006	Ambient Air AC 1/19/2007	Air Comparison Value
Compound	Result, ppb	Result, ppb	Result, ppb	Result, ppb	Value, ppb
Acetone	6.3	3.2	5.2	4.4	150
Acetonitrile	1.7		0.52		36
Acrylonitrile	1.1				0.17
Benzene	0.19	0.28		0.19	0.4
n-Butane	0.45	1.6	0.59	1	
2-Butanone	0.96	0.6	0.72	1.1	340
Carbon tetrachloride	0.1				0.26
Cumene					81
Chlorodifluoromethane		0.52			14000
Chloromethane		0.52		0.47	12
Cyclohexane					
Dichlorodifluoromethane		0.47		0.46	40
Ethylbenzene					5.1
4-Ethyltoluene					
n-Heptane		0.11			
Hexane		0.31			57
Naphthalene	1.2		0.37		0.57
n-Nonane					
n-Octane					
n-Pentane		0.45		0.2	
Propylene	0.57	0.77	1.2	0.75	
n-Propylbenzene					28
Toluene	0.53	0.44	0.27	0.19	110
Trichlorofluoromethane		0.19		0.17	120
1, 2, 4-Trimethylbenzene					1.2
1, 3, 5-Trimethylbenzene					1.2
1, 1, 2-Trichloroethane					0.28
n-Undecane					
Vinyl acetate	0.41				
Vinyl chloride					1.1
Total m&p xylenes					

ppb = parts per billion
Note: The values presented for comparison are from the US EPA OSWER Draft Guidance document for Vapor Intrusion (2002) for target indoor air concentrations and may not be applicable to ambient (outdoor) air. For benzene, EPA's Integrated Risk Information System (IRIS) air concentration at a 1 in 100,000 carcinogenic risk level was applied.

CONCLUSIONS

Because of significant petroleum contamination beneath the building housing the Laugh and Learn Daycare Center, the Health Assessment Section (HAS) considered the intrusion of chemical vapors to have been a potential public health hazard. Sampling of the indoor air showed minimal chronic health risk at the time the samples were taken. However, changes in building conditions, such as the development of cracks in the slab over time, could affect its ability to keep chemical vapors from entering the indoor environment.

The HAS agreed with the Ohio EPA in recommending that the daycare install and continue to operate a vapor extraction system to minimize the potential of harmful vapors from entering the building. The sub-slab ventilation system installed at the site was effective in reducing the petroleum vapors from under the building. This is indicated by 2007 sampling results showing a dramatic reduction of petroleum vapors. The chemical concentrations in the indoor air improved as well. Chemical concentrations of contaminants both inside and beneath the building are now below the 2002 U.S. EPA vapor intrusion screening values.

This site currently poses *No Public Health Hazard* as sampling results indicate that the indoor air at the daycare is safe for children and workers and that the petroleum contamination beneath the building has been successfully addressed.

RECOMMENDATIONS

The HAS recommends the following actions be taken:

1) Annual checks of the vapor extraction system and periodic (every 3-5 years) indoor air and sub-slab sampling should also be considered by the daycare to verify that conditions have not changed.

2) HAS will review and evaluate any additional data with regard to chemical contamination issues that may affect the daycare in the future.

PREPARERS OF THE REPORT

Health Assessment Section
John Kollman, Environmental Specialist
Robert C. Frey, Chief

REFERENCES

AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR). 1993. Case Studies in Environmental Medicine: Gasoline Toxicity. US Department of Health and Human Services, US Public Health Service 20 p.

ATSDR. 1997. Toxicological Profile for Benzene (Update). US Department of Health and Human Services, Public Health Service. 423 p. + Appendices.

ATSDR. 2000. Case Studies in Environmental Medicine: Benzene Toxicity. US Department of Health and Human Services, Public Health Service. 28 p.

ATSDR. 2005. Draft Toxicological Profile for Benzene. US Department of Health and Human Services, Public Health Service. 415 p. + Appendices, September, 2005.

ATSDR. 2005. ToxGuide for Benzene. September 2005.

OHIO Environmental Protection Agency (EPA). 2006. Site Assessment Work Plan, Ashville Oil Company, Division of Emergency & Remedial Response (DERR). February, 2006.

OHIO EPA. 2006. Letter from Craig Butler to Pete Chase of the Bureau of Underground Storage Tank Regulations (BUSTR) and Rick Smith of the Ohio Department of Job and Family Services (ODJFS). May, 2006.

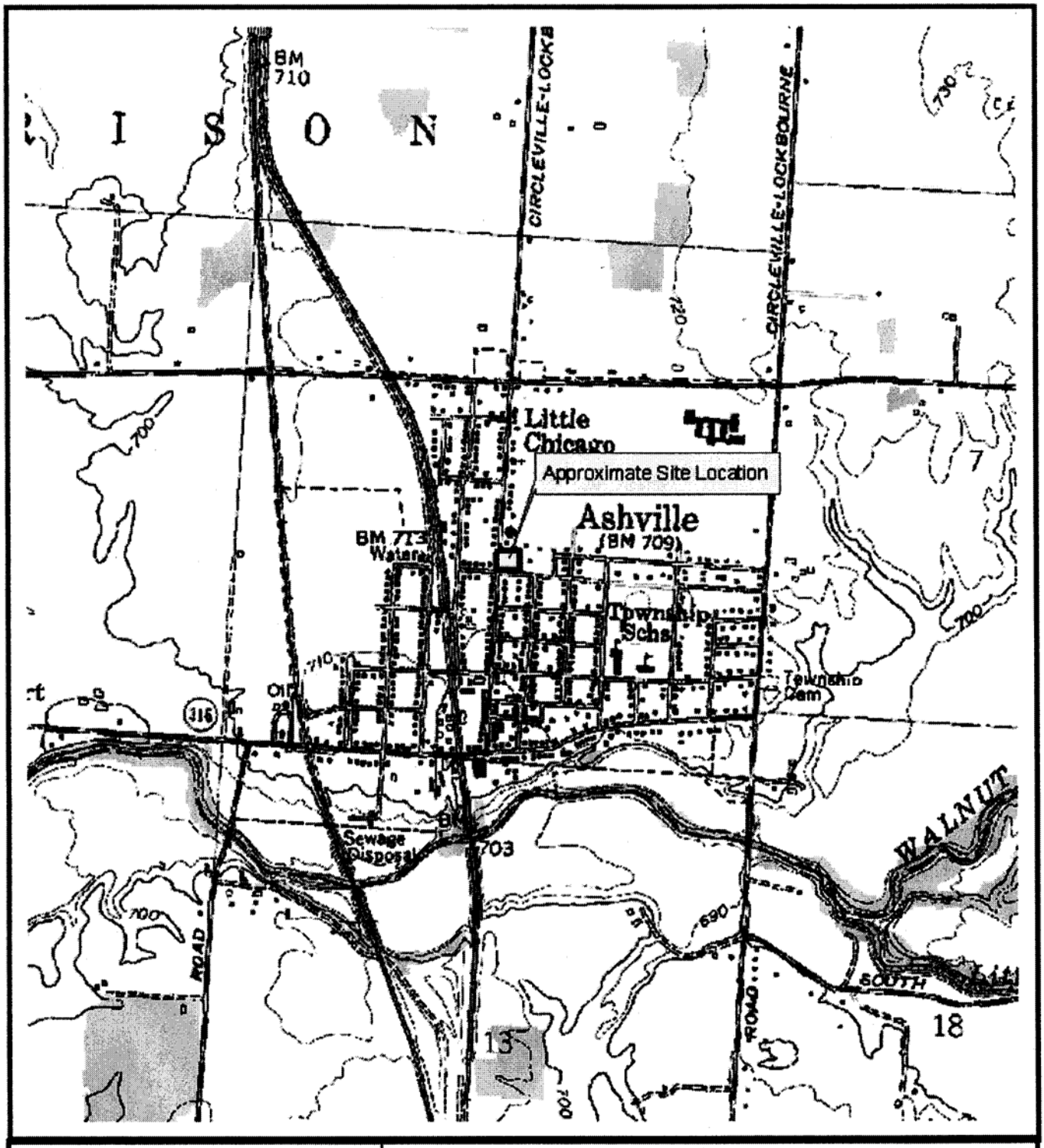
OHIO EPA 2006. Laboratory Organic Analysis Data Reports from Diane McClure of the OHIO EPA. June, 2006.

OHIO EPA. 2006. Letter from Craig Butler to Pete Chase of BUSTR and Rick Smith of ODJFS. June, 2006.

OHIO EPA. 2006. Letter from Craig Butler to Peggy Blevins of ODJFS. February, 2007.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (US EPA). 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance) Tables, US EPA, November, 2002, EPA 530-D-02-004.

FIGURES

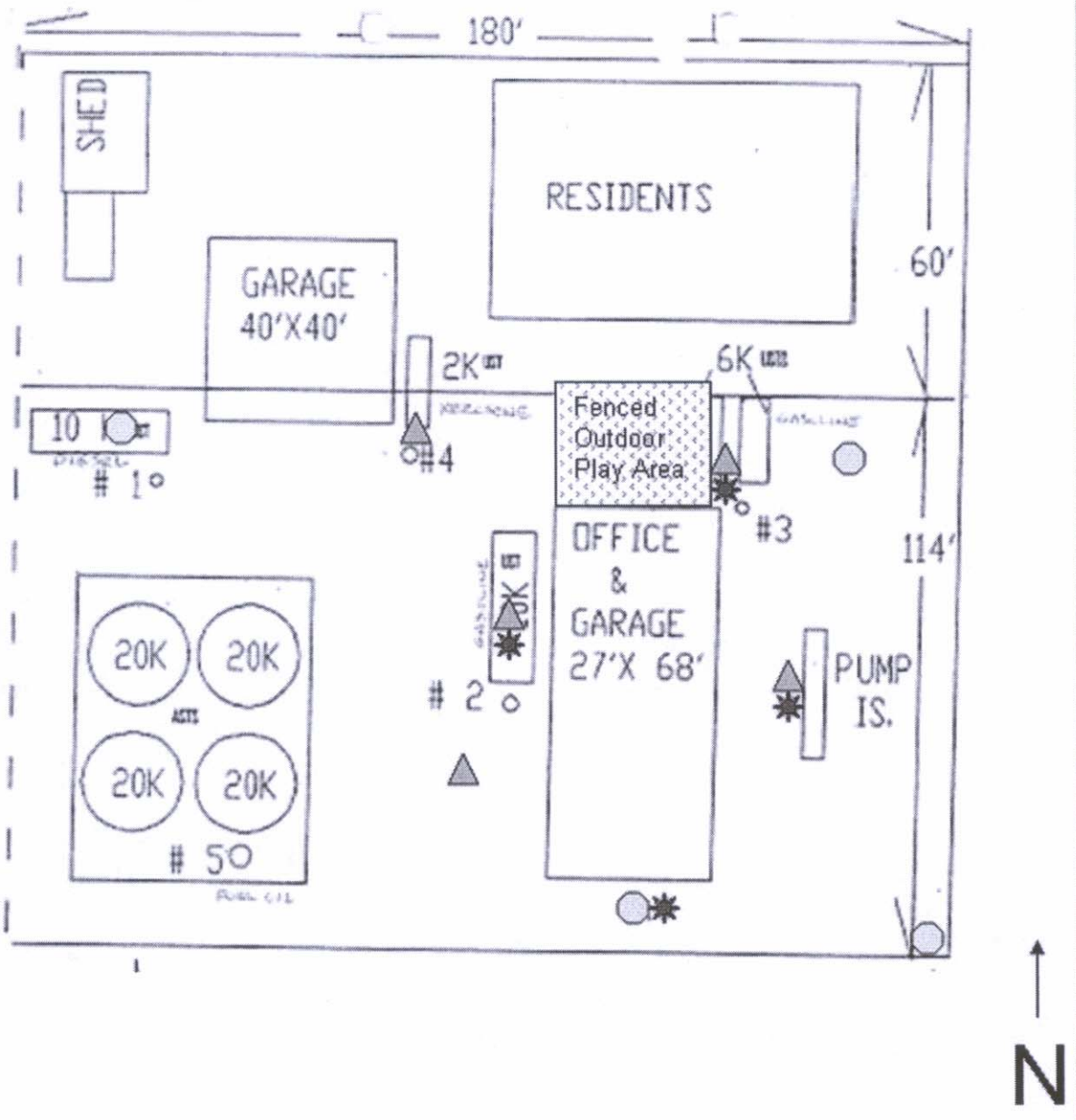


ASHVILLE OIL SITE
ASHVILLE, PICKAWAY COUNTY, OHIO
USGS ASHVILLE QUADRANGLE

FIGURE 1: SITE LOCATION

Ohio Environmental Protection Agency

0 305610 1,220 1,830 2,440 Feet



LEGEND

- Soil Gas Samples 2 per location
- Source Area Soil & Ground Water Samples
- Delineation Soil & Ground Water Samples

All Sample Locations Are Approximate

ASHVILLE OIL SITE
ASHVILLE, PICKAWAY COUNTY, OHIO

FIGURE 2: SAMPLE LOCATION MAP

Ohio Environmental Protection Agency

SCALE : NOT TO SCALE

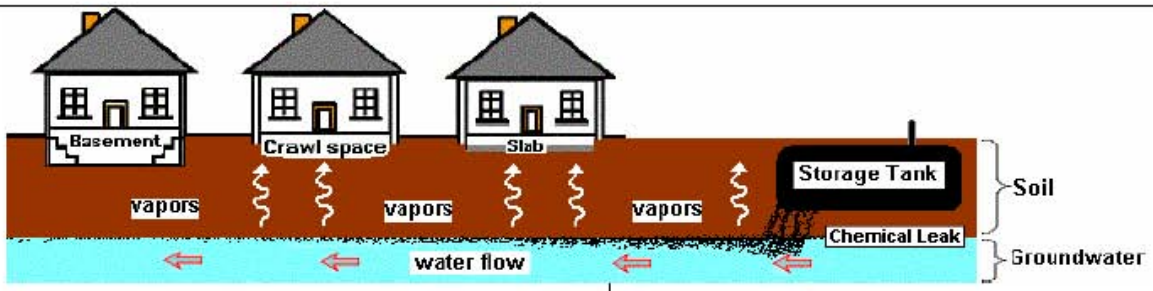
APPENDIX A

Bureau of Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans"

Vapor Intrusion

Answers to Frequently Asked Health Questions



What is vapor intrusion?

Vapor intrusion refers to the vapors produced by a chemical spill/leak that make their way into indoor air. When chemicals are spilled on the ground or leak from an underground storage tank, they will seep into the soils and will sometimes make their way into the groundwater (underground drinking water). There are a group of chemicals called volatile organic compounds (VOCs) that easily produce vapors. These vapors can travel through soils, especially if the soils are sandy and loose or have a lot of cracks (fissures). These vapors can then enter a home through cracks in the foundation or into a basement with a dirt floor or concrete slab.

VOCs and vapors:

VOCs can be found in petroleum products such as gasoline or diesel fuels, in solvents used for industrial cleaning and are also used in dry cleaning. If there is a large spill or leak resulting in soil or groundwater contamination, vapor intrusion may be possible and should be considered a potential public health concern that may require further investigation.

Although large spills or leaks are a public health concern, other sources of VOCs are found in everyday household products and are a more common source of poor indoor air quality. Common products such as paint, paint strippers and thinners, hobby supplies (glues), solvents, stored fuels (gasoline or home heating fuel), aerosol sprays, new carpeting or furniture, cigarette smoke, moth balls, air fresheners and dry-cleaned clothing all contain VOCs.

Can you get sick from vapor intrusion?

You can get sick from breathing harmful chemical vapors. But getting sick will depend on:
How much you were exposed to (dose).
How long you were exposed (duration).
How often you were exposed (frequency).
How toxic the spill/leak chemicals are.
General Health, age, lifestyle: Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

VOC vapors at high levels can cause a strong petroleum or solvent odor and some persons may experience eye and respiratory irritation, headache and/or nausea (upset stomach). These symptoms are usually temporary and go away when the person is moved to fresh air.

Lower levels of vapors may go unnoticed and a person may feel no health effects. A few individual VOCs are known carcinogens (cause cancer). Health officials are concerned with low-level chemical exposures that happen over many years and may raise a person's lifetime risk for developing cancer.

How is vapor intrusion investigated?

In most cases, collecting soil gas or groundwater samples near the spill site is done first to see if there is on-site contamination. If soil vapors or groundwater contamination are detected at a spill site, environmental protection and public health officials may then ask that soil vapor samples be taken from areas outside the immediate spill site and near any potential affected business or home. The Ohio Department of Health (ODH) does not usually recommend indoor air sampling for vapor intrusion before the on-site contamination is determined.

(continued on next page)

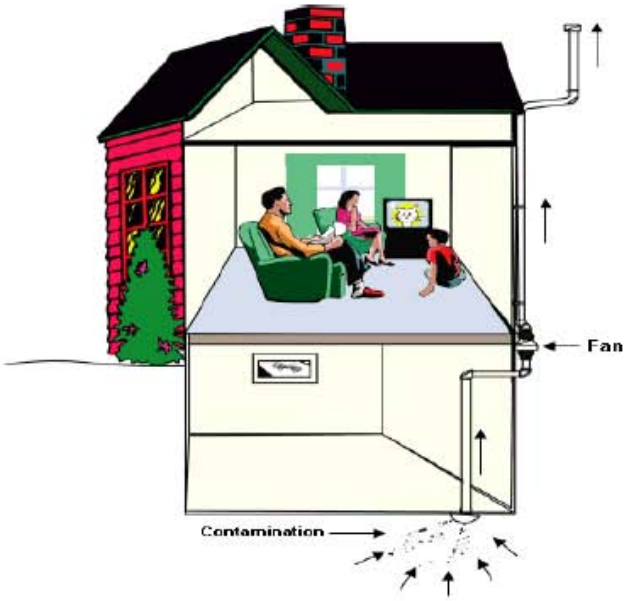
How is vapor intrusion investigated? (continued)

Because a variety of VOC sources are present in most homes, testing will not necessarily confirm VOCs in the indoor air are from VOC contamination in soils at nearby spill site. But if additional sampling is recommended, samples may be taken from beneath the home's foundation (called sub-slab samples), to see if vapors have reached the home. Sub-slab samples are more reliable than indoor air samples and are not as affected by other indoor chemical sources. If there was a need for additional sampling on a private property, homeowners would be contacted by the cleanup contractor or others working on the cleanup site and their cooperation and consent would be requested before any testing/sampling would be done.

What happens if a vapor intrusion problem is found?

If vapor intrusion is having an effect on the air in your home, the most common solution is to install a *radon mitigation system*. A radon mitigation system will prevent gases in the soil from entering the home. A low amount of suction is applied below the foundation and the vapors are vented to the outside. The system uses minimal electricity and should not noticeably affect heating and cooling efficiency. This mitigation system also prevents radon from entering the home, an added health benefit. Usually, the party responsible for cleaning up the contamination is also responsible for paying for the installation of this system. Once the contamination is cleaned up, the system should no longer be needed. In homes with on going radon problems, ODH suggests these systems remain in place permanently.

Radon Mitigation System



What can you do to improve your indoor air quality?

As stated before, the most likely source of VOCs in indoor air comes from the common items that are found in most homes. The following helpful hints will help improve air quality inside your home:

- Do not buy more chemicals than you need and know what products contain VOCs.
- If you have a garage or an out building such as a shed, place the properly stored VOC-containing chemicals outside and away from your family living areas.
- Immediately clean and ventilate any VOC spill area.
- If you smoke, go outside and/or open the windows to ventilate the second-hand, VOC-containing smoke outdoors.
- Make sure all your major appliances and fireplace(s) are in good condition and not leaking harmful VOC vapors. Fix all appliance and fireplace leaks promptly, as well as other leaks that cause moisture problems that encourage mold growth.
- Most VOCs are a fire hazard. Make sure these chemicals are stored in appropriate containers and in a well-ventilated location and away from an open pilot light (flame) of a gas water heater or furnace.
- Fresh air will help prevent both build up of chemical vapors in the air and mold growth. Occasionally open the windows and doors and ventilate.
- Test your home for radon and install a radon detector.

References:

Wisconsin Department of Health and Family Services, Environmental Health Resources, Vapor Intrusion, electronic, 2004.

New York State Department of Health, Center for Environmental Health, April 2003.

Ohio Department of Health, Bureau of Environmental Health, Indoor Environment Program, 2004.

For more information contact:

Ohio Department of Health
Bureau of Environmental Health
Health Assessment Section
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390
Fax: (614) 466-4556

Created September 2004

CERTIFICATION

This Laugh and Learn Daycare Health Consultation was prepared by the Ohio Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review completed by the Cooperative Agreement Partner.

Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

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

Team Lead, Cooperative Agreement Team, CAPEB, DHAC, ATSDR