Health Consultation

TDEC UST 4-930030

DIXIE FOOD MART

SPARTA, WHITE COUNTY, TENNESSEE

SEPTEMBER 19, 2003

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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SPARTA, WHITE COUNTY, TENNESSEE

Prepared by:

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

Background and Statement of Issues

In May 2003, the Tennessee Department of Environment and Conservation (TDEC) Division of Underground Storage Tanks (UST) contacted the Tennessee Department of Health (TDH) Division of Environmental Epidemiology (EEP). UST provided a file on the Dixie Food Mart, where an underground gasoline storage tank had leaked. TDEC UST wanted to know if air samples collected from within nearby residential homes represented a health concern. Furthermore, the indoor air samples identified and measured chemicals not associated with gasoline. TDEC UST wanted to know where these chemicals might have come from and if these unfamiliar chemicals were a health concern.

On February 10, 1984, the Dixie Food Mart gas station, located on North Spring Street in Sparta, White County, Tennessee, had a release of consumer-grade gasoline from a leaking elbow under a dispenser. A system test indicated a 0.293 gallon per hour leak (TDEC 2003). The date of the leak was prior to the development of UST regulations. Figure 1 is a simplistic street map to help illustrate the site. Figures 2 and 3 are photos taken June 13, 2003, of the Dixie Food Mart.

On January 5, 1988, the TDEC Division of Groundwater Protection received a complaint from a nearby dental office on North Spring Street. The proprietor complained that fumes entered the dental office from the sanitary sewer. The problem was first noticed two years before and was associated with heavy rainfall. At that time, other residents were spoken with and no other odor complaints were filed.

On April 17, 2000, TDEC UST received a complaint from a resident on Moore Street concerning an odor problem. Again, heavy rainfall seemed to trigger this odor problem associated with gasoline-like vapors venting up from the sanitary sewer. The resident reported occasional odors dating back six years. Following a repair between the home and the city sewer, the odors became stronger and more noticeable. A TDEC UST investigation followed.

During the investigation, a different Moore Street resident complained of similar odor problems. TDEC UST advised both residences in writing that vapors entering their homes could result from poorly constructed plumbing. Additionally, the residences were advised that household chemicals, accidental chemical releases, pesticides, illegal dumping, and naturally occurring pollutants such as radon may occur in sewers (TDEC UST 2003).

The investigation also uncovered a clandestine drug laboratory that was operated on Moore Street. A homeowner found red-colored water seeping from the sanitary sewer onto their property and reported it to the local sheriff's department. After law enforcement busted the drug lab, acetone and Coleman Fuel mixed with caustic soda were removed from the property.

On May 11, 2000, TDEC UST collected a drinking water sample from a Moore Street faucet. The water was analyzed for petroleum compounds to determine if the city drinking water supply might have been contaminated. All compounds related to petroleum were below detection limits (TDEC UST 2003).

On December 18, 2000, two large temporary blowers were installed at the residences where complaints originated to remove vapors which may have entered from the sewer. Permanent

smaller blowers were installed at the residences on January 17, 2001 (Figure 4). TDEC UST reported that the blowers lowered the incidence of odors from the sewer. Another large blower was installed at the Dixie Food Mart to vent the sewer (Figure 2). The non-sparking blowers are designed to operate continuously.

On January 18, 2001, Agency for Toxic Substances and Disease Registry (ATSDR) Regional Representative Mr. Carl Blair visited the Dixie Food Mart site. He reviewed indoor air data collected March 14–19, 2001. Carl discussed the situation with Mr. Ronald Zabrocki, ATSDR Emergency Response Section, prior to making recommendations. In the ATSDR Record of Activity dated April 27, 2001, recommendation number three reads, "While it is unlikely that past exposures to the contaminants will result in any adverse health effects, ATSDR recommends stopping continued exposures."

On July 18, 2001, TDEC UST approved a proposal from the Dixie Food Mart to line the sewer to prevent petroleum from migrating into it. An inversion liner was installed in the sewer on Spring Street and along Brown Street. TDEC UST reported that resident complaints decreased in frequency and there was a reduction in the severity of odor after installation of the liner.

Environmental Systems Corporation, an environmental contractor, conducted air sampling on numerous occasions after the original odor complaint. TDEC UST reported that it was common to turn off the blowers that vented the sewer in an attempt to mimic a worst-case scenario during sampling (TDEC UST 2003). Vapor sampling was done with portable field instruments able to detect petroleum-related compounds, but unable to identify specific compounds. Compound-specific sampling was performed with summa canisters via gas chromatography. The most recent air samples were collected with summa canisters over two hours on April 10, 2003. When the indoor air samples were analyzed, vapors associated with gasoline and vapors not associated with gasoline were detected.

Following the request made to Environmental Epidemiology in May 2003, Environmental Specialist Mr. David Borowski, reviewed the Dixie Food Mart files and screened the air data by use of ATSDR comparison values. A site visit was scheduled with TDEC UST for the afternoon of June 13. On June 11, prior to the site visit, Mr. Borowski contacted Mr. Carl Blair, the ATSDR representative who initially investigated the environmental health aspects of the site in January 2001. Mr. Blair was faxed the April 10 summa canister data with ATSDR comparison values. Mr. Blair and Mr. Borowski discussed the data and together created questions to be answered during the upcoming site visit.

Eliminating the Exposure

Possible solutions to the elimination of the indoor air exposure pathway have been discussed between TDEC, an environmental contractor representing the Dixie Food Mart owner, an attorney representing two residents, and TDH. Beyond the installation of the sanitary sewer blowers on the homes, no other remediation methods have been installed. The environmental contractor diagramed a building trap or running trap system of sewer pipes and cleanouts that could be installed between the main sewer line and a home. The plumbing system, designed by a senior codes inspector, would trap vapors, preventing them from entering the home (ESC 2001). The building trap system was not installed because a property owner was afraid it might be prone

to clogging (TDEC UST 2001b). Recently, a septic system was under consideration. A septic system would remove the home from the sanitary sewer, eliminating the exposure pathway. Concern over reduced property value from removing the home from the sanitary sewer and maintenance of the septic system (TDEC UST 2003a) stalled the interest in this possible solution. At the time of publication, no agreement had been reached between the parties as to how to reconcile the indoor air quality issue.

Site Visit

On Monday, June 13, 2003, David Borowski and Ms. Susan Miller, Health Educator for Environmental Epidemiology, met with Mr. Rocky Hannah, TDEC UST. The Dixie Food Mart was visited first. Mr. Hannah explained the source of the gasoline release. He showed EEP the large sewer blower installed to vent the source of the gasoline. He described the underground gasoline plume located by groundwater monitoring well data. Mr. Hannah discussed a plan under negotiation to dig up the soil thought to be at the origin of the release. He then drove the EEP representatives around the neighborhood to point out monitoring well locations, sewer manholes, stormwater drains, the dental office, the residences where complaints originated, and the location of the former clandestine drug lab.

After TDEC UST left the site, Mr. Borowski and Ms. Miller proceeded to go door-to-door to the residences where complaints originated. One woman and her eighteen-year old daughter reported having unpleasant odors in their home. They said the blowers were helpful in reducing the odor, but sometimes the blower exhaust would reenter their home via an open window or the HVAC intake. Another resident was spoken with by telephone on a later date. The resident had similar odor complaints. The resident said that the sewer liner helped but did not solve the odor problem. Several health issues had arisen within this resident's family, especially over the last three years. Illnesses and other health concerns are detailed in the Discussion section.

Discussion

Resident Health Concerns

In-person and over-the-telephone conversations with residents of Moore Street revealed several health concerns. In one household, listed as House #1 in Table 1, all four members had some type of health concern after living there for 8 years. They had routine complaints about the sewage system's generation of odor in their bathroom. The odor was reported to be worst on cold, damp, dewy days. The odor led to nausea and headache. Rashes were noticed on face, back, and arms. Numbness was reported in face, hands, and feet. Complaints of weakness in legs and arms were common. All family members reported having memory loss. Residents described encountering fatigue, including breathing problems following moderate exertion. The household participated in exercise three nights per week and did not smoke tobacco. An adult female complained of nervous spasms in her shoulders and arms. She reported tiredness in legs, high blood pressure, and a burst blood vessel around her eye. Recently, she had cysts removed, one from her neck and one from her back. A teenage female was diagnosed with polycystic ovarian syndrome. She had irregular periods, if any at all. Symptoms, including daily headaches, caused her to miss many days of school. The daughter continues to have symptoms, including chest pain.

The residents of House #2 in Table 1 also reported health concerns. The family had lived on Moore Street for eleven years. The residents complained that their home was sampled only once and that the indoor air sampling was not performed when the odor was most severe. They reported the worst old-gasoline odor occurred after heavy rains usually in the colder months. The household of up to four members, depending on the timeframe, all suffered from frequent headaches and nausea. One son, now age 18, experienced upset stomach and vomiting while living at the Moore Street address. Another son, now age 29, has a recurring cyst on the back of his neck. The mother reported having had only gall bladder surgery prior to their odor complaints in 2000. In the past three years, however, she has been diagnosed with diabetes, polycystic kidney disease, non-alcoholic cirrhosis of the liver, and acid reflux disease. She also reported stomach ache, vomiting, and trouble breathing since the onset of the odor problems. The family dog was reported to show signs of illness. The resident was concerned about contamination getting into drinking water pipes since the sewer lines were cracked and leaking.

Environmental Sampling

On April 10, 2003, summa canisters were used to collect indoor air samples. Three samples were collected from two residences on Moore Street. One sample was collected from House #1. Two samples were collected from House #2. Indoor locations were selected because sanitary sewer lines were present in the rooms sampled. Table 1 summarizes the results of the sampling.

Table 1. April 10, 2003 summa canister indoor air analytical results.

Chemical	House #1 bathroom	House #2 kitchen	House #2	Comparison Value (ATSDR 2003)	
unit label	ppb	ppb	ppb	ppb	
Acetone	16	14	14	13000	I-EMEG
Benzene	4.1	0.48	0.50	4	I-EMEG
				0.4	*EPA*
				0.1	C-CREG
2-butanone MEK	0.57	4.3	3.9	340	I-RFC
Chloroform	1.8	0.44	0.44	20	C-EMEG
Ethylbenzene	11	0.37	0.36	1000	I-EMEG
Toluene	30	2.7	2.7	80	C-EMEG
trichlorofluromethane	0.29	1.2	1.2		
xylenes-total	36	1.33	1.35	100	C-EMEG

**EPA* = risk of 1 additional cancer case in 100,000 exposed persons not 1 in 1,000,000 (ATSDR 1997).*

Chemicals of Concern

From the data observed in Table 1, two types of chemicals with separate origins appear to constitute the chemical vapors measured in the two residences. First, the traditional gasoline compounds of benzene, toluene, ethylbenzene, and xylenes are present. This result was expected by TDEC UST. Other compounds such as acetone, 2-butanone, and trichlorofluromethane were unexpected. When the manufacturing at clandestine drugs laboratories was researched (TDH & TDEC 2000), it was discovered that solvents, camping fuel, and refrigerants are all commonly used. Pseudoepherine, an ingredient in methamphetamine manufacturing, contains red pigment. Knowing that red dye was discovered in the sanitary sewer, it is likely that clandestine drug laboratory waste was dumped into the sanitary sewer. This dumping is a plausible, but not verifiable, explanation to the unexpected chemicals measured in the April 10, 2003 air samples.

On the basis of the initial screening of the April 2003 indoor air sampling data (Table 1), it was determined that only benzene was to be considered a potential chemical of concern.

Benzene C_6H_6

It is important to note that at the highest concentration of 4.1 ppb benzene that was measured in House #1's bathroom, the increased cancer risk is 1 unexpected cancer in 10,000 exposed persons. This risk level is calculated on the basis of a 70-year lifetime with continuous exposure.

Also, the sewer blowers were turned off to help create a worst-case-scenario for indoor air exposure. Literature indicates that benzene levels in ambient air range above the highest indoor concentration measured (ATSDR 1997). Therefore, the benzene levels measured on April 10, 2003, (Table 1) yield no apparent increased risk of experiencing adverse health effects. This follows the same environmental public health conclusion provided by the ATSDR in 2001.

Benzene is a colorless liquid with a sweet odor. Benzene dissolves only slightly in water and will rapidly evaporate into the air. Benzene is highly flammable. Literature indicates that people can smell benzene in the air at 1.5–4.7 parts of benzene per million parts of air (ppm) and can smell benzene in water at 2 ppm. Benzene can migrate with groundwater. It can pass from either water or soil into the air. In the air, benzene reacts with other chemicals and breaks down within a few days. Benzene does not build up in plants or animals.

Benzene found in the environment is from both human activities and natural processes. Benzene is found in air, water, and soil. Part of crude oil and gasoline, benzene is released with motor vehicle exhaust and evaporation from gasoline stations. Another important source of benzene in the air is from industrial discharges and the burning of coal and oil. Benzene is also part of tobacco smoke.

The ATSDR *Toxicological Profile for Benzene* (1997) states that background levels of benzene in air range from 2.8 to 20 parts of benzene per billion parts of air (ppb), or about 3 micrograms of benzene in a cubic meter of air ($\mu g/m^3$). People living in cities or industrial areas are generally exposed to higher levels of benzene. Similarly, people living around petrochemical operations and gas stations may be exposed to higher levels of benzene.

A recent European study had 125 volunteers in Brussels, Belgium, carry special sensors to monitor their levels of exposure to benzene (ENS 2003a). The tests showed that benzene levels in people's houses (6.4 $\mu g/m^3$ or 2.0 ppb) were twice that of the city background air (3.1 $\mu g/m^3$ or 0.97 ppb). This value is consistent with ATSDR literature.

Even though exposure to benzene in residences near the Dixie Food Mart yields no apparent public health hazard, the community may want a better understanding about the toxicity of benzene. Understand the measured benzene levels are not are likely to lead to adverse health effects as guided by the ATSDR health comparison values; and, that a symptom of benzene toxicity is not proof that adverse exposure occurred. The following paragraphs are meant to provide a general discussion on what is known about the toxicology of benzene.

People who breathe high levels of benzene for long periods may experience harmful effects in the tissues that form blood cells, especially the bone marrow. These effects can disrupt normal blood production and cause a decrease in important blood components. A decrease in red blood cells can lead to anemia. Reduction in other components in the blood can lead to excessive bleeding. Excessive exposure to benzene can be harmful to the immune system, increasing the chance for infection and perhaps lowering the body's defense against cancer (ATSDR 1997).

Long-term exposure to high levels of benzene in the air can cause cancer of the blood-forming organs (ATSDR 1997). This condition is called leukemia. The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. The

International Agency for Cancer Research (IARC) has also determined that benzene is carcinogenic to humans, as has the EPA.

Exposure to benzene may be harmful to the reproductive organs. Some women workers who breathed high levels of benzene for many months had irregular menstrual periods. When examined, these women showed a decrease in the size of their ovaries. However, exact exposure levels were unknown, and the studies of these women did not prove that benzene caused these effects. It is not known what effects exposure to benzene might have on the developing fetus in pregnant women or on fertility in men. Studies with pregnant animals show that breathing benzene has harmful effects on the developing fetus. These effects include low birth weight, delayed bone formation, and bone marrow damage (ATSDR 1997).

Residents were interested in medical tests that could determine if they had been exposed to chemicals. Some limited tests are available to indicate benzene exposure in people. Benzene can be measured in the breath shortly after exposure. This test is not helpful in detecting low levels of benzene – such as the benzene measurements discussed in this consultation. Blood testing can be performed. However, since benzene disappears rapidly from the blood, only recent exposures can be measured. The biological half-life for benzene was reported at 0.7 hr, a report that agrees with a reported experimental half-life ranging from 0.4 to 1.6 hr (HSDB 2003a). Certain metabolites of benzene, such as phenol, muconic acid, and S-phenyl-N-acetyl cysteine (PhAC) can be measured in urine. The amount of phenol in urine has been used to check for benzene exposure in workers. This test is useful only when benzene exposure is 10 ppm or greater, the test must be performed shortly after exposure, and a limitation is that the test cannot indicate how much benzene exposure actually occurred. Measuring phenol is further limited because phenol is present in urine from other sources, including diet and environment. Measurement of muconic acid or PhAC in the urine is more sensitive. It is important to note that measurement of benzene in blood or metabolites in urine cannot predict whether harmful health effects will be experienced. Measuring all parts of the blood and bone marrow are used to compare benzene exposure and health effects. Furthermore, these tests are usually not helpful when benzene exposure levels are low (ATSDR 1997).

Odor

Even though the data presented in Table 1 does not indicate an increased risk of adverse health effects from chemical exposure, it is important to recognize that the initial complaints were about odor. Several people, including TDEC UST personnel, have witnessed unpleasant odor in the homes of the concerned residents. Some of the chemicals identified in Table 1 are capable of producing noticeable odor at concentrations below health comparison values. Furthermore, it is likely that the odor is a mixture of the chemicals identified to be in the sanitary sewer vapor. Hydrogen sulfide, which smells like rotten eggs at a very low concentration, is a result of the natural decomposition of sanitary waste and, therefore, a common sewer odor. Household products poured down the drain can also produce bad smelling sewer vapors. Regardless of whether the exact cause of the odor can be identified, exposure to the unpleasant odor can lead to a decreased quality of life. As a measure of good public health practice the odor should be eliminated.

Children's Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

In 1996, the Agency for Toxic Substances and Disease Registry (ATSDR) launched an initiative to place a special agency-wide emphasis on environmental hazards to children's health and to emphasize child health in all agency programs and activities (ATSDR 1997, 1998). Exposure of children in the neighboring community to vapors from the Dixie Food Mart underground gasoline release were carefully considered in the preparation of this document.

Conclusions

1. While no apparent public health hazard exists for the homes near the Dixie Food Mart, Sparta, White County, Tennessee, offensive odor can negatively affect quality of life.

Recommendations

1. As a matter of good health practice, exposure to the offensive odor should be eliminated.

Public Health Action Plan

1. TDH EEP is available to review additional data.

2. TDH EEP will provide copies of the health consultation to the environmental regulatory agencies and concerned local residents.

3. TDH EEP will continue to provide health education to community members concerned about the site.

4. TDH EEP will maintain dialogue with TDEC and the concerned residents until a solution to the indoor air quality issue has been agreed upon and successfully implemented.

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Preparers of Report

Mr. David Borowski, Environmental Specialist
Ms. Bonnie Bashor, Director of Environmental Epidemiology
Tennessee Department of Health (TDH)
Division of Communicable and Environmental Disease Services (CEDS)
Environmental Epidemiology (EEP)
4th Floor Cordell Hull Building
425 5th Avenue North
Nashville TN 37247-4911

Reviewers of Report

Mr. Robert L. Williams, ATSDR
Mr. Elwin “Rocky” Hannah, TDEC

ATSDR Technical Project Officer

Mr. Alan Yarbrough
Division of Health Assessment and Consultation
Superfund Site Assessment Branch

Certification

This Health Consultation: Dixie Food Mart, Sparta, White County, Tennessee, was prepared by the Tennessee Department of Health Division of Environmental Epidemiology 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.

Alan W. Yarbrough

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Technical Project Officer, SPS, SSAB, DHAC, ATSDR

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

Roberta Erlwein

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Chief, State Program Section, SSAB, DHAC, ATSDR

Electronic Document

Figure 1
Map detailing N Spring St, Brown St, and Moore St with star near the Dixie Food Mart.
Sparta, White County, Tennessee (Map credit: MapQuest.com 7/15/03)

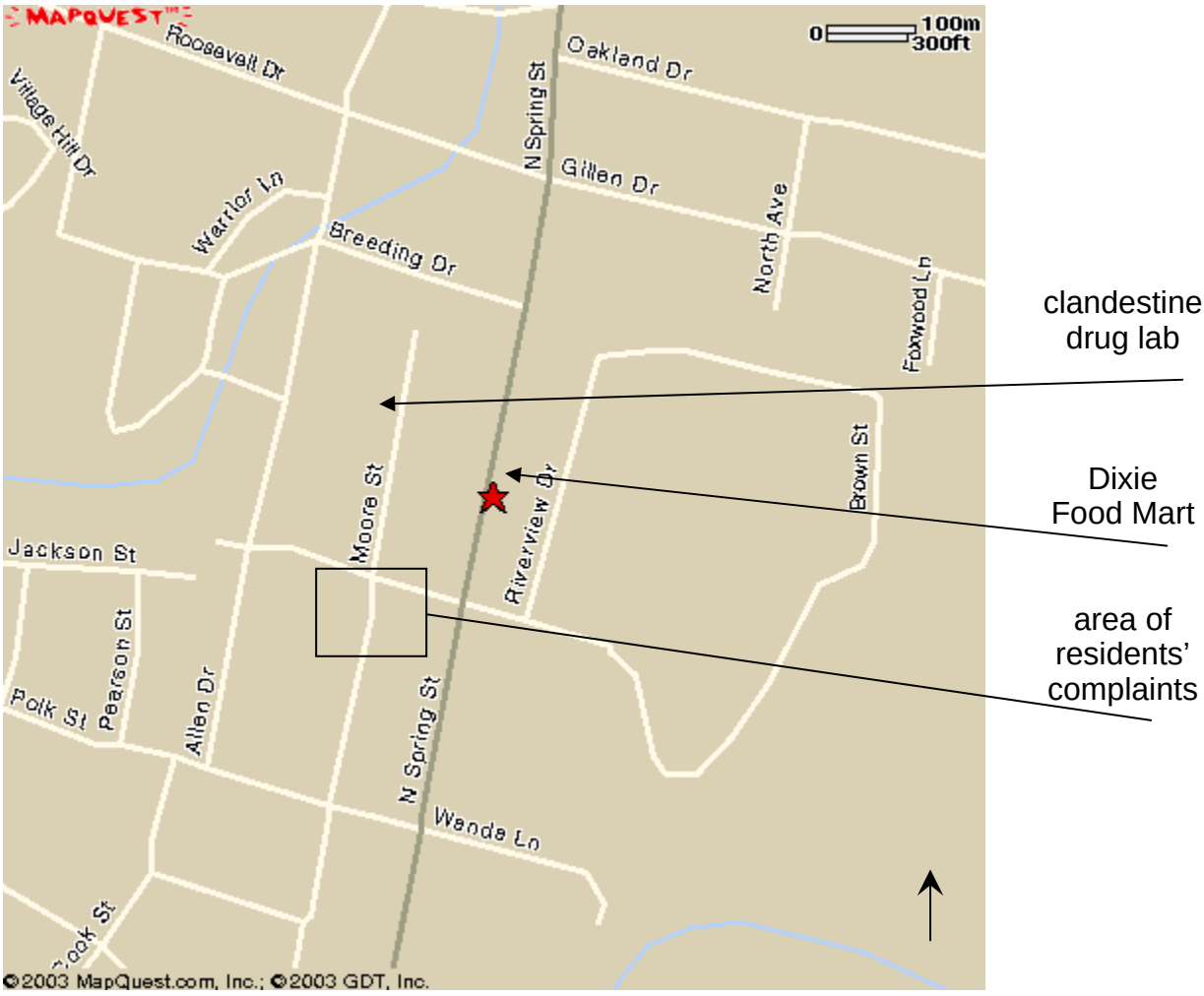

Figure 2
Photo of Dixie Food Mart looking North along N Spring St with 24hr/7d sewer blower visible.
Sparta, White County, Tennessee (Photo credit: David Borowski, TDH 6/13/03)

Figure 3
Photo from gas pump at Dixie Food Mart looking Southwest (direction of contaminant plume).
Sparta, White County, Tennessee (Photo credit: David Borowski, TDH 6/13/03)

Figure 4
Photo of a sewer blower on a home.
Sparta, White County, Tennessee (Photo credit: David Borowski, TDH 6/13/03)