

Health Consultation

KEROSENE SOOT CONTAMINATION OF RESIDENTIAL HOMES

HARRISVILLE, ALCONA COUNTY, MICHIGAN

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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 document has previously been released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The health consultation has now been reissued. 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

KEROSENE SOOT CONTAMINATION OF RESIDENTIAL HOME

HARRISVILLE, ALCONA COUNTY, MICHIGAN

Prepared by:

Michigan Department of Community Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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Summary

Owners of a home accidentally burned non-smokeless kerosene in lamps during an electrical outage, contaminating the interior of the home with soot. Working with their insurance company and the Michigan Department of Community Health, they have taken steps toward remediation of the premises. No apparent public health hazard exists.

Purpose and Health Issues

The purpose of this health consultation is to address the health concerns of the occupants of a home in which non-smokeless kerosene had been burned in lamps overnight, resulting in contamination of the interior of the home with soot. While there were hazards associated with the kerosene lamps burning while the occupants were asleep, the primary concern was dermal exposure to and incidental ingestion of soot resulting from the use of the kerosene.

Background

On December 3, 2003, the Michigan Department of Community Health (MDCH) received a call on the agency's Toxics Hotline regarding soot contamination in a home where non-smokeless (i.e., regular) kerosene had been burned in lamps overnight during an electrical outage. The homeowners are older adults who baby-sit their toddler grandchild on a regular basis. They were primarily concerned with the welfare of the child since his rate of exposure to contaminated carpeting, upholstery, and walls would likely be greater than theirs.

According to the homeowners, the area had lost electricity during a winter storm. They chose to use oil lamps they had been using primarily for decorative purposes as a light source. Unbeknownst to them, their daughter had placed regular kerosene into two of the lamps' reservoirs at an earlier date, on the assumption that the lamps would not be burned. The homeowners lit the lamps at about 8 o'clock in the evening, leaving two in the dining/living area and one in the master bedroom. The male occupant fell asleep on the couch and was woken up at around 4 o'clock in the morning by the family dog. He noticed smokiness in the air and soot on the walls and immediately extinguished all the lamps. Upon inspection of the house, the homeowners discovered soot covering a majority of the walls and furnishings throughout the structure. They contacted their home insurance company for assistance.

The insurance company sent a professional cleaning company to the home to wash the walls and ceiling, carpeting, and furnishings. The cleanup did not occur until several days after the incident. The homeowners did not vacate the premises during this time nor were they instructed to do so. (They had not yet contacted MDCH.) Following the work by the cleaning company, the homeowners noticed that there was still staining on the walls, suggesting that the unsealed surface had absorbed the soot and was not completely clean.

When the homeowners saw that a soot residue apparently remained, and after talking with several carpet stores about the incident, they became concerned that they and other

family members, especially a toddler grandson whom they regularly baby-sit, would be exposed to toxic compounds. They called MDCH to voice their concerns and get information on what chemicals could be present. MDCH toxicologists suspected that the most likely chemicals to be present in this type of situation would be polycyclic (or polynuclear) aromatic hydrocarbons (PAHs or PNAs). The toxicologist handling this site contacted the homeowners' insurance company to discuss potential exposure issues. The insurance agent made arrangements for an environmental consultant to take samples for chemical analysis.

Discussion

Environmental Contamination

The environmental consultant contracted by the insurance company conducted sampling in the home on December 11, 2003 to determine if there were significant residues of PAHs remaining following the cleaning. Field staff removed three small (about 1.5-inch square) samples of carpeting from inconspicuous areas in the dining room, living room, and master bedroom and sent them to a private laboratory for analysis (EPA Method 8310 [EPA 1986]). The consultant then compared the laboratory results to the Michigan Department of Environmental Quality (MDEQ) Part 201 Residential and Direct Contact Criteria (DCC) and Soil Volatilization to Indoor Air Inhalation Criteria (SVIIC).

Detected chemicals and their respective concentrations are shown below:

Chemical	Sample Results ^{A,B}			MDEQ Criteria Used ^{A,C}	
	Dining Room	Living Room	Bedroom	DCC	SVIIC
Chrysene	ND ^D	ND ^D	99	2,000,000	ID
Fluoranthene	ND ^D	ND ^D	1,300	46,000,000	1,000,000,000
Phenanthrene	120	79	450	1,600,000	2,800,000

A Units are µg/kg (ppb)

B Mackinac Environmental Technology Inc. 2004

C MDEQ 2002

D Reporting limit = 62 ppb

ND Not detected in sample

ID Insufficient data to develop criteria

The DCC identifies a soil concentration that is protective against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil (MDEQ 1999a). MDCH recognizes that the criteria pertain to soil, not to carpeting. The toxicologist discussed this discrepancy with the environmental consultant and the insurance agent. For purposes of this investigation, the toxicologist felt that, since there are no comparison values available for contaminants in carpeting or other household upholstery, the DCC would be a permissible surrogate to determine if PAHs were at levels of concern.

The SVIIC identifies a soil concentration that protects occupants of a building from exposure to indoor air concentrations that may cause adverse health effects. These criteria address the migration of contaminant vapors from soil into buildings (MDEQ 1999b). These criteria pertain to soil contamination, similar to the DCC, but address exposure via the air. PAHs are semi-volatile organic compounds (SVOCs), which are not

expected to readily volatilize. Hence, the SVIIC values for PAHs are relatively high (sometimes at or approaching complete saturation of the soil) compared to those of many volatile organic compounds. The main concern for this site, as explained further in the Human Exposure Pathways section, was not inhalation of PAHs, but dermal contact with them. The MDCH toxicologist felt that the SVIIC was an inappropriate screening value and explained the issue to the environmental consultant and the insurance agent before the sampling occurred.

According to the male occupant, who was present during the sampling event, the environmental consultant removed the sample for the living room from a corner of the room, under the molding, and the sample for the master bedroom from under the dresser. These specific sampling locations are problematic in that they were from areas that very likely did not receive significant, if any, soot deposition and would not be easily accessible, thereby not a likely exposure scenario. Also, the consultant did not sample the main traffic area, which likely would have soot residue remaining in the carpet, despite the professional cleaning. MDCH understands that the consultant sampled in this manner out of concern for aesthetics, assuming the carpet might not need replacement. However, by not sampling where deposition and exposure are likely to occur, the consultant could not present adequate information to determine any health implications.

As stated earlier, the homeowners also saw discoloration on the walls of their home following the professional cleaning, suggesting that some of the soot had absorbed into the walling material (mostly drywall but also paneling) and was leaching out. During pre-sampling conversations with the insurance agency and the consultant, the MDCH toxicologist suggested the consultant also collect wipe samples of the walls to determine if PAHs were present. While wipe samples cannot be used to quantitate chemicals, they can be useful in identifying areas of contamination. Subsequent to these discussions, the consultant did not take wipe samples, nor did he take any fabric samples from the upholstered furniture, which, although cleaned, was still redolent of the smoky odor.

It should be noted that there is a wood-burning stove in the home and that both homeowners smoke, although not when the child is present. Depending on the quality and use of the stove, it is possible that PAHs generated by burning wood could enter the home. (The homeowners told MDCH that the stove is air-tight and they use it infrequently, as a supplementary heat source.) Tobacco smoke is known to contain PAHs. It is possible that the PAHs detected in the carpet samples could have come from either of these activities. It is not possible to discern the source of the PAHs in the samples for this site.

Human Exposure Pathways

To determine whether persons are, have been, or are likely to be exposed to contaminants, MDCH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) an exposed 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 property. It is considered either a potential or an incomplete pathway if there is no evidence that at least one of the elements above are, have been, or will be present at the property, or that there is a lower probability of exposure. The exposure pathway elements for this site are shown in the following table:

Source	Environmental Transport and Media	Chemicals of Interest	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Kerosene in lamp	Indoor air	PAHs, carbon monoxide	Indoor air	Inhalation	Occupants of home	Past	Complete
						Present	Incomplete
						Future	Incomplete
Kerosene in lamp	Indoor air	PAHs	Carpeting, upholstery, walls	Dermal absorption, incidental ingestion	Occupants of home	Past	Incomplete
						Present	Potential
						Future	Potential

The initial concern of the MDCH toxicologist was the physical and health hazards of burning unattended (the occupants were sleeping) kerosene lamps in a home that might not have had adequate venting. Although the homeowners stated that they had placed the lamps in locations where they were unlikely to tip over, the risk of a fire is inherent in burning such a fuel indoors without keeping watch. Also, if the home is relatively air-tight, carbon monoxide levels could have reached lethal concentrations. Fortunately, the husband woke up and extinguished all the lamps, stopping the inhalation exposure and fire risk.

The primary concern, then, was that of dermal exposure to any PAHs in the soot, both before the professional cleaning and after, if any remained. The MDCH toxicologist considered it likely that adults aware of the situation would take precautions to minimize direct skin contact with the wall and carpet and would wash their hands after contact. However, young children, especially toddlers, would be at greater risk of exposure due to their behavior (discussed further in the ATSDR Child Health Considerations section).

Although exposure to PAHs was likely before the professional cleaning occurred, it should not have been of a duration to expect adverse health effects. Following the cleaning, levels of PAHs on carpeting, upholstery, and the walls likely were significantly reduced, if not eliminated.

Toxicological Evaluation

PAHs are a group of chemicals, generally occurring as complex mixtures, formed during the incomplete combustion of wood, coal, oil, and other organic substances. While not all PAHs are exactly alike, the Agency for Toxic Substances and Disease Registry (ATSDR) has grouped 17 of the chemicals in the agency's Toxicological Profile for Polycyclic Aromatic Hydrocarbons due to these chemicals' similar characteristics and their preponderance (versus other PAHs) at hazardous waste sites. The specific chemicals are: acenaphthene; acenaphthylene; anthracene; benz[a]anthracene; benzo[a]pyrene; benzo[e]pyrene; benzo[b]fluoranthene; benzo[g,h,i]perylene; benzo[j]fluoranthene; benzo[k]fluoranthene; chrysene; dibenz[a,h]anthracene;

fluoranthene; fluorine; indeno[1,2,3-cd]pyrene; phenanthrene; and pyrene (ATSDR 1995).

Exposure to PAHs typically is through inhaling the chemicals; however, people can be exposed through dermal contact and ingestion as well. Dermal exposure to high levels of PAHs, such as would be found in tar and creosote, may result in irritation to the skin. Long-term dermal exposure may result in skin cancer. Ingestion of sufficient levels of PAHs is likely to lead to gastrointestinal irritation and has been shown to cause cancer in laboratory animals (ATSDR 1995). Due to remedial actions that have taken or will take place at this home, MDCH does not expect adverse health effects to occur.

ATSDR Child Health Considerations

Children may be at greater risk than adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than most adults, and therefore breathe dust, soil, and vapors closer to the ground. Their lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages (ATSDR 1998). The obvious implication for environmental health is that children can experience substantially greater exposures than adults to toxicants that are present in soil, water, or air.

As stated earlier, the homeowners regularly baby-sit their 4-month-old grandson at their home. He is reportedly just beginning to crawl so he will have extensive exposure to the carpeting. Also, as he learns to stand, he will need to brace himself and will be exposed to the furniture and walls. Therefore, if there are residual PAHs in any of these items, he will be exposed to the chemicals. However, as discussed in the Human Exposure Pathways section, the professional cleaning likely reduced the levels of PAHs a significant extent, and adverse health effects would not be expected.

Conclusions

The potential for residual PAH contamination of the carpeting, upholstery, and walls was not eliminated by the analytical results of samples from the carpeting. Analytical testing of carpet and wipe samples from areas where exposure was most likely to occur would have provided more definitive information. However, the homeowners have since taken steps, based on recommendations from MDCH, to replace all carpeting, seal the walls with urethane, and minimize their grandson's exposure to upholstered furniture. Therefore, this site poses no apparent public health hazard.

Recommendations

None at this time.

Public Health Action Plan

MDCH will consider new data should it become available.

The results of this evaluation have been shared with the affected residents.

If any citizen has additional information or health concerns regarding this health consultation, please contact the Michigan Department of Community Health, Environmental and Occupational Epidemiology Division, at 1-800-648-6942.

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Certification

This Kerosene Soot Contamination of Residential Home Health Consultation was prepared by the Michigan Department of Community 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.

Technical Project Officer, Cooperative Agreement Team, SSAB, DHAC, ATSDR

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

Team Leader, Cooperative Agreement Team, SSAB, DHAC, ATSDR