HEALTH CONSULTATION

St. Louis Residential Mercury Spill

St. Louis, Gratiot County, Michigan

Prepared by

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

SUMMARY

The purpose of this mercury investigation was to ensure proper cleanup of a residential home. A family from St. Louis, Michigan reported they broke a fever thermometer in their home. The tenants of the home followed Michigan Department of Community Health (MDCH) recommendations to clean up the spill. MDCH conducted a site visit after the initial cleanup activities and measured mercury vapor concentrations in the home. Upon completion of recommended remediation measures, MDCH concluded the residence was acceptable for continued use.

EVENT AND RESPONSE

During the first week of January 2004, renters of a home in St. Louis, Michigan broke a fever thermometer in their master bedroom. On January 8, the tenants contacted the Mid-Michigan District Health Department (local health department). The tenants were not immediately convinced of the seriousness of a mercury spill. The family had one child under the age of six years and also used the residence for babysitting (i.e., child daycare). None of the occupants reported being pregnant. On January 12, the local health department contacted MDCH to discuss the situation. On January 22, MDCH staff contacted the tenants and reiterated a list of verbal recommendations (see Recommendations section) for isolation of contaminated items and remediation of property. The tenants agreed to follow through with the recommendations.

On February 3, 2004, MDCH staff and local health department staff visited the property to determine if further remediation was necessary. Prior to MDCH arrival, the occupants had removed a section of contaminated carpet and carpet padding (approximately 3 ft^2) and sealed the material in large plastic bags. The occupants also had removed other potentially contaminated items (chair and desk) to a location outside the living space. MDCH used a Lumex® instrument, which measures inorganic mercury in the atmosphere in the low ng/m^3 range, to measure the air within the home (Table 1).

Table 1. Mercury indoor air measurements by location within the home

Location	Measurement (ng/m^3)
Dining Room	14-34
Living Room	16-17
Master Bedroom (MB)	
Threshold entrance-floor	70-80
Breathing Zone	100
Baseboards/underlayment	70-120
Carpet	300-600
Personal Items	
Clothing (place in bag)	890-900
Vacuum Cleaner	2000[a]

[a] Mercury vapors from the vacuum cleaner would likely have been much greater if the measurements could have taken at room temperature (70 °F).

DISCUSSION

Mercury Data Evaluation

MDCH determined the mercury measurements taken with a Lumex® were of sufficient quantity and quality to allow proper evaluation of the home. MDCH determined that no further data collection was necessary.

Exposure Pathway Evaluation

Elemental mercury is a liquid at room temperature and can turn into a vapor and diffuse throughout. Inhalation is the primary route of exposure to elemental mercury. Inhaled mercury vapor is almost entirely (80%) absorbed via the lungs into the blood stream (ATSDR 1999). Because mercury vapor does not have an odor, it does not provide a warning of hazardous concentrations. Mercury vapors are also heavier than air and can accumulate in low level areas or areas with poor air circulation.

At the St. Louis property, the adult occupants were in the room at the time of the mercury release and continued to live in the home and sleep in the master bedroom during the remediation process (~ 1 month). MDCH determined the breathing zone in the master bedroom was two to four times above the rest of the home's breathing zone mercury concentrations. However, the value (100 ng/m^3) was 10 fold below the recommended 1000 ng/m^3 clearance value (ATSDR 2000) and half of the ASTDR MRL (200 ng/m^3) (ASTDR 1999). The ATSDR recommended value for residential setting of less than 1000 ng/m^3 is an action level that if exceeded would prompt the need for further cleanup or other remedial action. MDCH staff identified portions of the carpet that were still releasing mercury (300 to 600 ng/m^3) and recommended further carpet and pad removal.

MDCH collected mercury measurements in proximity to the potentially contaminated items that were being stored outside the living space (garage). The vacuum cleaner, which had been used to vacuum up the mercury, was emitting 2000 ng/m^3 in an open environment during cold weather (20 to 30 ^{o}F). MDCH recommended that the vacuum cleaner be sent to the local sanitary landfill. The occupants had already purchased a new vacuum cleaner to replace the contaminated unit. MDCH determined that the clothing and furniture (chair and desk), that had mercury spilled on them, were releasing well below 1000 ng/m^3. MDCH recommended these items remain in the non-living space until late spring, then placed outside for several weeks in warm, sunny weather to allow the mercury to be released into the air prior to re-use.

Description of Hazard and Public Health Implications

Repeated or continuous exposure to elemental mercury can result in accumulation of mercury in the kidneys and brain with the potential for permanent damage to the nervous and renal systems. Symptoms of poisoning may include neuropsychiatric effects, renal impairment, and oropharyngeal inflammation (ATSDR 1999). In some instances, muscle weakness, muscle atrophy, and muscle twitching can occur as well as slowed nerve conduction velocities (ATSDR 1999). MDCH determined that the exposure was primarily contained in the master bedroom after the initial remediation actions. MDCH determined exposure was likely to be minimal following remediation. MDCH concluded that the duration and amount of exposure was not likely to be significant for the adults and that the remediation actions prevented long-term elevated exposures.

Addressing the Unique Vulnerabilities of Children

Children exposed to similar amounts of mercury vapor as adults may receive larger doses because of greater lung surface area relative to their body weight. Their lower body weight and higher intake rate can result in a greater dose of mercury per unit of body weight. Children tend to be shorter in stature than adults, thus their breathing zone is nearer the floor where higher mercury levels are typically found. Given that mercury affects the nervous system and that the neuropathways of children (<15 years old) are still developing, children

can sustain permanent damage if the mercury exposure attains toxic levels during critical growth periods.

Children who inhale significant levels of metallic mercury vapors may develop a disorder known as acrodynia, or “pinks disease.” The symptoms of this disorder include severe leg cramps; irritability; and abnormal redness of the skin, followed by peeling of the hands, nose, and soles of the feet. Itching, swelling, fever, fast heart rate, elevated blood pressure, excessive salivation or sweating, rashes, fretfulness, sleeplessness, and/or weakness may also be present. This disorder may occur, in some cases, when exposure lasts for only a few days. The levels found at this residence are not expected to cause these symptoms.

MDCH determined the location of the elevated mercury concentrations, after the initial remediation measures, were mainly in the master bedroom. MDCH estimates that child exposure was short-term (<30 days) and on average not extraordinary. ATSDR cites researchers concluding "recovery from chronic elemental mercury intoxication may be complete when patients are removed early from the (mercury) exposure environment" (ATSDR 1999). Considering the combined set of circumstances, MDCH concluded that the duration and amount of exposure to the child was minimal and that the remediation actions prevented the possibility of long-term elevated exposure.

CONCLUSIONS

At the time of the spill, MDCH deemed the event an urgent public health hazard given the presence of children, length of exposure, toxicity of mercury and MDCH’s experience with similar mercury spills. Since the mercury spill has been properly remediated, no current public health hazard exists in relation to this mercury spill event at this home.

RECOMMENDATIONS

MDCH recommended the following actions:

1. Remove section of carpet and padding onto which the mercury was released and clean the surface of the sub-flooring.
2. Remove and bag for testing and possible disposal any clothes or shoes that may have become contaminated.
3. Remove any contaminated furniture to a well ventilated, non-living space (i.e., garage).
4. Render vacuum cleaner unusable and send to a landfill.
5. At a minimum, remove an additional two feet of carpet and padding extending beyond the already removed section and clean sub-floor.
6. Place potentially contaminated clothes and furniture outdoors on warm sunny spring days for a couple of weeks prior to placing the items back into the home.

PUBLIC HEALTH ACTION PLAN

MDCH provided occupants with verbal recommendations to begin cleanup of the mercury spill.

MDCH conducted a site visit after initial cleanup actions to ensure all sources of mercury were removed and that concentrations were below the ATSDR clearance value.

MDCH assisted the local health department by lending them a mercury vapor analyzer and providing onsite training.

MDCH provided occupants additional verbal recommendations followed by a letter detailing those recommendations.

MDCH determined that no further actions are necessary at this time.

MDCH remains available to address any public health questions or concerns regarding this contamination event. Please contact the Michigan Department of Community Health, Division of Environmental and Occupational Epidemiology at 1-800-648-6942.

PREPARERS OF THE REPORT

Michigan Department of Community Health
Division of Environmental and Occupational Epidemiology

Kory J. Groetsch, M.S., Health Assessor / Educator

Brendan Boyle, M.P.A., Health Assessor

Christina R. Bush, M.S., Toxicologist/ Health Assessor

Linda D. Dykema, Ph.D., Toxicologist

ATSDR Regional Representative

Mark Johnson
Regional Services, Region V
Office of the Assistant Administrator

ATSDR Technical Project Officer

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

REFERENCES

ATSDR. 1999. Toxicological Profile for Mercury, Update. Agency for Toxic Substances and Disease Registry. Atlanta, GA.

ATSDR. 2000. Suggested Action Levels for Indoor Mercury Vapors in Homes or Businesses with Indoor Gas Regulators. Agency for Toxic Substances and Disease Registry. Atlanta, GA.

CERTIFICATION

This St. Louis Residential Mercury Spill 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, SPS, 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