

HEALTH CONSULTATION

PETERSBURG MERCURY SITE

PETERSBURG, MONROE COUNTY, MICHIGAN

Prepared By:

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



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## Summary

A citizen called the Michigan Department of Community Health (MDCH) Toxics and Health Hotline to report finding a relatively large amount of mercury on a workbench in the basement of her home. After giving the resident some initial advice, state and local health agency representatives visited the home and found high levels of mercury vapor throughout the home, especially in the area of the home where visible beads were seen. None of the family members living there knew how long ago the spill may have occurred or the source of the mercury. The health agencies requested the assistance of the U.S. Environmental Protection Agency in responding to the spill. They also made recommendations that included evacuating the home during remedial activities and biologic testing of anyone who had spent significant time in the home. The EPA actions returned the home to a safe living environment, and the residents were allowed to reoccupy it.

## Background

On June 20, 2006 a resident of the small town of Petersburg in southeastern Michigan called the Michigan Department of Community Health (MDCH) regarding a possible elemental mercury spill in her basement. She had called the Poison Control Center in Detroit, and they had referred her to MDCH. She described what sounded like elemental mercury beads on a wooden workbench in her basement but added that her family thought they were beads of solder or shot from shotgun shell reloading supplies. MDCH questioned her about how the beads behaved when touched with an object. Based on her response, MDCH decided she did have a mercury problem. MDCH suggested the family relocate the 3 year old boy who lived there half-time to his father's home until the home could be investigated. MDCH called the Monroe County Health Department (MCHD) and made arrangements to have a representative meet them at the house on the morning of June 22.

MDCH and the local health representative arrived at the home on the 22<sup>nd</sup> and started sampling with the state's Lumex® RA 915+ Mercury Vapor Analyzer that was acquired with funds from a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). The Lumex has a detection limit of 2 nanograms of mercury per cubic meter of air ( $\text{ng}/\text{m}^3$ ) and a real time measurement response that displays readings at 1-second intervals. The initial measurement taken immediately inside the home's front door registered  $4,367 \text{ ng}/\text{m}^3$  in the breathing zone. This is well above background and more than four times the level ATSDR and MDCH consider safe for residential settings. The health agencies continued to screen the house, and a summary of the readings are listed in Table 1.

In basement of the home there is a finished family room area with a utility work and storage area off to the side (Figure 1). On a workbench in the latter the investigators saw visible beads of mercury, ammunition shot, and solder on a wooden surface (Figure 2 and 3). The area around the workbench and the floor underneath it were giving off mercury vapors that ranged in concentration from 13,000 to 49,000  $\text{ng}/\text{m}^3$ . Other readings

indicated a pattern of tracked mercury throughout the home that had concentrated in some areas such as carpeting in the main traffic pathways and staircases.

**Table 1. MDCH Lumex Readings Taken on June 22, 2006 during Petersburg Mercury Site Field Visit**

<b>Location</b>	<b>Reading</b>
Inside front door BZ	4,367
Dining Room BZ	4,845
Hallway BZ	4,678
Bedrooms (3) range BZ	4,008 to 4,280
Carpet, Top of Basement steps*	6,000 to 11,562
Carpet, bottom of basement steps*	22,000
Finished Basement Room BZ	11,000
Workbench Room BZ	13,000
Beads on workbench	18,000
Floor beneath workbench	49,000

All measurements are in nanograms of mercury per cubic meter of air (ng/m<sup>3</sup>),

Average temperature 73<sup>0</sup> F

BZ = breathing zone, three to four feet above the floor

\*measurement taken 2 inches above the floor

MDCH interviewed family members in-person and on the phone. None of them had any knowledge where the mercury had come from or how long it was present in the home. MDCH and local health determined that the scope and extent of the contamination were beyond the capability of the adult occupants, a mother and her twin 23 year-old daughters, to clean up. They recommend that the family contact their home insurance agent to see if their policy coverage might include the services of professional environmental contractors to remediate the mercury. MDCH wrote a letter to the insurance agency to document the environmental hazard and explain why occupancy was not possible until the hazard was removed.

When it became clear the following day that the insurance company would not cover the remediation, MDCH and the local health agency requested the assistance of the U.S. Emergency Protection Agency Emergency Response Branch located in Gross Isle, Michigan. They agreed to respond to the mercury spill that was contaminating the home and ultimately venting vapors to the outdoor environment. The county health agency sent a notice letter to the family to evacuate the home and not visit or occupy it until the home passed a clearance test indicating it was habitable.

The EPA, with the help of the Monroe County Health Department, characterized the mercury contamination in the home and sampled individual articles of clothing and household furnishings. They found readings as high as 80,000 ng/m<sup>3</sup> in various areas of the home. The spill investigation lead to the screening of two additional homes where one of the occupants spent a considerable amount of time. Neither additional home nor any of the vehicles used by the Teal Street residents or frequent visitors to the house showed any significant mercury contamination or required remediation.

A contractor, under the supervision of the EPA, removed the liquid mercury from the basement work area, and then heated and ventilated the entire house. Mercury vapor levels on the main floor of the house returned to acceptable levels, but unacceptably high vapors persisted in the basement work room. The contractor subsequently removed the uppermost layer of concrete floor in the work room that was contaminated with mercury, and again heated and ventilated the house. Clearance testing performed by the contractor on July 7, 2006, indicated that the mercury vapor concentration throughout the house was below the 1000 ng/m<sup>3</sup> level considered safe for residential occupancy (EPA 2006.) The Monroe County Health Department notified the family that it was safe to reoccupy the home.

## Discussion

MDCH frequently receives requests to assist with elemental mercury spills and is prepared to help in several ways. Staff can quickly fax or email procedural guidance to the caller which includes information on addressing small or large spills, sample press releases, sample letters to parents, patients, and employees. MDCH's response can include bringing in and coordinating the resources of other agencies such as ATSDR, the U.S. EPA Emergency Response Branch, and the Michigan-based Poison Control Centers. MDCH can also give guidance on containing the spill, managing the cleanup, and evaluating the need for biological sampling of exposed and potentially exposed people. We have assisted local health departments in drafting letters to home and business owners after the event for insurance coverage purposes.

The main routes of exposure for elemental mercury are ingestion, dermal absorption, and inhalation of mercury vapors. Of the three, inhalation is the most hazardous route, particularly to children and women of childbearing age (ATSDR 1999).

Inhalation of high levels of elemental mercury can cause permanent neurological damage and kidney impairment. The Agency for Toxic Substances and Disease Registry (ATSDR) recommends that breathing zone mercury levels not exceed 1,000 nanograms of mercury per cubic meter of air (ng/m<sup>3</sup>) for long term exposures as would be likely in a residence (1). This recommended level is based on both animal studies and human epidemiology studies that describe the health effects of inhalation of mercury-contaminated air. Workers who were exposed to mercury vapors in an occupational setting exhibited hand tremors, increases in memory disturbances, and slight subjective and objective evidence of autonomic nervous system dysfunction. The ATSDR minimal risk level (MRL) for mercury in air was derived from the lowest observed adverse effect level (LOAEL) of 26,000 ng/m<sup>3</sup> from this study. Because workers were only exposed during working hours, the LOAEL was adjusted to account for continuous exposure. The resulting value was divided by an uncertainty factor of 10 to protect sensitive human subgroups and by a factor of 3 because a LOAEL was used rather than a no observed adverse effect level (NOAEL). The resulting MRL is 0.2 micrograms per cubic meter (ug/m<sup>3</sup>) or 200 ng/m<sup>3</sup>. An MRL is defined as an estimate of the daily exposure level to a hazardous substance that is likely to be without appreciable risk of adverse, non-cancer

health effects. ATSDR and MDCH guidance recommends that the breathing zone of a residence not exceed a mercury vapor concentration of 1000 ng/m<sup>3</sup> once the home has been remediated and ventilated. If levels exceed that guidance number, there needs to be additional cleanup to remove residual source mercury and mercury vapor (ATSDR 2000).

Although MDCH recommended that all family members have their blood and urine tested for mercury as soon as possible and even supplied the Monroe County Health Department with kits for sample collection, the documentation collected afterward indicated that only one adult and the sole child were tested. The residents submitted samples on July 12, 2006, twenty days after their exposure was terminated by their evacuation from the home. Based on the fragmentary laboratory records made available to MDCH, it appears the one adult and child did not show blood or mercury level outside the reference ranges reported by the laboratories (Less than 5 ug/L urine, 10 or less ug/L for blood).

**Table 2. Biological Test Results for Residents at the Petersburg Site**

	Urine in ug/L	Blood in ug/L
<b>Child</b>	< 0.15 (non detect)	< 4
<b>Adult</b>	1.3	Not available

The residents volunteered qualitative observations that after they were evacuated from the house, they started to feel better. One of the daughters, who was taking classes, related that she had been having problems studying and sleeping, and all that cleared up considerably after the exposure was terminated (Boyle 2006).

#### Addressing the Unique Vulnerabilities of Children

Children may be at greater risk than adults from certain kinds of exposure to hazardous substances at sites of environmental contamination. They engage in activities such as hand-to-mouth behaviors that increase their exposure to hazardous substances. They are shorter than adults, which means they breathe dust, soil, and vapors close 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).

Children who breathe metallic mercury vapors for an extended period of time 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 also occur in teenagers and adults. Exposure to mercury vapors is more dangerous for children than for adults, because inhaled mercury vapors easily pass into the brain and nervous system of young children and may interfere with the development process. Exposure to high

levels of mercury vapor can also cause lung, stomach, and intestinal damage. Death due to respiratory failure can result in cases of extreme exposures (3).

The 3-year-old boy in this home spends alternate weeks in this home and in his father's home. Of all the family members present, he would be the one most at risk from a mercury vapor atmosphere. Blood and urine samples submitted by the child did not show mercury levels above concentrations that would require treatment. Mercury vapor levels in the entire home are below 1000 ng/m<sup>3</sup> following EPA clean up efforts and the child is at no further risk from mercury exposures related to this incident.

## **Conclusions**

The Petersburg home was considered an **Urgent Public Health Hazard** because mercury vapor was present at concentrations that can cause adverse health effects after short-term exposure. The situation was exacerbated by the unknown length of exposure of residents to the mercury and called for immediate intervention to prevent serious health effects and perhaps permanent damage. Based on the blood and urine sample results as well as the successful cleanup, the home now poses no apparent public health hazard with respect to mercury.

## **Recommendations**

During the course of the investigation, MDCH recommended the following:

- Vacate the home until clearance testing shows it to be safe for occupancy.
- Have an environmental professional thoroughly characterize the contaminated areas of the home and clean it for mercury.
- Remove and appropriately dispose of carpet, padding, vacuum cleaner and other contaminated materials.
- Test other suspect household items for contamination.
- All family members and frequent guests should have blood and urine test for mercury vapor since the duration of exposure was unknown.

## **Public Health Action Plan**

The MDCH screened the home, identified the hazard, investigated the options to address the circumstances, and requested the assistance of the U.S. EPA Emergency Response Branch.

The MCHD initiated the order for the residents to vacate the home until it was cleaned of mercury contamination.

The MDCH and the MCHD referred the residents and others to their physicians for testing and arranged urine testing through the MDCH laboratory.

The MDCH documented the contamination for the homeowner's insurance agent in an attempt to have the remediation work covered.

The EPA characterized the contamination in the home and alternate sites, removed contaminated materials, and cleaned the house to acceptable levels indicated by clearance testing. EPA recommended additional ventilation of the home for one month as weather permitted.

The MCHD removed the occupancy restriction once the remedial work and clearance testing were completed.

The MDCH will remain available as needed for future consultation at this site.

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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## References

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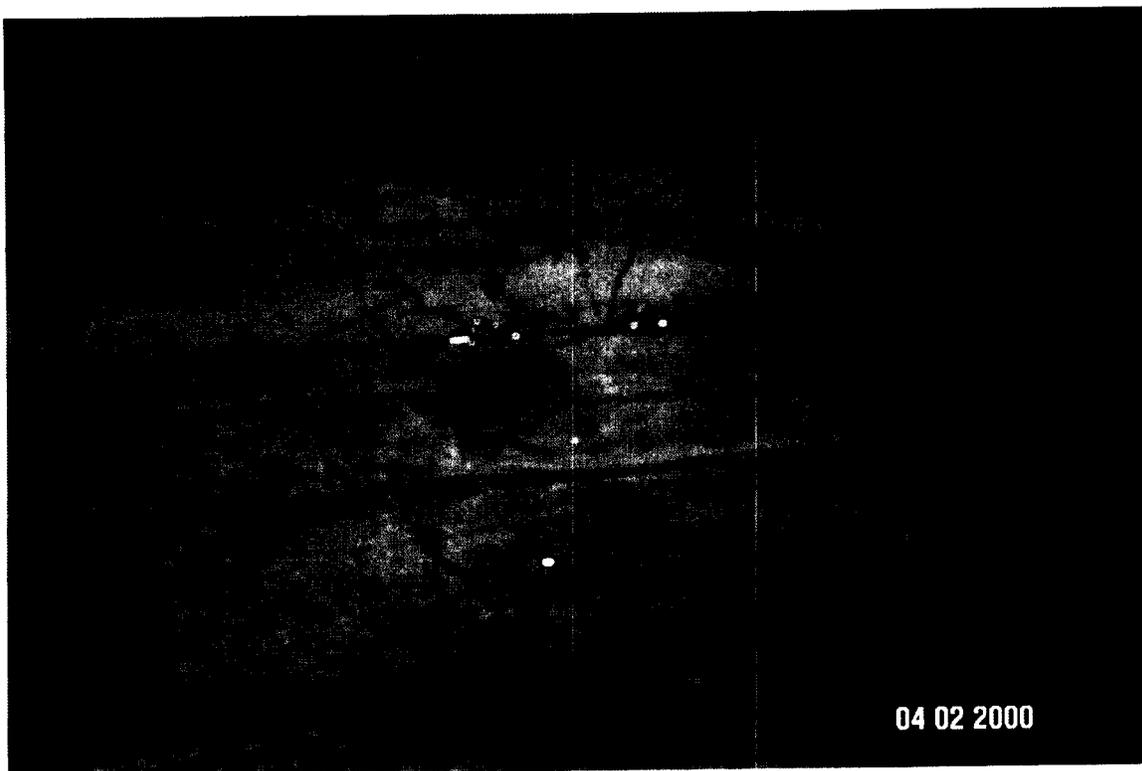


Figure 1. Basement Storage Area and Work Room at the Petersburg Mercury Site





Figure 2. and 3. Workbench at the Petersburg Mercury Site





## Certification

This Petersburg Mercury Site Public 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.

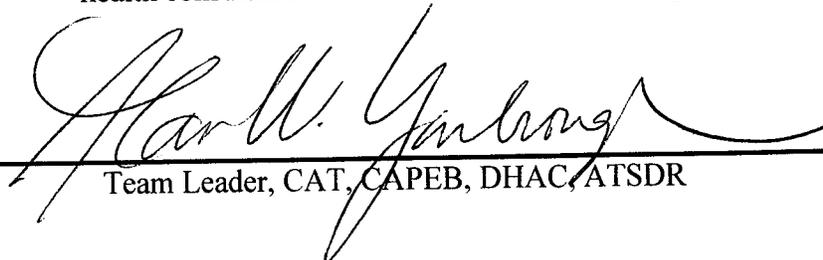
Editorial review was completed by the Cooperative Agreement Partner.



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



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Team Leader, CAT, CAPEB, DHAC, ATSDR

