

Health Consultation

EASTERN CLINIC MERCURY SPILL
GRAND RAPIDS, KENT COUNTY, MICHIGAN

NOVEMBER 5, 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

EASTERN CLINIC MERCURY SPILL
GRAND RAPIDS, KENT COUNTY, MICHIGAN

Prepared by:

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

Background and Statement of Issues

On July 18, 2003, a wall-mounted sphygmomanometer fell to the floor in an examining room of the Eastern Clinic (EC), located in Grand Rapids, Michigan. Elemental mercury spilled from the device onto the carpet. The physician who owns the clinic contacted the Poison Control Center (PCC) in Grand Rapids. The Kent County Health Department (KCHD) also provided the doctor clinical advice regarding cleaning up the spill and other measures necessary to make the room and surrounding areas usable once again. As of July 29, 2003, the doctor and his office manager had not carried out PCC's and KCHD's recommendations, and concerned clinic staff called the Michigan Department of Community Health for assistance.

After consulting with the agencies already involved, a staff member from MDCH's Toxicology and Response Section called the physician. They discussed the health hazards associated with the vapors that emanate from elemental mercury, especially in small enclosed areas. The doctor explained that he had been gathering information on sphygmomanometers and mercury from a number of sources, including the Internet. He had not acted upon PCC's and KCHD's cleanup advice and recommendations because the other sources had led him to believe that the mercury used in the device was less toxic and more easily managed than the health agencies had told him. The MDCH representative offered to visit the clinic that day and bring a Lumex RA 914+ Mercury Vapor Analyzer to characterize the impacted areas of the facility, and the doctor accepted.

MDCH, accompanied by the Environmental Health Director of the local health department, visited the clinic that afternoon after business hours. The office manager and the owner were there, and the four discussed the implications of mercury contamination before the start of sampling. The doctor was referring to literature he had downloaded from the W.A. Baum Co. Inc. website. This company manufactured the sphygmomanometer that had broken in the examining room. The doctor had thought the advice from PCC and KCHD was inaccurate, and he had concluded that their recommendations were unnecessarily complex compared to the simpler cleanup measures described by W.A. Baum Co. Inc.

MDCH asked the doctor to consider the results of the real time sampling equipment that he was willing to use rather than rely on the literature he considered neither accurate nor applicable to the specific situation present in the clinic. After coming to an agreement to allow screening of the clinic, the doctor led the health representatives on a tour of the entire building starting in basement storage areas. The team conducted air sampling of the breathing zones of many individual rooms (Table 1).

At the conclusion of the building screening, the health agency representatives shared the data and made recommendations to the doctor and the office manager. MDCH followed up with a letter (Attachment A) the next day. The doctor eventually engaged the services of an environmental contracting firm, which came in to characterize and remediate the spill and tracked-around mercury.

When MDCH contacted the firm to obtain a copy of the clearance testing data, however, the representative learned that clearance testing was never done. At the conclusion of the cleaning, a

contractor employee scanned the various locations at the request of the doctor using a Jerome mercury vapor analyzer. This device is not sufficiently sensitive to detect very low levels of mercury vapor accurately, especially when reporting levels below 10 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The contractor said he had explained this limitation to the doctor, yet the doctor felt testing with the Jerome meter was sufficient and refused to have them perform the modified NIOSH 6009 clearance test, which is the standard clearance for commercial properties.

Discussion

Human Exposure Pathways

Dermal contact with and ingestion of elemental mercury are not significant human exposure pathways for the Eastern Clinic mercury spill. Inhalation of mercury vapors was the major concern of the health agencies, especially in the still-very-contaminated second floor examining room. When MDCH visited on July 29, 2003, high levels were detected in the second floor exam room. In addition, the room was crowded with equipment and furniture that also may have been contaminated.

The business of the Eastern Clinic is service to substance-abuse patients. Patients and the staff who serve them come to the clinic most days for testing and maintenance doses of medication. How often and for what duration patients and staff spend time in the examining room on the second floor is unknown. However, on the basis of the breathing zone levels found there during building screening, MDCH regards spending even a short period of time in the room as inadvisable.

Toxicologic Evaluation

Chronic inhalation of high levels of elemental mercury can cause permanent neurological damage and kidney impairment. ATSDR recommends that breathing-zone mercury levels not exceed $1,000 \text{ ng}/\text{m}^3$ for long-term exposures, as would be likely in a residence (1). ATSDR developed this level on the basis of animal studies and human epidemiology studies.

In one study, workers 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. ATSDR derived its minimal risk level (MRL) for mercury in air from the lowest observed adverse effect level (LOAEL) of $26,000 \text{ ng}/\text{m}^3$ in this study. 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.

Because workers were exposed only during working hours, the LOAEL was adjusted to account for continuous exposure. MDCH divided the resulting value by an uncertainty factor of 10 to protect sensitive human subgroups, and by a factor of three because the study used an LOAEL rather than a "no observed adverse effect level" (NOAEL). The resulting adjusted MRL is $0.2 \text{ micrograms per cubic meter } (\mu\text{g}/\text{m}^3)$ or $200 \text{ ng}/\text{m}^3$. The ATSDR recommended value for residential setting of less than $1000 \text{ ng}/\text{m}^3$ is an action level that, if exceeded, would signal the need for further clean up or other remedial action. ATSDR recommends a re-occupancy action

level of 3,000 ng/m³ following an effective remediation and ventilation of a contaminated commercial setting where mercury is not usually handled.

The main routes of exposure for elemental mercury at this site 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. Inhalation of high levels of elemental mercury can cause permanent neurological damage and kidney impairment (ATSDR 1999).

In the Eastern Clinic Mercury incident, investigators were most concerned about indoor air exposure. Short-term exposure (hours) to high levels of metallic mercury vapor in the air can damage the lining of the mouth and irritate the lungs and airways, causing tightness of the chest, a burning sensation in the lungs, and coughing (ATSDR 1999).

Addressing the Unique Vulnerabilities of Children

Children may be at greater risk than are adults from certain kinds of exposure to hazardous substances at sites of environmental contamination. They engage in activities such as playing outdoors and hand-to-mouth behaviors that increase their exposure to hazardous substances. They are shorter than adults, which means they breathe dust, soil, and vapors closer to the ground. Their lower body weight and higher intake rate may result 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.

Children who breathe metallic mercury vapors for an extended period 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 weakness may also be present. This disorder may also occur in teenagers and adults. Exposure to mercury vapors is more dangerous for children and pregnant women than for other adults because inhaled mercury vapors pass easily into the brain and nervous system of young children and fetuses and may interfere with the development process. Exposure to high levels of mercury vapor can also cause lung, stomach, and intestinal damage. Respiratory failure and death can result in cases of extreme exposures (2).

The patients of the clinic and the staff that attend them are possibly women of childbearing age and pregnant women. Children sometimes accompany a patient to an appointment. The level of mercury vapor detected in the 2nd floor examining room and in the tracked-out contamination areas of carpet leading from that room could present an acute exposure opportunity for children and others similarly sensitive to mercury.

Conclusions

MDCH determined the Eastern Clinic mercury spill situation to be an Urgent Public Health Hazard at the time of the spill because the levels detected in the breathing zone of the 2nd floor examining room exceed the occupational American Conference of Government Industrial Hygienists (ACGIH) threshold limit value of 25 ug/m³. The Eastern Clinic is not a setting where

workers or patients would expect to be working in the presence of mercury, nor would they have the personal protective equipment and medical monitoring those in a regulated industry would be expected to have. MDCH has also determined that the indoor air concentrations in the contaminated areas must not exceed 3 ug/m³ (3,000 ng/m³) after all source mercury has been removed and the areas have ventilated and stabilized prior to testing. Since an environmental firm was brought in to remediate the spill, the hazard has probably diminished. However, this site is currently classified as posing an “indeterminate hazard” since post-remedial clearance testing has not yet been conducted.

Recommendations

After the screening was conducted on July 29, MDCH made four verbal recommendations to the doctor and his clinic manager. The representative also recorded the recommendations on a mercury investigation report, including readings and locations, that the doctor copied on the office copier. These recommendations included the following:

- Secure the room and seal the space at the door bottom.
- Get professional environmental cleanup that will
 1. Characterize the contamination;
 2. Remediate and ventilate the (impacted) areas and perform clearance testing;
 3. Send a copy of the clearance test results to D. Kracker or K. Overmeyer at the Kent County Health Department.

Upon return to the MDCH office in Lansing, the representative sent a letter to the doctor reiterating the aforementioned recommendations and adding three additional points:

- Shoes worn into the room after the spill should be sealed in a plastic bag so the contractor can test them to determine if they are safe;
- Have vehicle carpets tested also;
- Anyone exposed to high levels of mercury vapor in the examining room and is concerned about their health may want to have a blood test.

Public Health Action Plan

Actions Completed:

1. MDCH and the Kent County Health Department (KCHD) performed a preliminary screen of the Eastern Clinic for mercury vapor subsequent to a spill.
2. MDCH made specific recommendations regarding restricting access to contaminated areas of the building and cleanup activities that needed to be performed before those areas could be used for commercial purposes.
3. MDCH followed up to ascertain what was done in response to the recommendations.
4. MDCH provided information regarding mercury toxicity, health effects, and biological testing to employees of the Eastern Clinic, the office manager and the physician who owns the facility.

5. MDCH referred the W.A.Baum Co. Inc. website, www.wabaum.com, to EPA for their review of the information offered there regarding mercury toxicity and spills management.

Actions to be Completed:

1. KCHD will follow-up to ensure the affected parts of the facility are safe for reuse.

Contact Information

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

Report Prepared by

Michigan Department of Community Health

Brendan Boyle
Health Assessor/Community Involvement Specialist

Agency for Toxic Substances and Disease Registry

Mark Johnson
Office of Regional Operations, Region V
ATSDR Technical Project Officer
Alan W. Yarbrough
Division of Health Assessment and Consultation
Superfund Site Assessment Branch

References

1. Agency for Toxic Substances and Disease Registry. Suggested action levels for indoor mercury vapors in homes or businesses with indoor gas regulators. Atlanta: US Department of Health and Human Services; 2000
2. Agency for Toxic Substances and Disease Registry. 1999. Toxicological profile for mercury, update. Atlanta: US Department of Health and Human Services; 1999. Report No.
3. Personal Correspondence, Brendan Boyle, MDCH, July 30, 2003

Eastern Clinic Mercury Spill Data

Collected on July 29, 2003

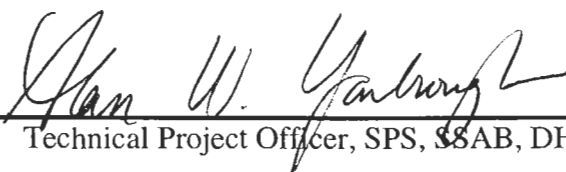
Location	Level	Reading (ng/m ³)*
Outdoor at front door	Breathing zone (BZ) (3 to 4 feet off the ground surface)	15
Building entryway	BZ	334
Patient waiting room	BZ	252
Floor mat entry area	Floor level (FL)	338
Copy/fax machine	BZ	825
Top of stairs to 2 nd Floor	BZ	934 to 1350
Upper office center	BZ	1700 to 1705
Office front at corridor	BZ	622
Office front at N. corridor	BZ	440
2 nd Floor examining room	BZ	42,000
3 rd Floor storage area	BZ	151
Threshold carpet outside 2 nd floor examining room	FL	10,000
Stair (top) threshold	FL	1758
Vacuum cleaner		room background
Basement	BZ	237
South Basement hall	BZ	258
South basement room	BZ	196
Basement phone area	BZ	179
Basement area east	BZ	198
Basement area southeast	BZ	196
Outdoor sample	BZ	33

* The data is recorded in nanograms per cubic meter.

- Elevated levels are noted with shading.

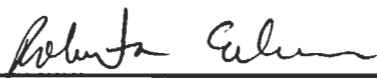
Certification

This *Eastern Clinic 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), an agency within the U.S. Department of Health and Human Services. 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.



Chief, State Programs Section, SSAB, DHAC, ATSDR

Attachment A

Dr. Leon Smith
The Eastern Clinic
1555 Eastern S.E.
Grand Rapids, Michigan 49507

Dear Dr. Smith:

Yesterday, July 29, 2003 I visited your clinic to investigate a mercury spill that resulted from the breakage of a wall mounted sphygmomanometer on July 18, 2003. With me was Dave Kraker, the Environmental Health Director for the Kent County Health Department. Mr. Kraker recorded the readings that I was getting using the Michigan Department of Community Health's Lumex RA 915+ ® mercury vapor analyzer.

With your help, we briefly sampled what appeared to be every room and storage place in the building in which your Eastern Clinic is housed. I gave you a copy of the recorded readings after the walk-through was complete and am enclosing another that includes the recommendations I gave you before we left.

Those recommendations included:

1. Securing the second floor examining room that showed mercury vapors up to 42,000 nanograms per cubic meter of air, and all the furniture and fixtures within it until it is remediated.
2. Restrict access to the carpet immediately outside the door of the above mentioned room since air sampling indicated that track-out of mercury from the examining room's carpet had occurred. Plastic sheeting 4 foot square taped to the carpet will suffice temporarily.
3. Engage professional environmental contractors to characterize all possibly affected areas, remediate all source mercury areas, ventilate the cleaned areas, and perform clearance testing to determine if the areas are acceptable for reuse.
4. Provide the Kent County Health Department representative, either Mr. Overmeyer or Mr. Kraker, with information regarding the remediation and a copy of the a clearance testing results.

Any shoes that were worn into the room after the spill should be sealed in a plastic bag so the contractor can test them to determine if they are safe or need to be disposed of. Similarly, I suggest you have your vehicles' carpets tested also. Anyone that was exposed to the high levels of mercury vapor in the examining room and is concerned about their health might want to have a blood test.

If I can help you further, please call me at the number indicated on my business card.

Sincerely,

Brendan Boyle, Departmental Specialist

cc: Linda Dykema
Dave Kraker
Kurt Overmeyer
Daryl Smith