Health Consultation

BUCKLEY SCHOOL MERCURY SPILL

BUCKLEY, WEXFORD COUNTY, MICHIGAN

MAY 25, 2001

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

BUCKLEY SCHOOL MERCURY SPILL

BUCKLEY, WEXFORD 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 January 18, 2001, the Michigan Department of Community Health received a request for assistance from the Buckley Community School in Buckley, Wexford County, Michigan, regarding a spill of elemental mercury that had occurred on January 15. The amount of mercury spilled was unclear because estimates by people who witnessed the spill and the events that occurred afterwards were very different. The mercury had been in the school's science room and was taken to the school library where it was spilled onto a counter and then onto a carpeted floor. A student then stepped on one of the mercury puddles on the floor, further scattering it on the carpet of the library. Further characterization conducted later in the investigation revealed that some carpeted areas of hallways between the rooms were also contaminated.

The school staff initially attempted to pick up the mercury using cardboard or similar scooping material, and then used a vacuum to clean up the remaining visible beads. At the time of the initial call, MDCH staff advised the school administration to render this vacuum inoperable and to place it in a plastic bag in a secure location because it too was now contaminated. They also suggested that all areas suspected of being contaminated be isolated from students and faculty and try to limit any air exchanges between contaminated rooms and adjacent unaffected areas. MDCH contacted District Health Department #10 and the U.S. EPA Emergency Response Branch to ask for their assistance in investigating the incident and advising the Buckley Community School administrators regarding the additional clean up needed.

Discussion

Calls for assistance on residential and school mercury spills occur with regularity at the MDCH/DEOE. The calls often involve households, schools and facilities where young children are present. The possible routes of exposure to mercury include inhalation, ingestion, and dermal absorption; however, inhalation of mercury vapors is the primary route of concern.

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 ng/m^3 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) from this study of 26,000 nanograms of mercury per cubic meter of air (ng/m^3). 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

($ug/m^{3)}$ or 200 ng/m^3. An MRL is defined as an estimate of the daily exposure level to a hazardous substance that is likely to without appreciable risk of adverse, non-cancer health effects. 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.

The route of exposure of concern following this incident was inhalation of mercury vapor volatizing from residual beads of mercury on surfaces that included a counter, a tile floor and various carpeted surfaces in the school. MDCH was also concerned about the clothing of people that were directly involved in the spill or walked through contaminated areas and might have tracked mercury elsewhere with their shoes. The EPA assigned their contract technicians to help characterize the areas of contamination, and the school engaged the services of an environmental contracting firm to remove carpet and other contaminated materials. The school's contractor came to the Buckley School on Saturday, January 20 and removed carpeting and other items identified as being contaminated. He was most experienced with mercury clean-ups in industrial occupational settings. The contractor did not have any of the solutions typically used to suppress mercury vapors and to finish cleaning the surfaces where the carpet had been. He was also not equipped to conduct the type of sensitive clearance testing for mercury that would determine which areas were safe to reoccupy for a non-industrial use with children present. The EPA technician helped identify the most heavily contaminated materials. As a result, 5 pairs of shoes, approximately 400 square feet of carpet, one computer, 4 vacuum cleaners, and three 5-ounce containers of mercury were removed from the school and disposed of at the Drug and Laboratory Disposal, Inc. facility in Plainwell, Michigan (2).

The initial remedial activities that were done did not clean the affected areas to a sufficient degree to ensure the 1 to 3 ug/m^3 in the breathing zone levels recommended by MDCH and the federal Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR recommended this range rather than the lower residential target level because no child or adult is present at the school enough hours of a week to equal a potential residential exposure.

After the initial clean up was conducted, MDCH participated in a conference call with the school officials and custodial staff, the EPA, their contractors, environmental health representatives of District Health Department #10 Health Department, and the Wexford County Emergency Services Director. MDCH and EPA recommended that the school engage another contractor capable of additional clean-up and more sensitive testing for the affected areas. MDCH recommended the NIOSH 6009 clearance protocol, which uses a pump and tube sampling method, for the clearance test that would assure the areas affected and cleaned were safe for reuse.

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

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 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.

Children who breathe metallic mercury vapors may develop a disorder known as acrodynia, or pink skin. 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 hear 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).

Given the levels of mercury detected and the number and age of the children who would frequent the school, MDCH was particularly concerned that no residual mercury remains that could constitute contaminated "hot-spots" and also contribute to breathing zone levels.

Conclusions

The following conclusions were made at the time of the initial report:

According to the EPA technician's screening, mercury was present at levels ranging from 40 to 230 times the background level, or 0.8 to 4.6 $\mu g/m^3$ (background was 20 nanograms per cubic meter measured outside the building) in the breathing zones of the affected rooms and hallways and 40 to 850 times background, or 0.8 to 17$\mu g/m^3$ near the floors (4). All the mercury vapor measurements were taken using a Lumex RA915+ Mercury Analyzer. The Buckley Community School situation was then considered an Urgent Public Health Hazard.

After the second round of clean up on January 24 the school was tested once more with the Lumex and on January 26 the NIOSH 6009 clearance test was performed. The results of this test indicated breathing zone levels in the affected areas had been reduced to less than 0.05 $\mu g/m^3$, well below the acceptable levels recommended for reuse of the rooms and halls. At the time these results were reported to MDCH, the school was determined to be no public health hazard.

Recommendations

The following recommendations were made in the course of the investigation by MDCH:

1. Isolate the areas and objects known to have been impacted by mercury contamination.
2. Engage contractors to characterize, clean up and clearance test all potential areas of human exposure to mercury including the homes and vehicles possibly associated with tracked-out mercury.
3. Notify students, parents, and any others who may need to know of what had happened and what was being done in response. Offer them and their physicians the opportunity to contact MDCH if they had questions relating to exposure, health effects or biological testing.

These recommendations were implemented, and no further action is necessary at this site.

References

1. ATSDR (Agency for Toxic Substances and Disease Registry). 2000. Suggested Action Levels for Indoor Mercury Vapors in Homes or Businesses with Indoor Gas Regulators.

2. Gregg, David, District Health Department #10. Letter to Mr. Wes Vandenberg at the Buckley School, January 22, 2001

3. ATSDR (Agency for Toxic Substances and Disease Registry). 1999. Toxicological Profile for Mercury, Update.

4. Dollopf, Ralph, OSC, U.S. EPA Emergency Response Branch, Pollution Report January 23, 2001.

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CERTIFICATION

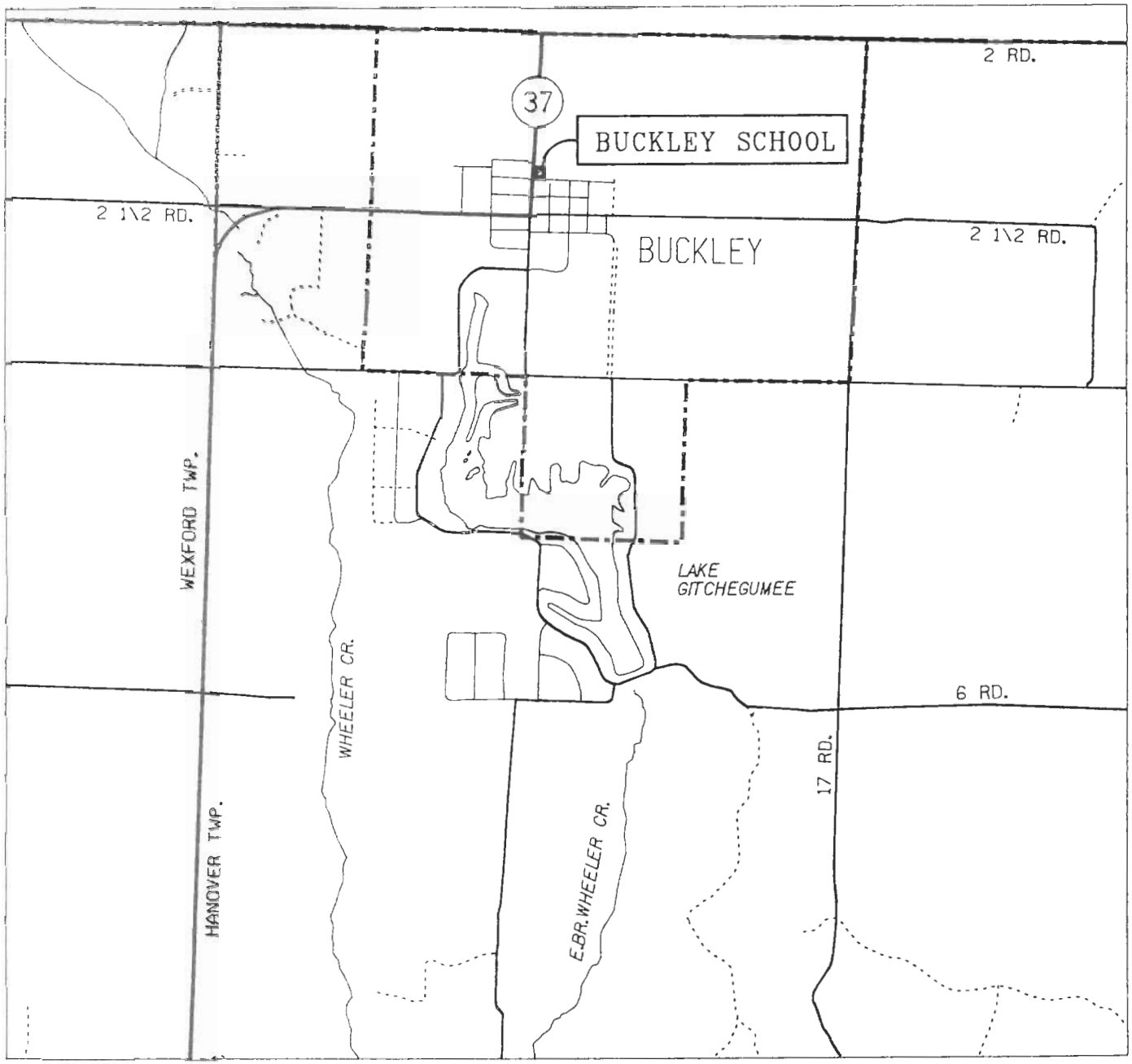
This Buckley School Mercury Spill Health Consultation was prepared by the Michigan Department of Community Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health 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.

Chief, State Program Section, SSAB, DHAC, ATSDR

Figure 1.



BUCKLEY SCHOOL

WEXFORD COUNTY, MICHIGAN

SCHOOL LOCATION

- INTERSTATE HIGHWAYS (496)
- U.S. HIGHWAYS (2)
- STATE HIGHWAYS (55)
- OTHER MAJOR ROADS
- MINOR ROADS
- TWO-TRACK ROADS
- AIRPORTS
- GRASS AIRSTRIPS
- RAILROADS
- ABANDONED RAILROADS
- RIVERS AND STREAMS
- INTERMITTENT STREAMS
- POLITICAL BOUNDARIES
- SCHOOL

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MILES

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Michigan Department of Community Health

Base map information provided by Michigan Department of Natural Resources, MIRIS Program

05/09/2001