

Health Consultation

FORSYTH PUBLIC MIDDLE SCHOOL MERCURY SPILL

FORSYTH, TANEY COUNTY, MISSOURI

EPA FACILITY ID: MON000706048

**Prepared by the
Missouri Department of Health and Senior Services**

DECEMBER 16, 2009

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PURPOSE

On August 18, 2009, the Missouri Department of Natural Resources (DNR) requested that the Missouri Department of Health and Senior Services (DHSS) provide health-based assistance for a mercury spill at the Forsyth Public Middle School. In response to this request, DHSS staff assisted the DNR and the U.S. Environmental Protection Agency (USEPA) with cleanup recommendations and use restriction recommendations. This health consultation summarizes the public health response to this action.

BACKGROUND AND STATEMENT OF ISSUES

On August 18, 2009, DNR notified DHSS of a mercury spill in a public middle school in Taney County, Missouri. A chemistry teacher brought a plastic bottle of mercury to the Forsyth Middle School on August 18, 2009. The quantity of mercury in the vial is unknown but was “a lot more than a thermometer’s worth”. The bottle spilled on a desk, notebook and onto the floor in room number 23 at approximately 10:00 am on August 18, 2009. Students and staff were reported to occupy room number 23 until the end of the school day. DNR was notified of the spill at 3:38 pm on August 18, 2009.

DNR mobilized their Environmental Emergency Response (EER) unit from the Springfield Regional Office to the Forsyth Middle School the evening of August 18 to conduct air monitoring and assess the situation. DNR used a Jerome Mercury Vapor Analyzer. Results of the initial air monitoring conducted by DNR the evening of August 18, 2009, showed that not only the classroom where the mercury spill occurred was contaminated, but that mercury had been tracked into the hallway and nearly a dozen other classrooms in the 5th-6th grade wing of the school. A request was made for USEPA to conduct air sampling using their more sensitive Lumex mercury vapor analyzer because the Jerome meter has a detection limit of 300 nanograms per meter cubed of air (ng/m^3) mercury vapor.

The USEPA conducted air sampling with the Lumex on August 18, 2009, and the results ranged from 1,000 to 8,000 nanograms per meter cubed of air (ng/m^3). The highest reading was in the classroom where the spill occurred. Based on these air sampling results, DHSS recommended that students and staff not be allowed back into the affected classrooms until the mercury was cleaned up and air sampling results were at or below 300 ng/m^3 . Based on this recommendation, the Forsyth School District cancelled classes at the middle school on Wednesday, August 19, 2009.

On August 19, 2009, USEPA mobilized Sunbelt Environmental, a cleanup contractor, to remediate the school. Staff from Sunbelt Environmental collected the pooled mercury and visible micro beads, wiped hard surfaces down and re-cleaned the wing with Mercury Sorb. DNR and USEPA staff were onsite to oversee the cleanup and conduct air monitoring.

After the initial cleanup, which included a round of heating and ventilating the rooms by the contractor, air sampling results obtained by USEPA using the Lumex meter were

greatly reduced. Five areas remained above 300 ng/m³. The results of the air sampling following the initial round of cleaning are shown in Table 1.

Table 1. Sampling Results After Initial Cleaning, Heating and Ventilating of the 5th-6th Grade Wing of the Forsyth Middle School (August 19, 2009, 4:44 pm)

Sampling Locations	Results
Room 20	575 ng/m ³
Room 21	411 ng/m ³
Room 22 (where spill occurred)	792 ng/m ³
Room 30	171 ng/m ³
Cafeteria	371 ng/m ³
Girls Bathroom	350 ng/m ³
Boys Bathroom	296 ng/m ³
Outside background	30 ng/m ³

Based on the test results, DHSS advised that areas with mercury vapor concentrations below 300 ng/m³ could be re-occupied by students and staff. The decreased mercury concentration indicated that most of the mercury had been removed and the level of mercury vapor should continue to decline so rooms in the 300-400 ng/m³ range could also be re-occupied. DHSS advised DNR to resample classrooms 20, 21 and 22 to verify that the mercury source had been removed and the vapor numbers were declining.

Following a second round of cleaning, heating and ventilating, the three elevated classrooms were re-sampled. Based on the results of this sampling, DHSS advised that the concentrations were at or below acceptable levels (Table 2). Classes resumed at the middle school on Thursday, August 20, 2009.

Table 2. Sampling Results for Elevated Classrooms in the 5th-6th Grade Wing of the Forsyth Middle School (August 19, 2009, 7:53 pm)

Sampling Locations	Results
Room 20	1.0 ng/m ³
Room 21	23 ng/m ³
Room 22 (where spill occurred)	299 ng/m ³

On Friday, August 21, 2009, DNR staff returned to the school to conduct follow-up air sampling for mercury. This sampling showed that levels in classroom 22, where the spill had originally occurred, had increased to 3000 ng/m³. Concentrations in adjoining classrooms were as high as 1000 ng/m³. After further investigation, additional mercury micro beads were found in the chalk tray of the white board and on a bookcase and some dictionaries and encyclopedias in the bookcase. Sunbelt Environmental was called back to the school on Friday evening to clean these areas and to dispose of the contaminated books. After cleaning, the area was reheated and ventilated again. Air monitoring results

obtained with the Lumex after the second round of cleaning showed levels of mercury vapor well below 300 ng/m³ with some results below 10 ng/m³.

DNR returned to the school on Tuesday, August 25, 2009, to conduct additional air sampling to verify that all sources of mercury had been removed and that the mercury vapor levels are continuing to decline.

DISCUSSION

Mercury vapor levels in the affected classrooms, hallway and the cafeteria in the Forsyth Middle School, prior to cleanup, were greater than the acceptable residential mercury exposure level of 300 ng/m³ (EPA 2009). The affected area was confined to the 5th-6th grade wing of the middle school. This was due in part to the school being located in a relatively new building with each classroom having its own separate ventilation. In addition, the floors were all solid hard surfaces with no tears or cracks.

After extensive remediation involving collection of free standing mercury droplets, wiping down the exposed surfaces, using a mercury cleaning fluid to cover, crystallize and remove mercury, heating the affected rooms and areas in the 5th-6th grade wing, ventilating the wing and disposing of contaminated books the mercury vapor levels were below 300 ng/m³.

In addition to sampling, cleaning and remediating the school, DNR staff also went to the homes of the students in the chemistry class and screened the children, their clothes, including their shoes and the houses. Shoes were taken from one child and disposed of when the screening indicated the shoes were contaminated with mercury. Others with low levels of mercury found on shoes were given the recommendation to leave them outside to off-gas.

Chemicals of Interest

The only chemical of interest for this response investigation was metallic (elemental) mercury.

Metallic Mercury

Mercury occurs naturally in the environment and exists in several forms. These forms can be organized under three types: metallic mercury, inorganic mercury and organic mercury. Metallic mercury metal is the liquid metal used in thermometers, some electrical switches and medical devices. Metallic mercury is a shiny, silver-white metal that is a liquid at room temperature. At room temperature, some metallic mercury will evaporate to form colorless and odorless mercury vapor. The higher the temperature, the more vapors will be released from liquid metallic mercury (ATSDR 1999).

Toxicological Evaluation

About 70-80% of mercury vapors inhaled are absorbed by the lungs and enter the bloodstream (ATSDR 1999). However, ingestion of metallic mercury results in absorption of less than 0.01% by the stomach or intestines. Once absorbed, metallic mercury primarily accumulates in the kidneys, but will accumulate throughout the body, including the liver, spleen, bone marrow, red blood cells, intestines, and respiratory mucosa (ATSDR 1999). About 10% of the total body burden of mercury is sequestered by the central nervous system and has a half-life of several months (Knobeloch et al. 2007).

Mercury exposure can cause permanent damage to the brain or the kidneys. Short term exposure to high levels of metallic mercury vapors include: lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation. There is a greater chance of a toxic effect from exposure to mercury if a person has a preexisting liver, kidney, lung, or nervous system condition (ATSDR 1999).

In cases of inhalation of extremely high levels of mercury vapor or ingestion of extremely high levels of inorganic mercury or organic mercury, death is possible due to respiratory failure. However, most of the deaths from mercury exposure are due to neurotoxicity (ATSDR 1999).

Children's Health Considerations

Children could be at greater risk as compared to adults from certain kinds of exposure to hazardous substances. Metallic mercury is a novel substance that can be handled making it attractive to children. Exposure to mercury could be quite high from encounters with this shiny, silver metal. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage.

Exposure Evaluation

The primary route of human exposure to metallic mercury is via inhalation of vapor. When metallic mercury vapors are inhaled, they readily enter the bloodstream and are carried throughout the body. Ingestion of and direct contact with metallic mercury are not significant routes of exposure.

The acceptable level of mercury for a school classroom used was the USEPA acceptable residential level of 300 ng/m³ (EPA 2009). This is slightly higher than the ATSDR chronic Minimal Risk Level of 200 ng/m³, but was appropriately conservative for this school setting. Humans can be exposed to mercury at this level for years without experiencing adverse health effects.

Exposure to students and staff would have been of short duration. Exposure was less than six hours the day of the initial spill and eight hours or less on both Thursday and Friday. Although a few students would have been exposed to somewhat higher concentrations, this short-term exposure would not have been at levels that would cause adverse health effects and the spill was cleaned up before chronic exposures would occur. In addition, the cancellation of classes at the middle school for August 19, 2009, prevented the students and staff from any further exposure to high levels of the metallic mercury.

CONCLUSIONS

Based on the sampling results provided by DNR before, during and after the cleanup of the affected areas in the Forsyth Middle School, exposure to mercury has been reduced to acceptable levels and a public health hazard no longer exists. Cleanup has reduced the mercury vapor in the 5th-6th grade wing to acceptable levels.

RECOMMENDATIONS

DHSS recommended that DNR conduct air monitoring after the final cleanup to verify that all the mercury has been recovered and that the levels of mercury vapor continue to drop. This recommendation has been completed and no further action is necessary.

PUBLIC HEALTH ACTION PLAN

- DHSS will provide additional health education materials to school officials, educators and parents as requested.
- DHSS will follow up with parents of those students who may have had the highest exposure to answer health questions or concerns.

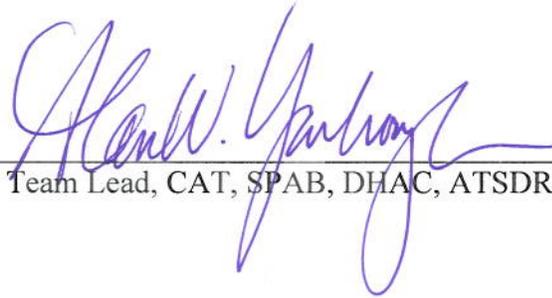
CERTIFICATION

The Missouri Department of Health and Senior Services (DHSS) prepared this Forsyth Public Middle School Mercury Spill Health Consultation under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with the approved methodologies and procedures existing at the time the health consultation was initiated. The Cooperative Agreement partner completed editorial review.



Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Team Lead, CAT, SPAB, DHAC, ATSDR

REFERENCES

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