

Letter Health Consultation

**Collection and Analysis of Air Samples for Mercury Vapor at
A Hospital in Central Texas**

**Texas Department of State Health Services
Exposure Assessment, Surveillance & Toxicology Group
Environmental Epidemiology and Disease Registries Section
Texas Department of State Health Services
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Introduction

On Wednesday evening, December 17, 2014, representatives from the Texas Department of State Health Services (DSHS), the Texas Commission for Environmental Quality (TCEQ), and the U.S. Environmental Protection Agency (US EPA) met with administrative, nursing, medical, and surgical staff at a hospital in central Texas to present the results of air sampling measurements for any residual mercury vapor remaining in the rooms of the three siblings admitted for mercury toxicity earlier this month. At this meeting, the Vice President of Patient Care Services asked that I submit a written report of the air sampling results, a risk analysis of any potential exposures, and our recommendations for any further precautions either for the children or for the nursing staff. The following paragraphs summarize the DSHS findings and the recommendations of the three agencies regarding those findings.

On Monday, December 15, 2014, I spoke with the doctor caring for 3 siblings (ages 9, 10, and 16) admitted with mercury toxicity. On learning that the parents had brought some of the children's belongings from home, I asked that the doctor have the belongings bagged up and put aside so that I could come over to the hospital and measure mercury levels inside the bags to determine if any mercury had inadvertently been brought to the hospital from home. This action caused some concerns among the nursing staff (a number of whom are pregnant) and the family as well. In response to the bagging recommendation and parental concerns regarding the possibility of immunosuppression in the children as a result of their exposures, the hospital instituted both isolation and reverse-isolation procedures for the children, and staff began wearing gown, gloves, and masks on entering the rooms and caring for the children.

On Wednesday morning, December 17, 2014, using a Jerome J505 mercury vapor analyzer, I obtained 14 different readings on the fourth and second floors of the south wing of the hospital, in the rooms where the children had stayed. I first obtained a background measurement of 40 ng/m³ from the doctor/staff work room near the nurse's station. Measurements made in the children's rooms averaged 23.1 ng/m³, (range, 0–60 ng/m³). However, since they were well below the chronic inhalation minimal risk level (MRL) of 200 ng/m³, we can confidently conclude that there are no significant residuals of mercury or mercury vapor present in the hospital rooms occupied by the children. Also, since there is little scientific evidence to support the possibility of immunosuppressive effects in children with mercury toxicity, we can conclude that it should be safe to remove the isolation and reverse isolation precautions that were instituted on Monday.

Limitations of the analysis include the following: DSHS did not become involved in the investigation until 10 days after the initial child's admission to the hospital. It is possible that air mercury levels could have been slightly higher in the beginning. All of the mercury vapor measurements were very near or below the detection limit of the instrument (50 ng/m³). In this range, the recorded numerical results are expected to have considerable variability and lack of reproducibility. Consequently, while there is uncertainty in the precise concentrations, we can be relatively certain that the results are not significantly elevated at the present time. Also, from mercury measurements in the bagged belongings, we can be relatively certain that there were no significant room air concentrations when the children were first admitted.

Background

On Monday afternoon, December 15, 2014, I received a call from the environmental epidemiologist at a city/county health department, who informed me of a call she had received from one of the doctors at a local hospital, regarding three siblings admitted to the hospital with elevated blood mercury levels and symptoms of mercury toxicity. The parents reported a history of a breakage and spill of a small bottle of liquid mercury in the garage of the family home back in August 2014. They had scooped up as much of the liquid as they could find and disposed of it at a hazardous materials disposal center.

As the local health department lacked the equipment and expertise for evaluating or remediating such a residential mercury spill, the epidemiologist asked if I could provide some assistance. I told her that DSHS has a relatively new Jerome J505 meter for measuring mercury vapor concentrations as low as 50 ng/m³ but that we have no resources for handling a residential cleanup. I told her that I had been peripherally involved with a number of mercury spill incidents in the past and that either the US EPA or TCEQ usually handled the cleanup. I told her I would call my contacts at these agencies to see if I could get their assistance.

I then called the doctor at the hospital to obtain more information about the children, the parents, and the family residence. On learning that the children had brought belongings from home, I asked that the doctor have the belongings bagged up and put aside so that I could come over to the hospital and measure mercury levels inside the bags to determine if any mercury had inadvertently been brought to the hospital from home. On Tuesday, I coordinated with US EPA and TCEQ regarding a plan of action and charged up the Jerome meter so it would be ready to go. On Wednesday, I drove to the hospital and checked in with hospital administration, and they took me to the floor where the children were admitted. The pediatric nursing staff arranged for me to take some mercury vapor readings in the various rooms where the children had stayed and are staying.

Discussion

Air samples were obtained in the various rooms occupied by any of the three siblings, using a Jerome J505 mercury vapor analyzer with a sample quantitation limit of 50 nanograms of mercury per cubic meter of air (50 ng/m³). Results (see Table 1 below) were compared to the Agency for Toxic Substances and Disease Registry (ATSDR's) chronic inhalation Minimal Risk Level (MRL) of 200 ng/m³. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure [1].

Except for 2 readings of 60 ng/m³ in the 16 y.o.'s last room, all observed readings were below the instrument's limit of quantitation (50 ng/m³) and should be considered "Non-Detects." Thus, while we can't be certain of the exact mercury vapor levels in these patients' rooms, we can be confident that they are well below a level of concern even for the most sensitive sub-populations, such as pregnant women and the fetuses they carry. Significantly elevated mercury vapor levels obtained in the children's home (data not shown) clearly indicate that their primary exposures very likely occurred in the home. The absorbed mercury in the children's systems does not present an exposure risk for anyone entering the children's room or contacting the children or their bodily fluids. Consequently, isolation precautions are not necessary, even for pregnant hospital staff.

The children's mother brought the bagged children's belongings out to the house while I was assisting the U.S. EPA and the TCEQ in measuring the home air mercury concentrations. I was able to measure the mercury levels with a probe inside each of the four sealed bags and found values that ranged from 200–700 ng/m³ (see Table 2). These values were all well below the recommended limit for headspace mercury levels in bagged personal belongings, which is 6,000 ng/m³[2]. If headspace levels exceed 6,000 ng/m³, experience has shown that there is usually a residual quantity of liquid mercury present in the bag or adhering to belongings. However, for levels in the range of the ones seen in the four blue bags — particularly ones that have been allowed to equilibrate for nearly 24 hours — it is virtually certain that, if allowed to equilibrate in a room over 1,000 times the volume of the sealed bags, the resulting room air mercury levels would be well below the detection limit of the meter. This is a good indication that room air levels prior to the bagging would not have been a significant health risk, even for sensitive sub-populations.

Review of the toxicologic literature, summarized in the Agency for Toxic Substances and Disease Registry's Toxicologic Profile for Mercury [1], indicates that there is little consistent scientific evidence to indicate that there are any significant immunosuppressive effects resulting from mercury vapor exposures. Consequently, reverse isolation precautions are not any more necessary for these children than for other children on the ward. Good hand-washing practices, before and after contact with a patient, of course are always recommended, as are hospital policies of not allowing visitors with flu or flu-like signs or symptoms to visit children's rooms.

Conclusions

1. Mercury vapor levels in the children's rooms are consistent with "background" measurements and indicate that there has been no mercury contamination in the rooms.
2. Mercury vapor levels, measured in sealed bags of children's belongings, are well below a level that might cause concern for staff exposures if the belongings were allowed to equilibrate with the hospital room air.
3. Neither pregnant staff nor non-pregnant staff are at any increased risk for mercury exposure as a result of contact with the children, the children's bodily fluids, or from breathing air from the children's rooms.
4. The children should not require any additional isolation or reverse-isolation precautions beyond that routinely provided for other sick children.

Recommendations

1. DSHS recommends that special isolation and reverse-isolation precautions for the children can be discontinued.
2. If further information is needed, please call or email Dr. Beauchamp at the numbers listed below.
3. If Dr. Beauchamp is not available, you may also call the Texas Poison Control Centers at 1-800-222-1222 for further information about mercury exposures.

References

1. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Mercury. Atlanta: U.S. Department of Health and Human Services. March, 1999.
2. Joint EPA/ATSDR National Mercury Cleanup Policy Workgroup. Action Levels for Elemental Mercury Spills. Atlanta: U.S. Department of Health and Human Services. March 22, 2012.

Tables

Table 1. Mercury Vapor Analyses in Nanograms Mercury per Cubic Meter Air (ng/m³) Collected in 6 Rooms at a Central Texas Hospital

Date	Time	Room Number	Room Description	Location in Room	Air Mercury (ng/m ³)
12/17/2014	11:34:15	4Y.017A	Doctor's/Staff's work Rm (background)	Desk near computer	40
12/17/2014	11:41:53	Rm 472	16 y.o.'s first room (stayed 2 days)	Near sofa	20
12/17/2014	11:46:48	Rm 451	16 y.o.'s last room (stayed 3 days)	Near bed	40
12/17/2014	11:49:38	Rm 451	16 y.o.'s last room (stayed 3 days)	Near sofa	60
12/17/2014	11:51:36	Rm 451	16 y.o.'s last room (stayed 3 days)	Near bath sink	0
12/17/2014	11:54:31	Rm 451	16 y.o.'s last room (stayed 3 days)	Near room sink	60
12/17/2014	11:57:50	Rm 455	9 y.o.'s present room (stayed 7 days)	Near bed	10
12/17/2014	12:00:48	Rm 455	9 y.o.'s present room (stayed 7 days)	Near sofa	0
12/17/2014	12:03:39	Rm 455	9 y.o.'s present room (stayed 7 days)	Near computer	0
12/17/2014	12:06:23	Rm 455	9 y.o.'s present room (stayed 7 days)	Near bath sink	0
12/17/2014	12:12:26	Rm 452	10 y.o.'s present room (stayed 3 days)	Near bed	30
12/17/2014	12:15:12	Rm 452	10 y.o.'s present room (stayed 3 days)	Near sofa	40
12/17/2014	12:18:17	Rm 452	10 y.o.'s present room (stayed 3 days)	Floor near bags	30
12/17/2014	12:27:03	PICU 246	10 y.o.'s admission Rm (stayed 2 days)	Table near desks	10

Table 2. Mercury Vapor Analyses in Nanograms Mercury per Cubic Meter Air (ng/m³) in Sealed Bags of Children's Belongings Brought from Home

Date	Time	Bag Number	Bag Description	Location of Measurement	Air Mercury (ng/m ³)
12/17/2014	15:58:06	1	Blue bag of children's belongings	Front porch at residence	200
12/17/2014	15:58:39	2	Blue bag of children's belongings	Front porch at residence	500
12/17/2014	15:59:13	3	Blue bag of children's belongings	Front porch at residence	500
12/17/2014	15:59:40	4	Blue bag of children's belongings	Front porch at residence	700
12/17/2014	15:54:58	NA	Background measurement	Front porch at residence	300

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