Letter Health Consultation

Evaluation of Mercury Exposure Risk for Families Residing at Apartment Complex

TWIN FALLS MERCURY SPILL

341-359 PHEASANT ROAD WEST

TWIN FALLS, IDAHO

Prepared by the
Idaho Department of Health & Welfare

MARCH 3, 2010

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.

You May Contact ATSDR Toll Free at
1-800-CDC-INFO
or
LETTER HEALTH CONSULTATION

Evaluation of Mercury Exposure Risk for Families Residing at Apartment Complex

TWIN FALLS MERCURY SPILL

341-359 PHEASANT ROAD WEST

TWIN FALLS, IDAHO

Prepared By:

Idaho Department of Health & Welfare
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry
March 2, 2010

Melody Bowyer
South Central Public Health District
1020 Washington St N
Twin Falls ID 83301-3156

Tom Askew
IDEQ Twin Falls Regional Office
1363 Fillmore St
Twin Falls, ID 83301

RE: Evaluation of risk for families exposed to mercury at an apartment complex

Dear Partners,

At the request of the South Central Public Health District (SCPHD) and the Twin Falls office of the Idaho Department of Environmental Quality (IDEQ), the Bureau of Community and Environmental Health’s (BCEH) Environmental Health Education and Assessment Program (EHEAP) has completed an evaluation of mercury exposure risk for families living in two apartment units located at 341-359 Pheasant Road West in Twin Falls, Idaho. This letter provides BCEH’s conclusions and recommendations based on that evaluation in order to help safeguard the health of the apartment residents.

BACKGROUND

Purpose
Elemental mercury spills occurred at an 8-plex apartment complex in Twin Falls. The EPA On-scene Coordinator report for this site is available at: http://www.epaosc.org/site/site_profile.aspx?site_id=5402.
IDEQ and SCPHD contacted EHEAP to help interpret risk from confirmed mercury exposures at this location. Exposure occurred for approximately 6 months. This document evaluates the health risk to the occupants exposed to mercury vapors. Cleanup efforts are completed at the site; thus, this evaluation will focus on retrospective exposure and risk. Findings will be communicated to impacted parents and children.

**Elemental Mercury Toxicity**
At a sufficient dose, mercury vapor can cause effects on the central and peripheral nervous systems, lungs, kidneys, skin, and eyes in humans. It is also mutagenic and affects the immune system at a sufficient dose (Hathaway et al. 1991; Clayton and Clayton 1981; Rom 1992). Acute exposure to high concentrations of mercury vapor can cause severe respiratory damage, while chronic exposure to lower levels is primarily associated with central nervous system damage (Hathaway et al. 1991). Sub-chronic (approximately six month) exposure will be considered here.

**DISCUSSION**
This evaluation focuses on inhalation exposure only (the major exposure pathway). Comparison values used in this evaluation all relate to the volume of contaminated air a person could inhale (breathe in) over a period of time.

**Acute Exposure Approach**
There are no relevant comparison values (CVs) for acute exposure to mercury in a non-occupational setting. Occupational exposure values are not relevant because they consider exposure only during the work shift. A likely exposure window in a residence is much longer in duration and more frequent.

**Sub-Chronic Exposure Approach**
Exposure occurred over a time period of approximately six months. ATSDR considers this an ‘Intermediate’ duration; however, there is no intermediate comparison value for mercury vapor. Sub-chronic refers to any exposure that is longer than an acute exposure. There are no federal or state standards for sub-chronic inhalation exposure to mercury vapor, so we must use chronic standards with a few caveats. The values considered are:
1) The ATSDR Minimal Risk Level (MRL) of 200 nanograms of mercury per cubic meter of air (ng/m³),
2) The ATSDR Action Level of 1,000 ng/m³, and
3) The experimentally-derived Lowest Observable Adverse Effect Level (LOAEL) of 9000 ng/m³.
## Data and Comparison to Standards and the LOAEL

**Table 1. Mean Detected Mercury Concentration in Air on September 16, 2009 and Comparison Values**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Concentration (C)</td>
<td>Unit 341 C 140-1,100 (ambient) 140-350 (furnishings) 2,000 (vacuum)</td>
<td>ng/m$^3$</td>
<td>Direct Lumex readings, not headspace</td>
</tr>
<tr>
<td></td>
<td>Unit 359 D 20-12,000 (ambient) 1,000-12,000 (furnishings and clothing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATSDR Action Level</td>
<td>1,000</td>
<td>ng/m$^3$</td>
<td>Clearance level; re-occupy level</td>
</tr>
<tr>
<td>ATSDR MRL</td>
<td>200</td>
<td>ng/m$^3$</td>
<td>Chronic; 24 hr</td>
</tr>
<tr>
<td>LOAEL</td>
<td>9000</td>
<td>ng/m$^3$</td>
<td>Chronic; 24 hr Health Endpoint: hand tremor, memory disturbance</td>
</tr>
</tbody>
</table>

ng/m$^3$: nanograms per cubic meter
Table 2. Mean Detected Mercury Concentration in Air by Specific Location on September 16, 2009 (Source: EPA)

<table>
<thead>
<tr>
<th>Bldg.</th>
<th>Apt.</th>
<th>Level</th>
<th>Location</th>
<th>Value (ng/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>341</td>
<td>C</td>
<td>Lower</td>
<td>Main entrance, floor</td>
<td>1050</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Main entrance, breathing zone</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bedroom entrance floor</td>
<td>1100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bedroom floor</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bedroom bed</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bathroom floor</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Kitchen floor</td>
<td>330</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Living room floor</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crib</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Washer/dryer</td>
<td>290</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Vacuum</strong></td>
<td><strong>2000</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper</td>
<td>Stairs</td>
<td>330</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Landing</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hamper</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Corner room floor</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Corner room bed</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Corner room crib</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Center room breathing zone</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Center room floor</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Center room closet</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bathroom</td>
<td>140</td>
</tr>
<tr>
<td>359</td>
<td>D</td>
<td>Lower</td>
<td>Main entrance breathing zone</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper</td>
<td>Landing floor</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Landing breathing zone</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Threshold to corner bedroom</td>
<td>260</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Corner room breathing zone</td>
<td><strong>12000</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clothing next to door (corner bedroom)</td>
<td><strong>1000</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NE corner (corner bedroom) floor</td>
<td>2800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NE corner (corner bedroom) breathing zone</td>
<td><strong>9600</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SE corner (corner bedroom) floor</td>
<td><strong>10000</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SE corner (corner bedroom) breathing zone</td>
<td><strong>7100</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Box w/clothing, SE corner (corner bedroom)</td>
<td><strong>12000</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Backpack</td>
<td><strong>8500</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SW corner bag of trash</td>
<td><strong>8500</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Top bed of bunk beds</td>
<td><strong>9500</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Closet</td>
<td><strong>8700</strong></td>
</tr>
</tbody>
</table>

*Values highlighted in red text are easily removable items that have moderate to high Lumex readings. Values highlighted in yellow represent levels of concern in comparison to the LOAEL. ng/m³: nanograms per cubic meter*
Acute Exposure
There are no relevant comparison values (CVs) for acute exposure to mercury in a non-
occupational setting. Occupational exposure values are not relevant because they consider
exposure only during the work shift. A likely exposure window in a residence is much longer in
duration and more frequent.

According to a study on mercury, acute inhalation of mercury vapor above occupational limits
may cause chills, nausea, general malaise, tightness in the chest, chest pains, dyspnea, cough,
salivation, and diarrhea (Hathaway et al. 1991). If none of these symptoms were reported by any
of the occupants or visiting children, it is still possible that other long-term effects could occur
given the six month or more duration of exposure.

Sub-Chronic Exposure
Sub-chronic refers to any exposure that is longer than an acute exposure. There are no federal or
state standards for sub-chronic inhalation exposure to mercury vapor, so we must use chronic
standards with a few caveats. The ATSDR chronic MRL is simply a screening tool, not a
threshold of health effects. Clearly, most of the samples from the apartments were above the
MRL of 200 ng/m³, indicating that further analysis is justified. The MRL and RELs all
incorporate uncertainty factors to insure protectiveness of even the most sensitive receptors. The
LOAEL does not. The chronic LOAEL is the threshold at which health effects are known to
occur. As noted above, chronic exposure is generally defined as one year or longer. In the case
of the study that found the chronic LOAEL in humans, many of the exposed people were in a
workplace with mercury vapors for approximately 12-18 years. Many measured mercury levels
at the Pheasant Road apartments, particularly in the one child’s bedroom at 359D, were above
this LOAEL level, and the levels were likely much higher back when the initial spill(s) occurred.
The documented health endpoint with this level of exposure over several years is hand tremor
and memory disturbance (nervous system toxicity), as determined by the LOAEL study.

Being above the LOAEL for six months, particularly in the child’s bedroom at 359D, is
sufficient reason to have a full medical monitoring work-up on the child. The initial assessment
of the child’s symptoms by a clinician prior to indoor air sampling was consistent with mercury
poisoning. Urine measurements are more reliable than blood for assessment of chronic
exposure. Hair samples may be difficult to interpret and are not recommended. Neurobehavioral
tests and long-term monitoring may be recommended by the physician/healthcare provider if
neurological impairment is suspected. If urine mercury levels are still high, chelation therapy to
draw mercury out of the body may be recommended by the physician/healthcare provider.

Exposure Uncertainty
Duration and frequency of exposure are estimated but not known. Children have different
breathing rate and volume-to-body weight ratios than adults; in general, they breathe a greater
overall volume of air per kg of body weight than adults. Children also have behaviors that make
them more susceptible to higher exposures, such as playing and sleeping on floors that are
contaminated. The most exposed child (who is 8 years old) at 359D was reported to sleep on the
floor right next to the spill location. The child also reportedly spent a significant amount of time
in her bedroom each day. The duration of the exposure was sub-chronic, whereas the LOAEL
used in these comparisons is from a study of chronic multiple-year exposure.
Health Effect Uncertainty
All available human health effects data are for adults. Children are not small adults; their bodies behave differently in response to toxicants. Children’s bodies are known to be more susceptible to neurotoxicants such as mercury, but there is not any data to quantify how they might respond differently than adults to elemental mercury vapor. The duration of the exposure was sub-chronic, whereas the LOAEL used in these comparisons is from a study of chronic multiple-year exposure.

CONCLUSIONS
The top priority of the Bureau of Community and Environmental Health (BCEH) is to ensure that the residents of these apartments have good information to safeguard their health. BCEH concludes the following:

Sub-Chronic Exposure. Past levels of mercury in air due to the mercury spill could harm the health of children. The child with the most contaminated bedroom (in 359D) and possibly other children and adults were exposed above the chronic LOAEL. Hand tremor and memory disturbance (nervous system toxicity) are the documented health effects of multiple-year exposure to mercury at these levels in adults. It is possible that these effects could occur in the most exposed child given a six month exposure. Other children were likely not exposed for a sufficient duration to cause these serious effects. Parents of the child whose room was most contaminated (359D) should take the child to see a physician/care provider immediately. Parents of each exposed child may want their child to see a physician/care provider if worried about potential health effects. Adults living in the more contaminated apartment (359D) may also want to be assessed by a physician/care provider, especially if any symptoms are noted.

Current levels of mercury in air due to spilled mercury are not expected to harm the health of residents breathing the air at either of the apartment units, provided that no contaminated personal items were intentionally or unintentionally overlooked by residents. EPA and its contractors did a thorough job of cleaning the units.

RECOMMENDATIONS
Based on our Bureau’s communication with IDEQ and the EPA On-Site Coordinator, cleanup was completed according to EPA protocol and occurred rapidly following the spills. Affected rooms were remediated, mercury vacuumed, heated, ventilated, and re-sampled. The post-cleanup air concentration of mercury in both units was below the ATSDR action level standard listed in Table 1. Further recommendations are:

1. The 8 year old child whose room was the most contaminated (359D) should be taken to a physician/healthcare provider immediately.
2. All individuals with confirmed or suspected exposures should consult with their physician/healthcare provider if they experienced any adverse health effects or would like more information about the health effects of mercury exposure.
3. All non-essential personal items contaminated with mercury should be discarded if they have not been already.
4. Individuals should contact IDEQ for directions on where and how to dispose of mercury in their area. A list of sites that accept mercury thermometers is available from the IDEQ website at: http://www.deq.state.id.us/waste/recycling/Recycle_category.cfm?county=&recycle_category_id=97, or by calling (208) 373-0124.

If you have questions, please feel free to contact us any time.

Best Regards,

Kai Elgethun PhD MPH
ATSDR Health Assessor
208-334-5682

Attachment: References
CERTIFICATION

This health consultation was prepared by the Idaho Division of Public Health (IDPH) under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies and procedures existing at the time the health consultation was initiated. The editorial review was completed by the Cooperative Agreement partner.

Audra Henry
Technical Project Officer
Division of Health Assessment and Consultation
Agency for Toxic Substances & Disease Registry

Alan W. Yarbrough
Team Lead
Division of Health Assessment and Consultation
Agency for Toxic Substances & Disease Registry
REFERENCES


Underwood MC. Health Consultation: El Camino Middle School mercury spill; Lompoc, Santa Barbara County, California. California Department of Health Services, under cooperative agreement with the Agency for Toxic Substances and Disease Registry. October 4, 2005.