Letter Health Consultation

Mercury Retort site,
Homedale, Idaho

May 12, 2015

Prepared by

Idaho Department of Health and Welfare
Division of Public Health
Bureau of Community and Environmental Health
Under Cooperative Agreement with
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from the Agency for Toxic Substances and Disease Registry (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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May 12, 2015

Mrs. Carrie Wontorcik
Haz-Mat, Abandoned Mine Land, and Drinking Water Programs Coordinator
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3948 Development Avenue
Boise, ID 83705

Dear Mrs. Wontorcik:

On February 8, 2013, the Bureau of Community and Environmental Health (BCEH) staff met with the Bureau of Land Management (BLM) to discuss potential human health effects of the Mac D Mercury Mine and Retort Site (henceforth referred as "Mercury Retort site"). BLM requested BCEH to review environmental data to determine whether levels of mercury in soil and air pose a human health problem. After visiting the site and reviewing available data, BCEH determined that people who trespass onto the site and accidentally ingest contaminated soil or breathe mercury vapors are not likely to be harmed. A limitation of this letter health consultation is the small sample size. Although BCEH determined health effects from exposures at the site are unlikely, BCEH recommends that BLM keeps the barbed wire fence and posts signage specific to mercury contamination to warn sporadic recreationalists and visitors of the presence of mercury at the site. Our program is available to assist with developing warning signs for the area and provide educational outreach as needed.

Background and Statement of Issues

The Mercury Retort site occupies roughly five acres and it is located in the foothills of the Owyhee Mountains, approximately 6.5 miles southwest of Homedale, Idaho (BLM, 2013). The retort intermittently produced mercury from 1958 to 1966 (BLM, 2013). The Mercury Retort site was comprised of the remnants of the concrete foundation, the retort structure, and ore bins. On September 30, 2011, BLM was notified about the vandalism of the structure. The vandalism caused damage to the metallic structures and deposited the mercury remaining in the structures onto the soil surface. Removal of the mercury retort structure was completed on November 14, 2013 and a barbed wire fence surrounds the former retort structure location. According to BLM, the nearest occupied residence is half a mile northwest of the Mercury Retort site (BLM, 2013). However, exposures to trespassers and recreationalists can occur through accidental ingestion of contaminated soil or inhalation of mercury vapor.

Results and Discussion

Environmental Data

For this letter health consultation, BCEH evaluated metal levels from surface soil sampling provided by BLM during their October 2011 sampling effort (BLM, 2013). Soil samples were taken from the upper most (1-10 inches) layer where soil depth allowed and in areas where people are most likely to come into contact with soil. A total of 33 samples soil samples were collected and analyzed for 21 metals. An X-ray fluorescence (XRF) spectrometer was used to determine the levels of metals in the samples. Five of the 33 samples were sent to an analytical laboratory for confirmatory testing. Due to the imprecision of the XRF method, BCEH used the laboratory confirmatory results for the calculation of the geometric mean used in this letter health consultation. On July 26, 2012, the Idaho Department of Environmental Quality (IDEQ) measured mercury vapors at the site using an Ohio Lumex RA 915 + Mercury vapor analyzer. Readings around the entire perimeter of the fence surrounding the Mercury Retort site were collected every three feet and measured approximately two inches above the ground (IDEQ, 2013). Airborne mercury was also recorded at breathing level inside the fence (IDEQ, 2013).

Pathway Analysis and Public Health Implications

Comparison values (CVs) specify levels of chemicals in particular media (air, soil, and water) that are considered to be safe for human health contact with respect to identified health effects. If contaminant levels are below their CVs, then it is unlikely that exposure would result in harm. However, if a contaminant is above its non-cancer health-based CV, then BCEH determines an estimated daily exposure dose. The estimated exposure dose is then compared to ATSDR's Minimal Risk Levels (MRLs). If an MRL is not available, an Environmental Protection Agency (EPA) oral reference dose (RfD) or other health-based standard is used. If the estimated daily exposure is above an MRL or an RfD, further investigation is required to determine if adverse health effects are likely.

Although a barbed wire fence surrounds the site, exposure to contaminated soils is possible. Trespassers (adults or children) who will occasionally enter the site would be exposed. In addition, BLM reported occasional recreational use (trap shooting, hunting, ATV/UTV use, rock hunting, and hiking) in the immediate vicinity of the Mercury Retort site (BLM, 2013). Since several toxic metals were detected in surface soils, adults or children trespassers on the site would be exposed by accidental ingestion of contaminated soils. Mercury vapor was also detected on-site; thus, breathing contaminated air is another likely route of exposure.

Scenario Analyses for Mercury soil ingestion

For those metals above a CV, BCEH evaluated the toxicological effects associated with potential ingestion of contaminated soils by calculating an estimated dose using an adult trespasser scenario and standard soil ingestion rate and approximate exposure time (a 70 kg adult ingesting 100 mg of soil per day, exposed four hours per week for nine months out of the year). The child trespasser scenario assumed a 20 kg child ingesting 200 mg of soil per day, exposed four hours per week for nine months out of the year. Nine months (36 weeks) was used instead of 52 weeks because it is assumed that exposure would be limited in the winter months due to frozen ground and snow cover; however, the total exposure period used for averaging exposures in the calculations is 12 months.

Metals in Soil

The geometric mean values of mercury, arsenic, and cobalt exceeded at least one CV. Mercury exists in three forms: metallic, inorganic and organic; the form of mercury depends on the mercury source and various environmental factors. Metallic mercury in soils undergoes chemical and biological transformations, usually forming inorganic complexes with chloride and hydroxide ions (ATSDR, 1999). Thus, for the purposes of this letter health consultation, it is assumed that the total mercury data for soils represent metallic and/or inorganic mercury (mercury salts).

Inorganic mercury compounds (i.e., mercury combined with elements such as chlorine, sulfur, or oxygen), commonly called mercury salts, are most readily absorbed by humans (up to 40% efficiency) through the gastrointestinal system. Other routes of exposure are inconsequential; inorganic mercury compounds are not generally volatile, and they are not readily absorbed through the skin (ATSDR, 1999). The geometric mean for mercury in soil at the site is 1,427 milligrams per kilogram (mg/kg). If we assume that all this mercury is inorganic mercury (i.e., mercuric chloride and other salts), this value exceeded the adult Reference Dose Media Evaluation Guide (RMEG) of 210 mg/kg and the child RMEG of 15 mg/kg (Table 1). The geometric mean for cobalt (838.9 mg/kg) was below the adult RMEG of 7,000 mg/kg, but it was above the children RMEG of 500 mg/kg. The geometric mean for arsenic in soil was 305.9 mg/kg and exceeded both the ATSDR RMEG for children (15 mg/kg) and adults (210 mg/kg). Since these three metals (mercury, cobalt and arsenic) in soil were above the health screening guidelines, they were further analyzed by deriving estimated dose calculations using adult and child trespasser scenarios described above.

Table 1. Soil sampling data that exceed comparison values for non-cancer effects

Contaminant	Percentage of detected values	Concentration Range[a] (mg/kg)	Geometric mean (mg/kg)	Non-cancer CV (mg/kg) Adult	Non-cancer CV (mg/kg) Child	Cancer CV (mg/kg)
Mercury (mercuric chloride)	100	261–8,290	1,427	210[b]	15[b]	NA
Cobalt	100	618–1,199	838.9	7,000[c]	500[c]	NA
Arsenic	100	148–544	305.9	210[d]	15[d]	0.47[e]

a = Concentration range of five laboratory confirmatory samples
b = ATSDR Reference Dose Media Evaluation guides (RMEGs) for Mercuric Chloride
c = ATSDR Intermediate Environmental Media Guides (EMEGs) for Cobalt
d = ATSDR Reference Dose Media Evaluation guides (RMEGs) for Arsenic
e = ATSDR Cancer Risk Evaluation Guide (CREG) for Arsenic. Since this value is below background levels ATSDR recommends to use 15 mg/kg.
mg/kg = milligram per kilogram
NA = Not available

The estimated dose calculations for adults and children are in Table 2. The estimated doses were compared to their MRL to determine if harmful health effects were possible. All estimated doses

were below the ATSDR MRL; therefore BCEH does not expect exposure to soil contaminated with mercury salts, cobalt or arsenic at the Mercury Retort site will result in harmful non-carcinogenic human health effects.

Table 2: Estimated Dose Calculations

Contaminant	Geometric Mean Concentration (mg/kg)	Estimated Adult Dose (mg/kg-bw/day)	Estimated Child Dose (mg/kg-bw/day)	MRL (mg/kg-bw/day)	Exceeds MRL
Mercury (mercuric chloride)	1,427	0.00003	0.0002	0.002	No
Cobalt	838.9	NA	0.0001	0.01	No
Arsenic	305.9	0.000007	0.00005	0.0003	No

mg/kg = milligram per kilogram
mg/kg-bw/day = milligram per kilogram of bodyweight per day
MRL= ATSDR Minimal Risk Level
NA = Not applicable

Arsenic has been classified by EPA as a "known human carcinogen" (ATSDR, 2007). This classification is used only when there is sufficient evidence from epidemiologic studies to support a causal association between exposure to the agents and cancer. The geometric mean of 305.9 mg/kg of arsenic in surface soils exceeds the Cancer Risk Evaluation Guides value of 15 mg/kg (Table 1) and the site-background arsenic soil of 25.4 mg/kg (BLM, 2013). Estimates of cancer risk from long term exposure (1 year) to these doses indicate a low risk of developing cancer in children and adults. The cancer risk estimates from exposure to arsenic in soil are 2 additional cancers in a population of 10 million adults and 1 additional cancer in a population of 1 million children. These estimated cancer risk calculations are considered to be low. Thus, BCEH does not expect exposure to soil contaminated with arsenic at the Mercury Retort site to result in increases in the risk of developing cancer above what is normally seen in U.S. populations.

Mercury in Air

Metallic mercury is primarily absorbed by humans through inhalation of volatilized vapors; whereas, only about 0.01% of ingested metallic mercury is absorbed through the gastrointestinal system (ATSDR, 1999). Mercury vapors were detected at the perimeter and inside the fenced area; therefore, it is likely an exposure pathway exists at this site. Average readings of airborne mercury levels at the perimeter varied from 0.03 $\mu g/m^3$ on the West side to 0.15 $\mu g/m^3$ on the East side (Table 3). IDEQ also measured airborne mercury at breathing zone inside the fenced area. All the mercury vapor readings inside the fence were below 0.005 $\mu g/m^3$ (Table 3).

Concentration measured inside the fence was 0.02 $\mu g/m^3$, this value is higher than background levels in nonurban settings (i.e., 0.006 $\mu g/m^3$or less) (ATSDR, 1999). However; all the average readings of airborne mercury level at the perimeter and inside the fence were below the ATSDR recommended action level for mercury vapor of 1 $\mu g/m^3$ in a residential indoor setting (Table 3).

Similarly, all the average concentrations were at or below the ATSDR's chronic inhalation MRL for metallic mercury vapor of 0.2 $\mu g/m^3$ and the EPA's Reference Concentration (RfC) of 0.3 $\mu g/m^3$.

Table 3: Mercury vapor levels at the perimeter fence that exceed non-cancer comparison values

Location	Highest concentration ($\mu g/m^3$)	Average concentration ($\mu g/m^3$)	Non-cancer CV ($\mu g/m^3$)	Other CVs ($\mu g/m^3$)
West Perimeter	0.04	0.03	1[a]	0.2[b] 0.3[c]
North Perimeter	0.28	0.05		
East Perimeter	3.0	0.15		
South Perimeter	0.08	0.05		

$\mu g/m^3$ = micrograms per cubic meter of air
a = ATSDR Recommended action level for mercury vapor in a residential settings
b = ATSDR Chronic inhalation Minimal Risk Level (MRL) for metallic mercury vapor
c = EPA Reference Concentration (RfC)

Possible adverse human health effects from exposures to mercury vapor at this particular site would depend upon several factors such as the amount of time and frequency people would be exposed to mercury vapor on-site, climatic factors such as wind speed and temperature, and physicochemical properties of the soils. The presence of trespassers to the site was confirmed during the site visit with the presence of empty drink bottles; however, BCEH believes that mercury vapor exposure to trespassers is very sporadic and for limited time due to the presence of the fence and the isolated location. In addition, the mercury vapor levels found on the perimeter fence and inside the fence are below levels of concern; therefore, BCEH concludes that mercury vapor in the Mercury Retort site poses no health hazard to those who trespass on the site.

Conclusions

- Based on the soil sampling data provided by BLM, BCEH concludes that it is unlikely that a future adult or child trespasser would be harmed from exposure to metals in soils on the site through accidental ingestion.

- Based on the relatively low levels of mercury vapor, BCEH concludes that it is unlikely that anyone exposed to the mercury vapors would suffer from adverse health effects.

Recommendations

BCEH recommends that BLM:

- Post signage specific for mercury exposures around the fence site to discourage people from accessing the site and to prevent accidental exposures to metals.

- Ensure the worker health and safety plan for remediation activities addresses the possible exposure to contaminants on site.

- Plan for a permanent soil remediation for the site to minimize accidental exposures as time and resources allow.

Public Health Action Plan

- BCEH will communicate the findings to BLM and offer any assistance for developing signage and provide outreach to neighboring communities as needed.

- BCEH will coordinate with BLM and IDEQ during the remedial activities to communicate possible risks.

If you have any questions, please do not hesitate to contact me at 208-334-5682 or at padenn@dhw.idaho.gov

Best regards,

Norka E. Paden, PhD.
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REPORT PREPARATION

This Health Consultation for the Mercury Retort site in Homedale was prepared by the Bureau of Community and Environmental Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented.

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