

Letter Health Consultation

LIVINGSTON MILL AND MINE SITE
CLAYTON, CUSTER COUNTY, IDAHO

JUNE 23, 2008

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

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LETTER HEALTH CONSULTATION

LIVINGSTON MILL AND MINE SITE
CLAYTON, CUSTER COUNTY, IDAHO

Prepared By:

Idaho Department of Health & Welfare
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

LETTER HEALTH CONSULTATION

TITLE: Evaluation of Lead and Arsenic Exposure to Workers at the Livingston Mill Site near Clayton, ID

Bureau of Community & Environmental Health
ATSDR Cooperative Agreement Program
Idaho Division of Health

Requested by: U.S. Forest Service

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Date: July 1, 2008

BACKGROUND

The Livingston Mill is an abandoned lead-zinc-silver ore processing facility located in central Idaho near the confluence of Jim Creek and Big Boulder Creek in Custer County. The site is approximately 26 miles southwest of the town of Clayton, Idaho. The mill operated from the late 1800s to the 1950s and produced approximately 86,700 tons of lead-zinc-silver ore. The mill site consists of two mills and associated structures and five bulk tailings areas. A former mining camp and several cabins are located directly across from the site on the other side of Jim Creek and are occasionally occupied by the mill owners. The site is located within the Sawtooth National Recreation Area and a U.S. Forest Service (USFS) trailhead and campground are located immediately downstream of the site. USFS personnel have worked intermittently at the site for the previous 30 years.

The five bulk tailings sites cover a large area and it is believed that tailings have been scattered by wind and water over the drainage area. The erosion has resulted in shallow deposits around the tailings sites and downstream near the USFS campground and trailhead. A USFS-hired contractor conducted a site assessment that included a human health risk assessment. The report determined that the potential risk to the health of campers and recreational users was high for lead and extremely high for arsenic. In February 2008, the USFS asked the Bureau of Community and Environmental Health (BCEH) to further evaluate the possible risk associated with arsenic and lead exposure to trail crew members working in and around the Livingston Mill. This report presents a human health-focused data review and assessment of potential hazards posed by tailings piles located on the site.

DISCUSSION

Environmental Sampling and Exposure Histories

In 2002, the USFS conducted a preliminary assessment of the site and determined a broader, more in-depth study should be performed. Millennium Science and Engineering, Inc (MSE) was contracted by the USFS to perform an Engineering Evaluation/Cost Analysis (EE/CA) of the Livingston Mill site. As part of the EE/CA, MSE gathered samples from the tailing piles on the site and published the results in a

June 2006 report (Millennium Science and Engineering). The report only presented maximum concentrations (see Table 1).

Table 1. Maximum Concentrations*

Sample Site	Maximum Concentrations (ppm)	
	Arsenic	Lead
Tailing Area 1	3000	25400
Tailing Area 2	1930	16300
Tailing Area 3	973	11100
Tailing Area 4	2080	23900
Tailing Area 5	8120	32800
*Source – Millennium Science and Engineering, Inc’s Engineering Evaluation/Cost Analysis Report, June 2006		

The maximum arsenic levels in the tailings range from 973 to 8120 parts per million (ppm). According to the Agency for Toxic Substances and Disease Registry (ATSDR), the adult comparison value for arsenic in soil is 200 ppm (ATSDR 2007). The comparison value is set well below levels that are known or anticipated to result in non-cancer adverse health effects and helps a health assessor determine if a contaminant needs to be studied more closely. Since the levels of arsenic in the tailings piles are up to 40 times higher than ATSDR’s comparison value, a closer review of the data and exposure potential is required.

The maximum levels of lead in the tailing piles range from 11,100 to 32,800 ppm. The health based standard for lead in residential yards is 400 ppm (US HUD 1999; US EPA 2001). This level is set to protect children who are more susceptible to the toxic effects of lead exposure. The levels of lead at the Livingston Mill Site are 28 – 82 times higher than the residential standard. Of course the mill site is not a residential site but USFS workers are at the site a few times a year so exposure is probable.

Employee Exposure

The USFS employees provided BCEH with estimates of time spent at the site (personal communications 2008). Employees or their supervisors reported employment duration ranged from 3 – 35 years and days per year at the sites ranged from less than 1 day to 7 days. A USFS trailhead is located on the site and there is also a USFS campground at the site. USFS personnel conduct regular trail maintenance and the staging area for loading their pack animals is on the site. A few of the employees reported camping at the campground up to two nights per year.

Arsenic

Using the work hour estimates provided by the USFS, BCEH derived estimated exposure doses for arsenic. The estimated exposure doses were calculated using the average of the maximum detections of the tailings. The average level of arsenic and lead (see Table 2) was deemed more representative of exposure than the absolute maximum levels since the tailing piles with the highest levels of both arsenic and lead were located further away (approximately 3,200 ft) from the campground and trailhead than the other tailing piles. Using the average of the maximum values is still likely to overestimate the actual

exposure since employees are not likely to be exposed to the levels of contaminants found at the tailings. Most likely the levels of arsenic and lead at the campground and the trailhead are much lower than levels found in the tailings.

Table 2. Average Contaminant Levels

Contaminant	Average Concentration (ppm)	Screening Levels (ppm)
Arsenic	3221	200*
Lead	21900	400**
*ATSDR EMEG (adult, non-cancer)		
** US EPA/HUD Residential Soil Standard		

ATSDR’s Minimum Risk Level (MRL) for chronic exposure to arsenic is 0.0003 milligrams per kilogram of body weight per day (mg/kg/day) (ATSDR 2007). This means that an adult can ingest up to 0.0003 mg of arsenic for each kilogram that he/she weighs each day without any non-cancer adverse health effects. For example, a person weighing 100 kg (220 lbs) could ingest 0.03 mg of arsenic each day without risk. Using a standard body weight of 70 kg (154 lbs), BCEH calculated the possible amount of arsenic a worker could ingest according to the number of days of exposure at the site (see Table 3).

Table 3. Estimated Arsenic Exposure Doses

Number of Days	Ingestion Dose*	Dermal Absorption Dose*	Inhalation Dose*	Total Dose*	Health Comparison Value* **
1	0.0000032	0.0000013	0.0000000015	0.0000044	0.0003
2	0.0000063	0.0000025	0.0000000029	0.0000087	0.0003
3	0.0000095	0.0000037	0.0000000044	0.000013	0.0003
4	0.000013	0.0000049	0.0000000058	0.000017	0.0003
5	0.000016	0.0000062	0.0000000073	0.000022	0.0003
10	0.000032	0.000012	0.000000015	0.000044	0.0003
15	0.000047	0.000018	0.000000022	0.000066	0.0003
20	0.000063	0.000025	0.000000029	0.000088	0.0003
25	0.000079	0.000031	0.000000036	0.00011	0.0003
30	0.000095	0.000037	0.000000044	0.00013	0.0003
70	0.00022	0.000086	0.0000001	0.00031	0.0003
*milligram per kilogram of body weight per day (mg/kg/day)					
**ATSDR Chronic Minimal Risk Level (MRL)					

Based on these estimates, workers would need to spend 70 days at the site before ingesting enough arsenic in the soil to reach the MRL. None of the employees reported spending more than 7 days per year at the site.

While it may seem that inhaling dust is the most likely way to be exposed to lead and arsenic at the Livingston Mill (especially since it is a windy and dusty area), in actuality

the organs of the upper respiratory tract (nose, nasal passages, mouth, esophagus) do a very good job of keeping dust from entering the lungs. The majority of dust gets trapped in the nose and mouth, or absorbed into fluid in the esophagus. This trapped dust then gets expelled via nose blowing and spitting, or it gets swallowed and is considered as part of the ingested intake of dust (Rozman and Klaassen 1996). This becomes clear when looking at the relative contribution of the ingestion pathway versus the inhalation pathway (Table 3). For arsenic, the inhaled amount accounts for only 0.03% of the total exposure, versus 72% for ingestion and 28% for dermal (skin absorption).

Because almost 30% of arsenic exposure is dermal, the importance of covering exposed skin when working in these areas, and washing exposed areas of skin as soon as possible should be emphasized. Even water alone will remove a large amount of contaminated dust from skin. Arsenic does not pass across the skin all at once, so removing dust and dirt on the skin via showering is an important prevention strategy to prevent later absorption.

Arsenic is considered a carcinogen so it is important to examine the possible influence that exposures at the Livingston Mill Site may have on individuals working there. It is important to note that cancer risk estimates do not provide definitive answers about whether or not a person will get cancer; rather, they are measures of chance (probability). Cancer is a common illness, with many different forms that result from a variety of causes; not all are fatal. According to the American Cancer Society, nearly half of all men and one-third of all women in the U.S. population will develop cancer at some point in their lives (American Cancer Society, 2008). Using standard cancer risk calculations (ATSDR Public Health Assessment Guidance Manual), BCEH found that no USFS worker's exposure history would account for more than 1 excess (additional) cancer per 100,000 people over the course of a lifetime. This is not high enough to distinguish from normal background or expected rates of cancer. Thus, the cancer risk is considered very low for USFS employees.

Lead

The US Environmental Protection Agency (EPA) has models that can be used to estimate the amount of lead in a person's blood if the amount of lead in the soil is known. BCEH used the EPA's Adult Blood Lead Model (ALM) to estimate the level of lead in the blood of USFS workers. Results for lead exposure are expressed in terms of circulating blood lead levels (Table 4). Again, since BCEH is using the average of the maximum values detected at all tailing sites when making these calculations, these calculations are likely to over estimate blood lead levels in workers at the site. In a study published in 2005 (CDC), the average blood lead level for adults in United States citizens was 1.6 micrograms per deciliter ($\mu\text{g}/\text{dL}$). Using the ALM (EPA 2005), the workers' blood lead levels are predicted to be above the national average. However, they are still well below any level that would be considered a public health hazard. In fact, BCEH calculated that it would take 60 days of exposure per year to the average of the maximum lead levels in the mill site to yield a blood lead level of 10 $\mu\text{g}/\text{dL}$, which is the standard set by the CDC for blood lead in children under six years of age (CDC 2008). It would take 240 days of exposure per year to attain the blood lead level (40 $\mu\text{g}/\text{dL}$) set by the Occupational Safety

and Health Administration (OSHA) to protect adult workers (OSHA 2008). None of the USFS workers at this site reported working more than seven days per year at the site.

Table 4. Estimated Blood Lead Levels	
Number of Days	Estimated Blood Lead Level*
1	1.6
2	1.7
3	1.9
4	2.0
5	2.2
10	2.9
15	3.6
20	4.3
25	5.1
30	5.8
70	10.1
*microgram per deciliter of blood (µg /dL)	

CHILD HEALTH CONSIDERATION

This evaluation is only for adult workers at the site so no assessment of potential health effects for children was completed. A follow up assessment for recreational users will be completed in the near future which will consider children’s exposures.

CONCLUSIONS

Although the levels of arsenic and lead in the mine tailings are quite high, the infrequent exposure to the contaminants means there is *no apparent public health hazard* posed to the USFS workers who are only on site a few days a year. If site conditions or land use changes then the hazard category will need to be reassessed. Workers should be careful to practice good hygiene when working near the Livingston Mill. The most important route of exposure for both arsenic and lead is ingestion, followed by dermal. Washing hands frequently, particularly before eating, smoking or using smokeless tobacco, is the key to preventing ingestion exposure, as is keeping food dust-free. Washing frequently and showering as soon as possible following working at the site is the best way to prevent dermal exposure. Wearing long sleeve shirts and long pants to cover up as much skin as possible will reduce dermal exposure. Reducing the ‘take-home’ pathway by cleaning shoes and boots or leaving them outside the home is also a good practice, as is washing work clothes separately from regular clothes upon return from the mill area.

RECOMMENDATIONS

1. USFS workers at the Livingston Mill site should practice good hygiene: frequent hand washing, washing any food (such as fruit) that might get dusty, and prompt showering upon return from the field.

2. A clean water supply should be available for washing at the site. Water should also be used for wetting the soil any time digging or moving soil is necessary.
3. Pack animals should be kept in vegetated areas whenever possible to prevent creating excess dust.
4. Shoes and boots worn at the site should not be worn into the house or office upon returning from the field until they have been cleaned. Also, an attempt should be made to keep dust out of vehicles.
5. Workers should wear long sleeve shirts, long pants and gloves to reduce the amount of dirt and dust on skin.
6. Clothes worn in the field should be laundered separately from other clothes.

PUBLIC HEALTH ACTION PLAN

1. BCEH will communicate these findings to affected USFS employees as soon as possible.
2. BCEH will inspect the site in June and will follow up this letter with a full health consultation that also looks at exposures to recreational users of the mill site and surrounding area.

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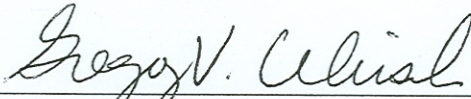
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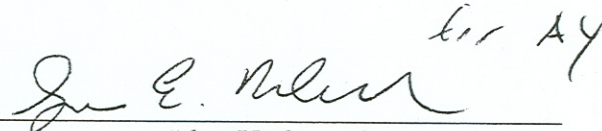
CERTIFICATION

The health consultation for the Evaluation of Lead and Arsenic Exposures to Workers at the Livingston Mill Site, Clayton, Idaho, was prepared by the Idaho Division of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the health assessment were initiated. Editorial review was completed by the cooperative agreement partner.



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



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