

***Lead and Arsenic Employee Exposure Assessment
Former Kennecott Mine Town
Wrangell St. Elias National Park & Preserve
Kennicott, Alaska***

August 11, 2003

***Prepared for
National Park Service***

***Prepared by
U.S. Public Health Service
Federal Occupational Health***

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3.0 Survey Procedures

3.1 Air Samples

Personal air samples were collected on June 23 and 24 from a carpenter performing window and door removal and repair in the former two-room schoolhouse and from two resource employees during inventorying of artifacts in the former store. At the end of the sampling period, the filter cassettes were removed and capped. The filters were then shipped to the FOH lab in Chicago, for analysis by flame atomic absorption spectroscopy, according to National Institute for Occupational Safety and Health (NIOSH) Method 7300. The sampling system was calibrated to a flow rate of approximately 2.0 liters of air per minute with a precision rotameter that had been previously calibrated with a Dry Cal DC Lite primary calibration system.

3.2 Wipe Samples

Wipe samples were collected on horizontal surfaces in the maintenance break room, resource employee kitchen, shower and change room, Concentration Mill, and Leaching Plant. A 'background' wipe sample was collected from a stairway in the nearby Glacier Lodge, constructed within the past 10 years. "Ghost Wipe" brand wipes were used with either a 16-square-inch or 144 square-inch template. The wipes conform to American Standards for Testing Materials E1792-96A, *Standard Specification for Wipe Sampling Materials for Lead in Surface Dust*. The wipe samples were placed in labeled plastic Ziplock bags. Wipe samples were analyzed for lead and arsenic.

3.3 Bulk Samples

Bulk samples were collected from settled dust and residues in the Store, Concentration Mill, and Leaching Plant. Samples were collected by scooping the dust into labeled Ziplock bags using disposable plastic spoons. Bulk samples were analyzed for lead and arsenic.

3.4 Soil Samples

Soil samples were collected from adjacent to the two-room Schoolhouse and the West Bunkhouse. A 'background' soil sample was also collected across the road and upgradient of the Store building. Soil samples were collected by scooping dirt into laboratory precleaned sample jars using disposable plastic scoops. Samples were analyzed for lead and arsenic. The primary objective of these samples was to determine the lateral extent of lead contamination from leaching of exterior paint and to evaluate for the presence of arsenic. Most soils around buildings at this facility consist of mill tailings that may contain elevated arsenic.

3.5 TCLP Sample

A single TCLP sample was collected to determine if the Tyvek suits worn by the carpenter during removal and preparation of windows could be characterized as hazardous wastes based on the leachable lead content. The sample consisted of pieces of Tyvek collected from a drum of used suits. The sample swatches were placed in a labeled ziplock bag. The sample was analyzed for Toxicity Characteristic Leaching Potential according to the procedures referenced in 40 CFR 260.11.

The wipe samples collected from the Concentration Mill and Leaching Plant contained up to 32,779 ug/ft² of lead. The lead levels exceed the above criteria, and indicate a need to reduce the potential for children and other susceptible populations to be exposed to lead via handrails in the mill and leach plant, should these buildings be open to the public.

There are no EPA standards for allowable levels of arsenic in surface dust as measured by wipe samples. Brookhaven National Laboratory has issued a recommended guideline of 10 ug/ft² as a cleanup criterion for interior surfaces. No arsenic was detected in the potential public access area wipe samples. However, it should be noted that the detection limit was 40 ug/ft². The detection limit is a factor of the surface area that was sampled. Since these consisted of handrails, the surface area was relatively small.

4.3 Bulk Samples

Bulk sample results are presented in Table 3, and the laboratory reports are contained in Appendix B. The bulk sample lead results can be compared to the 3,000 mg/kg criterion listed in the NPS-Kennecott Lead Compliance Program (Soil Dust Limits, page 5). According to the plan, lead concentrations less than 3,000 mg/kg in soil are unlikely to produce airborne lead above the OSHA limit. While the bulk samples were collected from dust versus soil, the same logic used to derive the soil criterion can be applied to settled dust. The bulk samples contained generally high concentrations of lead in excess of 3,000 mg/kg inside the Concentration Mill. Samples collected in the Store and Leaching Plant had lower lead levels; however, it should be noted that sampling in the Leaching Plant was limited to powders and residues, versus surface dust.

There are no OSHA dust or soil standards for arsenic. However, applying the same calculations from the Lead Compliance Program document to arsenic results in a criterion of 600 mg/kg for occupational exposures. The bulk samples contained concentrations of arsenic in excess of 600 mg/kg inside the Concentration Mill and Leaching Plant, but were below 600 mg/kg in the Store.

The lead and arsenic bulk dust sample results indicate a need to reduce dust residues inside the Mill and Leaching Plant using HEPA vacuums where feasible, as part of the ongoing renovation activities. Air sampling is also recommended during building maintenance and archiving activities to evaluate airborne lead and arsenic exposures in these buildings. Also, additional investigation of the lead and arsenic residues in these buildings is warranted before they are opened to the general public.

4.4 Soil Samples

Soil sample results are presented in Table 4, and the laboratory reports are contained in Appendix B. The same criteria listed above under bulk sample results may be applied to soil sample results. None of the soil sample results exceeded 3,000 mg/kg. Generally, lead concentrations decreased with increasing distance from the building drip line, with some minor anomalies. The results indicate that employees will not be exposed to lead above the PEL when performing soil-related construction tasks. No arsenic was detected in the soil samples. These results differ from the initial site investigation results reported in 1992 (see Introduction). This could be a factor of where the samples were collected, as the initial tailings reportedly had higher metal content.

4.5 TCLP Sample

The sample of Tyvek suits contained 7.05 mg/l of leachable lead. The hazardous waste limit is 5.0 mg/l. The suits were being stored along with paint debris and may have been contaminated by the other waste.

5.0 Observations

During the survey, employees were renovating the two-room schoolhouse and conducting archeological surveys inside the store. The schoolhouse renovation included roofing and work on windows and doors. Employees who were conducting the roof replacement were generally not exposed to lead paint, except during preparation of the rafter, when an employee was observed removing old paint with a wire brush. No PPE or respirator was being worn during this brief (under 5 minute) task. However, the task involves potential exposure to lead and should have been conducted while wearing proper PPE and respirator.

The carpenter who was removing and restoring windows and doors wore a half face air-purifying respirator with HEPA filters, and a Tyvek suit with attached booties and hood. The PPE appeared to be worn correctly. The employee removed the PPE before going on break and showered at the end of the shift, in compliance with the lead standard. Work practices were generally conducted to minimize release of lead paint and associated dust. An electric powered hand sander was used with a cloth dust bag collector. This type of dust collector is not very efficient in removing the fine particles of lead dust. If feasible, the HEPA vacuum hose should be connected to the sander (see recommendations section).

The employees performing archeological surveys of materials in the store building were carefully cataloging artifacts and did not appear to be generating excessive dust or disturbing painted surfaces. Employees were wearing Tyvek suits and respirators. A clothes change shed has been constructed for this crew, although it does not contain a shower.

6.0 Recommendations

Specify Protection Levels by Task and Maintain Lead Air Sampling Data An initial Excel spreadsheet has been developed to characterize and record exposure levels to lead by task. Figure 1 presents the information contained in the spreadsheet. Column 1 of the spreadsheet lists 15 tasks that may involve exposure to airborne lead and/or arsenic. This list should be expanded as additional tasks are identified during the renovation activities. Column 2 provides an initial evaluation of whether or not the task is likely to result in lead exposures above OSHA exposure limit. Employees performing any of the tasks that are indicated to be 'lead regulated' should wear appropriate personal protective equipment, follow the work practice and personal protection procedures specified in the Lead and Asbestos Management Plan (March 20, 2003). These determinations are subject to change depending upon the air monitoring results.

Note that OSHA requires minimum levels of respiratory protection during certain tasks that may involve exposure to lead, unless air monitoring data indicate otherwise. These include the following:

Half-face air-purifying respirator with HEPA filters:

- Manual demolition
- Manual sanding or scraping
- Power tool cleaning with HEPA ventilation
- Heat gun applications

Full-face air-purifying respirator with HEPA filters:

- Power tool cleaning without ventilation

Air-Supplied Respirator:

- Torch cutting or burning

Column 3 recommends the initial type of respiratory protection to be worn while the exposure assessments are being conducted. This level of protection is subject to downgrading or upgrading depending upon the air sampling results. Air sampling data for lead are inserted in columns 4 through 6 and an average is provided in column 7. The current spreadsheet design provides for up to three data points; however, additional columns may be inserted to increase the number of data points. (The formula will automatically adjust if the column is inserted between existing data columns).

FIGURE 1: LEAD TASKS, INITIAL CONTROLS, and EXPOSURE LEVEL ASSESSMENT SPREADSHEET						
TASKS	Assume Lead Regulated ?	Initial Resp. Protect.	Lead Result TWA ug/m3	Lead Result TWA ug/m3	Lead Result TWA ug/m3	AVG. Exposure Lead ug/m ³ PEL
Archeological Surveys						
Building Survey	No	None	ND	ND		ND
Intrusive (soil excavation) Survey	No	None				#DIV/0!
Construction/Renovation						
Soil excavation- Labor	No	None				#DIV/0!
Soil excavation- Equipt. Op.	No	None				#DIV/0!
Repairs to Foundation	No	None				#DIV/0!
Repair Interior-Manual Scraping/Sanding	Yes	Half Face APR/HEPA	ND			ND
Repair Interior-Power Sanding-HEPA Exhaust	Yes	Half Face APR/HEPA				#DIV/0!
Repair Interior- Power Sander-No Exhaust Ventilation	Yes	Full Face APR	67*			67*
Dust and Debris Cleanup- Interior	Yes	Half Face APR/HEPA				#DIV/0!
Repair Exterior-Manual Scraping/Sanding	Yes	Half Face APR/HEPA				#DIV/0!
Repair Exterior -Power Sanding-HEPA Exhaust	Yes	Half Face APR/HEPA				#DIV/0!
Repair Exterior- Power Sander-No Exhaust Ventilation	Yes	Full Face APR				#DIV/0!
Demolish Building- Manual Labor	Yes	Half Face APR/HEPA				#DIV/0!
Demolish Building- Equipt. Op.	No	None				#DIV/0!
Demolition of Painted Metal-Acetylene Torch	Yes	Air Supplied Resp.				#DIV/0!

Notes:

- 1) Tasks selected for lead exposure evaluation should consist of 'worst case' exposures, such as work on trim and windows that contain high levels of lead based paint.
- 2) The PEL for Lead for 10-hour shifts is 40 ug/m³. The PEL for arsenic is 10 ug/m³.

3) ND = None detected.

* The actual TWA exposure for the employee was 56 ug/m^3 . However, the employee was conducting the evaluated task (interior repair with use of an unvented sander) for 7.5 hours out of an estimated maximum exposure time of 9.0 hours. The result was therefore multiplied by $9.0/7.5$ to obtain the 'worst-case' maximum exposure level for that task.

Proper PPE and Respirators Should be Worn When Performing any Regulated Task

As discussed under the Observations section, an employee was observed brushing paint off a roof rafter without wearing a respirator or PPE. OSHA lists this task as requiring respiratory protection (see above). Although the task was of short duration, a respirator and PPE should have been worn. The carpenter who was performing lead related tasks inside the building and was wearing the proper protection could have been called on to conduct this task.

Not All Employees Being Monitored for Lead and Arsenic Need to Wear PPE

As shown in the spreadsheet (Figure 1) there are some tasks that are being monitored for lead and arsenic exposures that do not have associated PPE or respirator requirements. These include archeological surveys inside buildings. Based on the initial air sampling results, it does not appear that this task would require use of respirators, PPE or change rooms. However, based on the relatively high concentrations of lead and arsenic in the Mill and Leaching Plant as detected in the building dust, employees should observe limited decontamination procedures, such as brushing off shoes and washing hands and faces, when performing non-intrusive tasks inside buildings the ore processing buildings.

The Shower Room Should Be Expanded

The drying area and clothes storage areas are located in close proximity and cross contamination is possible. In addition, there is no place to store cleaned respirators for drying. Expanding this room, if feasible, could help alleviate this problem.

Collect Air Samples for the Full Shift

The OSHA lead Standard requires that air samples be collected throughout the employee's entire shift. (The sample pump should be turned off during lunch but run throughout breaks and other periods). By collecting the sample throughout the shift (minus lunch) there is no need to calculate the Time Weighted Average (TWA) concentration, as the sample result equals the TWA.

The sample should be run even if the employee is performing other tasks that do not involve lead exposure. However, when determining 'worst-case' task-specific exposure levels as described above, the results need to be adjusted upward to obtain a 'worst-case' exposure estimate for that task (see example in Figure 1).

Tyveks Should Be Segregated from Paint Debris

The Tyvek TCLP indicates that this waste is hazardous. However, the Tyvek that was sampled was mixed with paint debris and may have been contaminated. As such, it should be segregated from the painted trim and other lead debris, and the TCLP analyses should be repeated.

Exposure to Lead and Arsenic Inside the Mill and Leaching Plant Should be Further Evaluated

The bulk dust results from within these buildings indicate a potential for exposure to lead and arsenic. Additional employee air monitoring is recommended during archiving and maintenance tasks, along with construction activities. In addition, if these buildings are to be opened for tours, the levels of surface and airborne lead and arsenic should be remeasured after the buildings are renovated, and the potential for any adverse exposure to residual contaminants should be evaluated. It may be desirable to restrict direct access

to ore residues as these may contain relatively high lead and arsenic concentrations. However, the ore residues do not appear to be very friable and may not be likely to release lead or arsenic into the air. Further study is needed to evaluate these concerns.

Table 1
Air Sampling Results
Kennecott Mill Facility
June 23-24, 2003

Sample ID	Name; Occupation	Building	Task	Time Weighted Average Lead (ug/m ³)	Time Weighted Average Arsenic (ug/m ³)
SHA62301	James Sill; Carpenter	School	Repair/Rebuild Windows/ Doors- Manual Scraping/ Sanding	<19	<6
SHA62401	James Sill; Carpenter	School	Repair/Rebuild Windows/Doors- Interior: Power Sander- No Exhaust	56	<4
STA62301	Marge Gohtley; Resources	Store	Inventorying Artifacts	<21	<43*
STA62402	Susan Sura; Resources	Store	Inventorying Artifacts	<6	<87*

Notes:

- 1) The Permissible Exposure Limit (PEL) for Lead for 10-hour shifts is 40 ug/m³. The PEL for Arsenic for 10-hour shifts is 8 ug/m³.
- 2) Note: Results preceded by '<' indicate that no lead or arsenic was detected. The listed number is the detection limit.

*The detection limit exceeded the PEL for these short-term (apx. 2 hour) samples. This does not indicate that the concentrations exceeded the PEL, rather there was insufficient air volume to adequately evaluate the exposure for arsenic.

**Table 4
Soil Sampling Results
Kennecott Mill Facility
June 24, 2003**

Sample ID	Building	Location	Sample Result Lead (mg/kg)	Sample Result Arsenic (mg/kg)
BKS62401	Background	Upgradient Store	<50	<50
RBS62401	Refrigeration Bldg.	Drip Line 18" from Bldg.	1,780	<50
RBS62402	Refrigeration Bldg.	48" from Bldg.	2,169	<50
RBS62403	Refrigeration Bldg.	84" from Bldg.	1,066	<50
WBS62401	West Bunkhouse	Drip Line 18" from Bldg.	1,610	<50
WBS62402	West Bunkhouse	48" from Bldg.	179	<50
WBS62403	West Bunkhouse	84" from Bldg.	59	<50
WBS62404	West Bunkhouse	120" from Bldg.	286	<50

Note: Results preceded by '<' indicate that no lead (or arsenic) was detected. The listed number is the detection limit.

Appendix A
Laboratory Reports



FOH ENVIRONMENTAL LABORATORY

536 S. CLARK STREET CHICAGO, IL 60605 PHONE: (312) 886-0413 FAX: (312) 886-0434

ANALYTICAL REPORT

Submitted To: USPHS/Federal Occupational Health
2201 Sixth Avenue, Mail Stop RX-21
Seattle, WA 98121

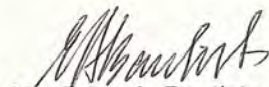
Attention: Mr. Wayne Mohler/Mr. Jim Neely

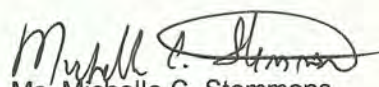
Submitted By: Ms. Edna Bautista

Reference Data: Lead and Arsenic
Sampling Site: NPS: Kennecott Mine & Mill Site
Sampling Type: Air (MCE filter), Surface (wipes), Bulk
Method Reference: OSHA ID-121
Project ID: Project 6449
DFOH Lab Nos.: TM-03-20442 through TM-03-20480
Date Received: 06/27/03
Date Analyzed: 07/09/03 through 07/30/03
Date Issued: 07/30/03

The samples were microwave digested using a CEM MDS-2000. The samples were run on a Varian SpectrAA 600 Flame Atomic Absorption Spectrophotometer.

Analytical results are given on the enclosed table. If you have any questions about these results, feel free to phone the Laboratory at (312) 886-0413.


Ms. Edna A. Bautista
Analyst


Ms. Michelle C. Stemmons
Laboratory Director

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FOH ENVIRONMENTAL LABORATORY

536 S. CLARK STREET CHICAGO, IL 60605 PHONE: (312) 886-0413 FAX: (312) 886-0434

LEAD and ARSENIC in AIR RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	AIR VOLUME (L)	LEAD CONCENTRATION (mg/m ³)*	ARSENIC CONCENTRATION (mg/m ³)*
SHA62301	TM-03-20442	310.8	<0.019	<0.008
STA62301	TM-03-20443	286.0	<0.021	<0.009
BLA62301	TM-03-20444		None Detected	None Detected
SHA62401	TM-03-20445	1060.0	0.056	<0.002
STA62401	TM-03-20446	1028.0	<0.006	<0.002
BLA62401	TM-03-20447		None Detected	None Detected

* All samples received in condition acceptable for analysis.

LEAD and ARSENIC in AIR LIMITS

Analytical Method	Method Detection Limit (mg/m ³)	Minimum Reporting Limit (mg/m ³)
OSHA ID-121	0.005 @ 480 liter sample 0.003 @ 960 liter sample	0.013 @ 480 liter sample 0.006 @ 960 liter sample
OSHA ID-121	0.005 @ 480 liter sample 0.003 @ 960 liter sample	0.005 @ 480 liter sample 0.003 @ 960 liter sample

ANALYTE	EXPOSURE LIMITS - (mg/m ³)		
	OSHA	NIOSH	ACGIH
Lead	0.05	<0.1	0.05
Arsenic	0.01	0.002 C (15 min)	0.01

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LEAD on SURFACE RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	CONCENTRATION (μg)	CONCENTRATION ($\mu\text{g}/\text{ft}^2$)
BRW62401	TM-03-20451	<5.00	<45.5
BRW62402	TM-03-20452	5.70	5.70
BRW62403	TM-03-20453	<5.00	<5.00
KIW62401	TM-03-20454	<5.00	<5.00
KIW62402	TM-03-20455	6.40	6.40
MBW62401	TM-03-20460	131	1050
MBW62402	TM-03-20461	4097	32779
BKW62401	TM-03-20463	<5.00	<45.5
LV62501	TM-03-20471	<5.00	<6.70
LV62501	TM-03-20472	<5.00	<5.00
DC62501	TM-03-20473	43.6	43.6
DC62501	TM-03-20474	10.2	10.2
LPW62401	TM-03-20477	1625	13004
BLW62301	TM-03-20478	<5.00	
BLW62401	TM-03-20479	<5.00	

* All samples received in condition acceptable for analysis.

AGENCY	FLOORS (uncarpeted)	WINDOW SILLS	WINDOW WELLS
EPA	100 $\mu\text{g}/\text{ft}^2$	500 $\mu\text{g}/\text{ft}^2$	800 $\mu\text{g}/\text{ft}^2$
HUD	200 $\mu\text{g}/\text{ft}^2$	500 $\mu\text{g}/\text{ft}^2$	800 $\mu\text{g}/\text{ft}^2$

LEAD on SURFACES Limits

Analytical Method	Method Detection Limit ($\mu\text{g}/\text{ft}^2$)	Minimum Reporting Limit ($\mu\text{g}/\text{ft}^2$)
OSHA ID-121	39.1	90.9

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ARSENIC on SURFACE RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	CONCENTRATION (μg)	CONCENTRATION ($\mu\text{g}/\text{ft}^2$)
BRW62401	TM-03-20451	<5.00	<45.5
BRW62402	TM-03-20452	<5.00	<5.0
BRW62403	TM-03-20453	<5.00	<5.0
KIW62401	TM-03-20454	<5.00	<5.0
KIW62402	TM-03-20455	<5.00	<5.0
MBW62401	TM-03-20460	<5.00	<40.0
MBW62402	TM-03-20461	<5.00	<40.0
BKW62401	TM-03-20463	<5.00	<45.5
LV62501	TM-03-20471	<5.00	<6.7
LV62501	TM-03-20472	<5.00	<5.0
DC62501	TM-03-20473	<5.00	<5.0
DC62501	TM-03-20474	<5.00	<5.0
LPW62401	TM-03-20477	<5.00	<40.0
BLW62301	TM-03-20478	<5.00	None Detected
BLW62401	TM-03-20479	<5.00	None Detected

* All samples received in condition acceptable for analysis.

ARSENIC on SURFACES Limits

Analytical Method	Method Detection Limit ($\mu\text{g}/\text{ft}^2$)	Minimum Reporting Limit ($\mu\text{g}/\text{ft}^2$)
OSHA ID-121	<5.0	<5.0

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LEAD in BULK RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	CONCENTRATION (% WEIGHT)	CONCENTRATION (mg/g)
STB62301	TM-03-20448	<0.005	<0.047
STB62302	TM-03-20449	0.21	2.1
STB62303	TM-03-20450	0.20	2.0
MBB62401	TM-03-20457	0.38	3.8
MBB62402	TM-03-20458	0.01	0.11
MBB62403	TM-03-20459	0.21	2.1
MBB62404	TM-03-20462	0.92	9.2
LPB62401	TM-03-20475	0.006	0.06
LPB62402	TM-03-20476	<0.005	<0.049

ARSENIC in BULK RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	CONCENTRATION (% WEIGHT)	CONCENTRATION (mg/g)
STB62301	TM-03-20448	<0.002	<0.02
STB62302	TM-03-20449	0.015	0.15
STB62303	TM-03-20450	0.011	0.11
MBB62401	TM-03-20457	0.355	3.55
MBB62402	TM-03-20458	0.307	3.07
MBB62403	TM-03-20459	0.066	0.66
MBB62404	TM-03-20462	0.283	2.82
LPB62401	TM-03-20475	0.151	1.51
LPB62402	TM-03-20476	<0.002	<0.02

* All samples received in condition acceptable for analysis.

Limits

Metal	Analytical Method	Method Detection Limit (mg/kg)	Minimum Reporting Limit ((mg/kg)
Lead	OSHA ID-121	25 @ 0.10 gram sample	50 @ 0.10 gram sample
Arsenic	OSHA ID-121	@ 0.10 gram sample	@ 0.10 gram sample

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LEAD and ARSENIC in SOIL RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	LEAD CONCENTRATION (mg/kg)	ARSENIC CONCENTRATION (mg/kg)
BKS62401	TM-03-20456	<50	<50
RBS62401	TM-03-20464	1780	<50
RBS62402	TM-03-20465	2169	<50
RBS62403	TM-03-20466	1066	<50
WBS62401	TM-03-20467	1610	<50
WBS62402	TM-03-20468	179	<50
WBS62403	TM-03-20469	59	<50
WBS62404	TM-03-20470	286	<50

*All samples received in condition acceptable for analysis.

ANALYTE	AGENCY	ACCEPTABLE LEVEL	ACTION LEVEL	ABATEMENT LEVEL
Lead	EPA	<400mg/kg	400-500 mg/kg	>5000 mg/kg

***NOTE:** Indicates that the sample is at or above the action/abatement level for the analyte as indicated by the Environmental Protection Agency (EPA).

Limits

Metal	Analytical Method	Method Detection Limit (mg/kg)	Minimum Reporting Limit ((mg/kg)
Lead	OSHA ID-121	25 @ 0.10 gram sample	50 @ 0.10 gram sample
Arsenic	OSHA ID-121	@ gram sample	@ gram sample

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LEAD in PAINT RESULTS

SAMPLE NUMBER*	LABORATORY NUMBER	CONCENTRATION (% WEIGHT)	CONCENTRATION (mg/g)
OE01	TM-03-20480	<0.010	<0.10

* **NOTE:** The Department of Housing and Urban Development classifies paint containing more than 0.5% lead by weight as being lead-based.

*All samples received in condition acceptable for analysis.

Lead in Paint Limits

Analytical Method	Method Detection Limit (%)	Minimum Reporting Limit (%)
OSHA ID-121	0.0010 @ 0.10 gram sample	0.010 @ 0.10 gram sample

Ms. Edna A. Bautista
Analyst

Project 6449
Page 7 of 7



Accredited by the American Industrial Hygiene Association (AIHA)
Environmental Lead (Lab ID #102843) and Industrial Hygiene (Lab ID #19902) programs
For all matrices

FOH Federal Occupational Health a component of the US Public Health Service		PROGRAM SUPPORT CENTER PSC		For Lab Use Only:		Conditions on Receipt (Name and Date)														
				Project #	Due Date:															
Environmental Reference Laboratories				Samples Received Chilled?		YES NO														
Client Information: USPHS/FOH Region 10 c/o Wayne Mohler / Tim Neely 2201 6th Ave MS BX21 Seattle WA 98129 (206) 615 2441				Sample Type*	Media Type*	Container*	Preservatives*													
				1-Air 2-Water 3-Paint 4-Soil 5-Wipe	1-Charcoal 2-XAD 3-Matched Weight 4-Preweighed 5-Other	Types: P-Plastic G-Glass V-VOC	A-None B-H2SO4 C-HNO3 D-NaOH													
				Analysis Requested																
Sample		Collected		Sample Location	Air			Water			Lab I.D. #	Total Lead	Total Arsenic							
I.D.	Type*	Media*	Date		Time	Flow (LPM)	Time (Min.)	Volume (Liters)	Container*	Volume (Liters)										Preservative*
MBB62403	Bulk		6/24/03		Mill Bldg. Ore Dust	Level 2	Shaking Table				1m-03-20459									
MBW62401	(5)				Mill Bldg. Handrail	Level 4	18 in ²				20460									
MBW62402	(5)				Mill Bldg. Handrail	Level 6C	18 in ²				20461									
MBB62404	Bulk				Mill Bldg. Floor	Level 6C					20462									
BKW62401	(5)				Glacier Lodge Stairs		16 in ²				20463									
RBS62401	(4)				Refrigeration Bldg	Drip Line (12" from Bldg.)					20464									
RBS62402	(4)				" "	- 48" from Bldg.					20465									
RBS62403	(4)				" "	- 84" from Bldg.					20466									
WBS62401	(4)				W. Bunkhouse	Drip Line (12" from Bldg.)					20467									
WBS62402	(4)				" "	- 48" from Bldg.					20468									
WBS62403	(4)				" "	84" from Bldg.					20469									
WBS62404	(4)				" "	120" from Bldg.					20470									
LV62501	(5)		6/25/03		Shower Bldg. ^{South} Lavatory	Toilet Lid	108 in ²				20471									
LV62502	(5)				" "	North Lav. - Toilet Seat Cover	144 in ²				20472									
DC62501	(5)				" "	Decon-Clean Side Dresser Top	144 in ²				20473									
DC62502	(5)				" "	Decon-Clean Side Floor	144 in ²				20474									

Agency NPS Location Kennecott Mine & Mill site POIS# D8H03 IN 30110 Task order number# NPS WRST 03-001
 Relinquished by: [Signature] Date: 6/26/03 Time: 1530 Turn Around Time Rush ✓
 Received by: [Signature] Date: 6/27/03 Time: Routine ✓
 COMMENTS (Instruction, sample hazards):



1380 Busch Parkway
Buffalo Grove, Illinois 60089

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(847) 808-7766 FAX (847) 808-7772

Federal Occupational Health
536 S. Clark St. Room 714
Chicago, IL 60605

Project: NPS: Kennecott Mine & Mill
Project Number: 6449
Project Manager: Michelle Stemmons

Reported:
07/08/03 16:52

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
TKB62401	B307006-01	Waste (S)	06/25/03 00:00	06/30/03 14:45

Great Lakes Analytical--Buffalo Grove

Andy Johnson

Andy Johnson, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.



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Project Number: 6449
Project Manager: Michelle Stemmons

Reported:
07/08/03 16:52

TCLP Metals by EPA 1311/6000/7000 Series Methods
Great Lakes Analytical--Buffalo Grove

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
TKB62401 (B307006-01) Waste (S) Sampled: 06/25/03 00:00 Received: 06/30/03 14:45									
Lead	7.06	0.0500	mg/l	10	3070082	07/03/03	07/07/03	EPA 7421	

Great Lakes Analytical--Buffalo Grove

Andy Johnson

Andy Johnson, Project Manager

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Chicago, IL 60605

Project: NPS: Kennecott Mine & Mill
Project Number: 6449
Project Manager: Michelle Stemmons

Reported:
07/08/03 16:52

TCLP Metals by EPA 1311/6000/7000 Series Methods - Quality Control
Great Lakes Analytical--Buffalo Grove

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 3070082 - EPA 3010A TCLP										
Blank (3070082-BLK1)				Prepared: 07/03/03 Analyzed: 07/07/03						
Lead	ND	0.00500	mg/l							
LCS (3070082-BS1)				Prepared: 07/03/03 Analyzed: 07/07/03						
Lead	0.0278	0.00500	mg/l	0.0240		116	76-139			
Matrix Spike (3070082-MS1)				Source: B307029-01 Prepared: 07/03/03 Analyzed: 07/07/03						
Lead	0.0297	0.00500	mg/l	0.0240	0.00265	113	41.6-170			
Matrix Spike Dup (3070082-MSD1)				Source: B307029-01 Prepared: 07/03/03 Analyzed: 07/07/03						
Lead	0.0297	0.00500	mg/l	0.0240	0.00265	113	41.6-170	0.00	24.1	

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Federal Occupational Health
536 S. Clark St. Room 714
Chicago, IL 60605Project: NPS: Kennecott Mine & Mill
Project Number: 6449
Project Manager: Michelle Stemmons**Reported:**
07/08/03 16:52**Notes and Definitions**

DET Analyte DETECTED

ND Analyte NOT DETECTED at or above the reporting limit

NR Not Reported

dry Sample results reported on a dry weight basis

RPD Relative Percent Difference

L This quality control measurement is below the laboratory established limit.

H This quality control measurement is above the laboratory established limit.

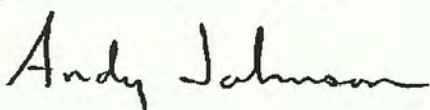
Great Lakes Analytical--Buffalo Grove Wisconsin DNR Certification Lab ID: 999917160

Great Lakes Analytical--Buffalo Grove NELAP Primary Accreditation: Illinois #100261

Great Lakes Analytical--Buffalo Grove NELAP Secondary Accreditation: New Jersey #IL001

Great Lakes Analytical--Oak Creek, WI Wisconsin DNR Certification Lab ID: 341000330

Great Lakes Analytical--Buffalo Grove



Andy Johnson, Project Manager

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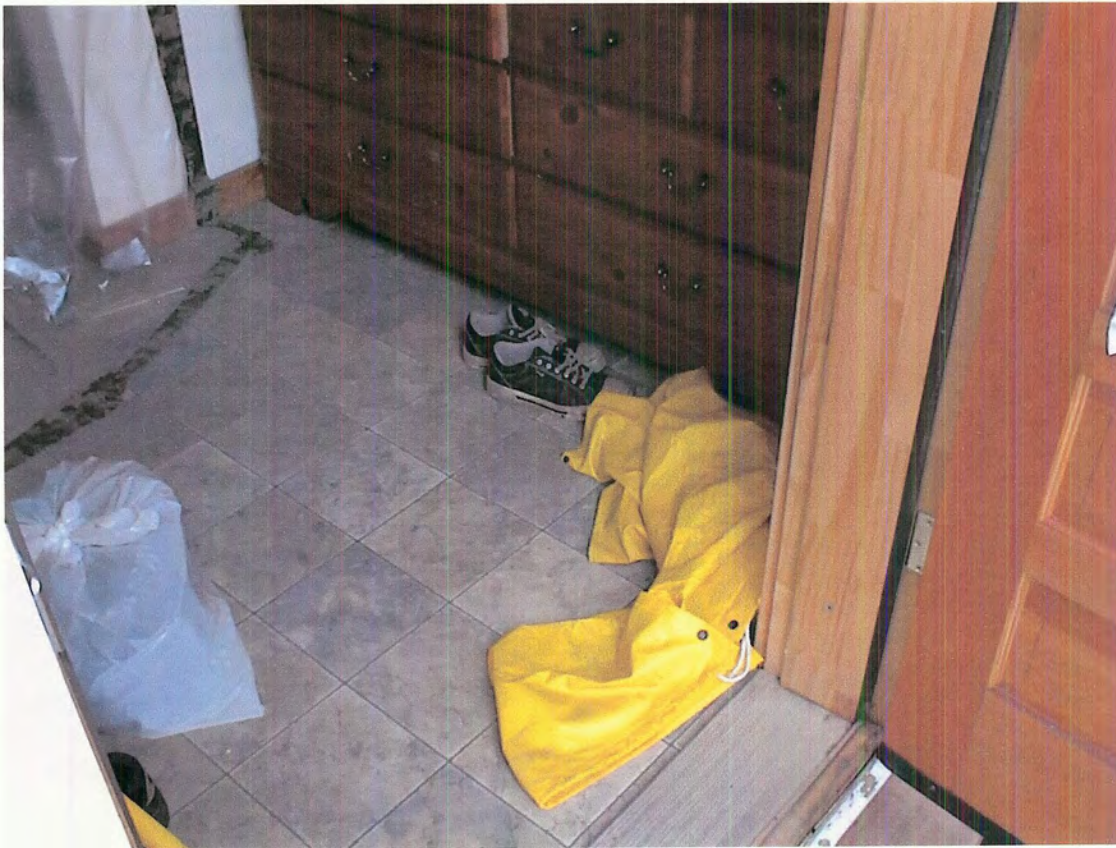
Appendix B
Photographs



Employee Vacuuming Window Sill



HEPA Vacuum



Shower Room- Clean Side



Respirator Drying Area in Restroom



Typical Window Sill with Deteriorated Paint



Concentration Mill



Artifact Items



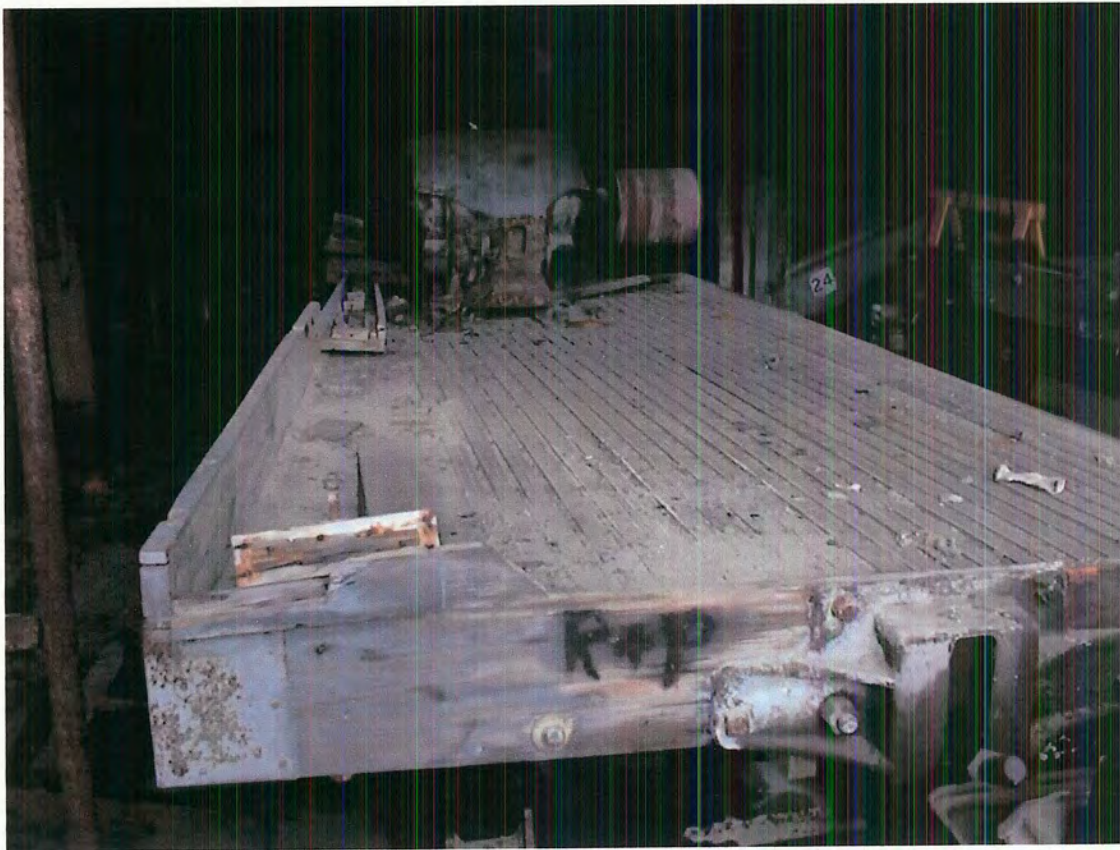
Employee Archiving Items in Store



School Building under Renovation



Employee Removing Door Trim



Concentration Mill Shaking Table with Residues



Handrail in Concentration Mill