Limited Hazardous
Building Materials Survey
Former Kennecott Mining Town
Kennecott, Alaska

Prepared for
National Park Service

Contract No. C9924000022
Task Order No. T992010023

May 10, 2002
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LIMITED HAZARDOUS BUILDING MATERIALS SURVEY
FORMER KENNECOTT MINING TOWN
KENNECOTT, ALASKA

This report presents the results of our limited hazardous materials survey at the former Kennecott Mining Town site (Kennecott) located in the Wrangell-St. Elias National Park and Preserve, Alaska (Figure 1). This work was conducted based on the Scope of Work, dated May 2001, as amended during negotiations conducted with Mr. Steven Peterson of the National Parks Service. Our project was completed for the National Park Service (NPS) as part of Contract No. C9924000022, Task Order No. T992010023 (TO-08). We understand that the NPS already owns or intends to buy the buildings surveyed during our work.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Lead in Paint

Painted surfaces were field-screened for the presence of lead using a portable field x-ray fluorescence (XRF) spectrum analyzer. While the U.S. Environmental Protection Agency (EPA) considers painted surfaces with lead concentrations above 1.0 mg/cm^2 as lead-based paints in homes or facilities where children are living or routinely present, this standard may only apply to the West Bunkhouse and the Old Schoolhouse, where children may stay in the future. In the other buildings within the scope of our survey, children will not reside or spend long periods of time; hence, the EPA limits cited above would not apply. The results of our lead in paint measurements are presented in Tables 1 and 5. Paint samples are identified with an L prefix; paint sample locations are presented on Figures 3 through 32, as appropriate.

Detailed scanning electron microscopic analysis of selected samples of site dusts and soils indicated that the lead content of those media were primarily derived from the degraded paint from site structures (see Appendix E).

Recommendations

Prior to repair or demolition of painted surfaces with high lead content, workers and contractors should be notified of the results of our lead survey. They should follow the appropriate provisions of the OSHA Lead in Construction Standard (29 CFR 1926.62), which involves personal exposure assessments and protective measures for workers involved in construction activities where lead may be present. A separate Lead and Asbestos Management Plan provides the appropriate guidance for notifying site workers and contractors on how to comply with applicable OSHA lead regulations. Consider training NPS personnel to do incidental and minor asbestos abatement work at the site.

We recommend that exterior painted surfaces be repainted as soon as possible, to minimize the continued contribution of degrading lead-based paint to site soils and dust.

Lead in Dust

Dusts present on selected floor surfaces were field-screened for the presence of lead using a portable XRF spectrum analyzer. Most samples contained lead concentrations greater than 40 ug/ft^2. While the U.S. Environmental Protection Agency (EPA) considers lead concentrations in dust above 40 ug/ft^2 as lead contamination only in homes or facilities where children are living or routinely present, this standard may only apply to the West Bunkhouse and the Old Schoolhouse, where children may stay in the future. In the other buildings within the scope of our survey, children will not reside or spend long periods of time; hence, the EPA limits cited above would not apply. OSHA has an industrial lead in dust standard of 200 ug/ft^2. Except for one sample, the lead in dust measurements made by Hart Crowser exceeded 200 ug/ft^2.

It appears that the lead measured in the dusts at Kennecott is primarily derived from deteriorating lead-based paint on exterior structural features. The results of our dust measurements are presented in Table 2 and Table 5. Lead in dust samples are identified with an LWS prefix and their locations are shown on Figures 3 through 32, as appropriate.

Recommendations

A separate Lead and Asbestos Management Plan provides the appropriate guidance for notifying site workers and contractors on how to comply with applicable OSHA lead regulations. Dust should be vacuumed with a HEPA vacuum cleaner before work begins on the inside portions of those buildings. Before allowing children to reside in a building, sampling should be conducted to verify that lead in dust concentrations are below 40 ug/ft^2.

Before internal repair of buildings with lead dust concentrations above 200 ug/ft^2, workers and contractors should be notified of the results of our lead survey. They should follow the appropriate provisions of 29 CFR 1926.62.

Lead in Soil

Soils from selected exterior areas near existing structures were field-screened for the presence of lead using a portable XRF spectrum analyzer. Many samples contained lead concentrations greater than 1,000 mg/kg. For comparison purposes, the Alaska Department of Environmental Conservation (ADEC) considers total lead concentrations in soil at or above 1,000 mg/kg to exceed soil lead cleanup criteria for non-residential uses (18 AAC 75). According to Footnote 11 to that regulation, lead cleanup levels must be determined on a site-specific basis, based on land use (i.e., residential 400 mg/kg; industrial/ commercial 1,000 mg/kg). Cleanup levels are determined through a site-specific risk assessment (18 AAC 75.340).

The lead measured in the soils at Kennecott is primarily derived from deteriorating lead-based paint from painted exterior structural features. The results of our lead in soil measurements are presented in Table 3 and Table 5. Lead in soil samples are identified with an LS prefix and their locations are shown on Figures 2 through 32, as appropriate. For comparison purposes, the lead in soil results (prefix BPS) from the previous lead survey performed at Kennecott, by America North/EMCON (August 1992) are included in Table 3, and the locations are plotted on Figure 2.

Recommendations

A separate Lead and Asbestos Management Plan provides the appropriate guidance for notifying site workers and contractors on how to comply with applicable OSHA lead regulations. Before allowing children to reside in a building, sampling should be conducted to verify that lead in soil concentrations are below 400 mg/kg.

Before external repair or excavation around buildings with lead in soil concentrations above 1,000 mg/kg, workers and contractors should be notified of the results of our lead survey. They should follow the appropriate provisions of 29 CFR 1926.62.

Lead in Debris

Samples from six debris piles (Figure 2) were collected and analyzed for leachable lead using the Toxicity Characteristic Leaching Procedure (TCLP). Debris Pile T1 contained a leachable lead concentration of 24.0 mg/L. For comparison purposes, wastes containing leachable lead concentrations above 5.0 mg/L are considered hazardous wastes and are not allowed to be either burned or disposed of in unpermitted landfills. The results of our TCLP measurements are presented in Table 4.

Recommendations

When Debris Pile T1 is packaged for disposal, it should be manifested as a Lead Hazardous Waste. Proper hazardous waste handling and disposal requirements, as specified in EPA regulations, should be followed. The debris piles that contain painted surfaces should not be intentionally burned as a method of waste disposal, unless special permission is received from the appropriate regulatory agency. The remaining debris piles that were sampled (T2 through T6, Figure 2) do not need to be disposed of as a Lead Hazardous Waste, based on our TCLP analysis results.

Because of the high lead content measured by XRF in white-painted exterior wood, the NPS could declare debris containing a preponderance of that wood type as a Lead Hazardous Waste without further testing. For other untested debris piles, or ruins, lead TCLP analysis should be conducted on the debris to characterize it. Debris with lead TCLP measurements at or above 5.0 mg/L should be disposed of as a Lead Hazardous Waste.

Prior to disposal of Debris Pile T1, workers and contractors should be notified of the results of our lead survey. They should follow the appropriate provisions of 29 CFR 1926.62. A separate Lead and Asbestos Management Plan provides the appropriate guidance for notifying site workers and contractors on how to comply with applicable OSHA lead regulations.

Asbestos-Containing Materials

The following table identifies asbestos-containing materials (ACM) that were detected during our limited asbestos survey. ACM is defined as a material that has 1 percent or greater asbestos content. The analytical results of the suspect asbestos samples are summarized in Table 6. Suspect asbestos samples are identified with an AS prefix and their sampling locations are shown on Figures 3 through 32, as appropriate.

Identified and Suspect ACM at Kennecott Mine Town

Building	Material and Location	Asbestos Type and Percent
West Bunkhouse	Pipe insulation (black cloth over hard white material) in utilidor	Chrysotile 10%; Amosite 25%
Power Plant	Soil/Debris from beneath building	Chrysotile 5%
Power Plant	Soil/Debris in trench of Generator Pit area	Chrysotile 5%
Machine Shop	Soil from beneath building under	Chrysotile <1%

	suspended pipes	(not ACM)

The asbestos identified at the West Bunkhouse (Appendix A, Photograph 8) is typical of the asbestos-containing pipe insulation in the utilidors throughout the Kennecott site. We understand that the asbestos in the soils beneath the Power Plant is residue from an improperly performed abatement project. While the asbestos in the soil collected from beneath the Machine Shop contains less than 1 percent asbestos, this detection indicates a potential that further sampling might reveal higher asbestos concentrations.

Our limited asbestos survey did not constitute a complete inspection of the site, and, therefore, additional asbestos may be encountered during demolition or repairs.

Recommendations

The soils beneath the Power Plant need to be further characterized in terms of asbestos depth and extent. Once the quantity of affected soils is determined, the asbestos-impacted soils beneath the Power Plant should either be removed, or an alternative plan to manage the asbestos in-place should be developed and implemented, if practicable. Any removal of asbestos-containing soil would need to be performed by Alaska-certified asbestos abatement supervisors and workers.

The asbestos content in the soils beneath the Machine Shop needs to be further characterized before recommendations can be made. Additional sampling in several locations are necessary to determine whether soils beneath the Machine Shop are consistently below 1 percent asbestos.

Before any work involving renovation or removal of the utilidors begins, asbestos pipe insulation inside the utilidors should be removed.

For all asbestos work, Hart Crowser recommends that abatement plans and specifications be prepared by an AHERA Project Designer prior to abatement. Selection of an asbestos abatement contractor should be partially based on the firm's prior abatement experience (including regulatory citation history). A key qualification factor should be the nature and disposition of any regulatory agency action previously taken against the contractor.

GLOSSARY OF TERMS

Action Level (Lead). The OSHA Lead in Construction Standard establishes an action level of 30 micrograms of lead per cubic meter of air (30 ug/m^3), averaged over an

8-hour workday. The action level triggers several provisions of the Standard, including exposure monitoring, medical surveillance, and training.

Asbestos. Asbestos is a class of magnesium-silicate minerals that naturally occur in fibrous form. The most common type of asbestos used in building materials is chrysotile. Crocidolite and amosite make up most of the remainder. Other forms, rarely encountered in building materials include anthophyllite, tremolite, and actinolite. The potential for fiber release depends largely on its degree of friability (the ability to be reduced to powder or dust by application of hand pressure).

Blood Lead Level. The amount of lead circulating in your blood, often expressed in units of micrograms of lead per deciliter (dl, equal to 100 milliliters) of blood (ug/dl).

Deteriorated Lead-Based Paint. Paint known to contain lead that shows signs of peeling, chipping, chalking, blistering, alligatoring, or otherwise separating from its substrate.

Dust Removal (Lead). The process of removing dust to avoid creating a greater problem of spreading lead particles; usually through wet or damp collection or using special HEPA vacuums.

Hazard Abatement (Lead). Long-term measures to remove the hazards of lead-based paint through selective paint stripping of deteriorated areas; or, in some cases, replacement of deteriorated features.

Interim Controls (Lead). Short-term methods to remove lead dust, stabilize deteriorating surfaces, and repaint surfaces.

Lead. Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds. The word "lead" as used in the Standard means elemental lead, all inorganic lead compounds and a class of organic lead compounds called lead soaps.

Lead-Based Paint. Any existing paint, varnish, shellac, or other coating that is in excess of 1.0 mg/cm^2 as measured by an XRF detector or greater than 0.5% by weight from laboratory analysis (5,000 ppm, 5,000 ug/g, or 5,000 mg/kg).

Lead Dust. Any interior dust containing more than 40 micrograms per square foot (ug/ft^2) of lead (EPA regulations for child-occupied residences); or 200 ug/ft^2 of lead (OSHA industrial health regulations).

Lead in Construction Standard. The Occupational Safety and Health Administration (OSHA) regulation governing worker exposure to lead in construction, 29 CFR 1926.62. Exposure to lead occurs in several different occupations in the construction industry covered by the OSHA Lead in Construction Standard, including:

- Demolition or salvage of structures where lead or lead-containing materials are present;
- Removal or encapsulation of lead-containing materials;
- Alteration, repair, or renovation of structures that contain lead or materials containing lead;
- Installation of products containing lead;
- Transportation, disposal, storage, or containment of waste containing lead or materials containing lead on construction sites; and
- Maintenance operations associated with construction activities

Lead-Safe. The act of making a property safe from contamination by lead-based paint, lead-dust, and lead in soil generally through short- and long-term methods to remove it, or to isolate it.

Permissible Exposure Limit (Asbestos). The permissible exposure limit (PEL) set by the OSHA Asbestos Standard is 0.1 fibers/cc, averaged over an 8-hour workday.

Permissible Exposure Limit (Lead). The PEL set by the OSHA Lead in Construction Standard is 50 micrograms of lead per cubic meter of air (50 ug/m^3), averaged over an 8-hour workday.

Risk Assessment (Lead). An on-site investigation to determine the presence and condition of lead-based paint, including limited test samples, and an evaluation of the age, condition, housekeeping practices, and uses of a building.

BACKGROUND AND REGULATIONS

Lead-Containing Building Materials

Lead in Paint

Lead is a metal element that is ubiquitous in the human environment as a result of industrialization and automotive transportation. It was commonly added to paints to enhance its durability. Buildings painted before 1960 represent potential sources of lead-based paint (LBP). Buildings constructed after 1960 are not necessarily free of LBP because the voluntary standard for limiting lead content in interior paint to less than 1 percent was only adopted in 1966 and, until very recently, exterior paint could contain significant amounts of lead. Although current (1977) federal regulations have limited the lead content of most paints to 0.06 percent, it is still important to consider older painted surfaces (e.g., walls, windows, trim, floors, eaves, banisters, etc.) as potential sources of lead.

Health Effects of Lead

Lead poisoning is one of the most common and preventable pediatric health problems today. New data indicate significant adverse effects of lead exposure in children at blood lead levels previously believed to have been safe. Of greatest concern are changes in the brain that cause reductions in intelligence and attention span, reading and learning disabilities, hyperactivity, and behavior problems. Adults exposed to lead in residential or industrial environments may suffer a variety of health problems. Pregnant women and their fetuses are at special risk from lead.

Lead Regulations

ADEC has set an industrial lead in soil cleanup level of 1,000 mg/kg (Footnote 11 to Table B1, 18 AAC 75). Alternative cleanup levels may be proposed under that regulation through a site-specific risk assessment conducted according to state-approved procedures. ADEC regulates the potential release of lead to the environment during building demolition and disposal. Demolition debris suspected of containing lead must be either declared as lead hazardous waste or tested by TCLP. Debris with leachable lead at concentrations at or above 5.0 mg/L must be disposed of as lead-containing Hazardous Waste in an EPA-permitted landfill.

OSHA regulates worker exposure to lead in construction under 29 CFR 1926.62. The regulation specifies exposure limits, work practices, and medical requirements for workers potentially exposed to lead.

Prior Studies of Lead at Kennecott

The NPS has previously summarized lead measurements in a document entitled "Kennicott National Historic Landmark: Integrated Emergency Stabilization and Lead-Based Paint Management Program," dated July 1977 (NPS 1997). That report indicated a consistent application of red paint to sidings and a white paint on the trim, with the last reported painting in the 1930s.

Paint. That report discussed analytical results obtained by America North/ EMCON in 1992 as confirming the presence of lead in the red, white, and a yellow paint used at the site. Lead concentrations in 12 samples of paints ranged from 50 to 525,000 mg/kg (0.005 to 52.5 percent lead). White paint was reported as containing more lead than the red paint, with one sample of yellow paint containing 286,000 mg/kg. That report also discussed four samples of paint analyzed for TCLP concentrations. Leachable lead concentrations ranged from 3.9 to 734 mg/L.

Soil. The America North/EMCON report also summarized surface soil lead results from around selected buildings. Total lead concentrations in soil ranged from 56 to 3,040 mg/kg in thirteen samples collected from depths ranging from 2 to 12 inches. That report also described four soil samples collected by NPS that were analyzed by TCLP for leachable lead. Three of the four samples had concentrations below 5.0 mg/L, with one having a concentration of 5.12 mg/L.

Dust. That report also described EPA dust samples collected in several buildings in 1995. These were reported to contain lead concentrations ranging from 0.59 to 97.4 ug/10 cm^2. Converting those values to the more commonly used units of ug/ft^2 yields lead measurements ranging from 55 to 9,052 ug/ft^2.

Asbestos-Containing Materials (ACM)

Asbestos as a Building Material

Asbestos is a class of magnesium-silicate minerals that naturally occur in fibrous form. The most common type of asbestos used in building materials is chrysotile. Crocidolite and amosite make up most of the remainder. Other forms, rarely encountered in building materials, include anthophyllite, tremolite, and actinolite. The potential for ACM to release fibers depends largely on its degree of friability (the ability to be reduced to powder or dust by application of hand pressure).

Because of its high thermal resistance, tensile strength, stability, and non-combustible nature, asbestos was widely used for many years as insulating material on pipes, boilers, ventilation ducts, tanks, and as a fireproofing material on structural steel beams and roofing decks. Asbestos was also applied extensively to control acoustics inside buildings before the 1970s. Asbestos can also be present in materials such as floor and ceiling tile, linoleum, cement asbestos boards, gaskets, woven fireproof cloths and blankets, transite, wallboard, wallboard joint compounds, plasters (particularly textured wall and ceiling finishes), caulking, mortar (i.e., fireplaces, boiler rooms, and fire walls), roofing felts, shingles, and window putty.

Health Effects of Asbestos

Inhalation of asbestos fibers has been shown to cause disease in humans, including lung cancer, mesothelioma (cancer of the lung and peritoneum lining), and asbestosis (scarring of the lung tissue). The symptoms of these diseases may not appear for up to 20 years following exposure.

Asbestos Regulations

Products that contain more than 1 percent asbestos are regulated as ACM by the EPA Asbestos Hazard Emergency Response Act (AHERA) (40 CFR 763). Quantification of asbestos in materials is typically performed by polarized light microscopy (PLM). Point counting (PCT) is a more accurate determination of asbestos content made by counting fibers in specific fields of a prepared microscope slide. An extremely accurate method involves use of transmission electron microscopy (TEM), but this method is not typically used because the regulations do not specify its use for bulk asbestos analysis.

Hazardous Air Pollutants (HAPs), including asbestos, are regulated by the EPA, under the Clean Air Act (CAA) (40 CFR Part 61, Subpart M). As authorized by the CAA, the National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulation addresses emissions of asbestos from renovation and demolition activities. In essence, NESHAPs prohibits the emission of any asbestos-containing dust to the environment. Under NESHAPs, a survey to identify ACM is required before beginning demolition or renovation projects.

OSHA regulates worker exposure to asbestos during construction, renovation, or demolition in 29 CFR 1926.58. Worker exposure to airborne asbestos fibers must be kept below an 8-hour time weighted average of 0.1 fiber/cc.

Prior Studies of Asbestos at Kennecott

Asbestos General Inc. (AGI) performed a survey of asbestos as reported in "Kennicott [sic] Asbestos Containing Materials Survey" (AGI 1991). Large quantities of ACM were identified at the site. Additional asbestos was documented in a report entitled "Site Investigation Final Report," dated August 1992 (America North/EMCON 1992), which mentioned ACM in the roofing of the Concentrator Plant. It was reported to Hart Crowser that previously identified asbestos was supposed to have been removed by a contractor in the late 1990s. However, we understand that during that abatement, large quantities of asbestos were intentionally washed through the floorboards of at least one building (Power Plant).

SCOPE OF WORK

Following pre-field organization, coordination, agency consultation, and data acquisition activities, Hart Crowser mobilized to the site to conduct our survey. Our paint sampling approach incorporated the use of a field XRF (Niton Model XL309) to field measure lead concentration in painted surfaces. A limited number of QC paint chip samples were to be collected from locations that will least impact historic preservation values (i.e., debris, hidden locations).

Our dust sampling approach incorporated the use of the XRF to field measure lead concentrations in wipe samples. A limited number of the wipes were to be submitted to a laboratory for atomic absorption spectroscopy analysis (AAS) of total lead in the wipe samples.

Our soil sampling approach incorporated the use of the XRF to measure the lead content of site soil samples. While primarily focusing on locations near historic structures, several samples were to be collected from areas away from buildings to establish background soil lead conditions. A limited number of soil samples were to be submitted to a laboratory for AAS analysis for total lead.

Our TCLP sampling and analysis approach incorporated collection of a limited number of samples of debris for leachable lead analysis.

As an additional task after field work was complete, two soil samples and one wipe sample were further analyzed using microprobe scanning electron microscopy (mSEM) to determine whether the lead in the soil and dust samples was primarily derived from the paint, or from the natural lead content of native soils. This analysis is critical, because lead from paint is soluble and, therefore, bioavailable to humans who get it into their bodies and more likely to leach into soils and impact groundwater. Several types of native lead minerals are non-soluble, and thus might not present as much of a health concern to employees and visitors.

Our limited asbestos survey approach was to conduct a cursory walk-through to locate and visually inspect, to the extent practical, locations in which abatement activities reportedly previously took place. We also assumed that only exposed features (buildings, open/wood-covered utilidors) or settings considered as having a reasonable potential to present future hazard would be addressed under this scope. Features in hidden context (buried utilidors, beneath debris piles) were excluded from our survey.

We were also tasked with developing a Lead and Asbestos Management Plan based on results of the asbestos and lead sampling and analysis performed at the site. The Plan includes safe work procedures to be followed by NPS workers and contractors, and includes key elements of managing lead and asbestos at the site. This plan is provided under separate cover.

SITE SURVEY AND RESULTS

On July 29 through August 7, 2001, William Damon of Hart Crowser, an AHERA-Certified Asbestos Building Inspector, conducted limited lead and asbestos survey at the Kennecott Town site (Figure 2).

Several of the soil and dust wipe samples, along with two paint chip samples, were submitted to NVL Laboratories, in Seattle, Washington, for total lead analysis using AAS. The two paint chip samples analyzed by NVL generally confirmed the XRF measurements of paint made in the field.

The laboratory analytical results for lead in the dust and soil samples were higher than those measured by the XRF in the field, so a calibration chart was prepared for those two parameters to allow for conversion of the soil and dust measurements relative to the laboratory findings. Calibration plots and laboratory results for the QC dust and soil samples are presented in Appendix D.

Lead in Paint

Using the XRF, Mr. Damon, an EPA-Certified Lead and Asbestos Inspector of Hart Crowser, tested selected interior and exterior painted surfaces for the presence of lead. Mr. Damon's inspector certificates are presented in Appendix C. The locations of the XRF lead in paint measurements are indicated on Figures 3 through 6, 8 through 11, 14, 15, and 18 through 32. The results of the lead in paint measurements are presented in Table 1.

Lead in Dust

Hart Crowser also collected dust wipe samples from selected floors and analyzed them on site for lead content. The samples were taken for a 1-square-foot area using a lightly moistened wipe pad, and field screened for lead content using the XRF. Three of the wipes were submitted for laboratory quality assurance analysis. This analysis indicated that the XRF was underreporting the true lead concentration. To calibrate the XRF measurements, a calibration curve was plotted for the lab lead analysis versus the XRF field measurements (Appendix D, Figure D-1). This resulted in adjusted dust lead concentrations, which were generally higher than those reported by the XRF.

The locations of dust wipe samples are indicated on Figures 7, 8, 12, 13, 17, 19, 21, 23, 24, 25, 27, 28, 30, and 31. Both the original XRF and adjusted measurements are plotted on the figures. The results of lead in dust measurements are presented in Table 2.

Lead in Soil

Hart Crowser also collected surface soil samples from areas where erosion or flaking of lead paint from the buildings might have affected surrounding soils. For comparison, we also collected several soil samples from areas away from painted buildings. We used a XRF to field screen surface soils for lead content. Some of the measurements were direct-read of the soil surface, while others were from composite soil samples excavated to a depth of approximately 6 inches. Where a composite was collected, we selected a single measurement that most closely approximates the average lead concentration.

Three of the soil samples were submitted for laboratory quality assurance analysis. This analysis indicated that the XRF was underreporting the true lead concentration. To calibrate the XRF measurements, a calibration curve was plotted for the lab lead analysis versus the XRF field measurements (Appendix D, Figure D-2). This resulted in adjusted soil lead concentrations, which were generally higher than those reported by the XRF.

The locations of soil samples are indicated on Figures 2, 5, 6, 14, 15, 18, 20, 23, 24, 25, 26, 28, 30, and 31. Both the original XRF and adjusted measurements are plotted on the figures other than Figure 2. The results of lead in soil measurements are presented in Table 3.

Lead in Debris

Hart Crowser also collected six debris samples for TCLP analysis, one from each of six discrete debris piles. The locations of these debris piles, designated T1 through T6, are presented on Figure 2. The results of the TCLP analyses are presented in Table 4. Photographs of representative debris piles are presented in Appendix A. Only Debris Pile T1 (Figure 2) exceeded TCLP criteria for lead.

Source of Lead in Dust and Soil

Hart Crowser submitted three samples of dust and soil with high lead content to Cannon Microprobe (Seattle, Washington) for analysis by mSEM. This method distinguishes the natural mineral forms of lead from lead derived from paint.

One dust wipe sample was submitted. This sample (LWS347), which had an XRF lead concentration of 8,070 ug/ft^2 (15,748 ug/ft^2 adjusted), was from the floor of the Middle Bunkhouse. Two soil samples were submitted: LS60, with an XRF lead concentration of 4,480 mg/kg (7,750 mg/kg adjusted) from outside the West Bunkhouse; and LS299, with an XRF lead concentration of 3,440 mg/kg (5,595 mg/kg adjusted) from outside the Schoolhouse. In each sample, preliminary results indicate that the lead on the site is primarily derived from white lead paint (lead carbonate). Lead carbonate is a soluble form of lead. The Cannon Microprobe report is presented in Appendix E.

Limited Asbestos Survey

Hart Crowser also investigated several locations where asbestos had been identified in the 1991 AGI report to verify that abatement had been complete. Where we suspected the continued presence of asbestos, we collected bulk samples for polarized light microscopy (PLM) analysis. The locations of these suspect asbestos samples are presented on Figures 16, 18, 21, 23, 28, 29, and 30. The results of the asbestos analyses are presented in Table 6.

Results by Building

Following are building-by-building descriptions of the samples collected from each structure, along with a brief description of the results.

Concentration Mill

The Concentration Mill (Mill) is a multi-story wood-frame industrial structure located on a steep hillside in the center of the town site (Photograph 2). The locations of samples collected from the Mill and vicinity are presented on Figures 3 through 13. Only the levels of the Mill where samples were actually collected are presented as figures in this report.

Exterior red siding and interior red-painted wood was generally low in lead content (0.01 to 0.85 mg/cm^2). However, one measurement of exterior red paint on the Mill (L206, Figure 6) was above 5 mg/cm^2. This measurement was made on painted wood of the east face, at the Third Floor Level, just under an eave. In addition, measurements of lead in interior gray paint were high (5.1 to 20.4 mg/cm^2).

Dust samples collected from the floor surfaces of various areas of the Mill detected lead ranging from 131 to 1,298 ug/ft^2 (1,381 to 3,493 ug/ft^2 adjusted). Soil samples collected from outside the Mill detected lead ranging from 71 to 1,100 mg/kg (71 to 1,197 mg/kg adjusted). A sample collected about 40 feet from the Mill, away from any buildings, yielded a lead soil concentration of 96 mg/kg (96 mg/kg adjusted).

Our walk-through of accessible features (top floor, ground floor, and stairwell of the main entrance) of the Concentration Mill was conducted to locate and visually inspect, to the extent practical, locations in which abatement activities previously took place. It appeared that the Thermal Systems Insulation (TSI) identified in these locations in the 1991 survey of the Mill had generally been abated; hence, no suspect asbestos samples were collected in this building.

As mentioned above, only exposed features (buildings, open/wood-covered utilidors) or settings considered as having a reasonable potential to present future hazard were addressed under this scope. Crawlspaces were not accessible in the Concentration Mill.

Leaching Plant

The Leaching Plant is a six-level wood-frame industrial structure located west of the Mill on relatively level ground (Photograph 3). The locations of samples collected from the Leaching Plant and vicinity are presented on Figures 14 through 17. Only the levels of the Leaching Plant where samples were actually collected are presented as figures in this report.

Exterior red siding was low in lead content (0.03 mg/cm^2), while white paint on the exterior trim was quite high (24.42 mg/cm^2).

A dust sample collected from the floor surface of Level 4 of the Leaching Plant detected lead at 777 ug/ft^2 (2,549 ug/ft^2 adjusted). Soil samples collected from outside the Leaching Plant detected lead ranging from 243 to 1,450 mg/kg (243 to 1,854 mg/kg adjusted).

Our walk-through of accessible features of the leaching plant was conducted to locate and visually inspect, to the extent practical, locations in which abatement activities previously took place. It appeared that the TSI, the tanks, and the 100-pound bags of ACM identified in the 1991 survey of the leaching plant had generally been abated. One suspect asbestos sample (AS-11), collected from gravelly tailings underneath previously abated pipes located beneath the building, indicated no detectable asbestos.

Machine Shop

The Machine Shop is a three-level wood-frame industrial structure located north of the Leaching Plant on relatively level ground. The locations of samples collected from the Machine Shop and vicinity are presented on Figures 18 and 19. Only the levels of the Machine Shop where samples were actually collected are presented as figures in this report.

Exterior red siding was low in lead content (0.0 to 0.14 mg/cm^2), while white paint on the exterior trim was generally quite high (26.27 to 38.04 mg/cm^2). The white paint on the interior had a very low lead concentration (0.01 mg/cm^2).

Dust samples (LWS167 and LWS172) collected from the floor surface of Level 1 of the Machine Shop (Photograph 4) detected lead at 1,188 to 1,495 ug/ft^2 (3,293 to 3,849 ug/ft^2 adjusted). Soil samples collected from outside the Machine Shop detected lead ranging from 101 to 224 mg/kg (101 to 224 mg/kg adjusted).

Our walk-through of accessible features of the Machine Shop was conducted to locate and visually inspect, to the extent practical, locations in which abatement activities previously took place. It appeared that the TSI identified suspended beneath the building and on the ground in the 1991 survey of the Machine Shop had generally been abated. One suspect asbestos sample (AS-13), collected from soil underneath previously abated pipes located beneath the building, indicated less than 1 percent asbestos.

Power Plant

The Power Plant is a six-level wood-frame industrial structure located north of the Machine Shop on relatively level ground (Photograph 5). The locations of samples collected from the Power Plant and vicinity are presented on Figures 20 and 21. Only the levels of the Power Plant where samples were actually collected are presented as figures in this report.

Exterior red siding was low in lead content (0.02 to 0.1 mg/cm^2), while white paint on the exterior trim was generally high (5.1 to 17.91 mg/cm^2). The white paint on the interior was non-detect for lead (0.0 mg/cm^2).

Dust samples (LWS195 and LWS200) collected from the floor surface of Level 1 of the Power Plant detected lead at 3,597 to 4,128 ug/ft^2 (7,652 to 8,614 ug/ft^2 adjusted). Soil samples collected from outside the Power Plant detected lead ranging from 113 to 1,190 mg/kg (113 to 1,365 mg/kg adjusted).

It was noted in the 1991 report that extensive TSI contamination was present throughout the building and that the roof of this building was damaged. Our walk-through of accessible features of the Power Plant was conducted to locate and visually inspect, to the extent practical, locations in which abatement activities previously took place. It appeared that the TSI from the pipe runs and the boilers identified in the 1991 survey of the Mill had generally been abated. However, two suspect asbestos samples (AS-09 and AS-10), collected from soil underneath the building, contain 5 percent chrysotile asbestos.

General Manager's Office

The General Manager's Office is a two-story wood-frame structure located south of the Mill on steep terrain (Photograph 6). The locations of samples collected from the General Manager's Office and vicinity are presented on Figure 22.

Exterior red siding was low in lead content (0.05 mg/cm^2), while white paint on the exterior trim was high (5.1 mg/cm^2). The white paint on the interior was high for lead (22.14 mg/cm^2), as was the gray paint (5.1 mg/cm^2). Brown interior varnish was quite low (0.03 mg/cm^2).

A dust sample collected from the floor surface of Floor 1 detected lead at 3,827 ug/ft^2 (8,069 ug/ft^2 adjusted), while a dust sample from Floor 2 (LWS372) was ever higher at 6,118 ug/ft^2 (12,216 ug/ft^2 adjusted). A soil sample (LS379) taken from outside the General Manager's Office detected lead at 2,200 mg/kg (3,265 mg/kg adjusted).

Our walk-through of accessible features of the General Manager's Office was conducted in this office to locate and visually inspect, to the extent practical, locations in which abatement activities previously took place. It appeared that the TSI identified on the first and second floor in the 1991 survey had generally been abated. No other suspect ACM was observed; hence, no suspect asbestos samples were collected.

West Bunkhouse

The West Bunkhouse is a three-story wood-frame structure with basement located south of the Refrigeration Plant on relatively level ground (Photograph 7). The locations of samples collected from the West Bunkhouse and vicinity are presented on Figure 23.

Exterior red siding was low in lead content (0.8 to 0.87 mg/cm^2). Exterior white paint was not measured on this building, but because it was identical in appearance to the other white-painted trim on other site buildings, it is assumed to also be high in lead content. The lead readings for the white paint on the interior ranged from 2.33 to 5.1 mg/cm^2, while interior brown paint ranged from 5.1 to 28.42 mg/cm^2, and interior gray paint was detected at 1.01 mg/cm^2.

Dust samples collected from each floor surface of the West Bunkhouse detected lead ranging from 2,139 to 17,920 ug/ft^2 (5,015 to 33,572 ug/ft^2 adjusted). Two soil samples detected concentrations of lead from 4,480 to 4,880 mg/kg (7,550 to 8,302 mg/kg adjusted).

Based on our walk-through of the accessible portions of the West Bunkhouse ground floor, and the second floor, it appeared that the mag insulated pipe and air cell insulated pipe identified in these portions of the structure in the 1991 survey had generally been abated. However, unencapsulated asbestos pipe insulation is still present inside the utilidor exiting the West Bunkhouse basement (Sample AS-07, Photograph 8). The insulation contained 10 percent chrysotile and 25 percent amosite. One suspect asbestos sample (AS-12), collected from soil underneath the building, indicated no detectable asbestos. Other suspect materials sampled include window putty (AS-05) and black cloth wiring insulation (AS-06). Both were non-detect for asbestos.

Middle Bunkhouse

The Middle Bunkhouse is a two-story wood-frame structure located south of National Creek. The locations of samples collected from the Middle Bunkhouse are presented on Figure 24.

Exterior red siding was low in lead content (0.07 mg/cm^2). Exterior white paint was high in lead content (5.1 mg/cm^2). Dust samples collected from the floor of the Middle Bunkhouse detected high lead concentrations, ranging from 6,950 to 8,070 ug/ft^2 (13,721 to 15,748 ug/ft^2 adjusted). Two soil samples were collected from opposite sides of the building. One was non-detect for lead, while the other was detected at 116 mg/kg (116 mg/kg adjusted).

It was noted in the 1991 survey and our walk-through of the accessible portions of the Middle Bunkhouse that the building has been impacted by soil intrusion, which limited access to the east end of the crawl space and covers the east end of the first floor to a depth of up to approximately 2 feet. We were able to observe the first floor, fire hose shack, and kitchen. It appeared that the mag insulated pipe and air cell insulated pipe identified in these portions of the structure in the 1991 survey had generally been abated. No suspect asbestos samples were collected.

Assay Office

The Assay Office is a one-story wood-frame structure located to the north of the Middle Bunkhouse on the opposite bank of National Creek. The locations of samples collected from the Assay Office (based on client verbal request in the field) are presented on Figure 24. Exterior red siding was low in lead content (0.14 mg/cm^2). Exterior white paint was high in lead content (27.03 mg/cm^2). No dust or soil samples were collected from this structure.

Soil intrusion has impacted this structure, and the Assay Office was not inspected for ACM (fiberboard and fiberboard insulation) identified in the 1991 survey. No suspect asbestos samples were collected.

Fire Protection Building 1

Fire Protection Building 1 is a small wooden shed attached to the west end of the Middle Bunkhouse. The locations of samples collected from the Fire Protection Building 1 are presented on Figure 24.

Exterior red siding was low in lead content (0.02 to 0.07 mg/cm^2). Exterior white paint was high in lead content (5.1 to 21.35 mg/cm^2).

We were not able to determine whether the 1991 asbestos survey included this building. No dust, soil, or suspect asbestos samples were collected from this structure.

Railroad Depot

The Railroad Depot is a small one-story wood-frame structure located just to the east of the bridge over National Creek (Photograph 9). The locations of samples collected from the Railroad Depot are presented on Figure 25.

Exterior red siding was low in lead content (0.1 to 0.17 mg/cm^2). Exterior white paint was high in lead content (5.1 to 8.91 mg/cm^2). Interior pink paint on a wall contained lead at 2.73 mg/cm^2.

One dust sample collected from the floor of the Railroad Depot detected a lead concentration of 914 ug/ft^2 (2,797 ug/ft^2 adjusted). One soil sample was collected from the east side of the building had low lead content (398 mg/kg [398 mg/kg adjusted]).

No TSI or other suspect ACMs were identified in the 1991 survey of this building; hence, no suspect asbestos samples were collected.

Store and Warehouse

The Store and Warehouse is a large three-story wood-frame structure located to the north of the Refrigeration Plant (Photograph 10). The locations of samples collected from the Store and Warehouse are presented on Figures 26 and 27.

Exterior red siding was low in lead content (0.05 to 0.21 mg/cm^2). Exterior white paint was not measured, but because it was identical in appearance to the other white-painted trim on other site buildings, it is assumed to also be high in lead content. Interior white and yellow paint was high in lead content (5.1 to 25.42 mg/cm^2). Interior brown paint was low in lead content (0.02 mg/cm^2).

One dust sample collected from the floor of the basement detected a high lead concentration 810 ug/ft^2 (2,610 ug/ft^2 adjusted). Two dust samples collected from the floor of the first floor detected high lead concentrations of 1,283 to 5,773 ug/ft^2 (3,466 to 11,590 ug/ft^2 adjusted). Three soil samples were collected from outside the building, with lead concentrations ranging from 1,500 to 2,989 mg/kg (1,949 to 4,747 mg/kg adjusted).

It was noted in the 1991 report that limited TSI contamination was present in the basement and the crawlspace. Based on our walk-through of the accessible portions of the basement and upper floors, it appears that the TSI, mag insulated pipe, and air cell insulated pipe identified in these portions of the structure in the 1991 survey had been abated. Portions of the building not safely accessible included the crawl space and utilidor. No suspect asbestos samples were collected.

Refrigeration Plant

The Refrigeration Plant is a two-story wood-frame structure with basement located north of the West Bunkhouse on relatively level ground. The locations of samples collected from the Refrigeration Plant are presented on Figure 28.

Exterior red siding was low in lead content (0.07 to 0.25 mg/cm^2). Exterior and interior white paint was high in lead content (5.1 mg/cm^2). Green paint on the interior had a lead concentration of 2.32 mg/cm^2.

Dust samples collected from two interior locations in the building detected lead ranging from 1,420 to 1,550 ug/ft^2 (3,713 to 3,948 ug/ft^2 adjusted). A soil sample collected from the southeast corner of the building detected lead at 6,218 mg/kg (10,816 mg/kg adjusted).

Electrical boxes containing ACM, identified in the 1991 survey, were not located in the current inspection. One suspect asbestos sample (AS-08) was collected from the Butcher Shop tabletop, but it was non-detect for asbestos.

Schoolhouse

The Schoolhouse is a one-story wood-frame structure located south of the West Bunkhouse on relatively level ground (Photograph 11). The locations of samples collected from the Schoolhouse are presented on Figure 29.

Exterior red siding was low in lead content (0.45 mg/cm^2). Exterior white paint was high in lead content (5.1 mg/cm^2). Interior gray and tan paint was also high in lead content (5.1 to 25.68 mg/cm^2).

Dust samples collected from two interior floors in the building detected lead ranging from 5,344 to 9,824 ug/ft^2 (10,814 to 18,921 ug/ft^2 adjusted). A soil sample collected from outside the northeast corner of the building detected lead at 3,440 mg/kg (5,595 mg/kg adjusted).

No ACM was identified in the 1991 survey in the Schoolhouse. One suspect asbestos sample (AS-04) collected from the black cloth wiring insulation was non-detect for asbestos.

Recreation Hall

The Recreation Hall is a one-story wood-frame structure located south of the main town site on relatively level ground. Renovation activities were taking place at this building at the time of our recent site visit and, therefore, our access to the building was limited. The locations of samples collected from the Recreation Hall are presented on Figure 30.

Exterior red siding was low in lead content (0.64 to 1.43 mg/cm^2). Exterior white paint was high in lead content (3.62 mg/cm^2). Interior green and white paint was also high in lead content (5.1 and 22.22 mg/cm^2, respectively) (Photograph 12). Interior red paint was non-detect for lead.

Dust samples collected from two interior floors in the building detected lead ranging from 1,448 to 2,762 ug/ft^2 (3,764 to 6,141 ug/ft^2 adjusted). Soil samples collected from outside the west side of the building detected lead at 87 to 109 mg/kg (87 to 109 mg/kg adjusted).

Based on our walk-through of the accessible portions of the first and second floors, ACM identified inside of the Recreation Hall in the 1991 survey appeared to have been abated. Three suspect asbestos samples (AS-01 through AS-03) were collected from the felt behind main exterior walls, black paper behind the exterior walls, and the silver movie screen material. These samples were non-detect for asbestos.

Old School

The Old School is a one-story wood-frame structure located south of the main town site on relatively level ground (Photograph 13). The locations of samples collected from the Old School are presented on Figure 31.

Exterior red siding was high in lead content (5.1 mg/cm^2). Exterior white paint was also high in lead content (2.38 to 5.1 mg/cm^2), as was interior white paint (5.1 to 30.64 mg/cm^2). Interior red paint was non-detect for lead.

Dust samples collected from two interior floors in the building detected lead ranging from 436 to 1,583 ug/ft^2 (1,933 to 4,009 ug/ft^2 adjusted). The soil samples collected from outside the building contained lead at 123 to 152 mg/kg (123 to 152 mg/kg adjusted).

This building was locked and inaccessible during the 1991 asbestos survey. No suspect materials were observed, and no samples were collected for asbestos analysis.

Fire Protection Building 2

Fire Protection Building 2 is a small wood shed located on the northeast corner of the Recreation Hall. The locations of samples collected from the Fire Protection Building 2 are presented on Figure 32.

Exterior red siding was low in lead content (0.05 mg/cm^2). Exterior white paint was high in lead content (5.1 mg/cm^2). No dust or soil samples were collected from this structure.

We were not able to determine whether the 1991 asbestos survey included this building. No suspect materials were observed, and no samples were collected for asbestos analysis.

Winch Hoist Buildings 1 and 2

Winch Hoist Building 1 is an unpainted metal shack located northwest of the Store and Warehouse (Photograph 14). No dust or soil samples were collected in this building. No suspect materials were observed, and no samples were collected for asbestos analysis.

Winch Hoist Building 2 is an unpainted structure located west of the Leaching Plant. No dust or soil samples were collected in this building. The brake shoes mentioned in the 1991 survey had been removed, and no other suspect materials were noted.

LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of NPS, for specific application to the referenced site. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Hart Crowser relied on information provided by individuals as indicated in the report. Hart Crowser can only relay this information as it has been presented and cannot be responsible for its accuracy nor its completeness.

We may not have identified all asbestos or lead present in or around the subject buildings, as our scope was limited in nature to the materials and areas described in this report. In addition, some of the areas we were asked to survey were inaccessible because of structural or other access problems.

We trust that this report meets your needs. Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to Bruce Ream at (907) 276-7475.

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APPENDIX A
SURVEY PHOTOGRAPHS

APPENDIX B
BULK ASBESTOS FIBER ANALYSIS REPORT
AND LEAD DUST WIPE RESULTS
NVL LABORATORIES, INC.
AND PREZANT ASSOCIATES, INC.

APPENDIX C
TRAINING CERTIFICATES
HART CROWSER INSPECTOR

APPENDIX D
XRF CALIBRATION CURVES

APPENDIX E
SOURCE ANALYSIS OF LEAD DUST AND SOIL
CANNON MICROPROBE