IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
MISSOULA DIVISION

UNITED STATES OF AMERICA, and THE STATE OF MONTANA Plaintiffs, vs. BNSF RAILWAY COMPANY, Defendant.	CV 20–126–M–DLC REMEDIAL ACTION CONSENT DECREE

Pursuant to this Court's prior Order (Doc. 16), the Court hereby LODGES the following Remedial Action Consent Decree as its final order:

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I. BACKGROUND

A. The United States of America (United States), on behalf of the Administrator of the United States Environmental Protection Agency (EPA), and the State of Montana filed a complaint in this matter pursuant to Sections 106 and 107 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9606 and 9607.

B. The Plaintiffs in their complaint seek, *inter alia*: (1) reimbursement of costs incurred by EPA, the Department of Justice (DOJ), and the State of Montana (State) for response actions at the Libby Asbestos Superfund Site, Operable Unit 6, as defined herein (Site), together with accrued interest; and (2) performance of response actions by the defendant at the Site consistent with the National Contingency Plan, 40 C.F.R. Part 300 (NCP).

C. The defendant (Settling Defendant) does not admit any liability to plaintiffs arising out of the transactions or occurrences alleged in the complaint, nor does it acknowledge that the release or threatened release of hazardous substances at or from the Site constitutes an imminent and substantial endangerment to the public health or welfare or the environment.

D. Pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, EPA placed the Libby Asbestos Superfund Site on the National Priorities List (NPL), set forth at 40 C.F.R. Part 300, Appendix B, by publication in the Federal Register on October 24, 2002, 67 Fed. Reg. 65315.

E. In approximately 2006, Settling Defendant completed a response action at the Libby Railyard pursuant to an Administrative Order on Consent (CERCLA Docket No. CERCLA-08-2003-0004, Libby Asbestos Site, Libby, Montana SSID#08-BC) (AO). EPA accepted final reports detailing the response action in 2010. On June 21, 2018, EPA issued a letter confirming the closure of the AO.

F. In response to a release or a substantial threat of a release of a hazardous substance at or from the Site, EPA commenced on September 24, 2013, a remedial investigation and feasibility study (RI/FS) for the Site pursuant to 40 C.F.R. § 300.430.

G. Settling Defendant completed a remedial investigation (RI) report on April 30, 2014, pursuant to EPA's Request for Additional Removal Action under the AO and the EPA completed a feasibility study (FS) Report in May 2015.

H. The decision by EPA on the remedial action to be implemented at the Site is embodied in a final Record of Decision (ROD), executed on February 8, 2016, on which the State has given its concurrence. The ROD includes a responsiveness summary to the public comments. Notice of the final plan was published in accordance with Section 117(b) of CERCLA, 42 U.S.C. § 9617(b).

I. Additional, substantial post-ROD confirmation sampling, at Plaintiffs' agreed depths and intervals (identified for the Site in Appendix B to the ROD) along locations identified as possibly having uncertainty, was completed by Settling Defendant. Applicable remedial action levels (RALs) were not exceeded in any of the confirmation samples and no additional sampling or removal work is required at this time.

J. Based on the information presently available to EPA and the State, EPA and the State believe that the Work will be properly and promptly conducted by Settling Defendant if conducted in accordance with this Consent Decree and its appendices.

K. Solely for the purposes of Section 113(j) of CERCLA, 42 U.S.C. § 9613(j), the remedy set forth in the ROD and the Work to be performed by Settling Defendant shall constitute a response action taken or ordered by the President for which judicial review shall be limited to the administrative record.

L. The Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and implementation of this Consent Decree will expedite the cleanup of the Site and will avoid prolonged and complicated litigation between the Parties, and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, it is hereby Ordered, Adjudged, and Decreed:

II. JURISDICTION

1. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331, 1345, and 1367 and 42 U.S.C. §§ 9606, 9607, and 9613(b). This Court also has personal jurisdiction over Settling Defendant. Solely for the purposes of this Consent Decree and the underlying complaint, Settling Defendant waives all objections and defenses that it may have to jurisdiction of the Court or to venue in this District. Settling Defendant shall not challenge the terms of this Consent Decree or this Court's jurisdiction to enter and enforce this Consent Decree.

III. PARTIES BOUND

2. This Consent Decree is binding upon the United States and the State and upon Settling Defendant and its successors and assigns. Any change in ownership or corporate or other legal status of Settling Defendant including, but not limited to, any transfer of assets or real or personal property, shall in no way alter Settling Defendant's responsibilities under this Consent Decree.

3. Settling Defendant shall provide a copy of this Consent Decree to each contractor hired to perform the Work and to each person representing Settling Defendant with respect to the Site or the Work, and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this Consent Decree. Settling Defendant or its contractors shall provide written notice of the Consent Decree to all subcontractors hired to perform any portion of the Work. Settling Defendant shall nonetheless be responsible for ensuring that its contractors and subcontractors perform the Work in accordance with the terms of this Consent Decree. With regard to the activities undertaken pursuant to this Consent Decree, each contractor and subcontractor shall be deemed to be in a contractual relationship with Settling Defendant within the meaning of Section 107(b)(3) of CERCLA, 42 U.S.C. § 9607(b)(3).

IV. DEFINITIONS

4. Unless otherwise expressly provided in this Consent Decree, terms used in this Consent Decree that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this Consent Decree or its appendices, the following definitions shall apply solely for purposes of this Consent Decree:

"Affected Property" shall mean all real property at the Libby Asbestos Superfund Site, Operable Unit 6, and any other real property where EPA determines, at any time, that access, land, water, or other resource use restrictions, and/or Institutional Controls are needed to implement the Remedial Action.

"AO" shall mean Administrative Order on Consent, issued under CERCLA Docket No. CERCLA-08-2003-0004, Libby Asbestos Site, Libby, Montana SSID#08-BC.

"CECRA" shall mean the Comprehensive Environmental Cleanup and Responsibility Act, §§ 75-10-705-729, MCA.

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. §§ 9601-9675.

"Consent Decree" shall mean this consent decree and all appendices attached hereto (listed in Section XXI). In the event of conflict between this Consent Decree and any appendix, this Consent Decree shall control.

"Day" shall mean a calendar day. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal or State holiday, the period shall run until the close of business of the next working day.

"DOJ" shall mean the United States Department of Justice and its successor departments, agencies, or instrumentalities.

"Effective Date" shall mean the date upon which the approval of this Consent Decree is recorded on the Court's docket.

"EPA" shall mean the United States Environmental Protection Agency and its successor departments, agencies, or instrumentalities.

"EPA Hazardous Substance Superfund" shall mean the Hazardous Substance Superfund established by the Internal Revenue Code, 26 U.S.C. § 9507.

"Future Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States incurs in reviewing or developing deliverables submitted pursuant to this Consent Decree, in overseeing implementation of the Work, or otherwise implementing, overseeing, or enforcing this Consent Decree, including, but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, Montana Department of Environmental Quality's (MDEQ's) costs under a State Cooperative Agreement with EPA, the costs incurred pursuant to Paragraph 9 (Emergencies and Releases), Paragraph 10 (Community Involvement) (including the costs of any technical assistance grant under Section 117(e) of CERCLA, 42 U.S.C. § 9617(e)), Section VII (Remedy Review), Section VIII (Property Requirements) (including the cost of attorney time and any monies paid to secure or enforce access or land, water, or other resource use restrictions and/or to secure, implement, monitor, maintain, or enforce Institutional Controls including the amount of just compensation), and Section XII (Dispute Resolution), and all litigation costs. Future Response Costs shall also include all costs, including, but not limited to, direct and indirect costs, (a) paid by the United States in connection with the Site accrued during the period from September 30, 2019 to the Effective Date, or (b) incurred prior to the Effective Date but paid after that date.

"Institutional Controls" or "ICs" shall mean Proprietary Controls and state or local laws, regulations, ordinances, zoning restrictions, or other governmental controls or notices that: (a) limit land, water, or other resource use to minimize the potential for human exposure to Waste Material at or in connection with the Site; (b) limit land, water, or other resource use to implement, ensure non-interference with, or ensure the protectiveness of the Remedial Action; and/or (c) provide information intended to modify or guide human behavior at or in connection with the Site.

"Interest" shall mean interest at the rate specified for interest on investments of the EPA Hazardous Substance Superfund, compounded annually on October 1 of each year, in accordance with 42 U.S.C. § 9607(a). The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year. Rates are available online at https://www.epa.gov/superfund/superfund-interest-rates.

"Libby Asbestos Operable Unit 6 Special Account" shall mean the special account, within the EPA Hazardous Substance Superfund, established for the Site by EPA pursuant to Section 122(b)(3) of CERCLA, 42 U.S.C. § 9622(b)(3).

"MDEQ" shall mean the Montana Department of Environmental Quality and any successor departments or agencies of the State.

"NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, codified at 40 C.F.R. Part 300, and any amendments thereto.

"Operation and Maintenance" or "O&M" shall mean all activities required to operate, maintain, and monitor the effectiveness of the Remedial Action as specified in the SOW or any EPA-approved O&M Plan.

"Paragraph" shall mean a portion of this Consent Decree identified by an Arabic numeral or an upper or lower case letter.

"Parties" shall mean the United States, the State of Montana, and Settling Defendant.

"Past Response Costs" shall mean all costs, including, but not limited to, direct and indirect costs, that the United States paid at or in connection with the Site through

September 30, 2019, plus Interest on all such costs that has accrued pursuant to 42 U.S.C. § 9607(a) through such date.

"Performance Standards" shall mean the cleanup levels and other measures of achievement of the remedial action objectives, as set forth in the ROD.

"Plaintiffs" shall mean the United States and the State of Montana.

"Proprietary Controls" shall mean easements or covenants running with the land that (a) limit land, water, or other resource use and/or provide access rights and (b) are created pursuant to common law or statutory law by an instrument that is recorded in the appropriate land records office.

"RCRA" shall mean the Solid Waste Disposal Act, 42 U.S.C. §§ 6901-6992 (also known as the Resource Conservation and Recovery Act).

"ROD" shall mean the EPA Record of Decision relating to the Libby Asbestos Superfund Site, Operable Units 4, 5, 6, 7, and 8, signed on February 8, 2016, by the Regional Administrator, EPA Region 8, or his/her delegate, and all attachments thereto. The ROD is attached as Appendix A.

"Remedial Action" shall mean the remedial action selected in the ROD, for Operable Unit 6 of the Libby Asbestos Superfund Site. The scope of the remedy is defined further in the attached Statement of Work (SOW).

"Section" shall mean a portion of this Consent Decree identified by a Roman numeral.

"Settling Defendant" shall mean BNSF Railway Company.

"Site" shall mean Operable Unit 6 of the Libby Asbestos Superfund Site, defined geographically by the boundary of Settling Defendant's railroad right-of-way from the eastern boundary of Operable Unit 4 of the Libby Asbestos Superfund Site (Residential/Commercial Area of Libby, Montana) to the western boundary of Operable Unit 7 of the Libby Asbestos Superfund Site (Town of Troy, Montana), totaling approximately 42 miles of Settling Defendant's right-of-way (from approximately BNSF Milepost 1301 of Settling Defendant's Kootenai River Subdivision to approximately BNSF Milepost 1342), and the extent of contamination associated with Settling Defendant's Libby and Troy railyards, depicted generally on the map attached as Appendix C. The width of Operable Unit 6 is defined by the width of Settling Defendant's right-of-way, which is variable, but is generally 100 feet to either side of the track centerline. The Settling Defendant's track and right-of-way generally follows the courses of the Fisher and Kootenai Rivers.

"State" shall mean the State of Montana.

"SOW" shall mean the Statement of Work, the document describing the activities Settling Defendant must perform to implement the Remedial Action and O&M regarding the Site, which is attached hereto as Appendix B.

"Supervising Contractor" shall mean the principal contractor retained by Settling Defendant to supervise and direct the implementation of the Work under this Consent Decree.

"Transfer" shall mean to sell, assign, convey, lease, mortgage, or grant a security interest in, or where used as a noun, a sale, assignment, conveyance, or other disposition of any interest by operation of law or otherwise.

"United States" shall mean the United States of America and each department, agency, and instrumentality of the United States, including EPA.

"Waste Material" shall mean (1) any "hazardous substance" under Section 101(14) of CERCLA, 42 U.S.C. § 9601(14); (2) any pollutant or contaminant under Section 101(33) of CERCLA, 42 U.S.C. § 9601(33); (3) any "solid waste" under Section 1004(27) of RCRA, 42 U.S.C.§ 6903(27); and (4) any "hazardous or deleterious substance" under Section 75-10-701(8), MCA.

"Work" shall mean all activities and obligations Settling Defendant is required to perform under this Consent Decree, except the activities required under Section XVIII (Retention of Records).

V. GENERAL PROVISIONS

5. **Objectives of the Parties**. The objectives of the Parties in entering into this Consent Decree are to protect public health or welfare or the environment by the implementation of response actions at the Site by Settling Defendant, to pay response costs of Plaintiffs, and to resolve the claims of Plaintiffs against Settling Defendant as provided in this Consent Decree.

6. **Commitments by Settling Defendant**. Settling Defendant shall finance and perform the Work in accordance with this Consent Decree and all deliverables developed by Settling Defendant and approved or modified by EPA pursuant to this Consent Decree. Settling Defendant shall pay the United States for its response costs and the State for its response costs as provided in this Consent Decree.

VI. PERFORMANCE OF THE WORK

7. Coordination and Supervision

a. Project Coordinators

(1) Settling Defendant's Project Coordinator must have sufficient technical expertise to coordinate the Work. The Parties' Project Coordinators may not be an attorney representing the parties in this matter and may not act as the Supervising Contractor. Settling Defendant's Project Coordinator may assign other representatives, including other contractors, to assist in coordinating the Work.

(2) EPA has designated Dania Zinner as EPA's Project Coordinator. EPA may designate other representatives, which may include its employees,

contractors and/or consultants, to oversee the Work. EPA's Project Coordinator will have the same authority as a remedial project manager and/or an on-scene coordinator, as described in the NCP. This includes the authority to halt the Work and/or to conduct or direct any necessary response action when he or she determines that conditions at the Site constitute an emergency or may present an immediate threat to public health or welfare or the environment due to a release or threatened release of Waste Material.

(3) The State has designated Jason Rappe as MDEQ's Project Coordinator. The State may designate other representatives, including its employees, contractors and/or consultants to oversee the Work. For any meetings and inspections in which EPA's Project Coordinator participates, the State's Project Coordinator also may participate.

(4) Notwithstanding the procedures of Paragraphs 7.b, Settling Defendant has proposed, and EPA has authorized Settling Defendant to proceed, regarding the following Project Coordinator:

Mark Engdahl
Manager – Environmental Remediation
BNSF Railway Company
800 North Last Chance Gulch
Helena, Montana 59601
Office: 406-256-4048
Mark.Engdahl@bnsf.com

b. Procedures for Disapproval/Notice to Proceed

(1) Settling Defendant may change their Project Coordinator, as applicable, by following the procedures of Paragraphs 7.b(2) and 7.b(3).

(2) Settling Defendant shall designate, and notify EPA, of the name, title, contact information, and qualifications of the Settling Defendant's proposed Project Coordinator, whose qualifications shall be subject to EPA's review for verification based on objective assessment criteria (e.g., experience, capacity, technical expertise) and do not have a conflict of interest with respect to the project.

(3) EPA, after a reasonable opportunity for review and comment by the State, shall issue notices of disapproval and/or authorizations to proceed regarding the proposed Project Coordinator, as applicable. If EPA issues a notice of disapproval, Settling Defendant shall, within 30 days, submit to EPA a list of supplemental proposed Project Coordinators, as applicable, including a description of the qualifications of each. EPA shall issue a notice of disapproval or authorization to proceed regarding each supplemental proposed coordinator. Settling Defendant may select any coordinator covered by an authorization to proceed and shall, within 21 days, notify EPA of Settling Defendant's selection.

8. **Performance of Work in Accordance with SOW**. Settling Defendant shall: (a) perform the Remedial Action and (b) operate, maintain, and monitor the effectiveness of the Remedial Action; all in accordance with the SOW and all EPA-approved, conditionally-approved, or modified deliverables as required by the SOW. All deliverables required to be submitted for approval under the Consent Decree or SOW shall be subject to approval by EPA in accordance with Paragraph 4.5 (Approval of Deliverables) of the SOW.

9. **Emergencies and Releases**. Settling Defendant shall comply with the emergency release response and reporting requirements under Paragraph 3.1 (Emergency Response and Reporting) of the SOW. Subject to Section XIV (Covenants by Plaintiffs), nothing in this Consent Decree, including Paragraph 3.1 of the SOW, limits any authority of Plaintiffs: (a) to take all appropriate action to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Site, or (b) to direct or order such action, or seek an order from the Court, to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release of Waste Material on, at, or from the Site. If, due to Settling Defendant's failure to take appropriate response action under Paragraph 3.1 of the SOW, EPA or, as appropriate, the State take such action instead, Settling Defendant shall reimburse EPA and the State under Section IX (Payments for Response Costs) for all costs of the response action.

10. **Community Involvement**. If requested by EPA, Settling Defendant shall assist with community involvement activities under EPA's oversight as provided for in, and in accordance with, Section 2 (Community Involvement) of the SOW. Costs incurred by the United States under this Section constitute Future Response Costs to be reimbursed under Section IX (Payments for Response Costs).

11. Modification of SOW or Related Deliverables

a. If EPA determines that it is necessary to modify the work specified in the SOW and/or in deliverables developed under the SOW in order to carry out and maintain the effectiveness of the Remedial Action, and such modification is consistent with the Scope of the Remedy set forth in Paragraph 1.3 of the SOW, then EPA may notify Settling Defendant of such modification. If Settling Defendant objects to the modification it may, within 30 days after EPA's notification, seek dispute resolution under Section XII.

b. The SOW and/or related work plans shall be modified: (1) in accordance with the modification issued by EPA; or (2) if Settling Defendant invokes dispute resolution, in accordance with the final resolution of the dispute. The modification shall be incorporated into and enforceable under this Consent Decree, and Settling Defendant shall implement all work required by such modification. Settling Defendant shall incorporate the modification into the deliverable required under the SOW, as appropriate.

c. Nothing in this Paragraph shall be construed to limit EPA's authority to require performance of further response actions as otherwise provided in this Consent Decree.

12. Nothing in this Consent Decree, the SOW, or any deliverable required under the SOW constitutes a warranty or representation of any kind by any party that compliance with the

work requirements set forth in the SOW or related deliverable will achieve the Performance Standards.

VII. REMEDY REVIEW

13. **Periodic Review**. Settling Defendant shall conduct studies and investigations to support EPA's reviews under Section 121(c) of CERCLA, 42 U.S.C. § 9621(c), and applicable regulations, of whether the Remedial Action is protective of human health and the environment.

VIII. PROPERTY REQUIREMENTS

14. **Agreements Regarding Access and Non-Interference.** Settling Defendant shall, with respect to any Affected Property it does not own, use best efforts to secure from such owner an agreement, enforceable by Settling Defendant and by Plaintiffs, that: (i) provides Plaintiffs and Settling Defendant, and their representatives, contractors, and subcontractors with access at all reasonable times to such Affected Property to conduct any activity regarding the Consent Decree, including those listed in Paragraph 14.a (Access Requirements); and (ii) refrain from using such Affected Property in any manner that EPA determines will pose an unacceptable risk to human health or to the environment due to exposure to Waste Material, or interfere with or adversely affect the implementation, integrity, or protectiveness of the Remedial Action, including the restrictions listed in Paragraph 14.b (Land, Water, or Other Resource Use Restrictions). Settling Defendant shall, with respect to Affected Property that it owns, provide Plaintiffs and their representatives, contractors, and subcontractors railroad-escorted access to such Affected Property, at all reasonable times, as set forth in this Paragraph. The Affected Property includes active railyards and rail lines. Any such access will be subject to Settling Defendant's Health and Safety Plan, Settling Defendant's railroad safety rules and, where possible, reasonable notice. Notwithstanding any provision of this Consent Decree, EPA and the State retain all of their access authorities and rights, as well as all of their rights to require land/water use restrictions, including enforcement authorities related hereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

a. **Access Requirements**. The following is a list of activities for which access is required regarding the Affected Property:

(1) Monitoring the Work;

(2) Verifying any data or information submitted to the United States or the State;

(3) Conducting investigations regarding contamination at or near the Site;

(4) Obtaining samples;

(5) Assessing the need for, planning, or implementing additional response actions at or near the Site;

(6) Assessing implementation of quality assurance and quality control practices as defined in the approved construction quality assurance quality control plan as provided in the SOW;

(7) Inspecting and copying records, operating logs, contracts, or other documents maintained or generated by Settling Defendant or their agents, consistent with Section XVII (Access to Information);

(8) Assessing Settling Defendant's compliance with the Consent Decree;

(9) Determining whether the Affected Property is being used in a manner that is prohibited or restricted, or that may need to be prohibited or restricted under the Consent Decree; and

(10) Implementing, monitoring, maintaining, reporting on, and enforcing any land, water, or other resource use restrictions and Institutional Controls.

b. **Land Use Restrictions**. Land use restrictions are set forth in the Environmental Covenant, attached hereto as Appendix D.

c. **Best Efforts**. As used in this Section, "best efforts" means the efforts that a reasonable person in the position of Settling Defendant would use so as to achieve the goal in a timely manner, including the cost of employing professional assistance and the payment of reasonable sums of money to secure access. If Settling Defendant is unable to accomplish what is required through "best efforts" in a timely manner, it shall notify the United States, and include a description of the steps taken to comply with the requirements. If the United States deems it appropriate, it may assist Settling Defendant, or take independent action, in obtaining such access. All costs incurred by the United States in providing such assistance or taking such action, including the cost of attorney time and the amount of monetary consideration or just compensation paid, constitute Future Response Costs to be reimbursed under Section IX (Payments for Response Costs).

15. In the event of any Transfer of the Affected Property, unless the United States otherwise consents in writing, Settling Defendant shall continue to comply with its obligations under the Consent Decree, including its obligation to secure access and ensure compliance with any land, water, or other resource use restrictions regarding the Affected Property, and to implement, maintain, monitor, and report on Institutional Controls.

16. Notwithstanding any provision of the Consent Decree, Plaintiffs retain all of their access authorities and rights, as well as all of their rights to require land, water, or other resource use restrictions and Institutional Controls, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statute or regulations.

IX. PAYMENTS FOR RESPONSE COSTS

17. Payments by Settling Defendant for Past Response Costs

a. Settling Defendant has previously paid all Past Response Costs, including MDEQ's costs under a State Cooperative Agreement with EPA.

18. **Payments by Settling Defendant for Future Response Costs**. Settling Defendant shall pay to EPA all Future Response Costs not inconsistent with the NCP.

a. **Periodic Bills**. On a periodic basis, EPA will send Settling Defendant an electronic billing notification to the following email address:

Mark.Engdahl@bnsf.com and Shannon.Boxberger@bnsf.com.

The billing notification will include a standard EPA cost report, which includes direct and indirect costs incurred by EPA, its contractors, subcontractors, the State and DOJ. Settling Defendant shall make all payments within 30 days after Settling Defendant's receipt of each bill requiring payment, except as otherwise provided in Paragraph 20, in accordance with Paragraph 19.a (instructions for future response cost payments).

If the electronic billing notification is undeliverable, EPA will mail a paper copy of the billing notification to Respondent to:

Mark Engdahl
Manager – Environmental Remediation
BNSF Railway Company
800 North Last Chance Gulch
Helena, Montana 59601

b. Settling Defendant may change its email address by providing notice of the new address to:

Financial Management Officer
U.S. EPA, Region 8 (MSD-FM-B)
1595 Wynkoop Street
Denver, Colorado 80202

c. **Deposit of Future Response Costs Payments**. The total amount to be paid by Settling Defendant pursuant to Paragraph 18.a (Periodic Bills) shall be deposited by EPA in the Libby Asbestos Special Account to be retained and used to conduct or finance response actions at or in connection with the Libby Asbestos Superfund Site, or to be transferred by EPA in its sole discretion to the EPA Hazardous Substance Superfund.

19. Payment Instructions for Settling Defendant

a. Future Response Costs Payments and Stipulated Penalties

(1) For all payments subject to this Paragraph 19.a, Settling Defendant shall make such payment in accordance with instructions provided in periodic bills from EPA.

(2) For all payments made under this Paragraph 19.a, Settling Defendant must include references to the Site/Spill ID and DJ numbers. At the time of any payment required to be made in accordance with Paragraph 19.a, Settling Defendant shall send notices that payment has been made to the United States, EPA, and the EPA Cincinnati Finance Center, all in accordance with Paragraph 74. All notices must include references to the Site/Spill ID and DJ numbers.

20. **Contesting Future Response Costs**. Settling Defendant may submit a Notice of Dispute, initiating the procedures of Section XII (Dispute Resolution), regarding any Future Response Costs billed under Paragraph 18 (Payments by Settling Defendant for Future Response Costs) if it determines that EPA has made a mathematical error or included a cost item that is not within the definition of Future Response Costs, or if it believes EPA incurred excess costs as a direct result of an EPA action that was inconsistent with a specific provision or provisions of the NCP. Such Notice of Dispute shall be submitted in writing within 30 days after receipt of the bill and must be sent to the United States (if the United States' accounting is being disputed) pursuant to Section XIX (Notices and Submissions). Such Notice of Dispute shall specifically identify the contested Future Response Costs and the basis for objection. If Settling Defendant submits a Notice of Dispute, Settling Defendant shall, as a requirement for initiating the dispute, within the 30-day period (a) pay all uncontested Future Response Costs to the United States and (b) establish, in a duly chartered bank or trust company, an interest-bearing escrow account that is insured by the Federal Deposit Insurance Corporation (FDIC), and remit to that escrow account funds equivalent to the amount of the contested Future Response Costs. Settling Defendant shall send to the United States, as appropriate, as provided in Section XIX (Notices and Submissions), a copy of the transmittal letter and check paying the uncontested Future Response Costs, and a copy of the correspondence that establishes and funds the escrow account, including, but not limited to, information containing the identity of the bank and bank account under which the escrow account is established as well as a bank statement showing the initial balance of the escrow account. If the United States prevails in the dispute, Settling Defendant shall pay the sums due (with accrued interest) to the United States. If Settling Defendant prevails concerning any aspect of the contested costs, Settling Defendant shall pay that portion of the costs (plus associated accrued interest) for which it did not prevail to the United States within 60 days after resolution of the dispute in accordance with Section XII (Dispute Resolution). Settling Defendant shall be disbursed any balance of the escrow account. All payments to the United States under this Paragraph shall be made in accordance with Paragraph 19.a (instructions for future response cost payments). The dispute resolution procedures set forth in this Paragraph in conjunction with the procedures set forth in Section XII (Dispute Resolution) shall be the

exclusive mechanisms for resolving disputes regarding Settling Defendant's obligation to reimburse the United States for its Future Response Costs.

21. **Interest**. In the event that any payment for Future Response Costs required under this Section is not made by the date required, Settling Defendant shall pay Interest on the unpaid balance. The Interest on Future Response Costs shall begin to accrue on the date of the bill. Except as otherwise provided in Paragraph 34, the Interest shall accrue through the date of Settling Defendant's payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to Plaintiffs by virtue of Settling Defendant's failure to make timely payments under this Section including, but not limited to, payment of stipulated penalties pursuant to Section XIII (Stipulated Penalties).

X. INDEMNIFICATION

22. Settling Defendant's Indemnification of the United States and the State

a. The United States and the State do not assume any liability by entering into this Consent Decree or by virtue of any designation of Settling Defendant as EPA's authorized representatives under Section 104(e) of CERCLA, 42 U.S.C. § 9604(e). Settling Defendant shall indemnify, save, and hold harmless the United States and the State and their officials, agents, employees, contractors, subcontractors, and representatives for or from any and all claims or causes of action arising from, or on account of, negligent or other wrongful acts or omissions of Settling Defendant, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on Settling Defendant's behalf or under its control, in carrying out activities pursuant to this Consent Decree, including, but not limited to, any claims arising from any designation of Settling Defendant as EPA's authorized representatives under Section 104(e) of CERCLA. Further, Settling Defendant agrees to pay the United States and the State all costs they incur including, but not limited to, attorneys' fees and other expenses of litigation and settlement arising from, or on account of, claims made against the United States and the State based on negligent or other wrongful acts or omissions of Settling Defendant, its officers, directors, employees, agents, contractors, subcontractors, and any persons acting on its behalf or under its control, in carrying out activities pursuant to this Consent Decree. Neither the United States nor the State shall be held out as a party to any contract entered into by or on behalf of Settling Defendant in carrying out activities pursuant to this Consent Decree. Neither Settling Defendant nor any such contractor shall be considered an agent of the United States or the State.

b. The United States and the State, respectively, shall give Settling Defendant notice of any claim for which the United States or the State plans to seek indemnification pursuant to this Paragraph 22 within 10 days after assertion of a claim or service of a complaint, and shall consult with Settling Defendant prior to settling such claim.

23. Settling Defendant covenants not to sue and agrees not to assert any claims or causes of action against the United States and the State, respectively, for damages or reimbursement or for set-off of any payments made or to be made to the United States or the State, arising from or on account of any contract, agreement, or arrangement between Settling

Defendant and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays. In addition, Settling Defendant shall indemnify, save and hold harmless the United States and the State with respect to any and all claims for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between Settling Defendant and any person for performance of Work on or relating to the Site, including, but not limited to, claims on account of construction delays.

XI. FORCE MAJEURE

24. "Force majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of Settling Defendant, of any entity controlled by Settling Defendant, or of Settling Defendant's contractors that delays or prevents the performance of any obligation under this Consent Decree despite Settling Defendant's best efforts to fulfill the obligation. The requirement that Settling Defendant exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure and best efforts to address the effects of any potential force majeure (a) as it is occurring and (b) following the potential force majeure such that the delay and any adverse effects of the delay are minimized to the greatest extent possible. "Force majeure" does not include financial inability to complete the Work or a failure to achieve the Performance Standards.

25. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree for which Settling Defendant intends or may intend to assert a claim of force majeure, Settling Defendant shall notify EPA's Project Coordinator orally or electronically or, in his or her absence, the Division Director of the Superfund and Emergency Management Division, EPA Region 8, within three days of when Settling Defendant first knew that the event might cause a delay. Within ten days thereafter, Settling Defendant shall provide in writing to EPA and the State an explanation and description of the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Settling Defendant's rationale for attributing such delay to a force majeure; and a statement as to whether, in the opinion of Settling Defendant, such event may cause or contribute to an endangerment to public health or welfare, or the environment. Settling Defendant shall include with any notice all available documentation supporting their claim that the delay was attributable to a force majeure. Settling Defendant shall be deemed to know of any circumstance of which Settling Defendant, any entity controlled by Settling Defendant, or Settling Defendant's contractors or subcontractors knew or should have known. Failure to comply with the above requirements regarding an event shall preclude Settling Defendant from asserting any claim of force majeure regarding that event, provided, however, that if EPA, despite the late or incomplete notice, is able to assess to its satisfaction whether the event is a force majeure under Paragraph 24 and whether Settling Defendant has exercised their best efforts under Paragraph 24, EPA may, in its unreviewable discretion, excuse in writing Settling Defendant's failure to submit timely or complete notices under this Paragraph.

26. If EPA, after a reasonable opportunity for review and comment by the State, agrees that the delay or anticipated delay is attributable to a force majeure, the time for

performance of the obligations under this Consent Decree that are affected by the force majeure will be extended by EPA, after a reasonable opportunity for review and comment by the State, for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure shall not, of itself, extend the time for performance of any other obligation. If EPA, after a reasonable opportunity for review and comment by the State, does not agree that the delay or anticipated delay has been or will be caused by a force majeure, EPA will notify Settling Defendant in writing of its decision. If EPA, after a reasonable opportunity for review and comment by the State, agrees that the delay is attributable to a force majeure, EPA will notify Settling Defendant in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure.

27. If Settling Defendant elects to invoke the dispute resolution procedures set forth in Section XII (Dispute Resolution) regarding EPA's decision, it shall do so no later than 15 days after receipt of EPA's notice. In any such proceeding, Settling Defendant shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Settling Defendant complied with the requirements of Paragraphs 24 and 25. If Settling Defendant carries this burden, the delay at issue shall be deemed not to be a violation by Settling Defendant of the affected obligation of this Consent Decree identified to EPA and the Court.

28. The failure by EPA to timely complete any obligation under the Consent Decree or under the SOW is not a violation of the Consent Decree, provided, however, that if such failure prevents Settling Defendant from meeting one or more deadlines in the SOW, Settling Defendant may receive like relief under this Section.

XII. DISPUTE RESOLUTION

29. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes regarding this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States to enforce obligations of Settling Defendant that have not been disputed in accordance with this Section.

30. A dispute shall be considered to have arisen when one party sends the other parties a written Notice of Dispute. Any dispute regarding this Consent Decree shall in the first instance be the subject of informal negotiations between the parties to the dispute. The period for informal negotiations shall not exceed 20 days from the time the dispute arises, unless it is modified by written agreement of the parties to the dispute.

31. Statements of Position

a. In the event that the parties cannot resolve a dispute by informal negotiations under the preceding Paragraph, then the position advanced by EPA shall be considered binding unless, within 30 days after the conclusion of the informal negotiation period, Settling Defendant invokes the formal dispute resolution procedures of this Section by serving on the United States and the State a written Statement of Position on the matter in dispute, including, but not limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by Settling Defendant. The Statement of Position shall specify Settling Defendant's position as to whether formal dispute resolution should proceed under Paragraph 32 (Record Review) or 33.

b. Within thirty days after receipt of Settling Defendant's Statement of Position, EPA will serve on Settling Defendant its Statement of Position, including, but not limited to, any factual data, analysis, or opinion supporting that position and all supporting documentation relied upon by EPA. EPA's Statement of Position shall include a statement as to whether formal dispute resolution should proceed under Paragraph 32 (Record Review) or 33. Within thirty days after receipt of EPA's Statement of Position, Settling Defendant may submit a Reply.

c. If there is disagreement between EPA and Settling Defendant as to whether dispute resolution should proceed under Paragraph 32 (Record Review) or 33, the parties to the dispute shall follow the procedures set forth in the Paragraph determined by EPA to be applicable. However, if Settling Defendant ultimately appeals to the Court to resolve the dispute, the Court shall determine which Paragraph is applicable in accordance with the standards of applicability set forth in Paragraphs 32 and 33.

32. **Record Review**. Formal dispute resolution for disputes pertaining to the selection or adequacy of any response action and all other disputes that are accorded review on the administrative record under applicable principles of administrative law shall be conducted pursuant to the procedures set forth in this Paragraph. For purposes of this Paragraph, the adequacy of any response action includes, without limitation, the adequacy or appropriateness of plans, procedures to implement plans, or any other items requiring approval by EPA under this Consent Decree, and the adequacy of the performance of response actions taken pursuant to this Consent Decree. Nothing in this Consent Decree shall be construed to allow any dispute by Settling Defendant regarding the validity of the ROD's provisions.

a. An administrative record of the dispute shall be maintained by EPA and shall contain all statements of position, including supporting documentation, submitted pursuant to this Section. Where appropriate, EPA may allow submission of supplemental statements of position by the parties to the dispute.

b. The Division Director of the Superfund and Emergency Management Division, EPA Region 8, will issue a final administrative decision resolving the dispute based on the administrative record described in Paragraph 32.a. This decision shall be binding upon Settling Defendant, subject only to the right to seek judicial review pursuant to Paragraphs 32.c and 32.d.

c. Any administrative decision made by EPA pursuant to Paragraph 32.b shall be reviewable by this Court, provided that a motion for judicial review of the decision is filed by Settling Defendant with the Court and served on all Parties within 30 days after receipt of EPA's decision. The motion shall include a description of the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of this Consent Decree. The United States may file a response to Settling Defendant's motion.

d. In proceedings on any dispute governed by this Paragraph, Settling Defendant shall have the burden of demonstrating that the decision of the Division Director of the Superfund and Emergency Management Division, EPA Region 8, is arbitrary and capricious or otherwise not in accordance with law. Judicial review of EPA's decision shall be on the administrative record compiled pursuant to Paragraph 32.a.

33. Formal dispute resolution for disputes that neither pertain to the selection or adequacy of any response action nor are otherwise accorded review on the administrative record under applicable principles of administrative law, shall be governed by this Paragraph.

a. The Division Director of the Superfund and Emergency Management Division, EPA Region 8, will issue a final decision resolving the dispute based on the statements of position and reply, if any, served under Paragraph 31. The decision of the Division Director of the Superfund and Emergency Management Division, EPA Region 8, shall be binding on Settling Defendant unless, within 30 days after receipt of the decision, Settling Defendant files with the Court and serve on the parties a motion for judicial review of the decision setting forth the matter in dispute, the efforts made by the parties to resolve it, the relief requested, and the schedule, if any, within which the dispute must be resolved to ensure orderly implementation of the Consent Decree. The United States may file a response to Settling Defendant's motion.

b. Notwithstanding Paragraph K (CERCLA § 113(j) record review of ROD and Work) of Section I (Background), judicial review of any dispute governed by this Paragraph shall be governed by applicable principles of law.

34. The invocation of formal dispute resolution procedures under this Section does not extend, postpone, or affect in any way any obligation of Settling Defendant under this Consent Decree, except as provided in Paragraph 20 (Contesting Future Response Costs), as agreed by EPA, or as determined by the Court. Stipulated penalties with respect to the disputed matter shall continue to accrue, but payment shall be stayed pending resolution of the dispute, as provided in Paragraph 40. In the event that Settling Defendant does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section XIII (Stipulated Penalties).

XIII. STIPULATED PENALTIES

35. Settling Defendant shall be liable to the United States for stipulated penalties in the amounts set forth in Paragraph 36.a for failure to comply with the obligations specified in Paragraph 36.b, unless excused under Section XI (Force Majeure). "Comply" as used in the previous sentence includes compliance by Settling Defendant with all applicable requirements of this Consent Decree, within the deadlines established under this Consent Decree. If an initially submitted or resubmitted deliverable contains a material defect, and the deliverable is disapproved or modified by EPA under Paragraphs 4.5(a) (Initial Submissions) or 4.5(b)

(Resubmissions) of the SOW due to such material defect, then the material defect shall constitute a lack of compliance for purposes of this Paragraph.

36. Stipulated Penalty Amounts - Payments, Major Deliverables, and Other Milestones

a. The following stipulated penalties shall accrue per violation per day for any noncompliance identified in Paragraph 36.b:

Period of Noncompliance	Penalty Per Violation Per Day
1st through 14th day	$750
15th through 30th day	$1,000
31st day and beyond	$2,500

b. Obligations

(1) Payment of any amount due under Section IX (Payments for Response Costs)

(2) Establishment of an escrow account to hold any disputed Future Response Costs under Paragraph 20 (Contesting Future Response Costs)

(3) Timely submission of Draft Final ICIAP

(4) Timely submission of Final ICIAP

(5) Timely submission of Draft Final Remedial Action Report

(6) Timely submission of Final Remedial Action Report

(7) Timely submission of Draft Final O&M Plan (including Best Management Practices Manual)

(8) Timely submission of Final O&M Plan (including Best Management Practices Manual)

(9) Timely submission of any other deliverables pursuant to the Consent Decree

37. All penalties shall begin to accrue on the day after the complete performance is due or the day a violation occurs and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity. However, stipulated penalties shall not accrue: (a) with respect to a deficient submission under Paragraph 4.5 (Approval of Deliverables) of the SOW, during the period, if any, beginning on the 31st day after EPA's receipt of such submission until the date that EPA notifies Settling Defendant of any deficiency; (b) with respect to a decision by the Division Director of the Superfund and Emergency Management Division, EPA Region 8, under Paragraph 32.b or 33.a of Section XII (Dispute Resolution), during the period, if any, beginning on the date that Settling Defendant's reply to EPA's Statement of Position is received until the date that the Director issues a final decision

regarding such dispute; or (c) with respect to judicial review by this Court of any dispute under Section XII (Dispute Resolution), during the period, if any, beginning on the 31st day after the Court's receipt of the final submission regarding the dispute until the date that the Court issues a final decision regarding such dispute. Nothing in this Consent Decree shall prevent the simultaneous accrual of separate penalties for separate violations of this Consent Decree.

38. Following EPA's determination that Settling Defendant has failed to comply with a requirement of this Consent Decree, EPA may give Settling Defendant written notification of the same and describe the noncompliance. EPA and the State may send Settling Defendant a written demand for payment of the penalties. However, penalties shall accrue as provided in the preceding Paragraph regardless of whether EPA has notified Settling Defendant of a violation.

39. All penalties accruing under this Section shall be due and payable to the United States within 30 days after Settling Defendant's receipt from EPA of a demand for payment of the penalties, unless Settling Defendant invokes the Dispute Resolution procedures under Section XII (Dispute Resolution) within the 30-day period. All payments to the United States under this Section shall indicate that the payment is for stipulated penalties and shall be made in accordance with Paragraph 19.a (instructions for future response cost payments).

40. Penalties shall continue to accrue as provided in Paragraph 37 during any dispute resolution period, but need not be paid until the following:

a. If the dispute is resolved by agreement of the parties or by a decision of EPA that is not appealed to this Court, accrued penalties determined to be owed shall be paid to EPA within 30 days after the agreement or the receipt of EPA's decision or order;

b. If the dispute is appealed to this Court and the United States prevails in whole or in part, Settling Defendant shall pay all accrued penalties determined by the Court to be owed to EPA within 60 days after receipt of the Court's decision or order, except as provided in Paragraph 40.c;

c. If the District Court's decision is appealed by any Party, Settling Defendant shall pay all accrued penalties determined by the District Court to be owed to the United States into an interest-bearing escrow account, established at a duly chartered bank or trust company that is insured by the FDIC, within 60 days after receipt of the Court's decision or order. Penalties shall be paid into this account as they continue to accrue, at least every 60 days. Within 15 days after receipt of the final appellate court decision, the escrow agent shall pay the balance of the account to EPA or to Settling Defendant to the extent that they prevail.

41. If Settling Defendant fails to pay stipulated penalties when due, Settling Defendant shall pay Interest on the unpaid stipulated penalties as follows: (a) if Settling Defendant has timely invoked dispute resolution such that the obligation to pay stipulated penalties has been stayed pending the outcome of dispute resolution, Interest shall accrue from the date stipulated penalties are due pursuant to Paragraph 40 until the date of payment; and (b) if Settling Defendant fails to timely invoke dispute resolution, Interest shall accrue from the end of the 30-day deadline communicated in the demand under Paragraph 39 until the date of

payment. If Settling Defendant fails to pay stipulated penalties and Interest when due, the United States may institute proceedings to collect the penalties and Interest.

42. The payment of penalties and Interest, if any, shall not alter in any way Settling Defendant's obligation to complete the performance of the Work required under this Consent Decree.

43. Nothing in this Consent Decree shall be construed as prohibiting, altering, or in any way limiting the ability of the United States or the State to seek any other remedies or sanctions available by virtue of Settling Defendant's violation of this Consent Decree or of the statutes and regulations upon which it is based, including, but not limited to, penalties pursuant to Section 122(l) of CERCLA, 42 U.S.C. § 9622(*l*), provided, however, that the United States shall not seek civil penalties pursuant to Section 122(*l*) of CERCLA for any violation for whicha stipulated penalty is provided in this Consent Decree, except in the case of a willful violation of this Consent Decree.

44. Notwithstanding any other provision of this Section, the United States may, in its unreviewable discretion, waive any portion of stipulated penalties that have accrued pursuant to this Consent Decree.

XIV. COVENANTS BY PLAINTIFFS

45. **Covenants for Settling Defendant by United States**. Except as provided in Paragraph 49 (General Reservations of Rights), the United States covenants not to sue or to take administrative action against Settling Defendant pursuant to Sections 106 and 107(a) of CERCLA for the Work, Past Response Costs, and Future Response Costs. These covenants shall take effect upon the Effective Date. These covenants are conditioned upon the satisfactory performance by Settling Defendant of its obligations under this Consent Decree. These covenants extend only to Settling Defendant and do not extend to any other person.

46. **United States' Pre-Certification Reservations**. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel Settling Defendant to perform further response actions relating to the Site and/or to pay the United States for additional costs of response if, (a) prior to Certification of Remedial Action Completion, (1) conditions at the Site, previously unknown to EPA, are discovered, or (2) information, previously unknown to EPA, is received, in whole or in part, and (b) EPA determines that these previously unknown conditions or information together with any other relevant information indicates that the Remedial Action is not protective of human health or the environment.

47. **United States' Post-Certification Reservations**. Notwithstanding any other provision of this Consent Decree, the United States reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel Settling Defendant to perform further response actions relating to the Site and/or to pay the United States for additional costs of response if, (a) subsequent to Certification of Remedial Action Completion, (1) conditions at the Site,

previously unknown to EPA, are discovered, or (2) information, previously unknown to EPA, is received, in whole or in part, and (b) EPA determines that these previously unknown conditions or this information together with other relevant information indicate that the Remedial Action is not protective of human health or the environment.

48. For purposes of Paragraph 46 (United States' Pre-Certification Reservations), the information and the conditions known to EPA will include only that information and those conditions known to EPA as of the date the ROD was signed and set forth in the ROD for the Site and the administrative record supporting the ROD. For purposes of Paragraph 47 (United States' Post-Certification Reservations), the information and the conditions known to EPA shall include only that information and those conditions known to EPA as of the date of Certification of Remedial Action Completion and set forth in the ROD, the administrative record supporting the ROD, the post-ROD administrative record, or in any information received by EPA pursuant to the requirements of this Consent Decree prior to Certification of Remedial Action Completion.

49. **General Reservations of Rights**. The United States reserves, and this Consent Decree is without prejudice to, all rights against Settling Defendant with respect to all matters not expressly included within Plaintiff's covenants. Notwithstanding any other provision of this Consent Decree, the United States reserves all rights against Settling Defendant with respect to:

a. liability for failure by Settling Defendant to meet a requirement of this Consent Decree;

b. liability arising from the past, present, or future disposal, release, or threat of release of Waste Material outside of the Site;

c. liability based on the ownership of the Site by Settling Defendant when such ownership commences after signature of this Consent Decree by Settling Defendant;

d. liability based on the operation of the Site by Settling Defendant when such operation commences after signature of this Consent Decree by Settling Defendant and does not arise solely from Settling Defendant's performance of the Work;

e. liability based on Settling Defendant's transportation, treatment, storage, or disposal, or arrangement for transportation, treatment, storage, or disposal of Waste Material at or in connection with the Site, other than as provided in the ROD, the Work, or otherwise ordered by EPA, after signature of this Consent Decree by Settling Defendant;

f. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

g. criminal liability;

h. liability for violations of federal or state law that occur during or after implementation of the Work; and

i. liability for additional response actions that EPA determines are necessary to achieve and maintain Performance Standards or to carry out and maintain the effectiveness of the remedy set forth in the ROD, but that cannot be required pursuant to Paragraph 11 (Modification of SOW or Related Deliverables);

j. liability for costs that the United States will incur regarding the Site but that are not within the definition of Future Response Costs.

50. **Covenants and Reservations by the State**. Except as provided in Paragraph 54 (General Reservations of Rights), the State covenants not to sue or to take administrative action against Settling Defendant pursuant to Sections 106 and 107(a) of CERCLA and Sections 711, 715, and 722 of CECRA for the Work, Past Response Costs, and Future Response Costs. These covenants shall take effect upon the Effective Date. These covenants are conditioned upon the satisfactory performance by Settling Defendant of its obligations under this Consent Decree. These covenants extend only to Settling Defendant and do not extend to any other person.

51. **State's Pre-Certification Reservations**. Notwithstanding any other provision of this Consent Decree, the State reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel Settling Defendant to perform further response actions relating to the Site and/or to pay the State for additional costs of response if, (a) prior to Certification of Remedial Action Completion, (1) conditions at the Site, previously unknown to the State, are discovered, or (2) information, previously unknown to the State, is received, in whole or in part, and (b) the State determines that these previously unknown conditions or information together with any other relevant information indicates that the Remedial Action is not protective of human health or the environment.

52. **State's Post-Certification Reservations**. Notwithstanding any other provision of this Consent Decree, the State reserves, and this Consent Decree is without prejudice to, the right to institute proceedings in this action or in a new action, and/or to issue an administrative order, seeking to compel Settling Defendant to perform further response actions relating to the Site and/or to pay the State for additional costs of response if, (a) subsequent to Certification of Remedial Action Completion, (1) conditions at the Site, previously unknown to the State, are discovered, or (2) information, previously unknown to the State, is received, in whole or in part, and (b) the State determines that these previously unknown conditions or this information together with other relevant information indicate that the Remedial Action is not protective of human health or the environment.

53. For purposes of Paragraph 51 (State's Pre-Certification Reservations), the information and the conditions known to State will include only that information and those conditions known to State as of the date the ROD was signed and set forth in the ROD for the Site and the administrative record supporting the ROD. For purposes of Paragraph 52 (State's Post-Certification Reservations), the information and the conditions known to the State shall include only that information and those conditions known to the State as of the date of Certification of Remedial Action Completion and set forth in the ROD, the administrative record supporting the ROD, the post-ROD administrative record, or in any information received by the

State pursuant to the requirements of this Consent Decree prior to Certification of Remedial Action Completion.

54. **State's General Reservations of Rights**. The State reserves, and this Consent Decree is without prejudice to, all rights against Settling Defendant with respect to all matters not expressly included within Plaintiff's covenants. Notwithstanding any other provision of this Consent Decree, the State reserves all rights against Settling Defendant with respect to:

a. liability for failure by Settling Defendant to meet a requirement of this Consent Decree;

b. liability arising from the past, present, or future disposal, release, or threat of release of Waste Material outside of the Site;

c. liability based on the ownership of the Site by Settling Defendant when such ownership commences after signature of this Consent Decree by Settling Defendant;

d. liability based on the operation of the Site by Settling Defendant when such operation commences after signature of this Consent Decree by Settling Defendant and does not arise solely from Settling Defendant's performance of the Work;

e. liability based on Settling Defendant's transportation, treatment, storage, or disposal, or arrangement for transportation, treatment, storage, or disposal of Waste Material at or in connection with the Site, other than as provided in the ROD, the Work, or otherwise ordered by EPA or the State, after signature of this Consent Decree by Settling Defendant;

f. liability for damages for injury to, destruction of, or loss of natural resources, and for the costs of any natural resource damage assessments;

g. criminal liability;

h. liability for violations of federal or state law that occur during or after implementation of the Work;

i. liability for additional response actions that EPA or the State determines are necessary to achieve and maintain Performance Standards or to carry out and maintain the effectiveness of the remedy set forth in the ROD, but that cannot be required pursuant to Paragraph 11 (Modification of SOW or Related Deliverables); and

j. liability for costs that the State will incur regarding the Site but that are not within the definition of Future Response Costs

XV. COVENANTS BY SETTLING DEFENDANT

55. **Covenants by Settling Defendant**. Subject to the reservations in Paragraph 57, Settling Defendant covenants not to sue and agree not to assert any claims or causes of action against the United States or the State with respect to the Work, past response actions regarding the Site, Past Response Costs, Future Response Costs, and this Consent Decree, including, but not limited to:

a. any direct or indirect claim for reimbursement from the EPA Hazardous Substance Superfund through CERCLA §§ 106(b)(2), 107, 111, 112 or 113, or any other provision of law or any direct or indirect claim for reimbursement or funding under State law, including any direct or indirect claim for reimbursement from the Environmental Quality Protection Fund (established pursuant to § 75-10-743, MCA), or any other provision of law;

b. any claims under CERCLA §§ 107 or 113 or state law regarding the Work, past response actions regarding the Site, Past Response Costs, Future Response Costs, Settling Defendant's Past Response Costs, Settling Defendant's Future Response Costs, and this Consent Decree; or

c. any claims arising out of response actions at or in connection with the Site, including any claim under the United States Constitution, the State Constitution, the Tucker Act, 28 U.S.C. § 1491, the Equal Access to Justice Act, 28 U.S.C. § 2412, or at common law.

56. Except as provided in Paragraph 65 (Res Judicata and Other Defenses), the covenants in this Section shall not apply if the United States or the State brings a cause of action or issues an order pursuant to any of the reservations in Section XIV (Covenants by Plaintiffs), other than in Paragraphs 49.a (claims for failure to meet a requirement of the Consent Decree), 49.g (criminal liability), and 49.h (violations of federal/state law during or after implementation of the Work), but only to the extent that Settling Defendant's claims arise from the same response action, response costs, or damages that the United States or the State is seeking pursuant to the applicable reservation.

57. Settling Defendant reserves, and this Consent Decree is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, and brought pursuant to any statute other than CERCLA and for which the waiver of sovereign immunity is found in a statute other than CERCLA, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States, as that term is defined in 28 U.S.C. § 2671, while acting within the scope of his or her office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, the foregoing shall not include any claim based on EPA's selection of response actions, or the oversight or approval of Settling Defendant's deliverables or activities.

58. **Settling Defendant's Reservation.** Settling Defendant avers that it is a common carrier by rail and the Affected Property is an integral part of the interstate commerce system. Settling Defendant does not waive preemption under the Interstate Commerce Commission Termination Act of 1995, 49 U.S.C. § 10501(b), or other applicable federal law to the extent that Plaintiffs seek to take or require some action on the Affected Property that impacts Settling Defendant's common carrier obligations.

59. Nothing in this Consent Decree shall be deemed to constitute approval or preauthorization of a claim within the meaning of Section 111 of CERCLA, 42 U.S.C. § 9611, or 40 C.F.R. § 300.700(d).

XVI. EFFECT OF SETTLEMENT; CONTRIBUTION

60. Nothing in this Consent Decree shall be construed to create any rights in, or grant any cause of action to, any person not a Party to this Consent Decree. Except as provided in Section XV (Covenants by Settling Defendant), each of the Parties expressly reserves any and all rights (including, but not limited to, pursuant to Section 113 of CERCLA, 42 U.S.C. § 9613), defenses, claims, demands, and causes of action that each Party may have with respect to any matter, transaction, or occurrence relating in any way to the Site against any person not a Party hereto. Nothing in this Consent Decree diminishes the right of the United States, pursuant to Section 113(f)(2) and (3) of CERCLA, 42 U.S.C. § 9613(f)(2)-(3), to pursue any such persons to obtain additional response costs or response action and to enter into settlements that give rise to contribution protection pursuant to Section 113(f)(2).

61. The Parties agree, and by entering this Consent Decree this Court finds, that this Consent Decree constitutes a judicially-approved settlement pursuant to which Settling Defendant has, as of the Effective Date, resolved liability to the United States within the meaning of Section 113(f)(2) of CERCLA, 42 U.S.C. § 9613(f)(2), and is entitled, as of the Effective Date, to protection from contribution actions or claims as provided by Section 113(f)(2) of CERCLA, or as may be otherwise provided by law, for the "matters addressed" in this Consent Decree.

The "matters addressed" in this Consent Decree are the Work, Past Response Costs and Future Response Costs.

62. The Parties further agree, and by entering this Consent Decree this Court finds, that the complaint filed by the United States in this action is a civil action within the meaning of Section 113(f)(1) of CERCLA, 42 U.S.C. § 9613(f)(1), and that this Consent Decree constitutes a judicially-approved settlement pursuant to which Settling Defendant has, as of the Effective Date, resolved liability to the United States within the meaning of Section 113(f)(3)(B) of CERCLA, 42 U.S.C. § 9613(f)(3)(B).

63. Settling Defendant shall, with respect to any suit or claim brought by it for matters related to this Consent Decree, notify the United States and the State in writing no later than 60 days prior to the initiation of such suit or claim.

64. Settling Defendant shall, with respect to any suit or claim brought against it for matters related to this Consent Decree, notify in writing the United States and the State within 10 days after service of the complaint on such Settling Defendant. In addition, Settling Defendant shall notify the United States and the State within 10 days after service or receipt of any Motion for Summary Judgment and within 10 days after receipt of any order from a court setting a case for trial.

65. **Res Judicata and Other Defenses**. In any subsequent administrative or judicial proceeding initiated by the United States or the State for injunctive relief, recovery of response costs, or other appropriate relief relating to the Site, Settling Defendant and, with respect to a State action, shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim-splitting, or other

defenses based upon any contention that the claims raised by the United States or the State in the subsequent proceeding were or should have been brought in the instant case; provided, however, that nothing in this Paragraph affects the enforceability of the covenants not to sue set forth in Section XIV (Covenants by Plaintiffs).

XVII. ACCESS TO INFORMATION

66. Settling Defendant shall provide to EPA and the State, upon request, copies of all records, reports, documents, and other information (including records, reports, documents, and other information in electronic form) (hereinafter referred to as "Records") within Settling Defendant's possession or control or that of their contractors or agents relating to activities at the Site or to the implementation of this Consent Decree, including, but not limited to, sampling, analysis, chain of custody records, manifests, trucking logs, receipts, reports, sample traffic routing, correspondence, or other documents or information regarding the Work. Settling Defendant shall also make available to EPA and the State, for purposes of investigation, information gathering, or testimony, their employees, agents, or representatives with knowledge of relevant facts concerning the performance of the Work.

67. Privileged and Protected Claims

a. Settling Defendant may assert that all or part of a Record requested by Plaintiffs is privileged or protected as provided under federal law, in lieu of providing the Record, provided Settling Defendant complies with Paragraph 67.b, and except as provided in Paragraph 67.c.

b. If Settling Defendant asserts a claim of privilege or protection, it shall provide Plaintiffs with the following information regarding such Record: its title; its date; the name, title, affiliation (e.g., company or firm), and address of the author, of each addressee, and of each recipient; a description of the Record's contents; and the privilege or protection asserted. If a claim of privilege or protection applies only to a portion of a Record, Settling Defendant shall provide the Record to Plaintiffs in redacted form to mask the privileged or protected portion only. Settling Defendant shall retain all Records that it claims to be privileged or protected until Plaintiffs have had a reasonable opportunity to dispute the privilege or protection claim and any such dispute has been resolved in the Settling Defendant's favor.

c. Settling Defendant may make no claim of privilege or protection regarding: (1) any data regarding the Site, including, but not limited to, all sampling, analytical, monitoring, hydrogeologic, scientific, chemical, radiological or engineering data, or the portion of any other Record that evidences conditions at or around the Site; or (2) the portion of any Record that Settling Defendant are required to create or generate pursuant to this Consent Decree.

68. **Business Confidential Claims**. Settling Defendant may assert that all or part of a Record provided to Plaintiffs under this Section or Section XVIII (Retention of Records) is business confidential to the extent permitted by and in accordance with Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and 40 C.F.R. § 2.203(b). Settling Defendant shall segregate and clearly identify all Records or parts thereof submitted under this Consent Decree for which

Settling Defendant assert business confidentiality claims. Records that Settling Defendant claim to be confidential business information will be afforded the protection specified in 40 C.F.R. Part 2, Subpart B. If no claim of confidentiality accompanies Records when they are submitted to EPA and the State, or if EPA has notified Settling Defendant that the Records are not confidential under the standards of Section 104(e)(7) of CERCLA or 40 C.F.R. Part 2, Subpart B, the public may be given access to such Records without further notice to Settling Defendant.

69. If relevant to the proceeding, the Parties agree that validated sampling or monitoring data generated in accordance with the SOW and reviewed and approved by EPA shall be admissible as evidence, without objection, in any proceeding under this Consent Decree.

70. Notwithstanding any provision of this Consent Decree, Plaintiffs retain all of their information gathering and inspection authorities and rights, including enforcement actions related thereto, under CERCLA and any other applicable statutes or regulations.

XVIII. RETENTION OF RECORDS

71. Until 10 years after EPA's Certification of Work Completion under Paragraph 3.2 (Certification of Work Completion) of the SOW, Settling Defendant shall preserve and retain all non-identical copies of Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to its liability under CERCLA with respect to the Site, provided, however, that Settling Defendant who are potentially liable as owners or operators of the Site must retain, in addition, all Records that relate to the liability of any other person under CERCLA with respect to the Site. Settling Defendant must also retain, and instruct its contractors and agents to preserve, for the same period of time specified above all non-identical copies of the last draft or final version of any Records (including Records in electronic form) now in its possession or control or that come into its possession or control that relate in any manner to the performance of the Work, provided, however, that Settling Defendant (and its contractors and agents) must retain, in addition, copies of all data generated during the performance of the Work and not contained in the aforementioned Records required to be retained. Each of the above record retention requirements shall apply regardless of any corporate retention policy to the contrary.

72. At the conclusion of this record retention period, Settling Defendant shall notify the United States and the State at least 90 days prior to the destruction of any such Records, and, upon request by the United States or the State, and except as provided in Paragraph 67 (Privileged and Protected Claims), Settling Defendant shall deliver any such Records to EPA or the State.

73. Settling Defendant certifies individually that, to the best of its knowledge and belief, after thorough inquiry, it has not altered, mutilated, discarded, destroyed, or otherwise disposed of any Records (other than identical copies) relating to its potential liability regarding the Site since notification of potential liability by the United States or the State and that it has fully complied with any and all EPA and State requests for information regarding the Site

pursuant to Sections 104(e) and 122(e)(3)(B) of CERCLA, 42 U.S.C. §§ 9604(e) and 9622(e)(3)(B) and state law.

XIX. NOTICES AND SUBMISSIONS

74. All approvals, consents, deliverables, modifications, notices, notifications, objections, proposals, reports, and requests specified in this Consent Decree must be in writing unless otherwise specified. Whenever, under this Consent Decree, notice is required to be given, or a report or other document is required to be sent, by one Party to another, it must be directed to the person(s) specified below at the address(es) specified below. Any Party may change the person and/or address applicable to it by providing notice of such change to all Parties. All notices under this Section are effective upon receipt, unless otherwise specified. Notices required to be sent to EPA, and not to the United States, should not be sent to the DOJ. Except as otherwise provided, notice to a Party by email (if that option is provided below) or by regular mail in accordance with this Section satisfies any notice requirement of the Consent Decree regarding such Party.

As to the United States:	EES Case Management Unit U.S. Department of Justice Environment and Natural Resources Division P.O. Box 7611 Washington, D.C. 20044-7611 eescdcopy.enrd@usdoj.gov Re: DJ # 90-11-2-07106/9
As to EPA:	Dania Zinner EPA Project Coordinator – Libby Asbestos Site U.S. EPA, Region 8 (SEM-RBB) 1595 Wynkoop Street Denver, Colorado 80202 Zinner.Dania@epa.gov
As to the Regional Financial Management Officer:	Regional Financial Management Officer Superfund Cost Recovery Financial Management Unit (MSD-FM-B) U.S. EPA, Region 8 1595 Wynkoop Street Denver, Colorado 80202 Johnson.Karren@epa.gov
At to EPA Cincinnati Finance Center:	EPA Cincinnati Finance Center 26 W. Martin Luther King Drive Cincinnati, Ohio 45268 cinwd_acctsreceivable@epa.gov

As to the State:

Jason Rappe
State Project Coordinator
P.O. Box 200901
Helena, Montana 59620-0901
Jason.Rappe@mt.gov

As to Settling Defendant:

Mark Engdahl
Manager – Environmental Remediation
BNSF Railway Company
800 North Last Chance Gulch
Helena, Montana 59601

XX. RETENTION OF JURISDICTION

75. This Court retains jurisdiction over both the subject matter of this Consent Decree and Settling Defendant for the duration of the performance of the terms and provisions of this Consent Decree for the purpose of enabling any of the Parties to apply to the Court at any time for such further order, direction, and relief as may be necessary or appropriate for the construction or modification of this Consent Decree, or to effectuate or enforce compliance with its terms, or to resolve disputes in accordance with Section XII (Dispute Resolution).

XXI. APPENDICES

76. The following appendices are attached to and incorporated into this Consent Decree:

"Appendix A" is the ROD.

"Appendix B" is the SOW.

"Appendix C" is the description and/or map of the Site.

"Appendix D" is the Environmental Covenant for Settling Defendant's Libby Railyard.

XXII. MODIFICATION

77. Except as provided in Paragraph 11 (Modification of SOW or Related Deliverables), material modifications to this Consent Decree, including the SOW, shall be in writing, signed by the United States and Settling Defendant, and shall be effective upon approval by the Court. Except as provided in Paragraph 11, non-material modifications to this Consent Decree, including the SOW, shall be in writing and shall be effective when signed by duly authorized representatives of the United States and Settling Defendant. All modifications to the Consent Decree, other than the SOW, also shall be signed by the State, or a duly authorized representative of the State, as appropriate. A modification to the SOW shall be considered material if it implements a ROD amendment that fundamentally alters the basic features of the selected remedy within the meaning of 40 C.F.R. § 300.435(c)(2)(ii). Before providing its

approval to any modification to the SOW, the United States will provide the State with a reasonable opportunity to review and comment on the proposed modification.

78. Nothing in this Consent Decree shall be deemed to alter the Court's power to enforce, supervise, or approve modifications to this Consent Decree.

XXIII. LODGING AND OPPORTUNITY FOR PUBLIC COMMENT

79. This Consent Decree shall be lodged with the Court for at least 30 days for public notice and comment in accordance with Section 122(d)(2) of CERCLA, 42 U.S.C. § 9622(d)(2), and 28 C.F.R. § 50.7. The United States and the State reserve their right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations that indicate that the Consent Decree is inappropriate, improper, or inadequate. Settling Defendant consents to the entry of this Consent Decree without further notice.

80. If for any reason the Court should decline to approve this Consent Decree in the form presented, this agreement is voidable at the sole discretion of any Party and the terms of the agreement may not be used as evidence in any litigation between the Parties.

XXIV. SIGNATORIES/SERVICE

81. The undersigned representative of Settling Defendant to this Consent Decree and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice and the Director of the Department of Environmental Quality for the State certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind such Party to this document.

82. Settling Defendant agrees not to oppose entry of this Consent Decree by this Court or to challenge any provision of this Consent Decree unless the United States or the State has notified Settling Defendant in writing that it no longer supports entry of the Consent Decree.

83. Settling Defendant shall identify, on the attached signature page, the name, address, and telephone number of an agent who is authorized to accept service of process by mail on behalf of that Party with respect to all matters arising under or relating to this Consent Decree. Settling Defendant agrees to accept service in that manner and to waive the formal service requirements set forth in Rule 4 of the Federal Rules of Civil Procedure and any applicable local rules of this Court, including, but not limited to, service of a summons. Settling Defendant needs not file an answer to the complaint in this action unless or until the Court expressly declines to enter this Consent Decree.

XXV. FINAL JUDGMENT

84. This Consent Decree and its appendices constitute the final, complete, and exclusive agreement and understanding among the Parties regarding the settlement embodied in the Consent Decree. The Parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Consent Decree.

85. Upon entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment between and among the United States, the State, and Settling Defendant. The Court enters this judgment as a final judgment under Fed. R. Civ. P. 54 and 58.

SO ORDERED THIS 30th day of November, 2020.

Dana L. Christensen

Dana L. Christensen, District Judge
United States District Court

Signature Page for Consent Decree regarding the Libby Asbestos OU6 Superfund Site

FOR THE UNITED STATES OF AMERICA:

Nathaniel Douglas
Deputy Chief
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Environment and Natural Resources Division
Washington, D.C. 20530

5/18/2020
Dated

James D. Freeman

James D. Freeman
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
999 18th Street
South Terrace Suite 730
Denver, Colorado 80202

Kurt G. Alme
United States Attorney
District of Montana
316 N 26th St #5018
Billings, MT 59101

Victoria Francis
Assistant United States Attorney
District of Montana
316 N 26th St #5018
Billings, MT 59101

Signature Page for Consent Decree regarding the Libby Asbestos OU6 Superfund Site

FOR THE EPA:

5/21/2020
Dated

K.C. Schefski
Regional Counsel
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, Colorado 80202

5/22/2020
Dated

Betsy Smidinger
Director, Superfund and Emergency Management Division
U.S. Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, Colorado 80202

Signature Page for Consent Decree regarding the Libby Asbestos OU6 Superfund Site

FOR THE STATE OF MONTANA:

5/12/2020
Dated

George Mathieus
Deputy Director
Montana Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0901

5/12/2020
Dated

Jessica L. Wilkerson

Jessica Wilkerson
Legal Counsel
Montana Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0901

Signature Page for Consent Decree regarding the Libby Asbestos OU6 Superfund Site

FOR BNSF Railway Company:

04/16/2020
Dated

John Lovenburg
Vice President, Environmental
BNSF Railway Company
2500 Lou Menck Drive, AOB-3
Fort Worth, Texas 76131

Agent Authorized to Accept Service on Behalf of Above-signed Party:	Name:	Jeff Hedger
	Title:	Registered Agent
	Company:	Hedger Friend, PLLC
	Address:	2800 Central Avenue, Suite C Billings, Montana 59102

RECORD OF DECISION

FOR

LIBBY ASBESTOS SUPERFUND SITE

LIBBY AND TROY RESIDENTIAL AND COMMERCIAL PROPERTIES, PARKS AND SCHOOLS, TRANSPORTATION CORRIDORS, AND INDUSTRIAL PARK

OPERABLE UNITS 4 through 8

LINCOLN COUNTY, MONTANA

RECORD OF DECISION

LIBBY ASBESTOS SUPERFUND SITE

LIBBY AND TROY RESIDENTIAL AND COMMERCIAL PROPERTIES, PARKS AND SCHOOLS, TRANSPORTATION CORRIDORS, AND INDUSTRIAL PARK

OPERABLE UNITS 4 through 8

LINCOLN COUNTY, MONTANA

The U.S. Environmental Protection Agency (EPA), with the concurrence of the Montana Department of Environmental Quality (DEQ), presents this Record of Decision (ROD) for Operable Units 4 through 8 (OU) of the Libby Asbestos Superfund Site (Site) in Libby, Montana. The ROD is based on the administrative record for OUs 4 through 8, including the Remedial Investigation and Feasibility Study (RI/FS), the Proposed Plan, the public comments received, and EPA responses. The ROD presents a brief summary of the Site characterization, past response actions, actual and potential risks to human health and the environment, and the Selected Remedy. EPA followed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Contingency Plan (NCP), and EPA guidance (EPA, 1999) in preparation of the ROD. The three purposes of the ROD are to:

1. Certify that the remedy selection process was carried out in accordance with the requirements of CERCLA, 42 U.S.C. § 9601 et seq., as amended, and, to the extent practicable, the NCP;

2. Outline the components and remediation requirements of the Selected Remedy; and

3. Provide the public with a consolidated source of information about the history, characteristics, and risk posed by the conditions at OUs 4 through 8, as well as a summary of the cleanup alternatives considered, their evaluation, the rationale behind the Selected Remedy, and the agencies' consideration of, and responses to, the comments received.

The ROD is organized in three distinct parts:

1. The Declaration functions as an abstract and data certification sheet for the key information in the ROD and includes the formal authorizing signature page for the ROD.

2. The Decision Summary provides an overview of the characteristics of OUs 4 through 8, alternatives evaluated, and the analysis of those options. It also identifies the Selected Remedy and explains how the remedy fulfills statutory and regulatory requirements.

3. The Responsiveness Summary serves the dual purposes of: (1) presenting stakeholder concerns about OUs 4 through 8 and preferences regarding the remedial alternatives; and (2) explaining how those concerns were addressed and how the preferences were factored into the remedy selection process.

DECLARATION

DECLARATION

SITE NAME AND LOCATION

The Libby Asbestos Superfund Site (Site) (Superfund Enterprise Management System [SEMS] #MT0009083840) is located in and around the Town of Libby, Montana. Libby is the county seat of Lincoln County and is in the northwest corner of Montana, about 35 miles east of Idaho and 65 miles south of Canada (Exhibit 1-1). The Site has been divided into eight operable units (OUs), five of which (4, 5, 6, 7, and 8) are included in this Record of Decision (ROD): Operable Unit 4 encompasses the residential, commercial, and public properties in and around Libby; Operable Unit 5 is the 400-acre industrial park (former Stimson Lumber Mill); Operable Unit 6 contains all Burlington Northern Santa Fe (BNSF) railroad property in and between Operable Units 4 and 7, including rights-of-way and rail yards; Operable Unit 7 includes residential, commercial, and public property in and around Troy (about 20 miles west of Libby); and Operable Unit 8 consists of the U.S., state and county rights-of-way within and between Operable Units 4 and 7. EPA previously selected remedies for Operable Unit 1 (former Export Plant) and Operable Unit 2 (former Screening Plant). Operable Unit 3, the former Libby Vermiculite Mine and surrounding areas, is being addressed separately.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for OUs 4 through 8. The remedy selected in this ROD was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP). The decision is based on the administrative record file for OUs 4 through 8 of the Site. This document is issued by the EPA Region 8, the lead agency, and the Montana Department of Environmental Quality (DEQ). EPA and DEQ (with reservations) concur on the selected remedy presented herein. The remedial action selected in this ROD is necessary to protect public health and welfare and the environment from actual or threatened releases of hazardous substances at the Site. It will reduce the public health risks by blocking contaminant pathways to the available receptors.

ASSESSMENT OF SITE

The response action selected in this ROD is necessary to protect the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF SELECTED REMEDY

The majority of the properties within OUs 4 through 8 have already been remediated through past removal actions. The selected remedy for residential/commercial properties (includes properties within OUs 4 and 7) will minimize the remaining exposures to the Libby amphibole asbestos (LA) contamination present at those properties by a combination of excavation of contaminated soil with backfill and/or physical removal of contaminated building materials and disposal of these two contaminated media, encapsulation of contaminated building materials, and institutional controls (ICs). Because past removal actions for parks and schools, transportation corridors, and the industrial park (within OUs 4, 5, 6, 7, and 8) addressed unacceptable exposures, the selected remedy for parks and schools, transportation corridors, and the industrial park will rely on ICs to manage any remaining exposures to LA contamination.

ICs with monitoring and statutory reviews will provide assurance that the integrity of the remedy will be protected. EPA will conduct 5 year site reviews to evaluate effectiveness of the remedy.

STATUTORY DETERMINATIONS

The selected remedy meets the mandates of CERCLA § 121 and the NCP. The remedy is protective of human health and the environment. It complies with all federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

Treatment was not chosen as a component of the selected remedy. Thus, the remedy does not satisfy the CERCLA preference for treatment as a principal element of the remedy. The remedy also does not include treatment to address principal threat waste where practicable as indicated in the NCP. The use of treatment technologies for LA contaminated soils and contaminated building materials is not practical or viable based on the rationale presented below and discussed in Part 2 to address both the CERCLA preference and the NCP expectation for use of treatment where practicable.

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. Contaminated soil and contaminated building materials act as a source for direct exposure to inhalation of LA when encountered. In addition, these source materials could present a significant risk to human health should exposure occur and, thus, are classified as principal threat wastes.

Contaminated soil and contaminated building materials at the Site generally have large volumes and due to their solid matrix and ability to be isolated from inhalation exposures are particularly amenable to containment. Conversely, the large volumes of materials, as well as the heterogeneity of the materials, are generally detrimental to implementing treatment technologies. Treatment technologies were evaluated within the Site-wide FS. The treatment of contaminated soil and building materials was determined not to be practical nor viable for the selected remedy because treatment would be very difficult to implement and costly relative to the additional benefit it provides to long-term effectiveness and permanence at the Site. Thus, the selected remedy will not to meet the CERCLA preference for treatment as a principal element of the remedy and does not include treatment to address the NCP expectation for treatment of principal threat wastes where practicable.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

FUTURE PUBLIC COMMENT

Public participation will be an important part of designing and implementing an IC program. Other opportunities for public comment will be provided at the time of the subsequent 5 year site reviews in the form of community interviews.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the decision summary section (Part 2) of this ROD.

Additional information can be found in the administrative record file for this Site:

- Contaminants of concern and their respective concentrations (Section 5 – Summary of Site Characteristics);
- Current and reasonably anticipated future land use assumptions used in the risk assessment (Section 6 – Current or Reasonably Anticipated Future Land and Resource Uses;
- Risks represented by the contaminants of concern (Section 7 – Summary of Site Risks);
- Cleanup levels established for contaminants of concern and the basis for the levels (Section 8 – Remedial Action Objectives and Remedial Goals);
- How source materials constituting principal threats are addressed (Section 11 – Principal Threat Wastes; Section 12 – Selected Remedy);
- Potential land use that will be available at the Site as a result of the selected remedy (Section 12 – Selected Remedy);
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 12 – Selected Remedy);
- Key factors that led to selecting the remedy (Section 12 – Selected Remedy; Section 13 – Statutory Determinations).

AUTHORIZING SIGNATURES

Martin C Hestmark
Martin Hestmark
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation

2/8/16
Date

Tom Livers
Tom Livers, Director
Montana Department of Environmental Quality

2/4/16
Date

DECISION SUMMARY

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LIST OF ACRONYMS

ABS	activity-based sampling
ACM	asbestos-containing material
AHERA	Asbestos Hazard Emergency Response Act
AIHA	American Industrial Hygiene Association
ARAR	applicable or relevant and appropriate requirement
ARM	Administrative Rules of Montana
ARP	Asbestos Resource Program
ASTM	American Society for Testing and Materials International
ATSDR	Agency for Toxic Substances and Disease Registry
ATV	all-terrain vehicle
BERA	baseline ecological risk assessment
BNSF	Burlington Northern Santa Fe Railroad
CAA	Clean Air Act
CAG	Community Advisory Group
cc^{-1}	per cubic centimeter of air
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIC	community involvement coordinator
COC	contaminant of concern
CSM	conceptual site model
CSS	contaminant screening study
CTE	central tendency exposure
DEQ	Montana Department of Environmental Quality
DI	detailed investigation
ED	exposure duration
EF	exposure frequency
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERS	environmental resource specialist
ESD	Explanation of Significant Differences
ET	exposure time
f/cc	fibers per cubic centimeter
FS	feasibility study
GN	Great Northern Railway
GPI	general property investigations
GRA	general response action
Grace	W.R. Grace and Company
GRZ	geographic removal zone
HDR	HDR Engineering, Inc.
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IC	institutional control

ICIAP	institutional control implementation and assurance plan
IUR	inhalation unit risk
KDC	Kootenai Development Corporation
Kennedy/Jenks	Kennedy/Jenks Consultants
KRDC	Kootenai River Development Council
LA	Libby amphibole asbestos
LATAG	Libby Areas Technical Assistance Group
MCA	Montana Code Annotated
MCLG	maximum contaminant level goal
MDT	Montana Department of Transportation
MFL	million fibers per liter
mi^2	square miles
Ms/g	million structures per gram
NAVD88	North American Vertical Datum of 1988
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NVLAP	National Voluntary Laboratory Accreditation Program
O&M	operation and maintenance
ORD	Office of Research and Development
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCM	phase contrast microscopy
PCME	phase contrast microscopy equivalent
PDI	pre-design inspection
PLM	polarized light microscopy
PLM-Grav	PLM-gravimetric
PLM-PC	PLM-point counting
PLM-VE	PLM- visual estimation
PPE	personal protective equipment
PRAO	preliminary remedial action objective
PRP	potentially responsible party
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RA	remedial action
RACM	regulated asbestos-containing material
RAL	remedial action level
RAO	remedial action objective
RD	remedial design
RfC	reference concentration
RG	remediation goal

RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
ROW	right-of-way
s/cc	structures per cubic centimeter
s/cm^2	structures per square centimeter
SAP	sampling and analysis plan
SEMS	Superfund Enterprise Management System
SHPO	State Historic Preservation Office
SI	screening investigation
Site	Libby Asbestos Superfund Site
SOP	standard operating procedure
TEM	transmission electron microscopy
Tetra Tech	Tetra Tech EM Inc.
TWF	time-weighting factor
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UU/UE	unlimited use/unrestricted exposure
VCI	vermiculite-containing insulation
VI	vermiculite insulation
VRP	Voluntary Recruitment Program
XRD	X-ray powder diffraction
Zonolite	Universal Zonolite Insulation Company
µm	micrometer

1.0 INTRODUCTION

This record of decision (ROD) is for the Libby Asbestos Superfund Site (Site) (Superfund Enterprise Management System [SEMS] # MT0009083840). The U.S. Environmental Protection Agency (EPA) is the lead agency, the Montana Department of Environmental Quality (DEQ) is the primary support agency, and the U.S. Forest Service (USFS) is also involved in Site activities. W.R. Grace and Company (Grace) is the primary potentially responsible party (PRP) for the former Libby Vermiculite Mine, and Burlington Northern Santa Fe Railroad (BNSF) is a PRP for the railroad corridors portion of the Site, which they own. Monies for investigation and cleanup are provided, in part, from a $250,000,000 cash settlement between EPA and Grace. The Site is located in and around the City of Libby and the Town of Troy in Lincoln County, Montana that were contaminated by Libby amphibole asbestos (LA) originating from the former Libby Vermiculite Mine.

1.1 BASIS OF ACTION

The response actions selected in this ROD are necessary to protect the public health and welfare and the environment from actual or threatened releases of hazardous substances into the environment and of pollutants or contaminants that may present an imminent and substantial endangerment to public health or welfare.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response actions generally are not undertaken for releases associated with products that are part of a structure and result in exposure within residential buildings, business structures, and community structures (40 Code of Federal Regulations [CFR] § 300.400(b)(2)). However, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR § 300.400(b)) does provide that response actions can be undertaken for those materials if the lead agency, EPA, determines that a release constitutes a public health or environmental emergency and no other person with the authority and capability to respond will do so in a timely manner.

The adverse effects of asbestos exposure in humans have been the subject of a large number of studies and publications. Exposure to asbestos may induce several types of non-cancer and cancer effects. A detailed summary of the cancer and non-cancer effects of asbestos is provided in the Agency for Toxic Substances and Disease Registry (ATSDR) *Toxicological Profile for Asbestos* (ATSDR 2001) and in EPA's *Airborne Asbestos Health Assessment Update* (EPA 1986). A detailed summary of effects related specifically to Libby amphibole asbestos (LA) is provided in the *Toxicological Review for Libby Amphibole Asbestos* (EPA 2014a).

The EPA Administrator declared a public health emergency at the Site on June 17, 2009, and ongoing removal actions performed by EPA indicate the urgency of the situation. Unique circumstances at the Site include not only the level of cumulative exposure and multiple pathways but also the fact that structures at the Site contain contaminated building materials that were not inspected, packaged, labeled, regulated, or sold as commercial products. Based on this information, it was reasonable to evaluate remedial alternatives that address releases or potential releases from disturbance of LA-contaminated building materials and other impacted materials such as LA-contaminated soils.

1.1.1 Cancer Effects

Many epidemiological studies have reported increased mortality from cancer in workers exposed to asbestos, especially from lung cancer and mesothelioma (tumor of the thin membrane that covers and protects the internal organs of the body). In addition, a number of studies suggest asbestos exposure may increase risk of cancer at various gastrointestinal sites. Based on these findings, and supported by extensive carcinogenicity data from animal studies, EPA has classified asbestos as a known human carcinogen.

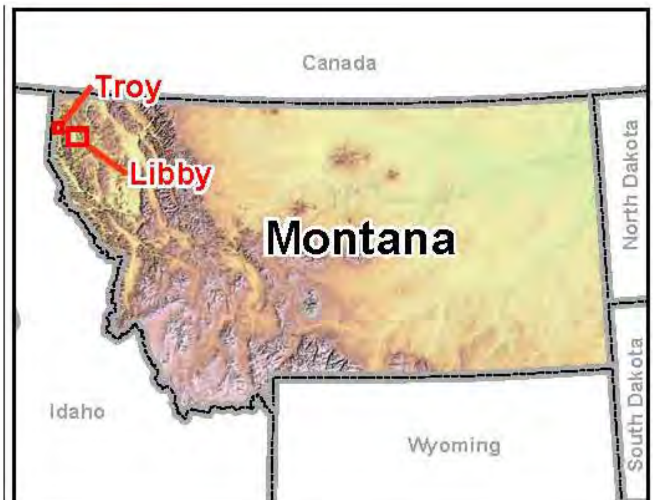
1.1.2 Non-Cancer Effects

Non-cancer effects from asbestos exposure include asbestosis (formation of scar tissue in the lung parenchyma) and several types of abnormality in the pleura (the membrane surrounding the lungs) such as pleural effusions (excess fluid accumulation in the pleural space), pleural plaques (collagen deposits and calcification), and pleural thickening.

1.2 SITE OVERVIEW

The Site is located in and around the City of Libby and the Town of Troy in Lincoln County, Montana. Libby is the county seat of Lincoln County and lies in the northwest corner of Montana, about 35 miles east of Idaho and 65 miles south of Canada (Exhibit 1-1). The towns lie in a valley carved by the Kootenai River and framed by the Cabinet Mountains to the south. The community's assets include recreational opportunities such as fishing, hiking, hunting, boating, and skiing.

Exhibit 1-1. Site Location Map



The response action activities being completed at the Site include the removal of vermiculite-containing insulation (VCI), LA-contaminated soil, LA-contaminated dust, and LA-contaminated vermiculite-containing building materials from residential, commercial, and industrial properties. The VCI encountered in the structures is typically found in attics where residents placed it for insulation. VCI can also be found in interior or exterior walls where it was used for insulation or where it leaked into the wall cavity from the attic. The LA-contaminated soil encountered at the properties is typically from vermiculite placed there for a variety of reasons, including amending soil in flowerbeds and gardens, leveling low spots, and backfilling utilities. It also may have been spread in yards from other sources. LA-contaminated dust encountered in the structures is due to a variety of reasons, including VCI leaking into the living spaces from the attic or walls and LA tracked in from the outdoor source locations discussed above.

The contaminant of concern (COC) for the response actions is LA. Asbestos fibers are odorless and tasteless and vary in length, structure, and chemical composition. Fibers are microscopic and environmentally persistent. They do not evaporate, burn, or dry out from heat or degrade in water. The toxicity of different types of asbestos fibers varies, but chronic and acute exposure to any one of them potentially can be fatal. While some chrysotile asbestos is likely present, it is not due to Site-related contamination and is not considered a COC. EPA actions at the Site have not focused on the removal of chrysotile or other forms of asbestos, only LA.

1.3 SITE DESCRIPTION

1.3.1 Site OUs

Initially, to support Site-wide property-specific investigation planning, EPA established a study area boundary. As information regarding contamination at the Site became available through investigations, EPA ultimately ceased use of the study area boundary and established a formal National Priorities List (NPL) boundary for all operable units (OUs) except OU3. The NPL boundary encompasses the Site's eight OUs (Exhibit 1-2). Establishment of the OUs facilitates a multi-phase approach to remediation of the Site. The OUs are described as follows:

- OU1 – Former Export Plant. OU1 is defined geographically by the parcel of land that included the former Export Plant and the Highway 37 embankments and is situated on the south side of the Kootenai River, just north of the downtown area of the City of Libby. The property is bound by the Kootenai River on the north, the BNSF railroad thoroughfare on the south, and residential properties on the east and west.

- OU2 – Former Screening Plant. OU2 includes areas impacted by contamination released from the former Screening Plant. These areas include the former Screening Plant, the Flyway property, the Highway 37 right-of-way (ROW) adjacent to the former Screening Plant and/or Rainy Creek Road, and privately owned properties. The Kootenai Bluff Subdivision area (the former Grace railroad loading station area), located directly across the Kootenai River from the former Screening Plant, was removed from OU2 and is now part of OU4.

- OU3 – Former Libby Vermiculite Mine (the mine). OU3 is defined as the property in and around the Zonolite Mine owned by Grace or Grace-owned subsidiaries (excluding OU2) and any area (including any structure, soil, air, water, sediment, or receptor) impacted by the release and subsequent migration of hazardous substances and/or pollutants or contaminants from such property, including, but not limited to, the mine property, the Kootenai River and sediments therein, Rainy Creek, Rainy Creek Road, and areas in which tree bark is contaminated with such hazardous substances and/or pollutants and contaminants.

- OU4 – Libby Residential/Commercial Area. OU4 is defined as the residential, commercial, industrial (not associated with Grace mining operations), and public properties, including schools and parks, in and around the City of Libby.

- OU5 – Former Stimson Lumber Company. OU5 is defined geographically by the parcel of land that included the former Stimson Lumber Company. OU5 is bounded by the high bank of Libby Creek to the east, the BNSF railroad to the north, and properties within OU4 to the south and west. This OU is currently occupied by various vacant structures/buildings as well as multiple operating businesses (e.g., lumber processing, log storage, excavation contractor). Within the OU5 boundary exists the Libby Groundwater Superfund Site, which is not associated with the Libby Asbestos Superfund Site and will not be discussed further within this ROD.

- OU6 – BNSF Railroad. This OU is owned and operated by the BNSF railroad. OU6 is defined geographically by the BNSF property boundaries from the eastern boundary of OU4 to the western boundary of OU7 and the extent of contamination associated with the Libby and Troy railyards.

- OU7 – Town of Troy. OU7 is defined as the residential, commercial, and public properties in and around the Town of Troy, Montana, located 20 miles west of downtown Libby.

- OU8 – Roadways. OU8 is comprised of the United States and Montana state highways and ROWs within the boundaries of OU4 and OU7.

OU1 and OU2 were previously addressed in separate response actions, and RODs were published for both in May 2010. OU3 will be addressed separately in the future. Thus, extent and risks from LA contamination in these OUs and remedial alternatives for contaminated media such as soils and building materials within these OUs were not evaluated in the feasibility study (FS). When referring to OUs 4, 5, 6, 7, and 8, the term “non-OU3 areas” is often used.

While OUs have been used at the Site to organize investigations and subsequent response actions, EPA has determined that categories related to current and future land use are more consistent with the risk management approach for the non-OU3 areas of the Site evaluated within the FS. Thus, the non-OU3 areas of the Site have been organized in four separate land use categories:

- Residential/commercial

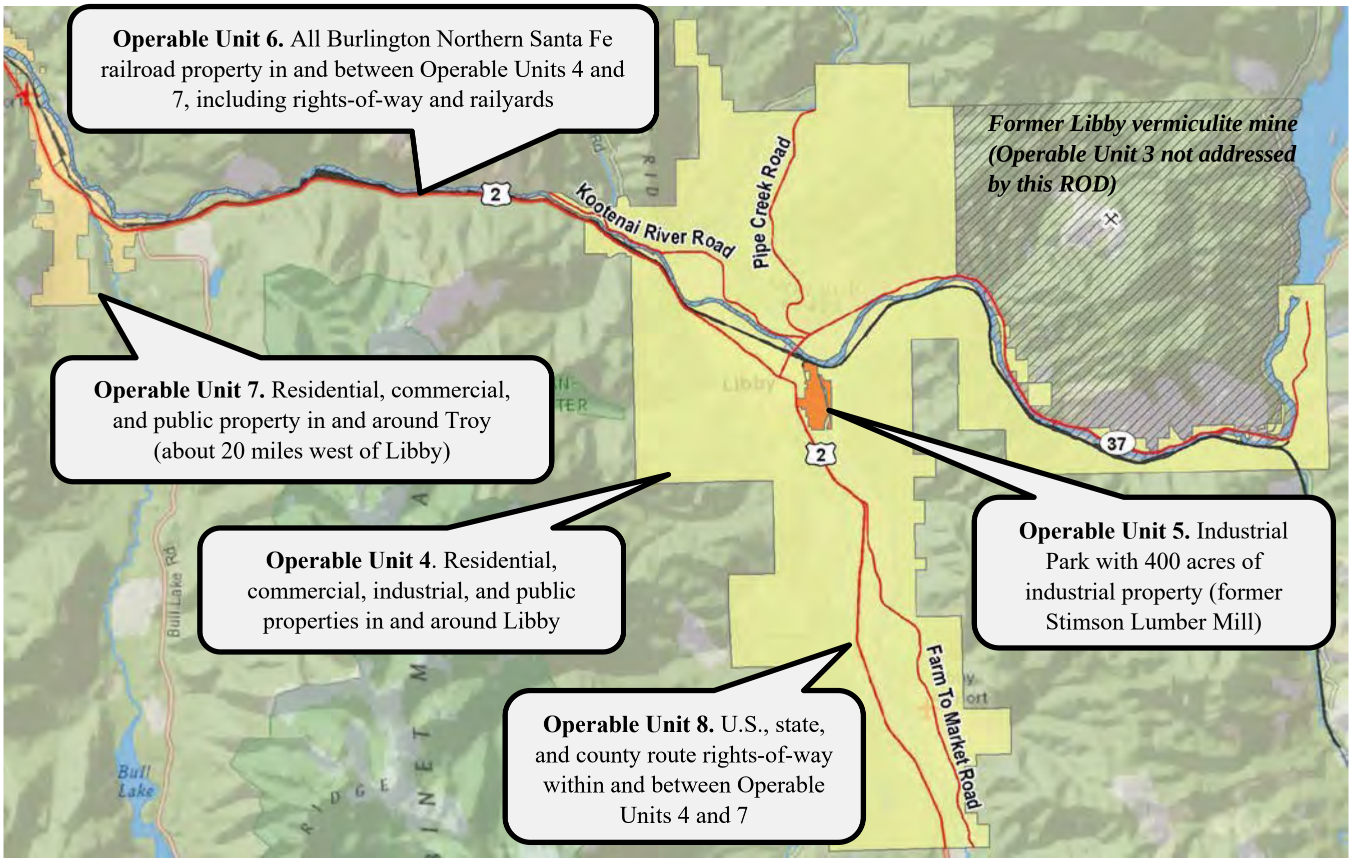
- Industrial

- Transportation corridors

- Parks/schools

While these land use categories were primarily identified to categorize existing land uses for properties within the Site, they also form the framework in which to evaluate land uses when a property owner changes the land use in the future. Thus, the definitions of the land use categories may contemplate uses that do not currently exist.

Exhibit 1-2. Site Layout Showing Locations of Operable Units



1.3.2 Site Contamination

The City of Libby is located 7 miles southwest of a vermiculite mine that operated from the 1920s until 1990 (herein referred to as the former Libby Vermiculite Mine). The Libby Vermiculite Mine began limited operations in the 1920s and was operated on a larger scale by Grace from approximately 1963 to 1990. The vermiculite deposit near Libby is contaminated with a distinct form of naturally occurring amphibole asbestos that is comprised of a range of mineral types and morphologies, referred to as LA. LA refers generally to amphibole materials that originated in the Libby vermiculite deposit; these materials have the ability to form durable, long, and thin structures that are generally respirable and can reasonably be expected to cause disease.

During investigations performed to determine LA exposure for the pathways of concern, LA was observed in all media sampled: air (indoor, outdoor ambient, and outdoor near disturbed soil), vermiculite insulation and bulk materials, indoor dust, soil (surface and subsurface), water, duff, tree bark, and tissue. Hence LA is considered the COC at the Site.

Vermiculite products and wastes containing LA were used in thousands of private residences, businesses, and public buildings across the Site. Vermiculite insulation, both commercially purchased and obtained otherwise, was used at a high rate in Libby buildings. Since the beginning of Site investigations in 1999, EPA has encountered vermiculite used as an additive in building materials such as mortar, plaster, and concrete; as insulation in attic and walls; in soils at depth in areas such as around septic tanks, tree roots, underground pipe trenches, and building foundations; and in surface soils in areas such as gardens, yards, driveways, and play areas. Response actions, such as removal of LA-contaminated dust, soil, and debris, have been performed across the Site in conjunction with investigatory activities.

The remedial investigation (RI) of OU3 is in progress, but other impacted areas of the Site, which include properties within the City of Libby, the Town of Troy, and unincorporated Lincoln County, have completed RIs and have been evaluated in the FS.

- OU1 – Former Export Plant. LA-containing vermiculite and/or vermiculite concentrate was transported to OU1 from the mine for stockpiling and staging prior to distribution. It is also believed that these vermiculite materials were used to fill in low lying areas of OU1. Response actions were conducted at the Export Plant by Grace in 2001 and 2002 (CDM Smith 2009a) to remove LA-contaminated soil.

- OU2 – Former Screening Plant. LA-containing vermiculite and/or vermiculite concentrate was transported to OU2 from the mine to be screened by size and grade. This vermiculite was transported by truck, sorted, and bulk stored in two sheds at the facility. There have been extensive response actions performed at this OU since EPA began emergency response activities in Libby in 1999 (CDM Smith 2009b).

- OU4 – Libby Residential/Commercial Area. LA-containing vermiculite products and wastes were used in private residences, businesses, and public buildings. Vermiculite-containing insulation (VCI), either commercially purchased or obtained otherwise, was used at a high rate, and EPA has encountered vermiculite used as an additive in mortar, plaster, and concrete; as insulation in attic and walls; in soils at depth around septic tanks, tree roots, underground pipe trenches, and building foundations; and in surface soils in gardens, yards, driveways, and play areas. LA was also unintentionally transported by mineworkers on clothing, shoes, and cars into homes and businesses. EPA has conducted interim response actions, such as removal of LA-contaminated dust, soil, and debris. Property investigations and related response actions are still taking place.

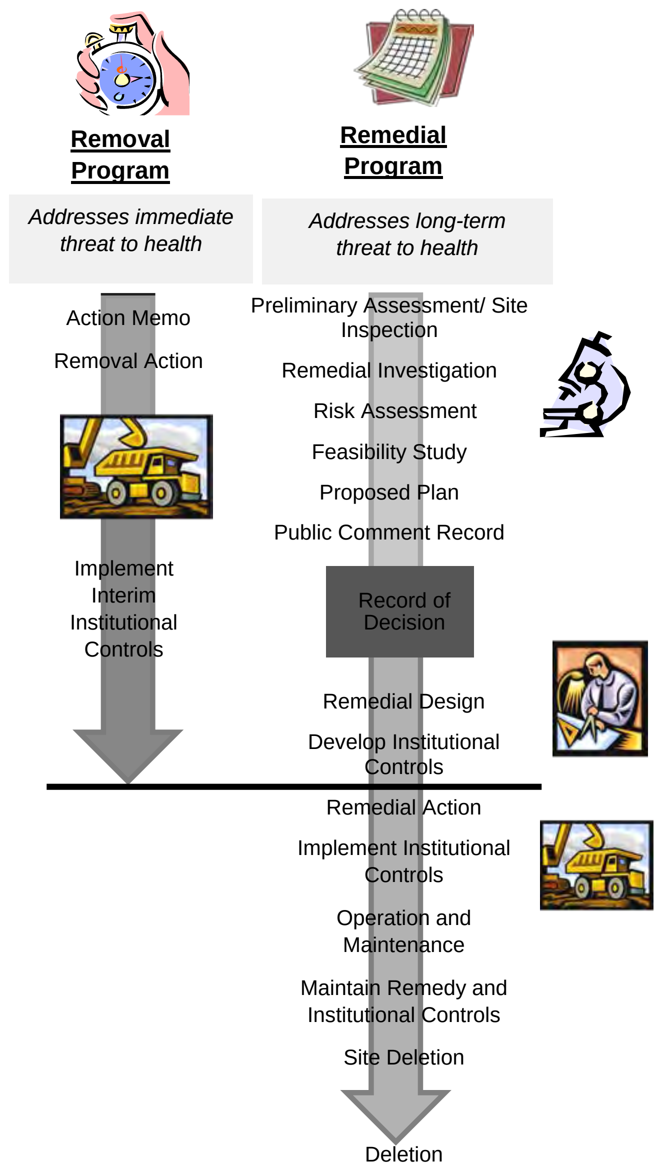
- OU5 – Former Stimson Lumber Company. LA-containing vermiculite and vermiculite products were transported using the railroad spur at OU5, and vermiculite products previously were stockpiled on native soil at the former Expansion Plant. The railroad spur was used for shipping raw and processed vermiculite material to and from the mill. It is also believed that the former Raintree Nursery may have incorporated vermiculite product into fill material and growth medium. Historical lumber processing activities generated waste bark piles that are still present on the property. Vermiculite insulation was installed in buildings (central maintenance building, finger jointer, and the plywood plant) and since has been removed. Furthermore, there has been extensive soil sampling and removal of contaminated soil at this OU.

- OU6 – BNSF Railroad. LA-containing vermiculite and/or vermiculite products were transported throughout the Libby and Troy areas on BNSF railroads. Vermiculite released during loading, unloading, and transporting along BNSF railroads represents potential sources of LA in OU6. Response actions in OU6 have included extensive sampling of the Libby and Troy railyards, soil and air sampling of the BNSF corridors throughout the Site, and removal and demolition activities at the Libby railyard.

- OU7 – Town of Troy. Similar to OU4, LA-containing vermiculite products and wastes were used in private residences, businesses, and public buildings in the Troy area, including as an additive in building materials and in surface soils. LA was transported by mineworkers on clothing, shoes, and cars into homes and businesses. EPA has conducted interim response actions (removal of LA-contaminated dust, soil, and debris), and property investigations and related response actions are still taking place.

- OU8 – Roadways. LA-containing vermiculite and/or vermiculite concentrate was transported throughout the Libby and Troy areas on federal, state, and local highways. Vermiculite released from trucks during transport as well as imported fill used for roadway construction and aggregate used in asphalt construction represent potential sources of LA within OU8.

Exhibit 1-3. The Superfund Process



1.4 ROD FORMAT

This ROD is the final decision document at the end of a detailed investigation and evaluation of conditions at the Site (Exhibit 1-3). Because the selected remedy will leave LA contamination in place that does not allow for unlimited use/unrestricted exposures, the remedy will be evaluated at least every 5 years to ensure it remains protective.

Once the remedy has been implemented and performance standards have been met, there will be an opportunity to delete the Site (or one or more of the OUs) from the NPL. Institutional controls (ICs) and operation and maintenance (O&M) will continue. Deletion from the NPL does not preclude any additional response actions to ensure protectiveness of the remedy.

EPA's detailed investigation and evaluation of conditions at OUs 4, 5, 6, 7, and 8 included performance of individual RIs and a FS and the completion of numerous removal actions to address significant human health risks during completion of the RI and FS. The RI reports include a comprehensive description of the nature and extent of contamination and a description of past investigative and removal actions at the Site. The FS report uses information from the RIs to perform a systematic analysis to determine the need for, and scope of, any required remedial action. The steps leading up to the ROD also included numerous opportunities for public involvement, including preparation of a Proposed Plan (issued May 8, 2015), a public meeting, and a 90-day public comment period.

This ROD documents EPA's selected remedy for OUs 4, 5, 6, 7, and 8. The next step in the Superfund process at these OUs will be completion of remedial designs (RDs) followed by implementation of remedial actions (RAs) based on the selected remedy documented in this ROD. Following the RAs, institutional control implementation and assurance plans (ICIAPs) will be developed. Individual RDs and ICIAPs will be prepared for OUs 4 and 7, OU5, OU6, and OU8.

This ROD is organized in the following sections:

Part I: Declaration

Part II: Decision Summary

- Section 1 – Introduction. Provides a brief introduction to the ROD.
- Section 2 – Site History and Response Activities. Provides a brief history of the Site, the OUs, the PRPs' actions, and EPA's activities.
- Section 3 – Highlights of Community Participation. Describes the range of community outreach activities.
- Section 4 – Scope and Role of the OUs. Describes how the actions taken at OUs 4, 5, 6, 7, and 8 fit into the overall scope of the Site and the remaining OUs.
- Section 5 – Summary of Site Characteristics. Contains an overview of the Site, a conceptual site model (CSM), and a summary of the results of the RIs.
- Section 6 – Current and Reasonably Anticipated Future Land and Resource Uses. Describes land and resource use.
- Section 7 – Summary of Site Risks. Discusses the Site-wide human health risk assessment.

- Section 8 – Remedial Action Objectives and Remedial Goals. Discusses the goals and objectives developed by EPA to protect human health and the environment at the Site.

- Section 9 – Description of Alternatives. Describes the remedial alternatives developed and evaluated in the FS, including a description of remedy components, common elements and distinguishing features, and expected outcomes.

- Section 10 – Comparative Analysis of Alternatives. Presents a summary of the remedial alternatives that were retained for detailed analysis in the FS.

- Section 11 – Principal Threat Wastes. Identifies the principal threat waste Site-wide and discusses how the selected remedy will prevent exposure to it.

- Section 12 – Selected Remedy. Provides a detailed description of the selected remedy, including its components, cost, expected outcomes, performance standards, and compliance with EPA's environmental justice mandate.

- Section 13 – Statutory Determinations. Describes how the selected remedy is protective of human health and the environment, complies with or appropriately waives applicable or relevant and appropriate requirements (ARARs), is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

- Section 14 – Documentation of Significant Changes. Confirms that no significant changes were made to the Preferred Alternative that was outlined in the Proposed Plan prior to it becoming the selected remedy described in this ROD.

- Section 15 – References. Provides a list of references cited in the ROD.

Part III: Responsiveness Summary

- Section 1 – Summary of opportunities for public involvement surrounding the Proposed Plan.

- Section 2 – Summary of quantitative information about the comments received (how many stakeholders provided written comments, names of commenters serving in an official capacity (i.e., county officials, Grace) and what topics raised the most comments, concerns, and questions. Topics where conflicting comments were received are also noted.

- Section 3 – Summary of how EPA is responding or making changes to the Proposed Plan on a general level.

- Section 4 – Summary (by topic) of significant comments received, both supportive and non-supportive, and EPA's response. These are summarized by three general categories of comments – Human Health Risk Assessment (HHRA), Remedy, and ICs.

2.0 SITE HISTORY AND RESPONSE ACTIVITIES

2.1 SITE BACKGROUND AND HISTORY

2.1.1 Site-Wide

Vermiculite was discovered 7 miles northeast of Libby, Montana in 1881 by gold miners. In the early 1920s, Mr. Edward Alley began initial mining operations on the vermiculite ore body. Full-scale operations began later that decade under the name of the Universal Zonolite Insulation Company (Zonolite). This ore body contained a mixture of amphibole mineral fibers of varying elemental composition (e.g., winchite, richterite, tremolite) that have been identified in the Rainy Creek complex near Libby (herein referred to as LA) as defined by Meeker et al. (Meeker et al. 2003). Unlike the commercially exploited chrysotile asbestos, the LA material has never been used commercially on a wide scale, and, for the mine's operating life, it was considered a byproduct of little or no value. The commercially exploited vermiculite was used in a variety of products including insulation and construction materials, as a carrier for fertilizer and other agricultural chemicals, and as a soil conditioner.

The vermiculite ore was mined using standard strip mining techniques and conventional mining equipment. The ore was then processed in an onsite dry mill to remove waste rock and overburden material. Once processed, the ore was transported down from the mine to the former Screening Plant, which sorted the ore into five size ranges. After the sorting process, the material was shipped to various locations across the United States for either direct inclusion in products or for "expansion" prior to use in products. Expansion (also known as "exfoliation" or "popping") was accomplished by heating the ore, usually in a dry kiln, to approximately 2000°F. This process explosively vaporizes the water contained within the mica structure, causing the vermiculite to expand by a factor of 10 to 15. This produces the vermiculite material most commonly seen in stores and sold as soil conditioner for gardens and greenhouses.

In Libby, operations handling this material occurred at four main locations: the mine and mill located on Rainy Creek Road on top of Zonolite Mountain; the former Screening Plant and railroad loading station located at the intersection of MT Highway 37 and Rainy Creek Road and directly across the Kootenai River, respectively; the former Expansion/Export Plant (the former Export Plant) located immediately west of MT Highway 37 where it crosses the Kootenai River; and at the former expansion plant located at the end of Lincoln Road, near 5th Street. The Lincoln Road Expansion Plant went off line sometime in the early 1950s.

In 1963, Grace purchased Zonolite and continued vermiculite-mining operations in a similar fashion. In 1975, a wet milling process was added that operated in tandem with the dry mill until the dry mill was taken off line in 1985. The wet milling process was added to reduce dust generation by the milling process. Expansion operations at the former Export Plant ceased in Libby sometime prior to 1981, although this area was still used to bag and export milled ore until mining operations were stopped in 1990. Before the mine closed in 1990, Libby produced about 80 percent of the world's supply of vermiculite.

Since 1999, EPA has conducted sampling and response action activities to address highly contaminated areas in the Libby Valley. The EPA investigation was initiated in response to media articles, which detailed extensive asbestos-related health problems in the Libby population. While at first the situation was thought to be limited to those with direct or indirect occupational exposures, it soon became clear there were multiple exposure pathways, and many persons with no link to mining-related activities were affected.

Typically, the amphibole asbestos contamination found in the Libby Valley comes from one or some combination of source materials (e.g., vermiculite insulation, processed vermiculite ore, mine wastes). Asbestos from these source materials has been found in interior building dust samples and local soils, which in turn act as secondary sources. To date, EPA's goal has been to find and identify areas with elevated levels of asbestos and remove them.

2.1.2 Individual OUs

2.1.2.1 OU1 – Former Export Plant

From the early 1960s to approximately 1990, the Export Plant was used by Grace for stockpiling and distributing vermiculite concentrate to Grace expansion plants and customers throughout the United States. Ownership was transferred to the City of Libby in the mid-1990s. Throughout its history, portions of OU1 were leased to various parties for both commercial and non-commercial enterprises. From approximately 1977 to 1997, organized youth baseball events (games and practices) were held at the ball fields in OU1. Between approximately 1987 and 2000, the Millwork West Company, a retail lumberyard and building material supplier, leased the northwestern portion of Area 1. Buildings and equipment owned by Millwork West were removed and/or demolished by Grace in 2001 and 2002. Other commercial and industrial uses reportedly included a metal scrap dealer and a larch tree gum manufacturer. Infrastructure for these businesses (power supply, railroad spur, and truck scales) was removed by EPA.

Area 1 (12 acres) is owned by the City of Libby and is undeveloped with the exception of a small area used by David Thompson Search and Rescue, which contains a building with an office and a five-bay garage. Area 2, Riverside Park (4.7 acres) is also owned by the City and serves recreational visitors with two boat ramps, two pavilions, picnic tables, and a pump house. Area 3 (less than 1 acre), the embankments, is owned and maintained by the Montana Department of Transportation (MDT) which performs only periodic maintenance of the embankments, as needed. Exposure has been mitigated throughout the OU by removal of surface soils and extensive capping of contaminated soils.

2.1.2.2 OU2 – The Former Screening Plant

Vermiculite and LA were transported to OU2 (5 miles northeast of Libby) from the mine for decades, and contamination remains in subsurface soil (EPA 2010). Exposure has been mitigated by removal of surface soils and the extensive cap placed across the OU during removal activities. The former Screening Plant (21 acres) is on the east side of the Kootenai River, bordered by MT Highway 37, the Flyway, and the Kootenai River. From 1975 to 1990, it was used by Grace to screen mined vermiculite by size and grade. The vermiculite was transported from the mine by truck and was sorted and bulk stored in two sheds. It was then loaded onto a conveyor system and transported across the Kootenai River to a conveyor unloading station, where it was then trucked to the Export Plant (OU1) for processing and shipping or loading onto rail cars for transportation to expansion plants elsewhere. From 1993 to 1999, it was used as a fully operational retail nursery with an onsite residence and office. The largest building on the property was the "long shed," and there were five greenhouses and a number of smaller buildings and support structures. Two concrete tunnels were used to grow mushrooms. The former screening plant has undergone extensive investigation and removal actions.

Owned by Kootenai Development Corporation (KDC), (a subsidiary of Grace), the area commonly referred to as the Flyway (19 acres) is immediately south of the former Screening Plant. It is also bounded by MT Highway 37, a residential subdivision, and the Kootenai River. The Flyway housed a pump that was used during vermiculite mining operations to convey water from the river to the mine site. The pump house has since been abandoned, and the pump is no longer functional. In 1999, when EPA first visited the property, the Flyway was found to contain several vermiculite piles. One portion had been covered with imported fill, and it was suspected that vermiculite-containing material had been moved from the former Screening Plant and used as fill to level parts of the Flyway where drainages existed. A portion of the Flyway was remediated in 2001 by Grace at the direction of EPA, and remediation was performed by EPA in 2003. In 2004 additional remediation was performed by Grace, and in 2005 the MT Highway 37 ROW was remediated by EPA. The Flyway is vacant, undeveloped land.

Subarea 3 (1 acre) lies between the former Screening Plant and the Flyway and is a continuation of the Flyway ROW that is used and maintained by MDT. The property was used for vermiculite mining-related activities, such as the storage of equipment and materials. More recently, portions were used for equipment decontamination during remediation of the former Screening Plant and Flyway. EPA investigated and remediated the property. It is currently vacant, undeveloped land. The Rainy Creek Road frontages are privately owned and lie immediately north and south of Rainy Creek Road on the east side of MT Highway 37. They were remediated in 2005 and are currently vacant, undeveloped land.

2.1.2.3 OU3 – The Former Libby Vermiculite Mine

As described earlier, the vermiculite mine is approximately 7 miles northeast of Libby and was developed in the 1920s under the name of the Universal Zonolite Insulation Company (Zonolite). The ore body contained a mixture of amphibole mineral fibers referred to as LA that was considered a byproduct of little or no value. The vermiculite ore was mined using standard strip mining techniques and conventional mining equipment. It was then processed in an onsite dry mill and transported to the former Screening Plant for sorting and shipment across the United States.

This OU is defined as the property in and around the Zonolite Mine owned by Grace or Grace-owned subsidiaries (excluding OU2) and any area (including any structure, soil, air, water, sediment, or receptor) impacted by the release and subsequent migration of hazardous substances and/or pollutants or contaminants from such property, including, but not limited to, the mine property, the Kootenai River and sediments therein, Rainy Creek, Rainy Creek

Road, and areas in which tree bark is contaminated with such hazardous substances and/or pollutants and contaminants.

2.1.2.4 OU4 – Residential/Commercial Areas within Libby

Most of the workers at the vermiculite mine lived in Libby and commuted to the mine to work each day. The workers were exposed to asbestos-contaminated materials at the mine and processing facilities, and they transported asbestos-contaminated dust to their homes on their heavily contaminated clothing and equipment, unknowingly exposing their families and their property.

As discussed in OU2, vermiculite and VCI were transported from the mine to Libby for decades, and Libby residents had access to these materials. Waste vermiculite was used for amending soils in gardens, flowerbeds, and lawns; bringing low areas to a level grade beneath sidewalks, driveways, and low lying areas; backfilling utilities and septic systems; and insulating houses. The VCI was used in attics and, to a lesser extent, in walls for insulation. In some cases, the VCI was added to existing insulation to increase the R-value, or insulating capability, of the existing insulation. Property investigations and response actions are ongoing.

2.1.2.5 OU5 – The Former Stimson Lumber Mill

The former Stimson Lumber Mill (400 acres) was operated under various lumber companies from 1946 to 2003. The former Expansion Plant was located on the former Stimson Lumber Company property and included an area used as an aboveground storage area for uncontainerized vermiculite ore. This area was converted to a parking lot in 1990. The railroad spur was used for shipping raw and processed vermiculite material to and from the former Stimson Lumber Mill. The Stimson Lumber Company operated the facility from 1993 to 2003, when it was sold to the Lincoln County Port Authority (CDM Smith 2007). A landscaping nursery was also previously located along the southern boundary of the former Stimson Lumber Company property. OU5 is currently used mainly for commercial and industrial purposes, and portions are used for recreation. This includes an area that has been developed as a motocross park for dirt biking riding and a trail along Libby Creek that is popular for hiking and bicycle riding. OU5 has been investigated and has had subsequent response actions performed.

2.1.2.6 OU6 – BNSF Railroad

For over 70 years, much of the processed ore produced by the mine was transported by BNSF predecessor railroads from a load out across the Kootenai River from the screening plant to either a processing plant located in Libby or to plants located across the country (CDM Smith 2008a). Incidental spillage during the loading, unloading, and transportation processes is suspected to have deposited LA along the current BNSF ROW (CDM Smith 2008a). Railroad tracks were originally built through the area in the late 1800s by a BNSF predecessor railroad, the Great Northern Railway (GN). For the majority of the route through OU6, the current BNSF tracks follow the original GN route, with the exception of a section that parallels the Fisher River. This section was laid in the early 1970s in preparation for the construction of the Libby dam, which was dedicated in 1975. Several investigations have been performed throughout this OU, and the area of the Libby railyard has had extensive response actions performed.

2.1.2.7 OU7 – Residential/Commercial Areas within Troy

The history of contamination in OU7 is similar to that of OU4. Some of the workers at the vermiculite mine lived in Troy and commuted to the mine to work each day. The workers were exposed to asbestos-contaminated materials at the mine and processing facilities, and they transported asbestos-contaminated dust to their homes on their clothing and equipment. Residents of Troy also traveled to Libby for everyday activities such as shopping, working (other than at the mine), and attending school sporting events, and likely came in contact with LA in Libby during these frequent visits (Tetra Tech 2014). Unlike OU4, LA-contaminated vermiculite does not appear to have been used for public projects (e.g., school track or baseball fields). Waste vermiculite and VCI were used in homes and yards for the same purposes described in OU4. Property investigations and response actions are ongoing.

2.1.2.8 OU8 – Highways

During the time the former Vermiculite Mine operated, MT Highway 37, US Highway 2, and county roads (Kootenai River Road, County Highway 482 [Farm to Market Road], and County Highway 567 [Pipe Creek Road]) included in this OU were used to transport vermiculite and vermiculite products from the mine to the former Screening Plant and Export Plant as well as other mining-related areas. They were also used by workers and industries servicing the mine. LA-contaminated materials may also have been used as fill in some instances to build or repair the road embankments.

2.2 RESPONSE ACTIVITIES

Asbestos is a hazardous substance as defined by 40 CFR § 302.4 of the NCP. In November 1999, EPA responded to requests from the State of Montana and Lincoln County Board of Health to investigate the potential exposure to asbestos related to the former mine operations and vermiculite processing. The EPA Response Team briefly inspected the former mine and processing facilities, interviewed local officials and members of impacted families, interviewed a pulmonologist in Spokane, Washington, and collected a small set of initial samples. A more detailed summary of initial Libby Site evaluation is found in the EPA Action Memorandum (EPA 2000a).

The initial investigation revealed two significant findings:

- There were a large number of current and historic cases of asbestos-related diseases centered on Libby, Montana.
- There was a likelihood that significant amounts of asbestos-contaminated vermiculite still remained in and around Libby.

These findings led EPA to initiate a larger-scale rapid investigation in December 1999, the Phase 1 investigation, to meet the following goals:

- Obtain information on airborne asbestos levels in Libby in order to determine whether time-critical intervention was needed to protect public health.
- Obtain data on asbestos levels in potential source materials and identify the most appropriate analytical methods to screen and quantify asbestos in source materials. Locations investigated for potential source materials included Rainy Creek Road within the former Libby Vermiculite Mine, the former Export Plant, and the former Screening Plant.

Under CERCLA, Section 104, EPA has the authority to complete both removal and remedial actions. To date, all removals have been conducted using removal action authority to facilitate the timely removal of the most contaminated areas. The initial removal authority for time-critical actions began at the processing areas in May 2000 (EPA 2000a). As additional areas requiring removal were identified, amendments to the initial action memorandum were approved.

This approach has allowed the agency to quickly evaluate and clean up contaminated properties. EPA has focused on the response action of properties with materials that can clearly act as a source of contamination to air or indoor dust such as those with vermiculate insulation and detectable LA in soils. While this response action proceeds, EPA also conducted RIs, a FS, a HHRA, and baseline ecological risk assessments (BERAs) to inform final response action goals and response action approach for the Site. Following publication of the ROD, EPA will commence remedial action at remaining properties with contamination exceeding the remedial action levels (Section 8.3).

EPA's current investigation and response action approach focused on finding and addressing sources of LA. The major sources in the area outside of the OU3 study area, such as the Screening Plant, Export Plant and large vermiculite piles, have already been isolated or cleaned up. Remaining sources on a much smaller scale may include, but are not necessarily limited to, vermiculite insulation, raw vermiculite, or soils with elevated levels of LA at residential and commercial properties within OU4 and OU7. Sources of LA remain within the OU3 study area, such as the former Libby vermiculite mine and surrounding forested areas, and are being investigated and addressed as part of a separate response action.

When removals started in 2002, properties were characterized and placed into one of three categories: removal not required, removal required, or pending. Exhibit 2-1 summarizes the changes that have been made to these categories throughout the removal phase.

Exhibit 2-1. Removal Action Timeline

Removal Action History

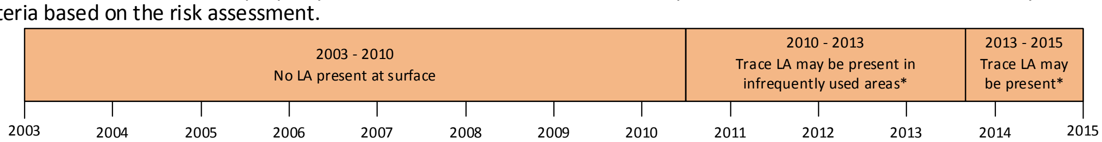
Throughout development of the risk assessment, EPA has learned more about Libby amphibole asbestos (LA) and the risk of exposure. All removals that EPA has conducted have been protective. The timelines below illustrate property conditions if 1) a removal was completed, 2) a removal was not required, or 3) the property was deferred.

What's Important?

- The risk assessment shows that all past removals are protective. If a property has had a removal, EPA will not need to return to the property. All properties meet today's cleanup criteria based on the risk assessment. About 200 properties already investigated will require additional investigation and some of those may require a removal action.
- Properties with higher concentrations of LA were cleaned up first. As the risk assessment was developed, EPA was able to make cleanup decisions for properties with only lower concentrations of LA.
- Not all vermiculite contains asbestos. EPA currently relies on analytical data to make decisions about removing soil containing LA whether or not it contains vermiculite. Some properties where EPA completed a removal may have visible vermiculite remaining on the property.
- For interior removals, accessible vermiculite has been removed, leaving in place only vermiculite that does not present current exposure.

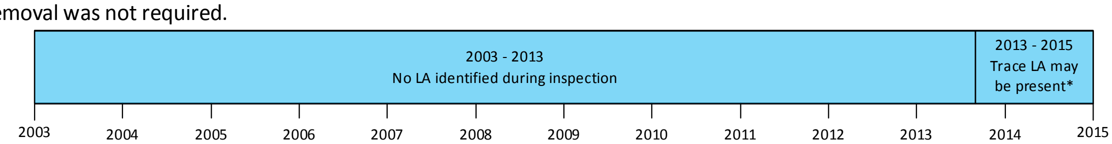
1. Removal Completed

The timeline below indicates property conditions where a removal was completed. Current conditions meet today's cleanup criteria based on the risk assessment.



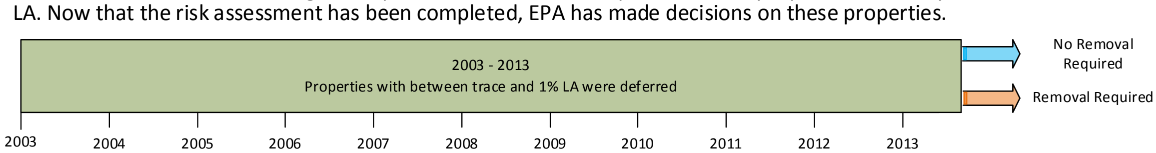
2. Removal Not Required

Removal is not required when there is no LA present at a property. The risk assessment determined that low amounts of trace LA could be present at the property and not require removal. The timeline below indicates property conditions where removal was not required.



3. Property Deferred

As the risk assessment was being developed, EPA deferred cleanup decisions on properties with only lower concentrations of LA. Now that the risk assessment has been completed, EPA has made decisions on these properties.



*The risk assessment shows that small areas of trace LA contamination may be left on a property without posing an unacceptable risk. The area of trace LA does not exceed 25% of a typical residential property. The area of trace LA may exceed 25% for infrequently used areas.

2.2.1 Site-Wide EPA Activities

EPA's first priority at Libby was to reduce risk as quickly as possible. Beginning in 1999, early removal activities focused on understanding the sources of contamination and removing those source areas that presented the highest potential risk. Exhibit 2-2 depicts the key activities at the Site.

In a January 2002 letter to EPA officials, Montana's governor officially asked EPA to add Libby's asbestos contamination to the NPL on the basis of the threat presented to human health and the environment. The governor acknowledged the tie between widespread illness and death in Libby and the Grace vermiculite mining operations and requested use of Montana's lone state pick (i.e., "silver bullet") with the EPA for an expedited Superfund listing process for the asbestos cleanup. The Site was added to the NPL in October 2002. Highlights of Site-wide response activities conducted prior to and after the listing are provided in Sections 2.2.1.1 and 2.2.1.2.

On June 17, 2009, EPA and the U.S. Department of Health and Human Services determined that conditions at the Site constituted a public health emergency due to the fact that asbestos is a known hazardous substance. LA has been released throughout the Libby area due to the vermiculite mining. Hundreds of cases of asbestos-related disease have been documented in Libby and Troy. The occurrence of asbestos-related diseases was not limited to the mine workers but was spread throughout the population. EPA is working closely with the U.S. Department of Health and Human Services, which helps provide asbestos-related medical care to Libby and Troy residents. The public health emergency was based on a number of factors including multiple sources of potential exposure to asbestos, the high number of asbestos-related diseases in the communities of Libby and Troy, and limited access to medical care.

This was the first time EPA made such a finding under CERCLA. In making this determination, EPA recognized the serious health impacts from LA contamination in Libby and made it possible for the U.S. Department of Health and Human Services to provide asbestos-related medical care to eligible Libby and Troy residents. This determination also allowed EPA to clean up commercial product. EPA is continuing to identify and conduct activities needed to complete the remedial action so the public health emergency may be lifted.

2.2.1.1 Activities Conducted prior to October 2002 NPL Listing

Between 1999 and 2002, EPA's activities in Libby included:

- **1999**. Opened the EPA Information Center in Libby.
- **1999 to 2002**. Investigated sources of contamination.
- **2000 and 2001**. Removed several major source areas (Kootenai Valley Head Start, Libby High School, Libby Middle School, Cemetery Park Ballfields, Export Plant, and Screening Plant).

- **2002**. Built a special cell in the Libby Class II Landfill for disposal of asbestos wastes; reconsidered standard protocols for analyzing asbestos samples and assessing risk from asbestos exposure, tested methods of remediating indoor contamination, and began a formal human health risk assessment; proposed the Site for the NPL at the request of the governor; expanded the Superfund investigation to include extensive sampling and analysis and additional risk assessment; began inspection and sampling of over 3,000 residential and commercial properties as part of the Contaminant Screening Study (CSS); and authorized and began removal of vermiculite from Libby homes and businesses (26 homes completed in 2002).

2.2.1.2 Activities Conducted after October 2002 NPL Listing

After the Libby Site was added to the NPL, response activities intensified. Listed below are the major activities conducted since listing:

- **2003.** Completed the CSS (over 1,200 properties inspected or sampled), completed 157 residential or commercial cleanups and the city boat ramp cleanup, and published interim cleanup standards and protocols. ATSDR released the final version of its report, *Public Health Assessment for the Libby NPL Site, Operable Unit 4, Town of Libby and Affected Libby Valley Residential and Commercial Properties*. The report concluded, in part, that the citizens of Libby were exposed to hazardous levels of asbestos and had elevated levels of disease and death from exposure to asbestos. It also recommended, in part, that EPA conduct a toxicological investigation (toxicity assessment) and epidemiological studies.

- **2004.** Completed 170 residential or commercial cleanups and cleanup of BNSF railyard and Flyway property. Announced that Troy will be included in the cleanup.

- **2005.** Completed 225 residential or commercial cleanups, conducted special sampling to verify protectiveness of cleanup, initiated RI/FS, and began initial coordination for 2006 Troy investigations.

- **2006.** Completed 216 residential or commercial cleanups and initiated Outdoor Ambient Air sampling program.

- **2007.** Completed 160 large and complicated cleanups; continued Outdoor Ambient Air sampling program; initiated the Residential Activity-Based Sampling (ABS) program, Environmental Resource Specialist (ERS) program, and sampling in Troy; created the Troy Information Center; identified toxicity studies for risk assessment; and investigated several creeks in the Libby and Troy areas to evaluate the presence and extent of LA in materials used for the construction of riprap.

- **2008.** Completed 143 residential or commercial cleanups in Libby and 6 in Troy; conducted initial OU4 residential ABS; continued toxicity studies for risk assessment, sampling in Troy, and investigations at all OUs; investigated several creeks in the Libby and Troy areas to evaluate the presence and extent of LA in materials used for the construction of riprap; and conducted response actions, resulting in the removal of over 7,000 cubic yards of material from the creeks.

- **2009**. Completed 159 residential or commercial cleanups and sampling in Troy; conducted removals at Cabinet View Golf Course, Pipe Creek, and Libby Creek; and completed various investigations.

- **2010.** Completed 201 residential and commercial removal actions in Libby, began removals in Troy, completed a removal action for the Historic Hotel Libby, signed the RODs for OU1 and OU2, continued RIs for OU3 and OU4, and revised the community engagement plan.

- **2011**. Completed 141 residential or commercial cleanups in Libby and submitted draft LA-specific toxicity values to the Scientific Advisory Board for review. Completed soil removal at the former Expansion Plant and performed an interior cleaning of areas impacted by land owner removal of asbestos-containing roof materials in the Central Maintenance Building at OU5.

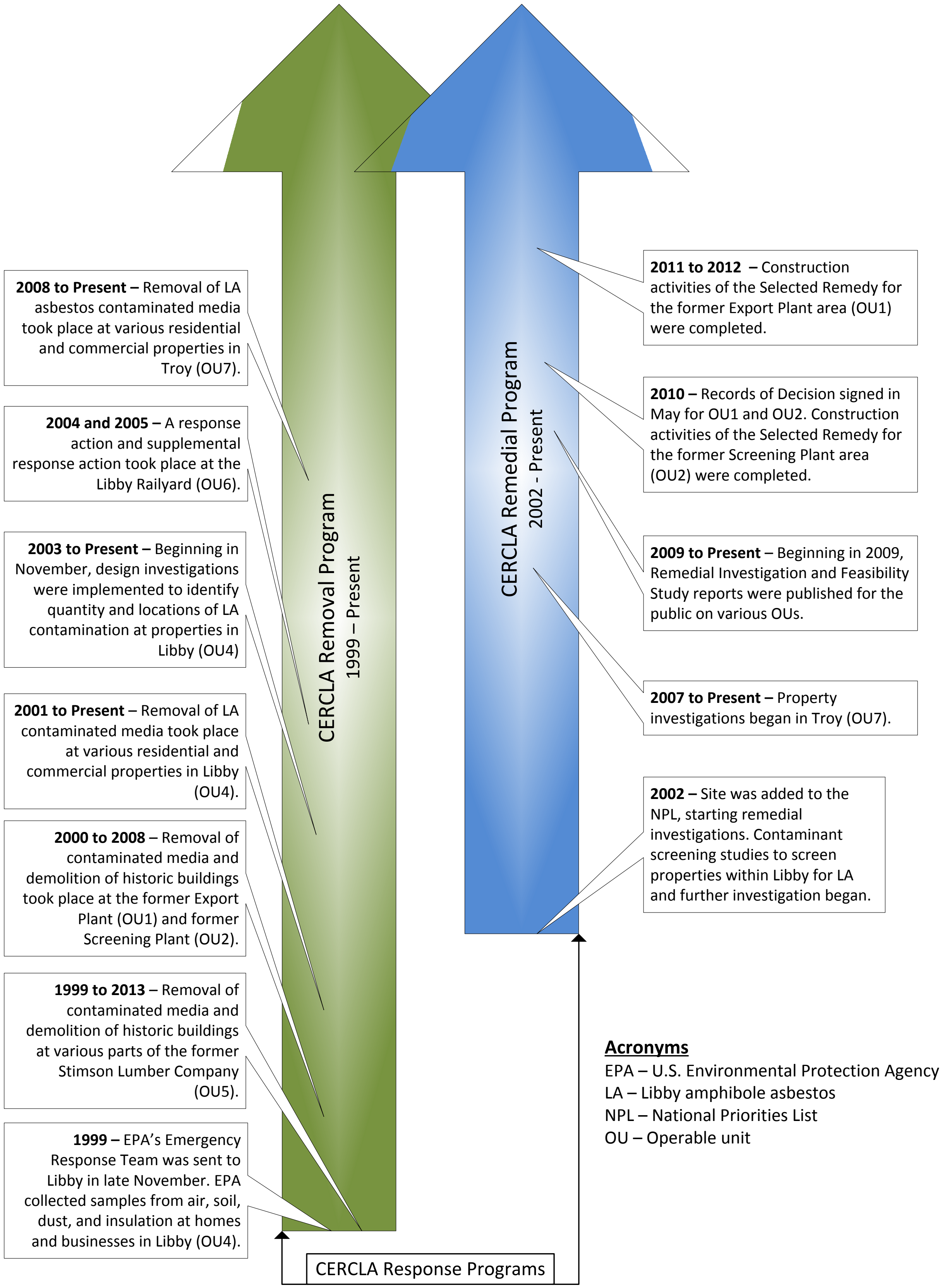
- **2012**. Completed 174 residential and commercial cleanups (74,400 cubic yards of impacted soil), characterized LA contamination in forested areas in the Libby valley, and finalized remediation of OU1. Completed soil removal at the Port Authority Building in the area associated with revegetation demonstration plot, soil removal in the former nursery area, and removal of VCI and interior cleaning at the Central Maintenance Building at OU5. Collaborated with the City-County Board of Health in the development of the Asbestos Resource Program (ARP). The purpose of the ARP was to educate the public regarding the remaining risks of LA exposure; provide resources to manage the risks associated with LA exposure; and implement initiatives to reduce or prevent the risk of LA exposure.

- **2013**. Completed 103 residential and commercial cleanups (34,000 cubic yards of soil), completed investigations at more than 700 properties, celebrated Riverfront Park and the cleanup and redevelopment of the former Export Plant, and closed the Troy Information Center to streamline operations from the Libby office. Completed soil removal of the former tree nursery at OU5 and continued to support the City-County Board of Health with implementation of the ARP.

- **2014**. Completed 79 residential and commercial cleanups, finalized RIs at 5 OUs, completed ABS, completed investigations at over 700 properties, completed the toxicity assessment, finalized the Site-wide BERA and issued the draft HHRA and FS reports, completed the 5 year site review of OU1, and continued to support the City-County Board of Health with implementation of the ARP.

- **2015**. Completed approximately 110 residential and commercial cleanups, completed ABS, completed investigations at approximately 500 properties, finalized HHRA and FS reports, completed the 5 year site review of OU2, and continued to support the City-County Board of Health with implementation of the ARP. To date, more than 2,200 residential and commercial cleanups and approximately 7,100 investigations have been completed.

Exhibit 2-2. Timeline of Regulatory Activities at the Site



2.2.2 Response Activities Specific to OUs 4, 5, 6, 7, and 8

RI reports were completed for each OU (Exhibit 2-3) and detail the information used to characterize conditions and determine the nature and extent of contamination. The FS for OUs 4, 5, 6, 7, and 8 was completed in May 2015.

Exhibit 2-3. Summary of Previous RI and FS Reports Completed

Operable Unit	Remedial Investigation Completion	Feasibility Study Completion
OU4 – City of Libby	June 2014[1]	May 2015
OU5 – Former Stimson Lumber Company	June 2013	
OU6 – Burlington Northern and Santa Fe Railroad Corridor	April 2014	
OU7 – Town of Troy	September 2014	
OU8 – United States and Montana State Highway Corridors	June 2013	

1 OU4 RI report covers period from 1999 through 2013.

2.2.2.1 Highlights of Investigations and Removal Activities

Highlights of the investigations and removals for each OU are summarized in Exhibit 2-4. For complete details on the actions specific to each OU, reference their respective RI report.

Exhibit 2-4. Highlights of Investigations and Removal Activities by OU

	Investigation	Removal/Construction
OU4	• Investigations completed at approximately 5,800 commercial and residential properties • Specialty investigations conducted at schools and unique properties such as Cabinet View Country Club and the former landfill • LA nature and extent investigation • ABS investigations, including multiple-year residential [five scenarios], schools, limited use area, background and borrow, woodstove ash, and comparative exposure	• Removals completed at approximately 2,100 commercial and residential properties • Construction of Class IV asbestos cell at the Libby Class II Landfill
OU5	• Site interview in 2001 that indicated three areas of interest: the former Expansion Plant, the railroad spur, and the former tree nursery • Soil sampling and characterization of several areas within the operable unit	• Removed VCI from a portion of the roof and walls at the Central Maintenance Building • Removal of contaminated soil in several areas, including an area of the former tree nursery in preparation for construction of a fishing pond, which was opened in August 2015
OU6	• Sampling began in 2001 and focused on characterization in and around the BNSF Libby Railyard • Sampling efforts after response actions were completed focused on receptor exposure during railroad maintenance activities along the tracks and are considered representative of areas outside the BNSF Libby Railyard	• Removal of 14,091 feet of railroad track and 8,000 railroad ties to access the underlying, potentially LA-contaminated soils • Removal and disposal as potential asbestos-containing material (ACM) of the BNSF scale house and associated concrete foundation

Exhibit 2-4. Highlights of Investigations and Removal Activities by OU (continued)

	Investigation	Removal/Construction
OU7	• Investigations completed at approximately 1,300 commercial and residential properties	• Removals completed at approximately 100 commercial and residential properties
OU8	• Designated an OU in 2009 • Systematic soil sampling was performed in support of the RI report along the ROW	• EPA has addressed some parts of OU8 along with the response actions for other OUs • EPA addressed the portion of MT Highway 37 adjacent to OUs 1 and 2 as part of their respective removal and remedial actions

2.3 CHANGES TO REMOVALS OVER TIME

EPA has conducted removals since 2003, and as the science has evolved over time and the LA toxicity values and risk assessments were developed, EPA made adjustments to the investigations and cleanups conducted to ensure the removals were both effective and efficient.

Based on a review of past removals as well as the information developed through the risk assessment, the following points summarize what is important about the removal program conducted to date:

- The current protocol is based on the risk assessment; an evaluation of past removal protocol indicates that removals were completed under more stringent requirements and therefore have been effective at reducing human health exposure and risks.

- At the beginning of the project, EPA completed the "worst first;" in other words, properties with the higher amounts of LA contamination were cleaned up first. Remaining properties generally have lower amounts of LA contamination relative to properties already cleaned up.

- EPA has determined that the focus of a removal should be based on the analysis for LA rather than the observation of visible vermiculite. Therefore, some properties that have undergone a removal may have visible vermiculite remaining.

EPA has made changes to both exterior and interior removals over time. For more information on the history of the removal criteria reference *Libby Asbestos Site Residential/Commercial Cleanup Action Level and Clearance Criteria Technical Memorandum* (EPA 2003) and its amendments (EPA 2011 and 2014b). As discussed above, the removals conducted have been determined to be effective based on the draft risk assessment. Following is a discussion of the changes made to exterior and interior removals and how EPA is addressing the changes, if needed.

Exterior removals:

Exhibit 2-5 highlights soil removal criteria and changes to removal criteria during the course of the project.

Exhibit 2-5. Overview of Soil Removals at Libby

Soil Condition†	Triggers for Soil Removal								
	SUA		CUA			LUA			
	2003 - Oct 2013	**Nov 2013 - present****	2003 - Dec 2006	Jan 2007 - Oct 2013*	**Nov 2013 - present****	2003 - Dec 2006	Jan 2007 - Jun 2010*	Jul 2010 - Oct 2013*	**Nov 2013 - present****
Bin A (ND)									
Bin B1 (Trace)		Trace in >25% of total area ‡			Trace in >25% of total area ‡				
Bin B2 (<1%)									
Bin C (≥1%)									
Vis +			Vis + & PLM +					mod. & high Vis + only	
Vis -									

Exhibit 2-5. Overview of Soil Removals at Libby (continued)

Primary trigger

Conditional trigger

Not a trigger

† See Section 2.4.1 for a description of the bins
** Changed per Amendment A Tech Memo*
*** Changed per Amendment B Tech Memo*
‡ Total area = SUA + CUA + SS + SB

Definitions:

SUA = specific-use area (e.g., garden, flowerbed, unpaved driveway, play area)

CUA = common-use area (e.g., yard)

LUA = limited-use area (e.g., pasture, maintained/mowed fields)

SS = secondary structure (e.g., unpaved carport or lean-to)

SB = secondary building (e.g., soil floor of a garage or shed)

PLM = polarized light microscopy

Primary trigger = if one or more primary triggers are met, a soil removal is needed

Conditional trigger = conditional triggers are only evaluated for properties where a soil removal is needed (i.e., a primary trigger is present)

Not a trigger = this soil condition is not a primary or conditional trigger for soil removal; however, these soil conditions may be removed during response actions due to constructability at the discretion of EPA

Interior removals:

- All accessible vermiculite insulation is removed from attics, knee walls, and interior living spaces. Vermiculite in inaccessible areas is sealed in place and/or encapsulated. This approach has remained consistent throughout the removal program.

- When removals started in 2002, dust samples were collected to determine whether an indoor cleaning was required. In general, living spaces were cleaned if dust samples collected had analytical results greater than or equal to 5,000 structures per square centimeter (s/cm^2). EPA conducted a pilot study in 2007 to determine whether collecting dust samples was an effective means of deciding whether a cleaning was needed. The pilot study resulted in EPA eliminating the collection of dust samples due to the low LA concentrations observed in the analytical results and the inability to collect samples with reproducible data. However, if dust sample data are available, they are used along with other data to determine if an interior cleaning is needed.

- Crawlspaces and unfinished basements determined to have contamination are addressed in different ways based on access and cost-effectiveness. These include applying shotcrete or fastening sheets of high density polyethylene over the surface. In 2012, the protocol was updated to also base the need for cleanup on the frequency of use. Now, a response is required if the space is entered more than once a month by property owners and has greater than or equal to 0.2 percent LA in the soil. Infrequently used areas are addressed if sample results are greater than or equal to 1 percent LA.

2.4 SUMMARY OF ANALYTICAL AND SAMPLING METHODS

Various analysis, sampling, and inspection methods were used to determine the potential presence of LA fibers in different media such as soil, dust, and air. The following lists provide examples of analysis, sampling, and inspection methods implemented as part of the response action activity and risk assessment evaluation at the Site.

2.4.1 Analytical Methods

- Polarized light microscopy (PLM) – There are two different types of PLM methods utilized at the Site to analyze soil and other bulk materials: PLM 9002 and the Libby-specific PLM methods.

  - PLM-9002, or National Institute for Occupational Safety and Health (NIOSH) Method 9002 (Issue 2), Asbestos (Bulk) by PLM (NIOSH 1994a), utilizes visual estimation techniques (e.g., standard area projections, photographs, drawings, or trained experience) to determine the asbestos content of bulk materials (e.g., soil, insulation). Results are reported qualitatively for levels below 1 percent, either as non-detect when no asbestos is observed or as "less than 1 percent" when asbestos is present but at levels lower than 1 percent. At the Site, PLM-9002 is principally used as a screening tool for rapid turn-around PLM analysis of unprocessed soil samples collected during response actions and restoration activities.

- PLM-gravimetric (PLM-Grav) is a Libby-specific method (standard operating procedure [SOP] SRC-LIBBY-01) developed in 2002 that contains elements from NIOSH Method 9002 and EPA Method 600/R-93/116. PLM-Grav provides a screening method to examine the coarse soil fraction for evidence of asbestos mineral content using stereomicroscopy with confirmation of asbestos by PLM.

- PLM using visual estimation (PLM-VE) is a Libby-specific method (SOP SRC-LIBBY-03). This is a semi-quantitative method that utilizes LA-specific reference materials to allow assignment of fine ground soil samples into one of four reporting "bins," as follows:

  - Bin A (non-detect): no LA is observed
  - Bin B1 (trace): LA is present, but at levels less than 0.2 percent
  - Bin B2 (less than 1 percent): LA is present at levels less than 1 percent but greater than or equal to 0.2 percent
  - Bin C (greater than or equal to1 percent): LA is present at levels greater than or equal to 1 percent

- PLM using point counting (PLM-PC) is performed in general accordance with the descriptions provided in EPA Method 600/R-93/116 and California Environmental Protection Agency Air Resources Board Method 435. The total numbers of particles counted (usually 400 or 1000) is specified in the chain of custody request.

• Phase contrast microscopy (PCM) – The NIOSH Method 7400 (Issue 2), *Asbestos and Other Fibers by PCM* (NIOSH 1994b), is the historical technique used for the measurement of asbestos fibers in air and is the method upon which many occupational exposure regulations are based. This is the primary method used to analyze personal health and safety samples collected for the purposes of Occupational Safety and Health Administration (OSHA) compliance. A key limitation of PCM is that structure discrimination is based only on size and shape. Because of this, it is not possible to distinguish between asbestos and non-asbestos structures. All structures that have a length greater than 5 micrometers (µm) and have an aspect ratio (length:width) of 3:1 or more are counted as PCM fibers. The limit of resolution of PCM is about 0.25 µm, so structures thinner than this are generally not observable; there is no upper width restriction imposed.

• Transmission electron microscopy (TEM) – TEM methods are more complex than PCM and PLM and require the use of a more sophisticated analytical instrument that operates at higher magnification (e.g., 20,000 times) and hence is able to detect structures much smaller than can be seen by other methods. TEM methods can be used for air, dust, water, and solid media (e.g., soil, duff, tree bark, tissue). When a sample is analyzed by TEM, the analyst records the size (length and width) and structure type (e.g., fiber, bundle) of each individual asbestos structure that is observed. As noted above, in the PCM method (NIOSH 1994b), a structure is counted as a PCM fiber if it has a length of 5 µm or longer and an aspect ratio of at least 3:1. For the purposes of estimating potential human health risks, the concentration of asbestos in air must be expressed in units of PCM fibers because the risk models for estimation of risks from inhalation exposure to LA (EPA 2014a) are based on exposures expressed as PCM asbestos fibers per cubic centimeter (f/cc). Estimates of concentration used in this report used to support risk assessment are based on phase contrast microscopy-equivalent (PCME) structures observed during the TEM analysis.

- Water – Water samples collected at the Site are prepared according to EPA Method 100.2, *Determination of Asbestos Structures over 10 μm in Length in Drinking Water*, and analyzed by TEM.

2.4.2 Sampling Methods

- Activity-based sampling – ABS simulates activities conducted by individuals at the Site to estimate potential exposures. Samples are collected from the breathing zone of the individual performing the ABS using a pump and air filtering cassette. The samples are analyzed for asbestos structures using TEM analysis.

- Ambient air sampling – Ambient air sampling is completed by establishing stationary air monitoring stations throughout the Site and collecting long-term (5-day) continuous air samples using a pump and air filtering cassette. The purpose of ambient air sampling is to estimate human health risks associated with inhalation of LA in outdoor ambient air in and around the City of Libby. Samples are analyzed for asbestos structures using TEM analysis.

- Perimeter air sampling – Perimeter air sampling is completed by establishing stationary air monitoring stations within the vicinity or downwind of contaminated areas where response actions are being performed and collecting continuous air samples using a pump and air filtering cassette. The purpose of perimeter air sampling is to determine the extent of friable asbestos fiber released from the soil during construction events. Samples are analyzed for asbestos structures using TEM analysis.

- Indoor Dust – The American Society for Testing and Materials International (ASTM) D5755 method provides a standardized procedure to sample and identify asbestos in dust and estimate the surface loading of asbestos in the sampled dust. The estimate of the surface loading of asbestos in the sampled dust is reported as the number of asbestos structures per unit area of the sampled surface (e.g., s/cm^2). The collection of dust samples was discontinued by EPA in 2007 due to the low concentrations of LA observed in the analytical results and the lack of a discernable pattern in the concentration of LA in the samples taken during a pilot study conducted in 2007. However, samples that were collected, along with other data, are still used to make interior removal decisions.

- Personal air monitoring – Personal air samples are collected from the breathing zones of the event participants during various activities (intrusive and non-intrusive) in accordance with SOP EPA-LIBBY-01. Personal air samples are collected in support of worker health and safety OSHA compliance and as part of ABS. Samples are collected from the breathing zone of the individual being monitored using a pump and air filtering cassette. Worker air monitoring samples are analyzed by PCM, with subsequent analysis by TEM if deemed necessary.

- Composite soil sampling – Composite soil samples have been collected at the Site since the beginning of the RI. In the early stages of the RI, these composite samples consisted of up to five aliquots collected from a particular use area (e.g., yard, garden, flowerbed). As the nature of the contamination was better understood, these composite samples were comprised of 30 aliquots and included a visual inspection. These samples are first processed (dried, sieved, and ground) and then submitted to the analytical laboratory for analysis using PLM-VE and, if applicable, PLM-Grav.

- Confirmation soil sampling – Confirmation soil samples are composite soil samples that are collected from the floor of an excavation area during the removal phase of the response action. These samples are collected to determine if contamination is being left at the bottom of the excavation and include a visual inspection. Confirmation soil samples are analyzed by PLM-9002.

- Bulk sampling – Bulk material samples may be collected for asbestos analysis from a variety of sources (e.g., log chinking, chimney mortar, plaster, or other building material) where vermiculite additives are visually identified. Bulk material samples are analyzed by NIOSH 9002, Issue 2, *Asbestos (bulk) by PLM* (NIOSH 1994a), with subsequent analysis by PLM-PC400 as deemed necessary.

2.4.3 Inspection Methods

Interior Inspections:

Interior detailed inspections are performed when previous investigatory findings indicate either contamination is present or unknown within buildings (e.g., house, garage, shed, barn) on the property. Interior inspection activities include:

- Attic inspection
- Living space assessment and wall inspection
- Understructure inspection and sampling, as required
- Interior soil samples, as required
- Interior inspection documentation
- Bulk material samples, as required

Interior inspections are performed to evaluate the location and extent of mine-related materials within a building. Information is also collected regarding the general construction and condition of the building and access to mine-related materials.

<u>Exterior Inspections:</u>

A visual inspection for possible sources of exterior LA contamination, such as vermiculite, is completed by first segregating the area to be inspected into sub-areas based on type of use. The soil is then visually inspected for vermiculite using an intrusive or non-intrusive method:

- Non-Intrusive Visual Inspection: A non-intrusive visual inspection is an inspection of the immediate ground surface to determine the presence or absence of possible sources of LA contamination such as vermiculite.

- Intrusive Visual Inspection: An intrusive visual inspection is an inspection of the subsurface to determine the presence or absence of possible sources of LA contamination such as vermiculite.

Visual inspections are completed in conjunction with sampling and analysis by PLM-VE. While the presence of vermiculite in soil is a good indicator that LA contamination may be present, current removal decisions are based on analytical results.

2.5 Summary of Data Sources and Quality Assurance/Quality Control

All analytical laboratories participating in the analysis of samples for the Libby project are subject to national, local, and project-specific certifications and requirements. Each laboratory is accredited by the National Institute of Standards and Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP) for the analysis of airborne asbestos by TEM and/or analysis of bulk asbestos by PLM. This includes the analysis of NIST/NVLAP standard reference materials, or other verified quantitative standards, and successful participation in two proficiency rounds per year each of bulk asbestos by PLM and airborne asbestos by TEM supplied by NIST/NVLAP.

In addition, PCM laboratories are required to successfully participate in the Proficiency Analytical Testing program of the American Industrial Hygiene Association (AIHA). These are PCM proficiency testing samples submitted quarterly to the laboratories directly from AIHA.

Copies of recent proficiency examinations from both NVLAP and AIHA or an equivalent program are maintained by each participating analytical laboratory. Many of the laboratories also maintain certifications from other state and local agencies. Copies of all proficiency examinations and certifications are also maintained by the laboratory coordinator in the Libby project file.

Data from numerous sources (primary and secondary) were collected and evaluated for use for a wide variety of reasons at the Site since 1999. Highlights include:

- Sampling was conducted for the various removal actions to mitigate sources of LA and determine if cleanups were protective.

- Sampling was conducted specific to the RIs for OUs 4 (CDM Smith 2014a), 5 (HDR Engineering, Inc. [HDR] 2013a), 6 (Kennedy/Jenks Consultants [Kennedy/Jenks] 2014), 7 (Tetra Tech EM Inc. [Tetra Tech] 2014), and 8 (HDR 2013b).

- Sampling was conducted to support the risk assessment (including toxicity studies) (SRC, Inc. and CDM Smith 2014, CDM Smith 2014b) and the FS (CDM Smith 2015a).

- Sampling of fill material was conducted to determine if it was free of contaminants (above background levels) and met project-specific physical characteristics prior to use.

- Sampling was conducted for ambient air to estimate exposure associated with inhalation of LA in outdoor ambient air at the Site.

For work conducted by EPA and its contractors and the PRPs and their contractors, quality assurance (QA)/quality control (QC) measures include, but are not limited to, the following:

- The development of detailed sampling and analysis plans (SAPs)/quality assurance project plans (QAPPs) to guide all sample collection and analysis efforts

- The development of detailed Site-specific SOPs for sample collection, preparation, and analysis

- Extensive training of all field and laboratory staff

- Extensive review and checking by senior staff of the work performed by field and laboratory staff

- Periodic internal and external audits of field and laboratory operations

- Iterative modifications to improve methods and document procedures used to address any issues or problems identified by field staff, laboratory staff, or data users

- The development of electronic data management tools for recording and transferring data that include a variety of error checks and error traps

- The collection and analysis of a variety of different types of QC samples

- Validation and verification of electronic data in the project database

A detailed evaluation of the QA procedures and QC analysis results is presented in CDM Smith (2012a, 2014b, 2015c).

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA has implemented a robust program of community participation at the Site. This program began in 2000 and continues today. Copies of these materials are available in the Community Engagement Plan (EPA 2010). A brief description of these activities is provided below.

3.1 PUBLIC PARTICIPATION TO MEET REQUIREMENTS UNDER CERCLA

3.1.1 Conducted Interviews and Prepared the Community Involvement Plan

In 2000, EPA conducted community interviews with citizens living at or near the Site to find out general information about the properties, information on the property owners' concerns and issues with the Site, and how best to communicate with the public. Access and land use information was also gathered during those interviews. Using the information from those interviews, a community involvement plan was prepared and distributed in March 2001. Additional interviews were conducted in January 2009 and summarized in the revised community engagement plan (EPA 2010).

3.1.2 Established an Information Repository

In December 1999, EPA established the EPA Information Center, which is the primary information resource for the Libby community on the project. Located at 108 E. 9th Street, it is a resource for the community and visitors who need information on EPA's work, either in general or as it relates to their property.

The administrative record is housed at the EPA Superfund Records Center in Denver, Colorado. The information repository contains a subset of documents from the administrative record and is located at the EPA's Information Center in Libby. The repository contains basic Site information, documents on Site activities, technical Site documents, and general information about the Superfund program all for public review. Information about the administrative record file and information repository has been included in Site fact sheets, so that the general public is aware of the existence and location of the Site documents.

3.1.3 Established and Supported the Community Groups

EPA has funded the Libby Area Technical Assistance Group (LATAG) since 2003. In 2004, EPA developed an audience-specific technical workshop aimed at helping LATAG members understand the science behind analytical methods and ongoing risk management decisions at the Site. This included planning content, presentation materials, travel arrangements, and other topics. Support also includes the cost of advertisement of the meetings each month. EPA has provided meeting support for the monthly Community Advisory Group (CAG) since its inception in 2000. This support has included arranging for and paying for the meeting space and a meeting facilitator. Support also includes the cost of advertisement of the meetings each month.

3.1.4 Prepared and Distributed Fact Sheets

EPA uses a commercially obtained mailing list of all people with mailing addresses within the Libby area zip code (59923). A new list is purchased about every other year. In addition, a smaller mailing list of stakeholders who are located outside of the Libby area (e.g., county, state, and federal elected officials and regulators associated with the Site) is also maintained. EPA has prepared and distributed 16 fact sheets about the Site to the community since 2000.

3.1.5 Published Advertisements

A series of questions and answers advertisements has been developed and placed in local newspapers. Titled Ask EPA, these ads provide a question and answer in a concise format. They were originally published biweekly and are now published as needed. To date, over 200 Ask EPA ads have been placed. EPA has also prepared and placed an advertisement each month to announce the meeting times, places, and dates of the LATAG, CAG, and O&M meetings. EPA has used paid advertisements in the form of newspaper columns targeted at specific Site issues, from general topics (e.g., what is Superfund) to specific issues (e.g., cleanups of specific areas). Fifteen columns have been placed in the local newspapers.

3.1.6 Held Public Meetings and Availability Sessions

Numerous public meetings, joint meetings, availability sessions, and listening sessions have been held by EPA since 2004. These meetings are advertised well in advance, and at least one was also broadcast simultaneously on the radio.

3.1.7 Issued Proposed Plan, Held a Public Meeting, Provided Public Comment Period, and Developed Responsiveness Summaries and RODs

EPA issued a Proposed Plan for OUs 4, 5, 6, 7, and 8 on May 8, 2015. This plan was made available at the EPA Information Center and the Libby and Troy public libraries. A Proposed Plan fact sheet was mailed to all residents. A public meeting for the Proposed Plan was held on May 20, 2015 in Troy and May 21, 2015 in Libby, at which EPA gave a brief presentation and the public had an opportunity to provide oral or written comment.

3.2 ADDITIONAL COMMUNITY INVOLVEMENT ACTIVITIES

3.2.1 Established a Local Information Center

In December 1999, EPA established the EPA Information Center, which is the primary information resource for the Libby community on the project. Located at 108 E. 9th Street in the City of Libby, it is a resource for the community and visitors who need information on EPA's work, either in general or as it relates to individual properties.

3.2.2 Established the Environmental Resource Specialist Program

The objective of the ERS program is to provide Libby area property owners with a means to mitigate potential exposure to LA or LA source materials, such as Libby vermiculite, during routine and non-routine activities at Libby properties. These activities may consist of, but are not limited to, building repair, remodeling, maintenance, utility servicing, installation, and construction.

Specifically, the ERS program provides property owners and residents with information related to LA and guidance on safely working with material potentially containing LA or LA source materials. ERS personnel may conduct onsite evaluations of reported situations, providing recommendations, if necessary, of methods to safely continue the intended work activities. ERS personnel perform an initial assessment to evaluate the level of response needed, which could be an information only, emergency, interior (non-emergency designed), or exterior (non-emergency designed) response.

If the ERS performing the initial site assessment determines that government assistance to the owner or resident is appropriate, recommendations are made to EPA to facilitate any necessary removal action. EPA provides overall direction and guidance for any ERS response activity, including final approval of work plans and removal action decisions.

3.2.3 Established Asbestos Resource Program to Implement Interim ICs

The Lincoln County Board of Health established the ARP in 2012 through a cooperative agreement with EPA. The mission of the ARP is to reduce exposure to asbestos found within the Superfund site and in the surrounding areas of Lincoln County. A key goal is to minimize the burden on the community members themselves. Beginning on January 1, 2014, the ARP assumed responsibility of the ERS program. In 2015, ARP began to conduct interviews and hold workshops to discuss the development of the ICs to help gain community input and acceptance.

3.2.4 Established an Onsite Community Involvement Team

A team of onsite community involvement coordinators (CICs) was established to facilitate interaction between the field team and residents. The CICs are contractors who are responsible for issues that need to be coordinated for sampling and cleanups to occur. These include briefing residents on the scope of work, providing information on temporary relocations, arranging for relocations, facilitating interactions between the field crew and residents, documenting the scope of work and obtaining residential approval, coordinating with residents during relocations, facilitating their return to the property, taking care of all outstanding issues, and ensuring residents were reimbursed for their costs during relocation. This support is also provided to business owners during cleanup of their properties.

3.2.5 Provided Support to the Real Estate Community

Libby leaders and the real estate community were concerned that work being done by EPA would slow or stop home sales, make appraisals cumbersome, and make financing more difficult to obtain. In response, EPA developed a multi-phased assistance approach for the real estate community. This includes writing hundreds of "comfort letters" to support real estate transactions. EPA also provided additional information to complete mortgage transactions and arranged for representatives of federal mortgage insurers, lenders, and loan underwriters to attend meetings in Libby. Finally, EPA makes the sampling of properties pending sale a priority and regularly adjusts schedules to accommodate these requests.

3.2.6 Provided Education to Stakeholders via Classes and Workshops

EPA has offered a variety of workshops for target audiences that included housing industry representatives (realtors and mortgage lenders) and area contractors. The goal was to ensure development questions were answered and contractors knew the issues related to preservation of the integrity of the work conducted to date at the Site. EPA set up training classes for area contractors on the subject of asbestos abatement in 2006, 2007, 2008, and 2009. EPA also coordinated with multiple stakeholders while putting together two major workshops (in 2003 and 2006) at the Site.

3.2.7 Developed and Distributed Informational Brochures, Written Materials, and a Website

EPA has worked to provide the materials needed to educate and engage the public on the serious health issues associated with the Site. As needs arise, information pieces are designed for a wide variety of audiences. EPA also developed a Libby Superfund website that is user-friendly and presents cleanup information. The website is based in large part on the brochure EPA developed as a community resource. The address for the website is www.epa.gov/libby.

3.2.8 Updated Commissioners and Other Groups

EPA has made it a priority to regularly provide updates to the City Council and county commissioners. These updates are made monthly at the regularly scheduled commission meetings. Presentations are also made to other local groups (e.g., Rotary) upon request.

3.2.9 Implemented Targeted Informational Campaigns

EPA has conducted educational efforts targeted at specific upcoming events at the Site. The first event was in 2005 and involved a series of advertisements and meetings to provide information on the Superfund process in anticipation of a ROD. The second event was designed to launch the Libby Area ERS position in 2007.

3.2.10 Conducted ICs Outreach

In 2011, EPA awarded a cooperative agreement to the City and County Board of Health to assist Lincoln County with establishing an ICs program to reduce LA exposures over the long-term and to protect the final remedy. In preparation for the Proposed Plan for OUs 4 through 8, EPA solicited input from the LATAG on community acceptance of various potential ICs. That information was used to craft the list of potential ICs used in the Proposed Plan. ARP held a public meeting on June 15, 2015 and conducted interviews with individuals and small groups to evaluate input received on the proposed controls. Monitoring and reporting will be conducted according to a schedule established by the *Institutional Control and Implementation and Assurance Plan*, which will be prepared after the ROD is signed. EPA will continue to involve the public throughout the design process.

3.2.11 Provided Classes on Post-Removal Care and Established Test Plots

EPA, in conjunction with the County Extension Office, offered courses to residents on how to care for a property after a removal has been performed. Furthermore, EPA established test plots of different restoration types using the same materials that are used during the restoration of residential and commercial properties. These were created to demonstrate to the public the efficacy of the materials that are used on the project.

3.2.12 Other Outreach

Other activities undertaken by EPA to engage the communities and keep the public informed have included, but are not limited to, public meetings discussing expectations for post-construction O&M, Libby Legacy Group[1] meetings, public meetings in Libby and Troy in May 2015 to present the Proposed Plan, and an availability session in June 2015 to discuss the Proposed Plan.

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[1] The Libby Legacy Group was an all-volunteer group established in 2012 with the overall goal of helping the Lincoln County community understand the legacy and impacts of the Libby vermiculite mine. Nine lectures were presented in the series, held at the school administration building theater. The lecture series, which is available on YouTube, was also part of a Lincoln County Campus of Flathead Community College course designed for teachers on the historical significance of the mine, government agency involvement, and research and cleanup activities.

4.0 SCOPE AND ROLE OF OPERABLE UNITS

As with many Superfund sites, the problems at the Site are complex. As a result, EPA has organized the work into eight operable units, OU1 through OU8. They are described in Section 1.2.1. The following subsections describe the scope and role of each operable unit within the overall Site cleanup strategy.

4.1 OVERALL STRATEGY AND RELATIONSHIP OF OUS

The overall strategy at the Site has been to remediate LA-contaminated media that pose the greatest contribution to unacceptable human health and ecological risks. Since 1999, EPA's approach to mitigating unacceptable risks to human health and the environment at the Site using CERCLA authority has been to use both removal and remedial authorities to timely remediate LA contamination that poses the most significant human health risk. This has been accomplished by initiating removal actions prior to the 2002 NPL listing and addressing investigation and remediation of OUs individually or as a group based on the most effective way to achieve cleanup.

To date, these response actions primarily have consisted of mitigating inhalation exposures to LA from contaminated soils and building materials. A key component of EPA's approach to addressing the Site has been consideration of current and reasonably anticipated future use (discussed in Section 4.3 and Section 6).

There are approximately 8,100 properties in OU4 and OU7. Of those properties, approximately 7,100 have been investigated and approximately 4,000 have been categorized as Removal Not Required. Removal actions have been conducted or are ongoing at OU4, 5, 6, 7, and 8. Removal actions have been completed at more than 2,200 of the estimated 2,450 contaminated private homes and properties. Remedial actions have been performed at OU1 and OU2; the focus of the remedial actions was to remove LA-contaminated soil and contain (cover) the remaining LA in subsurface soil.

Direct coordination with PRPs under an Administrative Order on Consent is ongoing at OU3 and OU6. OU6 is addressed as part of this ROD; OU3 is being addressed under a future ROD as discussed in Section 4.3.1.

The boundaries of OUs are generally defined as shown on Exhibit 1-2, with the exception of the boundary of OU3. Currently, OU3 is roughly defined by a boundary for the study area, but delineation of the actual boundary of OU3 is ongoing. Because of this, the boundary between OU3 and OU4 is subject to further refinement. The current approach is to establish a boundary for OU4 and address the predominant LA-contaminated media associated with it (soil and building materials). After the boundary of OU3 is established and the remedial approach for contaminated media within it is determined, EPA will determine whether any additional work needs to be performed to address contaminated media within OUs addressed by this ROD. If necessary, EPA will address any additional work in a change to this ROD.

4.2 USE OF PROPERTY TYPE VERSUS OPERABLE UNIT IN THIS ROD

The following sections describe the four land use categories introduced in Section 1 and their relationship to properties within the Site OUs (excluding OU1, OU2, and OU3). The land use status for each property included in the selected remedy will be established at the completion of the remedial action, prior to start of operation and maintenance for purposes of monitoring and maintaining the remedy. Land use status in this context is defined as classification of a property in Operable Units 4 through 8 with respect to land use categories defined in Sections 4.2.1 through 4.2.4.

4.2.1 Residential/Commercial

This land use category includes private residential and commercial properties as well as public properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used, or will be used in the future, for residential and commercial or governmental (service-related) purposes that are not involved in large-scale manufacturing of products for sale and export outside of the site. Alleyways and streets within OU4 and OU7 as well as churches that do not provide primary, secondary, or higher education in a school setting are also included in the residential/commercial land use category.

This land use category also includes future public and private school properties within the City of Libby (OU4) and the Town of Troy (OU7) that do not currently exist but are planned to provide primary, secondary, or higher education.

This category excludes parks, currently existing schools, industrial (manufacturing-related) properties, and rail and highway transportation corridors that traverse or are included within the boundaries of OU4 and OU7.

Within a residential or commercial property, outdoor exposures may differ as a function of location within a property (e.g., the amount of time spent in yards is expected to be different than time spent in a garden). For this reason, the HHRA (CDM Smith 2015b) evaluated risks separately for each of four exposure locations:

- Yards
- Gardens/flowerbeds
- Driveways
- Limited-use areas (e.g., maintained pastures and fields)

Because current use is not necessarily indicative of future use (e.g., what a garden is under current conditions could become a different yard under future conditions), this ROD employs a broader classification of use areas to encompass both current and reasonably anticipated future uses.

The term “frequently used areas” applies to those areas of residential/commercial properties that are likely to be used on a regular basis by residents and outdoor workers such as yards, gardens, flowerbeds, play areas, unpaved walkways and driveways, lawns, and landscaped areas. The term “infrequently used areas” applies to those areas of residential/commercial properties that are likely to be used on a less regular basis such as pastures and fields, wooded lots, and areas beneath structures (e.g., soils beneath low clearance decks and raised sheds).

4.2.2 Industrial

This land use category includes industrial properties that are currently used, or will be used in the future, for large-scale manufacturing of products for sale and export outside of the site. Currently, only a portion of the properties at the existing industrial park within OU5 will be identified within this land use category.

This category includes rail spurs and roadways within an industrial property but excludes rail and highway transportation corridors (OU6 and OU8, respectively) that border industrial properties.

4.2.3 Transportation Corridors

This land use category includes rail and highway corridors that are currently used, or will be used in the future, for vehicular transportation as defined in the descriptions for OU6 and OU8, respectively. This land use category also includes buildings and facilities used by transportation entities (e.g., Montana Department of Transportation, BNSF Railway).

Although none currently exist, this category excludes rail or highway corridors that are converted and repurposed in the future to non-vehicular recreational trails (e.g., “rails to trails” projects), which would be part of the park/school properties category.

4.2.4 Parks/Schools

This land use category includes the park properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used, or will be used in the future, for public or commercial recreational purposes. It also includes roadways within public or commercial parks.

This land use category also includes the public and private school properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used to provide primary, secondary, or higher education. Churches that do not provide primary, secondary, or higher education and schools established in the future are part of the residential/commercial properties land use category.

4.3 SEQUENCE OF ACTIONS AT EACH OPERABLE UNIT

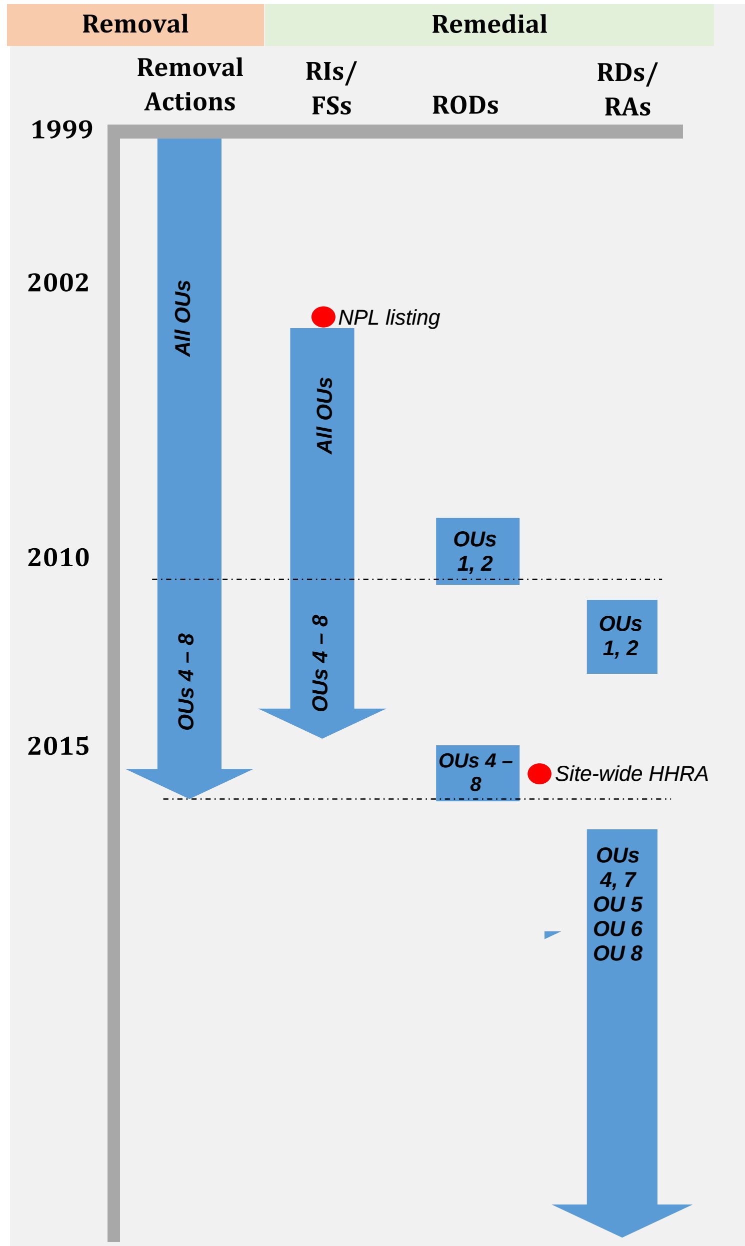
4.3.1 Past and Current RODs

RODs have been issued and remedial actions completed at two OUs (1 and 2). ***This ROD addresses OUs 4, 5, 6, 7, and 8.*** For more information on the actions performed at each of these OUs, reference their respective RI and/or ROD. OU3 is being completed last for a number of reasons, including but not limited to:

- Residential exposures are primarily in the non-OU3 OUs, which are being addressed first.
- Performance of the work by Grace under an Administrative Order on Consent
- Complex interactions between highly contaminated media
- A patchwork of land ownership, including various federal and state lands
- Stability issues related to the tailings impoundment dam that are regulated under a current state operating permit

The current and proposed cleanup status of these OUs and how they relate to the Site as a whole is discussed below and shown in Exhibit 4-1.

Exhibit 4-1. Overview of OUs and Significant Actions at Site



HHRA= human health risk assessment
NPL = EPA National Priorities List
OU = operable unit
RDs/RAs = remedial designs/remedial actions
RIs/FSs – remedial investigations/feasibility studies
RODs = records of decision

4.3.2 Future ROD (OU3)

This OU is owned by Grace, which is performing the investigation and cleanup under the oversight of EPA. RI sampling was conducted between 2007 and 2015, and the RI report is being developed. An FS is in preparation, and a draft FS report is anticipated in the near future. EPA will release a Proposed Plan for public comment following the FS and will sign a ROD once comments have been addressed. OU3 will be the last OU to be remediated. Remediation of OU3 also will include the forested areas surrounding the mine, which were contaminated with airborne emission of LA from the mining and processing facilities at OU3. Firewood, bark, and duff obtained from those areas and potentially transported to other OUs in the future also will be addressed in OU3.

4.4 USE OF ADAPTIVE MANAGEMENT IN THIS ROD

Adaptive management is an iterative approach to site investigation and remedy implementation that provides the opportunity to respond to new information and conditions throughout the lifecycle of a site. While some aspects of adaptive management have been used historically, EPA's current plan for use of adaptive management emphasizes integrating it more deliberately throughout the remedial process.

Through this approach, only the necessary data are collected to improve the conceptual site model as well as to select and make adjustments to the implementation of the RAs to ensure efficient and effective remediation.

EPA has elected to use an adaptive management approach during design, construction, and O&M of the selected remedy (physical remedy components) only as needed at each property as presented in this ROD. Elements amenable to adaptive management may include specific adjustments to physical remedy components at each property. An adaptive management framework describing considerations and parameters that define the degree to which elements of the selected remedy can be adjusted without constituting a post-ROD change will be developed during the remedial design process.

If property-specific considerations and the information and data collected at each property during design, construction, or O&M indicate that adjustments are warranted, they will be made under the parameters of the adaptive management framework as long as protectiveness is not compromised and the adjustments do not constitute changes in the overall selected remedy approach. Information collected during 5 year site reviews may also indicate that adjustments are needed for continued protectiveness and would be made pursuant to the adaptive management framework previously discussed. If an adjustment is warranted that is beyond the scope of the remedy components described in this ROD, and thus outside of the adaptive management framework, a post-ROD change will be initiated by EPA. Specific considerations for use of adaptive management in the context of the selected remedy are further described in Section 12.

5.0 SUMMARY OF SITE CHARACTERISTICS

The summary of Site characteristics includes an overview of physical characteristics, the nature and extent of contamination, and the CSM. Complete details of the Site characteristics and the nature and extent of contamination are presented in each of the OU-specific RI reports. The media of interest resulting from the various investigations and other activities are soil and building materials contaminated with LA.

5.1 SITE OVERVIEW

5.1.1 Site Topography and Features

The City of Libby is situated along the Kootenai River, at the confluence of several smaller creeks, in a relatively narrow river valley. The Town of Troy is located approximately 20 miles west of Libby, also along the Kootenai River. Mountains and National Forest surround the Kootenai River valley on all sides: the Cabinet Mountains to the south, the Purcell Mountains to the north, and the Salish Mountains to the east. The elevation of Libby is approximately 2,100 feet above sea level based on the North American Vertical Datum of 1988 (NAVD88) while the elevation of Troy is approximately 1,800 feet above sea level based on NAVD88. The area is primarily coniferous forest and heavily vegetated.

5.1.2 Demography

The City of Libby is concentrated in the valley formed by the Cabinet Mountain range and Kootenai River. It has a small "downtown" core with populated areas spreading in several directions, primarily along highways and stream valleys. Businesses are focused in the downtown core and along U.S. Highway 2 and MT Highway 37. The size and construction of typical residential and commercial structures in the area varies considerably, but there are numerous older buildings in various states of disrepair. Roughly 78 percent of residential properties were built prior to 1990, and 40 percent were built prior to 1960 (U.S. Census Bureau 2013).

Local tax records and other information suggest there are approximately 8,100 individual residential, commercial, and public properties within the NPL boundary (Montana Cadastral 2013). Property inspections by EPA indicate the presence of significant numbers of houses with "non-standard" construction and deteriorating conditions. Most residential yards are grass covered and vegetated, but bare or thin areas are not uncommon.

Based on the most recent population estimates available, approximately 2,600 people reside within the city limits of Libby, and approximately 10,000 people reside in the general area of Libby (zip code 59923), which includes the populated areas outside the city limits (U.S. Census Bureau 2013).

Approximately 1,000 people reside within the city limits of Troy, located approximately 20 miles west of Libby. Businesses and residences in Troy are most concentrated along U.S. Highway 2, which transects the town.

5.1.3 Surface Features and Size

The Site covers approximately 150 square miles, and OU4 (Libby) is separated from OU7 (Troy) by a distance of approximately 20 miles. As such, a complete description of surface features is not possible. OUs 4 and 7 cover the communities of Libby and Troy and are a mix of residential and commercial buildings. There are about 6,600 residential/commercial properties in Libby and 1,500 properties in Troy. Also included are a variety of public buildings, parks, and open spaces. OU5 is a 400-acre industrial area in the middle of OU4. OU6 has 42 miles of rail line, rights-of-way, and railyards in Libby and Troy. OU8 encompasses 30 miles of U.S. 2, Montana 37, and Farm to Market and River roads. These OUs are described in greater detail in Section 1.3.1.

5.1.4 Areas of Archeological or Historical Importance

No areas of archeological or historic importance were identified in the individual RI reports completed for OUs 4, 5, 6, 7, and 8.

5.1.5 Geology and Soils

The mountains surrounding the Kootenai River valley are generally composed of folded, faulted, and metamorphosed blocks of Precambrian sedimentary rocks and minor basaltic intrusions. Primary rock types are meta-sedimentary argillites, quartzites, and marbles (CDM Smith 2014a).

The vermiculite deposit at Vermiculite Mountain is located approximately 7 miles northwest of Libby in the Rainy Creek drainage. The vermiculite deposit specific to the former Libby Vermiculite Mine is classified as a deposit within a large zoned alkaline ultramafic intrusion, such as of pyroxenite plutons, which is zoned and cut by syenite or alkalic granite and by carbonatitic rock and pegmatite. The original ultramafic body is an intrusion into the Precambrian Belt Series of northwestern Montana. The formation of vermiculite and asbestiform amphiboles in the mine deposit have been assessed to be the result of the hydrothermal alteration of augite by high-temperature silica-rich solutions (Boettcher 1967).

The Vermiculite Mountain deposit is contained within the Rainy Creek alkaline-ultramafic complex. The Rainy Creek complex is described as the upper portion of a hydrothermally altered alkalic igneous complex composed primarily of magnetite pyroxenite, biotite, and pyroxenite. The original ultramafic body is an intrusion into the Precambrian Belt Series of northwestern Montana, with a syenite body southwest of and adjacent to the altered pyroxenite, and is associated with numerous syenite dikes that cut the pyroxenites (CDM Smith 2014a).

X-ray powder diffraction (XRD) analyses by the U.S. Geological Survey (USGS) of shallow, subsurface soil from more than 10 sites in the Libby area show that it is composed of major (greater than 20 percent) quartz; minor (5 to 20 percent) muscovite (or illite) and albitic feldspar; and trace (less than 5 percent) orthoclase, clinoclore, non-fibrous amphibole (likely magnesio-hornblende), calcite, amorphous material (probably organic), and possible pyrite and hematite. Other minerals are likely present at levels below 0.5 percent and are generally not detectable by routine XRD analysis. These mineral components represent the average components for the area and likely vary to some extent depending on local conditions. Surface soil contains the above components with the addition of more organic material (CDM Smith 2014a).

Soil is largely derived from the pre-Cambrian rocks, which break down to form loamy soil composed of sand and silt with minor amounts of clay. The Kootenai River valley area is somewhat enriched in clays due to its river valley location, and the dense forest of the region contributes organic matter to the soil. Much of the original soil in the area now occupied by the City of Libby has been modified by human activities. These include addition of vermiculite from the Rainy Creek Complex to the soil and reworking of the soil during construction, road building, railroad operations, gardening, processing of vermiculite (i.e., expansion), and other activities. Soil generally varies in color from tan to gray to black.

5.1.6 Surface Water Hydrology

The Site is contained within the Kootenai drainage basin. The Kootenai drainage basin is located in both Canada and the United States, encompassing about 18,000 million square miles (mi^2) or 11,520,000 acres. The Kootenai River, which transects the Site, has its origins in British Columbia's Kootenay National Park in Canada. From there, it flows 485 miles into northwest Montana and through the City of Libby and Town of Troy. From there, it flows into northern Idaho, then back into Canada and Kootenay Lake. Ultimately, it joins with the Columbia River. Seventeen miles east of Libby, the river is held back by the Libby Dam, creating a 90-mile long reservoir called Lake Koocanusa, which reaches into Canada (www.LibbyMT.com 2013).

Major tributaries to the Kootenai River below Libby Dam include the Fisher River (average daily discharge 425 cubic feet per second [cfs] over the last 10 years) and the Yaak River (average daily discharge 769 cfs over the last 10 years) (U.S. Geological Survey 2014). Kootenai River tributaries are characteristically high-gradient mountain streams with bed material consisting of various mixtures of sand, gravel, rubble, boulders, and drifting amounts of clay and silt, predominantly of glacio-lacustrine origin. Fine materials, due to their instability during periods of high stream discharge, are continually abraded and redeposited as gravel bars, forming braided channels with alternating riffles and pools. Streamflow in unregulated tributaries generally peaks in May and June after the onset of snowmelt, then declines to low flows from November through March. Flows also peak with rain-on-snow events. Kootenai Falls, a 200-foot-high waterfall and a natural fish-migration barrier, is located 11 miles downstream of Libby, Montana.

The Kootenai River is the second largest tributary to the Columbia River in terms of runoff volume, third in terms of drainage area. The Kootenai Basin is largely mountainous and dominated by three major ranges. The Rocky Mountain Range and its offshoot, the Flathead Range, constitute the eastern boundary; the Purcell Range roughly bisects it from north to south. The Selkirk and Cabinet ranges mark the western boundary. Elevations reach a maximum of about 12,000 feet above mean sea level with most summit elevations between 6,000 and 7,500 feet above mean sea level. Except for a few areas, the entire watershed is heavily forested (www.LibbyMT.com 2013).

The Libby area has a relatively moist climate with annual valley precipitation slightly over 20 inches. Higher elevations receive significantly more precipitation and account for much of the creek flow. Seasonal fluctuations cause varying levels of runoff and creek flow. Typically, runoff is most significant in spring when snow at higher elevations begins to melt. Summer precipitation does occur; however, typical summer weather is hot and dry, and creek flow is moderated by high elevation lakes.

5.1.7 Hydrogeology

The Libby basin is hydrologically bound to the west by the pre-Cambrian bedrock, to the north by the Kootenai River, and to the east by Libby Creek. The southern boundary of the basin extends under the high terrace of glacial lake bed sediments and with the alluvium of Libby Creek (CDM Smith 2014a).

The sediments overlying bedrock in the Libby area are of glacial, glaciofluvial, or alluvial origins. The Site stratigraphy is characterized by lenses of interbedded units consisting of gravels, sands, and silty to clayey gravels and sands. These units are the result of numerous episodes of alluvial and glacial erosion and deposition.

Types of depositional environments likely to have existed in the Libby area include braided stream, overbank, splay, point bar, till, moraine, outwash, loess (aeolian), channel, and lacustrine. These environments moved in time and space, occurred contemporaneously, cancelled each other out (by erosion), and varied drastically in the level of energy and capacity to sort the available clastic material (CDM Smith 2014a).

5.1.8 Ecological Setting

5.1.8.1 Aquatic Setting

Within the Site, there are multiple streams and a fishing pond in OU5 that provide habitat for a range of aquatic species including fish, benthic macroinvertebrates, and amphibians. Site-specific population surveys have not been performed outside of OU3. However, information gathered for the Rainy Creek watershed as part of OU3 studies indicate that the most common species of fish are western cutthroat trout, rainbow trout, and “cutbow” trout (a rainbow/cutthroat hybrid). Aquatic invertebrate community surveys in OU3 indicate that the most common types of aquatic invertebrates observed include mayflies, stoneflies, caddisflies, true flies, and beetle larvae. The most common amphibian species observed are the tree frog, spotted frog, and western toad. Additional details regarding the population surveys for OU3 can be found in the Site-wide BERA (SRC, Inc. and CDM Smith 2014). Due to the proximity of OU3 to other OUs at the Site and similarities in terrain and habitat, it can reasonably be assumed that similar groups of organisms are present at the Site. It is recognized that all creeks for which environmental data are available may not have all groups of organisms present due to variations in environmental conditions (e.g., a creek may have seasonal fluctuation in flow such that the habitat is not supportive of fish populations). However, for the risk assessment, it was assumed that all receptor types may be present, and all creeks are evaluated as such.

5.1.8.2 Terrestrial Setting

The Site is surrounded by forested land, which is currently being evaluated as part of OU3. According to the USFS, the forested areas in the Libby area have a great diversity of over 350 fish, mammals, birds, reptiles, and amphibians. The biome classification for the Libby area is the taiga, which is also known as the northern coniferous forest or boreal forest biome. The Libby area exhibits tree and grass plant species dominant within the Kootenai National Forest. Data for the Kootenai National Forest indicate Douglas fir forest type is the most common, covering nearly 35 percent of the National Forest land area. Next in abundance are the lodgepole pine forest and spruce-fir forest types at 17 percent each and the western larch forest type at 11 percent. Other tree species reported in the area are the Black Cottonwood (*Populus trichocarpa*), Quaking Aspen (*Populus tremuloides*), Western Paper Birch (*Betula papyrifera var. occidentalis*), and Pacific Yew (*Taxus brevifolia*) (CDM Smith 2014a).

Threatened, endangered, and protected species that have been observed include grizzly bear, Canada lynx, and bald eagle (CDM Smith 2014a). While only about 30 to 40 grizzly bears exist in the surrounding Kootenai National Forest, these bears have been observed within areas in the wildland-urban interface. The population of Canada lynx in the surrounding forest is currently being studied. Bald eagles have been seen throughout the Site (CDM Smith 2014a).

The remaining land largely has been developed for human use (both residential and commercial), and habitat is not optimal to support terrestrial receptors. A brief discussion of terrestrial habitat availability is presented below for each OU:

- **OU1**. Numerous investigations and removal events have addressed contamination, and OU1 is now a landscaped park with paved access and parking. The main features of the park, which is frequented by recreational visitors, include two boat ramps, a pavilion with surrounding lawn areas, and picnic tables. It is not expected to provide significant habitat for terrestrial ecological receptors.

- **OU2**. Investigations and removal events have addressed contamination, and OU2 is being used for residential purposes or is vacant and undeveloped. The area is not expected to provide significant habitat for terrestrial ecological receptors.

- **OU4 and OU7**. These are residential/commercial properties in and around the City of Libby and Town of Troy. Because this land has been developed for human use, it is not considered to provide significant habitat for terrestrial ecological receptors.

- **OU5**. This is predominantly an industrial area, occupied by various vacant buildings and operating businesses (e.g., lumber processing, log storage, excavation contractor). There is a small, isolated forested area within OU5; however, due to the fragmented nature of the habitat and proximity to human activity and disturbance, terrestrial receptor use is not anticipated to be significant.

- **OU6 and OU8**. The rail line and road rights-of-way do not serve as viable habitat for terrestrial receptors due to their limited area, frequent disturbance, and proximity to transportation corridors.

As noted, extensive soil removal actions have been performed in OU1 and OU2 to address LA contamination at these former mine facilities. Soil removals also have been taken at properties in OU4, OU5, OU6, and OU7 to protect human health. The action levels used as the basis of these soil cleanup efforts also would be protective of ecological receptors based on the results of the Site-wide BERA.

5.1.9 Federal and State Species of Special Concern

There is only one federally listed protected species that has been reported to occur in or about the vicinity of the Site, the bull trout (*Salvelinus confluentus*). Critical habitat for bull trout also has been designated in the following streams in the area: Fisher River, Libby Creek, O'Brien Creek, Pipe Creek, Quartz Creek, and Callahan Creek. Species of concern to the State of Montana that have been observed to occur in the general vicinity of the Site are listed in Table 5-1. These include two amphibians, three fish, and seven invertebrates. However, not all of these species are equally likely to occur within the Site. Based on an evaluation of where the species were reported, the following listed species are considered to be the most likely to occur at the Site:

5.1.9.1 Federal

- Bull Trout (*Salvelinus confluentus*)

5.1.9.2 State of Montana

- Coeur d'Alene Salamander (*Plethodon idahoensis*)
- Boreal Toad, Green (also known as Western Toad) (*Bufo boreas*)
- Bull Trout (*Salvelinus confluentus*)
- Torrent Sculpin (*Cottus rhotheus*)
- Westernslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)

5.2 CONCEPTUAL SITE MODEL

The CSM incorporates the primary mechanisms that lead to release of contaminants from source materials, migration routes of contaminants in the environment, exposure pathways, and human and ecological receptors. Figure 5-1 is a diagrammatic figure illustrating these components for all OUs. LA is the dominant environmental concern at the Site. The CSM for current and future receptors for all OUs is presented in Figure 5-1. Table 5-2 summarizes the exposure locations and general types of disturbances that may occur for each of the nine exposure media identified in the CSM.

5.2.1 Migration Routes and Exposure Pathways

Vermiculite from the former Libby Vermiculite Mine contains varying concentrations of LA. Historical mining, milling, and processing operations; use of vermiculite as an insulation building material and as an additive in other building materials; transport of mining-related materials, tailings, and waste; and runoff from the former Libby Vermiculite Mine site are known to have released LA to the environment (Figure 5-1). There have been numerous studies conducted at the Site that demonstrate LA has been detected in a variety of source media at the Site, including indoor dust; vermiculite insulation in walls and attics; soil, tree bark, and duff in the forested areas; various wood products (e.g., wood chips, mulch); ash resulting from wood burning; surface water; and sediment (CDM Smith 2014a).

However, asbestos fibers in source materials are typically not inherently hazardous unless the asbestos is released from the source material into air where it can be inhaled (EPA 2008). Asbestos fibers may become airborne in a number of ways. These may include natural forces, such as wind blowing over contaminated soil, or human activities that disturb contaminated sources such as indoor dust or soil. The two main types of exposure media are indoor air and outdoor air. Although indoor air and outdoor air are identified as exposure media potentially posing human health risks, they would result in human health risks primarily through disturbance of the source media (e.g., contaminated soil and building materials).

The amount of LA in air, and hence the amount inhaled, will vary depending on the level of LA in the exposure media (which can vary from location to location) and the intensity and duration of the disturbing force. Because of this, it is convenient to stratify inhalation exposure scenarios according to the disturbance activity and the location where the disturbance activity occurs. Table 5-2 summarizes the exposure locations and general types of disturbances that may occur for each of the nine exposure media identified in Figure 5-1. It is recognized that not every possible disturbance activity is included in Table 5-2. The list of disturbance activities included is intended to be representative of the types of activities that are expected to occur more frequently and/or that have a higher potential for LA release. As shown, exposures to outdoor air under soil or duff disturbances are the most complex because the types of activities that may disturb soil or duff are so varied, ranging from playing on playgrounds and driveways, to hiking in the forest, to mowing lawn areas in parks.

5.2.2 Exposed Populations

Table 5-2 identifies several potential exposure populations that are evaluated quantitatively in the risk assessment, including residents, recreational visitors, teachers and students, and several types of workers. These exposure populations were chosen because they represent the majority of the individuals present at the Site. The types of exposures that are expected for each population are discussed below:

- **Residents** – By definition, residential exposures are expected to occur at residential properties located in OU4 and OU7. Expected residential exposure pathways include both indoor and outdoor exposures to source materials at the residence (e.g., indoor dust, vermiculite insulation, soil, woodstove ash). Residents may also be exposed while engaging in local wood harvesting in the forested areas of the Site or while driving on roads and alleys in Libby and Troy.

- **Recreational visitors** – The primary types of exposure for a recreational visitor are related to outdoor exposure scenarios under a wide variety of activities that may disturb soil, duff, and tree bark. These recreational activities may include, but are not limited to, use of local parks, riding bicycles along trails and paths, hiking, camping, and riding all-terrain vehicles (ATVs) in the forested areas, fishing and boating along creeks and rivers, and riding motorcycles at the local motocross track (in OU5).

- **Teachers and students** – Teacher and student exposures are expected to occur at schools located in OU4 and OU7 and include both indoor and outdoor exposure pathways. Indoor exposures would occur inside school classrooms and in common areas (e.g., hallways, cafeteria, gymnasium) while outdoor exposures are mainly related to exposures while playing on playgrounds and athletic fields.

For workers, several different types are delineated based on the types of exposure pathways that may be encountered while engaging in day-to-day occupational activities:

- **Indoor worker** – Examples of indoor workers include office administrative assistants, shop keepers, and restaurant staff. Exposures are expected to occur mainly inside businesses located in OU4 and OU7. The primary types of exposure that would be expected for these workers are related to indoor exposure scenarios during both passive conditions and under active disturbances of indoor dust.

- **Tradesperson** – Local tradespeople are a special type of indoor worker that are evaluated separately due to the increased frequency of potential exposures to vermiculite insulation or other LA-containing building materials. Examples of tradesperson exposures include an electrician accessing attics or crawlspaces for re-wiring, a plumber cutting holes in walls or ceilings, a carpet layer removing and installing new flooring, and a general contractor performing remodeling. The types of exposure expected for a tradesperson are related to indoor exposure scenarios under active disturbances of vermiculite insulation or other LA-containing building materials during occupational activities. Although exposures may also occur during passive conditions, these are likely to be minor compared to active disturbance scenarios described above.

- **Outdoor worker** – The types of exposure expected for an outdoor worker are related to exposure scenarios under a wide variety of activities that may disturb soil or duff, tree bark, and woodchips or mulch at the Site. These occupational activities may include, but are not limited to, Montana Department of Transportation workers performing mowing or brush-clearing along highway rights-of-way, maintenance workers mowing or weed-trimming at parks and schools, BNSF workers performing railroad maintenance, U.S. Forest Service (USFS) employees conducting forest maintenance activities, fire fighters responding to wildfires, local landfill workers chipping accumulated wood waste, and commercial loggers in the forested areas near the Site.

All exposure populations are assumed to have exposures to outdoor ambient air and outdoor air while driving cars on Site roads. In the event of a wildfire, all exposure populations are assumed to have exposures to smoke in outdoor air related to the wildfires that may occur in forested areas at the Site.

Note that a given individual may be a member of several exposure populations. For example, an individual may live in Troy (OU7), work at a business in Libby (OU4), and recreate in the forest near the mine (OU3). In this example, aspects of the exposure scenarios for a resident, indoor worker, and recreational visitor would apply to the individual. The HHRA (CDM Smith 2015b) addresses cumulative exposures that span multiple exposure scenarios (see Section 7.1).

5.3 SAMPLING STRATEGY

Because the sources of contamination and exposure scenarios for each OU differ, the sampling strategy for the RIs at OUs 4, 5, 6, 7, and 8 varied but the end goal was to define the nature and extent of LA contamination in various media. Since December of 1999, 31 sampling events have been conducted at OU4. Since September 2001, 21 sampling events have been conducted at OU5. Since April 2001, 16 sampling events have been conducted at OU6. Since 2007, four sampling events have been conducted at OU7. Since July 2001, eight sampling events have been conducted at OU8. Details are provided in the various RIs and briefly summarized in Appendix A.

5.4 SOURCES OF CONTAMINATION

- OU4 – Libby. Vermiculite products and wastes were used in private residences, businesses, and public buildings. EPA has encountered vermiculite used as an additive in mortar, plaster, and concrete; as insulation in attic and walls; in soils at depth around septic tanks, tree roots, underground pipe trenches, and building foundations; and in surface soils in gardens, yards, driveways, and play areas. Vermiculite was also unintentionally transported by mineworkers on clothing, shoes, and cars into homes and businesses throughout the area. Contaminated media of concern are indoor air, indoor air during dust disturbance activities, indoor air during ash disturbance activities, general (ambient) outdoor air, outdoor air during soil or duff disturbance activities, outdoor air during bark disturbance activities, and outdoor air during woodchip or mulch disturbance activities.

- OU5 – Former Stimson Lumber Company. Vermiculite and/or concentrate was transported using the railroad spur, products were stockpiled at the former popping plant, the rail spur was used for shipping raw and processed vermiculite, lumber processing generated waste bark piles, and vermiculite insulation was used in buildings. Contaminated media of concern are indoor air, general (ambient) outdoor air, and outdoor air during soil or duff disturbance activities.

- OU6 – BNSF Railroad. Vermiculite released during loading, unloading, and transporting along BNSF railroads represents potential sources of vermiculite. Contaminated media of concern are general (ambient) outdoor air and outdoor air during soil or duff disturbance activities.

- OU7 – Town of Troy. Vermiculite products and wastes were used in private residences, businesses, and public buildings. Contaminated media of concern are indoor air, indoor air during dust disturbance activities, indoor air during ash disturbance activities, general (ambient) outdoor air, outdoor air during soil or duff disturbance activities, outdoor air during bark disturbance activities, and outdoor air during woodchip or mulch disturbance activities.

- OU8 – Roadways. Vermiculite released from trucks during transport as well as imported fill used for roadway construction and aggregate used in asphalt construction represent potential sources of vermiculite within OU8. Contaminated media of concern are general (ambient) outdoor air and outdoor air during soil or duff disturbance activities.

5.5 TYPE OF CONTAMINATION AND AFFECTED MEDIA

The former vermiculite mine site (OU3) is the primary source of LA Site-wide. In OUs 4, 5, 6, 7, and 8, LA-contaminated soil and building materials are the primary source media that contain LA and, when disturbed, could result in unacceptable human health risks. Although indoor air and outdoor air are the exposure media that result in human health risks, these exposure media become impacted via disturbance of the source media (e.g., contaminated soil and building materials). Thus, they cannot be directly remediated, but are addressed by remediation of the contributing source media. EPA has determined that not all vermiculite has LA, so it relies on analytical testing of soils for LA to determine if they need to be cleaned up.

Ash from the burning of contaminated wood bark and duff has been identified as a source medium potentially posing human health risks when disturbed, but the human health risks posed are dependent on the source of wood bark and duff (i.e., wood gathered from OU3 poses the greatest human health risks from LA, and wood gathered from a source outside of the Libby Valley may not contain LA). Mitigation of exposures from LA-contaminated bark and duff will be evaluated in the OU3 FS.

5.5.1 Contaminated Soil

Surface and subsurface soil contaminated with LA is one of the two predominant categories of contaminated source media at the Site, and contaminated soil is defined as soil or soil-like materials (e.g., gravel, sand, fill, boulders that are subsequently crushed into soil-like materials) which, when disturbed, would result in LA exposures that would result in unacceptable human health risks. Distribution of LA-contaminated soil is shown in Figures 5-2 through 5-27. Soil impacted by ash generated from wood or vegetation burning in outdoor areas, except in an enclosed structure like a wood furnace, also would be considered contaminated soil (e.g., a fire pit).

Contaminated soil may be found, at a minimum, in the following locations:

- Personal or community recreation locations (e.g., yards, outdoor recreation areas, play areas)

- Plant propagation locations (e.g., flowerbeds, gardens, potting soil in flower pots or greenhouses)

- Non-paved traffic surfaces, railways, and trail locations (non-paved traffic surfaces and the associated unpaved easement such as driveways, parking lots, roads, railways, alleys, trails, and walkways)
- Primary structure foundation locations (beneath porches, decks, crawlspaces that do not have a slab on grade, or basement foundation)
- Secondary structure foundation locations (beneath sheds, barns, livestock pens that do not have a slab on grade or basement foundation)
- Stockpile locations
- Controlled or uncontrolled burn locations within areas of contaminated soil

Exposure to LA can be either by incidental ingestion of contaminated soil or by inhalation of air that contains LA fibers released due to active soil disturbance activities. Of these two pathways, inhalation exposure to LA resulting from active soil disturbance is believed to be the most significant of these pathways.

5.5.2 Contaminated Building Materials

Contaminated building materials represent the other predominant category of contaminated source media at the Site. Vermiculite products and wastes generated from the mine were used in private residences, businesses, and public buildings throughout the Site. In the past, vermiculite was used as an additive in mortar, plaster, and concrete. Vermiculite was also used as an insulation building material in attic and walls. Vermiculite insulation represents the most likely contaminated building materials exposure to LA contamination. As with contaminated soil, inhalation exposure from disturbed building materials is believed to be the most significant exposure pathway for LA contamination.

Contaminated building materials are defined as vermiculite or other manufactured building materials (e.g., insulation, log chinking, chimney mortar, plaster, cinder blocks, pipe insulation) that, when disturbed, would result in LA exposures that would result in unacceptable human health risks. Other insulation building materials (such as fiberglass or cellulose) that are in contact or share airspace with vermiculite insulation would also be considered contaminated building materials for purposes of this definition.

Contaminated building materials may be found, at a minimum, in the following locations:

- Primary structures – residential or commercial structures that are designed for human occupancy and/or regularly occupied
  - Living spaces (e.g., living rooms, bedrooms, kitchens, dining rooms, bathrooms, finished attics, finished basements, offices)
  - Non-living spaces (e.g., unfinished attics, unfinished basements, attached garages, utility closets)

- Secondary structures – support structures for residential or commercial properties that are not designed for human occupancy
  - Unattached garages, sheds, barns, greenhouses, pet enclosures, livestock pens

5.6 LOCATION OF CONTAMINATION

During the investigations performed to determine LA exposure levels for the pathways of concern, LA was observed in all media sampled: air (indoor, outdoor ambient, and outdoor near disturbed soil), vermiculite insulation and bulk materials, indoor dust, soil (surface and subsurface), water, duff, tree bark, and tissue. Various sampling and analysis methods were used to determine the presence of LA fibers in different media such as soil, dust, and air. The following summarizes the observations and key findings related to the nature and extent of LA at the Site that are most relevant to the current status of the Site and presented for each of the contaminated media with a complete pathway as identified in the CSM (Figure 5-1). While the nature and extent of contamination has been delineated sufficiently to confirm the CSM and evaluate risks, ongoing sampling is being conducted to make property-specific decisions.

5.6.1 LA in Soil (OUs 4, 5, 6, 7, and 8)

Per EPA guidance (EPA 1989), the term “surface soil” is used to describe soils that would be encountered by human receptors under "typical" activities. In a residential or commercial setting, this may consist of various activities such as mowing the lawn, raking leaves, playing in the yard, a child digging in the dirt, planting in a garden or flowerbed, performing sprinkler maintenance, walking on an unpaved sidewalk, and driving in an unpaved driveway. In general, these types of soil disturbance activities likely would result in disturbances of soils within a shallow (less than 6 inches) depth interval. Current property investigation protocols seek to characterize this surface soil interval since this is the interval most likely to be encountered under "typical" activities.

The term “subsurface soil” is used to describe soils that are below “surface soils” as defined above. Subsurface soils would be encountered during deeper digging activities such as a resident digging holes to plant a tree or a construction worker digging a sewer or utility line. These activities are likely to result in disturbances of subsurface soils to several feet in depth.

Soil sampling has been conducted at all OUs at the Site with LA concentrations ranging from non-detect to 6 percent by PLM-VE and visible vermiculite detected at varying levels. The physical components of remedial action have been completed at OU1 in 2011 and 2012 to address LA contamination in surface soil (CDM Smith 2013a). The physical components of remedial action have been completed at OU2 in 2010 to address LA contamination in surface soil (CDM Smith 2012b).

There are approximately 6,600 properties in OU4. As of mid-October 2015, LA-contaminated surface soil has been removed during outdoor-only removal actions at approximately 1,100 of the properties in OU4. Additionally, approximately 750 properties in OU4 have had outdoor removal actions completed as part of indoor and outdoor removals. Figures 5-2 through 5-16 illustrate an overview of the geographic removal zones (GRZs) and the property status (e.g., Response Action Required, Response Action Completed) for properties located within each GRZ in OU4. GRZs are geographic groupings of geounits and were developed to subdivide OU4 into strategic areas or "neighborhoods." OU4 was subdivided into 24 GRZs (designated 1 through 24). In most cases, a geounit is the same as a tax parcel or ROW such as a street or waterway. Exceptions to this rule are discussed in the OU4 RI Report (CDM Smith 2014a).

Vermiculite and LA-containing soil is known to exist in the surface areas at OU5. The majority of PLM-VE surface soil samples in OU5 were non-detect. Areas with Bin B2 concentrations of LA (i.e., LA present at levels less than 1 percent but greater than or equal to 0.2 percent) include the northern part of the former tree nursery and areas southwest and northwest of the Pipe Shop (HDR 2013a). Composite visible vermiculite samples were taken throughout OU5 and assigned a weighted composite score based on a number of observations of visible vermiculite and relative levels of visible vermiculite in each observation. Elevated visible vermiculite was more widespread than elevated PLM concentration, with visible vermiculite most elevated (composite score greater than 0.1) in the former tree nursery and portions of the southwestern portion of OU5. Figure 5-17a illustrates the sample results for PLM and visual vermiculite in surface soils and Figure 5-17b illustrates the surface soil sample results in worker ABS areas. Figure 5-18 illustrates the sample results in subsurface soil.

Remedial action work was completed at the Libby Railyard within OU6 in 2004 to address LA contamination in soil (CDM Smith 2008a). Between September and November of 2004, a response action was performed at specific tracks within the Libby Railyard based on the results of soil sample analysis. Figure 2-19 shows the response action zones at the Libby Railyard. In addition to sample and removal actions at the railyard, sampling was also conducted on rail lines that traverse the Libby area. Figure 2-20 illustrates the sample results for PLM and visible vermiculite in soils and undercutter spoils at OU6.

There are approximately 1,500 properties in OU7. As of mid-October 2015, LA-contaminated surface soil has been removed during outdoor-only removal actions at 15 properties in OU7. Additionally, 29 properties in OU7 have had outdoor removal actions completed as part of indoor and outdoor removals (Tetra Tech 2014). Figures 5-21 through 5-25 illustrate the property status (e.g., Response Action Required, Response Action Completed) of properties located within each GRZ in OU7. OU7 was subdivided into seven GRZs (designated 25 through 31).

LA-containing vermiculite and soil are known to exist in the surface areas along the ROW of United States, state, and local highways within OU8 (HDR 2013b). A majority of the PLM-VE surface soil samples were non-detect, with the stretch of SH37 between Libby and Rainy Creek Road having the greatest concentration of samples with results of Bin B1 (i.e., LA present at levels less than 0.2 percent) or Bin B2 (i.e., LA present at levels less than 1 percent but greater than or equal to 0.2 percent). Figure 5-26 illustrates the sample results for PLM in surface soils. The areas with samples with visible vermiculite were confined to areas east of Rainy Creek Road along SH37. The remainder of surface soil samples was not found to have visible vermiculite. Figure 5-27 illustrates the sample results for visible vermiculite in surface soils.

5.6.2 LA in Building Materials (OUs 4, 5, 6, and 7)

As of February 2015, indoor-only removals had been completed at 256 properties, and additionally, 706 properties have had indoor removal actions completed as part of indoor and outdoor removals in OU4. As of 2013, indoor-only removals had been completed at 64 properties; additionally, 29 properties have had indoor removal actions completed as part of indoor and outdoor removals in OU7 (Tetra Tech 2014). Figures 5-2 through 5-16 illustrate the property status (e.g., Response Action Required, Response Action Completed) of properties in OU4. Figures 5-21 through 5-25 illustrate the property status of properties in OU7. Additionally, building materials have been sampled and analyzed by PLM-9002 at OU5, with LA concentrations ranging from non-detect to less than 1 percent (CDM Smith 2007). Building materials also have been identified and removed from several BNSF-owned buildings (Kennedy/Jenks 2014).

5.6.3 LA in Air (OUs 4, 5, 6, 7, and 8)

5.6.3.1 Indoor Air and Dust

It is not possible to estimate the remaining concentration of LA in indoor air based solely on whether or when a removal action has been completed, the levels of LA in indoor source materials (e.g., dust), or the characteristics and history of the property. However, a wide range of indoor air and dust sampling has been conducted at the Site, including microvacuum dust sampling and indoor ABS sampling at OUs 4, 5, and 7. Indoor dust sampling concentrations ranged from non-detect to 113,000 s/cm^2. Properties with dust samples $\geq$ 5,000 s/cm^2 have been identified for interior removal or interior cleaning or are being further investigated. ABS sampling events conducted at buildings within the Site detected LA at concentrations ranging from 0.00013 to 0.41 structures per cubic centimeter (s/cc) (CDM Smith 2014a; Tetra Tech 2014; HDR 2013a). For properties where interior cleanups have been performed, interior living space air samples were required to be non-detect for LA before the removal was considered complete (CDM Smith 2014a).

5.6.3.2 Outdoor Air

Data collected during the Ambient Air program from 2006 to the present indicate recent ambient air levels have remained relatively constant over time, with detected total LA concentrations within the community of Libby ranging from 0.000035 to 0.00053 s/cc and detected concentrations of 0.000031 to 0.0027 s/cc near transportation corridors and removal activities (CDM Smith 2014a). LA detections in the community of Troy ranged from 0.0000347 to 0.000267 s/cc (Tetra Tech 2014).

Concentrations of LA in outdoor air near soil-disturbance activities span several orders of magnitude, depending on the intensity of the disturbance scenario, location of the disturbance, level of LA in the disturbed soil, and soil conditions (e.g., moisture content, vegetative cover). Detected total LA concentrations range from 0.00011 to 58 s/cc in outdoor ABS air (CDM Smith 2014a). Disturbance activities ranked as "high intensity" (e.g., outdoor ABS performed in 2007 and 2008) resulted in higher levels of total LA in outdoor ABS air, whereas activities ranked as "typical intensity" (e.g., outdoor ABS performed in 2010) resulted in lower levels of total LA in outdoor ABS air. In general, outdoor ABS air concentrations tended to increase as LA levels in the disturbed soil increased.

5.6.4 LA in Groundwater (OUs 4 and 5)

A total of 62 groundwater samples have been collected at OU4. The majority of the samples have been collected from the Libby Class II Landfill as part of the semiannual groundwater monitoring activities while the remaining seven samples were collected from private residences. Of the 62 samples collected, three samples from the Libby Class II Landfill reported detectable LA, with concentrations ranging from 0.0026 to 0.088 million fibers per liter (MFL) (CDM Smith 2014a). These results were below the asbestos maximum contaminant level goal (MCLG) of 7 MFL.

5.6.5 LA in Surface Water (OU4)

Surface water samples were collected from major tributaries to the Kootenai River, including Granite Creek, Libby Creek Flower Creek, Pipe Creek, Callahan Creek, and the Fisher River, during several investigations as detailed in CDM Smith (2014a). Investigations related to the Kootenai River will be addressed as part of OU3. Total LA was detected at levels ranging from 0.049 to 0.1 MFL. LA greater than 10 μm was detected at levels ranging from 0.049 to 0.05 MFL (CDM Smith 2014a).

5.6.6 LA in Sediment (OU4)

Sediment samples were collected from major tributaries to the Kootenai River. LA has been detected at trace levels in sediment of the major tributaries to the Kootenai River (CDM Smith 2014a). Investigations related to the Kootenai River will be addressed as part of OU3.

5.6.7 LA in Porewater (OU4)

Porewater samples were collected from major tributaries to the Kootenai River. Investigations related to the Kootenai River will be addressed as part of OU3. Total LA was detected in one sample at 0.30 MFL; all other samples were non-detect for total LA (CDM Smith 2014a).

5.6.8 LA in Bark and Duff (OUs 4 and 5)

Tree bark and duff samples were collected from within a 2-mile buffer extending beyond the current NPL boundary located east of Kootenai Falls. Concentrations of LA range from 0.0045 to 2.4 million structures per gram (Ms/g) in tree bark and from 0.25 to 20 Ms/g in duff (CDM Smith 2014a).

A total of 19 waste bark samples were collected in OU5. LA was detected in 14 of the waste bark samples. The analytical method used for analyzing the waste bark is a qualitative, not quantitative, method. It can only determine whether a sample is a detect or a non-detect and cannot quantify further (HDR 2013a).

5.6.9 LA in Tissue (OU4)

Tissue samples were collected to evaluate two potential human ingestion exposure scenarios – ingestion of game and ingestion of fish. Data regarding LA levels in tissue are not available for OU4; fish tissue and game samples have only been collected from OU3. It may be practical to assume levels in tissue associated with OU4 are lower than OU3 because levels of LA in ingested materials (surface water, sediment, and soil) are higher in OU3 than in OU4. All game samples were non-detect for LA, and detected concentrations of LA in fish ranged from 9,400 to 6,400,000 structures per gram on a wet weight basis (CDM Smith 2014a).

5.6.10 LA in Background Locations

In order to better understand the nature and magnitude of naturally occurring levels of LA, EPA conducted several investigations to characterize LA in soil from areas thought to be representative of soils that are not expected to be affected by anthropogenic releases from vermiculite mining and processing activities, otherwise known as “background” locations.

The results of these studies support the conclusion there is a non-zero level of LA in soils within the Kootenai Valley that is not attributable to vermiculite mining and processing activities at the Site. Further, these results support the data reported by other researchers, including Gunter and Sanchez (2009), Adams et al. (2010), and Langer et al. (2010), indicating that low-level detections of amphibole fibers in background soils within the Kootenai Valley originated from normal geologic and geomorphic processes unrelated to mining and milling of vermiculite ore from Vermiculite Mountain.

ABS activities conducted on these background soils demonstrate LA can be released to air; however, estimated risks from background soil exposures appear to be low (i.e., cancer risk below 10^{-5} and non-cancer hazard quotient [HQ] below 1) and do not contribute significantly to a hazard or cancer risk (CDM Smith 2015b).

6.0 CURRENT AND REASONABLY ANTICIPATED FUTURE LAND AND RESOURCE USES

The current and reasonably anticipated future land uses for the Site are an important consideration for the development of remedial action objectives (RAOs) and remedial criteria such as remediation goals (RGs) to ensure remedial alternatives are protective of human health and the environment. The final condition of the Site after remediation must be considered in evaluating future land uses or activities and the related protection to human health and the environment that is provided.

Detailed information on current and future land uses within the Site are discussed in this section. The current land uses that occur at specific properties within the City of Libby and the Town of Troy are dependent on factors such as ownership and location, but uses are generally of a similar nature within specific areas of these communities (e.g., residential areas and commercial areas tend to be grouped in clusters). Industrial and school properties, by their nature, tend to have specific uses, but land use can change over time based on economic conditions and needs for the buildings on the properties. Rail/highway corridors and parks generally have specific, limited uses that stay relatively unchanged over time. However, if future development were to occur, necessitating a change in land use category, ICs will be implemented so that governmental agencies would be alerted to changes through a notification and planning process. ICs will be needed for land use changes as there are no zoning or building permits required in Lincoln County.

Please note that land uses as discussed in this section relate to factors such as ownership and the type of activities that typically take place on a property or category of properties and are not directly related to categories of outdoor soil use within a property developed for risk assessment purposes (e.g., "frequently used" area, "infrequently used" areas, "limited use" areas, etc.). That information can be found in Section 4.2.1 and in Appendix B.

The following assumptions were made for current and reasonably anticipated land uses:

- Although the remedy measures put in place to protect human health and the environment would not allow unrestricted uses, they would be protective for anticipated future uses contemplated, assuming the remedial measures put in place are kept intact.
- Future land uses or activities that would compromise the ability of the measures implemented under a remedial action to be protective would be considered unacceptable.

Detailed information on current and future land uses within the Site is discussed in the following subsections.

6.1 CURRENT LAND USE

Private residences, businesses, and public properties, including schools and parks, are still in use throughout the City of Libby (OU4) and Town of Troy (OU7). Interim response actions, such as removal of potentially LA-contaminated dust, soil, and debris, have been conducted as an ongoing part of EPA's removal program.

The former Stimson Lumber Mill (OU5) is being redeveloped by the Lincoln County Port Authority. Several companies lease buildings and land space within OU5 for commercial uses. Other current uses of property within OU5 include recreational features such as a hiking and biking path along Libby Creek and a motocross park.

The BNSF Libby Railyard (OU6) is used to load and unload goods transported to and from various parts of the country by rail. There is also a significant amount of train traffic moving goods by rail through, but not stopping in, the Libby and Troy railyards. The depot at the Libby Railyard is also a stop on Amtrak's Empire Builder passenger train line that runs from Chicago, Illinois to Seattle, Washington.

Federal (United States), Montana state, and local highways (OU8) are used by residents and commercial industry as the transportation thoroughfares throughout the area.

6.2 REASONABLY ANTICIPATED FUTURE LAND USE

It is expected that existing private residences, businesses, and public properties will remain in use throughout the Site. Interim response actions will continue to take place until the ROD is finalized, at which point the selected remedy will be implemented. Properties to be addressed as part of the remedial action will be tracked during construction of physical remedy components to ensure consistency in cleanup approach based on current land uses as discussed in Section 6.1. However, the land use status for each property included in the selected remedy will be established at the completion of the remedial action, prior to start of operation and maintenance for purposes of monitoring and maintaining the remedy. Land use status in this context is defined as classification of a property in Operable Units 4 through 8 with respect to land use categories defined in Section 4.2.

Redevelopment of individual properties within the former Stimson Lumber Mill property (OU5) is currently being planned. It is anticipated that use of a portion of the former Stimson Lumber Mill property will remain industrial and commercial; however, some recreational features, such as the hiking and biking path, the fishing pond, and the motocross track, are also incorporated within the property. The Kootenai River Development Council (KRDC) was awarded a grant to upgrade the rail lines and electrical system near the former Stimson Lumber Mill property for purposes of redeveloping the area (HDR 2013a). Plans are also being discussed for an additional walking path.

Numerous economic factors will affect the future use of the Libby and Troy railyards; thus, plans for each are unknown or are business-confidential. As a result, it is not possible to accurately predict whether operations will expand or contract from their current level. However, the main rail that runs through Libby and Troy is part of a major rail corridor for BNSF that runs between Chicago and Seattle. It is expected the BNSF property will remain primarily as a transportation corridor for the foreseeable future.

United States, Montana state, and local highways are expected to continue being used by residents and commercial industry as the transportation thoroughfares throughout the area.

7.0 SUMMARY OF SITE RISKS

Potential risks to humans and ecological receptors from exposures to LA are evaluated in the HHRA (CDM Smith 2015b) and the Site-wide BERA (SRC, Inc. and CDM Smith 2014). The following sections provide a brief overview of the risk assessment methodology, summarize the risk assessment results, and present the overall risk conclusions for both human health (Section 7.1) and ecological (Section 7.2) receptors.

7.1 HUMAN HEALTH RISK

The HHRA quantifies potential human health risks from exposures to LA at the Site under current and future conditions. The HHRA differs from other "typical" Superfund risk assessments in that extensive interior and exterior removal actions have been conducted for more than 10 years at the Site, prior to the completion of the risk assessment, to allow for the timely removal of LA contamination while awaiting the necessary exposure and toxicity data needed to complete a quantitative assessment of human health risk. Results of the HHRA help Site managers determine if past removal actions have been sufficient to mitigate risk and if additional remedial actions are necessary to address risks, and if so, which exposure scenarios would need to be addressed.

7.1.1 Exposure Assessment

Exposure is the process by which receptors come into contact with contaminants in the environment. The following subsections describe the CSM for human exposures to LA, describe the exposure scenarios and human populations that were evaluated in the HHRA, and summarize the methods for selecting exposure parameters and deriving the exposure point concentrations (EPCs) used in the risk characterization.

7.1.1.1 Conceptual Site Model

Historical mining, milling, and processing operations, use of vermiculite in building materials, transport of mining-related materials, tailings, and waste, and runoff from the mine site are known to have released LA to the environment.

People may be exposed to LA at the Site by two exposure routes: inhalation and ingestion. Of these two exposure routes, inhalation exposure of LA is considered to be of greatest concern. To the extent that ingestion exposures may occur at this Site (e.g., ingestion of LA in drinking water or food), the added risk from ingestion is expected to be negligible compared to the risk from inhalation (CDM Smith 2015b). As such, the HHRA focused only on inhalation pathways of exposure.

As discussed previously in Section 5.2.2, asbestos fibers in source media are typically not inherently hazardous unless the asbestos is released from the source material into air where it can be inhaled (EPA 2008). Asbestos fibers may become airborne in a number of ways. These may include natural forces, such as wind blowing over a contaminated soil, or human activities that disturb contaminated sources, such as soil or indoor dust. Figure 5-1 presents the CSM that depicts how LA in source media can be transported in the environment to exposure media that humans may encounter at the Site. The two main types of exposure media are indoor air and outdoor air.

7.1.1.2 Exposure Scenarios and Populations

Table 5-2 summarizes the inhalation exposure scenarios and populations that were evaluated in the HHRA. As shown, several potential exposure populations were evaluated quantitatively in the HHRA, including residents, recreational visitors, teachers and students, and several types of workers (indoor workers, local tradespeople, outdoor workers). The types of exposures that are expected for each population were described previously in Section 5.2.2.

7.1.1.3 Exposure Parameters

For every exposure scenario of potential concern, it is expected that there will be differences between different individuals due to differences in exposure time, exposure frequency, and exposure duration. Thus, there is normally a wide range of average daily exposures between different individuals of an exposed population. Exposure estimates in the risk assessment do not seek to evaluate exposures for specific individuals. Rather, risk estimates are calculated to represent members of the population with “typical” levels of exposure and members of the population with “high-end” exposures. These two exposure estimates are referred to as central tendency exposure (CTE) and reasonable maximum exposure (RME), respectively.

For each exposure scenario evaluated in the risk assessment, information on estimated exposure time (ET, in hours per day), exposure frequency (EF, in days per year), and exposure duration (ED, in years) is used to derive a lifetime time-weighting factor (TWF) as follows:

$$TWF = (ET/24 \cdot EF/365 \cdot ED/70)$$

The value of the TWF ranges from zero to one, and describes the average fraction of a lifetime during which the specific exposure scenario occurs.

7.1.1.4 Exposure Point Concentrations

Predicting the LA levels in air based on measured LA levels in source media is difficult. For this reason, EPA recommends an empirical approach for investigating asbestos-contaminated Superfund sites where concentrations of asbestos in air from source disturbances are measured rather than predicted (EPA 2008). This type of sampling is referred to as ABS.

To date, more than two dozen different ABS investigations have been conducted at the Site to evaluate potential exposures to LA from various disturbances of source media. These studies have included a wide range of activities including, but not limited to, dusting and vacuuming inside residences; raking, mowing, and digging in yard soil; riding ATVs; bicycling and driving on roads; and various worker activities. In total, more than 3,100 ABS air samples have been collected at the Site since 2001. In addition, more than 1,500 outdoor ambient air samples have been collected at the Site.

All ABS and ambient air samples have been analyzed by TEM. During the analysis, detailed information for each observed asbestos structure (e.g., asbestos type, structure type, length, width) is recorded. For the purposes of computing risk estimates, it is necessary to use the results from the TEM analysis to estimate what would have been detected had the sample been analyzed by PCM. This is because available toxicity information is based on workplace studies that used PCM as the primary method for analysis. For convenience, structures detected under TEM that meet the recording rules for PCM are referred to as PCME structures. TEM analysis results for air samples are expressed as PCME LA structures per cubic centimeter of air (s/cc).

In accordance with the EPA asbestos risk assessment guidance (EPA 2008), EPCs for each exposure scenario are calculated as the sample mean, evaluating non-detect samples at a concentration value of zero. In cases where air filters required the use of indirect preparation techniques prior to TEM analysis, the reported PCME LA air concentration was adjusted (decreased) by a factor of 2.5 (CDM Smith 2015b) to avoid potentially biasing calculated EPCs high due to the effect of indirect preparation.

7.1.2 Toxicity Assessment and LA-Specific Values

The adverse effects of asbestos exposure in humans have been the subject of a large number of studies and publications. Exposure to asbestos may induce several types of both non-cancer and cancer effects. A detailed summary of the cancer and non-cancer effects of asbestos is provided in the ATSDR *Toxicological Profile for Asbestos* (ATSDR 2001) and in EPA's *Airborne Asbestos Health Assessment Update* (EPA 1986). A detailed summary of effects related specifically to LA is provided in the *Toxicological Review for Libby Amphibole Asbestos* (EPA 2014a). The LA-specific toxicity values were released by EPA's Office of Research and Development (ORD) for public comment and review by a Scientific Advisory Board in 2011, and were finalized in December 2014.

7.1.2.1 Non-Cancer Effects

Non-cancer effects from asbestos exposure include asbestosis (formation of scar tissue in the lung parenchyma) and several types of abnormalities in the pleura (the membrane surrounding the lungs) such as pleural effusions (excess fluid accumulation in the pleural space), pleural plaques (collagen deposits and calcification), and pleural thickening.

Non-cancer risks from inhalation exposure are determined based on a reference concentration (RfC) value. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure that is likely to be without an appreciable risk of deleterious effects in humans (including sensitive subgroups) during a lifetime (EPA 2009). The LA-specific RfC, referred to as RfC_{LA}, was derived from a cohort of workers employed at the O.M. Scott Plant in Marysville, Ohio. This plant utilized vermiculite that originated from the mine in Libby from 1959 to 1980 in their lawn care products. Localized pleural thickening was selected as the critical effect endpoint for the derivation of the RfC_{LA}. The RfC_{LA} is 0.00009 PCM f/cc (EPA 2014a).

7.1.2.2 Cancer Effects

Many epidemiological studies have reported increased mortality from cancer in workers exposed to asbestos, especially from lung cancer and mesothelioma (tumor of the thin membrane that covers and protects the internal organs of the body). In addition, a number of studies suggest asbestos exposure may increase risk of cancer of the larynx (commonly called the voice box) and ovarian cancer (IARC 2012). Based on these findings, and supported by extensive carcinogenicity data from animal studies, EPA has classified asbestos as a known human carcinogen.

Carcinogenic risk from inhalation exposure is determined based on an inhalation unit risk (IUR) value, which is defined as the excess lifetime cancer risk estimated to result from continuous exposure to 1 f/cc. The LA-specific IUR, referred to as IUR_{LA}, is derived from a cohort of workers employed at the vermiculite mining and milling operation in and around Libby, referred to as the "Libby worker cohort." The IUR_{LA} is 0.17 (PCM f/cc)$^{-1}$ (EPA 2014a).

7.1.3 Risk Characterization Approach

7.1.3.1 Basic Equations

The basic equation used to estimate excess lifetime cancer risk from inhalation of LA is:

$$Risk = EPC \cdot TWF \cdot IUR_{LA}$$

where:

Risk = Lifetime excess risk of developing cancer (lung cancer or mesothelioma) as a consequence of LA exposure.

EPC = Exposure point concentration of LA in air (PCME LA s/cc). The EPC is an estimate of the long-term average concentration of LA in inhaled air for the specific activity being assessed.

TWF = Time-weighting factor for the specific activity being assessed.

IUR_{LA} = LA-specific inhalation unit risk (0.17 [PCM s/cc]$^{-1}$)

The basic equation used for characterizing non-cancer hazards from inhalation exposures to LA is as follows:

$$HQ = EPC \cdot TWF / RfC_{LA}$$

where:

HQ = Hazard quotient for non-cancer effects from LA exposure

EPC = Exposure point concentration of LA in air (PCME LA s/cc)

TWF = Time-weighting factor

RfC_{LA} = LA-specific reference concentration (0.00009 PCM s/cc)

7.1.3.2 Risk Interpretation

In general, EPA considers cumulative excess cancer risks that are less than 10^{-6} to be negligible, and risks greater than 10^{-4} to be sufficiently large that some form of remedial action is desirable. Excess cancer risks that range between 10^{-4} and 10^{-6} are generally considered to be acceptable, although this is evaluated on a case-by-case basis, and EPA may determine that risks lower than 10^{-4} are not sufficiently protective and warrant remedial action.

For non-cancer, if the cumulative HQ (referred to as the hazard index [HI]) is less than or equal to 1, then remedial action is generally not warranted. If the HI exceeds 1, there is some possibility that non-cancer effects may occur, although an HI greater than 1 does not indicate an effect will definitely occur. However, the larger the HI value, the more likely it is that an adverse effect may occur.

7.1.4 Summary of Exposure Scenario Risks

7.1.4.1 Risks from Exposures to Ambient Air

In the past (circa 1970s), ambient air concentrations as high as 1.5 PCM f/cc were measured in downtown Libby when the mine was in operation. Beginning in 2006, there have been several long-term outdoor ambient air monitoring studies conducted in Libby, Troy, and at the mine site. These data show that average ambient air concentrations in the Libby community and in Troy are less than 0.00001 PCME LA s/cc under current conditions. Current ambient air concentrations at the Site are greatly improved relative to historical conditions and are consistent with asbestos levels that have been measured in ambient air in Eureka and Helena, Montana, as well as across the country (SRC, Inc. 2013).

Data from the recent ambient air monitoring studies at the Site were used to calculate EPCs for use in evaluating potential exposures to LA in ambient air. All individuals at the Site have the potential to be exposed to LA in ambient air. However, for simplicity, risk estimates from exposures to ambient air were calculated for each exposure area based on the maximally exposed receptor (e.g., residential exposure scenario in Libby). RME cancer risks are less than or equal to 10^{-6}, and non-cancer HQs are less than 0.1 for all Site exposure locations; CTE cancer risks and non-cancer HQs are even lower. These results indicate that exposures to LA in ambient air are not likely to be of concern to individuals at the Site nor contribute significantly to cumulative risks.

7.1.4.2 Risks from Exposures During Soil and Duff Disturbances

Potential exposures to LA during disturbances of soil and duff can occur for a wide range of receptor types and exposure scenarios. More than 80 different types of exposures during soil and duff disturbances were evaluated, encompassing multiple disturbance activities, exposure populations, exposure locations, and LA concentrations. In reviewing the risk estimates for exposures during soil and duff disturbance activities, there are a number of general conclusions that can be drawn:

- Estimated cancer risks and non-cancer HQs span more than four orders of magnitude depending upon the exposure scenario.

- For a given exposure scenario, non-cancer HQs can exceed 1 even when cancer risks are less than 10^{-4}, which indicates that non-cancer exposure is a more sensitive metric of potential concern. (Note that the State of Montana's acceptable cancer risk is less than 10^{-5}. For LA, a cancer risk of 10^{-5} is approximately equivalent to a non-cancer HQ of 1.)

- There were only a few soil disturbance exposure scenarios where risks from the exposure pathway alone had the potential to be above a level of concern based on RME, including residential and outdoor worker exposures during disturbances of yard soils with detected LA at properties in Libby and Troy, outdoor worker exposures during disturbances of subsurface soils with LA contamination at properties in Libby and Troy, and rockhound exposures in the disturbed area of the mine.

- Quantitative risks were not calculated for potential exposures to workers exposed to residual LA in subsurface soils in the former Screening Plant and Export Plant areas; however, these exposure scenarios are presumed to result in potentially significant exposures and risks.

- Exposure to LA in outdoor air during yard soil disturbances has the potential to be an important exposure scenario. Even when only trace levels of LA are present in the soil, this exposure scenario, when considered alone, could yield non-cancer HQs greater than 1, depending upon the spatial extent of the LA in soil and the frequency and intensity that these soils are disturbed.

Extrapolation to Properties without ABS

As noted above, exposure to LA in outdoor air during yard soil disturbances has the potential to be an important exposure pathway. There are more than 8,000 residential and commercial properties in Libby and Troy. Because it is not feasible to evaluate risks by conducting outdoor ABS at every property, it is necessary to use the measured ABS data from the properties where ABS has been performed to draw risk conclusions about properties where ABS has not been performed. This is accomplished by assuming that properties without ABS data, but having the same LA soil level and similar disturbance activities, will have outdoor air concentrations similar to properties with ABS data.

Table 7-1 presents estimated RME cancer risks and non-cancer HQs from exposures to LA during soil disturbances for a range of LA soil levels at residential properties in Libby and Troy. In interpreting these risk estimates, it is important to understand that these calculations are intended to represent a given LA soil concentration. However, a specified exposure area for a property may have varying LA soil concentrations with differing spatial extents. The evaluation of risk at a property is based on the average exposure across the entire exposure area. Thus, for exposure areas that encompass varying soil concentrations, it is necessary to derive a spatially weighted average risk estimate for the entire exposure area. Figure 7-1 presents a simplified example of this approach.

<u>Background LA Concentrations in Soil</u>

EPA has conducted several investigations at the Site to characterize LA in soil from areas that are thought to be representative of "background" conditions, meaning the soils are not expected to be affected by anthropogenic releases from vermiculite mining and processing activities. LA structures have been consistently detected in background soils within the Kootenai Valley. However, as presented in the HHRA (CDM Smith 2015b), potential exposures and risks from LA in background soil are likely to be low.

7.1.4.3 Risks from Exposures to Indoor Air

There are a wide range of different activities that could occur inside buildings (e.g., residences, businesses, schools) at the Site that could result in exposures to LA. There have been several indoor ABS investigations to evaluate LA concentrations in air during various indoor disturbance scenarios, including indoor exposures inside residences, schools, and commercial and industrial buildings in Libby and Troy. In general, ABS air samples were collected under two representative conditions – active and passive behaviors. Active behaviors include indoor activities in which a person is moving about the building and potentially disturbing indoor sources; such activities have included walking from room to room, sitting down on upholstered chairs, sweeping, and vacuuming. Passive behaviors are minimally energetic actions, such as sitting and reading a book, watching television, and working at a desk, that will have low tendency to disturb any indoor source media. In addition, air samples were also collected to evaluate potential exposures to local tradespeople (e.g., carpenter, electrician, plumber) from high intensity disturbances of vermiculite insulation (VI) or other asbestos-containing building materials.

With the exception of indoor exposures at properties under "pre-removal" conditions and during tradesperson activities (discussed below), estimated RME cancer risks were less than 10^{-4}, and non-cancer HQs were below 1 for all indoor exposure scenarios.

Estimated RME non-cancer HQs were greater than 1 for both residential exposures and indoor worker exposures to LA inside "pre-removal" properties (these are properties where an interior removal has been deemed necessary, but a removal had not been completed at the time of the ABS). Activities associated with active disturbance behaviors contributed the most to total exposures. Non-cancer HQs were less than 1 for properties where an interior removal has been completed ("post-removal") and for properties where an interior removal was deemed not to be necessary ("no removal required"). These results demonstrate that interior investigations and removals have been effective at identifying and mitigating sources of LA inside properties.

Exposures of local tradespeople to LA while working inside buildings have the potential to result in RME cancer risks greater than or equal to 10^{-4} and non-cancer HQs above 1 for all the activities investigated, which included active disturbances of VI (e.g., wall demolition, attic detailing, cleaning living space areas with visible VI). These results indicate that local tradesperson exposures have the potential to be significant and result in risks above a level of concern if appropriate personal protective measures are not employed to mitigate exposures during active disturbances of indoor source media. There is the potential for tradesperson exposures to occur, even for properties that have had an interior removal or where no interior removal has been deemed necessary, if source media have been left in place (e.g., VI contained within walls).

7.1.4.4 Risks from Exposures during Disturbances of Wood-Related Materials

Extensive data have been collected in the forested area near the mine site (CDM Smith 2015d) and in the forested area near the current Site NPL boundary (CDM Smith 2013b). These data show that LA structures are present on the outer bark surface of trees at the Site. If LA-containing trees or wood-related materials (e.g., woodchips, mulch) are disturbed, people may be exposed to LA that is released to air from the wood. If LA-containing trees are used as a source of firewood (e.g., in a residential woodstove), studies have shown that LA fibers can become concentrated in the resulting ash (Ward et al. 2009; EPA 2012a), which itself can become a source of potential LA exposure.

A number of ABS studies have been performed at the Site to provide measured data on LA concentrations in air during a variety of disturbances of wood-related materials, including ABS studies during residential wood harvesting activities, woodchip and mulch disturbance activities, and woodstove ash disturbance activities. With the exception of activities related to commercial logging and the removal of ash from a woodstove (discussed below), estimated RME cancer risks were less than 10^{-4} and non-cancer HQs were less than 1 for all wood-related exposure scenarios.

When commercial logging activities were conducted in an area located near the mine (within 1 mile) with higher concentrations of LA in tree bark and duff, estimated RME cancer risks for all commercial logging activities were less than 10^{-4}, but non-cancer HQs were greater than or equal to 1 during timber skidding and site restoration activities. However, when commercial logging activities were conducted in an area further (about 4 miles) from the mine, where concentrations of LA in tree bark and duff were lower, estimated RME cancer risks were less than 10^{-4} and non-cancer HQs were less than 1 for all commercial logging activities.

Estimated RME non-cancer HQs for activities associated with the removal of ash from a woodstove differed, depending on the source of the firewood that was burned. The estimated HQ was greater than 1 when firewood was collected from a location near the mine (within 1 mile, where tree bark LA levels are highest), but HQs were below 1 when firewood was collected from a location far from the mine (i.e., 2-10 miles south of Libby). RME cancer risks from exposure to LA in woodstove ash were less than 10^{-4} regardless of the wood source. These risk estimates demonstrate that exposures to LA in ash may contribute significantly to cumulative exposures, if the ash is derived from a wood source in close proximity to the mine.

7.1.4.5 Risks from Exposures during Fire-Related Activities

ABS studies have been performed at the Site to provide measured data on LA concentrations in air during fire-related activities to provide information on potential exposures to fire fighters during an understory burn and to forest workers during a slash pile burn in an area located near the mine (within 1 mile) with higher concentrations of LA in tree bark and duff.

Estimated RME cancer risks were less than 10^{-4}, but non-cancer HQs were greater than or equal to 1 for several fire-related exposure scenarios. The RME non-cancer HQs were greater than 1 during slash pile building activities and were greater than or equal to 1 during mop-up activities for the understory burn (when mop-up activities were conducted by hand) for both “wet” and “dry” mop-up scenarios. These risk estimates demonstrate that fire-related exposures have the potential to be significant near the mine if appropriate personal protective measures are not employed to mitigate exposures.

There are only limited data on potential exposures from fire-related activities in areas further from the mine. During an authentic wildfire response for a small fire approximately 2.5 miles from the mine, RME cancer risks were less than or equal to 10^{-6} and non-cancer HQs were less than 0.1 for responding fire fighters. Residential exposures in and around Libby from smoke generated by fires in OU3, both during simulated burns and during an authentic wildfire, result in RME non-cancer HQs less than 0.1.

7.1.5 Summary of Cumulative Human Health Risks

7.1.5.1 Basic Approach

The calculation of cumulative risks is complicated by the fact that the exposure pattern of each individual at the Site may be unique. However, EPA does not typically perform risk calculations for specific individuals but rather for generic classes of receptor populations with common exposure patterns. Thus, the goal of the cumulative risk assessment is to illustrate how risk depends on different types of disturbance activities, LA levels in the source media, and exposure locations.

Cumulative risk from asbestos is expressed as the sum of all the cancer risks or non-cancer HQs from various types of asbestos exposure pathways. Exposure-specific TWF values for use in the cumulative assessment were selected by specifying the fraction of the lifetime spent engaging in each exposure scenario, taking care to ensure that the cumulative TWF is equal to 1.0. This approach is illustrated in Figure 7-2.

7.1.5.2 Cumulative Risk Examples

There are essentially an infinite number of possible exposure scenario combinations that could be evaluated in the cumulative risk assessment for the Site. The choice of which combinations to evaluate is a matter of professional judgment. For the purposes of this risk assessment, several alternate cumulative exposure scenario combinations were evaluated, representing a wide range of potential cumulative risks. These examples help to identify which exposure scenarios tend to have the largest contribution to cumulative risk.

Figure 7-3 presents a graphical illustration of the cumulative assessment for one example receptor scenario. In this figure, the upper panel illustrates the fraction of time that each exposure pathway contributes to the total lifetime (i.e., a 70-year lifetime). The lower panel illustrates the contribution of each exposure pathway to the cumulative HI. The table below the figures provides a tabular presentation of the information shown in the two figures. (Note: This figure only presents cumulative HIs as the non-cancer endpoint appears to be the more sensitive metric of potential risk.)

In reviewing the cumulative exposure scenarios, several general observations can be made:

- Cumulative HI estimates were less than 1 when exposures occurred at properties and locations with lower levels of LA. However, cumulative HI estimates were greater than 1 when exposures occurred at properties and locations with higher levels of LA.

- Exposure pathways that contributed the most time to the total lifetime exposure do not necessarily contribute most to the cumulative HI. In some cases, exposure pathways that contribute little to the total lifetime exposure time can contribute significantly to the cumulative HI. For example, in Figure 7-3, exposures to LA in outdoor air during disturbances of yard soil (exposure scenario "D") contribute about 3 percent to the total lifetime exposure time but about 14 percent to the cumulative HI.

- When cumulative exposure includes exposure pathways that actively disturb LA-contaminated source media (e.g., disturbing soils with detected LA, performing timber skidding operations near the mine site, or disturbing VI during tradesperson activities), these pathways are important risk drivers for cumulative HI estimates.

- It is possible to reduce cumulative exposures and risks, without altering activity behavior patterns, by lowering LA levels in source media where disturbance activities are performed (e.g., removing yard soil with LA) (Figure 7-4) and/or by changing the locations where the activities are performed (e.g., collecting firewood or performing logging in areas further from the mine site) (Figure 7-5).

- As illustrated in Figure 7-6, it is not necessary to address every single exposure pathway to significantly lower cumulative risk. Addressing exposures for a small subset of the potential exposure pathways and focusing on risk drivers will have the greatest impact in lowering cumulative exposures and risks.

- It is possible for individual exposure pathway HQs to be less than 1 but the cumulative HI across all exposure pathways to be greater than 1. Thus, risk managers should consider both cumulative risks and individual exposure pathway risks to identify potential risk drivers to guide decisions on future remedial levels and/or ICs.

7.1.5.3 Uncertainty Assessment

As with all HHRAs, uncertainties exist due to limitations in the exposure and toxicity assessments and our ability to accurately determine cumulative exposure and risk from multiple sources over a lifetime. The HHRA used the best available science to evaluate potential human health exposures and risks from LA at the Site; however, there are a number of sources of uncertainty that affect the risk estimates that must be considered when making risk management decisions. The most important of these uncertainties are listed below.

- Uncertainty in true long-term average LA concentrations in air

- Uncertainty in the EPC due to non-detects

- Uncertainty due to air filter preparation methods

- Uncertainty due to analytical methods
- Uncertainty due to field collection methods
- Uncertainty in human exposure patterns
- Uncertainty in toxicity values used in risk characterization
- Uncertainty in the cumulative risk estimates

Because of these uncertainties, the cancer risks and non-cancer HQs for individual exposure scenarios are uncertain, and consequently, all estimates of cumulative cancer risks and non-cancer HI values presented in the HHRA are also uncertain and should be considered to be approximate. Actual risks may be either higher or lower than estimated. Although there are some uncertainties and limitations associated with the conclusions for the Site as noted above, these uncertainties do not erode confidence in the overall findings.

7.2 ECOLOGICAL RISK

EPA performed a number of studies to investigate whether ecological receptors in OU3 (the former Libby Vermiculite Mine and surrounding areas) were adversely impacted by LA in the environment. These studies and their findings have been applied to the other OUs at the Site (defined herein as non-OU3 areas) because of similar ecological settings.

7.2.1 Conceptual Site Model

Figure 7-**7** presents the CSM for exposure scenarios of potential concern to each main ecological receptor group, including fish, benthic macroinvertebrates, amphibians, birds, mammals, terrestrial plants, and soil invertebrates. The following sections provide a more detailed discussion of the main elements of the CSM.

7.2.1.1 Potential Source of Contamination

Historic mining and milling activities at the mine site resulted in releases of asbestos fibers to air. Fibers released to air were carried downwind in air (mainly to the northeast), followed by deposition of the fibers to soil and water. Because creeks in the Libby and Troy areas are perennial streams and experience significant flow fluctuations during spring and following heavy precipitation events, many creeks have had riprap placed at various sections by the U.S. Army Corps of Engineers (USACE), Lincoln County, the City of Libby, and/or private land owners to control erosion (CDM Smith 2008b). Material used for the construction of riprap sections in the creeks included quarried argillite and siltstone from the Wallace Formation of the Precambrian Belt Group; quarried syenite from the Rainy Creek ultramafic complex; basalt; and concrete debris, tree stumps, and wood lagging. The syenite is exposed at the Vermiculite Mountain Mine, and riprap constructed with this material is thought to have originated at the mine. LA material in the form of biotite pyroxenite, magnetite pyroxenite, and LA are often found in the presence of the syenite (CDM Smith 2008b).

7.2.1.2 Migration Paths in the Environment

Asbestos that is present in soil may be carried in surface water runoff (e.g., from rain or snowmelt) into local creeks, resulting in contamination of waters and sediments in the creeks. Because the riprap material previously placed into the creeks has either been removed or coated with shotcrete, erosion of overbank material along the creeks is the main source of ongoing release of asbestos to the environment.

7.2.1.3 Potentially Exposed Ecological Receptors

Several ecological receptors are likely to occur at the Site that could be exposed to LA. However, it is generally not feasible or necessary to evaluate risks to each species individually. Rather, it is usually appropriate to group receptors with similar behaviors and exposure patterns and evaluate the risks to each group. For aquatic and semi-aquatic receptors, organisms are usually evaluated in three groups:

- Fish
- Benthic macroinvertebrates
- Amphibians (aquatic life stages)

Evaluation of risks to terrestrial receptors was not performed because the non-OU3 OUs were developed for human use and do not have habitat that would support significant terrestrial receptor populations. Potential risks to terrestrial receptors in forested areas that surround Libby and Troy, where there is habitat, were evaluated under the Site-wide BERA (SRC, Inc. and CDM Smith 2014).

7.2.1.4 Exposure Pathways of Concern

The primary exposure pathway of concern for fish is direct contact with asbestos fibers suspended in surface water. Fish may also be exposed to asbestos by incidental ingestion of sediment while feeding, ingestion of contaminated prey items, and direct contact with sediment. Incidental ingestion of sediment is likely to be a minor source of exposure, especially for fish (e.g., trout) that feed mainly in the water column. Likewise, ingestion of prey items is likely to be minor because asbestos is not expected to bioaccumulate in food web items. Direct dermal contact with sediment is also likely to be minor, at least for fish that reside mainly in the water column.

Benthic invertebrates that reside in the upper layer of stream sediment may be exposed to asbestos by direct contact with surface water. In addition, benthic organisms may be exposed by direct contact with fibers in sediment and/or sediment porewater and also by ingestion of fibers while feeding in the sediment. For this type of organism, distinguishing between direct contact and ingestion exposure is often not possible, so the pathways are often evaluated together.

Amphibians (e.g., frogs, toads) inhabit both aquatic and terrestrial (mainly riparian) environments, with early life stages being primarily aquatic and later life stages primarily terrestrial. In their early aquatic life stages, amphibians may be exposed to contaminants in surface water mainly by direct contact. They may also be exposed to contaminants in sediment by direct contact and incidental ingestion and to contaminants in aquatic prey items by ingestion.

7.2.2 Risk Characterization

- **Fish.** Risks to fish populations based on in situ early life stage toxicity testing, in situ lesions, and population surveys suggest that LA in surface water and porewater at OU3 is not causing adverse effects on resident trout. By extension, effects of LA on fish in tributaries at the Site are not of concern because concentrations of LA in Site waters are substantially lower than concentrations in OU3.

- **Benthic Macroinvertebrates.** Risks to benthic macroinvertebrate populations based on laboratory toxicity testing and population surveys suggest that LA in surface waters at OU3 is not causing adverse effects on benthic macroinvertebrates. By extension, effects of LA on benthic macroinvertebrates in tributaries at the Site are not of concern because concentrations of LA in Site sediments are substantially lower than concentrations in OU3.

- **Amphibians.** Risks to amphibian populations based on laboratory toxicity testing and in situ lesion studies suggest that LA in surface water and sediment at OU3 is not causing adverse effects on amphibians. By extension, effects of LA on amphibians in tributaries at the Site are not of concern, because concentrations of LA in Site surface water and sediment are substantially lower than concentrations in OU3.

7.2.3 Uncertainties

Quantitative evaluation of ecological risks is generally limited by uncertainty regarding a number of important data. This lack of knowledge is usually addressed by making estimates based on whatever limited data are available or by making assumptions based on professional judgment when no reliable data are available. Because of these assumptions and estimates, the results of the risk characterizations are themselves uncertain, and it is important to keep this in mind when interpreting the results of a risk assessment. The following text summarizes the key sources of uncertainty influencing the results of the Site-wide BERA.

- Representativeness of Samples Collected. Concentration levels of LA in environmental media can vary as a function of location and may also vary as a function of time. Thus, samples collected during a field sampling program may or may not fully characterize the spatial and temporal variability in actual concentration levels. At the Site, field samples were collected in accordance with SAPs/QAPPs that specifically sought to ensure that samples were representative of the range of conditions across each exposure area (e.g., surface water samples were collected during both high and low flow conditions). However, in some locations the number of samples collected was relatively small. Thus, without the collection of large numbers of samples over both space and time, some uncertainty remains as to whether the samples collected provide an accurate representation of the distribution of concentration values actually present. In addition, it was not possible to sample all bodies of water at the Site. Sampling did occur in creeks thought to have the greatest potential to have LA present due to previous efforts to stabilize the banks with riprap material and are representative of what the "worst case" scenario could be for the Site. Lastly, the fishing pond in OU5 was just recently filled in with water, making evaluation of future risks to aquatic receptors difficult. Because Libby Creek serves as the water source for the pond, samples collected from Libby Creek were used as surrogates for the pond. This introduces another level of uncertainty in that there is the potential for LA to settle in the pond and not have concentrations of LA equal to Libby Creek. Additionally, sediment data are not available for the fishing pond. However, sampling of the subsurface soil where the pond was dug indicates that LA was not present at the time of excavation. It could therefore be assumed that LA is not present in the sediment of the pond at levels observed in OU3 sediments.

- Uncertainties in Accuracy of Laboratory Analysis. Unlike traditional chemistry methods where analytical results are based solely on the output of a laboratory instrument, analytical results for asbestos are dependent upon subjective analyst interpretations. High data quality is ensured through use of laboratories and analysts well-trained in asbestos analysis and specifically trained in the analysis of LA. All analytical laboratories used are accredited by NIST NVLAP for the analysis of asbestos by TEM and/or PLM. This accreditation requires analysis of standard reference materials or other verified quantitative standards and two rounds of proficiency testing per year of bulk asbestos by PLM and airborne asbestos by TEM. Each laboratory is also required to pass an onsite EPA audit, participate in analytical discussions with other project laboratories, and meet site-specific data reporting requirements. Even with these QA measures in place, due to the subjective nature of the analyses, results can differ between analysts and laboratories. Because of this, the analytical QC program for the Site performs regular evaluations of variability in asbestos results.

- Uncertainties in Exposure Assessment. Exposure pathways selected for quantitative evaluation in the risk assessment did not include all potential exposure pathways for all ecological receptors. Exposure pathways that were not evaluated include inhalation of dust particles for amphibians and ingestion of prey items for fish, benthic macroinvertebrates, and amphibians. Omission of these pathways may tend to lead to an underestimation of total risk to the exposed receptors. However, these exposure pathways are likely to be minor compared to the pathways that were evaluated, and the magnitude of underestimation is not likely to be significant in most cases. However, the exclusion of some exposure pathways may tend to underestimate predicted risks in some cases.

- Uncertainties in Toxicity Assessment. Adverse effects in aquatic receptors resulting from exposure to asbestos have not been extensively studied, but several relevant reports were located related to the toxicity of chrysotile. No studies were located on the toxicity of LA to aquatic receptors. Because of this, the risk assessment relied heavily on studies performed at OU3 during the RI. This information is applicable due to the proximity of OU3 to the other OUs and the similar environmental conditions. Concentrations of LA measured in environmental media outside of OU3 are lower than concentrations in OU3, making it reasonable to draw the conclusion that ecological impacts due to LA exposures at the remainder of the Site would be lower than those observed at OU3. Confidence in the conclusions of the OU3-specific studies is generally medium to high, but there were specific uncertainties noted with each study. Despite these uncertainties, the conclusions from these studies are directly applicable to the remaining OUs because of the similarities in the exposure media, ecological receptors, and exposure pathways.

- Uncertainties in Risk Characterization. Assessment endpoints for the receptors at the Site are based on the sustainability of exposed populations, and risks to some individuals in a population may be acceptable if the population is expected to remain healthy and stable. However, even if it is possible to accurately characterize the distribution of risks or effects across the members of the exposed population, estimating the impact of those effects on the population is generally difficult and uncertain. The relationship between adverse effects on individuals and effects on the population is complex, depending on the demographic and life history characteristics of the receptor being considered as well as the nature, magnitude, and frequency of the stresses of LA and associated adverse effects. Thus, the actual risks that will lead to population-level adverse effects will vary from receptor to receptor.

Although there are some uncertainties and limitations associated with the conclusions for the Site as noted above, these uncertainties do not erode confidence in the overall finding that ecological receptors at the Site are unlikely to be adversely impacted by LA exposures.

7.2.4 Summary and Conclusions

For aquatic receptors, studies of fish, benthic macroinvertebrates, and amphibians exposed to LA in surface water, sediment, or porewater from OU3 revealed no evidence of unacceptable risks that were attributable to LA. Potential risks to terrestrial receptors in the forested areas were also evaluated under the Site-wide BERA. Based on a study of small mammals exposed to LA in soil and duff in an area of high LA contamination near the former Libby Vermiculite Mine, it was concluded that there was no evidence of effects attributable to LA. Additionally, an expert evaluation of the relative risk to avian receptors concluded that avian receptors were less likely to be negatively affected than small mammals.

Because concentrations of LA in environmental media in the habitats that surround Libby and Troy are similar to those in OU3, the risk conclusions drawn for aquatic and terrestrial wildlife receptors in the Site-wide BERA, that receptors are not exposed to unacceptable risk, would also apply to non-OU3 areas. Based on these findings, remedial approaches evaluated in the FS focused solely on human health risks from exposure to LA-contaminated media.

8.0 REMEDIAL ACTION OBJECTIVES AND REMEDIAL GOALS

8.1 REMEDIAL ACTION OBJECTIVES

RAOs are medium-specific and source-specific goals to be achieved through completion of a remedy that is protective of human health and the environment. These objectives are typically expressed in terms of the contaminant, the concentration of the contaminant, and the exposure routes and receptors. RAOs are typically developed by evaluating several sources of information, including results of the risk assessments and identified applicable or relevant and appropriate requirements (ARARs). These inputs are the basis for determining whether protection of human health and the environment is achieved for a particular remedial alternative.

RAOs and RGs are typically developed by evaluating several sources of information, including results of the risk assessments (i.e., the HHRA and Site-wide BERA) and tentatively identified ARARs. These inputs provide the basis for determination of whether protection of human health and the environment is achieved for a remedial alternative. A summary of the preliminary conclusions from the HHRA and Site-wide BERA process is provided in Section 7.

EPA considers current and reasonably anticipated future uses of the site when determining RAOs. As described in Section 6, the current and anticipated future land uses for the Site are an important consideration for the development of RAOs to ensure that remedial alternatives are protective of human health and the environment. The current and expected future land uses of the non-OU3 areas of the Site are residential/commercial, industrial, transportation corridors, and parks/schools.

Based on the HHRA and Site-wide BERA conclusions, the development of RAOs is exclusively focused on protection of human health. Section 5.4 identifies the affected media that pose human health risks; these are LA-contaminated soil (both surface and subsurface soils, as defined in Section 5.6.1) and LA-contaminated building materials.

The RAOs were developed to restrict or mitigate through management the continued release and migration of LA from contaminated soil and building materials, thus protecting human receptors across the non-OU3 areas of the Site from unacceptable exposure to LA. The RAOs include:

- Minimize the inhalation of LA during disturbances of soil contaminated with LA such that the resulting exposures result in cumulative cancer risks that are within or below EPA's acceptable risk range of 10^{-6} to 10^{-4} and cumulative non-cancer HIs that are at or below 1.

- Minimize the inhalation of LA during disturbances of building materials contaminated with LA such that the resulting exposures result in cumulative cancer risks that are within or below EPA's acceptable risk range of 10^{-6} to 10^{-4} and cumulative non-cancer HIs that are at or below 1.

Additional information concerning the basis and rationale for identification of contaminated media for inclusion or exclusion from the FS and development of related RAOs is provided in Appendix B.

8.2 RISK MANAGEMENT STRATEGY

A risk management strategy for remedial action has been developed based on the conclusions of the HHRA to provide adequate protection of human health from exposure to LA contamination within the non-OU3 areas of the Site. The focus of the risk management strategy is to target LA contamination sources that pose the greatest contributions to cumulative exposures. This can be achieved by physically mitigating exposure pathways, coupled with non-physical measures to inform people and/or prevent them from participating in activities that are important contributors to the cumulative LA exposures. A thorough discussion concerning development of the risk management strategy is presented in Appendix B.

For remedial alternatives to be successful in achieving adequate protection of human health, the contaminated media identified in the RAOs (soil and building materials) require comprehensive cleanups to mitigate the potential for LA exposures. These comprehensive cleanup approaches could include:

- Providing a barrier to LA exposure (i.e., access controls such as fencing or signage or containment)
- Relocating LA contamination to a protective location to prevent exposure (i.e., removal and disposal)
- Mitigating the toxicity, mobility, or volume of LA fibers that could be released to air from a contaminated source medium and result in exposure (i.e., treatment)

Cleanup, in combination with ICs and access controls, minimizes the potential for exposure to LA contamination that remains after the response actions. These active remedial approaches, used singularly or in combination for both contaminated media, could address the majority of the contributions to cumulative risks posed by LA exposures currently present at the non-OU3 areas of the Site.

ICs and access controls also play critical roles in the risk management strategy by minimizing the potential for exposure to LA contamination that remains after the response actions and protecting the integrity of the response actions. A combination of ICs, including legal controls and risk communication controls (e.g., community awareness activities) would inform and/or restrict humans from activities with higher exposure potential in the course of normal activities within the Site. In addition, the cleanup approaches for contaminated soils and building materials may also require ICs to protect any remedy components (e.g., covers or encapsulation) when LA contamination is left in place. ICs also will be used to require cleanup of LA contamination that is currently inaccessible but becomes accessible in the future and where the use of a property changes.

It is important to note that, although the majority of the cumulative cancer risks and non-cancer hazards from exposure to LA would be addressed through this risk management strategy approach, it is possible not all risks would be fully addressed. This could occur if:

- ICs for activities with higher exposure potential within the non-OU3 areas of the Site are ignored, which could result in excess cumulative cancer or non-cancer risks from exposure to LA contamination. Residual risks are effectively mitigated through management under the ICs, and following the ICs is necessary for the risk management strategy to be successful.

- Information regarding measures to reduce or eliminate exposures to LA from the OU3 study area are ignored and/or access controls such as fencing, gates, and signage within the OU3 study area are circumvented. The former Libby Vermiculite Mine, within the OU3 study area, has been largely unaddressed and is the source of LA contamination distributed throughout the Site. The remedial approach for OU3 is being evaluated and addressed on a separate timetable and thus is not addressed in this ROD. Thus, activities within the OU3 study area in areas identified through information provided or excluded by access controls may result in excess cumulative cancer or non-cancer risks from exposure to LA contamination.

If people adhere to the ICs established for the Site to mitigate these contributions to risk and the comprehensive cleanups are performed for both contaminated media, then adequate protection of human health from exposure to LA contamination can be achieved.

The assembly and identification of remedial alternatives for alternative screening in the FS incorporate various general response action approaches that when combined can potentially achieve protectiveness based on the conclusions of the risk management strategy. The basis and rationale used to develop the risk management strategy are discussed and illustrated graphically in Appendix B using a typical cumulative LA exposure scenario.

8.3 REMEDIAL GOALS AND CLEANUP CRITERIA

Remedial criteria are qualitative and quantitative thresholds used to determine if cleanups of source media are warranted to address exposures that pose unacceptable risks, and when those cleanups result in acceptable risk reduction. The remedial criteria typically identified during the FS and finalized in the ROD are remedial goals (RGs). The development of RGs is a requirement of the NCP (40 CFR § 300.430(e)(2)(i)). Identification and selection of the RGs are typically based on RAOs, the current and anticipated future land uses, and the identified ARARs. However, development of RGs for LA cannot be performed using conventional techniques, so factors related to technical limitations and uncertainty can be considered during RG development as indicated in 40 CFR § 300.430(e)(2)(i)(A)(3) and - (4). This subsection describes the remedial criteria that were established for use during remediation of LA contamination at the Site, and that when used in conjunction with ICs establish acceptable exposure levels that are protective of human health and the environment and thus meet the requirements of RGs stipulated in 40 CFR § 300.430(e)(2)(i).

RGs, or cleanup levels, are defined as the average concentration of a contaminant in an exposure area associated with a target risk level such that concentrations at or below the cleanup level do not pose an unacceptable risk. These values are typically used in the FS to guide evaluation of remedial alternatives. While it is possible to derive air-based cleanup levels for LA that correspond to an unacceptable risk level, these cleanup levels do not correlate directly to the source media concentration. For LA, the derivation of a source medium-based cleanup level is complicated by the fact that it is not possible to develop an empiric, quantitative relationship between the level of LA in a source medium (soil, building material) and the amount of LA that may be released when the source medium is disturbed. As such, much of the risk analysis and risk management information presented was based upon the results of ABS.

ABS techniques were used to evaluate potential exposures because the method and type of disturbance is the critical factor in creating an unacceptable exposure. The ABS approach demonstrated that a specific relationship between source media concentration and the airborne concentration due to a source medium being disturbed is not easily defined.

In lieu of cleanup levels, remedial actions at the Site are guided based on two types of remedial criteria – remedial action levels (RALs) and remedial clearance criteria. The RAL defines the condition when remedial action is and is not needed due to LA contamination in soil and building materials. For example, if surface soil conditions are below the RAL, no action is needed; if surface soil conditions are at or above the RAL, then action is warranted. The remedial clearance criteria define the conditions that must be met for the physical components or approaches of the remedial action to be deemed complete. When combined with ICs, the RALs and remedial clearance criteria satisfy the requirements of 40 CFR § 300.430(e)(2)(i). Specifics regarding the remedial criteria established for non-OU3 areas of the Site are discussed in Section 8.3.1, and the basis and rationale for selection of remedial criteria are discussed in Appendix B. RAOs are accomplished when these remedial criteria are achieved through active (i.e., physical) remedial components or approaches and combined with other overarching protective measures, such as ICs, to successfully implement the risk management strategy, as described in Section 8.1.

8.3.1 Identification and Role of Remedial Criteria to Achieve the Risk Management Strategy

In the absence of cleanup levels as discussed in Section 8.3, qualitative and quantitative remedial criteria have been developed as a surrogate for using direct quantitative measurements to assess acceptable reductions in cumulative exposure risks to LA contamination. These remedial criteria can be rapidly used during construction of remedies for contaminated soil and contaminated building materials to make a reasonable determination that LA contamination posing unacceptable human health risks is identified for remediation and successfully mitigated in the context of the risk management strategy. These remedial criteria for the contaminated media (soil and building materials) include RALs and remedial clearance criteria, which guide the initiation and completion of physical remedy components for the non-OU3 areas of the Site. The following factors considered in the development of the remedial criteria are discussed and defined in the memorandum included as Appendix B; the sections or subsections of that memorandum are noted below:

- Identification of contaminated media (i.e., contaminated soil and contaminated building materials)- Section 6.1.1
- Land use categories- Section 5.0
- Surface and subsurface contaminated soil- Section 6.1.1
- Frequently and infrequently used areas of contaminated soil- Section 5.1
- Accessibility of contaminated building materials- Section 6.1.2
- Identification of boundary conditions affecting cleanup of contaminated media- Section 6.1.3

RALs for contaminated media are site-specific criteria used to determine whether a remedial action at a particular property or location using physical remedy components or approaches would be required due to LA contamination in soil and building materials. RALs were developed separately for each contaminated source medium (i.e., soil and building materials) due to differences in the matrix containing the LA contamination. Furthermore, the RALs for contaminated soil were developed separately for each of the land use categories as discussed in Section 4.2. Specifics regarding the basis and rationale of RAL development for contaminated soil and contaminated building materials are discussed in Section 6.2 of Appendix B.

The remedial clearance criteria are site-specific criteria used to determine when the physical remedy component or approach used in a cleanup action at a particular property or location would be considered complete in the context of the risk management strategy. In contrast to RALs, which define conditions when remedial action should begin, remedial clearance criteria define conditions when the physical remedy component or approach can end. Comparison of analytical results to remedial clearance criteria would only occur once the specified physical remedy was implemented to the initial design limits (e.g., only once proper thicknesses of soil covers or backfill are placed, specified initial excavation depths of soil are reached, or encapsulation of accessible building materials is completed). Specifics regarding the basis and rationale of remedial clearance criteria development for contaminated soil and contaminated building materials are discussed in Section 6.2 of Appendix B.

Cleanup of properties with contaminated source media based on remedial clearance criteria, through a combination of physical remedial approaches and other overarching protective measures such as ICs, would achieve the established RAOs and thus successfully implement the risk management strategy. Thus, all viable remedial alternatives developed to physically address remediation of contaminated source media would have to meet the remedial criteria. It should be noted these remedial criteria are specific to the LA contamination conditions that must be achieved to provide protectiveness; however, there may be alternative methods of monitoring (e.g., inspection and/or sampling and analysis) that can be used to demonstrate they have been achieved as discussed in Section 9.

The following subsections present the remedial criteria for contaminated soil and contaminated building materials.

8.3.1.1 RALs for Contaminated Soil

Note: At the time of the preparation of the ROD, it was recognized there was a minor error in the Proposed Plan with regard to the interpretation of the LA concentrations that correspond to each PLM-VE "bin." In particular, when describing the RALs for contaminated soil, the Proposed Plan incorrectly interpreted Bin B2 as representing LA concentrations greater than 0.2 percent (the correct interpretation is greater than or equal to 0.2 percent). Similarly, the Proposed Plan incorrectly interpreted Bin B1 as representing LA concentrations less than or equal to 0.2 percent (the correct interpretation is less than 0.2 percent). Although this interpretation error does not alter any of the remedial decisions in the ROD, this minor discrepancy is noted here to avoid potential confusion. For ease of interpretation, the RALs presented below use the PLM-VE bin terminology and present the correct corresponding LA concentrations.

Residential/Commercial

The definitions of frequently used areas and infrequently used areas are provided in Section 4.2.1.

Frequently Used Areas

The RALs for addressing LA contamination in surface soil for frequently used areas at residential/commercial properties are as follows:

- LA soil concentrations of Bin B2 or Bin C by PLM-VE (i.e., LA present at levels greater than or equal to 0.2 percent) (regardless of spatial extent)

or

- LA soil concentrations of Bin B1 by PLM-VE (i.e., LA is present at levels less than 0.2 percent), if the spatial extent of the Bin B1 area is more than 25 percent of the total soil exposure area at a property

Infrequently Used Areas

The RAL for addressing LA contamination in surface soils for infrequently used areas at residential/commercial properties is as follows:

- LA soil concentrations of Bin B2 or Bin C by PLM-VE (i.e., LA present at levels greater than or equal to 0.2 percent)

Industrial

The RAL for addressing LA contamination in surface soil for industrial properties is as follows:

- LA soil concentrations of Bin C by PLM-VE (i.e., LA is present at levels greater than or equal to 1 percent)

Transportation Corridors

The RAL for addressing LA contamination in surface soil for transportation corridors is as follows:

- LA soil concentrations of Bin C by PLM-VE (i.e., LA is present at levels greater than or equal to 1 percent)

Parks/Schools

The RAL for addressing LA contamination in surface soil for park/school properties is as follows:

- LA soil concentrations of Bin B2 or Bin C by PLM-VE (i.e., LA present at levels greater than or equal to 0.2 percent)

8.3.1.2 RALs for Contaminated Building Materials

The RALs for addressing contaminated building materials regardless of land use category is as follows:

- Presence of accessible LA-containing vermiculite insulation in any quantity in living spaces, non-living spaces, and/or secondary structures

  or

- Presence of accessible friable and/or deteriorated building materials containing greater than or equal to 0.25 percent LA by PLM-PC400 (e.g., chinking, plaster, mortar, and other materials on boilers, pipes, or other appurtenances)

Note: PLM-PC400 refers to a specific approach previously used at the Site to perform point counting using PLM (i.e. examining 400 points) and is not an EPA standard method.

8.3.1.3 Remedial Clearance Criteria for Contaminated Soil

Remedial Clearance Criteria for Surface Soil

The remedial clearance criterion is the inverse of the RALs for the respective land use categories. For example, the remedial clearance criterion for frequently used areas of contaminated soil at residential/commercial properties is that no Bin B2 or Bin C by PLM-VE can be present (i.e., no LA concentrations of 0.2 percent or greater can be present), no more than 25 percent of the total soil exposure area can be Bin B1 by PLM-VE, and the remainder of the total soil exposure area is Bin A (i.e., LA levels less than 0.2 percent are present in less than 25 percent of the area and the remainder of the area is non-detect for LA). The remedial clearance criterion for surface soil applies to both containment-focused and excavation-focused approaches.

Input from the property owner, if provided, will be considered on a location-specific basis for extent of excavation or cover or backfill placement within the “frequently used’ portions of a residential/commercial property to meet the Bin B1 component of the remedial clearance criterion for surface soil, so long as the minimum requirement of less than 25 percent is met for the remainder of the total soil exposure area.

Remedial Clearance Criteria for Subsurface Soil

The remedial clearance criterion for subsurface soil only applies to excavation-focused approaches. The criterion for residential/commercial and schools/parks is as follows:

- Confirmation soil samples collected at the depth of cut are Bin A or Bin B1 by PLM-VE (i.e., LA is not present or is present at levels less than 0.2 percent) unless boundary conditions are reached.

The subsurface soil remedial clearance criterion for industrial and transportation corridors is as follows:

- Confirmation soil samples collected at the depth of cut are Bin A, Bin B1, or Bin B2 by PLM-VE (i.e., LA is not present or is present at levels less than 1 percent) unless boundary conditions are reached.

Boundary conditions primarily pertain to response actions that attempt to remove LA contamination in soil or building materials. The concept of boundary conditions is important because cleanup of LA contamination within media that are not accessible (i.e., there is no complete exposure pathway) do not necessarily result in additional reduction in LA risks.

Boundary conditions are defined as features or conditions that limit the ability to further remediate LA contamination due to physical or technical constraints and the related lack of accessibility these boundary conditions present. Boundary conditions include the following:

- Presence of building foundations that could be compromised
- Presence of pavement that is relatively permanent (e.g., roadways, sidewalks, or other types of pavement difficult to remove and replace intact)
- Presence of large tree root systems
- Presence of bedrock
- Presence of groundwater that is not seasonal or perched and thus cannot be readily avoided
- A pre-set maximum vertical extent due to limited future accessibility in subsurface soils during residential and commercial activities (3 foot depth used during previous removal actions)

- A maximum horizontal extent to an adjacent property boundary where cleanup is likely to occur or where other physical barriers previously mentioned that constitute boundary conditions exist

- Other conditions or features determined during remedial design or remedial action that are identified as part of a formal adaptive management strategy process (discussed in Section 4.4)

8.3.1.4 Remedial Clearance Criteria for Contaminated Building Materials

Indoor Non-Living Space

The remedial clearance criteria are as follows:

- No accessible vermiculite remaining.

  and

- Five clearance air samples, collected following leaf blower disturbances in the non-living space after remedial actions are complete, have an average total LA air concentration less than 0.005 s/cc when analyzed by TEM using Asbestos Hazard Emergency Response Act (AHERA) counting rules (achieved analytical sensitivity of 0.005 per cubic centimeter of air [cc^{-1}]).

Indoor Living Space

The remedial clearance criteria are as follows:

- No accessible vermiculite remaining.

  and

- All five clearance air samples, collected following leaf blower disturbances in the living space after remedial actions are complete, have total LA air concentrations that are non-detect when analyzed by TEM using AHERA counting rules (achieved analytical sensitivity of 0.005 cc^{-1}).

9.0 DESCRIPTION OF ALTERNATIVES

This section describes the remedial alternatives as developed and evaluated in the FS, including a brief explanation of the alternatives developed for LA contamination in OUs 4, 5, 6, 7, and 8. It is organized into two subsections: common elements of alternatives and description of remedy components, distinguishing features, and expected outcomes for each alternative. The detailed evaluation and comparative analysis of alternatives described in this section is summarized in Section 10.

9.1 SUMMARY OF REMEDIAL TECHNOLOGY SCREENING

General response actions (GRAs), remedial technologies, and process options that were potentially useful to address the RAOs for contaminated source media (soil and building materials) were identified and screened in accordance with the NCP. The purpose of this identification and screening process was to retain representative technologies and process options that can be assembled into remedial alternatives. The GRAs identified to address contaminated soil and contaminated building materials included the following:

- No action/no further action
- ICs
- Relocation
- Removal, transport, and disposal
- Monitoring
- Access controls
- Containment
- Treatment

Remedial technologies and process options were identified for each of the GRAs and broadly evaluated using a two-step screening process. The first screening step evaluated overall technical implementability and suitability of the technology for treatment of contaminated soil and contaminated building materials. Remedial technologies and process options that were retained from the first step were further evaluated for effectiveness, implementability, and relative cost.

The first screening step eliminated the specific process options listed below because of their lack of identified or demonstrated effectiveness or compatibility with the mine materials.

Contaminated Soil	Contaminated Building Materials
• Biological Treatment - Vermiprocess - Phytoremediation • Chemical and/or Physical Treatment - Chemical Digestion - Soil Washing - Soil Flushing • Thermal Treatment - Incineration (Ex Situ)	• Biological Treatment - Vermiprocess • Chemical and/or Physical Treatment - Pozzolan- or Cement-Based In Situ Stabilization/Solidification ▪ Chemical Digestion • Thermal Treatment - In Situ Vitrification - Incineration (Ex Situ)

The process options for all other GRAs as well as the remaining relevant treatment process options were retained for further screening. The second screening step further eliminated process options based on low effectiveness, low implementability, and/or high cost. These included the following specific process options:

Contaminated Soil

- Surface Source Controls
  - Negative Pressure Enclosures
  - In Situ Mixing
  - Geosynthetic Multi-Layer Exposure Barrier/Cover
- Transport
  - Hydraulic Transport (Slurry Pumping)
- Disposal
  - Subaqueous Disposal
- Chemical and/or Physical Treatment
  - Pozzolan- or Cement-Based Ex Situ Stabilization/Solidification
  - Pozzolan- or Cement-Based In Situ Stabilization/Solidification
  - Chemical Decomposition
- Thermal Treatment
  - In Situ Vitrification
  - Electric Arc Vitrification (Ex Situ)
  - Plasma Arc Vitrification (Ex Situ)
  - Thermo-Caustic Dissolution
  - Thermo-Chemical Treatment

Contaminated Building Materials

- Disposal
  - Subaqueous Disposal
- Chemical and/or Physical Treatment
  - Pozzolan- or Cement-Based Ex Situ Stabilization/Solidification
  - Physical Separation/Segregation
  - Size Reduction
  - Chemical Decomposition
- Thermal Treatment
  - Electric Arc Vitrification (Ex Situ)
  - Plasma Arc Vitrification (Ex Situ)
  - Thermo-Caustic Dissolution
  - Thermo-Chemical Treatment

The remedial technologies and process options retained after the two-step screening process and indicated in Exhibit 9-1a and Exhibit 9-1b were used to assemble remedial alternatives that could comprehensively address human health and ecological risks posed by contaminated soil and contaminated building materials.

Exhibit 9-1a. Retained General Response Actions, Remedial Technologies, and Process Options Used to Develop Remedial Alternatives for Contaminated Soils

General Response Action	Remedial Technology	Process Option
Monitoring	Inspection	• Non-Intrusive Visual Inspection (i.e., surficial inspection) • Intrusive Visual Inspection (i.e., inspection using excavations or boreholes)
	Sampling and Analysis	• Sample Collection and Microscopic Analysis
Institutional Controls	Institutional controls (specific to Legal Controls)	• Governmental Controls, Proprietary Controls, and Informational Devices
	Institutional controls (specific to Risk Communication Controls)	• Informational and Educational Programs • Notification Programs
Access Controls	Access Restrictions	• Fencing and/or Posted Warnings
Relocation	Temporary Relocation	• Temporary Relocation of Residents
	Permanent Relocation	• Permanent Relocation of Residents
Containment	Surface Source Controls	• Water-Based Suppression • Chemical-Based Suppression • Soil or Rock Exposure Barrier/Cover • Asphalt or Concrete Exposure Barrier/Cover
Removal, Transport, Disposal	Removal	• Mechanical Removal (Excavation) • Pneumatic Removal (Vacuum Extraction/Pumping)
	Transport	• Mechanical Transport (Hauling/Conveying) • Pneumatic Transport (Vacuum Truck/Pumping)
	Disposal	• Landfill Disposal • Mine Disposal

Exhibit 9-1b. Retained General Response Actions, Remedial Technologies, and Process Options Used to Develop Remedial Alternatives for Contaminated Building Materials

General Response Action	Remedial Technology	Process Option
Monitoring	Inspection	• Non-Intrusive Visual Inspection (e.g., surficial inspection) • Intrusive Visual Inspection (e.g., inspection using excavations or boreholes)
	Sampling and Analysis	• Sample Collection and Microscopic Analysis
Institutional Controls	Institutional controls (specific to (Legal Controls)	• Governmental Controls, Proprietary Controls, and Informational Devices
	Institutional controls (specific to Risk Communication Controls)	• Informational and Educational Programs • Notification Programs
Access Controls	Access Restrictions	• Posted Warnings
Relocation	Temporary Relocation	• Temporary Relocation of Residents
	Permanent Relocation	• Permanent Relocation of Residents
Containment	Surface Source Controls	• Water-Based Suppression • Chemical-Based Suppression • Encapsulation • Negative Pressure Enclosures
Removal, Transport, Disposal	Removal	• Mechanical Removal • Pneumatic Removal (Vacuum Extraction/Pumping)
	Transport	• Mechanical Transport (Hauling/Conveying) • Pneumatic Transport (Vacuum Truck/Pumping)
	Disposal	• Landfill Disposal • Mine Disposal

9.2 REMEDIAL ALTERNATIVES IDENTIFICATION AND SCREENING

Remedial alternatives were assembled in the FS by combining the retained remedial technologies and process options from the technology screening process. Exhibits 9-2a and 9-2b provide a list of the major remedy components derived from retained remedial technologies and process options that were used to develop remedial alternatives for contaminated soil and contaminated building materials. Fundamental site assumptions and factors were also considered during development of the remedial alternatives.

Exhibit 9-2a. Remedy Components Used in Contaminated Soil Remedial Alternatives Retained for Detailed Analysis

Remedy Component Used	Remedial Alternative						
	SO1	SO2	SO3	SO4	SO5	SO6	SO7
Five-year site reviews and monitoring	●	●	●	●	●	●	
Institutional controls (legal controls and risk communication controls), and access restrictions		●	●	●	●	●	
Temporary relocation				●	●	●	●
Permanent relocation			●				
Surface source controls				●	●	●	●
Covering of contaminated soils				●	●	●	
Limited excavation[1] and disposal of contaminated soil					●		
Partial excavation[2] and disposal of contaminated soil						●	
Complete excavation[3] and disposal of contaminated soil							●

Shaded alternatives (SO2, SO3, SO4, and SO7) were eliminated from consideration prior to detailed analysis.
[1]Limited excavation involves excavating contaminated soil to facilitate a cover over contaminated soils that matches the existing grade. This would typically be the shallowest excavation.
[2]Partial excavation involves excavating contaminated soils that exceed RALs until the remedial clearance criteria or a boundary condition is met. This would generally be deeper than limited excavations.
[3]Complete excavation involves excavating contaminated soils that meet RALs until no contaminated soil remains at the property (i.e., no boundary conditions).

Exhibit 9-2b. Remedy Components Used in Contaminated Building Materials Remedial Alternatives Retained for Detailed Analysis

Remedy Component Used	Remedial Alternative					
	BM1	BM2	BM3	BM4	BM5	BM6
Five-year site reviews and monitoring	●	●	●	●	●	●
Institutional controls (legal controls and risk communication controls), and access restrictions		●	●	●	●	
Temporary relocation				●	●	●
Permanent relocation			●			
Surface source controls				●	●	●
Interior cleaning				●	●	●
Encapsulation of accessible contaminated building materials				●	●	
Partial removal[1] and disposal of contaminated building materials					●	
Complete removal and disposal[2] of contaminated building materials						●

Shaded alternatives (BM2, BM3, and BM6) were eliminated from consideration prior to detailed analysis.
[1]Partial removal involves removing accessible contaminated building materials that exceed RALs. The remaining contaminated building materials would be encapsulated in place.
[2]Complete removal and disposal involves removing contaminated building materials that meet RALs.

The FS initially identified and screened seven alternatives for contaminated soil and six alternatives for contaminated building materials. Alternatives SO2, SO3, SO4, and SO7 and Alternatives BM2, BM3, and BM6 were eliminated and not retained for further evaluation.

Contaminated Soil

- Alternative SO2 (Institutional Controls, Access Controls, and Monitoring) was eliminated because of its low effectiveness as it would not be entirely effective at protecting human health and the environment. In addition, protectiveness may not be achieved in the context of the RAOs and the risk management strategy.

- Alternative SO3 (Permanent Relocation, Institutional Controls, Access Controls, and Monitoring) was eliminated because it had low effectiveness in that protectiveness in the context of the risk management strategy may not be achieved, and there would be short-term risks to the community, workers, and the environment due to permanent relocation of all residents and installation of access controls. Implementability would be difficult as some residents may not agree to be relocated and regulatory approval by the state and multiple agencies would be challenging to achieve. Costs for this alternative are significantly elevated when compared to other alternatives that could also achieve protectiveness.

- Alternative SO4 (Covering of Contaminated Soil, Institutional Controls, and Monitoring) was eliminated because long-term effectiveness and permanence is not as ensured, and due to the complexity of implementing cover construction without excavating to account for grade and structure elevation changes.

- Alternative SO7 (Complete Excavation of Contaminated Soil, Disposal of Excavated Soil at the former Libby Vermiculite Mine, Institutional Controls, and Monitoring) was eliminated due to the presence of additional short-term risks, the complexity of implementation, and excessive costs relative to the other screened alternatives.

Contaminated Building Materials

- Alternative BM2 (Institutional Controls, Access Controls, and Monitoring) was eliminated because of its low effectiveness, as it would not be entirely effective at protecting human health and the environment. In addition, protectiveness may not be achieved in the context of the RAOs and the risk management strategy.

- Alternative BM3 (Permanent Relocation, Institutional Controls, Access Controls, and Monitoring) was eliminated because it had low effectiveness in that protectiveness in the context of the risk management strategy may not be achieved, and there would be short-term risks to the community, workers, and the environment due to permanent relocation of all residents and installation of access controls. Implementability would be difficult as some residents may not agree to be relocated, and obtaining regulatory approval by the state and multiple agencies would be challenging. Costs for this alternative are significantly elevated when compared to other alternatives that could also achieve protectiveness.

- Alternative BM6 (Complete Removal of Contaminated Building Materials, Disposal of Removed Materials at an Existing Permitted Facility, Interior Cleaning, Institutional Controls, and Monitoring) was eliminated due to the presence of additional short-term risks, the complexity of implementation, and excessive costs relative to the other screened alternatives.

Further explanations of the screening determinations for Alternatives SO1 through SO7 and BM1 through BM6 can be found in the FS.

The remedial alternatives retained for detailed evaluation in the FS are described below:

Contaminated Soil

- Alternative SO1: No Action/No Further Action
- Alternative SO5: Covering of Contaminated Soil, Limited Excavation of Contaminated Soil to Facilitate Covering, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring
- Alternative SO6: Partial Excavation of Contaminated Soil, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring

Contaminated Building Materials

- Alternative BM1: No Action/No Further Action
- Alternative BM4: Encapsulation of Accessible Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring
- Alternative BM5: Partial Removal of Accessible Contaminated Building Materials, Disposal of Removed Materials at an Existing Permitted Facility, Encapsulation of Remaining Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring

9.3 DESCRIPTIONS OF REMEDIAL ALTERNATIVES

The following subsection gives a description of the remedy components included in remedial alternatives identified and analyzed within the FS.

Along with a description of remedy components for the alternatives, the following information is also provided:

- Estimated Costs (capital cost, O&M costs, periodic costs, present value cost)

Cost estimates are developed according to *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study* (EPA 2000b). Flexibility is incorporated in each alternative for the location of remedial facilities, the selection of cleanup levels, and the period in which remedial action will be completed. Assumptions of the project scope and duration are defined for each alternative to provide cost estimates for the various remedial alternatives. Important assumptions specific to each alternative are summarized in the description of the alternative. Additional assumptions are included in the detailed cost estimates in Appendix L of the FS.

The levels of detail employed in making these estimates are conceptual but are considered appropriate for making choices between alternatives; however, they are not meant to be design-level estimates used for budgeting purposes. The information provided in the cost estimate is based on the best available information regarding the anticipated scope of the remedial alternatives.

The costs are evaluated with respect to the following categories:

- Capital costs are expenditures that are required to construct a remedial action. They are exclusive of costs required to operate or maintain the action throughout its lifetime. Capital costs consist primarily of expenditures initially incurred to build or install the remedial action including initial implementation of ICs. Capital costs include all labor, equipment, and material costs (including contractor markups such as overhead and profit) associated with activities such as mobilization and demobilization, site work, installation of containment (cover) systems, and disposal facilities. Capital costs also include expenditures for professional and technical services necessary to support construction of the remedial action.

- Annual O&M costs are post-construction costs necessary to ensure or verify the continued effectiveness of a remedial action. These costs are estimated mostly on an annual basis. Annual O&M costs include all labor, equipment, and material costs (including contractor markups such as overhead and profit) associated with activities such as monitoring, operating and maintaining containment (cover) systems and disposal facilities, and continued operation of ICs. Annual O&M costs also include expenditures for professional and technical services necessary to support O&M activities.

- Periodic costs are costs that occur only once every few years (e.g., 5 year site reviews and equipment replacement) or expenditures that occur only once during the entire O&M period or remedial time frame (e.g., site closeout and remedy failure and replacement). These costs may be either capital or O&M costs, but because of their periodic nature, it is more practical to consider them separately from other capital or O&M costs in the estimating process.

- The present value cost of each alternative provides the basis for the cost comparison. The present value cost represents the amount of money that, if invested in the initial year of the remedial action at a given rate, would provide the funds required to make future payments to cover all costs associated with the remedial action over its planned life. Future O&M and periodic costs are included and discounted (reduced) by the appropriate present value discount rate over the period of analysis selected for each alternative. Per guidance, inflation and depreciation are not considered in preparing the present value costs.

Costs presented for these alternatives are expected to have an accuracy between -30 and +50 percent of actual costs, based on the scope presented. They are prepared solely to facilitate relative comparisons between alternatives for FS-level evaluation purposes.

- Estimate Construction Timeframe:

This is an estimate of construction timeframe for physical remedy components that is based on reasonable equipment availability and productivity in consecutive construction seasons. Other external factors that could affect timeframe, such as funding or weather delays, are excluded.

- Estimated Time to Achieve RAOs:

This is an estimate of when RAOs are achieved by remedy components to provide protectiveness. This timeframe does not necessarily coincide with construction timeframe since alternatives may have non-engineered remedy components such as ICs.

9.3.1 Contaminated Soil Alternatives

9.3.1.1 Alternative SO1: No Action/No Further Action

- Estimated capital cost: $ 0
- Estimated total O&M costs (first 30 years): $ 0
- Estimated total periodic costs (first 30 years): $ 1,518,000
- Estimated total present value cost: $ 550,000
- Estimated construction timeframe: None
- Estimated time to achieve RAOs: will never comply with RAOs

Alternative SO1 (No Action/No Further Action) is required by the NCP to provide an environmental baseline against which impacts of various other remedial alternatives can be compared. This alternative would leave removal action activities previously performed in their current conditions. No new removal and/or remedial activities would be initiated at the non-OU3 areas of the Site to address contaminated soil exceeding RALs or otherwise mitigate the associated risks to human health from exposure to LA.

As required by the NCP, 5 year site reviews would be performed to evaluate whether adequate protection of human health and the environment is provided because contaminated soil would remain that, if disturbed, could cause LA concentrations within air to pose unacceptable cancer and non-cancer risks and thus prevent unrestricted use of the non-OU3 areas of the Site. Non-OU3 areas of the Site monitoring (consisting solely of non-intrusive visual inspections) also would be conducted only as necessary to complete the 5 year site reviews. Alternative SO1 would leave removal action activities previously performed in their current conditions. No new removal or remedial action activities would be initiated at the non-OU3 areas of the Site to address contaminated soil exceeding RALs or otherwise mitigate the associated risks to human health from exposure to LA from disturbance of contaminated soils.

Summary of Major Remedial Components and Associated Quantities for Alternative SO1: None (no further action taken)

Key ARARs:

- National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Asbestos (40CFR 61, Subpart M) established under the federal Clean Air Act (CAA)

- CAA of Montana (Montana Code Annotated [MCA] 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.3.1.2 Alternative SO5: Covering of Contaminated Soil, Limited Excavation of Contaminated Soil to Facilitate Covering, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring

- Estimated capital cost: $ 29,776,000
- Estimated total O&M costs (first 30 years): $ 13,560,000
- Estimated total periodic costs (first 30 years): $ 1,686,000
- Estimated total present value cost: $ 35,990,000
- Estimated construction timeframe: 3 years
- Estimated time to achieve RAOs: upon completion of remedial action

Alternative SO5 provides protection of human health in the context of the risk management strategy through in-place containment (covering) of contaminated soil exceeding RALs along with limited excavation to a depth so as to facilitate the installation of covers at existing grades. Covers would be installed at locations with contaminated soil exceeding RALs to meet the established remedial clearance criteria as demonstrated through monitoring (consisting of intrusive visual inspections and sample collection with analysis). Covers would break the exposure pathway to human receptors and achieve RAOs when combined with ICs.

Limited excavation of contaminated soil would be conducted to adjust site grading and provide suitable surface for the application of cover materials. Typically, this approach would include excavation of contaminated soil to a depth the same as the thickness of the soil cover to be installed, but would not be intended to achieve remedial clearance criteria for subsurface soil. This approach in some cases would require tree and structure protection to safely excavate limited quantities of contaminated soil. Mechanical excavation is assumed to be conducted in most situations, but pneumatic excavation could be considered during construction for some specific applications where accessibility to contaminated soil using standard equipment is difficult. Excavated contaminated soil was assumed to be transported and placed within the former Libby Vermiculite Mine; however, some other waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill (referred to as the Lincoln County Landfill in the FS) could be used.

Covers over contaminated soil would be constructed to the extent practicable. However, it may not be possible to construct covers over contaminated soil directly adjacent to obstructions such as homes or structures, trees, subsurface utilities, and roads. An alternative approach to the conventional cover (such as another exposure barrier material) that adjoins the conventional cover is assumed to address the obstruction situation when coupled with ICs. The obstructions causing the change in covering approach (e.g., buildings, pavement) are assumed to be maintained in-place and thus provide an exposure barrier to the contaminated soil beneath it. The thickness of the covers would be designed in accordance with ARARs to keep LA fibers in soil from migrating to the surface in the future and eliminate exposure to LA concentrations in contaminated soil exceeding RALs.

Covers used for in-place covering of contaminated soil would be constructed from designated borrow soil transported from offsite borrow sources outside of the Libby Valley. These sources would be tested to determine that LA contamination exceeding remedial clearance criteria is not present as well as exclude importation of other types of contaminants that may exist within borrow sources but are not currently present at the non-OU3 areas of the Site. The covers would be revegetated or otherwise restored to match the surface conditions that previously existed at the affected property. Rock, concrete, and asphalt are also viable cover materials that could be used at some locations depending on current and future land uses. These assumptions would be refined at the time of remedial design.

Dust suppression would be maintained to mitigate contaminant migration during implementation of this alternative. Water-based dust suppression is assumed to be conducted in most situations, but chemical-based dust suppression could be considered during construction for some specific applications like haul road maintenance. During implementation of this alternative residents would be relocated temporarily, and businesses would be closed temporarily to minimize exposure risks to LA contamination as cleanup at affected properties occurs.

ICs involve administrative and legal measures (i.e., legal controls) and/or informational measures (e.g., risk communication controls) intended to protect the primary remedy (covers), as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA in contaminated soil exceeding RALs. These controls would be implemented as needed to maintain integrity of covered areas, as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide the public with risk communication tools to enhance awareness of potential hazards and the remedy for the non-OU3 areas of the Site. Access controls such as fencing and posted warnings would not be required under this alternative since an active remedy is undertaken to address contaminated soil exceeding RALs.

ICs would be evaluated and updated if necessary to ensure protectiveness. For instance, an IC implementation program could continue and be updated as necessary to enhance risk communication of potential hazards and the remedies for contaminated soil implemented in this alternative (e.g., legal controls, access controls, and monitoring). Notification programs such as “UDIG” would continue to be updated to inform the community of potential hazards from disturbance of contaminated soil at specific locations.

Post-construction monitoring and maintenance specific to this alternative would consist of inspection and repair as necessary to covers in public use areas to maintain their integrity. Maintenance would only occur during 5 year site review periods unless disturbances of contaminated soil have occurred that would necessitate changes to maintenance frequency.

Five-year site reviews would be performed because LA concentrations within contaminated soil would continue to exceed RALs, preventing unrestricted use of the non-OU3 areas of the Site. Non-intrusive visual inspections (e.g., surface inspections) and sample collection with analysis would be performed outside of areas addressed through covering in support of the 5 year site reviews.

Exhibit 9-3. Summary of Major Remedial Components and Associated Quantities for Alternative SO5

Remedial Component	Unit	Estimated Quantity	
		Residential/ Commercial	Parks/Schools
Estimated number of properties requiring response action	EA	317	1
Estimated horizontal extent of contaminated soil	ACR	82	
Estimated volume of contaminated soil to be excavated	BCY	196,000	3,000
Estimated volume of common fill to be used in covers	ECY	130,000	2,000
Estimated volume of topsoil to be used in covers	ECY	59,000	900
Estimated volume of gravel backfill to be used in covers	ECY	7,000	100
Estimated number of remedial clearance criteria samples to be collected	EA	3,500	60

Notes: ACR = acres; BCY = bank cubic yards; ECY = embankment cubic yards; EA = each

Key ARARs:

- NESHAPs for Asbestos (40CFR 61, Subpart M) established under the federal CAA
- CAA of Montana (MCA 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.3.1.3 Alternative SO6: Partial Excavation of Contaminated Soil, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring

- Estimated capital cost: $ 47,572,000
- Estimated total O&M costs (first 30 years): $ 13,560,000
- Estimated total periodic costs (first 30 years): $ 1,686,000
- Estimated total present value cost: $ 53,790,000
- Estimated construction timeframe: 4 years
- Estimated time to achieve RAOs: upon completion of remedial action

Alternative SO6 provides protection of human health in the context of the risk management strategy through partial excavation and disposal of contaminated soil exceeding RALs to the degree practical (partial excavation in this context means not all contaminated soils is excavated given horizontal and vertical conditions that complicate excavation) with placement of delineation marker barriers and uncontaminated backfill over remaining contaminated soil to meet the established remedial clearance criteria for both surface soil and subsurface soil as demonstrated through monitoring (consisting of intrusive visual inspections and sample collection with analysis). The backfill placed in excavations would break the exposure pathway to human receptors from any remaining contaminated soil and achieve RAOs when combined with ICs.

Excavation of contaminated soil would be conducted at locations that exceed RALs. Excavation of contaminated soil would be conducted until the established remedial clearance criteria for surface soil and subsurface soil are met as established through monitoring (consisting of intrusive visual inspections and sample collection with analysis). However, those remedial clearance criteria were developed with inherent vertical and horizontal boundary conditions that do not require complete removal of contaminated soil to avoid technical issues and limitations. These conditions include structure foundations, utilities, tree root systems, groundwater, deep contaminated soils, and property boundaries beyond which additional excavation is not warranted to provide protectiveness in conjunction with ICs. Thus, under this alternative, some contaminated soil could remain in place at those boundary conditions. Surface boundary conditions limiting excavation (e.g., buildings) are assumed to be maintained in-place and thus provide an exposure barrier to the contaminated soil beneath them. A delineation marker barrier would be placed in excavations as needed to indicate where contaminated soil is left in place. Mechanical excavation is assumed to be conducted in most situations, but pneumatic excavation could be considered during construction for some specific applications where accessibility to contaminated soil using standard equipment is difficult. This approach could also require tree, structure, and utility protection measures to safely excavate contaminated soil. Excavated contaminated soil was assumed to be transported and placed within the former Libby Vermiculite Mine; however, some other waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill could be used.

Designated borrow soil would be used to backfill and regrade excavation areas in accordance with ARARs. Soil used to backfill excavation areas would be transported from offsite borrow sources outside of the Libby Valley, tested to determine that LA contamination exceeding remedial clearance criteria is not present and to exclude importation of other types of contaminants that may exist within borrow sources but are not currently present at the non-OU3 areas of the Site. The backfill would be covered with topsoil and revegetated or otherwise restored to match the surface conditions that previously existed at the affected property. Rock, concrete, and asphalt that meet remedial criteria for LA contamination are also viable surface restoration materials that could be used at some locations depending on current and future land uses. These assumptions would be refined at the time of remedial design.

Dust suppression would be maintained to mitigate contaminant migration during implementation of this alternative. Water-based dust suppression is assumed to be conducted in most situations, but chemical-based dust suppression could be considered during construction for some specific applications like haul road maintenance. During implementation of this alternative, residents would be relocated temporarily and businesses would be closed temporarily to minimize exposure risks to LA contamination as cleanup at affected properties occurs.

ICs involve administrative, legal, and/or informational measures intended to protect the primary remedy (backfill over subsurface contamination), as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA in contaminated soil exceeding RALs. These controls would be implemented as needed to maintain integrity of backfill over delineation marker barriers, as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide the public with risk communication tools to enhance awareness of potential hazards and the remedy for non-OU3 areas. Access controls such as fencing and posted warnings would not be required under this alternative since an active remedy is undertaken to address contaminated soil exceeding RALs.

Post-construction monitoring and maintenance specific to this alternative would consist of inspection and repair as necessary to backfill over delineation marker barriers in public use areas to maintain their integrity. Monitoring and maintenance of ICs and access controls as well as 5 year site reviews would be performed as described for Alternative SO5.

Exhibit 9-4. Summary of Major Remedial Components and Associated Quantities for Alternative SO6

Remedial Component	Unit	Estimated Quantity	
		Residential/ Commercial	Parks/Schools
Estimated number of properties requiring response action	EA	3,135	1
Estimated horizontal extent of contaminated soil	ACR	1,124	
Estimated volume of contaminated soil to be excavated	BCY	391,000	7,000
Estimated volume of common fill to be used in backfill material	ECY	326,000	6,000
Estimated volume of topsoil to be used in backfill material	ECY	58,500	900
Estimated volume of gravel backfill to be used in covers	ECY	6,500	100
Estimated number of remedial clearance criteria samples to be collected	EA	3,500	60

Notes: ACR = acres; BCY = bank cubic yards; ECY = embankment cubic yards; EA = each

Key ARARs:

- NESHAPs for Asbestos (40CFR 61, Subpart M) established under the federal CAA
- CAA of Montana (MCA 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.3.2 Contaminated Building Material Alternatives

9.3.2.1 Alternative BM1: No Action/No Further Action

- Estimated capital cost: $ 0
- Estimated total O&M costs (first 30 years): $ 0
- Estimated total periodic costs (first 30 years): $ 918,000
- Estimated total present value cost: $ 330,000
- Estimated construction timeframe: None
- Estimated time to achieve RAOs: will never comply with RAOs

Alternative BM1 (No Action/No Further Action) is required by the NCP to provide an environmental baseline against which impacts of various other remedial alternatives can be compared. This alternative would leave removal action activities previously performed in their current conditions. No new removal and/or remedial activities would be initiated at the non-OU3 areas of the Site to address contaminated building materials or otherwise mitigate the associated risks to human health from exposure to LA.

As required by the NCP, 5 year site reviews would be performed to evaluate whether adequate protection of human health and the environment is provided because contaminated building materials would remain that, if disturbed, could cause LA concentrations within indoor air to pose unacceptable cancer and non-cancer risks and thus prevent unrestricted use of the non-OU3 areas of the Site. Site monitoring (consisting solely of non-intrusive visual inspections) would also be conducted only as necessary to complete the 5 year site reviews.

Summary of Major Remedial Components and Associated Quantities for Alternative BM1: None (no further action taken)

Key ARARs:

- NESHAPs for Asbestos (40CFR 61, Subpart M) established under the federal CAA
- CAA of Montana (MCA 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.3.2.2 Alternative BM4: Encapsulation of Accessible Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring

- Estimated capital cost: $ 4,240,000
- Estimated total O&M costs (first 30 years): $ 11,460,000
- Estimated total periodic costs (first 30 years): $ 1,080,000
- Estimated total present value cost: $ 9,370,000
- Estimated construction timeframe: 1 year
- Estimated time to achieve RAOs: upon completion of remedial action

Alternative BM4 provides protection of human health in the context of the risk management strategy through in-place containment (encapsulation) of contaminated building materials exceeding RALs in conjunction with interior cleaning and ICs. Encapsulation with interior cleaning would be performed at residential, commercial, and industrial structure locations with contaminated building materials exceeding RALs to meet the established remedial clearance criteria within indoor living and non-living spaces as demonstrated through monitoring (consisting of non-intrusive visual inspections and sample collection with analysis). Encapsulation with interior cleaning would break the exposure pathway to human receptors and achieve RAOs when combined with ICs.

Encapsulation would include in-place sealing and covering of accessible contaminated building materials with a high performance coating to prevent release of LA fibers into the indoor air of residential, commercial, and industrial structures. The encapsulant creates a membrane over the accessible LA surface or penetrates building materials that surround LA and binds its components together, resulting in those materials becoming inaccessible. The common method of applying an encapsulant is by brush, roller, or airless sprayer. The specific type of encapsulant selected for this alternative would be determined during remedial design.

Interior cleaning would be performed using vacuum extraction to remove LA fibers previously released within these structures. Negative pressure enclosures would be installed during encapsulation as needed to mitigate airborne transport of LA fibers outside of the enclosure. Encapsulation combined with interior cleaning would reduce exposure within indoor air to LA from disturbance of contaminated building materials.

Dust suppression would be maintained during encapsulation to mitigate LA contaminant migration during implementation of this alternative. Water-based dust suppression is assumed to be conducted in most situations, but chemical-based dust suppression could be considered during construction for some specific applications where use of water is problematic. During implementation of this alternative, residents would be relocated temporarily and businesses would be closed temporarily to minimize exposure risks to LA contamination as cleanup at affected properties occurs.

ICs involve administrative, legal, and/or informational measures intended to protect the primary remedy (encapsulation) as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA contamination posing unacceptable contributions to cumulative cancer and non-cancer risks from disturbance of contaminated building materials. These controls would be implemented as needed to maintain integrity of encapsulated areas, as well as restrict or prevent any activities or uses of the non-OU3 areas of the Site that could pose a risk to human receptors, and provide the public with risk communication tools to enhance awareness of potential hazards and the remedy for the non-OU3 areas of the Site. Access controls such as fencing and posted warnings would not be required under this alternative because an active remedy is undertaken to address contaminated building materials exceeding RALs.

Post-construction monitoring specific to this alternative would consist of inspection during 5 year site reviews at encapsulation locations in public use areas to observe their integrity. It is assumed maintenance of encapsulated areas would not be required if left undisturbed. Monitoring would only occur during 5 year site review periods unless disturbances of ICs and access controls have occurred that would necessitate changes to monitoring frequency.

Five-year site reviews would be performed because contaminated building materials would remain that, if disturbed, could cause LA concentrations within indoor air to pose unacceptable cancer and non-cancer risks and thus prevent unrestricted use of the non-OU3 areas of the Site. Monitoring (consisting of non-intrusive visual inspections and sample collection with analysis) would be performed outside of exclusion zones indicated by access controls during 5 year site reviews to demonstrate achievement of RAOs.

Exhibit 9-5. Summary of Major Remedial Components and Associated Quantities for Alternative BM4

Remedial Component	Unit	Estimated Quantity
Estimated number of properties requiring response action	EA	57
Estimated total accessible attic area requiring encapsulation	SF	68,000
Estimated time required to encapsulate other accessible LA contaminated building materials	HR	1,296
Estimated number of remedial clearance criteria samples to be collected	EA	57

Notes: HR = hours; EA = each, SF = square feet

Key ARARs:

- NESHAPs for Asbestos (40CFR 61, Subpart M) established under the federal CAA
- CAA of Montana (MCA 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.3.2.3 Alternative BM5: Partial Removal of Accessible Contaminated Building Materials, Disposal of Removed Materials at an Existing Permitted Facility, Encapsulation of Remaining Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring

- Estimated capital cost: $ 4,711,000
- Estimated total O&M costs (first 30 years): $ 11,460,000
- Estimated total periodic costs (first 30 years): $1,080,000
- Estimated total present value cost: $ 9,840,000
- Estimated construction timeframe: 1 year
- Estimated time to achieve RAOs: upon completion of remedial action

Alternative BM5 provides protection of human health in the context of the risk management strategy through partial removal and disposal of accessible contaminated building materials and encapsulation of remaining contaminated building materials exceeding RALs in conjunction with interior cleaning and ICs as described for Alternative BM4. Removal and disposal of contaminated building materials coupled with encapsulation and interior cleaning would be performed at residential, commercial, and industrial structure locations with contaminated building materials exceeding RALs to meet the established remedial clearance criteria within indoor living and non-living spaces as demonstrated through monitoring (consisting of intrusive visual inspections and sample collection with analysis). Removal and disposal of accessible contaminated building materials and encapsulation of remaining contaminated building materials would break the exposure pathway to human receptors and achieve RAOs when combined with ICs.

Contaminated building materials that are accessible would be removed using vacuum extraction or other mechanical means to minimize damage to the affected structure. Removed contaminated building materials would be transported and placed within a waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill. Portions of structures where contaminated building materials were removed would be reinsulated and restored as needed to a functional condition (but not necessarily to code).

Encapsulation would include in-place sealing and covering of contaminated building materials with a high performance coating to prevent release of LA fibers into the indoor air of residential, commercial, and industrial structures. Interior cleaning would be performed using vacuum extraction to remove LA fibers previously released within these structures. Negative pressure enclosures would be installed during removal and encapsulation as needed to mitigate airborne transport of LA fibers outside of the enclosure. Encapsulation combined with interior cleaning would reduce exposure within indoor air to LA concentrations exposing unacceptable contributions to cumulative cancer and non-cancer risks from disturbance of contaminated building materials.

Dust suppression would be maintained during encapsulation to mitigate LA contaminant migration during implementation of this alternative. Water-based dust suppression is assumed to be conducted in most situations, but chemical-based dust suppression could be considered during construction for some specific applications where use of water is problematic. During implementation of this alternative, residents would be relocated temporarily and businesses would be closed temporarily to minimize exposure risks to LA contamination as cleanup at affected properties occurs.

Post-construction monitoring specific to this alternative would consist of inspection during 5 year site reviews at encapsulation locations in public use areas to observe their integrity. It is assumed maintenance of encapsulated areas would not be required if left undisturbed. Monitoring and maintenance of ICs as well as 5 year site reviews would be performed as described for Alternative BM4.

Exhibit 9-6. Summary of Major Remedial Components and Associated Quantities for Alternative BM5

Remedial Component	Unit	Estimated Quantity
Estimated number of properties requiring response action	EA	57
Estimated total accessible attic area requiring removal and restoration	SF	68,000
Estimated volume of attic insulation to be removed and restored	BCY	3,200
Estimated time required to encapsulate other accessible LA contaminated building materials	HR	171
Estimated number of remedial clearance confirmation samples to be collected	EA	57

Notes: BCY = bank cubic yards; EA = each; HR = hour; SF = square feet

Key ARARs:

- NESHAPs for Asbestos (40CFR 61, Subpart M) established under the federal CAA
- CAA of Montana (MCA 75-2-101) and Asbestos Control Act (Section 75-2-501, et seq.)

9.4 COMMON ELEMENTS AND DISTINGUISHING FEATURES OF EACH REMEDIAL ALTERNATIVE

Common elements and distinguishing features in how contaminated soils under remedial Alternatives SO1, SO5, and SO6 and contaminated building materials under remedial Alternatives BM1, BM4, and BM6 are addressed are discussed below. These common elements and distinguishing features were derived from the retained remedial technologies and process options presented in Exhibit 9-1.

9.4.1 Contaminated Soil Alternatives

9.4.1.1 Excavation, Transport, and Disposal

Prior to excavation, site fixtures such as garden beds, sheds, or lawn ornaments would be removed and relocated during construction. Permanent site fixtures such as trees, structures, and utilities would require protection to safely excavate contaminated soil located adjacent to these fixtures. Contaminated soils would be excavated to varying degrees for alternatives. For Alternative SO5, the excavation depth of contaminated soil is assumed to be the same as the thickness of the cover, which is assumed to be 18 inches thick. In addition to the vertical and horizontal boundary conditions discussed for Alternative SO6 in Section 9.3.1.3, a pre-set maximum horizontal extent due to limited future accessibility during routine residential and commercial activities is used in current excavations at the non-OU3 areas of the Site conducted under the removal program. It is assumed this horizontal boundary condition will continue to be used, and the maximum depth will be 3 feet below ground surface. For both Alternatives SO5 and SO6, trucks with enclosed beds would be used to transport contaminated soil to the former Libby Vermiculite Mine or a waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill.

9.4.1.2 Covers, Backfill, and Restoration

Covers are used in Alternative SO5, whereas backfill is used in Alternative SO6. Alternative SO5 has only limited excavation, with the majority of contaminated soils being addressed through in-place covering where the cover thickness is assumed to be 18 inches thick. The backfill thickness in Alternative SO6 varies because contaminated soil is excavated until the established remedial clearance criteria for surface soil and subsurface soil are met, as established through monitoring, or the inherent vertical and horizontal boundary conditions are reached. The maximum depth of backfill will be 3 feet below ground surface based on the maximum depth of excavation for Alternative SO6.

It is anticipated many of the contaminated soil areas would have low intensity use (non-motorized or foot traffic) such as yards. Covers or backfill for these areas are assumed to be constructed of soil, with 6 inches of topsoil and the remaining cover or backfill constructed of common fill. It is anticipated a small portion of the contaminated soil areas would have high intensity use (motorized traffic) such as driveways or parking lots. Covers for these areas are assumed to be constructed of aggregate (gravel), with 6 inches of gravel and the remaining cover or backfill constructed of common fill.

The covers or backfill would be revegetated or otherwise restored to match the surface conditions that previously existed at the affected property. This may include placement of hydroseeding or erosion control devices such as silt fences, straw bales, and erosion control blankets. In some instances, additional landscaping may be required. Before placement of covers, a visibly distinct marker layer (such as orange construction fencing) would be placed at the bottom of the excavation to denote the extent of the covers constructed as part of the remedy. For backfill, a visibly distinct marker layer would only be placed at the bottom of the excavation if boundary conditions are met and contamination remains.

9.4.1.3 Access Controls

Access controls are engineered instruments that help reduce the potential for human exposure to LA contamination and/or protect the integrity of the selected remedy. Access controls play an important role in reducing unacceptable exposure risks to LA contamination in the context of the risk management strategy because they guide human behavior at the Site through physical barriers (fencing) and visual barriers (posted warnings). Access controls would be implemented during construction activities for both Alternatives SO5 and SO6 to warn of dangers or exclude access to areas being remediated.

Access controls generally would not be required post-construction for private property under this alternative because a physical remedy is undertaken to address contaminated surface soil exceeding RALs. However, access controls such as warning signs may be appropriate in public use areas where disturbance of covers could occur.

9.4.1.4 Monitoring and Maintenance

During construction, monitoring would be performed for both Alternatives SO5 and SO6. Borrow source testing would be conducted to determine if borrow source material is free of LA contamination exceeding RALs, as well as to exclude importation of other types of contaminants that may exist within borrow sources but are not currently present at the Site. Intrusive visual inspection and sampling and analysis of soil would be conducted to delineate the extent of contaminated surface soil that exceeds established RALs. In addition, Alternative SO6 would utilize excavation confirmatory sampling to determine if contaminated soils have been contained or removed to meet the established remedial clearance criteria for surface soil and subsurface soil. In addition to soil, both alternatives would use various types of air monitoring and sampling (perimeter, ambient, equipment, and personal) to monitor work practice and engineering controls and worker health.

Post-construction, Alternatives SO5 and SO6 would utilize non-intrusive visual inspection of soils to assess the integrity of the installed remedy during maintenance and monitoring of public use areas, with contaminated subsurface soil remaining below backfill, and during 5 year site review periods. Ambient air monitoring and sampling would be performed to assess the exposure risks from LA fibers in ambient air post construction activities.

9.4.1.5 Institutional Controls

During construction, ICs would be utilized for both Alternatives SO5 and SO6. Legal controls are used to minimize the potential for human exposure to contamination and/or protect the integrity of the installed remedy. Legal controls would consist of a combination of governmental controls, proprietary controls, and/or informational devices that would protect the primary remedy as well as restrict or prevent any activities or uses of the Site that could pose a risk to human receptors from potential exposure to LA. Risk communication controls give the public tools to gather information about site risks and the activities being performed to reduce exposure risks. Multiple tools such as, but not limited to, IC implementation programs like the "UDIG" notification program are assumed to be used to inform the community of potential hazards. These programs would continue to be updated as necessary to enhance community awareness of potential hazards, remedies for contaminated soil, and potential hazards from disturbance of contaminated soil at specific locations. Informed community members can be in a position to provide valuable information on possible ICs breaches that might otherwise go unnoticed.

Post-construction periodic review of legal controls is assumed to include site visits and review of aerial photos or other physical documentation to determine if there is any land or resource use inconsistent with the response. In addition, ICs would include reviewing updated title work to determine whether proprietary controls have been modified or terminated and evaluating the governmental control regulations (such as ordinances pertaining to zoning or permitting) for the Site to determine if there have been any changes. Routine and critical evaluation of the legal controls should determine whether the instrument remains in place and whether the legal controls are meeting the stated objectives and performance goals and providing the protection required by the remedy. Risk communication controls would continue to be utilized as described for the construction phase.

9.4.2 Building Materials Alternatives

9.4.2.1 Encapsulation

Encapsulation would be utilized for Alternatives BM4 and BM5. Typical accessible contaminated building materials include insulation in attics or openings such as outlets and light fixtures. The common method of applying an encapsulant is by brush, roller, or airless sprayer. Negative pressure enclosures would be installed during encapsulation as needed to mitigate airborne transport of LA fibers outside of the enclosure.

9.4.2.2 Interior Cleaning

Interior cleaning would be utilized for Alternatives BM4 and BM5. Interior cleaning would be performed using vacuum extraction to remove LA fibers previously released within these structures. Interior cleaning may be performed using hoses attached to vacuum trucks or handheld vacuums.

9.4.2.3 Removal and Restoration

As part of Alternative BM5, contaminated building materials that are accessible would be removed using pneumatic extraction or other mechanical means to minimize damage to the affected structure. In instances of pneumatic removal, contaminated building materials such as attic insulation would be vacuum-extracted using a vacuum truck. The removed material would then be transported in the vacuum trucks and placed within a waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill. It is assumed approximately 15 inches of fiberglass blown-in insulation with a rating of R-49 would be installed to replace insulation that was contaminated and removed to maintain functionality. Negative pressure enclosures would be installed during removal of accessible contaminated building materials as needed to reduce airborne transport of LA fibers outside of the enclosure.

9.4.2.4 Access Controls

Access controls are engineered instruments that help reduce the potential for human exposure to LA contamination and/or protect the integrity of the selected remedy. Access controls play an important role in reducing unacceptable exposure risks to LA contamination in the context of the risk management strategy because they guide human behavior at the Site through physical barriers (fencing) and visual barriers (posted warnings). Access controls would be implemented during construction activities for both Alternatives BM4 and BM5 to warn of dangers or exclude access to areas being remediated.

Access controls generally would not be required post-construction for private property under this alternative because an active remedy is undertaken to address contaminated building materials exceeding RALs, and other types of ICs would be implemented. However, access controls such as warning signs may be appropriate in public use areas where disturbance of contaminated building materials left in place could occur.

9.4.2.5 Monitoring and Maintenance

During construction, monitoring would be performed for both Alternatives BM4 and BM5. Non-intrusive visual inspection and sampling and analysis of building materials would be conducted to locate contaminated building materials within accessible areas. Intrusive visual inspection (meaning intrusive disturbance of the surface material to conduct inspection) and sampling and analysis of building materials would be conducted to locate contaminated building materials within inaccessible areas. It is an inspection tool for locating contaminated building material, primarily used for removal alternative BM5. In addition to building materials, both alternatives would use various types of air monitoring and sampling (indoor living space confirmatory, indoor non-living space confirmatory, equipment, and personal) to determine if interior LA contamination levels have been reduced to meet remedial clearance criteria established for indoor space and to monitor worker health.

Post-construction, Alternatives BM4 and BM5 would utilize non-intrusive visual inspection of building materials to assess the integrity of the installed remedy during maintenance and monitoring of public use areas with contaminated building materials encapsulated in place and during 5 year site review periods. Ambient air as well as indoor living space confirmatory and indoor non-living space confirmatory monitoring and sampling would be performed to assess the exposure risks from LA fibers in ambient air post construction activities and to determine if interior LA contamination levels have been reduced to meet remedial clearance criteria established for indoor space.

9.4.2.6 Institutional Controls

During construction, ICs would be utilized for both Alternatives BM4 and BM5. Legal controls are used to minimize the potential for human exposure to contamination and/or protect the integrity of the installed remedy. Legal controls would consist of a combination of governmental controls, proprietary controls, and/or informational devices that would protect the primary remedy as well as restrict or prevent any activities or uses of the Site that could pose a risk to human receptors from potential exposure to LA. Risk communication controls give the public tools to gather information about site risks and the activities being performed to reduce exposure risks. Multiple tools such as, but not limited to, the "UDIG" notification program are assumed to be used to inform the community of potential hazards. This program is assumed to continue to be updated as necessary to enhance community awareness of potential hazards, remedies for contaminated building materials, and potential hazards from disturbance of contaminated building materials. Informed community members can be in a position to provide valuable information on possible ICs breaches that might otherwise go unnoticed.

Post-construction periodic review of legal controls is assumed to include site visits and review of aerial photos or other physical documentation to determine if there is any land or resource use inconsistent with the response. Routine and critical evaluation of the ICs should determine whether the instrument remains in place and whether the ICs are meeting the stated objectives and performance goals and providing the protection required by the remedy. Risk communication controls would continue to be utilized as described for the construction phase.

9.5 EXPECTED OUTCOMES OF EACH ALTERNATIVE

Note: Since retained alternatives do not result in complete excavation or removal of contaminated media that could pose unacceptable risks if the remedy is disturbed, unlimited use and unrestricted exposure (UU/UE) to the remaining contaminated media would not be allowed.

9.5.1 Contaminated Soil

9.5.1.1 Alternative SO1: No Action/No Further Action

- Unlimited use and unrestricted exposure would not be allowed due to presence of contaminated soil exceeding RALs.
- LA fibers liberated in the air after disturbance potentially would represent an inhalation exposure risk to human receptors.

9.5.1.2 Alternative SO5: Covering of Contaminated Soil, Limited Excavation of Contaminated Soil to Facilitate Covering, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring

- All contaminated soils would be addressed in the context of the risk management strategy through in-place containment (covering) coupled with ICs as needed to inform the community of risks and restrict access and use of contaminated soil.

- Excavation of contaminated soil would be conducted at locations exceeding RALs to meet the established remedial clearance criteria for surface soil and would break the exposure pathway to human receptors through disposal of contaminated soil at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill.

- Covers over contaminated surface soil would be installed at locations exceeding RALs to meet the established remedial clearance criteria for surface soil and would break the exposure pathway to human receptors. Because covers do not physically address subsurface soil, the remedial clearance criteria for subsurface soil would not be met.

- The cover used for in-place containment could be breached, causing release and migration of LA fibers at the non-OU3 areas if disturbed. LA fibers liberated in the air after disturbance potentially would represent an inhalation exposure risk to human receptors.

- ICs would be implemented to protect the primary remedy (covers) as well as restrict any activities or uses of the non-OU3 areas, which could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA in contaminated subsurface soil exceeding remedial clearance criteria.

9.5.1.3 Alternative SO6: Partial Excavation of Contaminated Soil, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring

- All contaminated soils would be addressed in the context of the risk management strategy through partial excavation and disposal, to the degree practical, to meet remedial clearance criteria combined with ICs, as needed, to inform the community of risks and restrict access and use of remaining contaminated soil.

- Excavation of contaminated soil would be conducted at locations exceeding RALs to meet the established remedial clearance criteria for surface and subsurface soil and would break the exposure pathway to human receptors through disposal of contaminated soil at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill.

- Although remedial clearance criteria would be met, terminating excavation at boundary conditions would leave some contaminated soil in place. A delineation marker barrier would be placed in those locations to warn of potential exposure risks from disturbance of remaining contaminated subsurface soil.

- ICs would be implemented for all land use categories to protect the primary remedy as well as restrict any activities or uses of the non-OU3 areas, which could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA in contaminated subsurface soil exceeding remedial clearance criteria.

9.5.2 Building Materials

9.5.2.1 Alternative BM1: No Action/No Further Action

- Unlimited use and unrestricted exposure would not be allowed due to presence of contaminated building materials exceeding RALs.

- LA fibers liberated in the indoor air space after disturbance potentially would represent an inhalation exposure risk to human receptors.

9.5.2.2 Alternative BM4: Encapsulation of Accessible Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring

- All contaminated building materials would be addressed in the context of the risk management strategy through in-place containment (encapsulation) using high performance coatings coupled with interior cleaning and ICs as needed to inform the community of risks and restrict access and use of contaminated building materials.

- Contaminated building materials exceeding RALs would be left in place. Encapsulation materials would be installed at locations with accessible contaminated building materials exceeding RALs to break the exposure pathway to human receptors, thus meeting the established remedial clearance criteria for indoor living and non-living space.

- The high performance coating used for in-place encapsulation could be breached, causing release and migration of LA fibers to the indoor air of structures if disturbed. LA fibers liberated in the air after disturbance potentially would represent an inhalation exposure risk to human receptors.

- ICs would be implemented to protect the primary remedy (encapsulation) as well as restrict any activities or uses of the non-OU3 areas that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA fibers liberated in the air from disturbance of contaminated building materials.

9.5.2.3 Alternative BM5: Partial Removal of Accessible Contaminated Building Materials, Disposal of Removed Materials at an Existing Permitted Facility, Encapsulation of Remaining Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring

- All contaminated building materials would be addressed in the context of the risk management strategy through partial removal and disposal of accessible contaminated building materials and in-place containment (encapsulation) of remaining contaminated building materials using high performance coatings, coupled with interior cleaning and ICs as needed to inform the community of risks and restrict access and use of contaminated building materials.

- Removal of accessible contaminated building materials would be conducted at locations exceeding RALs to meet the established remedial clearance criteria for indoor living and non-living spaces and would break the exposure pathway to human receptors through disposal of contaminated building materials at an existing facility permitted for disposal of asbestos such as the Libby Class II Landfill.

- Encapsulation materials would be installed at locations with accessible contaminated building materials exceeding RALs that remain after removal to break the exposure pathway to human receptors, thus meeting the established remedial clearance criteria for indoor living and non-living space.

- The high performance coating used for in-place encapsulation could be breached, causing release and migration of LA fibers to the indoor air of structures if disturbed. LA fibers liberated in the air after disturbance potentially would represent an inhalation exposure risk to human receptors.

- ICs would be implemented to protect the primary remedy (encapsulation) as well as restrict any activities or uses of the non-OU3 areas that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA fibers liberated in the air from disturbance of contaminated building materials.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The FS evaluated the three retained remedial alternatives for contaminated soil and the three retained remedial alternatives for contaminated building materials against the two threshold criteria and five balancing criteria. The results of the detailed analysis for each remedial alternative for contaminated soil and contaminated building materials from the FS are presented in Exhibit 10-1. Presentation of this information aids in understanding a comparative analysis of the alternatives and identifying the key tradeoffs between them. A comparative analysis for the remedial alternatives using the threshold and balancing criteria has been put into narrative form in the following subsections. Only significant comparative differences between alternatives are presented; the full set of rationale for the qualitative ratings determined as part of detailed analysis for the alternatives is provided in Appendix K of the FS.

10.1 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR CONTAMINATED SOIL

10.1.1 Overall Protection of Human Health and the Environment

Of the three retained alternatives, only the no action/no further action alternative (i.e., Alternative SO1) would fail to provide protection for human health and the environment in the context of the risk management strategy and would not address the RAOs for contaminated soil. Thus, Alternative 1 was given a rating of “unacceptable.” Alternatives SO5 and SO6 were given a rating of “acceptable.”

Alternative SO5 achieves protectiveness and the RAOs primarily through in-place containment (covering) of contaminated soil as the predominant approach combined with ICs, as needed, to implement the risk management strategy. Limited excavation of contaminated soil would be conducted, as needed, to adjust site grading for the covers and provide suitable surfaces for the application of cover materials. Excavated contaminated soil would be transported and placed within the former Libby Vermiculite Mine (OU3) or a waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill. In-place containment using covers would provide a barrier that would break the exposure pathway to human receptors. However, contaminated soil potentially posing an unacceptable risk is left on site beneath covers and could pose inhalation exposure risk to human receptors if the covers were compromised. ICs would be implemented to protect the covers as well as restrict any activities or uses of the Site that could pose a risk to human receptors, and to provide awareness of risks from potential exposure to LA remaining in contaminated subsurface soils.

Alternative SO6 addresses protectiveness and the RAOs primarily through partial excavation and disposal of contaminated soil to the degree practical, given horizontal and vertical conditions that complicate excavation, combined with ICs, as needed, to implement the risk management strategy. Excavation and disposal of contaminated soil at the former Libby Vermiculite Mine or a waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill would break the exposure pathway to human receptors. Some contaminated soil would remain in place at the boundary conditions beneath backfill placed in excavations. Exposure to contaminated subsurface soil could pose inhalation exposure risk to human receptors if the backfill were compromised. ICs would be implemented to isolate contaminated subsurface soil beneath backfilled areas, as well as restrict any activities or uses of the Site that could pose a risk to human receptors, and to provide awareness of risks from potential exposure to LA in contaminated subsurface soil.

10.1.2 Compliance with ARARs

A list of ARARs is provided in Appendix C. Alternative SO1 fails to be compliant with the chemical-specific ARARs identified for the Site because no further action would be taken to address contaminated soil. Presence of unaddressed contaminated soil, when disturbed, may result in LA emissions in air that are not compliant with NESHAP. Thus, this alternative was given a rating of “unacceptable.”

In-place containment of contaminated soil using covers (Alternative SO5) or partial excavation and disposal of contaminated soil (Alternative SO6) would physically address contaminant sources and prevent discharges of LA fibers to air, thus, meeting visible and non-visible emission requirements of NESHAP and chemical-specific ARARs for air.

Location-specific ARARs for Alternatives SO5 and SO6 would be addressed during implementation of the remedial action. These primarily relate to work affecting threatened or endangered species, national historic preservation issues, and work performed within or adjacent to floodplains. If necessary, substantive requirements of the Montana Floodplain and Floodway Management Act and implementing regulations would be addressed on a location-specific basis through a variance process.

Action-specific ARARs for Alternatives SO5 and SO6 would be addressed during implementation of the remedial action. The activities under this alternative would be carried out in a manner that will comply with substantive requirements of the National Emission Standard for Asbestos under NESHAP. Contaminated soil would be excavated, transported, and disposed of in a manner that will comply with 40 CFR § 61.150 and 40 CFR § 61.151 and in accordance with Asbestos Control Administrative Rules of Montana (ARM) 17.74.369. Covering of the contaminated soil left in place and revegatation of the cover would be in compliance with this ARAR as allowed in 40 CFR § 61.151 and in accordance with Montana Strip and Underground Mining Reclamation Act ARM 17.24.631, ARM 17.24.703, ARM 17.24.713, ARM 17.24.714, ARM 17.24.716, and ARM 17.24.721, as appropriate. In addition, disposal of contaminated soil at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill would meet substantive requirements of the Solid Waste Management Act and implementing regulations, using a variance process if necessary.

Dust suppression would be maintained to mitigate contaminant migration during remedial action in compliance with these ARARs as allowed in ARM 17.8.204 and MCA 75-2-501 et seq. Particulate and dust levels would be controlled during remedial action in compliance with these ARARS as allowed in ARM 17.8.220, ARM 17.8.221, and ARM 17.8.223.

Because these alternatives can meet ARARs without a waiver per CERCLA Section 121(d)(4), they were given a rating of “acceptable.”

10.1.3 Long-Term Effectiveness and Permanence

Alternative SO1 fails to provide long-term effectiveness and permanence because no further action is taken. Thus, this alternative was given a rating of “none.”

Alternative SO5 provides long-term effectiveness and permanence primarily through in-place containment along with limited excavation to facilitate capping. Although limited excavation of contaminated soil is primarily meant to adjust site grading and provide suitable surface for application of cover materials, it may incidentally fully remove contaminated surface soil at some specific locations and result in additional long-term effectiveness and permanence. However, contaminated subsurface soil potentially posing a risk would still remain beneath the covers and could pose a risk if a cover were compromised. ICs are included in Alternative SO5 to protect the primary remedy (covers), restrict any activities or uses of the Site that could pose a risk to human receptors, and provide awareness of risk from potential exposure to LA in contaminated subsurface soil. However, effectiveness of ICs is uncertain as human receptors could simply ignore or not fully follow them. Due to these factors, long-term effectiveness and permanence for this alternative is not as certain as for alternatives that more fully excavate contaminated soil and dispose of them at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA. Thus, this alternative was given a rating of "moderate."

Alternative SO6 provides long-term effectiveness and permanence primarily through partial excavation and disposal of contaminated soil to the degree practical, given horizontal and vertical conditions that complicate excavation. Delineation marker barriers would be placed over areas of contaminated subsurface soil left in place at these boundary conditions, and uncontaminated backfill would be placed over the remaining contaminated subsurface soil. ICs such as legal controls and risk communication controls are needed to protect contaminated subsurface soil remaining under backfill, but to a lesser degree than alternatives that contain contaminated surface and subsurface soil under a cover. Because the majority of contaminated soil is excavated and disposed of at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA, long-term effectiveness and permanence is more certain than for alternatives that rely primarily on containment such as Alternative SO5. Thus, this alternative was given a rating of "moderate to high."

10.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

All of the retained alternatives fail to provide a reduction of toxicity, mobility, or volume through treatment since treatment is not a component of these alternatives. Thus, all of the retained alternatives were given a rating of "none."

10.1.5 Short-Term Effectiveness

Alternative SO1 fails to provide short-term effectiveness since no further action is taken. Thus, this alternative was given a rating of "none."

Alternative SO5 limits short-term risks to workers, the community, and the environment primarily through in-place containment of the majority of contaminated soil. ICs could be implemented quickly to address potential exposure risks to contaminated soil. Residents will be temporarily relocated and businesses would be temporarily closed during implementation of Alternative SO5 to enhance short-term effectiveness. Trucks used to haul materials for covers as well as for disposal of a limited volume of contaminated soil at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA, such as the Libby Class II Landfill, slightly increase short-term risks to the community. Transportation and placement of borrow soil have potential environmental impacts from equipment emissions and disturbance of borrow locations outside of the Libby Valley. Although limited excavation of contaminated soil and construction of covers would involve disturbance of contaminated surface soil, short-term risks to workers from inhalation of LA fibers would be mitigated through the use of safety measures such as personal protective equipment (PPE). Short-term risks to workers, the community, and the environment could be mitigated through measures such as dust suppression, establishment of work zones, and use of fuel efficient vehicles. Thus, Alternative SO5 was given a rating of "moderate to high."

There would be additional impact to workers and the community under Alternative SO6 as compared to Alternative SO5 because additional contaminated soil would be excavated, transported, and disposed of at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA. Backfilling of excavations also requires large volumes of offsite borrow, which poses additional risks to workers, the community, and the environment during transportation and placement and results in a slightly longer period of implementation. Thus, Alternative SO6 was given a rating of "moderate."

10.1.6 Implementability

Alternative SO1 has no further action taken other than 5 year site reviews and thus is easiest to implement. Since no new remedial action is taken, this alternative was given a rating of "high."

Alternative SO5 includes limited excavation of contaminated soil to facilitate covering, covering of remaining contaminated soil, and disposal of excavated soil at the former Libby Vermiculite Mine or other waste disposal facility authorized for disposal of LA such as the Libby Class II Landfill. Alternative SO6 includes excavation, transport, and disposal of larger volumes of contaminated soil at the former Libby Vermiculite Mine or waste disposal facility authorized for disposal of LA. Although the former Libby Vermiculite Mine and the Libby Class II Landfill have sufficient capacity and handling larger volumes of contaminated soil is feasible, Alternative SO6 results in longer construction periods and uses more construction equipment to complete than Alternative SO5, which makes logistical coordination more difficult. Longer construction periods for each property also result in longer durations of temporary relocation for affected residents and businesses.

Uncontaminated offsite borrow sources would need to be developed for Alternatives SO5 and SO6. Excavation of contaminated soil and cover construction (Alternative SO5) or placement of backfill (Alternative SO6) may be challenging at specific locations around homes or structures, trees, subsurface and above ground utilities, and roads. Temporary relocation of residents and temporary business closures will complicate work efforts and impact implementability. Inspection, monitoring, and maintenance of the cover system or backfilled areas, especially on privately owned parcels, could present difficulties in the future. However, monitoring previously has been implemented at the Site with available labor and technical resources.

ICs, particularly legal controls, may be difficult to implement and reliably operate, especially for occupied residential and commercial properties. Implementation of ICs is also dependent on the types of administrative and/or legal instruments proposed for the Site. Maintenance of ICs may be more difficult, especially for residential and commercial properties, since human receptors could ignore or not fully follow them and ownership in those land use categories is primarily private. Maintaining ICs would require agency coordination.

Overall, Alternative SO5 was given a rating of "moderate to high," and Alternative SO6 was given a rating of "moderate" for implementability.

10.1.7 Cost

Present value costs for all alternatives were evaluated over a 30-year period (Years 0 through 30).

The present value cost for Alternative SO1 was given a rating of "low." The present value cost for this alternative is approximately $550,000.

The present value cost for Alternative SO5 was given a rating of "moderate." The present value cost for this alternative is approximately $35,990,000.

The present value cost for Alternative SO6 was given a rating of "moderate to high." The present value cost for this alternative is approximately $53,790,000.

10.2 COMPARATIVE ANALYSIS OF ALTERNATIVES FOR BUILDING MATERIALS

10.2.1 Overall Protection of Human Health and the Environment

Of the three retained alternatives, only the no further action alternative (i.e., Alternative BM1) would fail to provide protection for human health and the environment in the context of the risk management strategy and would not address the RAOs for contaminated building materials. Thus, Alternative BM1 was given a rating of "unacceptable." Alternatives BM4 and BM5 were giving a rating of "acceptable."

Alternative BM4 achieves the RAOs primarily through in-place containment (encapsulation) of contaminated building materials using high-performance coatings coupled with interior cleaning and ICs, as needed, to implement the risk management strategy. Encapsulation combined with interior cleaning would mitigate exposure within indoor air to LA concentrations above RALs from disturbance of contaminated building materials. However, contaminated building materials above RALs would be left in place beneath the high performance coating and could pose LA inhalation exposure risks to human receptors if the encapsulation is breached. Also, it may not be possible to perform in-place encapsulation over all contaminated building materials, especially if the type or shape of the materials is unconventional, such as attic materials. ICs would be implemented to protect the encapsulation as well as restrict any activities or uses of the Site that could pose a risk to human receptors, and to provide awareness of risks from potential exposure to LA in contaminated building materials above RALs.

Alternative BM5 achieves the RAOs primarily through removal and disposal of accessible contaminated building materials and in-place containment (encapsulation) of remaining contaminated building materials, using high performance coatings, interior cleaning, and ICs, as needed, to implement the risk management strategy. Removal of accessible contaminated building materials would be conducted at locations exceeding RALs to meet the established remedial clearance criteria for indoor living and non-living spaces and would break the exposure pathway to human receptors through disposal of contaminated building materials at an existing facility permitted for disposal of asbestos such as the Libby Class II Landfill. Although remedial clearance criteria would be met, terminating removal based on accessibility would leave some contaminated building materials in place. Encapsulation would be performed to address the remaining building materials. ICs would be implemented to protect the encapsulation as well as restrict any activities or uses of the Site that could pose a risk to human receptors, and provide awareness of risks from potential exposure to LA in contaminated building materials above RALs.

10.2.2 Compliance with ARARs

A list of ARARs is provided in Appendix C. Alternative BM1 fails to be compliant with the chemical-specific ARARs identified for the Site because no further action would be taken to address contaminated building materials. Presence of unaddressed contaminated building materials, when disturbed, may result in LA emissions in air that are not compliant with NESHAP. Thus, this alternative was given a rating of "unacceptable."

In-place containment of contaminated building materials using encapsulation coupled with interior cleaning (Alternative BM4) or removal and disposal of accessible contaminated building materials and encapsulation of remaining building materials coupled with interior cleaning (Alternative BM5) would physically address contaminant sources and prevent discharges of LA fibers to air, thus meeting visible and non-visible emission requirements of NESHAP and chemical-specific ARARs for air.

Location-specific ARARs for Alternatives BM4 and BM5 would be addressed during implementation of the remedial action. These primarily relate to work affecting national historic preservation issues.

Action-specific ARARs for Alternatives BM4 and BM5 would be addressed during implementation of the remedial action. The activities under these alternatives would be carried out in a manner that will comply with substantive requirements of the National Emission Standard for Asbestos under NESHAP. The encapsulation requirements specified under NESHAP (40 CFR § 61.151) are a potential consideration as relevant and appropriate ARARs for the Site and would be in compliance with this ARAR as allowed in 40 CFR § 61.151 (c). During asbestos enclosure, encapsulation, or repair the substantive requirements of ARM 17.74.370, ARM 17.74.371, and ARM 17.74.372, respectively, would also need to be met. Air cleaning operations would be performed in a manner that complies with 40 CFR § 61.152. Reasonable precaution to control emissions of airborne particulate matter would be taken in accordance with MCA 75-2-101 ARM 17.8.308. Particulate and dust levels would be controlled to address ambient air quality ARARs. Emission of airborne particulate matter would be controlled to address airborne particulate matter ARARs. Dust suppression would be maintained to mitigate contaminant migration during remedial action in compliance with these ARARs as allowed in ARM 17.8.204 and MCA 75-2-501 et seq.

The removal, handling, and disposal of contaminated building materials generated during removal (Alternative BM5) would be in compliance with 40 CFR § 61.149 and 40 CFR § 61.150. Contaminated building materials would be excavated, transported, and disposed of in a manner that complies with 40 CFR § 61.150 and 40 CFR § 61.151 and in accordance with ARM 17.74.369. In addition, disposal of contaminated building materials at the Libby Class II Landfill would meet substantive requirements of the Solid Waste Management Act and implementing regulations.

Because these alternatives can meet ARARs without a waiver per CERCLA Section 121(d)(4), they were given a rating of "acceptable."

10.2.3 Long-Term Effectiveness and Permanence

Alternative BM1 fails to provide long-term effectiveness and permanence because no further action is taken. Thus, this alternative was given a rating of "none."

Alternative BM4 provides long-term effectiveness and permanence primarily through in-place encapsulation of contaminated building materials combined with interior cleaning. Long-term effectiveness and permanence is not entirely ensured since contaminated building materials potentially posing an LA exposure risk are left in place beneath the high performance coating. Also, it may not be possible to perform in-place encapsulation over all contaminated building materials, especially if the type or shape of the materials is unconventional. The high-performance coating used for in-place encapsulation could be breached by human receptors, causing release and migration of LA fibers to the indoor air of structures if disturbed. LA fibers liberated in the air after disturbance potentially would represent an inhalation exposure risk to human receptors. Interior cleaning would be performed to remove LA fibers previously released within these structures. ICs protect the primary remedy (encapsulant), restrict any activities or uses of the Site that could pose a risk to human receptors, and provide awareness of risk from potential exposure to LA in contaminated building materials exceeding RALs. However, effectiveness of ICs is uncertain as human receptors could simply ignore or not fully follow them. Due to these factors, long-term effectiveness and permanence for this alternative is not as certain as for alternatives that more fully remove accessible contaminated building materials and dispose of them at a facility authorized for the disposal of asbestos such as the Libby Class II Landfill. Thus, this alternative was given a rating of "low to moderate."

Long-term effectiveness and permanence for Alternative BM5 is not entirely ensured because inaccessible contaminated materials would remain encapsulated in place. However, removal of a larger quantity of accessible contaminated materials and disposal at a facility, such as the Libby Class II Landfill, coupled with encapsulation of remaining contaminated building materials and interior cleaning are reliable controls if not compromised. ICs, such as legal controls and risk communication controls, are needed to protect remaining inaccessible contaminated building materials but to a lesser degree than alternatives that leave the majority of contaminated building materials in place without removal and disposal. Because the majority of contaminated building materials are removed and disposed of properly at a facility authorized for disposal of asbestos, long-term effectiveness and permanence is more certain than alternatives that rely primarily on containment such as Alternative BM4. Thus, this alternative was given a rating of "moderate to high."

10.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

All of the retained alternatives fail to provide a reduction of toxicity, mobility, or volume through treatment because treatment is not a component of these alternatives. Thus, all of the retained alternatives were given a rating of "none."

10.2.5 Short-Term Effectiveness

Alternative BM1 fails to provide short-term effectiveness because no further action is taken. Thus, this alternative was given a rating of "none."

Alternative BM4 limits short-term risks to workers, the community, and the environment primarily through in-place containment of contaminated building materials. ICs could be quickly implemented to address potential exposure to contaminated building materials. Residents would be temporarily relocated and businesses would be temporarily closed during construction to enhance short-term effectiveness. Negative pressure enclosures would be installed to mitigate airborne transport of LA fibers and dust outside of the enclosure. Short-term risks posed to the community during implementation of the remedy relate to exposure to trespassers within the exclusion established within structures being remediated. Although disturbance of contaminated material could pose short-term risks to workers installing high-performance coating and performing interior cleaning from inhalation of LA fibers, exposure risks would be mitigated through the use of safety measures such as PPE and negative pressure enclosures. Short-term risks to workers, the community, and the environment could also be mitigated through measures such as dust suppression and establishment of work zones. Thus, Alternative BM4 was given a rating of "moderate to high."

There would be additional impact to workers, the community, and the environment under Alternative BM5 as compared to Alternative BM4 because accessible contaminated building materials would be removed, transported, and disposed of at the Libby Class II Landfill. While fuel-efficient vehicles could reduce some of the environmental impacts, trucks used to haul materials for disposal of contaminated building materials at Libby Class II Landfill slightly increase short-term risks to workers and the community, pose additional impacts to the environment from increased fuel use and engine emissions, and result in a slightly longer period of implementation. Thus, Alternative BM5 was given a rating of "moderate."

10.2.6 Implementability

Alternative BM1 has no further action taken other than 5 year site reviews. Because no new remedial action is taken, this alternative was given a rating of "high."

Alternative BM4 includes in-place containment of contaminated building materials and interior cleaning. Placement of high-performance coating used for in-place encapsulation is relatively straightforward and reliably operated in open spaces, such as an attic, but could be more difficult in small or constricted spaces within the residential, commercial, and industrial structures. It may not be possible to perform in-place encapsulation over all contaminated building materials, especially if the type or shape of the materials is unconventional such as attic insulation.

Alternative BM5 includes removal, transport, and disposal of accessible contaminated building materials at the Libby Class II Landfill as well as encapsulation of inaccessible contaminated building materials. Although the Libby Class II Landfill has sufficient capacity and handling larger volumes of contaminated building materials is feasible, Alternative BM5 results in slightly longer construction periods and uses more construction equipment to complete than Alternative BM4, which makes logistical coordination more difficult. Slightly longer construction periods for each property also result in longer durations of temporary relocation for affected residents and businesses. However, the majority of time spent to address contaminated building materials is during the establishment of work zones and protective measures, such as negative pressure enclosures, and thus logistical impacts are similar between Alternatives BM4 and BM5.

Inspection, monitoring, and maintenance of the encapsulants, especially on privately owned parcels, could provide difficulties in the future. However, monitoring has been implemented previously at the Site with available labor and technical resources.

ICs, particularly legal controls, may be difficult to implement and reliably operate, especially for occupied residential and commercial properties. Implementation of ICs is also dependent on the types of administrative and/or legal instruments proposed for the Site. Maintenance of ICs may be more difficult, especially for residential and commercial properties, since human receptors could ignore or not fully follow them and ownership in those land use categories is primarily private. Maintaining ICs would require agency coordination within state and local governments such as DEQ.

Overall, Alternatives BM4 and BM5 were both given a rating of “moderate” for implementability.

10.2.7 Cost

Present value costs for all alternatives were evaluated over a 30-year period after construction (Years 0 through 30).

The present value cost for Alternative BM1 was given a rating of “low.” The present value cost for this alternative is approximately $330,000.

The present value costs for Alternatives BM4 and BM5 were given a rating of “low to moderate.” The present value costs for these alternatives are approximately $9,370,000 and $9,840,000, respectively.

Exhibit 10-1. Summary of Comparative Analysis for Remedial Alternatives - Contaminated Soil and Contaminated Building Materials

		Threshold Criteria		Balancing Criteria					
Remedial Alternative	Description	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Present Value Cost (Dollars)	
Contaminated Soil Alternatives									
SO1	No Action/No Further Action	—	—	⓿	⓿	⓿	❺	$	$550,000
SO5	Covering of Contaminated Soil, Limited Excavation of Contaminated Soil to Facilitate Covering, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring	+	+	❸	⓿	❹	❹	$$$	$35,990,000
SO6	Partial Excavation of Contaminated Soil, Disposal of Excavated Soil at the Former Libby Vermiculite Mine, Institutional Controls, and Monitoring	+	+	❹	⓿	❸	❸	$$$$	$53,790,000
Contaminated Building Material Alternatives									
BM1	No Action/No Further Action	—	—	⓿	⓿	⓿	❺	$	$330,000
BM4	Encapsulation of Accessible Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring.	+	+	❷	⓿	❹	❸	$$	$9,370,000
BM5	Partial Removal of Accessible Contaminated Building Materials, Disposal of Removed Materials at an Existing Permitted Facility, Encapsulation of Remaining Contaminated Building Materials, Interior Cleaning, Institutional Controls, and Monitoring	+	+	❹	⓿	❸	❸	$$	$9,840,000

Notes:

1. The numerical designations for the qualitative ratings system used in this table are not used to quantitatively assess remedial alternatives (for instance, individual rankings for an alternative are not additive).
2. Detailed cost spreadsheets (cost summaries, present value analyses, and cost worksheets) for each alternative are presented in Appendix K of the Final FS.

Legend for Qualitative Ratings System:

Threshold Criteria

—	**Unacceptable**
+	**Acceptable**
+*	**Acceptable with ARAR Waiver(s)**

Balancing Criteria (Excluding Cost)

⓿	**None**
❶	**Low**
❷	**Low to Moderate**
❸	**Moderate**
❹	**Moderate to High**
❺	**High**

Balancing Criteria (Present Value Cost in Dollars)

⓿	**None**
$	**Low ($0 through $1M)**
$$	**Low to Moderate ($1M through $10M)**
$$$	**Moderate ($10M through $50M)**
$$$$	**Moderate to High ($50M through $100M)**
$$$$$	**High (> $100M)**

10.3 MODIFYING CRITERIA

10.3.1 State Acceptance

The State is providing Concurrence with Reservations for EPA's selected remedy for the Libby Asbestos Superfund Site Operable Units 4 through 8. The State concurs that the selected remedial action will be protective, but only after development and implementation of robust institutional controls to protect the remedy, establishment of a comprehensive operations and maintenance program to maintain remedy integrity, and creation of an EPA-lead rapid response program to address newly-discovered occurrences of LA or to address LA where changes in land use require a more stringent cleanup level. A copy of this concurrence letter is included in Appendix D.

10.3.2 Public Acceptance

Community involvement activities are discussed in Section 3. A total of 209 public comments were received from 15 private citizens and 11 identified entities or agencies via comment letters or during the Proposed Plan public hearing. Although most individuals supported the Proposed Plan, commenters raised one or more of the following substantive issues or questions to EPA on the following topics for three general categories (HHRA, Remedy, and ICs):

1. HHRA
   a. HHRA Purpose
   b. Conceptual Site Model
   c. Exposure Parameters
   d. Exposure Point Concentrations
   e. Indirect Preparation of Filters
   f. LA-specific Toxicity Values
   g. Cumulative Risk Assessment
2. Remedy
   a. Comment Period for Proposed Plan and Other Administrative Record Documents
   b. Remedy Selection Consensus and Application of the Selected Remedy to Other Locations Outside the Libby Asbestos Superfund Site
   c. Vagueness in Elements of the Selected Remedy
   d. Thoroughness of Cleanup
   e. Participation in Cleanup
   f. Uncertainty Regarding Numbers of Properties Requiring Cleanup and Associated Quantities of Contaminated Material Requiring Additional Cleanup
   g. Exclusion of Forested Areas from the Selected Remedy

h. Potential for Recontamination During and After Implementation of the Selected Remedy
i. Establishment of Cleanup Levels for LA Contamination Situations that Do Not Currently Exist

3. ICs
   a. Stakeholder Roles and Responsibilities for Development of ICs
   b. Timeline for Development of ICs
   c. Opinions on EPA's Preferred ICs
   d. Lack of Specificity for ICs
   e. Funding for ICs
   f. Effectiveness of ICs
   g. Impacts of New Regulations on ICs
   h. Property Status Information for ICs

Further information on these comments and EPA responses to them can be found in the Responsiveness Summary found in Part 3 of this ROD.

10.3.3 Modifications Made as a Result of Comments

Comments from the DEQ and the general public were addressed through clarification and explanation. These can be found in Part 3 of this document, the Responsiveness Summary. Based on these written and oral comments, EPA has not made any significant changes to the original proposal but has provided clarifying information based on the comments in this ROD.

In response to requests from local government representatives, EPA and DEQ will be forming an IC steering committee. This steering committee will include members from local government entities as well as private citizens to relay community concerns and provide input on the development of the ICs with EPA. All comments received on ICs will be shared with the steering committee and considered in the development of an IC plan.

11.0 PRINCIPAL THREAT WASTES

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present significant risk to human health or the environment should exposure occur. Low level threat wastes are those source materials that generally can be reliably contained and would present only a low risk in the event of release. Source materials are materials that include or contain hazardous substances, pollutants, or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, or air or act as a source for direct exposure.

Based on those definitions and the determinations made in the HHRA and FS, soil and building materials for non-OU3 areas of the Site, containing LA above their respective remedial criteria, constitute source materials. These media act as a source for direct exposure to inhalation of LA when encountered. In addition, these source materials could present a significant risk to human health should exposure occur, and thus are classified as principal threat wastes.

The NCP establishes an expectation that EPA will use treatment to address any principal threat waste. A range of treatment technologies for contaminated soils and contaminated building materials was evaluated and screened as part of remedial technology and process option screening within the FS for OU4, 5, 6, 7, and 8 as described in Section 9 of this ROD. Contaminated soil and contaminated building materials at the Site generally have large volumes and due to their solid matrix and ability to be isolated from inhalation exposures they are particularly amenable to containment. Conversely, the large volumes of materials, as well as the heterogeneity of the materials, are generally detrimental to implementing treatment technologies. Treatment technologies were evaluated within the FS and all were eliminated from further consideration in screening due to low implementability and high costs. Furthermore, treatment was determined not to be practical nor viable because treatment would be difficult to implement and costly relative to the additional benefit it provides to long-term effectiveness and permanence at the Site. Additional details on the screening of treatment technologies for contaminated soil and contaminated building materials are presented in the FS.

The selected remedy will address the exposure to these principal threat wastes primarily through removal and disposal without treatment of principal threat wastes exceeding the remedial clearance criteria. The remaining principal threat waste will be addressed through containment of residual contamination in contaminated soil and building materials where boundary conditions exist. The selected remedy also includes ICs along with monitoring to enhance the protection of the remedy components and minimize unacceptable exposures.

12.0 SELECTED REMEDY

Based on consideration of the CERCLA requirements, the detailed analysis of remedial alternatives, state comments, and all public comments (see Part 3, Responsiveness Summary), EPA has determined that the preferred remedial alternatives for contaminated soil and contaminated building materials presented in the Proposed Plan for the Site-wide cleanup is the appropriate remedy for OUs 4, 5, 6, 7, and 8 of the Site. The selected remedy consists of Alternative SO6: Partial Excavation/Disposal, Backfill, Institutional Controls, and Monitoring and Alternative BM5: Partial Removal/Disposal, Encapsulation, Interior Cleaning, Institutional Controls, and Monitoring, as described in this section.

As discussed in Section 4.1, EPA has elected to use an adaptive management approach during design, construction, and O&M of the selected remedy. Adaptive management is a critical component during implementation of the remedial action at the Site because property-specific investigation and designs are ongoing. Each property has a unique set of considerations, including but not limited to extent of contaminated soils and/or building materials both horizontally and vertically; property uses; presence of obstructions such as pavement, structures, or trees that affect implementation; and proximity to features such as floodplains or sensitive environments like wetlands.

Typical conceptual approaches for each component of the selected remedy (physical remedy components and ICs), including details and dimensions, have been provided for context in Sections 12.1 and 12.2 and are based on information derived from implementing previous removal actions at the Site. However, the details of the typical conceptual approaches for the physical remedy components may be adjusted during design and implementation of the selected remedy for a specific property or set of properties based on the considerations previously discussed and results of new information or data collected, such as from general property investigations or sampling and analysis. An adaptive management framework, describing these property-specific considerations and parameters that define the degree to which they can be adjusted without constituting a change to the selected remedy, will be developed during the remedial design process.

If property-specific considerations and the information/data collected at each property indicate that adjustments are warranted, they will be made under the parameters of the adaptive management framework during property-specific remedial design, construction and/or O&M. Information collected during 5 year site reviews may also indicate that adjustments are needed for continued protectiveness and would be made pursuant to the adaptive management framework previously discussed. If an adjustment is warranted that is beyond the scope of the remedy components described in this ROD and thus outside of the adaptive management framework, a post-ROD change will be initiated by EPA.

Sections 12.1 and 12.3 provide short and detailed descriptions of the selected remedy, respectively, that contain specific information regarding the typical conceptual approaches to implementing the selected remedy. As previously stated, these details or information are subject to adjustment based on property-specific considerations.

12.1 SHORT DESCRIPTION OF THE SELECTED REMEDY

12.1.1 Contaminated Soil

The selected remedy for the contaminated soil medium at residential/commercial properties is an excavation and disposal remedy with containment of contamination remaining at boundary conditions that will be conducted across the Site as determined by the remedial criteria discussed in Section 8.3. More detailed information on each of these remedy elements can be found in Section 12.3. ICs will be implemented on a sitewide basis for the four land use categories described in Section 4.3 because remaining LA contamination after the physical remedy components are constructed will not allow for UU/UE with the contaminated medium. Because LA contamination in soil will remain after remedial action, it may be determined that changed conditions exist that were not contemplated during the remedial action. The considerations for addressing them is discussed in Section 12.3.4.

The selected remedy includes the following components for residential and commercial properties:

1. Contaminated soils at a property exceeding RALs for the land use category will be excavated until remedial clearance criteria for surface soil and subsurface soil are met for the land use category, or a boundary condition is reached. Input from the affected property owner will be considered in the process of determining how excavation of contaminated soil from "frequently used" areas is conducted to meet the remedial clearance criteria for surface soil.

2. If contaminated soil is left in place due to a boundary condition, a visibly distinct marker layer will be installed at the bottom of the excavation.

3. Clean backfill is installed to replace the excavated material. Backfill will be revegetated or otherwise restored to match the previous surface conditions.

4. Excavated contaminated soil will be disposed of properly within a facility authorized for LA.

5. Access controls such as temporary fencing and signage will be implemented during construction to warn of dangers or exclude access to areas being remediated. Post construction, access controls may be appropriate in public use areas where disturbance of backfill could occur.

6. ICs including legal controls and risk communication controls will be implemented sitewide and will be tailored to land uses as necessary to reduce exposure risks during and post construction.

7. The remedy components (including ICs) will be monitored, maintained, and adjusted as necessary so exposure to contaminated soil does not occur and backfill remains effective for eliminating migration of LA to the surface or other media.

The selected remedy includes the following components for parks and schools, transportation corridors, and industrial park:

1. ICs including legal controls and risk communication controls will be implemented sitewide and will be tailored to land uses for each land use category as necessary to reduce remaining exposure risks.

2. The remedy components (including ICs) will be monitored, maintained, and adjusted as necessary so unacceptable exposures to contaminated soil do not occur and previously-placed backfill remains effective for eliminating migration of LA to the surface or other media.

Although the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, the use of treatment technologies for contaminated soils at the non-OU3 areas of the Site was considered but determined not to be practical or viable based on the rationale presented and discussed in Section 11. Additional details on the screening of treatment technologies for contaminated soils are presented in Section 4 of the FS. Thus, treatment is not a principal element of the selected remedy.

12.1.2 Contaminated Building Materials

The selected remedy for the building material medium at residential/commercial properties is a removal and disposal remedy with containment of inaccessible contamination that will be conducted across the Site as determined by remedial criteria discussed in Section 8.3. More detailed information on each of these remedy elements can be found in Section 12.3. ICs will be implemented on a sitewide basis for the four land use categories described in Section 4.3 because remaining LA contamination after the physical remedy components are constructed will not allow for UU/UE with the contaminated building materials medium. Because LA contamination in building materials will remain after remedial action, it may be determined that changed conditions exist that were not contemplated during the remedial action. The considerations for addressing them is discussed in Section 12.3.4.

The selected remedy will provide protection of human health and the environment by eliminating exposure to contaminated building materials. It reduces the long-term risk of exposure to LA within building materials by eliminating complete exposure pathways. This ensures that human receptors have no, or very limited, opportunities for inhalation of LA fibers, thus reducing cancer risk and non-cancer hazard from LA exposure.

The selected remedy includes the following components for residential and commercial properties:

1. Accessible contaminated building materials exceeding RALs will be removed until remedial clearance criteria for indoor non-living space or indoor living space are met.

2. Removed building materials, primarily attic insulation, will be restored as needed to a functional condition.

3. Contaminated building materials to remain in place will be addressed through encapsulation consisting of in-place sealing and covering.

4. Interior cleaning, when required, will be performed using vacuum extraction to remove LA fibers previously released within buildings.

5. Removed contaminated building materials will be disposed of properly within a facility authorized for LA.

6. Access controls will be implemented during construction to warn of dangers or exclude access to areas being remediated. Post-construction access controls may be appropriate in public use areas where disturbance of encapsulated areas could occur.

7. ICs including legal controls and risk communication controls will be implemented sitewide and will be tailored to land uses as necessary to reduce exposure risks during and post construction.

8. The remedy components (including ICs) will be monitored, maintained, and adjusted as necessary to mitigate exposure to or migration of LA to areas where they could become accessible.

The selected remedy includes the following components for parks and schools, transportation corridors, and industrial park:

1. ICs including legal controls and risk communication controls will be implemented sitewide and will be tailored to land uses for each land use category as necessary to reduce exposure risks during and post construction.

2. The remedy components (including ICs) will be monitored, maintained, and adjusted as necessary to mitigate exposure to or migration of LA to areas where they could become accessible.

Although the NCP establishes an expectation that EPA will use treatment to address any principal threat waste, the use of treatment technologies for contaminated building materials at the non-OU3 areas of the Site was considered but determined not to be practical or viable based on the rationale presented and discussed in Section 13.4. Additional details on the screening of treatment technologies for contaminated building materials are presented in the FS. Thus, treatment was not chosen as a component of the selected remedy.

12.2 RATIONALE FOR THE SELECTED REMEDY

12.2.1 Contaminated Soil

The selected remedy is a comprehensive cleanup of the Site that will protect human health and the environment and complies with ARARs (described more fully in Section 13.2). The selected remedy provides the best balance of tradeoffs among the alternatives and balancing and modifying criteria than the other Site-wide alternatives that were evaluated.

The selected remedy is a comprehensive cleanup of OUs 4, 5, 6, 7, and 8 at the Site that will protect human health and the environment and complies with ARARs (described more fully in Section 13.2). It has long-term effectiveness and permanence because it reliably removes and properly disposes of contaminated soil, to the degree practical given horizontal and vertical conditions, within a facility authorized for LA.

In areas where contamination is left in place, the backfill will keep LA fibers in soil from migrating to the surface in the future and mitigate exposure to LA concentrations in contaminated soil exceeding remedial criteria. The selected remedy is feasible and implementable, does not require offsite transport and disposal of untreated hazardous substances or contaminated materials, and has long-term effectiveness and permanence that is more certain than for alternatives that rely primarily on containment. Although the selected remedy does not allow for UU/UE with the contaminated media, residual risks are effectively mitigated through management under the selected remedy. Excavation and placement of backfill are remedy components that have been selected and performed at sites similar to the Site.

The selected remedy also includes requirements for ICs (initial establishment and ongoing implementation), monitoring (consisting of intrusive visual inspection and sampling and analysis during construction and non-intrusive visual inspections and limited sample collection with analysis post construction), and maintenance of backfilled areas to prevent exposure of contaminated soil and maintain protectiveness. EPA recognizes the importance of new information as knowledge about the Site grows through further investigation. EPA will review the protectiveness of the remedy at least every 5 years after the remedy has been initiated and consider changes, if necessary, to the physical components of the remedy through the adaptive management framework developed during RD and with any post-ROD documentation as appropriate.

12.2.2 Contaminated Building Materials

The selected remedy provides the best balance of tradeoffs among the alternatives and attains a level of achievement of the threshold and balancing criteria equal to or higher than other Site-wide alternatives that were evaluated.

The selected remedy is a comprehensive cleanup of OUs 4, 5, 6, 7, and 8 at the Site that will protect human health and the environment and complies with ARARs (described more fully in Section 13.2). It has long-term effectiveness and permanence because it reliably removes and properly disposes of accessible contaminated building materials at a waste disposal facility authorized for LA.

In areas where contamination is left in place, encapsulation will prevent the release of LA fibers into the indoor air of residential, commercial, and industrial structures and mitigate exposure to LA concentrations in contaminated building materials exceeding remedial criteria. The selected remedy is feasible and implementable, does not require offsite transport and disposal of untreated hazardous substances or contaminated materials, and has long-term effectiveness and permanence that is more certain than for alternatives that rely primarily on containment. Residual risks are effectively mitigated through management under the selected remedy. Removal, disposal, and encapsulation of contaminated building materials are remedy components that have been selected and performed at sites similar to the Site.

The selected remedy also includes requirements for ICs (initial establishment and ongoing implementation), monitoring (consisting of non-intrusive and intrusive visual inspection and sampling and analysis during construction and non-intrusive visual inspections and limited sample collection with analysis post construction), and maintenance of encapsulated areas to prevent exposure of contaminated building materials and maintain protectiveness. EPA recognizes the importance of new information as knowledge about the Site grows through further investigation. EPA will review the protectiveness of the remedy at least every 5 years after the remedy has been initiated and consider changes, if necessary, to the physical components of the remedy through the adaptive management framework developed during RD and with any post-ROD documentation as appropriate.

12.3 DETAILED DESCRIPTION OF THE SELECTED REMEDY

12.3.1 Containment and Removal

Common to both contaminated media (i.e., soils and building materials) during implementation of the selected remedy at residential and commercial properties, dust suppression will be maintained to mitigate contaminant migration during implementation of the selected remedy. Water-based dust suppression is assumed to be conducted in most situations, but chemical-based dust suppression could be considered during construction for some specific applications like haul road maintenance. During implementation of the selected remedy, when applicable, residents will be relocated temporarily and businesses will be closed temporarily to minimize exposure risks to LA contamination as cleanup at affected properties occurs.

Access controls such as fencing and posted warnings will be implemented during construction activities to warn of dangers or exclude access to areas being remediated. Access controls generally will not be required post-construction for private property under this alternative because an active remedy is undertaken to address contaminated soil and building materials exceeding RALs, and other types of ICs will be implemented. However, access controls such as warning signs may be appropriate in public use areas where disturbance of contaminated soil or building materials left in place could occur.

Containment and removal elements specific to each media are discussed below in the following subsections.

12.3.1.1 Contaminated Soils

Excavation of contaminated soil will be conducted at residential and commercial properties that exceed RALs until the established remedial clearance criteria for surface soil and subsurface soil are met as established through monitoring (consisting of intrusive visual inspections and sample collection with analysis). The use of each property scheduled for excavation of contaminated soil will be tracked during remedial action construction to confirm that the applicable remedial criteria are considered and attained. Trucks with enclosed beds will be used to transport and properly dispose of the excavated contaminated soil within a facility approved for LA.

Remedial clearance criteria were developed with inherent vertical and horizontal boundary conditions that do not require complete removal of contaminated soil to avoid technical issues and limitations. These conditions include structure foundations, utilities, tree root systems, groundwater, deep contaminated soils, and property boundaries beyond which additional excavation is not warranted to provide protectiveness in conjunction with ICs. With respect to property boundaries, excavation will continue laterally until remedial clearance criteria are met if consent to access (permission) can be obtained from the adjacent property owner. The maximum depth of excavation will be 3 feet below ground surface. Mechanical excavation is assumed to be conducted in most situations, but pneumatic or manual excavation could be considered during construction for some specific applications where accessibility to contaminated soil using standard equipment is difficult.

Surface boundary conditions limiting excavation (e.g., structures) are assumed to be kept in place and thus provide an exposure barrier to the contaminated soil beneath them. Because they will remain in place, permanent site fixtures such as trees, structures, and utilities will require protection to safely excavate contaminated soil located adjacent to these fixtures. Site fixtures such as garden beds, sheds, or lawn ornaments will be removed and relocated during construction of the selected remedy.

Thus, under the selected remedy, some contaminated soil could remain in place at those boundary conditions. A delineation marker barrier will be placed at the bottom of the excavations, as needed, to indicate where contaminated soil is left in place due to boundary conditions. If the excavation boundaries meet the remedial clearance criteria, a delineation marker barrier will not be required. Records will be kept to indicate which properties have contamination left in place. These records will be used to inform residents and potential buyers during property transactions as well as define where property specific ICs and monitoring will be instituted at properties.

The action levels for interior and exterior soils vary based on frequency of use as discussed in Section 8.3.1.1. The RALs for frequently used areas trigger a remedial action for contaminated soils with lower concentrations than infrequently used areas due to the higher exposure risks to humans within those areas. The remedial clearance criteria for frequently used areas are also more stringent than for infrequently used areas. The terms used for differentiating between the two types of frequency are defined in Section 4.2.1.

Designated borrow soil will be used to backfill and regrade excavation areas in accordance with ARARs. Soil used to backfill excavation areas will be transported from borrow sources that will be tested to determine that LA contamination exceeding remedial clearance criteria is not present and to exclude importation of other types of contaminants that may exist within borrow sources but are not currently present at the non-OU3 areas of the Site.

Properties will be restored appropriately for the use of the property, and specific details will be determined during the remedial design. The backfill will be revegetated or otherwise restored to match the surface conditions that previously existed at the affected property. This may include placement of hydroseeding or erosion control devices such as silt fences, straw bales, and erosion control blankets. In some instances additional landscaping may be required. These assumptions will be refined at the time of remedial design.

12.3.1.2 Contaminated Building Materials

Contaminated building materials at residential and commercial properties that are accessible (reference to definition of accessible is in Section 8.3.1) will be removed using pneumatic or mechanical means to minimize damage to the affected structure. In instances of pneumatic removal, contaminated building materials such as attic insulation will be vacuum-extracted using a vacuum truck. The use of each structure on property scheduled for removal of contaminated building materials will be tracked during remedial action construction to confirm that the applicable remedial criteria are considered and attained. Some residential, commercial, and/or industrial structures with contaminated building materials could require demolition to reduce the risks to human health or the environment. Substantial demolition would be required for structures that are constructed with large amounts of LA; removal could undermine stability of structures and potentially require substantial repair or even condemnation.

Removed contaminated building materials will be transported, typically in the vacuum trucks, and properly disposed of within a facility authorized for LA. Portions of structures where contaminated building materials were removed will be reinsulated and restored as needed to a functional condition (functional condition to be defined during remedial design). Insulation in the interior walls and floors or any exterior walls that are to be remodeled will not be replaced unless prior arrangements are made between the government and the resident or business owner.

Encapsulation will include in-place sealing and covering of contaminated building materials with a high-performance coating to prevent release of LA fibers into the indoor air of residential, commercial, and industrial structures. Typical accessible contaminated building materials include insulation in the attics or openings such as outlets and light fixtures. The common method of applying an encapsulant is by brush, roller, or airless sprayer. The specific type of encapsulant selected for this alternative will be determined during remedial design. Records will be kept to document which properties have contamination left in place. These records will be used to inform residents and potential buyers during property transactions as well as to define where property specific ICs and monitoring will be instituted at properties.

Interior cleaning will be performed, when required, using vacuum extraction to remove LA fibers previously released within these structures. Interior cleaning may be performed using hoses attached to vacuum trucks or handheld vacuums. Negative pressure enclosures will be installed during removal and encapsulation as needed to mitigate airborne transport of LA fibers outside of the enclosure. Encapsulation combined with interior cleaning will reduce exposure within indoor air to LA concentrations.

12.3.2 Institutional Controls

ICs are defined as “non-engineered instruments that help minimize the potential for exposure to contamination and/or protect the integrity of a response action” per ICs: A Guide to Planning, Implementing, Maintaining, and Enforcing ICs at Contaminated Sites (EPA 2012b). ICs are required if contamination remains after the active cleanup is complete that does not allow for UU/UE or if the active cleanup alone cannot feasibly mitigate the risks from exposure to contamination. (EPA 2000c).

The selected physical remedy for the Site will leave contamination at depth in soil and within inaccessible building materials where it does not present a risk of exposure as long as the physical remedy components are not compromised based on future land use. Land use must be tracked to inform property owners and others about the potential to encounter asbestos contamination should land use change or ownership transfers occur. ICs will be used at the Site to require cleanup of LA contamination that is currently inaccessible and becomes accessible in the future; ICs also provide a mechanism to address property use changes between land use categories that could affect protectiveness. These issues and concerns that could affect protectiveness form the basis for IC objectives as discussed in Section 12.3.2.2.

12.3.2.1 Types of ICs

Two types of ICs that were considered during evaluation of remedial alternatives in Section 9 were retained for the selected remedy. The types of ICs are risk communication controls (i.e., information measures) and legal controls (i.e., administrative and legal measures). Together these ICs provide three pillars of support (resources, education, and initiatives) that achieve and maintain protectiveness of the overall remedy in conjunction with physical remedy components as indicated in the risk management strategy discussed in Section 8.1.

Risk communication controls are non-legal ICs, which involve community awareness activities and other risk communication techniques. They provide education regarding risks from exposures to LA contamination and information regarding resources and initiatives to avoid unacceptable exposures.

Legal controls are administrative and legal measures. They provide initiatives to track land uses and control or limit activities within those land uses that could result in unacceptable exposures to LA. There are four categories of legal controls within ICs, all of which are available to be employed and implemented in layers (use of different categories at the same time depending on the OU and the land uses within the OU) at this Site.

1. Proprietary controls
2. Government controls
3. Enforcement tools with IC components
4. Informational devices

ICs also will be required to be maintained over time throughout the Site because LA contamination remaining in soils and building materials does not allow for UU/UE of these media. Monitoring and reporting will be required for 5 year site reviews to document whether ICs remain in place and are functioning as intended when established, and whether the remedial action remains protective.

12.3.2.2 IC Objectives and Tools for the Selected Remedy

In 2012, EPA began developing an interim ICs program for the Site. Interim ICs were developed as part of the ongoing removal program to enhance education of community residents and provide information on activities property owners may take that could disturb LA and create an unacceptable exposure. Based on the interim ICs and initial community outreach, EPA worked with DEQ and local agencies to develop a list of preferred ICs, which were published in the Proposed Plan. During the comment period for the Proposed Plan, outreach was conducted to obtain feedback from the community on the preferred list of ICs. EPA and DEQ will continue to work with the community to develop the final ICs program for each OU addressed by the selected remedy, which will be documented in an OU-specific ICIAP and fully implemented prior to the start of operation and maintenance of the remedy.

During preparation of the Proposed Plan, interim IC objectives were developed. ICs developed to meet these objectives, when implemented with the physical remedy components, provide a protective remedy with resulting cumulative risks below EPA's level of concern. The objectives address soil, building materials, and change of land use. The ICs program and the tools to be implemented will be developed to meet those objectives and will be finalized prior to operation and maintenance. The IC objectives are included in the sections below.

Because the exposure scenarios and remedial actions differ as a function of land use, the ICs also may be different for each of the four land use categories noted previously (residential/ commercial, industrial, transportation corridors, and parks/schools). In addition, the mixed ownership of properties within OUs 6 and 8 may result in additional differences of IC components within the industrial and transportation corridor land use categories. However, the objectives of the ICs for each land use category will be the same.

EPA recognizes that while the objectives for the ICs identified in this ROD are unlikely to change, the specific ICs have yet to be formally identified. EPA and DEQ will work with the community to develop an ICIAP that will help clarify the tools that will be used to implement the ICs selected in this ROD. This plan will explain in more detail how encounters with asbestos following cleanup will be managed. It is likely that EPA will use a layering approach for ICs, meaning that multiple tools may be used to implement each selected IC and to ensure that each objective is met. EPA will accept public comment on the ICIAP and prepare a modification to this remedy known as an "Explanation of Significant Differences" (ESD). The ESD will reference the ICIAP and will identify the specific IC requirements and IC tools that EPA will use to implement the ICs selected in this decision. EPA expects to publish the ICIAP and ESD by the completion of Remedial Action for the non-OU3 areas. EPA anticipates that the actual ICs or tools may require modification over time to meet the community's needs, and as needed based on determinations of protectiveness made during 5 year site reviews.

The actual tools to implement along with the details of the overall IC program, the entity responsible for implementing the tools, and who is responsible for the cost of the tools will be finalized and documented in the ICIAP for each OU. The ICIAP for each OU will be prepared during remedial design, prior to completion of the selected remedy and start of operation and maintenance.

The following sections include the objectives for the ICs program and examples of the types of tools that may be selected for implementation to address activities under each objective.

Soil

Objective: Prevent LA fibers that may remain in soil at properties after meeting remedial criteria for the land use category, or at undeveloped properties, from becoming a future source of unacceptable exposure.

Tools:

- Moving excavated material offsite
  - Permit for disturbance of soil
  - UDIG program
  - Landfill permit
  - Ban on illegal dumping
  - Contractor certification
  - Education
- Moving backfill and other materials onsite
  - Best management practices for use of imported material sources
  - Education
- Bringing subsurface soils to the surface
  - Best management practices for managing excavated soils onsite
  - UDIG program
  - Permit for disturbance of soil
  - Education

Building Materials

Objective: Prevent LA fibers that may remain in inaccessible building materials from becoming a future source of unacceptable exposure.

Tools:

- Demolition
  - Disconnecting utilities notification
  - Landfill permit for contractors
  - Building permits in the city
  - Permit for disturbance of building materials
  - Contractor certification
  - Education
- Renovation
  - New utility notification
  - Landfill permit for contractors
  - Building permits in the city
  - Permit for disturbance of building materials
  - Dumpster program
  - Contractor certification
  - Education

Land Use

Objective: Track changes in land use and develop a notification system to ensure that property owners, prospective property owners, and workers are aware of remaining or potential LA, which could become a future source of unacceptable exposure and IC requirements.

Tools:

- Transaction information
  - Transaction disclosure through Board of Realtors
  - Property status map
  - Education
- Changes in land use
  - Land use classification in the city
  - Subdivision requirements
  - Building permits in the city
  - UDIG program
  - New utility notification
  - Overlay district
  - Rights-of-way permits (e.g., MDT encroachment permit)
  - Education

The remedy will be evaluated for protectiveness during each 5 year site review. In addition, the ICs program will be evaluated for effectiveness annually.

12.3.3 Operation and Maintenance

Long-term O&M will be required to maintain the integrity of ICs, backfilled areas, encapsulated areas, and covers placed during previous response actions at all four land use categories. Monitoring will be performed sitewide during 5 year site reviews to evaluate and document whether physical remedy components and ICs are protective. The specifics of an O&M program, including monitoring, will be developed during remedial design.

Post-construction monitoring and maintenance will be performed at public use areas with contaminated subsurface soil remaining below backfill and accessible contaminated building materials. At a minimum, post-construction monitoring (consisting of non-intrusive visual inspections [i.e., surface inspections] and limited sample collection with analysis) will be conducted during 5 year site review periods unless disturbances of contaminated subsurface soil or encapsulated building materials have occurred that will necessitate changes to monitoring frequency. Post-construction maintenance of encapsulated areas will not be required if left undisturbed.

Post-construction monitoring and maintenance of contaminated subsurface soil remaining below backfill and within locations of encapsulated or otherwise inaccessible contaminated building materials on private property will be left to the property owner. Information will be provided to assist property owners and their contractors in understanding the appropriate maintenance procedures that apply to their properties.

12.3.4 Additional Contamination Remaining

Contamination will remain beneath backfilled areas and encapsulation locations as well as within infrequently used areas and boundary conditions at properties as discussed in Section 12.3.1. In the event property owners do not participate in the selected remedy, there is a potential for contamination to be left in place at their properties as well.

"Infrequently used areas" applies to those areas of residential and commercial properties that are likely to be used on a less regular basis such as pastures and fields, wooded lots, and areas beneath structures (e.g., soils beneath low clearance decks and raised sheds). Because of this, the RAL for addressing soils in infrequently used areas at residential and commercial properties is less stringent than those in "frequently used areas," as described in Section 8.3. If the future use of an area changes such that it is used on a more frequent basis (e.g., the yard at a property is extended into what was once a pasture), the RALs for frequently used areas would become applicable. This is also true for areas within a property that are currently not used (e.g., wooded areas, unmaintained fields, areas beneath low decks). If areas that are not used under current conditions become used in the future (either on a frequent or infrequent basis), then the appropriate RALs would apply. ICs can be used to track these use changes and allow for monitoring to determine if the new RALs are exceeded. Based on monitoring results, the appropriate means by which to address LA contamination exceeding the RAL for the land use category can be determined.

Prior to completion of the selected remedy, EPA will conduct a "last call," allowing property owners who have previously refused to consent to access or cleanup under the removal program the opportunity to have contamination on their property addressed through the selected remedy. In the event these property owners do not participate, contamination will be left in place at their properties.

Because of the potential for LA contamination to remain in soil and structures after the remedial action is concluded, there may be a need to implement a response action during O&M. The O&M Plan, which will be prepared prior to the start of O&M, will detail response actions to be taken when LA contamination is encountered during O&M. If the material encountered was not reasonably anticipated prior to the start of O&M, EPA and DEQ will evaluate whether the material represents a changed condition and determine how the response action will be funded.

12.4 ESTIMATED COST OF THE SELECTED REMEDY

The present value cost of the contaminated soil selected remedy (Alternative SO6) is approximately $53,790,000. The estimated capital costs are $47,572,000, and O&M and 5 year site review costs (for the first 30 years) are $15,246,000. The construction timeframe is estimated to be four construction seasons (May to October), assuming full funding, maximized productivity, and no substantial delays after initiation. Exhibit 12-1 presents the cost estimate summary for the contaminated soil selected remedy, including the present value analysis on a year-by-year basis, assuming a real discount rate of 7 percent.

The present value cost of the contaminated building materials selected remedy (Alternative BM5) is approximately $9,840,000. The estimated capital costs are $4,711,000, and O&M and 5 year site review costs (for the first 30 years) are $12,540,000. The construction timeframe is estimated to be one construction season (May to October), assuming full funding, maximized productivity, and no substantial delays after initiation. Exhibit 12-2 presents the cost estimate summary for the contaminated building materials selected remedy, including the present value analysis on a year-by-year basis, assuming a real discount rate of 7 percent.

The information in Exhibits 12-1 and 12-2 is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the administrative record file, an Explanation of Significant Differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

12.5 EXPECTED OUTCOMES OF THE SELECTED REMEDY

The selected remedy achieves protectiveness through a combination of containment and removal. The remedy is expected to meet the clearance criteria when combined with ICs and the risk management strategy. Risks to human health from inhalation of LA from contaminated soil and building materials will be eliminated or reduced to acceptable levels. Risks will be managed through a combination of physical cleanup activities to address LA exposure from the primary contaminated media (soil and building materials) and establishment of ICs to address any remaining risks.

12.5.1 Available Uses of Land upon Achieving Remedial Criteria

The selected remedy will allow non-OU3 areas to continue to be used for residential/commercial, industrial, transportation corridors, and park/school land uses. It removes accessible contamination through excavation and vacuuming, contains the remaining contamination, and prevents direct contact through the use of backfill covers for soil and encapsulation for building materials. Because certain activities can compromise backfill and encapsulation, ICs will be used to limit those activities, thereby preserving the integrity of the containment and limiting potential unacceptable exposure.

As discussed above, land use categories may change over time depending on use of an area. These changes in land use can affect protectiveness. For example, remedial action at a property using residential/commercial remedial clearance criteria would still be protective of other land use categories if the land use category of the property changed. However, this likely would not be true if the property were one of the other three land use categories and then changed to residential/commercial. During land use changes (especially infrequently used areas and areas not previously investigated), it may be determined that changed conditions exist that were not contemplated during the remedial action. The considerations for addressing changed conditions is discussed in Section 12.3.4.

EPA will work with the ATSDR to determine the end of the public health emergency.

12.5.2 Performance Standards

This ROD defines performance standards (RALs and remedial clearance criteria) for contaminant sources at the Site that will be used to measure the overall effectiveness of the remedy over the long term. Performance standards are directly linked to the long-term protection of human health and the environment from contaminants of concern present at the Site and include the final ARARs for the Site. Performance will be monitored through comprehensive and interrelated monitoring programs for each media, respectively.

The RALs and remedial clearance criteria were discussed in Section 8.3. The use of each property scheduled for excavation of contaminated soil and/or removal of contaminated building materials will be tracked during remedial action construction to confirm that the applicable remedial criteria are considered and attained during construction. In addition to the RALs being used to determine whether a remedial action at a particular property or location using physical remedy components or approaches will be required due to LA contamination in soil and building materials, RALs will be used at any time a property changes ownership to ensure protection of human health and the environment. This will be enforced through ICs, and protects future owners from properties which under previous ownership were refused access or remedial action as discussed in Section 12.3.4. These properties will be cleaned up to meet remedial clearance criteria through physical remedial approaches and other overarching protective measures, such as ICs, at that time.

Exhibit 12-1. Cost Estimate Summary for the Contaminated Soil Portion of the Selected Remedy

Year[1]	Capital Costs (ICs)	Capital Costs (Earthwork)	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[2]	Present Value[3]
0	$2,127,000	$45,445,000	$0	$0	$47,572,000	$47,572,000
1	$0	$0	$452,000	$0	$452,000	$422,439
2	$0	$0	$452,000	$0	$452,000	$394,777
3	$0	$0	$452,000	$0	$452,000	$368,968
4	$0	$0	$452,000	$0	$452,000	$344,831
5	$0	$0	$452,000	$281,000	$733,000	$522,629
6	$0	$0	$452,000	$0	$452,000	$301,168
7	$0	$0	$452,000	$0	$452,000	$281,460
8	$0	$0	$452,000	$0	$452,000	$263,064
9	$0	$0	$452,000	$0	$452,000	$245,843
10	$0	$0	$452,000	$281,000	$733,000	$372,584
11	$0	$0	$452,000	$0	$452,000	$214,745
12	$0	$0	$452,000	$0	$452,000	$200,688
13	$0	$0	$452,000	$0	$452,000	$187,580
14	$0	$0	$452,000	$0	$452,000	$175,286
15	$0	$0	$452,000	$281,000	$733,000	$265,639
16	$0	$0	$452,000	$0	$452,000	$153,092
17	$0	$0	$452,000	$0	$452,000	$143,103
18	$0	$0	$452,000	$0	$452,000	$133,747
19	$0	$0	$452,000	$0	$452,000	$124,978
20	$0	$0	$452,000	$281,000	$733,000	$189,407
21	$0	$0	$452,000	$0	$452,000	$109,158
22	$0	$0	$452,000	$0	$452,000	$102,016
23	$0	$0	$452,000	$0	$452,000	$95,327
24	$0	$0	$452,000	$0	$452,000	$89,089
25	$0	$0	$452,000	$281,000	$733,000	$135,019
26	$0	$0	$452,000	$0	$452,000	$77,834
27	$0	$0	$452,000	$0	$452,000	$72,727
28	$0	$0	$452,000	$0	$452,000	$67,981
29	$0	$0	$452,000	$0	$452,000	$63,551
30	$0	$0	$452,000	$281,000	$733,000	$96,316
TOTALS:	$2,127,000	$44,445,000	$13,560,000	$1,686,000	$62,818,000	
TOTAL PRESENT VALUE OF SELECTED ALTERNATIVE FOR CONTAMINATED SOIL						**$53,790,000**

Notes:
[1] The alternative is expected to require cost expenditures in perpetuity because soils under covers and structures will have contaminant concentrations above RALs that will not allow for UU/UE under the current and reasonably anticipated future uses. However, the period of analysis was assumed to be 30 years (Years 0 through 30).
[2] Total annual expenditure is the total cost per year with no discounting.
[3] Present value is the total cost per year, including a 7.0 percent real discount factor for that year, and is used for comparative purposes.
[4] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from present value cost. Costs presented are expected to have accuracy between -30 to +50 percent of actual costs, based on the scope. They are prepared solely for remedy selection and not remedial design.

Exhibit 12-2. Cost Estimate Summary for the Contaminated Building Materials Portion of the Selected Remedy

Year[1]	Capital Costs (ICs)	Capital Costs (Earthwork)	Annual O&M Costs	Periodic Costs	Total Annual Expenditure[2]	Present Value[3]
0	$1,231,000	$3,480,000	$0	$0	$4,711,000	$4,711,000
1	$0	$0	$382,000	$0	$382,000	$357,017
2	$0	$0	$382,000	$0	$382,000	$333,639
3	$0	$0	$382,000	$0	$382,000	$311,827
4	$0	$0	$382,000	$0	$382,000	$291,428
5	$0	$0	$382,000	$180,000	$562,000	$400,706
6	$0	$0	$382,000	$0	$382,000	$254,527
7	$0	$0	$382,000	$0	$382,000	$237,871
8	$0	$0	$382,000	$0	$382,000	$222,324
9	$0	$0	$382,000	$0	$382,000	$207,770
10	$0	$0	$382,000	$180,000	$562,000	$285,665
11	$0	$0	$382,000	$0	$382,000	$181,488
12	$0	$0	$382,000	$0	$382,000	$169,608
13	$0	$0	$382,000	$0	$382,000	$158,530
14	$0	$0	$382,000	$0	$382,000	$148,140
15	$0	$0	$382,000	$180,000	$562,000	$203,669
16	$0	$0	$382,000	$0	$382,000	$129,383
17	$0	$0	$382,000	$0	$382,000	$120,941
18	$0	$0	$382,000	$0	$382,000	$113,034
19	$0	$0	$382,000	$0	$382,000	$105,623
20	$0	$0	$382,000	$180,000	$562,000	$145,221
21	$0	$0	$382,000	$0	$382,000	$92,253
22	$0	$0	$382,000	$0	$382,000	$86,217
23	$0	$0	$382,000	$0	$382,000	$80,564
24	$0	$0	$382,000	$0	$382,000	$75,292
25	$0	$0	$382,000	$180,000	$562,000	$103,520
26	$0	$0	$382,000	$0	$382,000	$65,780
27	$0	$0	$382,000	$0	$382,000	$61,464
28	$0	$0	$382,000	$0	$382,000	$57,453
29	$0	$0	$382,000	$0	$382,000	$53,709
30	$0	$0	$382,000	$180,000	$562,000	$73,847
TOTALS:	$1,231,000	$3,480,000	$11,460,000	$1,080,000	$13,042,000	
TOTAL PRESENT VALUE OF SELECTED ALTERNATIVE FOR CONTAMINATED BUILDING MATERIALS						**$9,840,000**

Notes:
[1] The alternative is expected to require cost expenditures in perpetuity because encapsulated contaminated building materials will have contaminant concentrations above RALs that will not allow for UU/UE under the current and reasonably anticipated future uses. However, the period of analysis was assumed to be 30 years (Years 0 through 30).
[2] Total annual expenditure is the total cost per year with no discounting.
[3] Present value is the total cost per year, including a 7.0 percent real discount factor for that year, and is used for comparative purposes.
[4] Total present value is rounded to the nearest $10,000. Inflation and depreciation are excluded from present value cost. Costs presented are expected to have accuracy between -30 to +50 percent of actual costs, based on the scope. They are prepared solely for remedy selection and not for remedial design.

13.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121 and the NCP, EPA must select a remedy that is protective of human health and the environment, complies with or appropriately waives ARARs, is cost effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that include treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy includes components to address human health and the environmental risks associated with both contaminated soil and contaminated building materials. Excavation and disposal of contaminated soils and removal of contaminated building materials above remedial clearance criteria will be contained within an approved disposal facility. The remaining contamination will be contained in place and addressed through ICs and monitoring. Unacceptable human health risks identified in the risk assessment process will be addressed. The selected remedy will minimize the inhalation of LA during disturbances of contaminated soils and contaminated building materials so that the resulting exposures result in cumulative cancer risks that are within or below EPA's acceptable risk range of 10^{-6} to 10^{-4} and cumulative non-cancer HIs that are at or below 1. There are no unacceptable environmental risks identified in the Site-wide BERA that need to be addressed.

LA contamination above remedial clearance criteria remaining after implementation of the selected remedy will be monitored and maintained through comprehensive programs using ICs. There are no short-term threats associated with either medium addressed by the selected remedy that cannot be readily controlled through applicable health and safety requirements, monitoring, and best management practices during construction. In addition, no adverse cross-media impacts are expected from either contaminated source medium addressed by the selected remedy.

13.2 COMPLIANCE WITH ARARS

ARARs are determined based on analysis of which requirements are applicable or relevant and appropriate to the distinctive set of circumstances and actions contemplated at a specific site. The NCP requires that ARARs be attained during the implementation and at completion of the remedial action unless a waiver is justified.

A summary of federal and state ARARs for the Site is attached as Appendix C. The selected remedy will address the chemical-, location-, and action-specific ARARs described in Appendix C through adherence to substantive requirements of those ARARs during implementation of the remedial action. No permits will be necessary to implement a remedial action within the site boundary in accordance with Section 121(e) of CERCLA; however, the substantive requirements of any permits will be followed.

The selected engineered component of the final remedy for OUs 4 through 8 contemplates leaving in place LA that is less than the RALs or that meets the remedial clearance criteria; this remaining LA is not equivalent to disposal and would not trigger solid waste requirements. To the extent that the selected remedy involves management of LA contaminated soil or contaminated building materials at the former Libby Vermiculite Mine (OU3), compliance with ARARs will be the responsibility of the mine owner (Grace) or successor entity.

When contaminated soil and contaminated building materials are addressed, as described in Section 12, EPA has determined that the selected remedy meets ARARs while providing protection of human health and the environment. Exhibits 13-1 and 13-2 present the evaluation criteria considerations and justifications for compliance with ARARs during implementation of the contaminated soil and contaminated building materials portions of the selected remedy, respectively.

Exhibit 13-1. Evaluation of Compliance with ARARs for the Contaminated Soil Portion of the Selected Remedy

Evaluation Criteria Considerations for Compliance with ARARs	Justification for Rating
Compliance with Chemical-Specific ARARs	• Excavation and disposal of contaminated surface and subsurface soil will physically address contaminant sources and prevent discharges of LA fibers to air, thus meeting visible emission requirements of NESHAP and chemical-specific ARARs for air. • Dust suppression will be maintained to mitigate contaminant migration during RA in compliance with these ARARs as allowed in ARM 17.8.204, MCA 75-2-501, et seq., and implementing regulations, including ARM 17.74.369. • Reasonable precaution to control emissions of airborne particulate matter will be taken in accordance with MCA 75-2-101 and ARM 17.8.308. • Particulate dust level will be controlled in compliance with ARM 17.8.220, ARM 17.8.221, and ARM 17.8.223.
Compliance with Location-Specific ARARs	• Location-specific ARARs for the remedy will be addressed during implementation of the RA. • National Historic Preservation: To date, no cultural/archaeological resources have been found at non-OU3 areas. If any are found, consultation with the State Historic Preservation Office (SHPO) and the National Historic Preservation Act (NHPA) will be addressed during RA. • Fish and Wildlife Coordination Act, Bald Eagle Protection Act, and Migratory Bird Treaty Act: Consultation with the U.S. Fish and Wildlife Service (USFWS) and the relevant state agency with jurisdiction over wildlife resources will be required during design and implementation of this alternative. • Endangered Species: Seven endangered, threatened, or candidate species have been identified in Lincoln County. If threatened or endangered species are identified within remedial areas, activities will be designed to conserve the species and their habitat. • Floodplain Management Regulation: Excavation and in-place containment of the contaminated soil will be conducted in a manner that will avoid or minimize adverse effects in a floodplain. Excavated materials will not be disposed of in a floodplain. • Solid Waste Management Act and implementing regulations: Excavated materials will be disposed of at a location that meets all of the location-specific requirements, including any requirements triggered by wetlands, seismic impact zones, or unstable areas, as well as other requirements. Disposal at the Libby Class II Landfill meets all location-specific requirements; the solid waste location-specific requirements would only be triggered by disposal at another location at the site.

Exhibit 13-1. Evaluation of Compliance with ARARs for the Contaminated Soil Portion of the Selected Remedy (continued)

Evaluation Criteria Considerations for Compliance with ARARs	Justification for Rating
Compliance with Action-Specific ARARs	• Action-specific ARARs for the remedy will be addressed during implementation of the RA. • The activities under this alternative will be carried out in a manner that will comply with substantive requirements of the National Emission Standard for Asbestos under NESHAP. Contaminated soil will be excavated, transported, and disposed of in a manner that will comply with 40 CFR § 61.150 and 40 CFR § 61.151. • Backfilling over contaminated soil left in place and revegetation of the backfilled areas will be in compliance with this ARAR as allowed in 40 CFR § 61.151 and in accordance with the substantive requirements of Montana Strip and Underground Mining Reclamation Act ARM 17.24.631, ARM 17.24.703, ARM 17.24.713, ARM 17.24.714, ARM 17.24.716, and 17.24.721, as appropriate. • Transportation and disposal of contaminated soil will be performed in accordance with the substantive requirements in ARM 17.74.369, MCA 75-10-212 and implementing regulations in 17.50.523, and the Solid Waste Management Act MCA 75-10-201 and implementing regulations. Variances will be used, if needed, based on disposal facility conditions. It is not anticipated that variances would be required if contaminated soil was disposed of at a waste disposal facility authorized for LA. • Dust suppression will be maintained to mitigate contaminant migration during remedial action in compliance with these ARARs as allowed in ARM 17.8.204, MCA 75-2-501, et seq., and implementing regulations, including ARM 17.74.369. • Particulate dust level will be controlled in compliance with ARM 17.8.220, ARM 17.8.221, and ARM 17.8.223.

Exhibit 13-2. Evaluation of Compliance with ARARs for the Contaminated Building Materials Portion of the Selected Remedy

Evaluation Criteria Considerations for Compliance with ARARs	Justification for Rating
Compliance with Chemical-Specific ARARs	• Removal and disposal as well as encapsulation of contaminated building materials combined with interior cleaning will physically address LA contaminant sources and prevent discharges of LA fibers to air, thus meeting numerical emission requirements of NESHAP and chemical-specific ARARs for air. • Dust suppression will be maintained to mitigate contaminant migration during remedial action in compliance with these ARARs as allowed in ARM 17.8.204, MCA 75-2-501, et seq., and implementing regulations, including ARM 17.74.369. • Reasonable precaution to control emissions of airborne particulate matter will be taken in accordance with MCA 75-2-101 ARM 17.8.308.

Exhibit 13-2. Evaluation of Compliance with ARARs for the Contaminated Building Materials Portion of the Selected Remedy (continued)

Evaluation Criteria Considerations for Compliance with ARARs	Justification for Rating
Compliance with Location-Specific ARARs	• Location-specific ARARs for the remedy will be addressed during implementation of the RA. • National Historic Preservation: To date, no cultural/archaeological resources have been found at the non-OU3 areas. If any are found, consultation with the SHPO and the NHPA will be addressed during remedial action. • Floodplain Management Regulation: Building materials will not be disposed of in a floodplain. • Solid Waste Management Act and implementing regulations: Building materials will be disposed of at a location that meets all of the location-specific requirements, including any requirements triggered by wetlands, seismic impact zones, or unstable areas as well as other requirements. Disposal at the Libby Class II Landfill meets all location-specific requirements; the solid waste location-specific requirements would only be triggered by disposal at another location at the site.
Compliance with Action-Specific ARARs	• Action-specific ARARs for the remedy will be addressed during implementation of the RA. • The activities under this alternative will be carried out in a manner that will comply with substantive requirements of the National Emission Standard for Asbestos under NESHAP and ARM 17.74.370. • The encapsulation requirements specified under NESHAP (40 CFR § 61.151) are a potential consideration as relevant and appropriate ARARs for the non-OU3 areas and will be in compliance with this ARAR as allowed in 40 CFR § 61.151 (c). In addition, encapsulation activities will be conducted to comply with ARM 17.74.371 and ARM 17.74.357. • Air cleaning operations will be performed in a manner that complies with 40 CFR § 61.152. • Ambient Air Quality: Particulate/dust levels will be controlled. • Airborne Particulate Matter: Emission of airborne particulate matter will be controlled. • Dust suppression will be maintained to mitigate contaminant migration during RA in compliance with these ARARs as allowed in ARM 17.8.204, MCA 75-2-501, et seq., and implementing regulations, including ARM 17.74.369. • The removal, handling, and disposal of contaminated building materials will be in compliance with these ARARs as allowed under 40 CFR § 61.149, 40 CFR § 61.150, ARM 17.74.355, and ARM 17.74.359. • Transportation and disposal of contaminated building materials will be performed in accordance with the substantive requirements in ARM 17.74.369, MCA 75-10-212 and implementing regulations in 17.50.523, and the Solid Waste Management Act MCA 75-10-201 and implementing regulations. Variances are not anticipated to be needed based on proper disposal at a facility authorized for LA.

13.3 COST EFFECTIVENESS

The selected remedy addressing both contaminated media (soil and building materials) is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness" [NCP §300.430(f)(1)(ii)(D)]. This is determined by evaluating the overall effectiveness of the selected remedy and comparing that effectiveness to the overall costs. Effectiveness is evaluated by examining how the remedy meets three criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. Overall effectiveness of the remedial alternatives was compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of the selected remedy was determined to be proportional to its cost, and hence this remedy represents a reasonable value for the cost to be incurred.

Often more than one cleanup alternative is cost effective, but CERCLA does not mandate the selection of the most cost-effective cleanup alternative. This is because the most cost-effective remedy does not always provide the best balance of tradeoffs with respect to remedy selection criteria. In addition, the most cost-effective cleanup alternative is not necessarily the least-costly alternative that is both protective of human health and the environment and ARAR-compliant. Rather, cost effectiveness is concerned with the reasonableness of the relationship between the effectiveness afforded by each alternative and its costs compared to other available options.

Net present value costs for each alternative were compared in the FS, and a range of costs for each alternative was developed that represents the range and possible scope of actions. The cost of the contaminated soil portion of the selected remedy is expected to have a present value cost of approximately $53,790,000. The cost of the contaminated building materials portion of the selected remedy is expected to have a present value cost of approximately $9,840,000. EPA believes the selected remedy achieves an appropriate balance between cost effectiveness and adequate protectiveness.

13.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT (OR RESOURCE RECOVERY) TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

This determination looks at whether the selected remedy provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria set forth in NCP §300.430(f)(1)(i)(B) such that it represents the maximum extent to which permanence and treatment can be practicably utilized at the Site. NCP §300.430(f)(1)(ii)(E) provides that the balancing shall emphasize the factors of "long-term effectiveness" and "reduction of toxicity, mobility, or volume through treatment," and shall consider the preference for treatment and bias against offsite disposal. The modifying criteria were also considered in making this determination.

Of the alternatives evaluated that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy (consisting of Alternative S06 for contaminated soil and Alternative BM5 for contaminated building materials) provides the best balance of tradeoffs in terms of the five balancing criteria while also considering the statutory preference for treatment and bias against offsite treatment and disposal and considering state and community acceptance. Based on the technology screening evaluation in the FS, treatment technologies are very difficult to implement due to the large quantities and heterogeneity of material to treat. Additionally, the treatment technologies that are feasible (such as stabilization and solidification, and various forms of thermal treatment) are costly relative to the additional benefit to long-term effectiveness and permanence they provide at the Site.

The primary criterion driving the selection of the selected remedy was long-term effectiveness and permanence. Protection and long-term effectiveness are achieved through maintenance, monitoring, and ICs. The selected remedy addressing each contaminated medium is expected to provide short-term effectiveness with a low level of risk to the community, cleanup workers, and the environment utilizing effective mitigation techniques. The selected remedy also has moderate implementability.

13.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

Treatment is not a component of the selected remedy addressing either contaminated medium and thus does not satisfy the statutory preference for treatment as a principal element. Contaminated soil and contaminated building materials at the Site generally have large volumes, and due to their solid matrix and ability to be isolated from inhalation exposures they are particularly amenable to containment. Conversely, the large volumes of materials, as well as the heterogeneity of the materials, are generally detrimental to implementing treatment technologies. Treatment technologies were evaluated within the FS and all were eliminated from further consideration in screening due to low implementability and high costs.

13.6 FIVE YEAR SITE REVIEWS

Because the selected remedy addressing each contaminated medium results in hazardous substances, pollutants, or contaminants remaining on Site (although under backfill or encapsulated) above levels that allow for unlimited use and unrestricted exposure, 5 year site reviews will be conducted pursuant to CERCLA §121(c) and NCP §300.430(f)(5)(iii)(C). EPA shall conduct a review of RAs no less often than each 5 years after the initiation of such remedial action to ensure the remedy is, or will be, protective of human health and the environment.

14.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for OUs 4, 5, 6, 7, and 8 for the Site was released for public comment in May 2015. It identified Alternative SO6 as the preferred alternative for contaminated soil and Alternative BM5 as the preferred alternative for contaminated building materials occurring on residential/commercial properties. Furthermore, the Proposed Plan indicated that for the other three land use categories (industrial, transportation corridors, and parks/schools), no additional physical cleanup would occur, but implementation of ICs would be required. Those alternatives are described in Section 12 of this ROD as the selected remedy.

The public comment period was extended from 30 to 60 days, and EPA reviewed all written and verbal comments submitted during that comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

EPA recognizes that while the objectives for the ICs identified in this ROD are unlikely to change, the specific ICs have yet to be formally identified. EPA and DEQ will work with the community to develop an ICIAP that will help clarify the tools that will be used to implement the ICs selected in this ROD. This plan will explain in more detail how encounters with asbestos following cleanup will be managed. It is likely that EPA will use a layering approach for ICs, meaning that multiple tools may be used to implement each selected IC and to ensure that each objective is met. EPA will accept public comment on the ICIAP and prepare a modification to this remedy known as an ESD. The ESD will reference the ICIAP and will identify the specific IC requirements and IC tools that EPA will use to implement the ICs selected in this decision. EPA expects to publish the ICIAP and ESD by the completion of Remedial Action for the non-OU3 areas. EPA anticipates that the actual ICs or tools may require modification over time to meet the community's needs, and as needed based on determinations of protectiveness made during 5 year reviews.

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TABLES

Table 5-1. State Species of Concern
Libby Asbestos Superfund Site

Group	Common Name (*Genus species*)	Rank
Amphibians	Coeur d'Alene Salamander (*Plethodon idahoensis*)	S2
	Boreal Toad, Green (also known as Western Toad) (*Bufo boreas*)	S2
Fish	Bull Trout (*Salvelinus confluentus*)	S2
	Torrent Sculpin (*Cottus rhotheus*)	S3
	Westernslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*)	S2
Invertebrates	Stonefly (*Utacapnia columbiana*)	S2
	Slug, Magnum Mantleslug (*Magnipelta mycophaga*)	S1S3
	Slug, Pygmy Slug (*Kootenaia burkei*)	S1S2
	Land Snail, Robust Lancetooth (*Haplotrema vancouverense*)	S1S2
	Slug, Sheathed Slug (*Zacoleus idahoensis*)	S2S3
	Land Snail, Smoky Taildropper (*Prophysaon humile*)	S1S3
	Land Snail, Striate Disc (*Discus shimekii*)	S1

S1 = At high risk because of extremely limited and potentially declining numbers, extent and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
S2 = At risk because of very limited and potentially declining numbers, extent and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3 = Potentially at risk because of limited and potentially declining numbers, extent and/or habitat, even though it may be abundant in some areas.

TABLE 5-2
Conceptual Site Model, Exposure Pathways and Populations
Libby Asbestos Superfund Site

Primary Source	Primary Transport Mechanism	Secondary Source	Exposure Media	Exposure Locations	Operable Unit	Disturbance Description	Exposure Population[a]: Resident	Exposure Population[a]: Recreational Visitor	Exposure Population[a]: Teachers/ students	Exposure Population[a]: Worker: Indoor Worker	Exposure Population[a]: Worker: Tradesperson	Exposure Population[a]: Worker: Outdoor Worker
Mine site & past mining, milling, processing operations	Aerial emissions (current and historical, deposition/resuspension during disturbance activities	soil/duff	Outdoor air, ambient conditions	Outdoor	All	---	1	1	1	1	1	1
	Transport of solid waste, raw materials	soil/duff	Outdoor air, during soil/duff disturbance activities	Parks	OU1, OU4, OU7	lawn/park maintenance						1
						park use		1				
				Road ROW	OU2, OU8	mowing/brush-hogging						1
				Forested Areas	OU4	hiking		1				
						building campfires		1				
						ATV riding		1				
				Residential/Commercial Properties	OU2, OU4, OU7	yard work	1					1
						gardening	1					1
						playing on driveways	1					
						ATV riding in LUAs	1					
				Schools	OU4, OU7	outdoor maintenance						1
						playing on playgrounds			1			
				Bike Trails/Paths	OU4, OU5, OU7	riding bicycles		1				
				Roads	OU8	driving cars	1	1	1	1	1	1
				Motocross Track	OU5	motocross participant/spectator		1				
				Industrial Properties	OU5	site maintenance						1
				Railyard/Railroad Corridors	OU6	RR maintenance						1
	Aerial emissions	Tree bark	Outdoor air, during tree bark disturbance activities	Forested Areas	OU4	local wood harvesting	1					
						campfire burning		1				
						wildfire	1	1	1	1	1	1
				Landfills	OU4, OU7	woodchipping						1
	Aerial emissions to tree bark; use of bark as a landscaping material	Wood chips/mulch	Outdoor air, during woodchip/mulch disturbance activities	Residential/Commercial Properties	OU2, OU4, OU7	gardening/landscaping	1					1
				Woodchip Piles	OU5	pile maintenance						1
	Aerial emissions (current and historical)/indoor air potentially impacted by previous disturbance of LA-containing material[b]	indoor air mixed with outdoor air	Indoor air, passive conditions	Residential/Commercial Properties	OU4, OU7	---	1			1		
				Industrial Properties	OU5	---				1		
				Schools	OU4, OU7	---			1			
	Use of vermiculite in building materials	vermiculite insulation (VI)	Indoor air, during VI disturbance activities	Residential/Commercial Properties	OU4, OU7	attic use, routine property maintenance	1				1	
						construction/demolition					1	
	Aerial emissions (current and historical) to outdoor air mixing with indoor air potentially impacted by previous disturbance of LA-containing material[b]	indoor dust	Indoor air, during indoor dust disturbance activities	Residential/Commercial Properties	OU4, OU7	cleaning (sweeping, dusting, vacuuming)	1					
				Commercial/Industrial Buildings	OU1, OU5	general				1		
				Schools	OU4, OU7	general			1			
	Aerial emissions (current and historical) to tree bark used for firewood	woodstove ash	Indoor air, during woodstove ash disturbance activities	Residential/Commercial Properties	OU4, OU7	woodstove ash removal	1					

[a] Note that a given individual may be a member of several exposure populations. For example, an individual may live in OU7, work in OU4, and recreate in OU5. In this example, aspects of the exposure scenarios for a resident, indoor worker, and recreational visitor would apply to the individual. The cumulative assessment addresses cumulative exposures that span multiple exposure scenarios.
[b] LA-containing material could include VI or woodstove ash.

Notes:

ATV - all-terrain vehicle
LA - Libby amphibole asbestos
LUAs - limited-use areas
OU - operable unit
ROW - right-of-way
RR - railroad
USFS - United States Forest Service
VI - vermiculite insulation

TABLE 7-1
Estimated Risks from Residential Exposures to LA During Soil Disturbance Activities
Libby Asbestos Superfund Site

Location	Expsoure Scenario & Soil Concentration	Yard ABS Script Intensity	EPC	RME Exposure Parameters				Cancer Risk	Non-cancer HQ
			Mean Air Conc. (PCME LA s/cc)+	ET (hours/ day)	EF (days/ year)	ED (years)	TWF		
Libby (OU4)	**Yards (Mowing, Raking, Digging)**								
	Non-detect	**high intensity**	0.0040	0.3	60	50	0.0015	**1E-06**	**0.07**
		typical intensity	0.00011	6.3	60	50	0.031	**6E-07**	**0.04**
							TOTAL	**2E-06**	**0.1**
	Trace (<0.2%)	**high intensity**	0.061	0.3	60	50	0.0015	**2E-05**	**1**
		typical intensity	0.0024	6.3	60	50	0.031	**1E-05**	**0.8**
							TOTAL	**3E-05**	**2**
	≥ 0.2%	**high intensity**	0.21	0.3	60	50	0.0015	**5E-05**	**3**
		typical intensity	0.0080	6.3	60	50	0.031	**4E-05**	**3**
							TOTAL	**9E-05**	**6**
	Gardens (Rototilling)								
	Trace (<0.2%)	---	0.039	2	2	50	0.00033	**2E-06**	**0.1**
	Gardens (Digging)								
	Non-detect	---	0.00020	3.3	40	50	0.011	**4E-07**	**0.02**
	Trace (<0.2%)	---	0.00066	3.3	40	50	0.011	**1E-06**	**0.08**
	≥ 0.2%	---	0	3.3	40	50	0.011	**0E+00**	**0**
	Driveway (Playing & Digging)								
	Non-detect	---	0	2	225	15	0.011	**0E+00**	**0**
	Trace (<0.2%)	---	0.0057	2	225	15	0.011	**1E-05**	**0.7**
	≥ 0.2%	---	0.0050	2	225	15	0.011	**9E-06**	**0.6**
	LUAs (ATV-riding)								
	Non-detect	---	0.0012	2	20	50	0.0033	**7E-07**	**0.04**
	Trace (<0.2%)	---	0.0014	2	20	50	0.0033	**8E-07**	**0.05**
Troy (OU7)	**Yards (Mowing, Raking, Digging)**								
	Non-detect	**typical intensity**	0.000062	6.6	60	50	0.032	**3E-07**	**0.02**
	Trace (<0.2%)	**typical intensity**	0	6.6	60	50	0.032	**0E+00**	**0**
	Residential, Outdoor Gardens (Digging & Rototilling)++								
	Non-detect	---	0.000023	5.3	42	50	0.018	**7E-08**	**0.005**
	Trace (<0.2%)	---	0	5.3	42	50	0.018	**0E+00**	**0**
	Residential, Outdoor Driveway (Playing & Digging)								
	Non-detect	---	0.000079	2	225	15	0.011	**1E-07**	**0.01**
	Trace (<0.2%)	---	0.000085	2	225	15	0.011	**2E-07**	**0.01**

+ Concentrations have been adjusted to account for filter preparation method
++ Exposure time and frequency have been summed because the EPC is based on a combination of the activities.

Notes:
ABS - activity-based sampling
ATV - all- terrain vehicle
Conc. - concentration
CTE - central tendency exposure
ED - exposure duration
EF - exposure frequency
EPC - exposure point concentration
ET - exposure time
HQ - hazard quotient
LA - Libby amphibole asbestos
LUA - limited use areas
PCME - phase contrast microscopy - equivalent
RME - reasonable maximum exposure
s/cc - structures per cubic centimeter
TWF - time-weighting factor
% - percent
< - less than

FIGURES

Appendix A

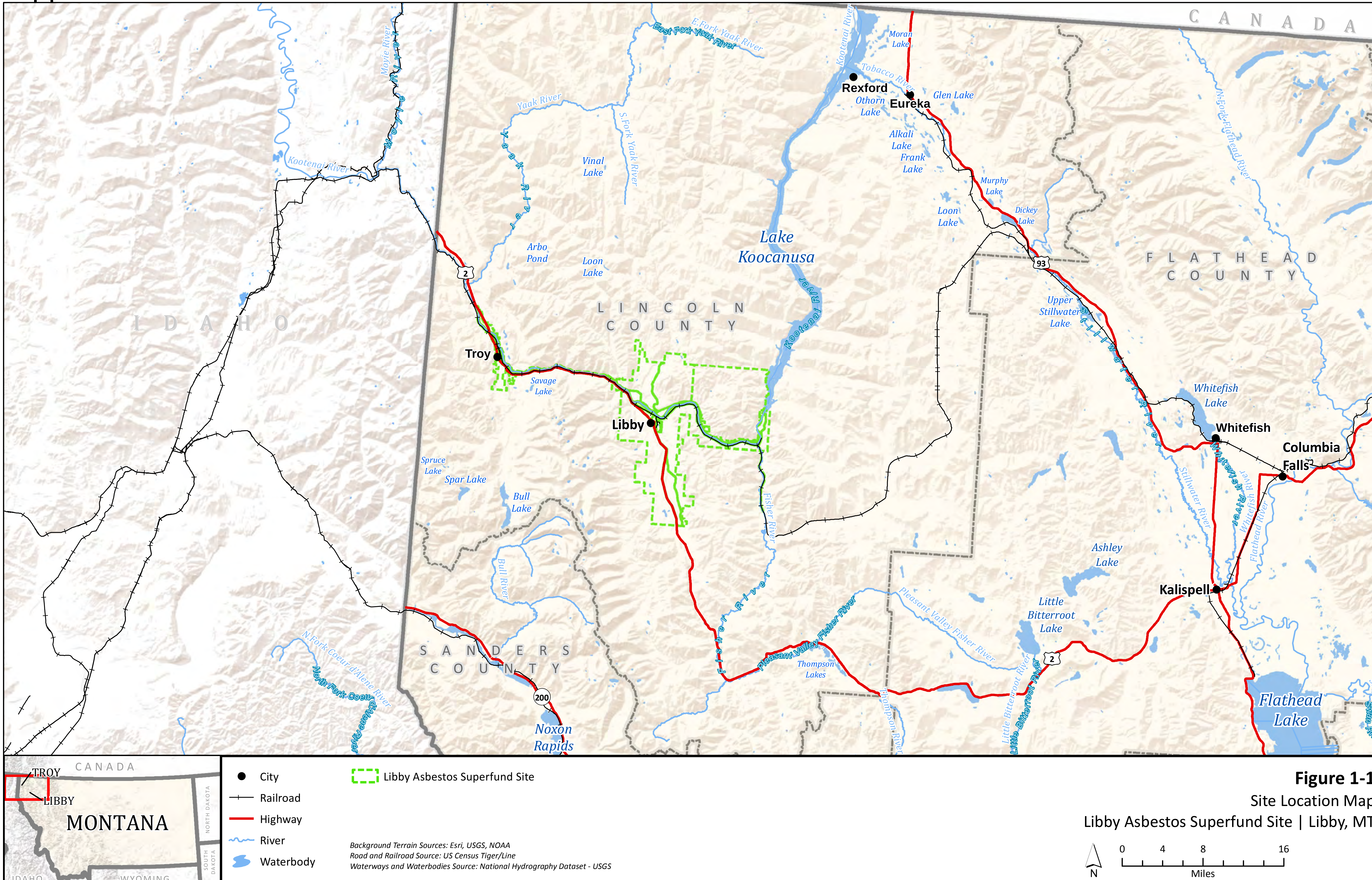
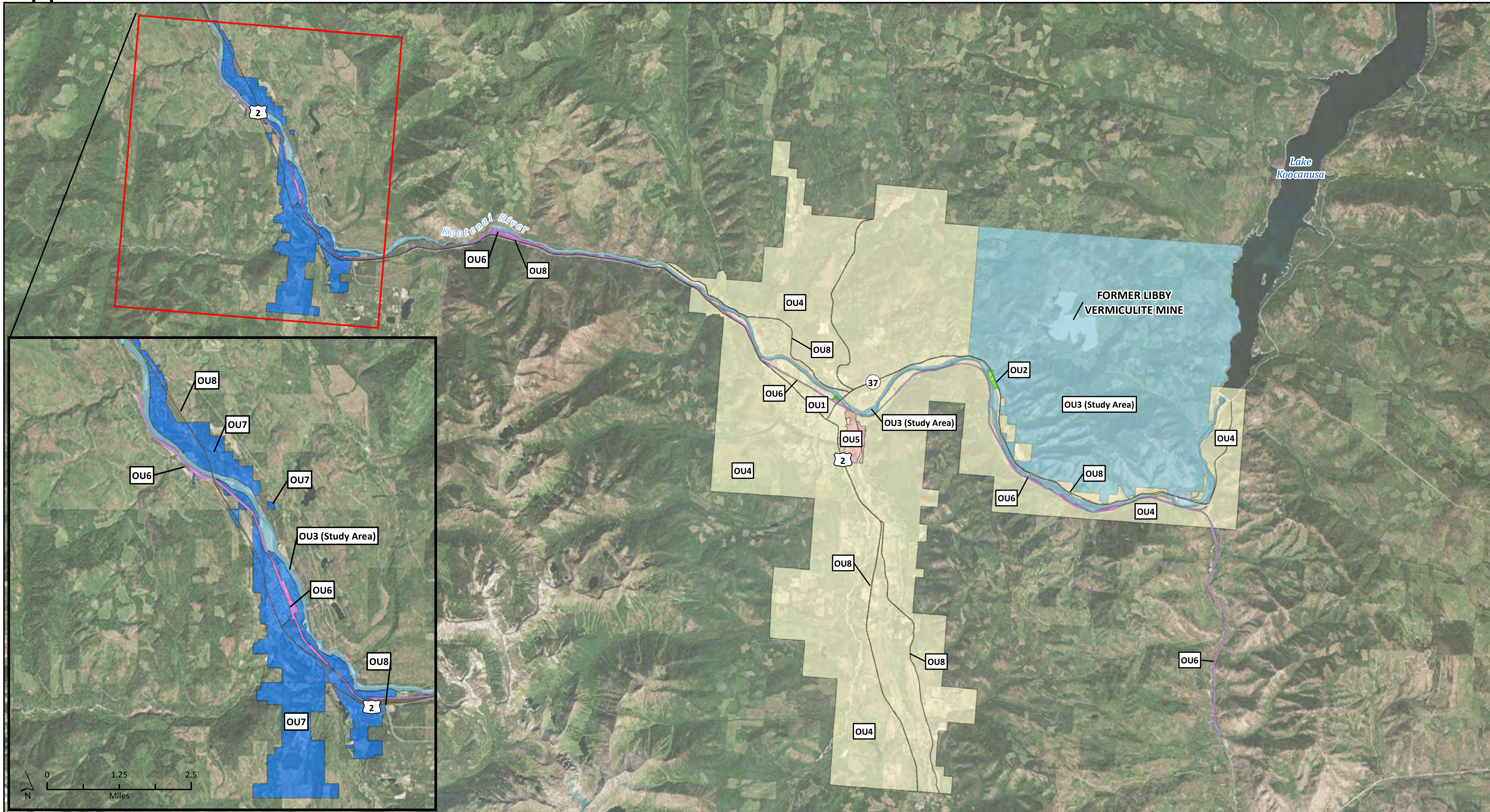


Figure 1-1
Site Location Map
Libby Asbestos Superfund Site | Libby, MT

Appendix A



- OU1 - Former Export Plant
- OU2 - Former Screening Plant
- OU3 - Former Libby Vermiculite Mine and Kootenai River (Study Area)
- OU4 - City of Libby
- OU5 - Former Stimson Lumber Company
- OU6 - Burlington Northern and Santa Fe Railroad Corridor
- OU7 - Town of Troy
- OU8 - U.S. and Montana State Highway Corridors

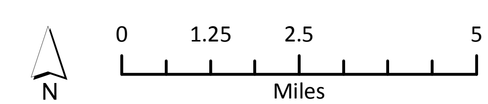
Note(s):

1. EPA established the preliminary study area boundary for the purposes of planning and developing the scope of the Remedial Investigation/Feasibility Study (RI/FS) for OU3. This study area boundary may be revised as data are obtained during the RI for OU3 on the nature and extent of environmental contamination associated with releases that may have occurred from the mine site. The final boundary of OU3 will be defined by the final EPA-approved RI/FS.

2. Operable Units that do not have a Record of Decision in place are also referred to as study areas (i.e. OU4, OU5, OU6, OU7, and OU8).

Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, USGS, NOAA
Road and Railroad Source: US Census Tiger/Line
Waterways and Waterbodies Source: National Hydrography Dataset - USGS

Figure 1-2
Operable Unit Boundaries
Libby Asbestos Superfund Site | Libby, MT



Appendix A

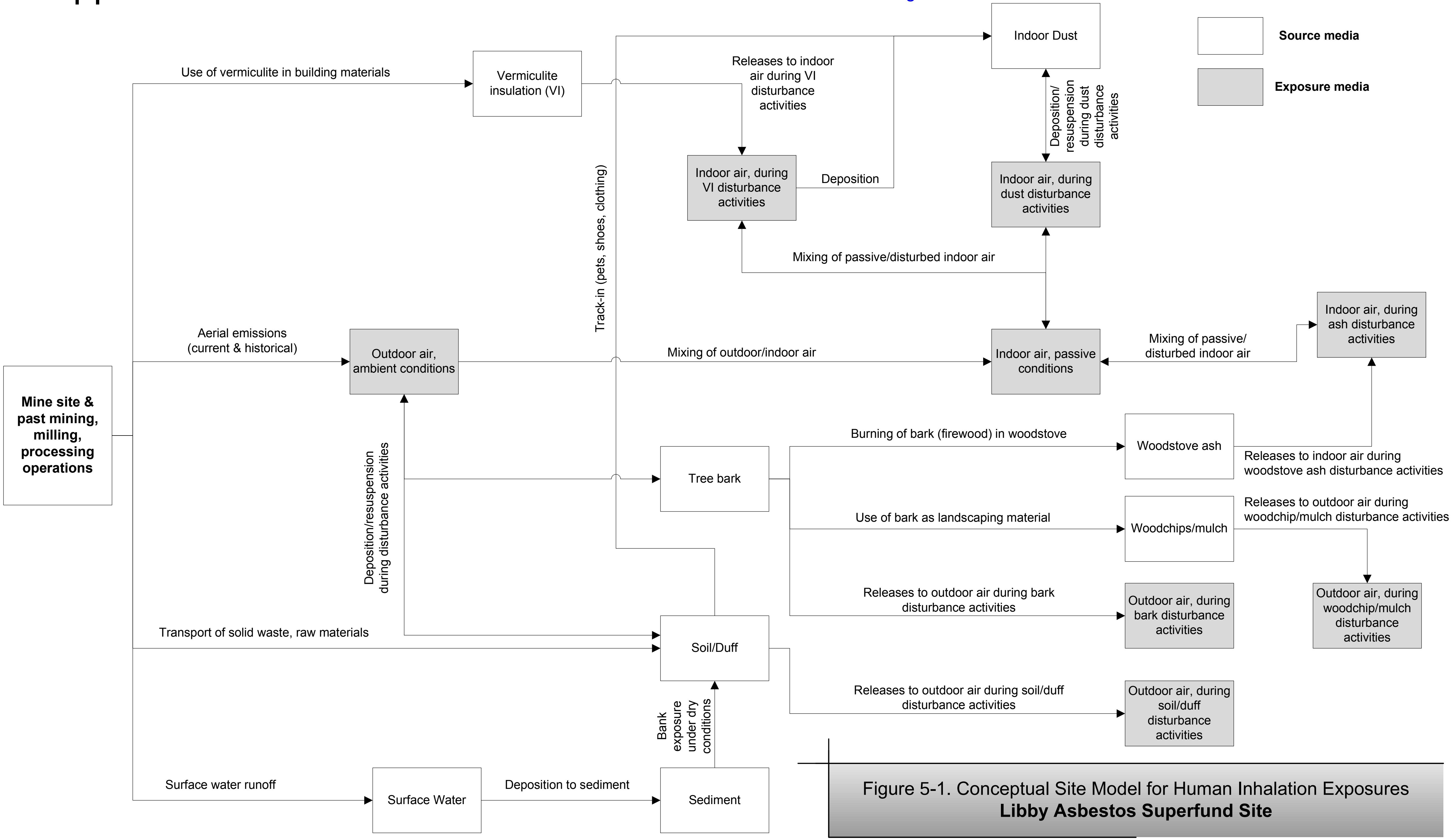


Figure 5-1. Conceptual Site Model for Human Inhalation Exposures
Libby Asbestos Superfund Site

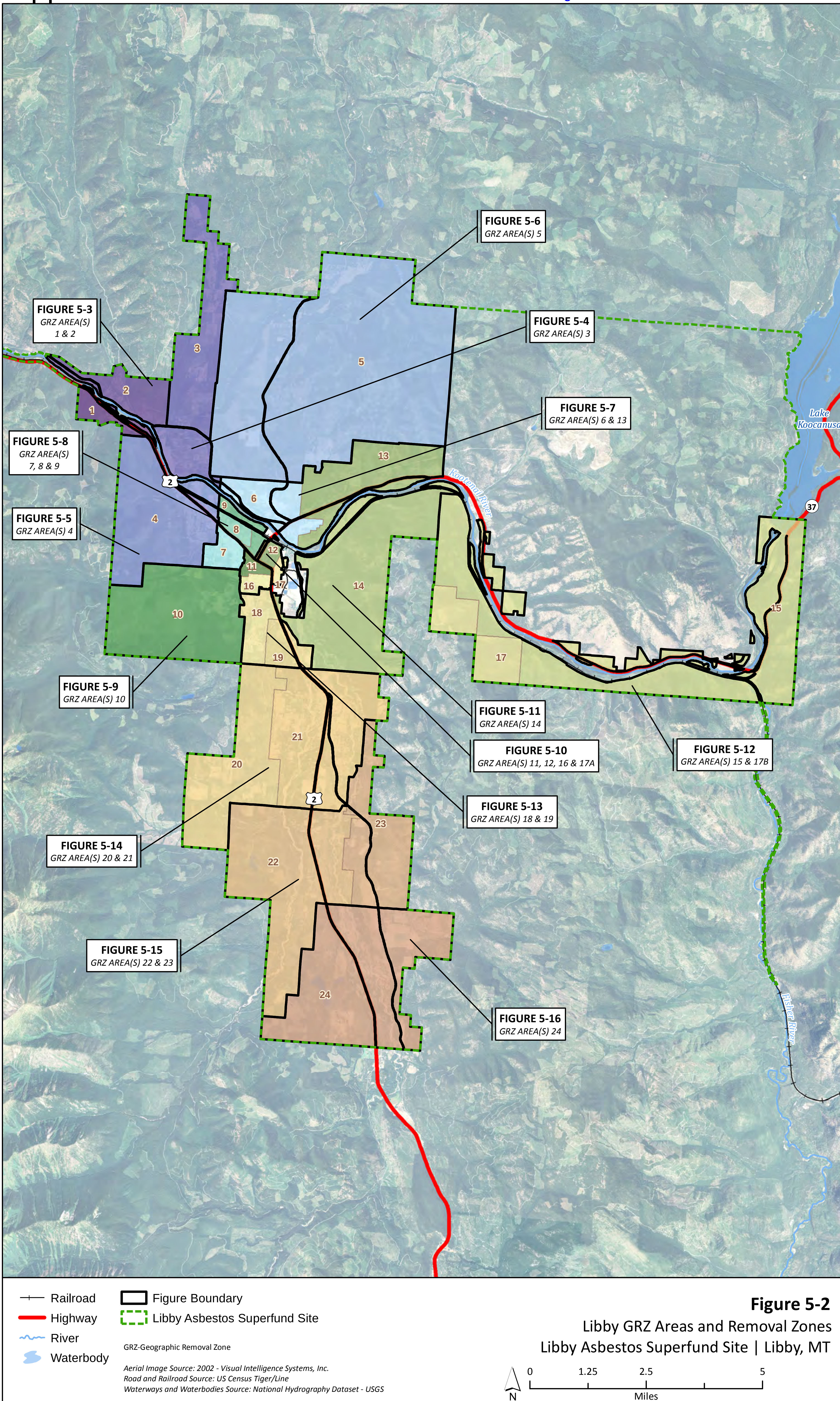
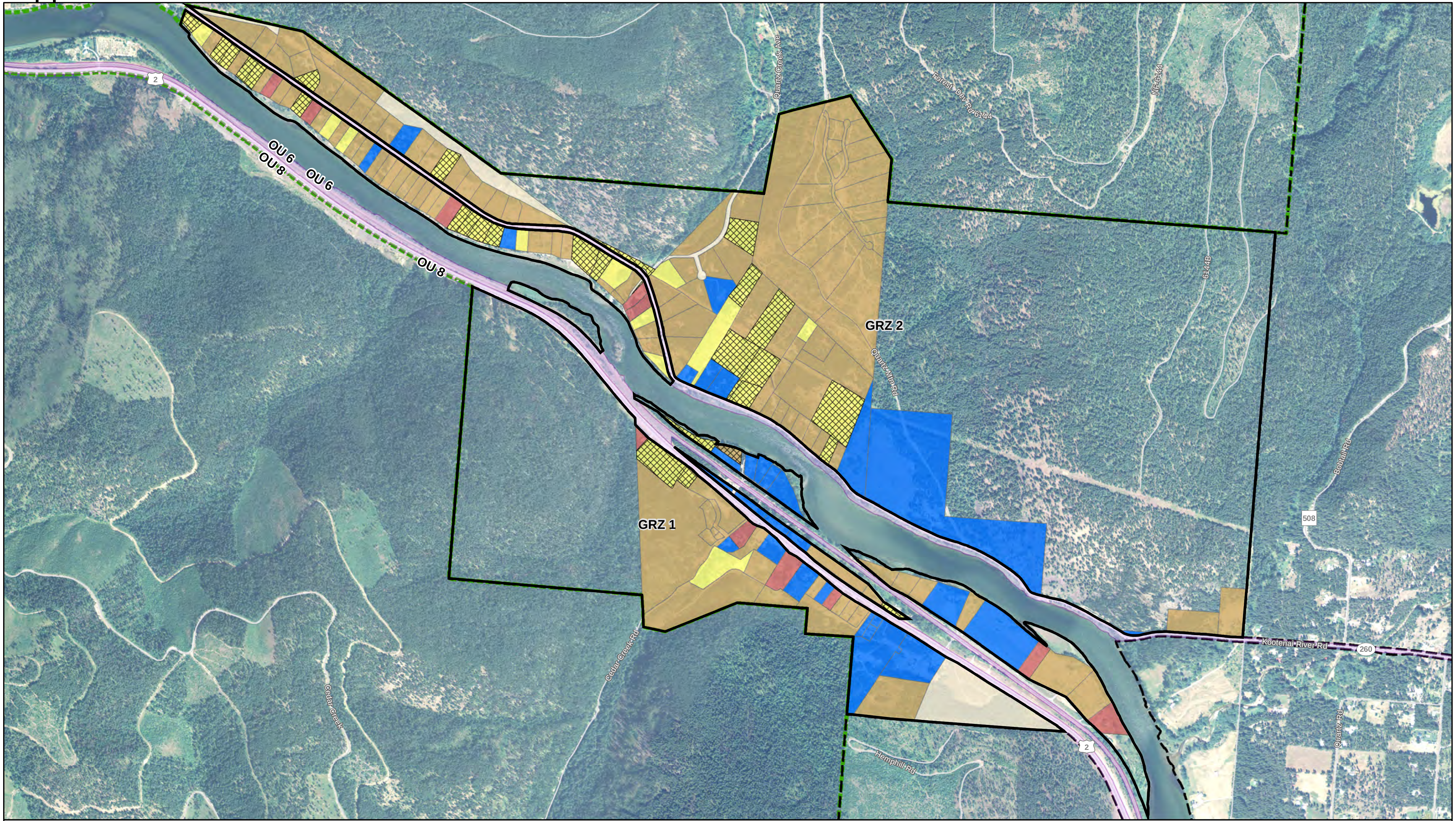


Figure 5-2
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

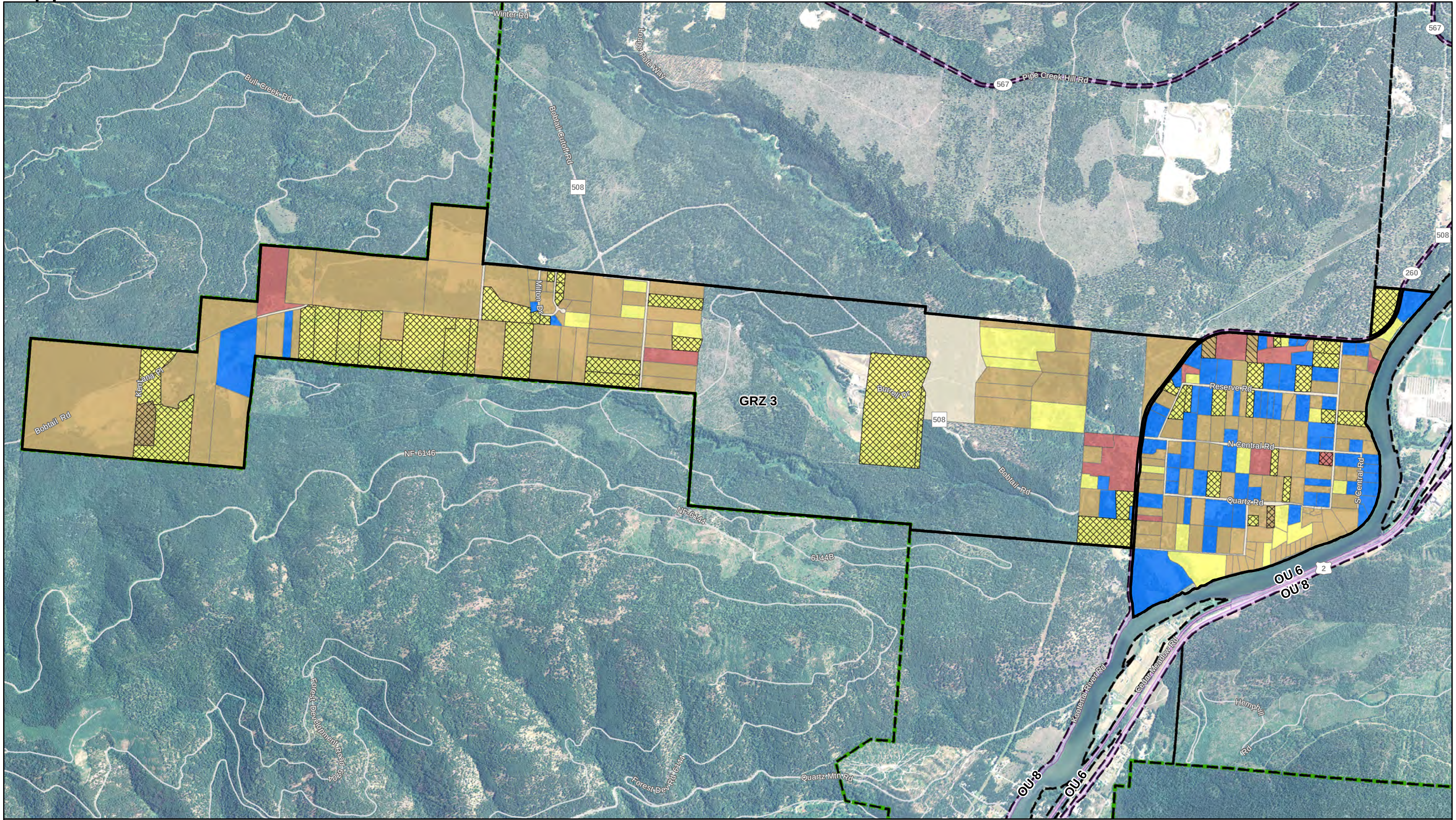
Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-3. GRZ(s) 1 and 2
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 600 1,200 2,400
Feet

Appendix A



Property Status
- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required
- Response Action Required
  - -Indoor
  - -Outdoor
  - -Combination
- Response Action Completed
  - -Indoor
  - -Outdoor
  - -Combination

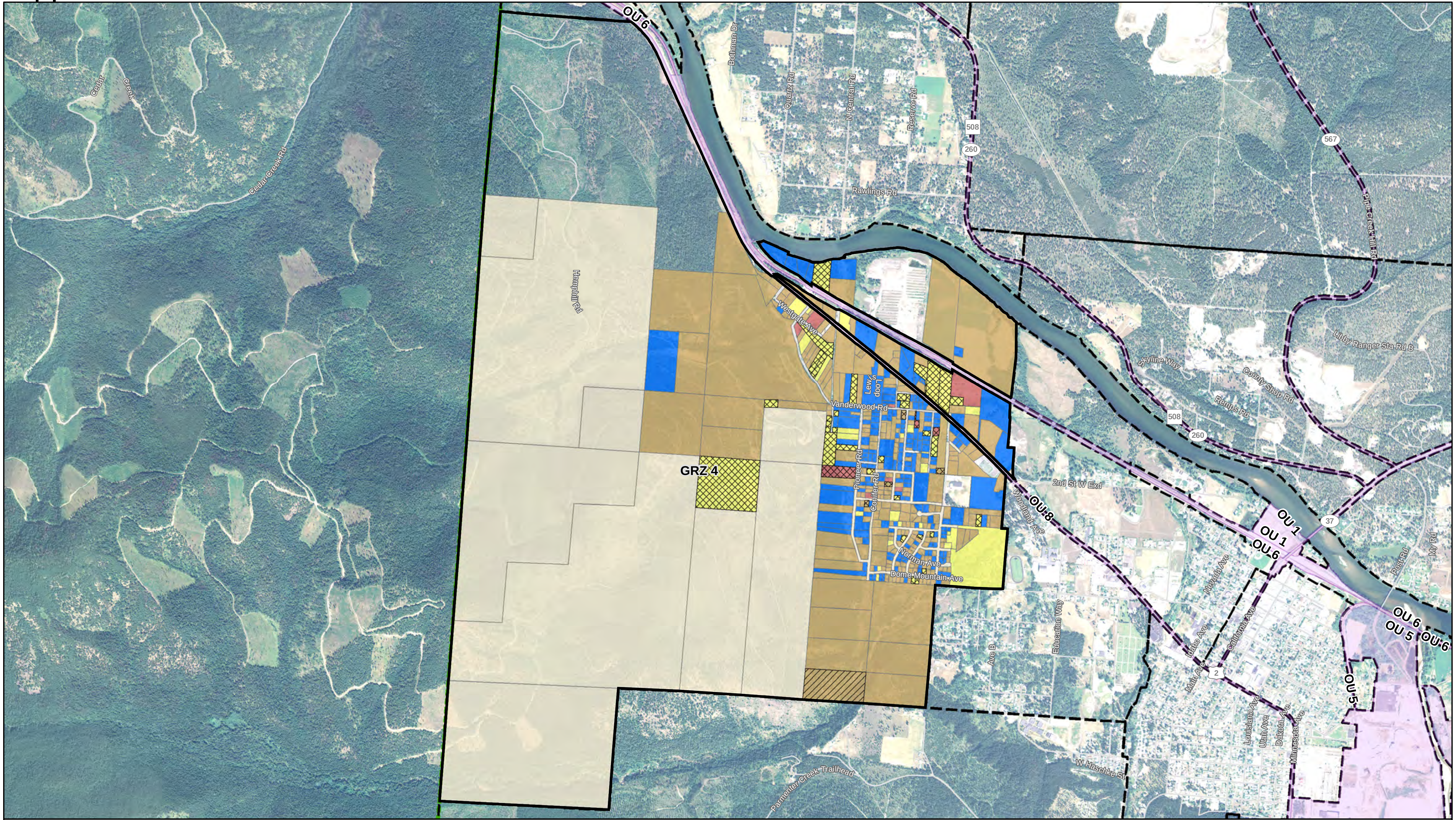
GRZ Boundary (Property Status Shown On This Figure)
GRZ Boundary (Property Status Not Shown On This Figure)
Limited Property Access
Refused Property Access
Libby Asbestos Superfund Site
OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-4. GRZ(s) 3
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 1,100 2,200 4,400
Feet



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-5. GRZ(s) 4

Libby GRZ Areas and Removal Zones

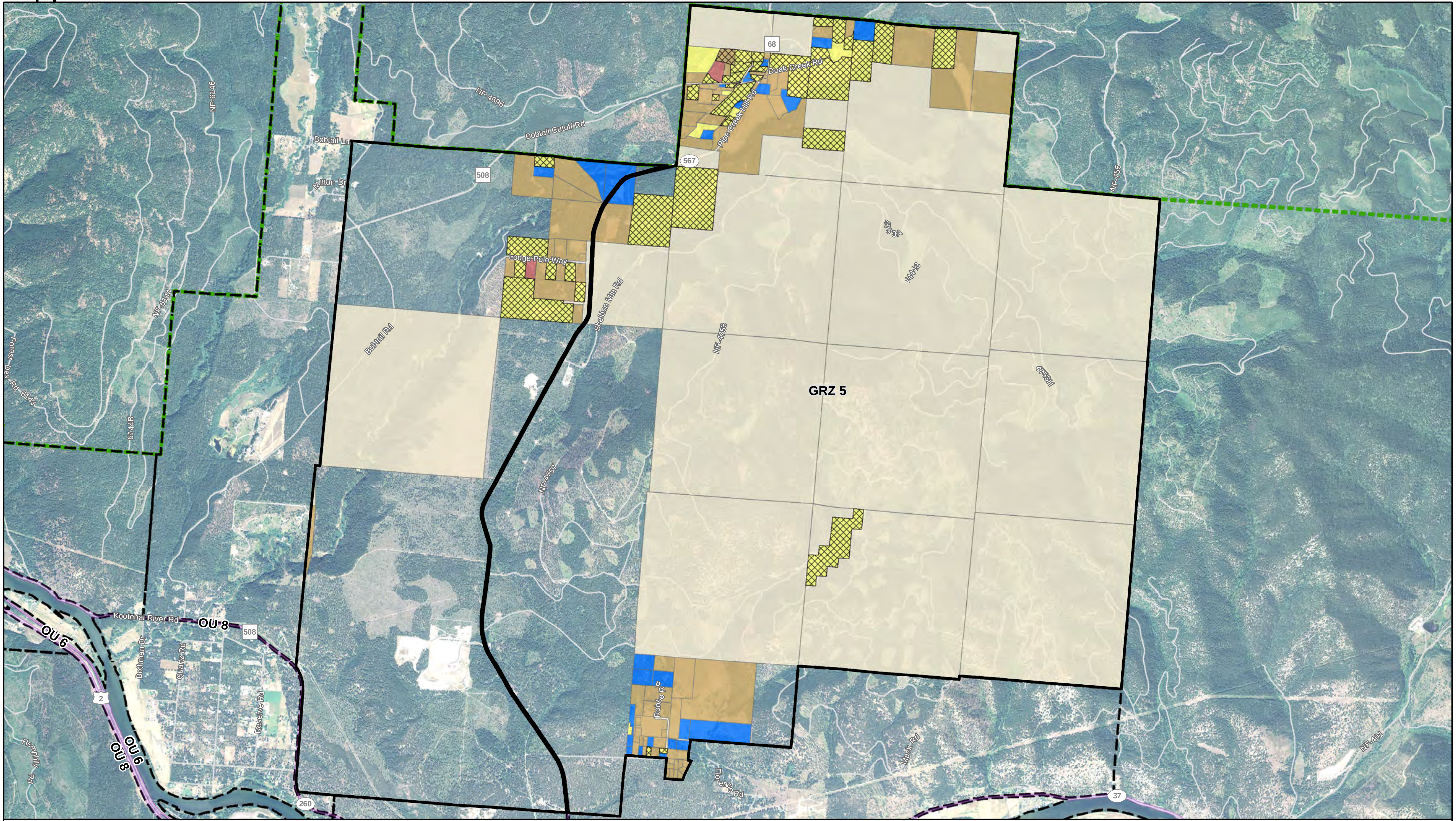
Libby Asbestos Superfund Site | Libby, MT

N

0 1,000 2,000 4,000

Feet

Appendix A



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): Property Access Status: Refused category includes properties where access has been deferred.
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-6. GRZ(s) 5

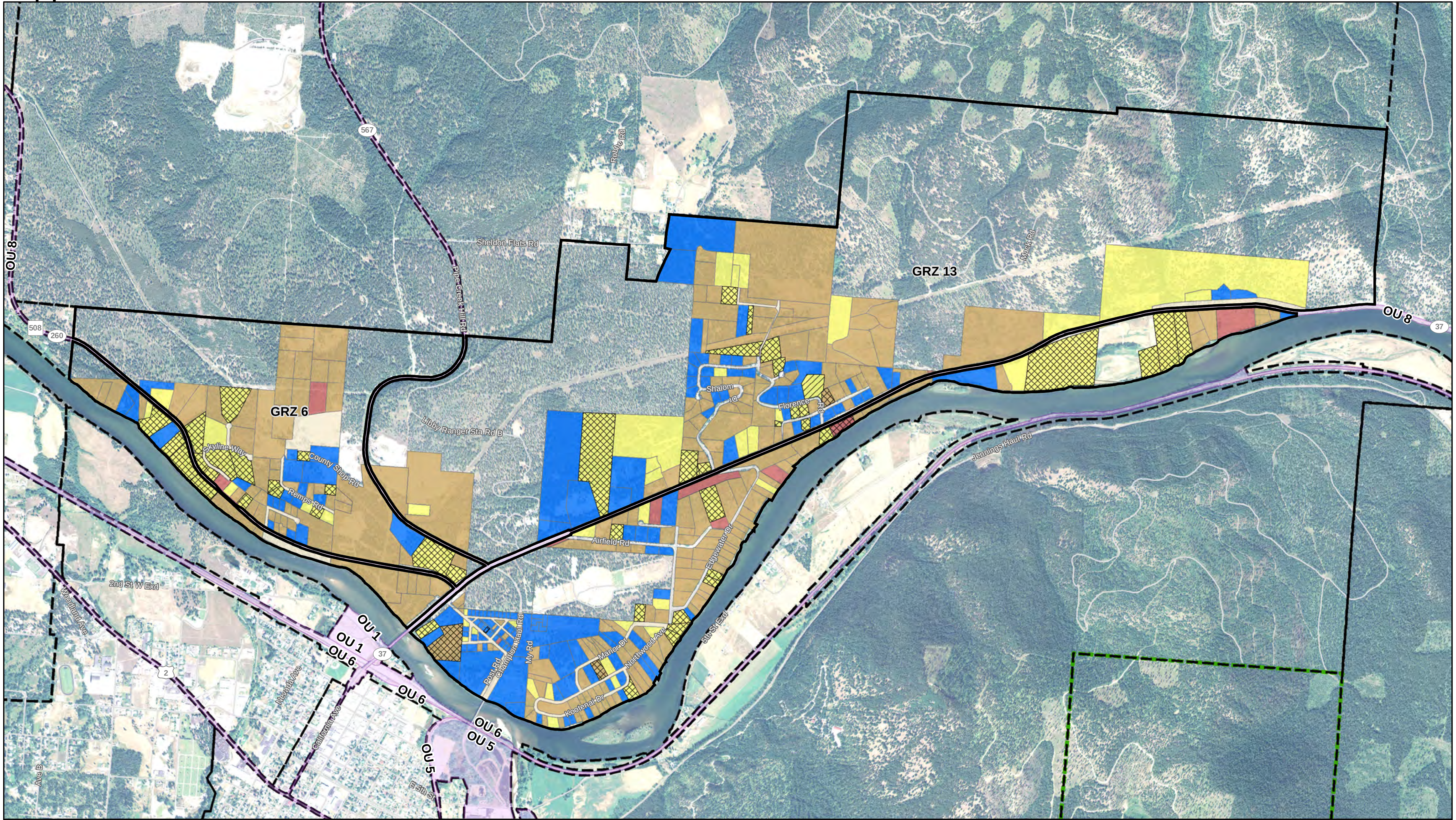
Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 1,500 3,000 6,000

Feet



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
- -Indoor
- -Outdoor
- -Combination

Response Action Completed
- -Indoor
- -Outdoor
- -Combination

- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

Note(s): Property Access Status: Refused category includes properties where access has been deferred.
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

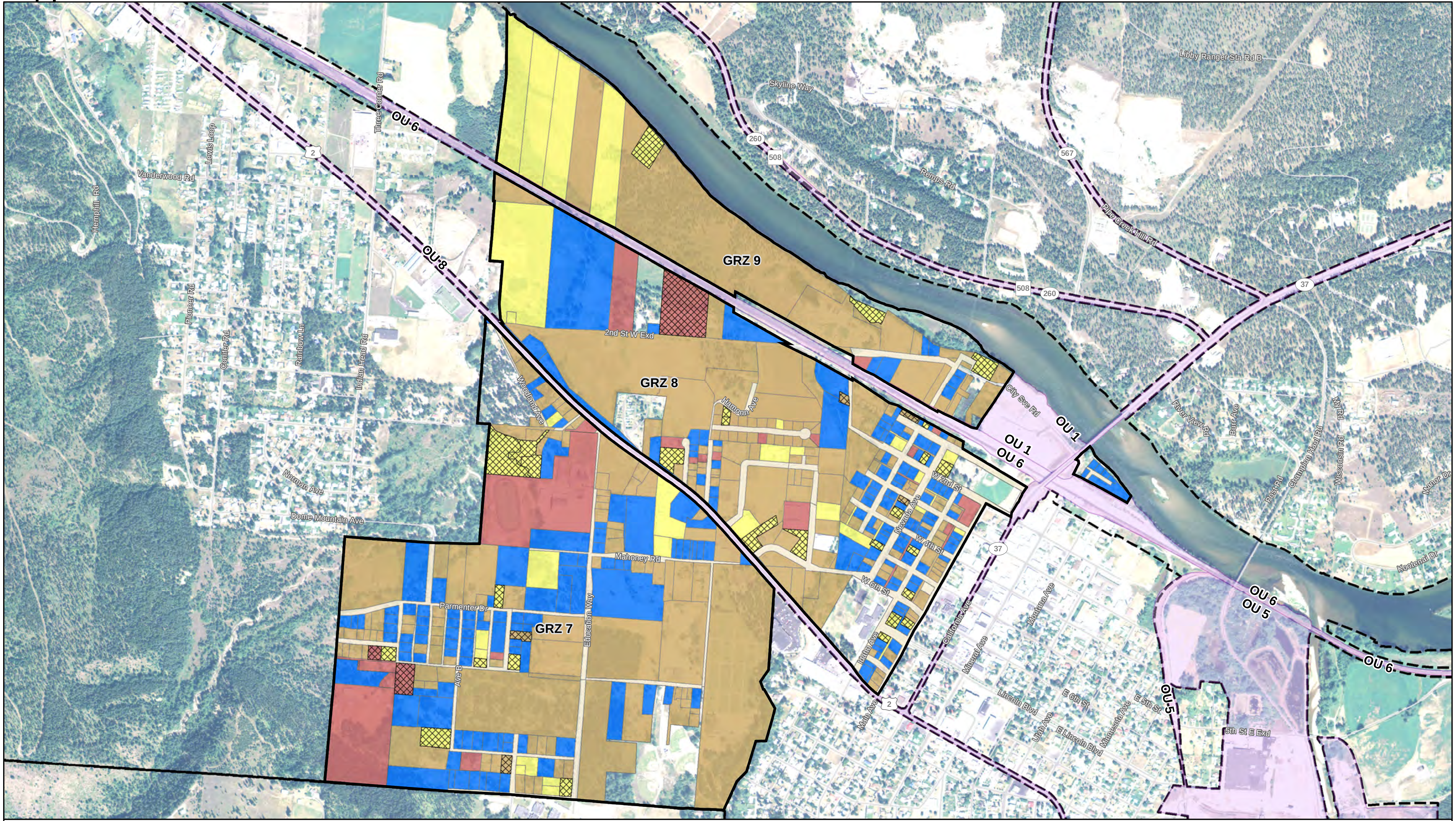
Property Status Source: Scribe and EPA Response Manager, 02/05/15

N

0 900 1,800 3,600
Feet

Figure 5-7. GRZ(s) 6 and 13
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

Appendix A



Property Status
- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
- -Indoor
- -Outdoor
- -Combination

Response Action Completed
- -Indoor
- -Outdoor
- -Combination

- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access

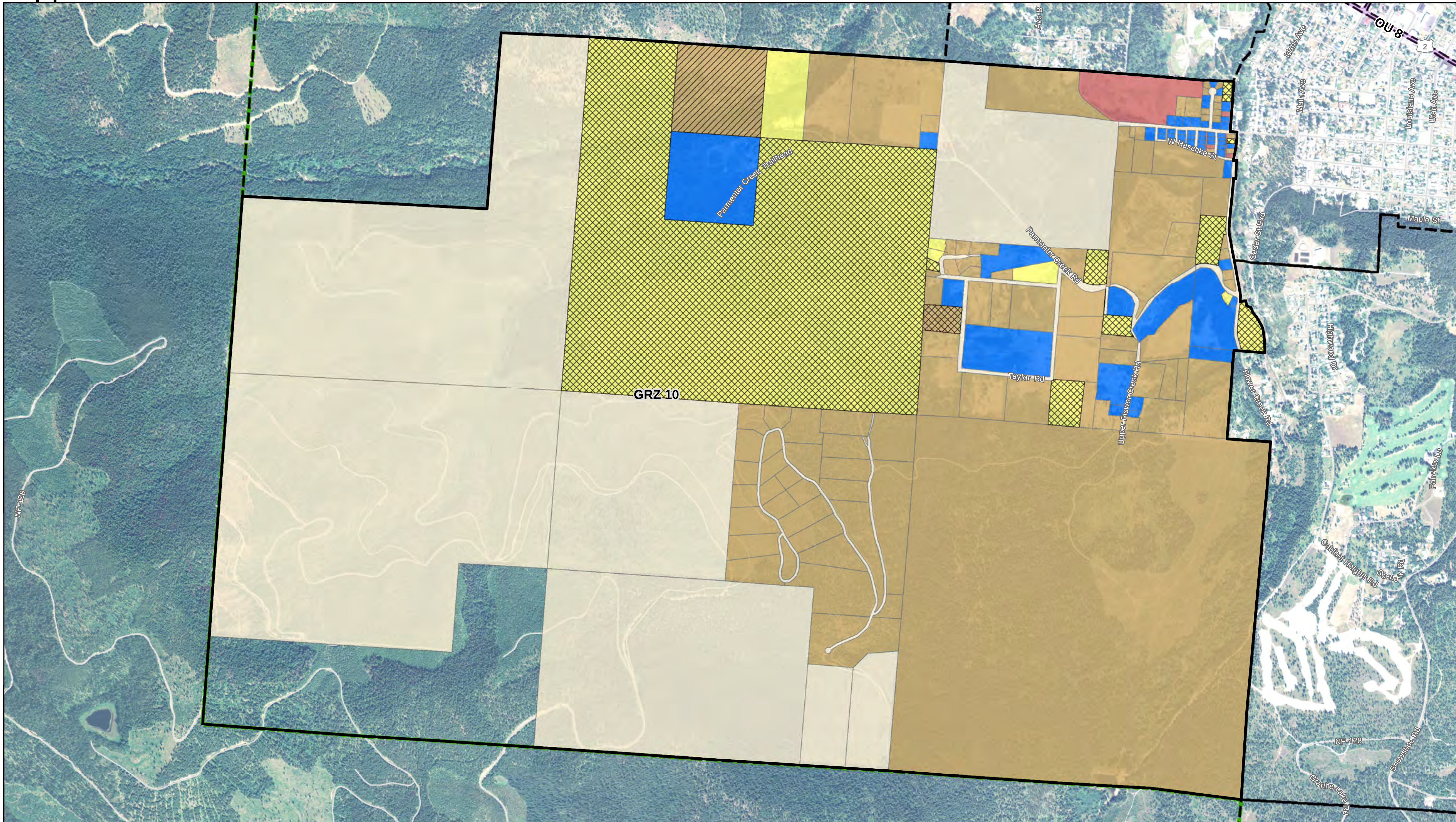
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

Note(s): Property Access Status: Refused category includes properties where access has been deferred.
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-8. GRZ(s) 7, 8, and 9
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 500 1,000 2,000
Feet



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

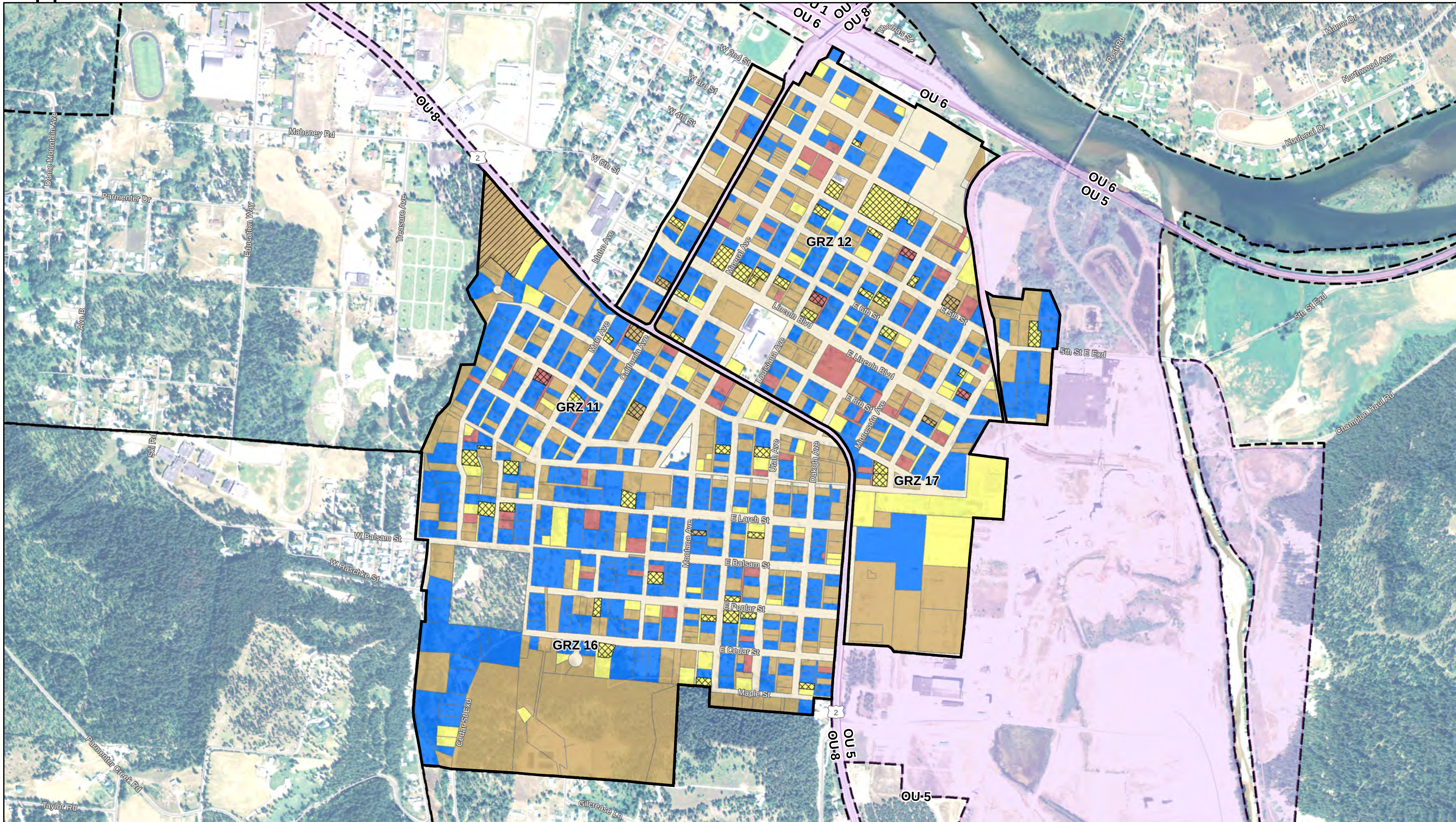
Figure 5-9. GRZ(s) 10

Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 700 1,400 2,800
Feet



Property Status

Inspection Not Required

Inspection Required

Inspection Completed

Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-10. GRZ(s) 11, 12, 16, and 17A

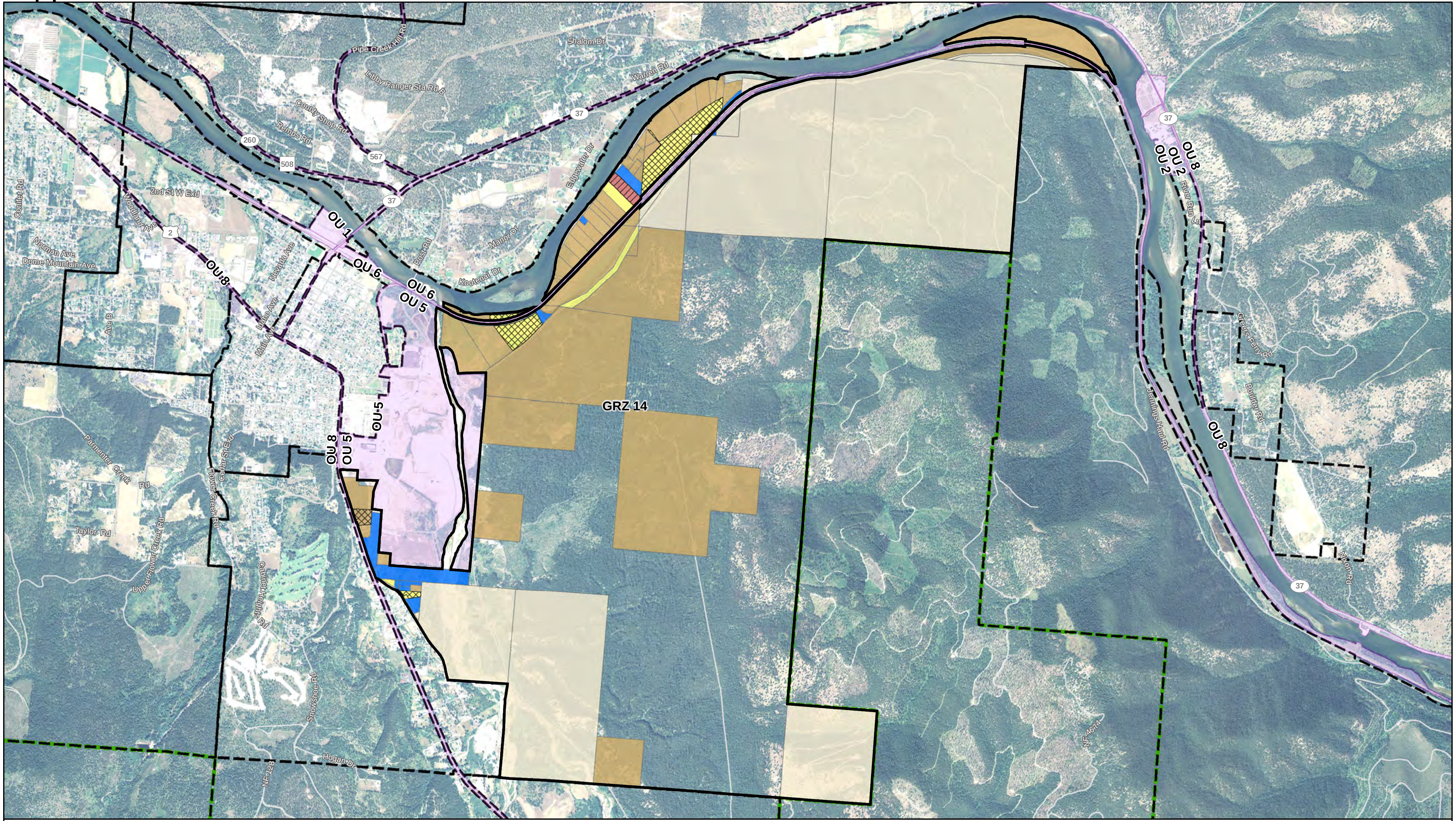
Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 400 800 1,600
Feet

Appendix A



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required
- Response Action Required
  - *-Indoor*
  - *-Outdoor*
  - *-Combination*
- Response Action Completed
  - *-Indoor*
  - *-Outdoor*
  - *-Combination*
- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

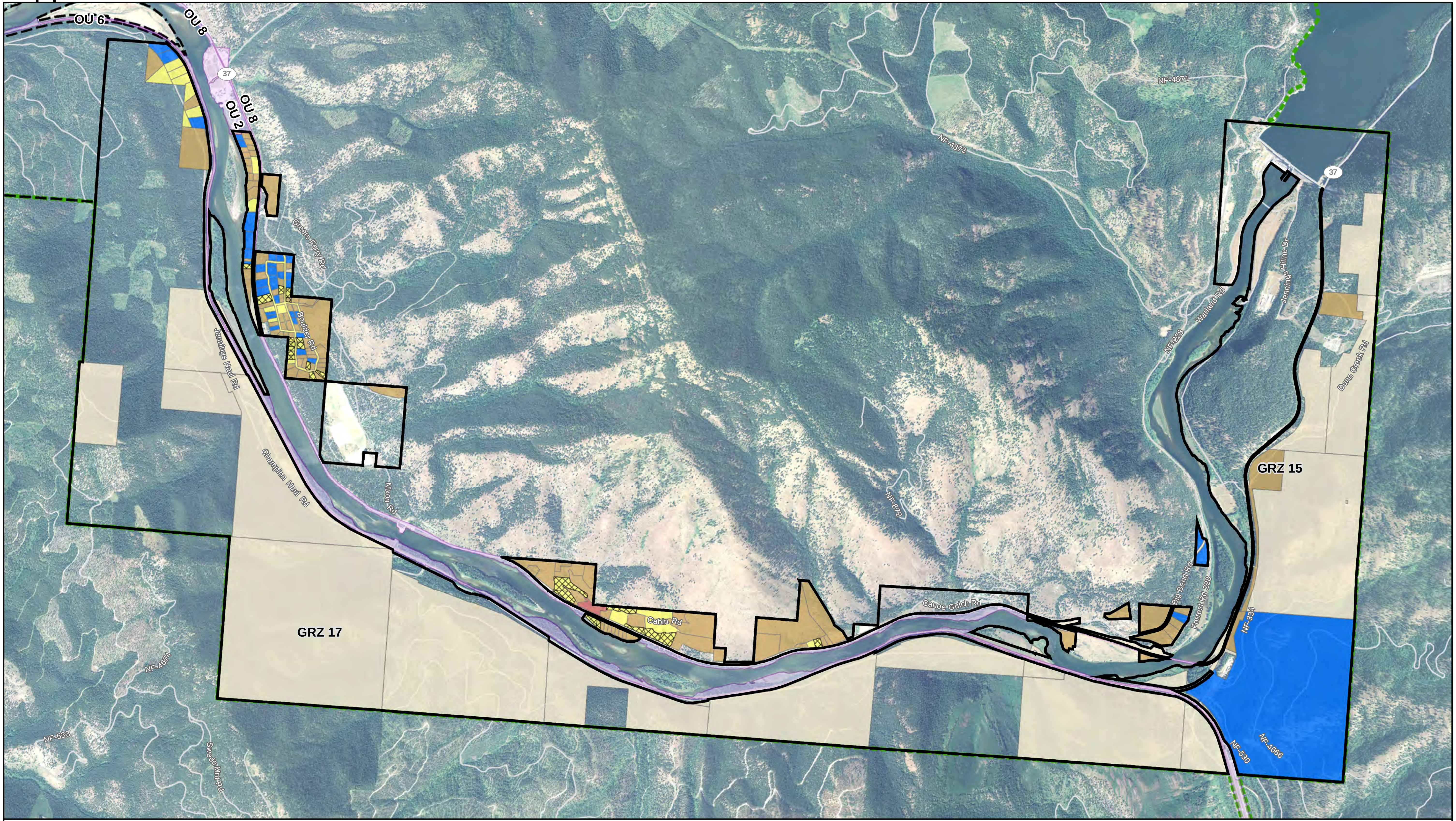
Figure 5-11. GRZ(s) 14

Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N 0 1,300 2,600 5,200 Feet

Appendix A



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

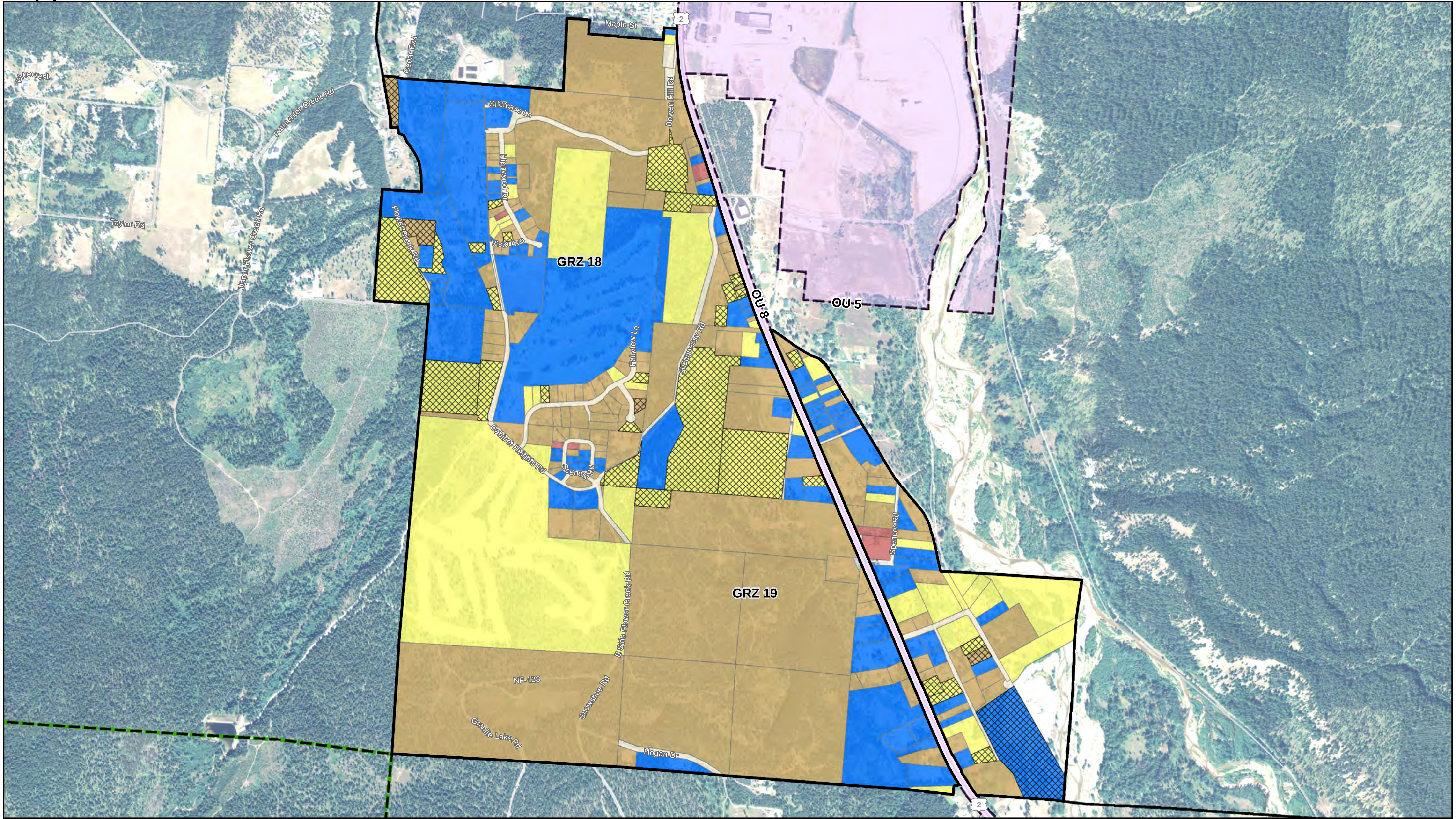
Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-12. GRZ(s) 15 and 17B
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 1,500 3,000 6,000
Feet

Appendix A



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): Property Access Status: Refused category includes properties where access has been deferred.
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-13. GRZ(s) 18 and 19

Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 550 1,100 2,200
Feet

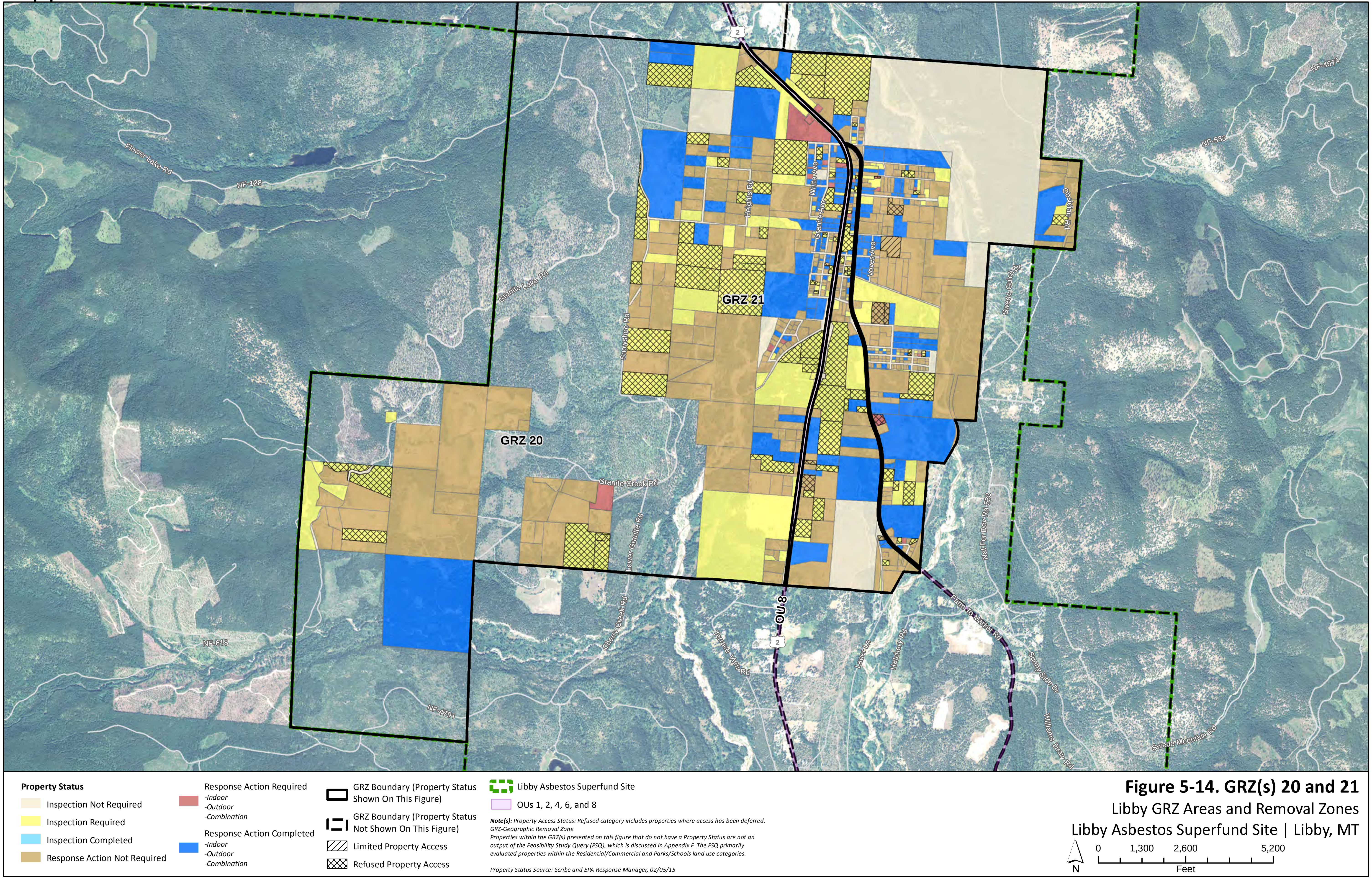
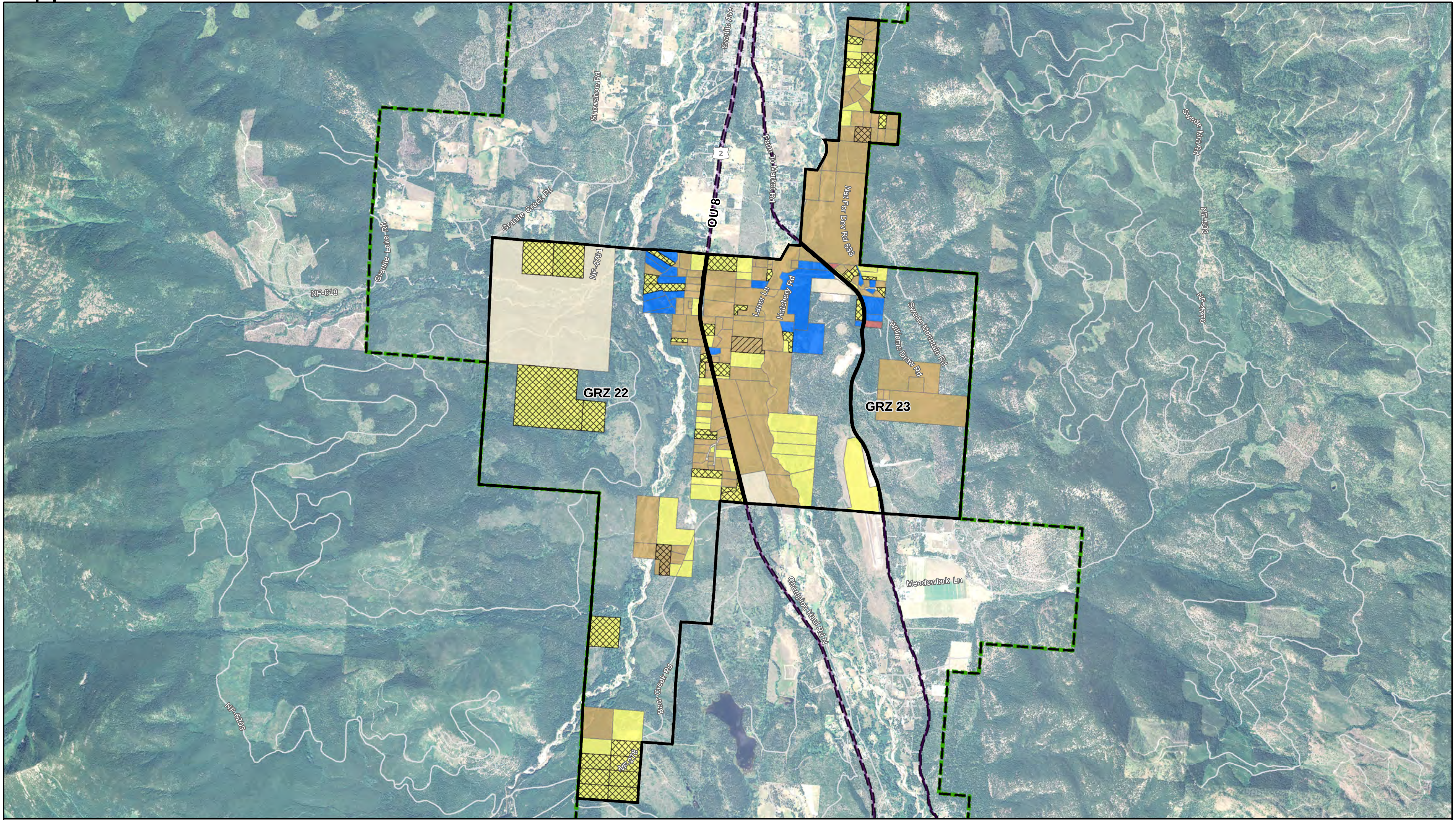


Figure 5-14. GRZ(s) 20 and 21

Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

Appendix A



Property Status
- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

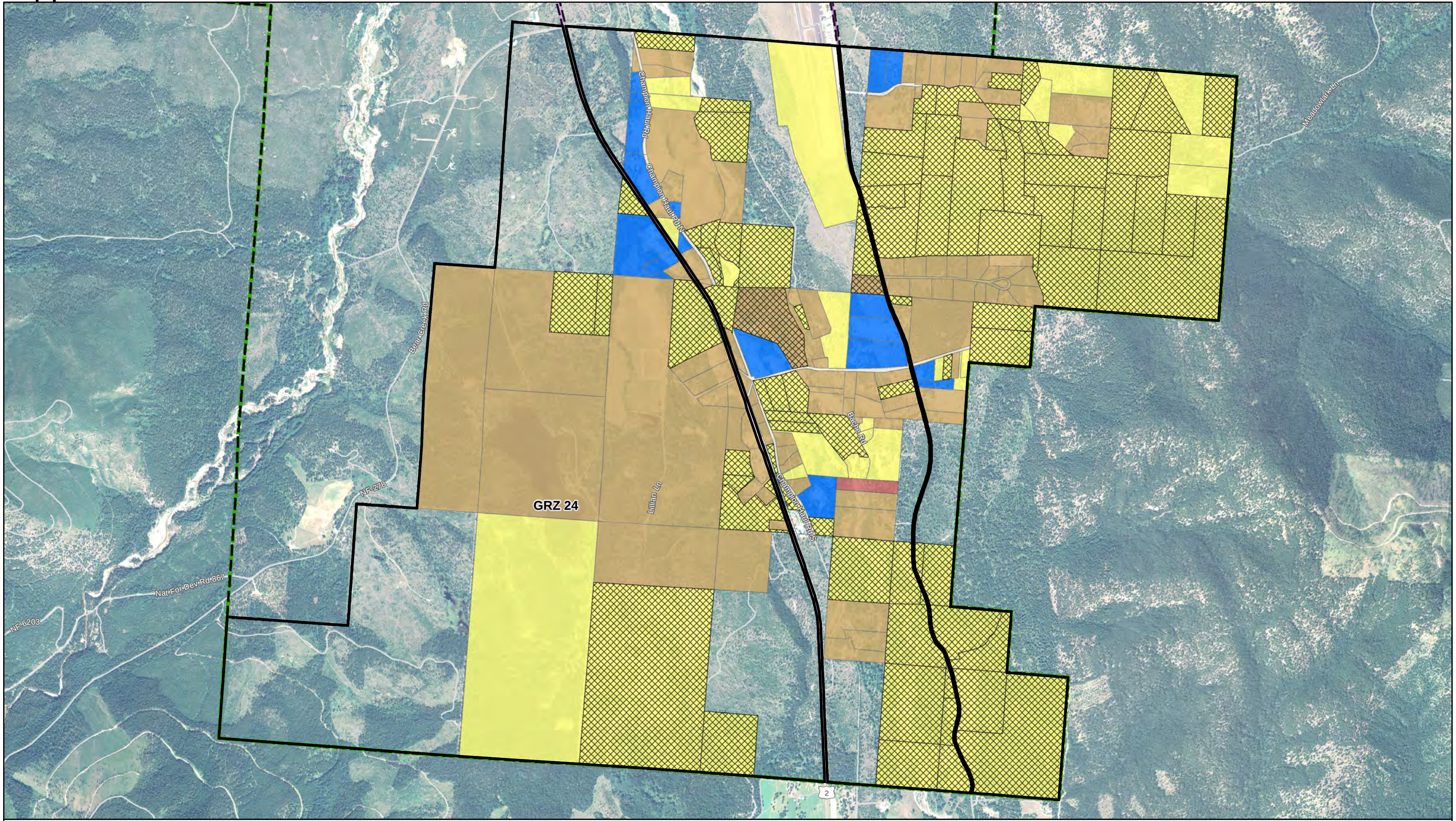
OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-15. GRZ(s) 22 and 23
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 2,000 4,000 8,000
Feet



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-16. GRZ(s) 24

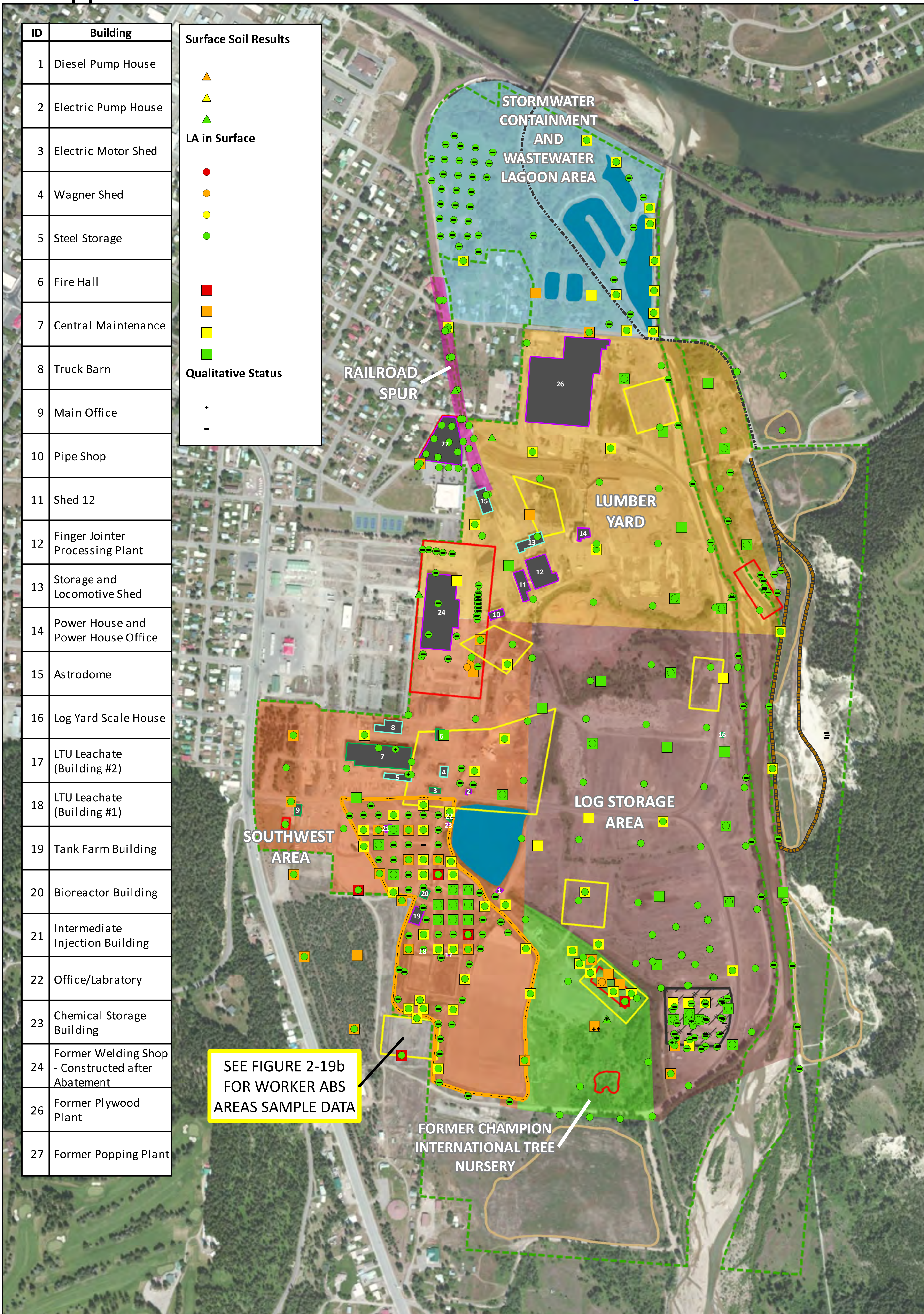
Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 1,000 2,000 4,000
Feet

ID	Building
1	Diesel Pump House
2	Electric Pump House
3	Electric Motor Shed
4	Wagner Shed
5	Steel Storage
6	Fire Hall
7	Central Maintenance
8	Truck Barn
9	Main Office
10	Pipe Shop
11	Shed 12
12	Finger Jointer Processing Plant
13	Storage and Locomotive Shed
14	Power House and Power House Office
15	Astrodome
16	Log Yard Scale House
17	LTU Leachate (Building #2)
18	LTU Leachate (Building #1)
19	Tank Farm Building
20	Bioreactor Building
21	Intermediate Injection Building
22	Office/Labratory
23	Chemical Storage Building
24	Former Welding Shop - Constructed after Abatement
26	Former Plywood Plant
27	Former Popping Plant



OU 5 Boundary
Bike Path (Paved as of September 2010)
Bike Path (Unpaved or Partially Paved)
MotoX Track
Surface Water
Worker ABS Areas
Abatement Response Action Areas*
Libby Groundwater Superfund Site
Approved Waste Bark Disposal Area

Building Status

Occupied
Open Air
Vacant

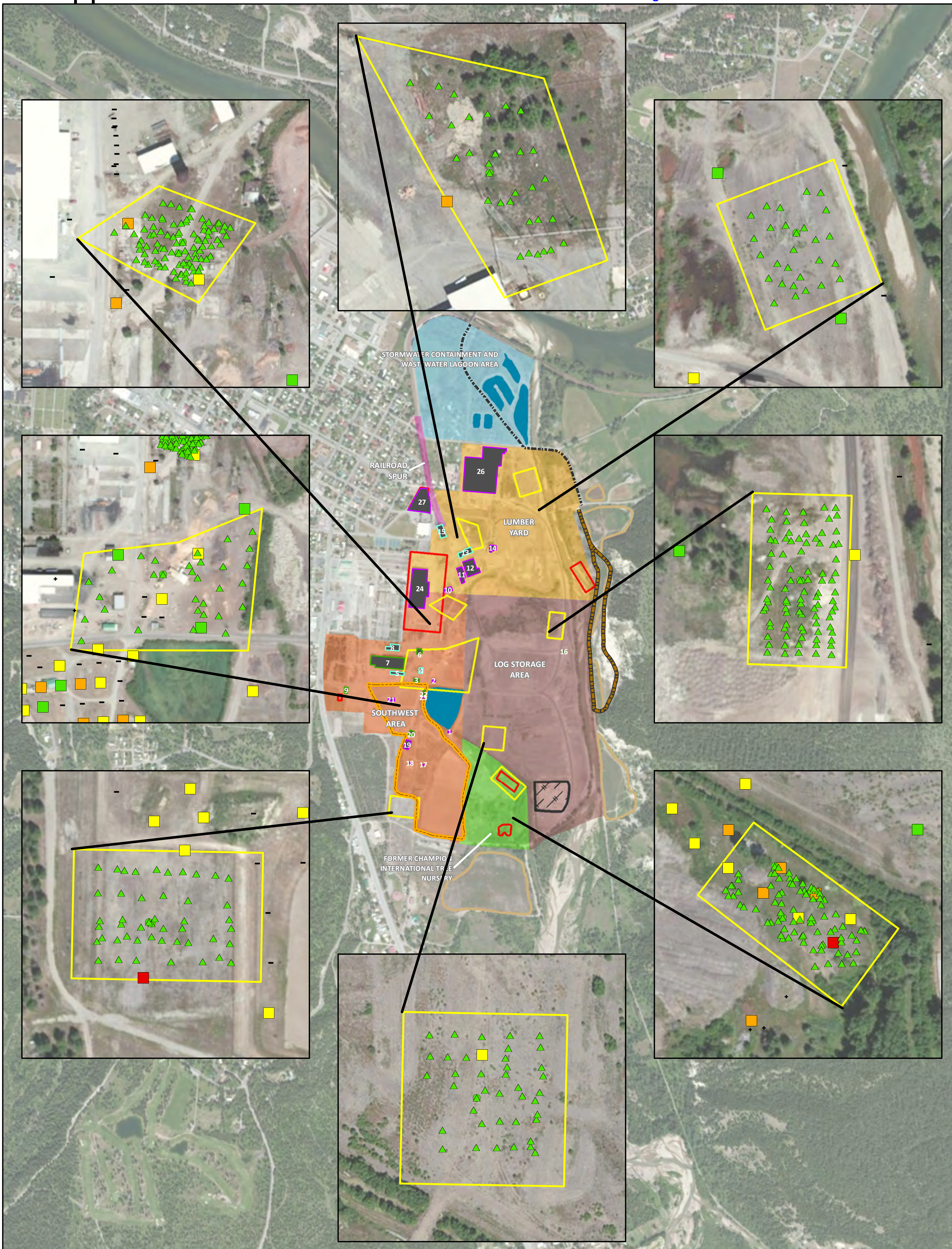
Figure 5-17a

LA and Visible Vermiculite in Surface Soil at OU5

Libby Asbestos Superfund Site | Libby, MT

*Results shown on figure reflect testing done before abatement response actions.
GRZ-Geographic Removal Zone
Shapefile source: HDR Engineering, Inc. - OU5 Remedial Investigation
Aerial: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N 0 250 500 1,000 Feet



OU 5 Boundary
Bike Path (Paved as of September 2010)
Bike Path (Unpaved or Partially Paved)
MotoX Track
Worker ABS Areas
Abatement Response Action Areas*
Libby Groundwater Superfund Site
Approved Waste Bark Disposal Area
Surface Water

Building Status
Occupied
Open Air
Vacant

See Figure 2-19a for building index

Surface Soil Results

LA in Surface (Grab)
< 1%
Trace
Non-Detect

LA in Surface (Composite)
>= 1%
< 1%
Trace
Non-Detect

Visible Vermiculite Results

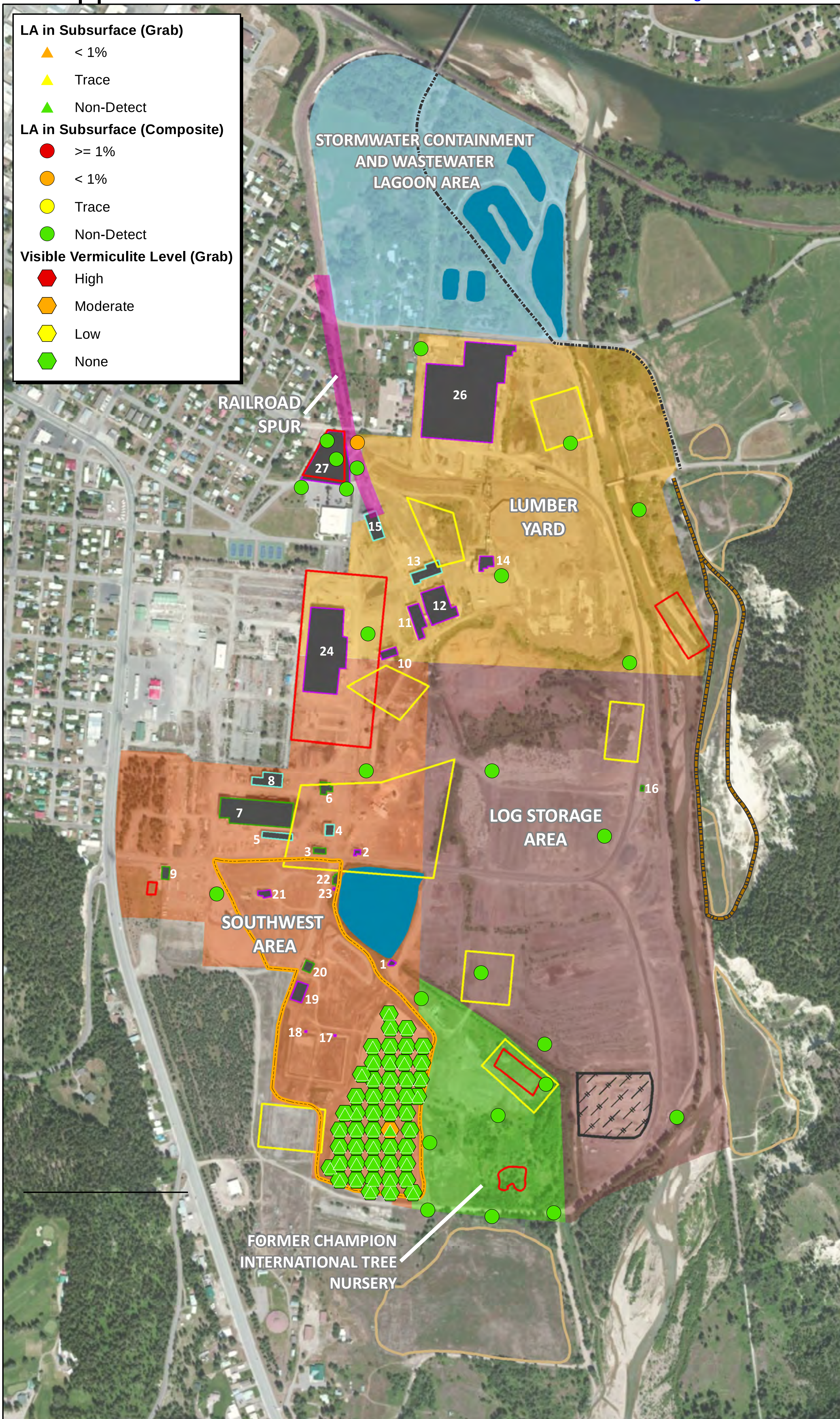
Composite Score
>0.3-0.5
>0.1-0.3
<= 0.1
0 (Non-Detect)

Qualitative Status
(Grab & Composite)
VIS +
VIS -

Figure 5-17b
LA and Visible Vermiculite in Surface Soil at OU5
Worker ABS Areas
Libby Asbestos Superfund Site | Libby, MT

*Results shown on figure reflect testing done before abatement response actions.
GRZ –Geographic Removal Zone
Shapefile source: HDR Engineering, Inc. - OU5 Remedial Investigation
Aerial: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N
0 500 1,000 2,000
Feet (Basemap Scale)



ID	Building
1	Diesel Pump House
2	Electric Pump House
3	Electric Motor Shed
4	Wagner Shed
5	Steel Storage
6	Fire Hall
7	Central Maintenance
8	Truck Barn
9	Main Office
10	Pipe Shop
11	Shed 12
12	Finger Jointer Processing Plant
13	Storage and Locomotive Shed
14	Power House and Power House Office
15	Astrodome
16	Log Yard Scale House
17	LTU Leachate (Building #2)
18	LTU Leachate (Building #1)
19	Tank Farm Building
20	Bioreactor Building
21	Intermediate Injection Building
22	Office/Labratory
23	Chemical Storage Building
24	Former Welding Shop - Constructed after Abatement
26	Former Plywood Plant
27	Former Popping Plant

OU 5 Boundary
Bike Path (Paved as of September 2010)
Bike Path (Unpaved or Partially Paved)
MotoX Track
Surface Water
Worker ABS Areas
Abatement Response Action Areas*

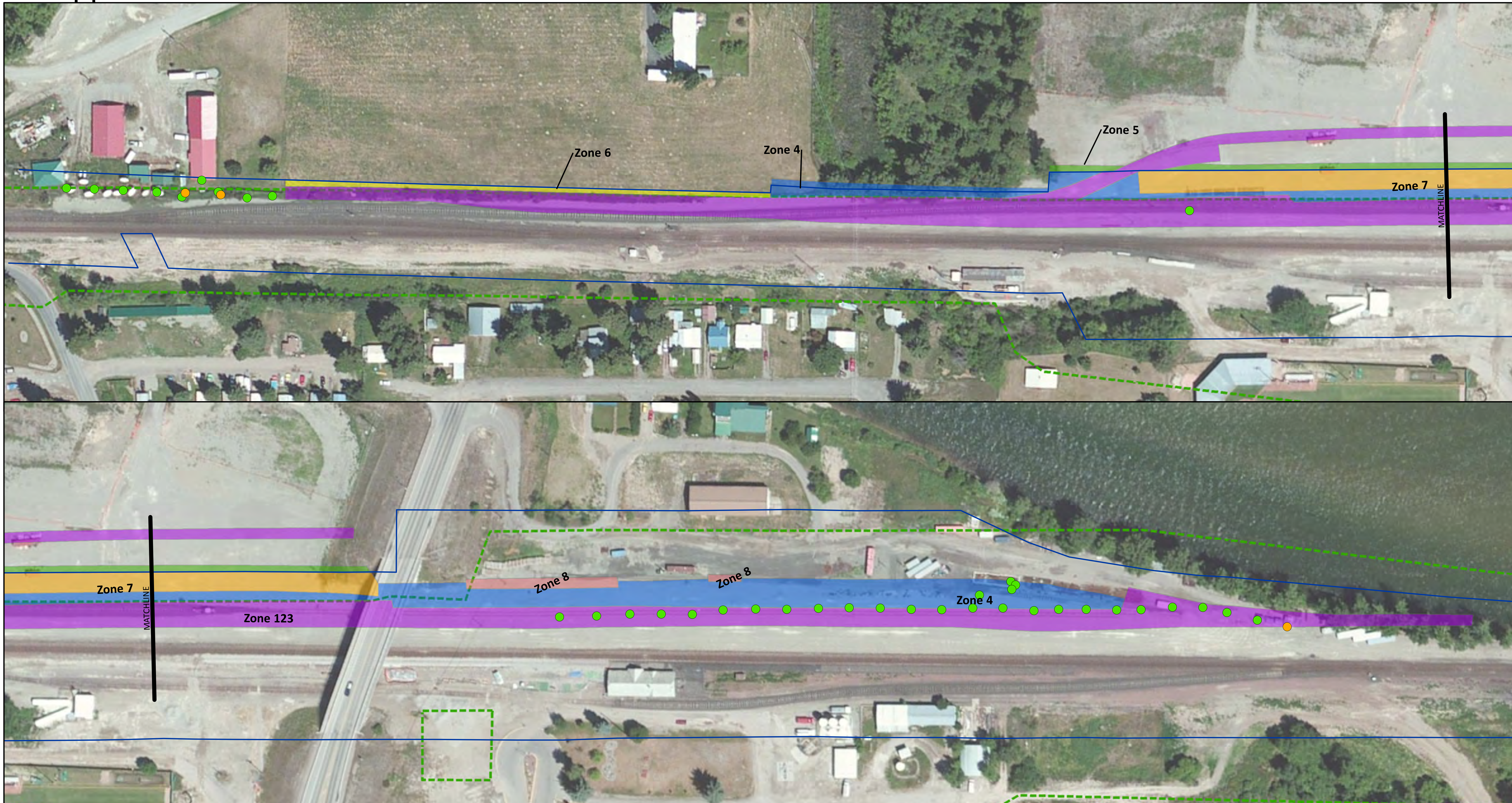
Libby Groundwater Superfund Site
Approved Waste Bark Disposal Area

Building Status
Occupied
Open Air
Vacant

Figure 5-18
LA and Visible Vermiculite in Subsurface Soil at OU5
Libby Asbestos Superfund Site | Libby, MT

*Results shown on figure reflect testing done before abatement response actions.
GRZ –Geographic Removal Zone
Shapefile source: HDR Engineering, Inc. - OU5 Remedial Investigation
Aerial: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 250 500 1,000 1,500
Feet
N



OU6 Boundary
BNSF Libby Railyard Property Line
Zone 1/2/3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8

LA in Surface
Non-Detect
Trace
< 1%
>= 1%

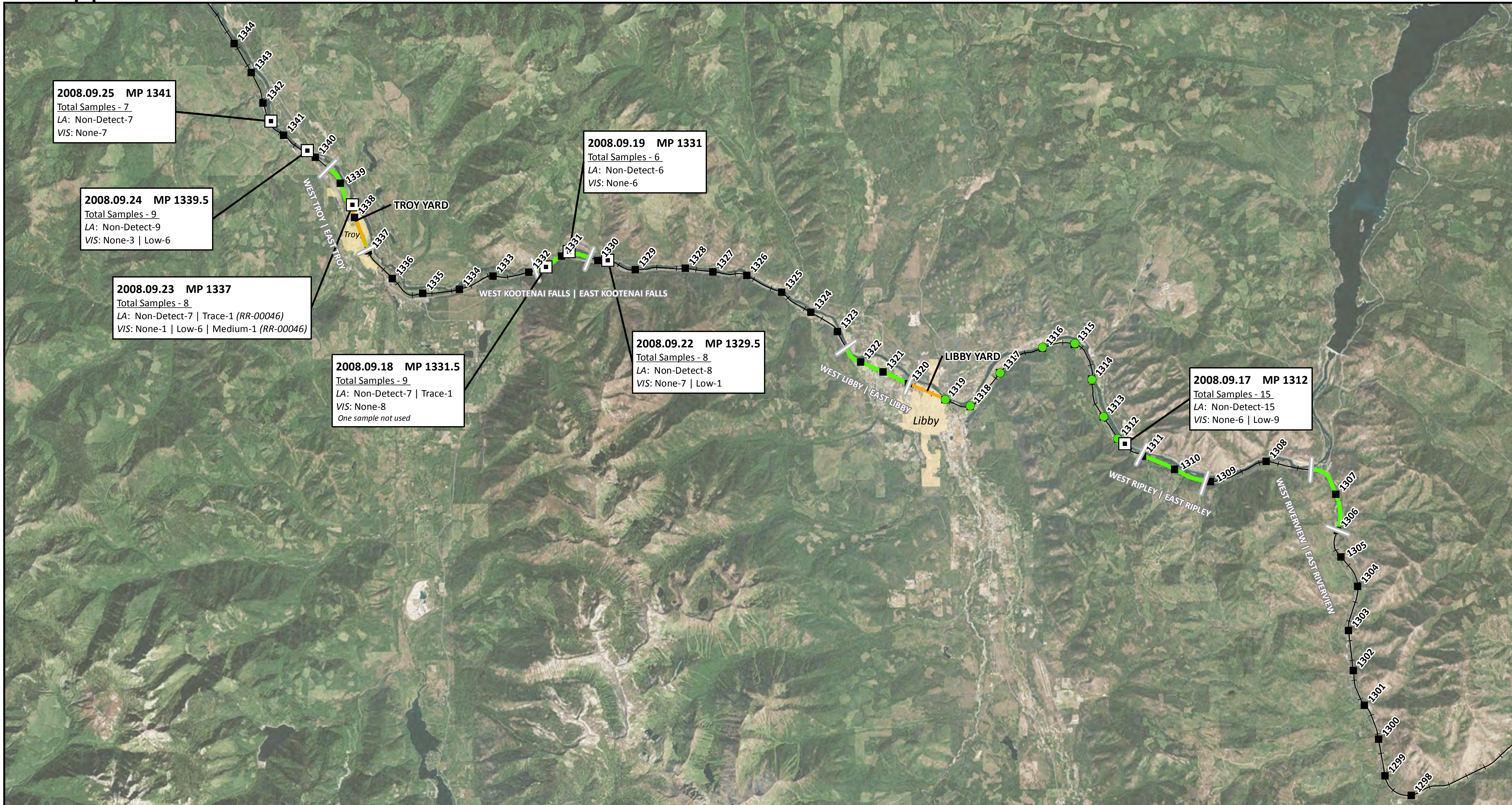
Data from Libby Railyard Response Action 2004 Revised Construction Completion Report, March 2005, prepared for BNSF Railway Company by Kennedy/Jenks Consultants and

AerialSource: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 5-19
Response Action Zones and LA in Surface Soil at BNSF Libby Railyard
Libby Asbestos Superfund Site | Libby, MT

N
0 125 250 500
Feet

Appendix A



City Boundary
Railway
City Yard
Rail Sidings
Mileposts

EMR 2008 ABS Sampling Report - Soil PLM-VE Results

Right-of-Way Sampling Results - LA Non-Detect

WEST LIBBY | EAST LIBBY Rail Siding Section Start Point | End Point

Locations for Right of Way sample results are approximate.
Shapefile source: EMR, Inc. - 2008

Aerial: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 5-20
LA and Visible Vermiculite in Surface Soil within OU6 Right-of-Way
Libby Asbestos Superfund Site | Libby, MT

N
0 1.25 2.5 5
Miles

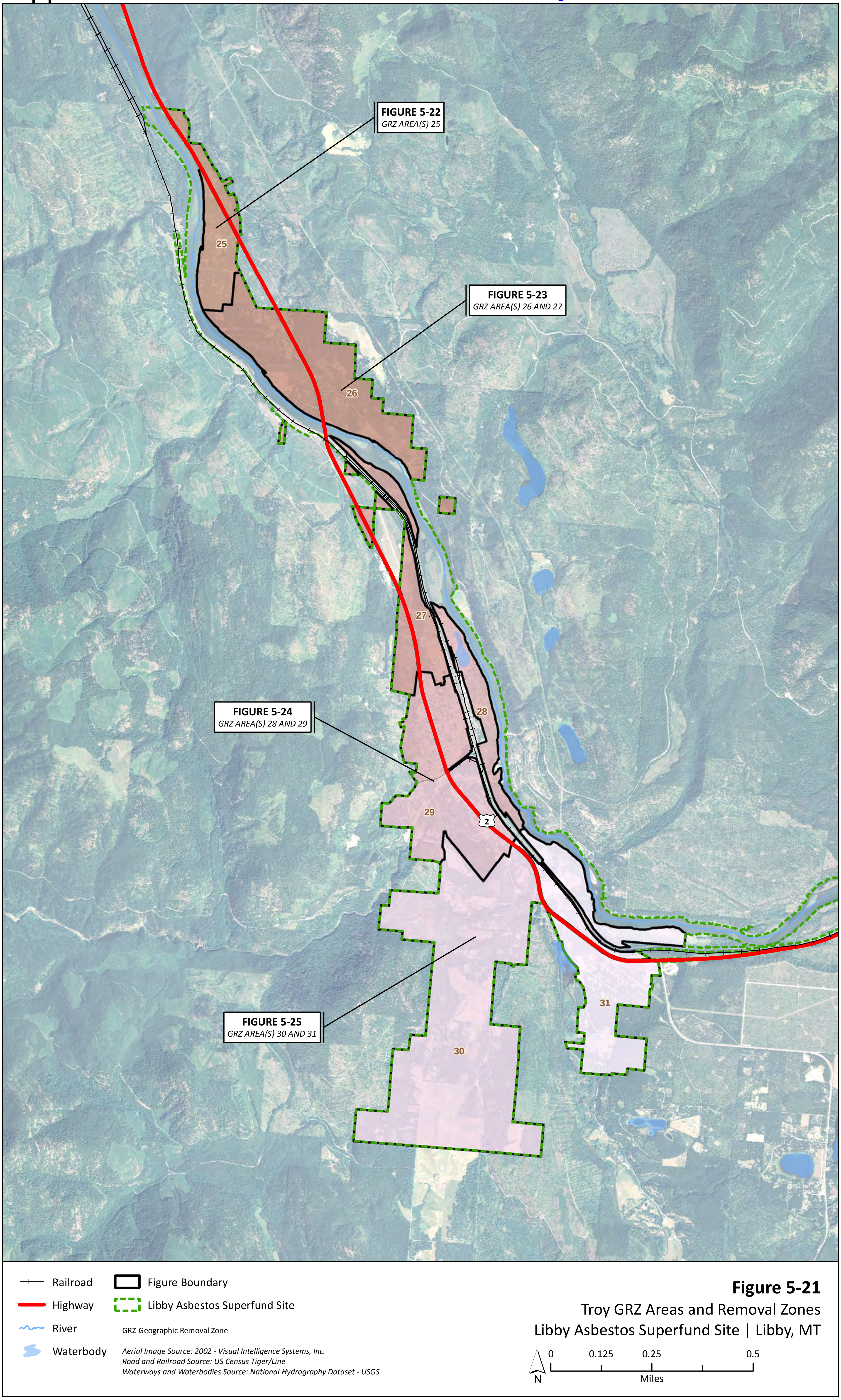
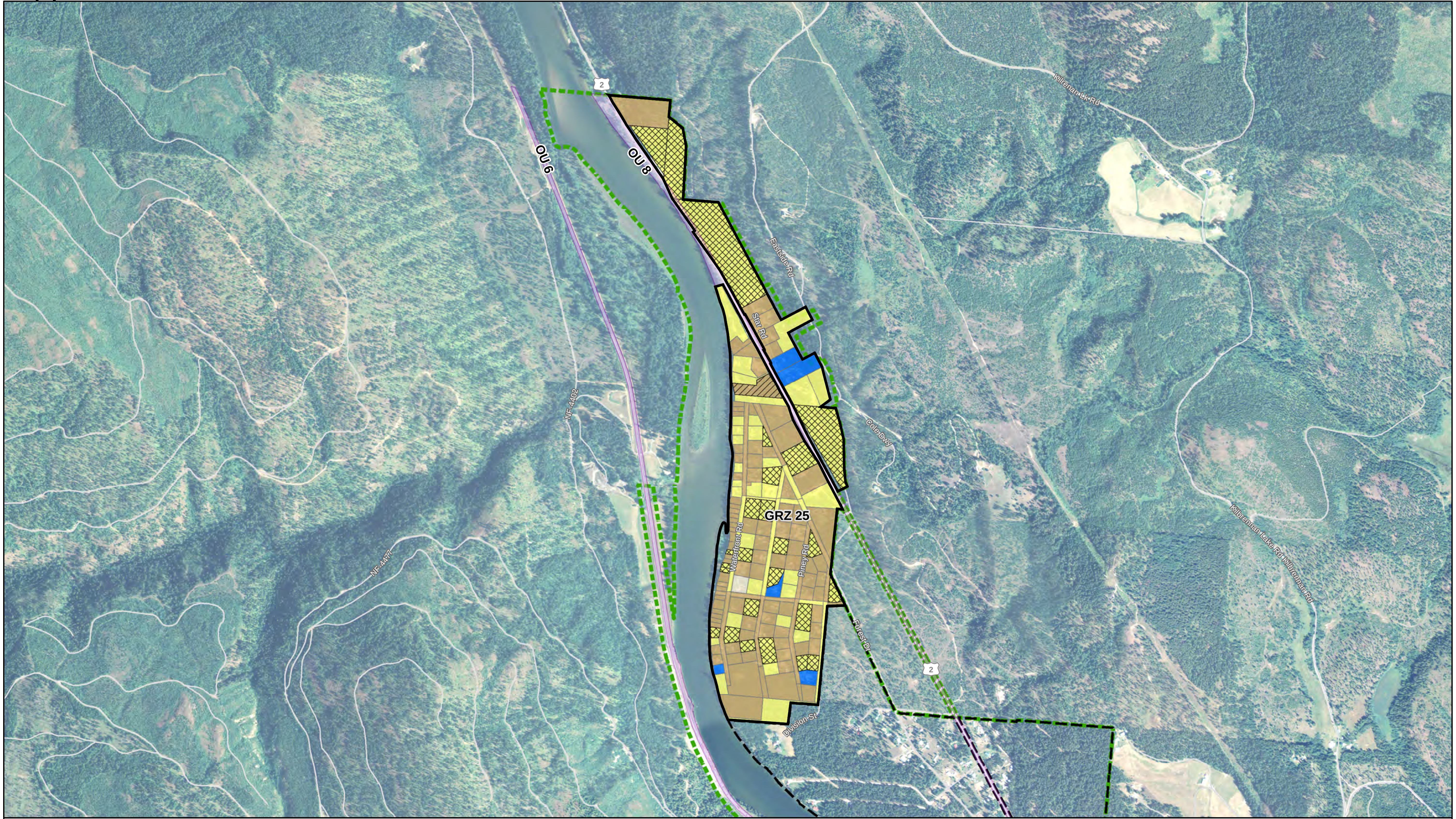


Figure 5-21
Troy GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

Appendix A



Property Status

- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required
- Response Action Required
  - *-Indoor*
  - *-Outdoor*
  - *-Combination*
- Response Action Completed
  - *-Indoor*
  - *-Outdoor*
  - *-Combination*
- GRZ Boundary (Property Status Shown On This Figure)
- GRZ Boundary (Property Status Not Shown On This Figure)
- Limited Property Access
- Refused Property Access
- Libby Asbestos Superfund Site
- OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-22. GRZ(s) 25

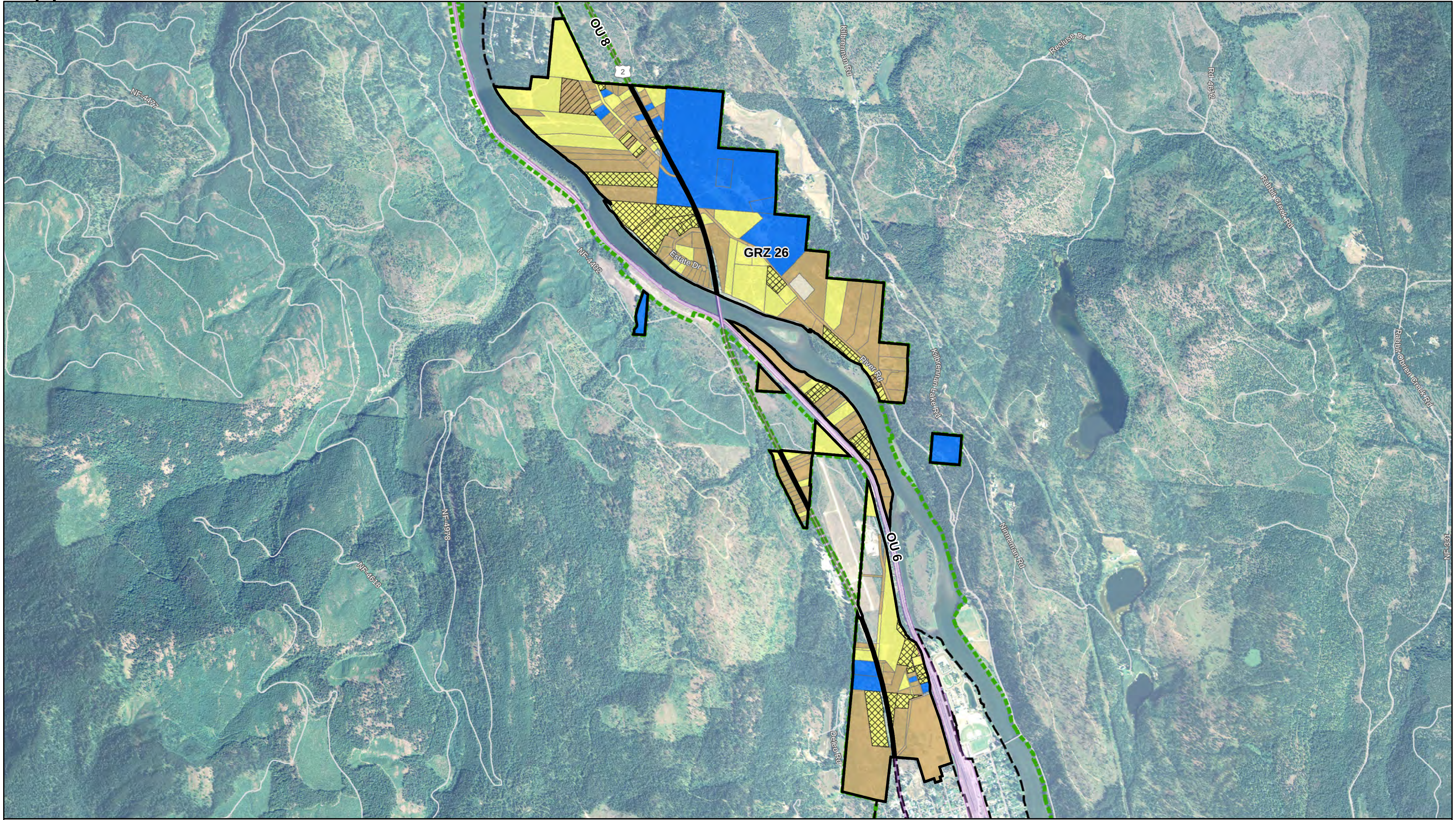
Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 625 1,250 2,500

Feet



Property Status

Inspection Not Required
Inspection Required
Inspection Completed
Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)
GRZ Boundary (Property Status Not Shown On This Figure)
Limited Property Access
Refused Property Access

Libby Asbestos Superfund Site
OUs 1, 2, 4, 6, and 8

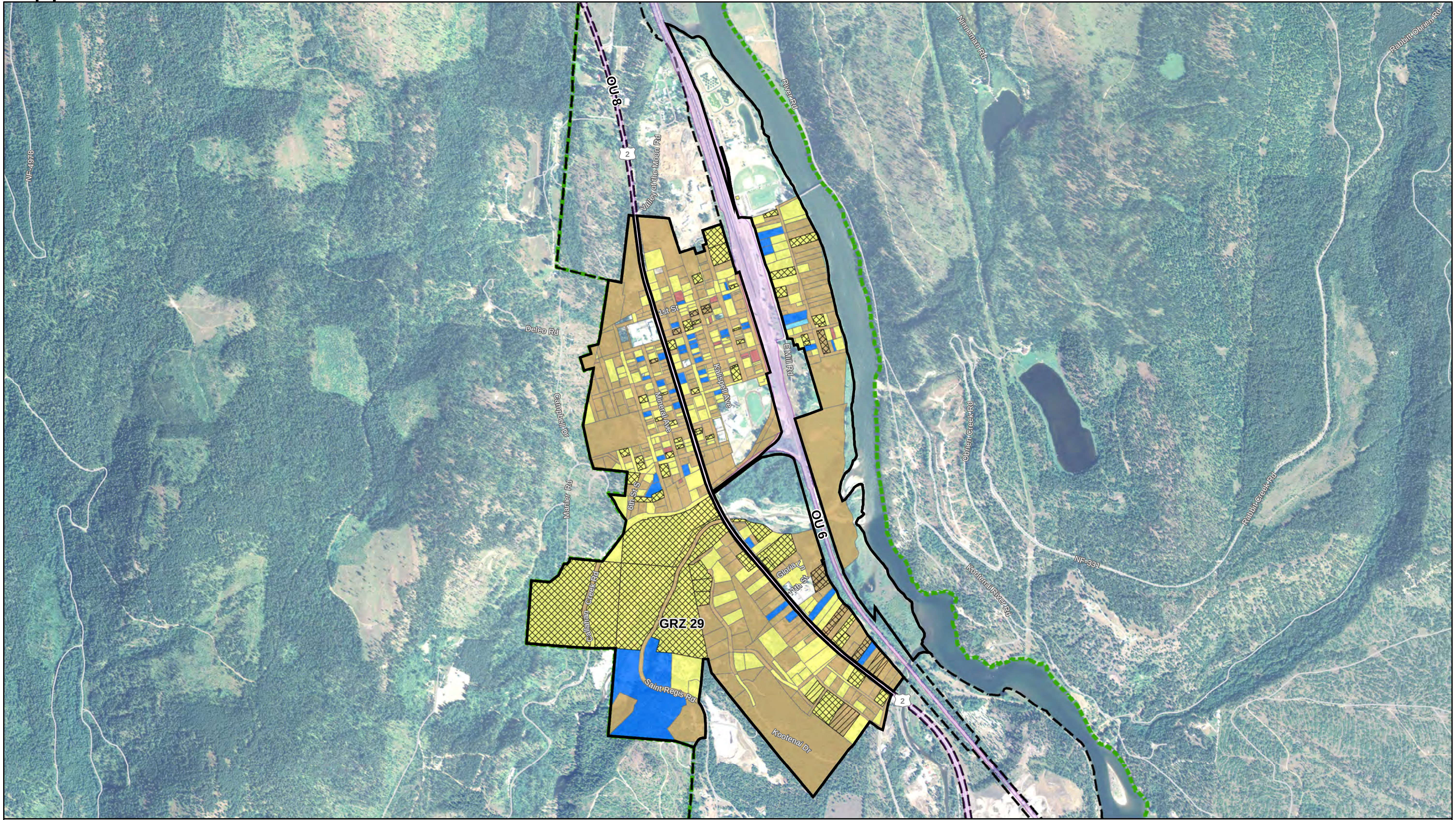
Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-23. GRZ(s) 26 and 27
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 1,050 2,100 4,200
Feet

Appendix A



Property Status

Inspection Not Required

Inspection Required

Inspection Completed

Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-24. GRZ(s) 28 and 29

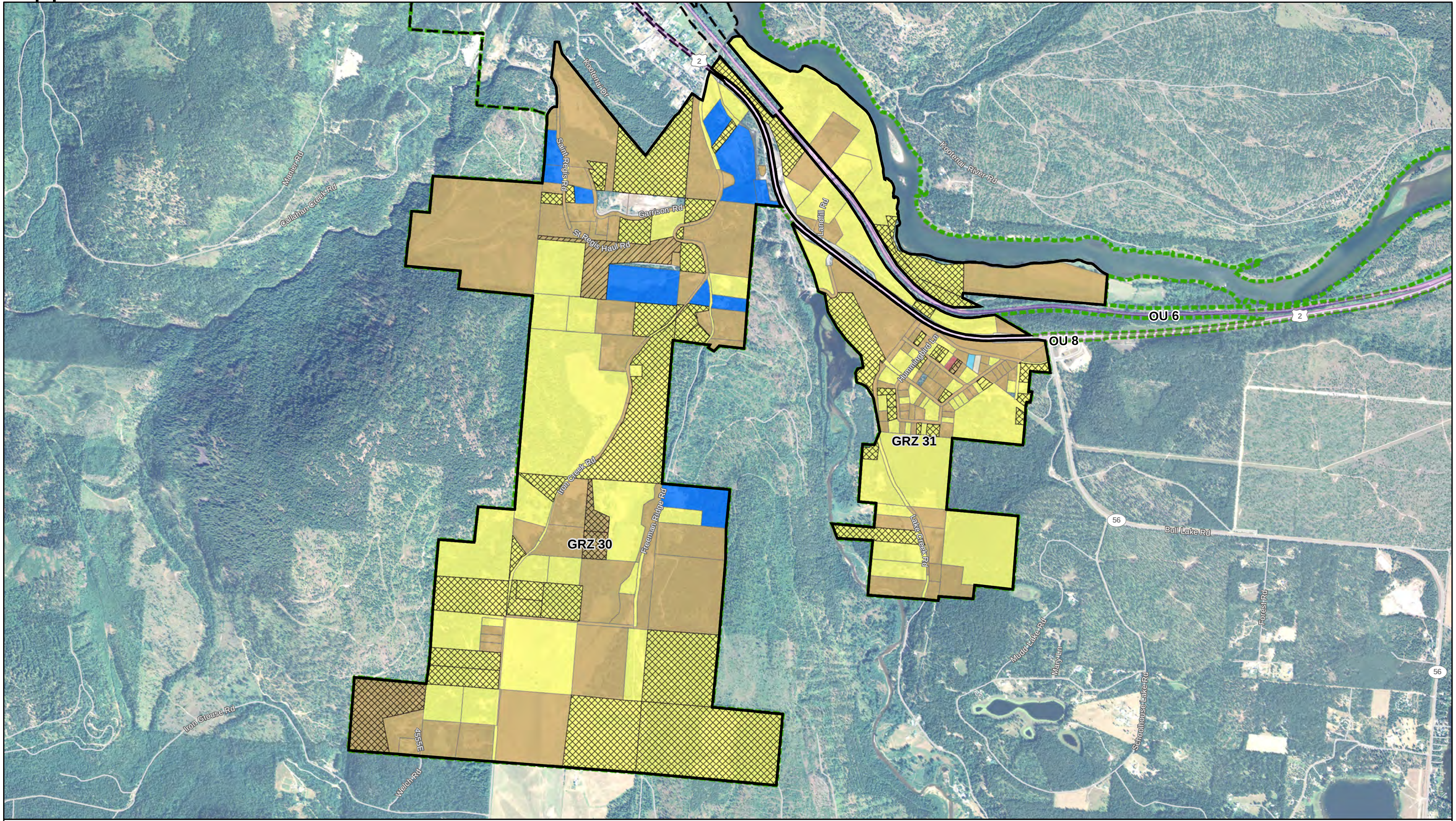
Libby GRZ Areas and Removal Zones

Libby Asbestos Superfund Site | Libby, MT

N

0 700 1,400 2,800
Feet

Appendix A



Property Status
- Inspection Not Required
- Inspection Required
- Inspection Completed
- Response Action Not Required

Response Action Required
-Indoor
-Outdoor
-Combination

Response Action Completed
-Indoor
-Outdoor
-Combination

GRZ Boundary (Property Status Shown On This Figure)

GRZ Boundary (Property Status Not Shown On This Figure)

Limited Property Access

Refused Property Access

Libby Asbestos Superfund Site

OUs 1, 2, 4, 6, and 8

Note(s): *Property Access Status: Refused category includes properties where access has been deferred.*
GRZ-Geographic Removal Zone
Properties within the GRZ(s) presented on this figure that do not have a Property Status are not an output of the Feasibility Study Query (FSQ), which is discussed in Appendix F. The FSQ primarily evaluated properties within the Residential/Commercial and Parks/Schools land use categories.

Property Status Source: Scribe and EPA Response Manager, 02/05/15

Figure 5-25. GRZ(s) 30 and 31
Libby GRZ Areas and Removal Zones
Libby Asbestos Superfund Site | Libby, MT

N
0 850 1,700 3,400
Feet

Appendix A

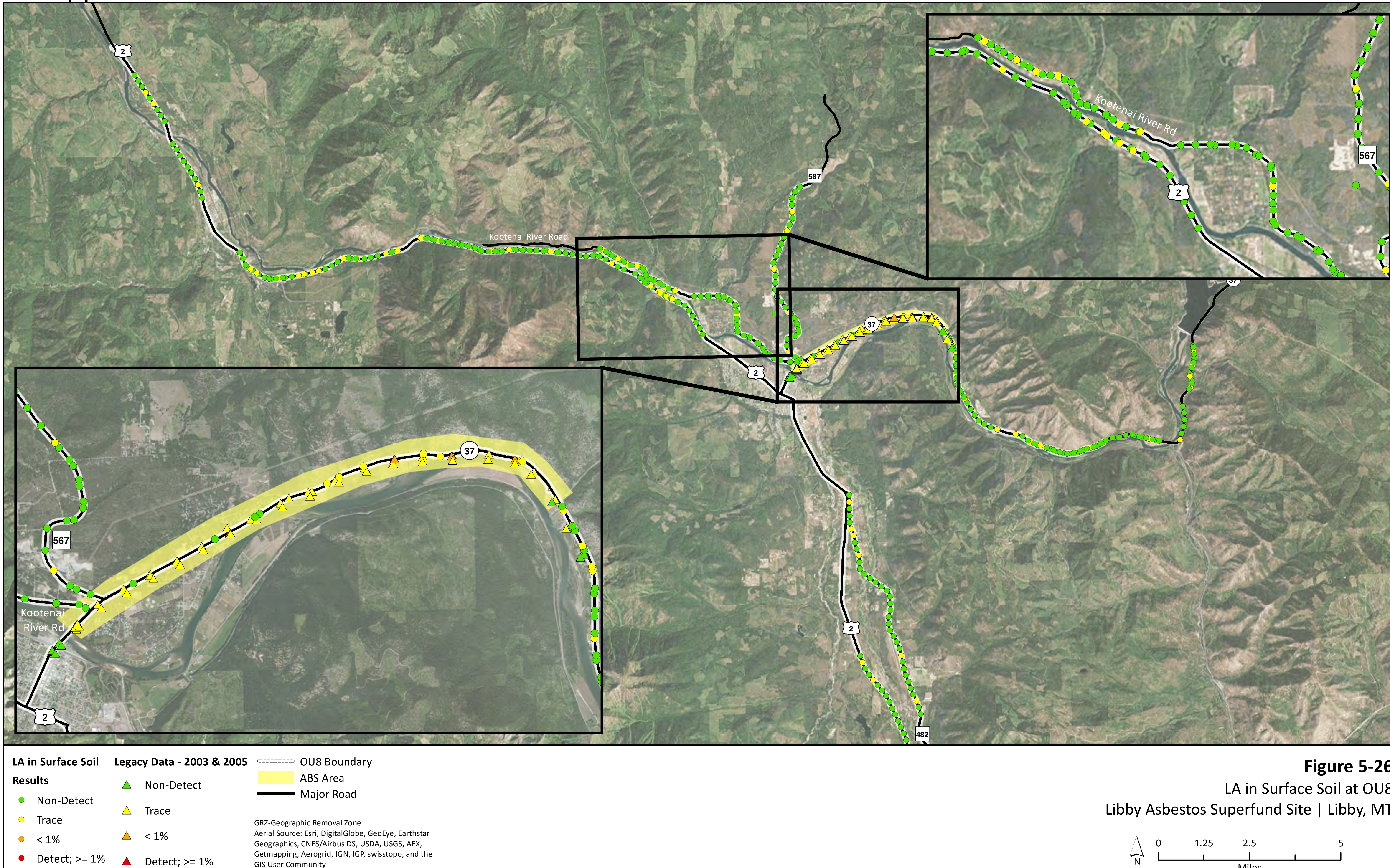
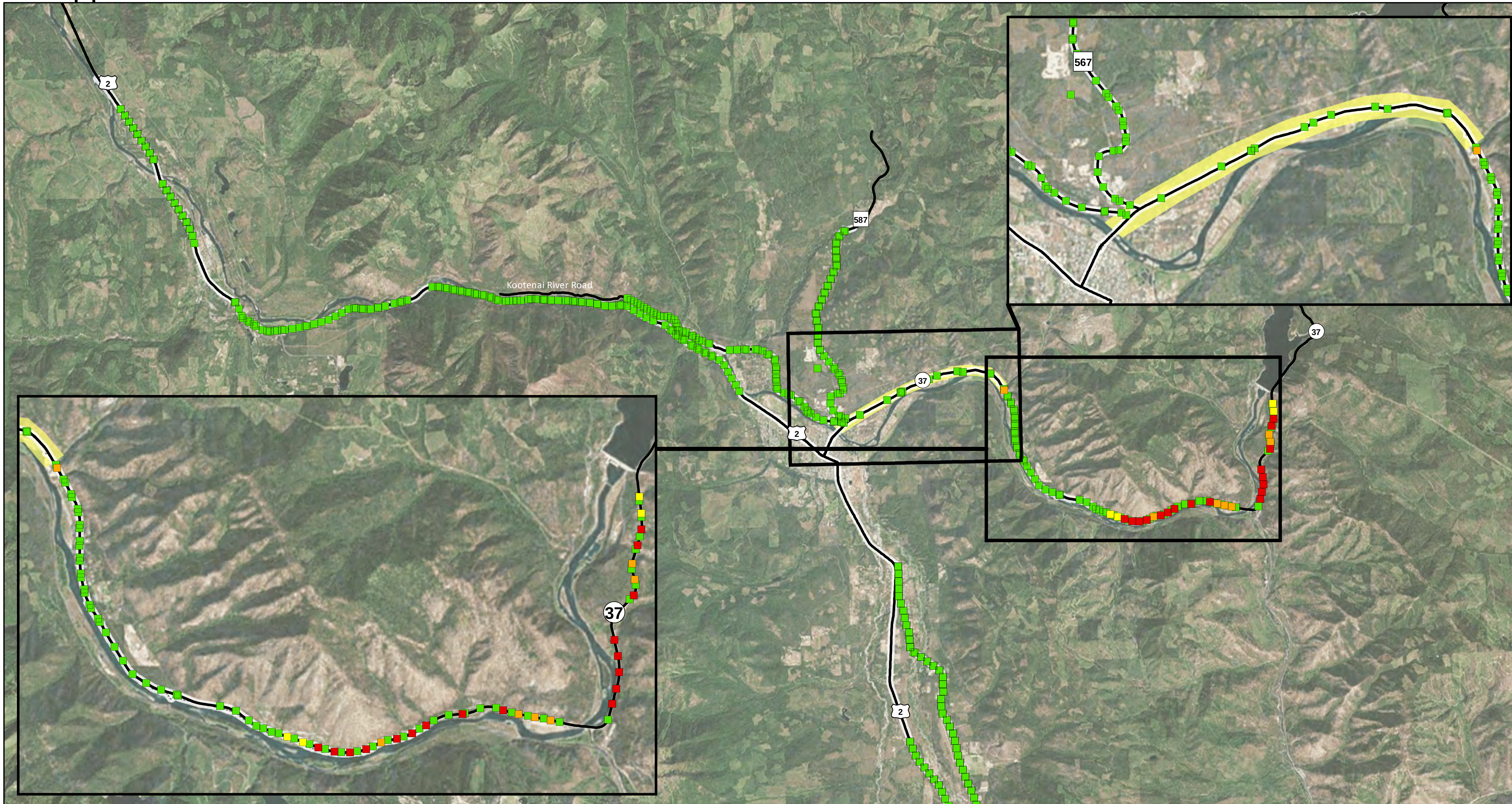


Figure 5-26
LA in Surface Soil at OU8
Libby Asbestos Superfund Site | Libby, MT

Appendix A



Visible Vermiculite Composite Score
- 0.00
- 0.01 - 0.10
- 0.11 - 0.29
- 0.30 - 5.00

OU8 Boundary
ABS Area
Major Road

GRZ-Geographic Removal Zone
Aerial Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 5-27
Visible Vermiculite in Surface Soil at OU8
Libby Asbestos Superfund Site | Libby, MT

N
0 1.25 2.5 5
Miles

FIGURE 7-1
Example of Exposure Area Spatial-Weighting Approach

Panel A: Exposure Area Soil Concentrations

Soil Sample #1:
Bin A

Soil Sample #2:
Bin B1

Soil Sample #3:
Bin C

Panel B: Estimated HQs* for Each Subarea

Bin A
Soil Concentration HQ = 0.1

Bin B1
Soil Concentration HQ = 2

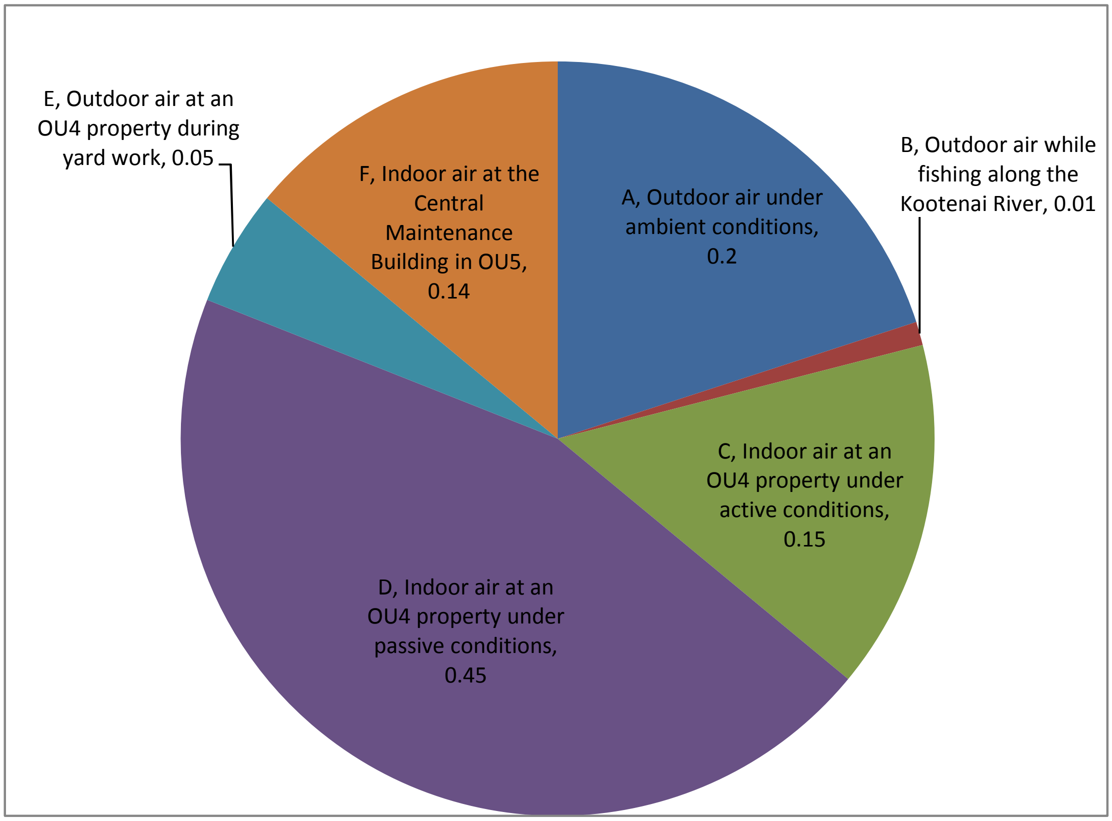
Bin C
Soil Concentration HQ = 6

Panel C: Estimated Average HQ for the Entire Exposure Area

Exposure Area HQ =
$(0.1 \cdot 0.5) +$
$(2 \cdot 0.25) +$
$(6 \cdot 0.25)$
= **2**

*Based on OU4 Yard Soil Disturbance ABS Residential RME HQs

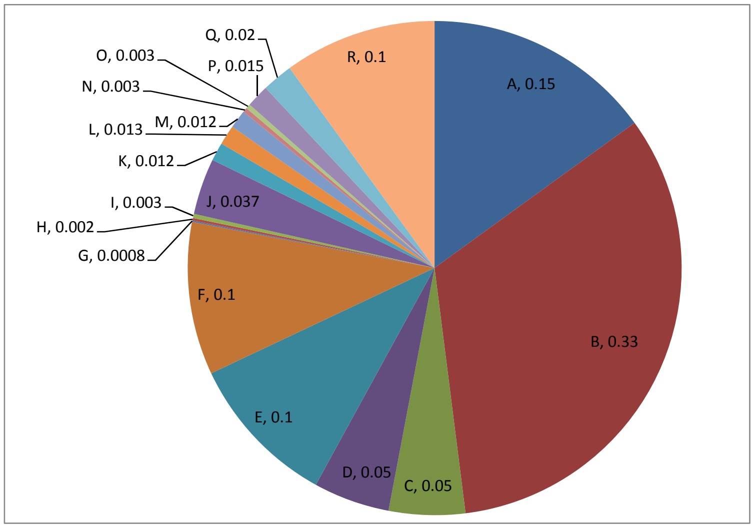
FIGURE 7-2. ILLUSTRATION OF CUMULATIVE ASSESSMENT TWF APPROACH



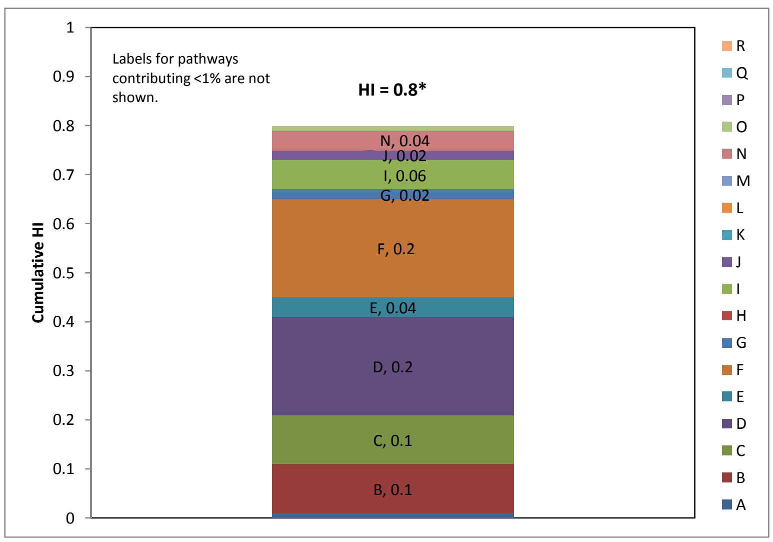
Exposure Scenario		TWF	% of total
A	Outdoor air under ambient conditions	0.2	20%
B	Outdoor air while fishing along the Kootenai River	0.01	1%
C	Indoor air at an OU4 property under active conditions	0.15	15%
D	Indoor air at an OU4 property under passive conditions	0.45	45%
E	Outdoor air at an OU4 property during yard work	0.05	5%
F	Indoor air at the Central Maintenance Building in OU5	0.14	14%
	cumulative:	**1.00**	

FIGURE 7-3. CUMULATIVE ASSESSMENT FOR RECEPTOR EXAMPLE 1

Panel A: Exposure Scenario Contribution to Cumulative TWF



Panel B: Exposure Scenario Contribution to Cumulative HI



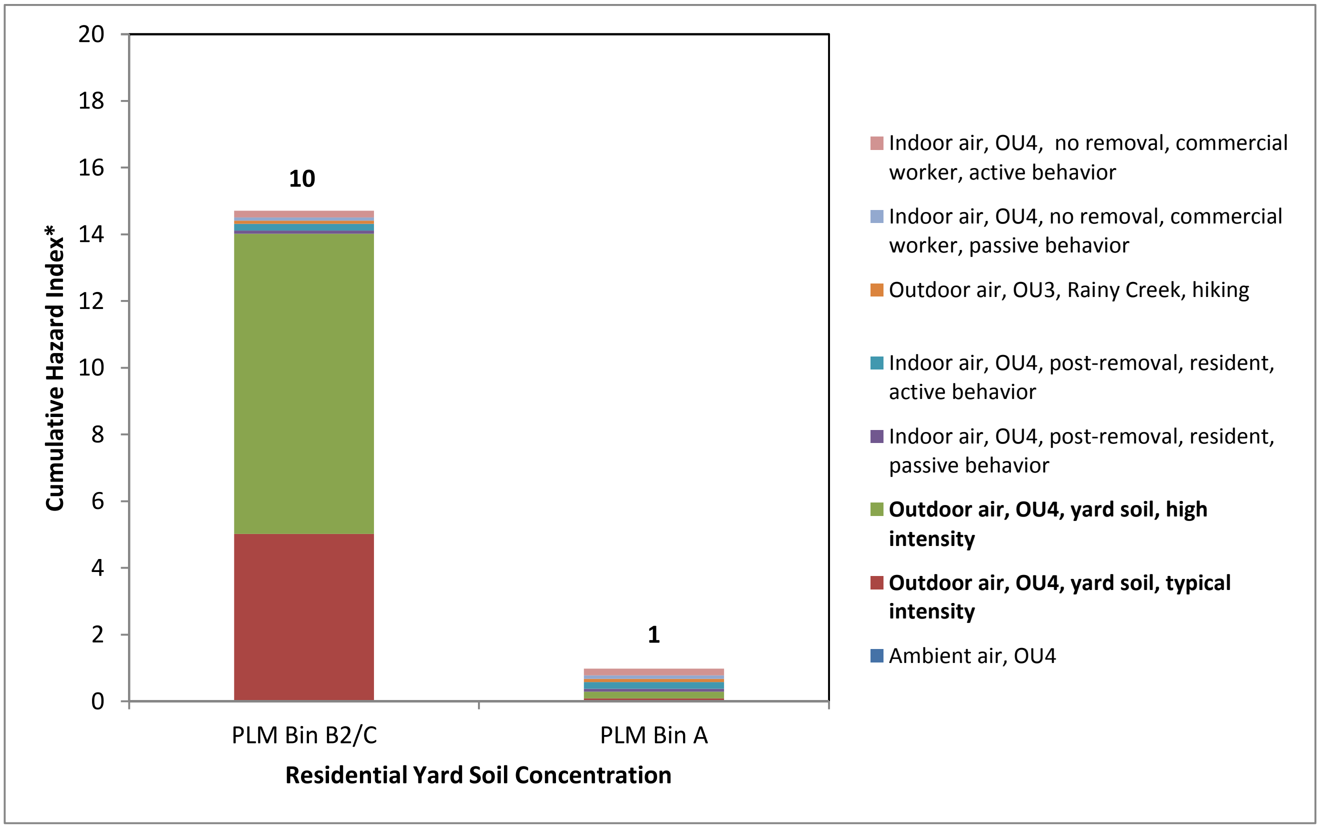
	Exposure Scenario	TWF		Risk Estimates		
		Value	**% of total**	**Risk**	**HQ**	**% of total**
A	Ambient air, OU4	0.15	15%	2E-07	0.01	1%
B	Indoor air, OU4, post-removal, resident, passive	0.33	33%	2E-06	0.1	13%
C	Indoor air, OU4, post-removal, resident,active	0.05	5%	2E-06	0.1	13%
D	Outdoor air, yard soil, curb-to-curb	0.05	5%	3E-06	0.2	25%
E	Indoor air, OU4, no removal, worker, passive	0.1	10%	7E-07	0.04	5%
F	Indoor air, OU4, no removal, worker, active	0.1	10%	4E-06	0.2	25%
G	Outdoor air, OU4, Libby Middle, student	0.00082	0.08%	3E-07	0.02	3%
H	Outdoor air, OU4, Koot. Valley HS, student	0.0016	0.2%	0E+00	0	0%
I	Outdoor air, OU4, Libby Elem., student	0.0029	0.3%	9E-07	0.06	8%
J	Indoor air, OU4, student, Elem. School	0.037	4%	4E-07	0.02	3%
K	Outdoor air, OU7, Golf course, adult	0.012	1%	0E+00	0	0%
L	Outdoor air, OU4, biking, adult	0.013	1%	0E+00	0	0%
M	Outdoor air, OU5, MotoX, participant	0.012	1%	0E+00	0	0%
N	Outdoor air, OU4, LUA soil, ATV, A	0.0030	0.3%	6E-07	0.04	5%
O	Outdoor air, OU3, forest, hiking, far	0.0030	0.3%	1E-07	0.008	1%
P	Outdoor air, OU3, Kootenai, fishing	0.015	1%	0E+00	0	0%
Q	Outdoor air, OU8, Driving in Libby	0.020	2%	0E+00	0	0%
R	Offsite	0.1	10%	0E+00	0	0%
	cumulative*:	**1.000**		**1E-05**	**0.8**	

* All HQ and HI values are expressed to one significant figure; thus, the height of the bar may appear different from the HI value shown in the table.

FIGURE 7-4

ILLUSTRATION OF CUMULATIVE HI FOR DIFFERENT YARD SOIL CONCENTRATIONS

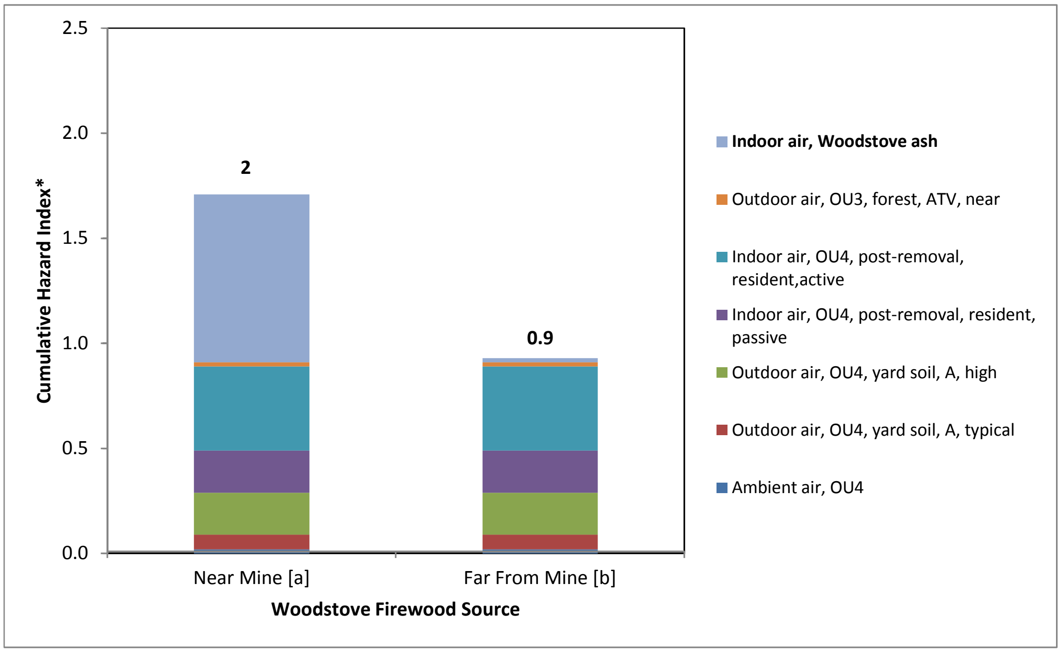
Libby Asbestos Superfund Site



* All HQ and HI values are expressed to one significant figure; thus, the height of the bar may appear different from the HI value shown.

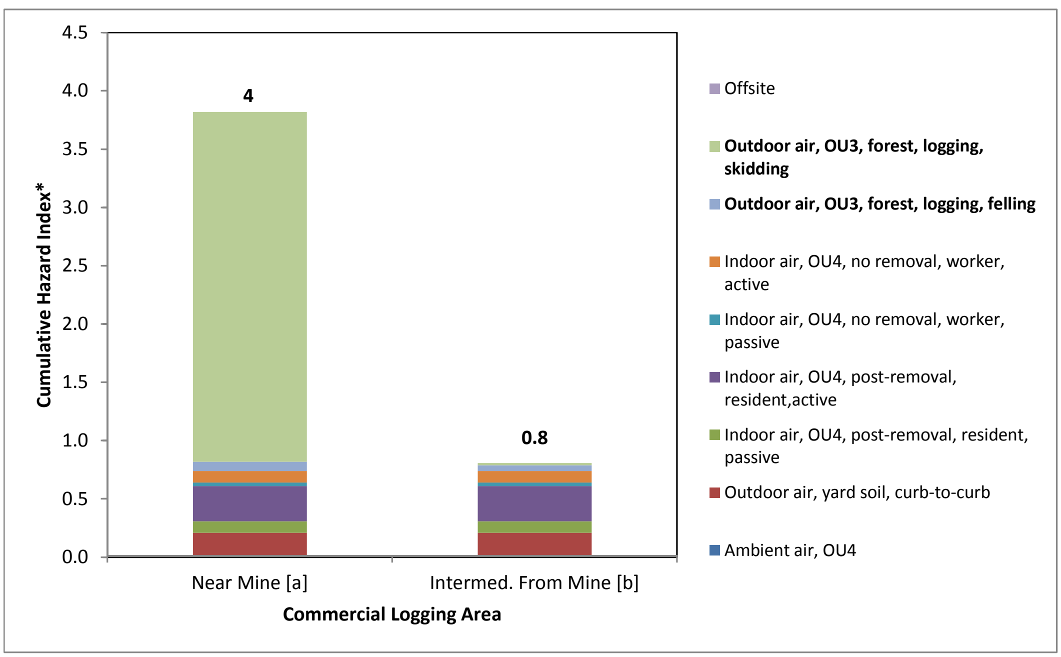
FIGURE 7-5
ILLUSTRATION OF CUMULATIVE HI FOR DIFFERENT ACTIVITY LOCATIONS
Libby Asbestos Superfund Site

Panel A: Woodstove Firewood Source



[a] Near mine: firewood collected approximately one mile downwind of the mine site
[b] Far from mine: firewood collected approximately 10 miles south of Libby and outside the current NPL boundary

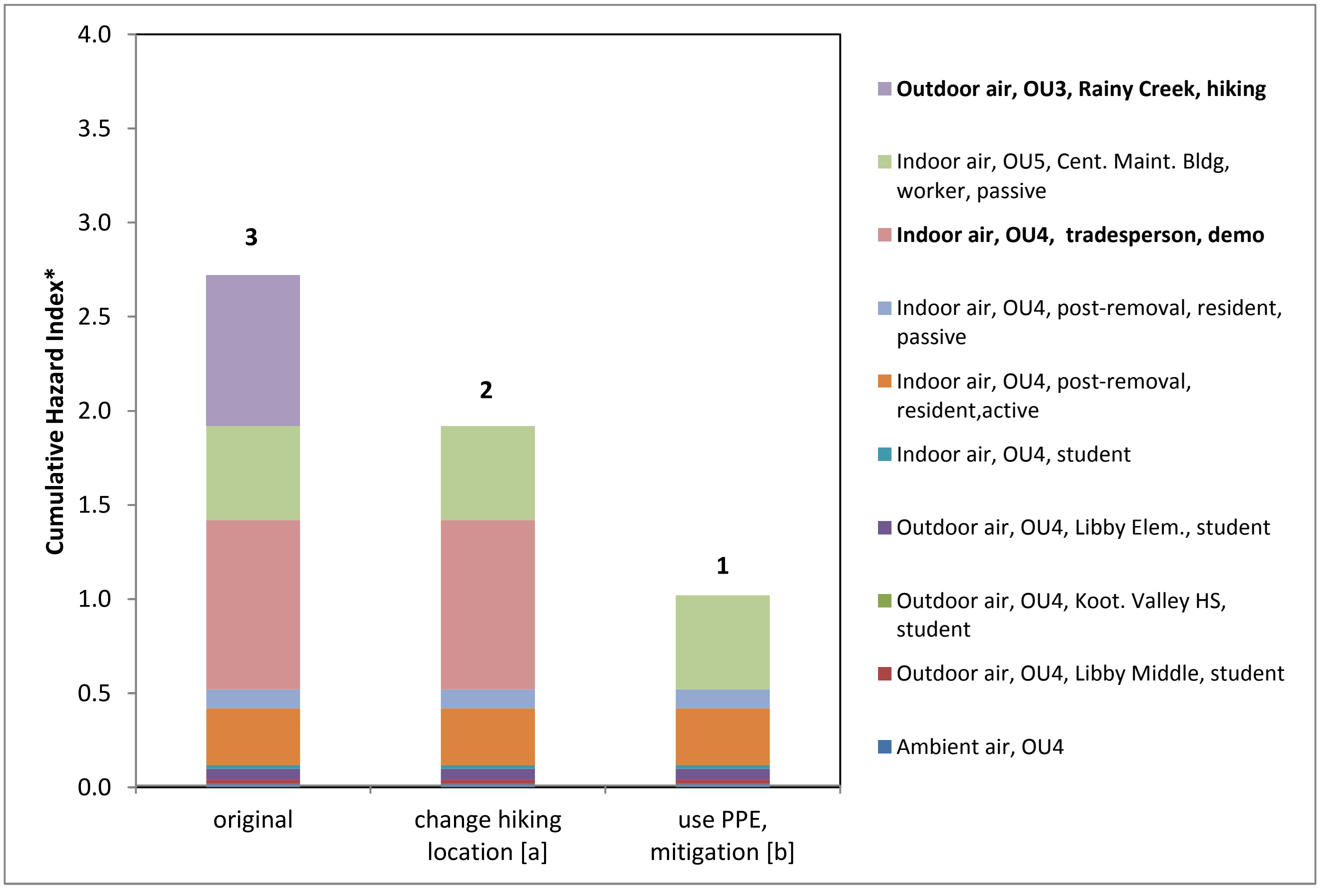
Panel B: Commercial Logging Area



[a] Near mine: Logging activities performed within 1 mile of the mine
[b] Intermed. from mine: Logging activities performed about 4 miles from the mine

* All HQ and HI values are expressed to one significant figure; thus, the height of the bar may appear different from the HI value shown.

FIGURE 7-6
ILLUSTRATION OF CUMULATIVE HI CHANGE WHEN ADDRESSING MAIN RISK DRIVERS
Libby Asbestos Superfund Site

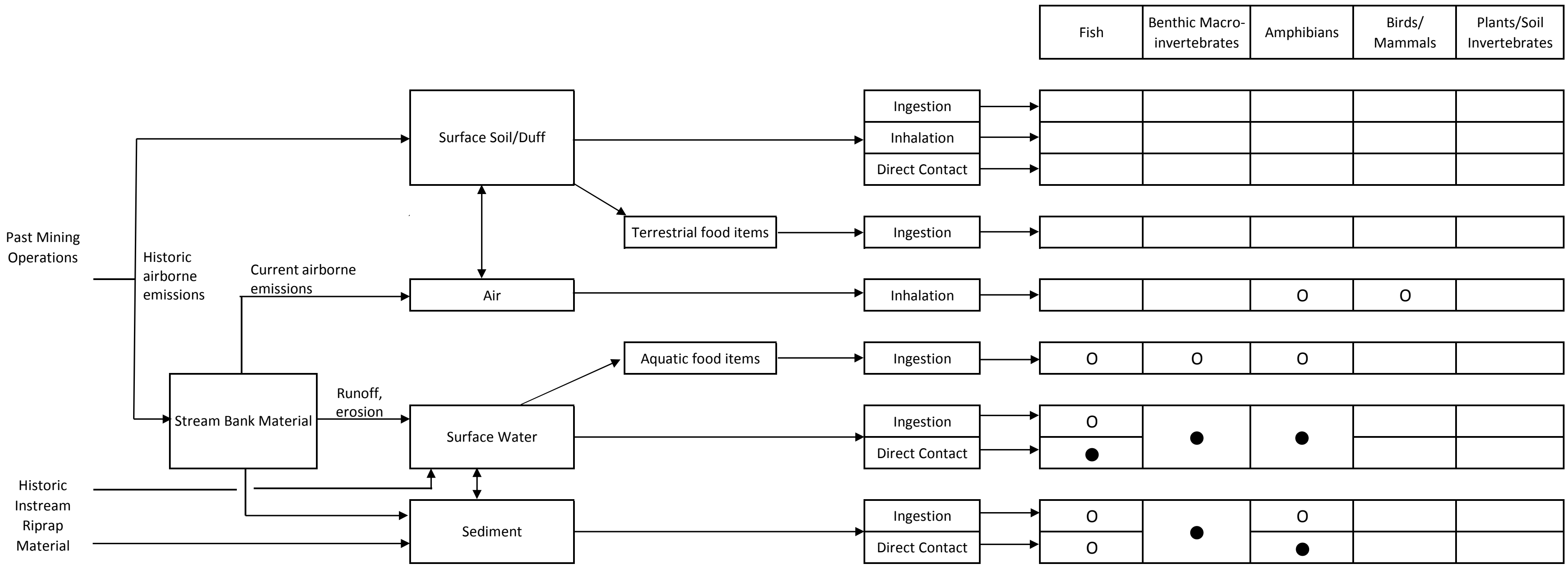


[a] Change hiking location from along Rainy Creek to along the Kootenai River

[b] Use appropriate personal protective equipment and employ dust mitigation measures during tradesperson demolition activities

* All HQ and HI values are expressed to one significant figure; thus, the height of the bar may appear different from the HI value shown.

Figure 7-7. Conceptual Site Model for Ecological Receptors to Asbestos



		Fish	Benthic Macro-invertebrates	Amphibians	Birds/ Mammals	Plants/Soil Invertebrates
Surface Soil/Duff	Ingestion					
Surface Soil/Duff	Inhalation					
Surface Soil/Duff	Direct Contact					
Terrestrial food items	Ingestion					
Air	Inhalation			O	O	
Aquatic food items	Ingestion	O	O	O		
Surface Water	Ingestion	O	●	●		
Surface Water	Direct Contact	●				
Sediment	Ingestion	O	●	O		
Sediment	Direct Contact	O		●		

● Pathway is believed to be complete, and might be significant

O Pathway is believed to be complete, but is probably minor

(blank) Pathway is incomplete or believed to be negligible

APPENDIX A
OU SPECIFIC SAMPLING STRATEGIES

APPENDIX A: OU SPECIFIC SAMPLING STRATEGIES

OU4

- December 1999 – March 2002: Phase 1. The Phase I investigation was a rapid pilot-scale investigation with two main objectives: (1) determine airborne LA in Libby to judge whether a time-critical intervention was needed to protect public health and (2) obtain data on LA in source materials to determine the most appropriate analytical methods. Subsequent samples included indoor ambient air, bulk building materials, indoor dust, outdoor surface and subsurface soil, and well water.

- Fall 2001: Phase 2. This investigation focused on the concentrations of LA fibers in air that may occur in the breathing zone due to disturbance of LA-contaminated dust, vermiculite insulation, and soil. It included four ABS "scenarios:" routine household, active household cleaning, active disturbance of vermiculite, and active disturbance of soil (rototilling).

- April 2002: Contaminant Screening Study. The CSS was designed to systematically screen OU4 properties using a combination of visual inspections, verbal interviews, and outdoor soil sampling for LA source materials in areas where exposure was most likely.

- Various: Contamination Assessments at Specialty Properties. Some properties in OU4 required assessments that differed from established protocol due to a unique history of contamination or special interest as a public area. For these "Specialty Properties," alternative assessment methods were used to determine possible future remedial alternatives.

- 2002: Natural Resources Conservation Service (NRCS). The NRCS requested several samples for vermiculite. Exfoliated vermiculite, unprocessed vermiculite, and processed vermiculite were identified and sent off site.

- June 2002: Sediment Core Pilot Study. EPA conducted a pilot study to assess sediment deposition in several lakes surrounding the Libby Valley.

- November 2003 – Present: Property Inspections. The pre-design inspection (PDI) program began in 2003 and was the process for characterizing properties before removal actions. The PDI program expanded on previously collected data to more precisely locate and quantify the LA at each property. Activities included collection of additional soil, bulk, and/or dust samples; inspection of attics, soil, and building materials for vermiculite; and production of sketches, measurements, and relevant construction information. In 2010, the PDI was re-named and altered. Investigations are now referred to as general property investigations (GPIs) (both screening investigations [SIs] and detailed investigations [DIs]). The SI and DI are the current CSS and PDI, respectively. The SI identifies if an action level is triggered at a property, and the DI delineates contamination and supports removal decisions.

- Various: PDI/GPIs at Specialty Properties. PDIs/GPIs were performed at some of the unique or complex properties, which required contamination assessments. These properties are discussed in detail in Section 3.34 of the OU4 RI Report (CDM Smith 2014a).

- November 2003/February 2004: Post Cleanup Evaluation Study. Stationary indoor air, personal air, and dust samples were collected to evaluate post-cleanup residual LA at houses; understand time periods that indoor LA levels may remain below acceptable cleanup criteria; and evaluate if certain residual sources (e.g., dust inside air ducts, furnaces, carpets, and upholstery) may result in recontamination of indoor dust.

- June 2005 – October 2006: Supplemental RI. Collection of air, dust, and soil samples to support areas of uncertainty and data gaps. Twelve areas of investigation were identified, and 58 properties were sampled.

- June/July 2005 and October 2006: Building Demolition Study. Monitoring activities were completed for demolitions in 2005 and 2006 to assess if demolition released LA to the environment. Air, dust, and soil samples were collected during four different demolitions.

- December 2005: Cumulative Exposure Assessment. EPA implemented a pilot program to measure varying LA exposures to individuals at indoor and outdoor locations. Due to the complexity of collecting personal air samples over days and the inability to correlate sampling results to specific activities, no additional cumulative risk sampling was conducted. Instead, ABS was initiated to gather LA exposure data.

- October 2006 – June 2008, May 2010 – March 2013: Outdoor Ambient Air Program. Air samples were collected to provide spatial and temporal representativeness of LA concentrations.

- May – June 2007: Dust Pilot Study. A dust pilot study was conducted to investigate the usefulness and reproducibility of dust sample results collected within the City of Libby (OU4).

- August 2007: Creek ABS. ABS was conducted along Flower Creek to gather additional data to support risk management decisions and to more accurately represent long-term health risks from exposure to LA in exposed sediments along the creek banks.

- 2007, 2008, 2010, 2011, and 2013: Residential ABS. ABS was initiated to collect data for risk management and to further evaluate the efficacy and protectiveness of the cleanup strategy.

- June 2008: USGS Background Soil Study. Sampling was conducted to investigate factors that could have contributed to low levels of LA in background soils. USGS staff selected specific locations and soil horizons. Samples were collected from three borrow sources.

- June – July 2008: School Investigation. The five public school buildings in Libby were inspected for visible vermiculite, and outdoor soil samples were collected. These inspections were to identify sources or exposure pathways within the indoor and outdoor portions of the school buildings, delineate each school into preliminary sampling zones based on airspaces and use, and conduct outdoor inspections in areas of new construction and/or soil disturbances.

- August – September 2009: School ABS. ABS was conducted at the five school buildings to determine if past cleanup actions were sufficient to provide adequate health protection to students and staff engaged in a range of normal outdoor activities on school grounds.

- August 2011: Woodchip ABS. ABS and wood chip samples were collected to estimate exposure and risk from LA due to disturbances of wood chips from OU5 used in OU4 and to determine if response actions are needed to protect individuals from unacceptable risks.

- August – September 2011: Limited-Use Area ABS. ABS took place at 10 areas and in 2 categories. Category 1 had results of non-detect, and visible vermiculite was not present. Category 2 had results of less than 0.2 percent LA or greater, and visible vermiculite was present. Three ABS events took place at each area involving two separate riders on ATVs. Soil sample were also submitted.

- September 2011: Background and Borrow Source ABS. The background soil investigation was performed in 11 background areas. ABS air samples were collected during digging activities, simulating a child digging and playing in the dirt. A soil sample was also submitted for each background area. EPA conducted an investigation to provide information on LA in soils from topsoil borrow sources that have been used as fill material at the Site.

- November 2011/May 2012: Water Source Study (Phase I and II). Phase I of the water source study measured LA concentrations at water source candidate locations under low flow conditions. Phase II of the water source study measured LA concentrations at water source candidate locations under high flow conditions.

- May and September 2012: Nature and Extent of LA in Surface Water. Surface water and sediment data were collected in the spring and fall to characterize the nature and extent of LA in surface water and sediment and to evaluate potential ecological and human health risks.

- August – September 2012: Tradesperson ABS. A subset of personal air health and safety monitoring samples previously collected was reanalyzed by TEM to support estimates of long-term exposure and to represent a range of potential indoor disturbance activities.

- September 2012: Flowerbed ABS. ABS was conducted to collect data to evaluate if the presence of visible vermiculite in flowerbeds is a reliable indicator of LA contamination.

- October 2012: Nature and Extent of LA in Tree Bark and Duff from the Forest. Data were collected on LA in tree bark and forest duff to evaluate the nature and extent of LA in forested areas around the Site.

- November 2012: Woodstove Ash ABS. ABS was completed to evaluate potential exposures to individuals from exposure to LA in air from removal of ash from a wood-burning stove.

- August 2012: Comparative Exposure ABS. ABS was completed to evaluate LA concentrations in a variety of media from cities outside the Libby Valley that were not expected to be affected by the former Libby Vermiculite Mine to provide a frame of reference for comparison to exposure in Libby. Samples included air, soil, tree bark, and duff material.

- August/October 2012: Tissue Assessment. Investigated the LA tissue burden in fish and large game collected from the Site to evaluate two potential human ingestion scenarios.

- May – June 2013: Porewater in the Tributaries. Sediment porewater samples were collected from locations in tributaries to the Kootenai River to compare the effect levels for trout established in Site-specific toxicity studies in support of the Site-wide BERA.

- June 2014: OU4 Final RI Report. Summarized the nature and extent of LA in various media.

OU5

- September 2001: Site interviews identified three subareas of interest due to potential for LA contamination: the former Expansion Plant, the railroad spur, and the former tree nursery. Additionally, waste bark piles remained from historical lumber processing activities.

- May 2002: Microvacuum Sampling in Former Nursery Shed. Two dust samples were collected.

- September 2002: CSS of the former Stimson Lumber Mill. Included inspections and sampling of personal air, stationary air, dust, and soil.

- May 2004: Bicycle Motocross Track soil sampling. Soil samples were collected from the proposed area for the bicycle motocross track within the former Stimson Lumber Mill property.

- May 2004: PDI at the Central Maintenance Building. Included soil, dust, and bulk sampling.

- July 2004: Soil Sampling at Proposed Demolition Derby Area. Additional soil samples were collected from the proposed area for the demolition derby track.

- June 2005: ABS at Former Nursery. ABS of mowing, raking, child's play scenarios.

- October 2006 – September 2007: Outdoor Ambient Air Program. Used to determine general background asbestos concentrations at the Site.
- October 2007: OU5 Site-wide Soil Data Gap Sampling. Collected samples from areas not previously investigated to evaluate LA content and presence/absence of surficial vermiculite.
- October 2007: Wood Chip Piles. Personal air, soil, waste bark, and wood chip samples were collected from the wood chip stockpiles.
- November 2007 – January 2008: Indoor Worker ABS. Collected data on worker exposures inside buildings to determine if actions taken have reduced LA to a level protective of human health.
- June – July 2008: OU5 Site-wide Soil Data Gap Sampling Addendum. Composite sampling and opportunistic personal air samples to estimate potential exposures from soil disturbance.
- September 2008: Motocross Track ABS. Investigation to provide a reasonable representation of activities that may result in LA exposures during motorcycle use.
- September 2008: Recreational Visitor ABS. Investigation to provide a reasonable representation of recreational activities that may result in exposure to LA. ABS air samples were collected from the path along Libby Creek during activities consistent with use.
- September – October 2008: Outdoor Worker ABS. Investigation to collect data to provide a representation of outdoor worker exposures during soil disturbance. ABS areas represented a range of expected soil contamination conditions. Personal air samples were collected during raking and heavy machinery uses.
- October 2008: Landfarm Soil Sampling.
- April 2009: OU5 Re-Development Area. Investigation to sample the proposed re-development area further to determine the extent of quick response activities needed to prepare the location for re-development. Included 30-point composite soil samples and visual inspection for vermiculite.
- April 2009: PDI Soil Libby Creek Driveway. Samples were collected for a staging area, which could be used to assist with riprap removal in Libby Creek.
- August 2011: Wood Chip Piles ABS. ABS and wood chip sampling to estimate exposure and risk from LA due to disturbances of wood chip piles and to determine if response actions are needed.
- June 2012: Pre-Design Soil Sampling at Proposed Fishing Pond Location. Soil sampling to assess LA to identify areas requiring excavation prior to design/construction of pond.

- March 2013: GPI at Proposed Fishing Pond Location. Visual inspection and soil sampling in the areas to be impacted by the proposed fishing pond.

- June 2013: Completion of OU5 RI Report. Summarized the nature and extent of LA contamination.

OU6

- 2001: Structure Inspections. Seven structures were inspected for vermiculite and ACM in 2001 (Libby Depot, Scale House, Section House, Tool House and Troy Section House, and West and East Storage Buildings). ACM was found in each building except the Troy Storage Buildings. Vermiculite was reported only at the Libby and Troy Section Houses.

- April 2001: Soil Sampling in Libby Railyard and Mileposts East of Railyard. Asbestos characterization of soil along the main rail track at milepost locations and random locations. The main rail track samples were collected from "linear debris piles that run parallel to the mainline" and not in in situ soil (Kennedy/Jenks 2014).

- November 2001: Soil Sampling in Libby Railyard. Surface soil samples were collected along the railroad tracks and the railyard. Samples were analyzed for tremolite, chrysotile, and other amphiboles. Unexpanded vermiculite was observed along Tracks 1, 2, and 3 in the railyard.

- October 2002: Characterization of Non-Asbestos in Soil for Landfill Disposal. Soil samples were collected to establish the non-asbestos profile for landfill disposal (hydrocarbons, metals, and volatile organic compounds) and were within landfill disposal limits.

- November 2002: Soil Sampling in Libby Railyard. Additional samples were collected for further characterization.

- August 2003: Soil Sampling in Libby Railyard during Remedial Activities. Samples were collected for additional characterization.

- July 2004: Soil Sampling in Libby Railyard. Additional surface composite samples were taken for further LA characterization of the western limit of the exclusion zone.

- September 2004: Soil Sampling in Libby Railyard. Supplemental sampling was conducted for further characterization.

- July 2008: Rail Crossing Air Monitoring. Personal air monitoring was conducted during the replacement of rail crossings at Jay Effar Road and Cedar Creek.

- September 2008: Maintenance Right-of-Way Workers and General Public ABS. ABS air samples were collected for workers, pedestrian trespassers, and on-looker trespassers during rail maintenance activities. Stationary air samples were collected during maintenance as were discrete grab soil samples.

- September 2008: Steel Gang Air Monitoring for OSHA Exposure Sampling. Personal air monitoring was conducted to gather data to allow BNSF to ensure that work practices prescribed by BNSF are sufficient for worker protection.

- May 2009: Super Surfacing Gang for OSHA Exposure Sampling. Personal air monitoring was conducted to determine whether LA was released to air during track maintenance activities. Stationary air samples also were collected.

- June 2009: Undercutter Spoils Sampling. Composite samples were collected from undercutting spoils piles generated during maintenance to promote drainage.

- March – April 2010: Steel Gang Asbestos Exposure Sampling. Sampling to determine whether asbestos fiber releases were being created by track maintenance activities and to collect air quality data from near the BNSF property boundary.

- May 2010: Stimson Wye Track Removal. Sampling during demolition of track to determine whether asbestos was released to air by track maintenance activities.

- September 2011: OSHA Exposure Sampling. Personal and stationary air samples were collected during track maintenance to ensure that BNSF personnel were not being exposed to LA above permissible limits.

- April 2014: Completion of Final OU6 RI Report.

OU7

- 2007 – Present: Troy Asbestos Property Evaluation Program. Sampling to determine eligibility of properties for removal actions and to obtain sufficient information to evaluate the properties if the eligibility criteria should change.

- October 2009 – October 2011: Outdoor Ambient Air Study for OU7. Measurement of LA concentrations in outdoor ambient air and combination of collected data with discrete data from other exposure routes to support HHRA and evaluation of future remedial actions.

- December 2010: Draft Final OU7 RI Report. Summarized the nature and extent of LA.

- May/August 2011: Outdoor ABS. Obtained data needed to complete a HHRA for OU7. Two residential properties were evaluated and two outdoor ABS events were performed.

- November – December 2012: Background ABS. The background soil investigation was performed in 11 background areas and ABS air samples were collected during digging activities simulating a child digging and playing in the dirt.

- February 2012: Draft Final Addendum for Calendar Year 2010 to the OU7 RI Report.

- July 2013: Draft Final Addendum for Calendar Year 2011 to the OU7 RI Report.

- September 2014: Completion of OU7 RI Report. The nature and extent of OU7 contaminated media was summarized in the RI report.

OU8

- July – August 2001/September 2003/May 2005: MT Highway 37 Investigation (Pre-OU8 Designation). In 2001, air samples were collected for people driving along MT Highway 37, people driving behind trucks carrying contaminated materials from Plummer Elementary School to the Flyway or the former Screening Plant, and people walking along MT Highway 37 while trucks were hauling contaminated materials. In 2003, a visual inspection was performed and CSS soil samples were collected to determine if vermiculite and/or LA are present along the highway. EPA requested a supplemental soil and stationary air sampling event, which took place in 2005.

- July 2006: MDT Industrial Hygiene Sampling (Pre-OU8 Designation). Bulk soil sampling included locations within a 5-mile radius of Libby, surface soil at the MDT Libby facility, and road sweepings piles from two road sweepers. Air sampling included pumps on vehicles, operators, and laborers during maintenance activities.

- July – September 2010: ABS and Soil Sampling. ABS was conducted during MDT brush-hogging and grass cutting activities as well as during ATV activity. Soil samples were collected prior to ABS along ROWs of Highways 2 and 37, Kootenai River Road, and County Highways 482 and 567.

- April 2011: OU8 ABS and Stationary Air Sampling. ABS and stationary air sampling was conducted during rotomilling to determine the level of LA contamination in outdoor air.

- June 2013: OU8 RI Report completed.

APPENDIX B

PROTECTIVENESS EVALUATION FOR POTENTIAL RISK MANAGEMENT APPROACHES

Memorandum

To: *Rebecca Thomas, Remedial Project Manager, U.S. Environmental Protection Agency (EPA)*

Mary Darling, Project Manager, U.S. Army Corps of Engineers (USACE)

From: *Scott Felton, CDM Smith Project Manager*

Date: *December 4, 2015*

Subject: *Updated Protectiveness Evaluation for Potential Risk Management Approaches, Libby Asbestos Superfund Site - Operable Units (OUs) 4, 5, 6, 7, and 8*

1.0 Introduction

1.1 Purpose and Objectives of Memorandum

CDM Federal Programs Corporation (CDM Smith) is tasked by the USACE under Contract W9128F-11-0023 to provide technical support for the U.S. Environmental Protection Agency (EPA) at the Libby Asbestos Superfund Site (Site) in Lincoln County, Montana.

Potential risks to humans and ecological receptors from exposure to Libby amphibole asbestos (LA) contamination were identified in the *Human Health Risk Assessment* (HHRA) CDM Smith 2015a) and *Site-wide Baseline Ecological Risk Assessment* (BERA) (SRC, Inc. and CDM Smith 2014). This memorandum, herein referred to as the "*Protectiveness Evaluation Memorandum*", was developed to discuss how human health and ecological risks from exposure to LA contamination could be addressed in the context of a risk management strategy for Operable Units (OUs) 4, 5, 6, 7, and 8. For the purposes of this memorandum, these OUs will be referred to using the term "Site-wide." The risk management strategy identifies how risks from exposure to LA contamination within these OUs could be mitigated with potential remedial approaches to achieve and maintain protectiveness of human health and the environment.

OUs 1 and 2, while having similarities to the OUs evaluated in this memorandum, are excluded from discussion because remedial action is complete, and evaluation of protectiveness achieved from the selected remedies for those OUs will occur during 5-year site reviews. OU3 is specifically excluded from this memorandum because it will be addressed as a separate remedial action using an OU3-specific risk management strategy.

The original *Protectiveness Evaluation Memorandum* (dated May 1, 2015) was developed as part of, and attached as an appendix to, the *Feasibility Study* (FS) (CDM Smith 2015b) and was based on the results of the draft HHRA. The HHRA was finalized in November 2015 (CDM Smith 2015a); thus, this version of the *Protectiveness Evaluation Memorandum* has been revised to be consistent with the results and conclusions of the final HHRA.

1.2 Use and Impacts of Evaluations to Remedial Alternatives in the FS and a Selected Remedy

The potential remedial approaches identified as part of the risk management strategy discussed in the original version of this memorandum were used within the FS (CDM Smith 2015b) to identify remedial alternatives capable of successfully addressing the exposure media and pathways posing unacceptable risks at the Site. The remedial approaches discussed in this memorandum are solely presented as examples to illustrate protectiveness achieved from a range of general response actions and do not constitute a full evaluation of technologies or process options. The comprehensive identification and screening of technologies and process options is presented in the FS (CDM Smith 2015b).

Alternatives identified for evaluation in the FS were based upon the presumption that viable remedies would require active (i.e. physical) risk management approaches to comprehensively address exposure to LA-contaminated media as well as overarching institutional control (IC) approaches to maintain protectiveness. Examples of physical risk management approaches include, but are not limited to, access controls, containment, removal/disposal, and treatment. Examples of IC approaches include, but are not limited to legal controls (e.g. governmental controls, proprietary controls, enforcement tools with IC components, and informational devices), and risk communication controls (e.g., community awareness activities, notification programs). These physical and IC risk management approaches are discussed in greater detail in Sections 7.0 and 8.0, respectively.

The conclusions in the original version of this memorandum were used as the foundational basis for the evaluation of remedial alternatives within the FS, especially in the context of achieving overall protection of human health and the environment. The conclusions in the updated version of this memorandum are also useful to confirm that remedy components for the selected remedy can also achieve overall protection of human health and the environment, given the updates to the HHRA.

2.0 Summary of Risk Assessments

2.1 Human Health Risk Assessment

The HHRA evaluated potential risks to humans from exposures to LA under a variety of different exposure scenarios, including both indoor and outdoor exposure scenarios that may occur at the Site. For LA, inhalation is the dominant exposure pathway; exposures from ingestion pathways were demonstrated to be minor (CDM Smith 2015a). Potential risks were evaluated both alone and across multiple inhalation exposure scenarios as part of the cumulative exposure assessment. Health risks were evaluated based on both cancer and non-cancer endpoints.

In general, EPA considers excess cancer risks that are below about 10^{-6} to be as small as to be negligible and risks above 10^{-4} to be sufficiently large that remediation is typically warranted. Excess cancer risks, ranging between 10^{-4} and 10^{-6}, are generally considered to be acceptable (EPA 1991) although this is evaluated on a case-by-case basis, and EPA may determine risks lower than 10^{-4} are not sufficiently protective and warrant remedial action. For non-cancer effects, if the cumulative hazard index (HI) is less than or equal to 1, then remedial action is generally not warranted unless there are adverse environmental impacts. If the HI exceeds 1, there is some possibility that non-cancer effects may occur although an HI above 1 does not indicate an effect will definitely occur. However, the larger the HI value, the more likely it is an adverse effect may occur.

Note that risk management decisions generally consider the sum of all the risks contributed by differing exposure scenarios (i.e., cumulative risk) rather than simply evaluating each one independently.

Cumulative risk from LA is expressed as the sum of all cancer risks or non-cancer hazard quotients (HQs) across various exposure scenarios. The HHRA illustrated how risk depended on different types of source disturbance activities, LA levels in the source media, and exposure locations.

In reviewing the exposure scenario-specific risk calculations, the following conclusions were drawn:

- For a given exposure scenario, non-cancer HQs can exceed 1 even when cancer risks are less than 10^{-4}, which indicates non-cancer exposure is a more sensitive endpoint. For LA, when the non-cancer HQ is 1, the excess cancer risk is approximately 10^{-5}.
- Ambient air under current conditions is significantly improved relative to historical conditions. Under current conditions, cancer risks are less than or equal to 10^{-6}, and non-cancer HQs are less than 0.1.
- There were very few exposure scenarios that, when considered alone, yielded non-cancer HQs that exceeded 1. These exposure scenarios included (listed from highest to lowest HQ):
  - **Tradesperson exposures** during active source disturbance activities, such as vermiculite insulation removal or demolition, inside residential and commercial properties in Libby (OU4) and Troy (OU7)
  - **Outdoor worker exposures** during disturbances of subsurface soils (as defined in Section 6.1.1) with LA contamination
  - **Residential and outdoor worker exposures** during disturbances of surface soils (as defined in Section 6.1.1) with detected concentrations of LA
  - **Outdoor worker exposures** during commercial logging activities in OU3 near the former Libby Vermiculite Mine (within about 1 mile), especially those logging activities that disturb soil and duff material (e.g., skidding)
  - **Firefighter exposures** while performing dry mop-up activities after an understory burn that occurs in OU3 near the former Libby Vermiculite Mine (within about 1 mile)
  - **Residential and indoor commercial worker exposures** to indoor air during active source disturbance activities inside residential and commercial properties (OU4/OU7) where one or more interior removal triggers are present (i.e., at "pre-removal" properties)
  - **Residential exposures** to indoor air while emptying woodstove ash from wood-burning stoves when the firewood source is located near the former Libby Vermiculite Mine (within about 1 mile)
  - **Forest worker exposures** while building slash piles in OU3 near the former Libby Vermiculite Mine (within about 1 mile)
  - **Rockhound exposures** in the disturbed area of the former Libby Vermiculite Mine in OU3

- Although quantitative risk estimates were not calculated, the HHRA concluded risks also had the potential to be above a level of concern if individuals disturbed subsurface soils where LA contamination has been left at depth following soil removal actions (e.g., in OU1 and OU2).
- There were also several exposure scenarios that, when considered alone, yielded non-cancer HQs that approached 1 (e.g., hiking along Rainy Creek in OU3, brush-hogging along road right-of-ways (ROWs) in OU8, residential exposures while digging in subsurface soil with LA contamination). Although these exposure scenarios alone do not result in unacceptable risks, they have the potential to be important contributors to cumulative risk.

In reviewing the cumulative risk calculations, the following conclusions were drawn:

- Cumulative HI estimates were less than 1 when exposures occurred at properties and locations with lower levels of LA. However, cumulative HI estimates have the potential to be greater than 1 when exposures occurred at properties and locations with higher levels of LA.
- When cumulative exposure scenarios represent activities that actively disturb LA-contaminated source media (e.g., hiking along lower Rainy Creek near the former Libby Vermiculite Mine, performing timber skidding operations near the former Libby Vermiculite Mine, or disturbing vermiculite insulation during tradesperson activities), these scenarios were important risk drivers for cumulative HI estimates.
- Exposure scenarios that contribute the most time to the total lifetime exposure do not necessarily contribute most to the cumulative HI. In some cases, exposure scenarios that contribute little to the total lifetime exposure time can contribute significantly to the cumulative HI.
- It is possible to reduce cumulative exposures and risks, without altering activity behavior patterns, by lowering LA levels in source media where disturbance activities are performed (e.g., removing yard soil with LA) and/or by altering the locations where the activities are performed (e.g., collecting firewood from areas far from the former Libby Vermiculite Mine).
- It is not necessary to address every single exposure scenario to significantly lower the cumulative risks. Addressing exposures for a small subset of the potential exposure scenarios, focusing on risk drivers, will have the greatest impact in lowering cumulative exposures and risks.
- It is possible for individual exposure scenario HQs to be less than 1 but the cumulative HI across all exposure scenarios to be greater than 1. Thus, risk managers should consider both cumulative risks and individual exposure scenario risks to identify potential risk drivers to guide decisions on future remedial criteria and/or remedial approaches, such as ICs.

2.2 Ecological Risk Assessment

EPA performed a number of studies to investigate whether ecological receptors in OU3 (the former Libby Vermiculite Mine and surrounding areas) were adversely impacted by LA in the environment. These studies and their findings have been applied to the other OUs at the Site (defined herein as non-OU3 areas) with similar ecological settings.

For aquatic receptors, studies of fish, benthic invertebrates, and amphibians exposed to LA in surface water, sediment, or porewater from OU3 revealed no evidence of ecologically significant effects that were attributable to LA. These studies indicate aquatic receptors in OU3 are unlikely to be adversely impacted by LA. Because concentrations of LA in environmental media in non-OU3 areas are substantially lower than those in OU3, it can reasonably be expected that aquatic receptors in these areas are also unlikely to be adversely impacted by LA.

For terrestrial receptors, the forested areas surrounding Libby and Troy were evaluated as part of OU3 because the extent of OU3-related impacts has not been formally delineated. In non-OU3 areas, the land has largely been developed for human use (e.g., residential, commercial, industrial); thus, habitat is not optimal to support terrestrial receptors. Because of the lack of optimal habitat, LA risks to terrestrial receptors were not evaluated for non-OU3 areas. The Site-wide BERA (SRC, Inc. and CDM Smith 2014) concluded terrestrial receptor populations in the forested areas are unlikely to be adversely impacted by LA.

Based on these results, remedial approaches evaluated within this memorandum focus solely on human health risks from exposure to LA-contaminated media.

3.0 RAOs and Remedial Criteria

3.1 RAOs

Remedial action objectives (RAOs) are medium-specific and source-specific goals to be achieved through completion of a remedy that is protective of human health and the environment. Based on the HHRA, there are several source media that have the potential to result in unacceptable LA exposures, including soil (both surface and subsurface soils, as defined in Section 6.1) contaminated with LA, vermiculite insulation and other building materials containing LA, indoor dust contaminated with LA, and ash generated from burning wood contaminated with LA.

The RAOs were developed to restrict or eliminate continued release and migration of LA from contaminated soil and building materials to protect human receptors across the non-OU3 areas of the Site. The RAOs include:

- Minimize the inhalation of LA during disturbances of soil contaminated with LA such that the resulting exposures result in cumulative cancer risks that are within or below EPA's acceptable risk range of 10^{-6} to 10^{-4} and cumulative non-cancer HIs that are at or below 1.
- Minimize the inhalation of LA during disturbances of building materials contaminated with LA such that the resulting exposures result in cumulative cancer risks that are within or below EPA's acceptable risk range of 10^{-6} to 10^{-4} and cumulative non-cancer HIs that are at or below 1.

RAOs were not developed for ash or indoor dust contaminated with LA for the reasons stated herein. As demonstrated in the HHRA, exposures to LA resulting from disturbances of woodstove ash differed, depending on the source of the firewood that was burned. The estimated reasonable maximum exposure (RME) non-cancer HQ was greater than 1 when firewood was collected from a location near the former Libby Vermiculite Mine (i.e., less than 2 miles, where tree bark LA levels are highest), but HQs were less than 1 when firewood was collected from locations far from the Former Libby Vermiculite Mine (i.e., 2 to10 miles south of Libby). RME cancer risks from exposure to LA in woodstove ash were below 10^{-4} regardless of the wood source. The HHRA also demonstrated RME non-cancer HQs were greater than or equal to 1 when ash/soil disturbances occurred as part of fire mop-up activities conducted near (within one mile) of the former Libby Vermiculite Mine. There is no information on potential exposures during mop-up activities at locations further from the former Libby Vermiculite Mine (i.e., in non-OU3 areas). Because unacceptable exposures from ash disturbances are associated with locations inside the OU3 Study Area, and this memorandum is focused on addressing risks in Site-wide areas (as defined in Section 1.1, i.e., non-OU3 areas of the Site), no RAOs were developed for ash. However, it is anticipated this source medium will be addressed as part of the OU3-specific record of decision (ROD).

Indoor dust containing LA is an important source medium for indoor exposures. However, indoor dust is a secondary source medium, meaning it is derived from other media (e.g., airborne particulates containing LA from soils and building materials that settle out on interior surfaces). Indoor dust becomes contaminated with LA as a result of other primary source media being contaminated. As such, no RAOs were developed for indoor dust, but they were developed for the two primary source media containing LA that are likely to affect indoor dust – soil and building materials.

3.2 Remedial Criteria

Remedial criteria are qualitative and quantitative thresholds used to determine if cleanups of source media are warranted to address exposures that pose unacceptable risks and when those cleanups result in acceptable risk reduction. The remedial criteria typically identified during the FS and finalized in the ROD are remedial goals (RGs). The development of RGs is a requirement of the NCP (40 CFR § 300.430(e)(2)(i)). Identification and selection of the RGs are typically based on RAOs, the current and anticipated future land uses, and the identified ARARs. However, development of RGs for LA cannot be performed using conventional techniques, so factors related to technical limitations and uncertainty can be considered during RG development as indicated in 40 CFR § 300.430(e)(2)(i)(A)(3) and -(4). This subsection describes the remedial criteria that were established for use during remediation of LA contamination at the Site, that when used in conjunction with ICs, establish acceptable exposure levels that are protective of human health and the environment and thus meet the requirements of RGs stipulated in 40 CFR § 300.430(e)(2)(i).

RGs are defined as the average concentration of a contaminant in an exposure area associated with a target risk level such that concentrations at or below the RG do not pose an unacceptable risk. These values are typically used in the FS to guide evaluations of remedial alternatives. While it is possible to derive air-based RGs for LA that correspond to a target cancer risk or non-cancer HQ, these air-based RGs cannot be directly used to guide response actions that are focused on remediating source media (not air). For LA, the derivation of a source medium-based RG is complicated by the fact that it is not possible to develop an empiric, quantitative relationship between the level of LA in a source medium (soil, building materials) and the amount of LA that may be released into air when that source medium is disturbed. As such, much of the risk analysis and risk management information was based upon the results of ABS. In addition, it is not possible to establish a source medium-based PRG for cumulative exposures because the number of exposure scenarios/activities that may be included in a cumulative assessment is infinite and person-specific. For these reasons, source medium-based RGs have not been established for the Site.

In lieu of RGs, remedial actions at the Site are guided based on two types of remedial criteria – remedial action levels (RALs) and remedial clearance criteria. The RAL defines the condition when remedial action is and is not needed due to LA contamination in soil and building materials. For example, if surface soil conditions are below the RAL, no action is needed; if surface soil conditions are at or above the RAL, then action is warranted. The remedial clearance criteria define the conditions that must be met for the physical components or approaches of the remedial action to be deemed complete. When combined with ICs, the RALs and remedial clearance satisfy the requirements of 40 CFR § 300.430(e)(2)(i). Specifics regarding the remedial criteria established for non-OU3 areas of the Site are discussed in Section 6.0.

RALs initiate cleanups to reduce LA exposures so that resulting post-cleanup risks will achieve the remedial action objectives. To meet these objectives, EPA will perform cleanup until the remedial clearance criteria are met. Since the remedial clearance criteria may leave LA contamination in subsurface soils or within inaccessible areas of buildings, ICs will be implemented to address LA contamination that remains after the physical cleanup is complete. These ICs will also protect the integrity of the physical cleanup components, thereby achieving the remediation goals. This cleanup approach is part of the risk management strategy discussed in Section 4.0. Protectiveness provided by physical cleanup approaches and ICs is discussed further in Sections 7.0 and 8.0, respectively.

4.0 Summary of Risk Management Strategy

A risk management strategy for remedial action has been developed based on conclusions of the HHRA to provide adequate protection of human health from exposure to LA contamination within the non-OU3 areas of the Site. The focus of the risk management strategy is to target LA contamination sources that pose the greatest contributions to cumulative exposures. This can be achieved by physically mitigating the source media, coupled with non-physical measures to inform and/or prevent people from participating in activities that are important contributors to the cumulative LA exposures.

For remedial alternatives to be successful in achieving adequate protection of human health, the contaminated media identified in the RAOs (soil and building materials) require comprehensive cleanups to mitigate the potential for LA exposures. These comprehensive cleanup approaches could include:

- Providing a barrier to LA exposure (i.e., access controls or containment)
- Relocating LA contamination to a protective location to prevent exposure (i.e., removal/disposal)
- Mitigating the toxicity/mobility/volume of LA fibers that could be released to air from a contaminated source medium and result in exposure (i.e., treatment)

Physical remediation, in combination with ICs and access controls, minimizes the potential for exposure to LA contamination that remains after response actions. These physical remedial approaches, used singularly or in combination for both contaminated soils and building materials, could address the majority of the contributions to cumulative risks posed by LA exposures currently present at the non-OU3 areas of the Site.

ICs and access controls also play a critical role in the risk management strategy by minimizing the potential for exposure to LA contamination that remains after the response actions and protecting the integrity of the response actions. A combination of ICs, including legal controls and risk communication controls would inform and/or restrict human receptors from activities with higher exposure potential in the course of normal activities within the Site. In addition, the remediation approaches for contaminated soils and building materials may also require ICs to protect any remedy components (e.g., covers or encapsulation) when LA contamination is left in place. ICs could also be used to require cleanup of LA contamination that is currently inaccessible but becomes accessible in the future and where the use of a property changes. The concept of accessibility is discussed in Section 6.0, and these situations are discussed further in Section 8.0.

It is important to note that, although the majority of the cumulative cancer risks and non-cancer hazards from exposure to LA would be addressed through this risk management strategy approach, it is possible not all risks would be fully addressed. This could occur when:

ICs for activities with higher exposure potential within the non-OU3 areas of the Site are ignored, which could result in excess cumulative cancer or non-cancer risks from exposure to LA contamination. Residual risks are effectively mitigated through management under the ICs, and following the ICs is necessary for the risk management strategy to be successful.

Information regarding measures to reduce or eliminate exposures to LA from the OU3 study area are ignored and/or access controls such as fencing, gates, and signage within the OU3 study area are circumvented. The former Libby Vermiculite Mine, within the OU3 study area, has been largely unaddressed and is the source of LA contamination distributed throughout the Site. The remedial approach for OU3 is being evaluated and addressed on a separate timetable and thus is not addressed in this memorandum. Thus, activities within the OU3 study area in areas identified through information provided or excluded by access controls may result in excess cumulative cancer or non-cancer risks from exposure to LA contamination.

If people adhere to the ICs established for the Site to mitigate these contributions to risk and the comprehensive cleanups are performed for both contaminated media, then adequate protection of human health from exposure to LA contamination could be achieved. The approach to the risk management strategy can be illustrated graphically using an example cumulative LA exposure scenario as presented in Exhibit 4-1.

In this example, the cumulative exposure scenario includes the following exposure scenarios:

1. Outdoor air in OU4 under ambient conditions
2. Outdoor air while fishing along the Kootenai River
3. Indoor air in an OU4 residential property during active behaviors
4. Indoor air in an OU4 residential property during passive behaviors
5. Outdoor air at an OU4 residential property during yard work
6. Indoor air in the Central Maintenance Building within OU5

7. Outdoor air while hiking in the forest within OU3 at locations intermediate (i.e., 2 to 6 miles) from the former Libby Vermiculite Mine
8. Air in off-Site locations (i.e., outside of the Site)

Time-weighting factors (TWFs) are important in assessing cumulative LA exposures. TWFs describe the average fraction of a lifetime during which LA exposure occurs from the specific activity being assessed. The exposure-specific TWF values for use in the cumulative assessment must be selected by specifying the fraction of the lifetime spent engaging in each exposure scenario, taking care to ensure the cumulative TWF is equal to 1.0. In the example presented in Exhibit 4-1 (Panel A), the TWF values have been adjusted to ensure the total number of hours of LA exposure does not exceed a 70-year lifetime of 613,200 hours (i.e., the cumulative TWF sums to 1.0). Panel A illustrates the contribution of each exposure scenario to the total lifetime LA exposure time (i.e., a 70-year lifetime). Panel B illustrates the contribution of each exposure scenario to the cumulative HI. Exhibit 4-1 shows the cumulative non-cancer HI for this example receptor would exceed 1, which is one of the acceptable limits established in the RAOs, without remedial action.

Exhibit 4-2 (Panel A) provides a tabular presentation of the information shown in Exhibit 4-1. This table also includes a summary of the various remedial actions that could be implemented to address the example exposures.

It is possible to reduce cumulative LA exposures and risks without altering activity behavior patterns simply by lowering LA concentration levels in source media through cleanups, providing physical barriers to source media to prevent exposures, and/or altering the locations where the activities are allowed. The risk management strategy for the cumulative risk example is illustrated in Panel B of Exhibit 4-2.

The assembly and identification of remedial alternatives for alternative screening in the FS incorporated various general response action approaches to address implementation of the risk management strategy.

5.0 Role of Land Use Categories

While OUs have been used at the Site to organize investigations and subsequent response actions, EPA has determined that categories related to current and future land use are more consistent with the risk management approach for the non-OU3 areas of the Site that were evaluated within the FS. Thus, the non-OU3 areas of the Site have been organized into four separate land use categories: (1) residential/commercial, (2) industrial, (3) transportation corridors, and (4) parks/schools. It should be recognized that while these land use categories were primarily identified to categorize existing land uses for properties within the Site, they also form the framework for evaluation of land uses when a property owner elects to change the land use in the future. Thus, the definitions of the land use categories may contemplate uses that do not currently exist. Future land use changes are discussed further in Section 8.0.

The following sections describe the four land use categories and their relationship to properties within the Site OUs (excluding OU1, OU2, and OU3).

5.1 Residential/Commercial

This land use category includes private residential/commercial properties as well as public properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used, or will be used in the future, for residential and commercial/governmental (service-related) purposes that are not involved in large-scale manufacturing of products for sale and export outside of the site.. This land use category includes alleyways and city streets within OU4 and OU7 as well as churches that do not provide primary, secondary, or higher education in a school setting. This land use category also includes future public and private school properties within the City of Libby (OU4) and the Town of Troy (OU7) that do not currently exist but are planned to provide primary, secondary, or higher education.

This category excludes parks, currently existing schools, industrial (manufacturing-related) properties, and rail/highway transportation corridors that traverse or are included within the boundaries of OU4 and OU7.

Within a residential or commercial property, outdoor exposures may differ as a function of location within a property (e.g., the amount of time spent in yards is expected to be different than time spent in a garden). For this reason, the HHRA evaluated risks separately for each of four exposure locations – yards, gardens/flowerbeds, driveways, and limited-use areas (LUAs; e.g., maintained pastures and fields). Because current use is not necessarily indicative of future use (i.e., a garden under current conditions could become a different yard under future conditions), this memorandum employs a broader classification of use areas to encompass both current and potential future uses.

The term "frequently used areas" applies to those areas of residential/commercial properties that are likely to be used on a regular basis by residents and outdoor workers, such as yards, gardens, flowerbeds, play areas, unpaved walkways and driveways, lawns, landscaped areas, etc. The term "infrequently used areas" applies to those areas of residential/commercial properties that are likely to be used on a less regular basis, such as pastures and fields, wooded lots, and areas beneath structures (e.g., soils beneath low clearance decks, raised sheds).

5.2 Industrial

This land use category includes industrial properties that are currently or will be used in the future for industrial purposes (e.g., large-scale manufacturing of products for sale and export outside of the Site). Currently, a portion of the properties at the currently existing industrial park within OU5 has been identified as being within this land use category.

This category includes rail spurs and roadways within an industrial property, but excludes rail and highway transportation corridors (OU6 and OU8, respectively) that border industrial properties.

5.3 Transportation Corridors

This land use category includes rail and highway corridors that are currently used, or will be used in the future, for vehicular transportation, as defined in the descriptions for OU6 and OU8, respectively. This land use category also includes buildings and facilities used by transportation entities (e.g., Montana Department of Transportation, Burlington Northern and Santa Fe [BNSF] Railway).

Although none currently exist, this category excludes rail or highway corridors that are converted and repurposed in the future to non-vehicular recreational trails (e.g., “rails to trails” projects), which would be part of the park/school properties category.

5.4 Parks/Schools

This land use category includes the park properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used, or will be used in the future, for public or commercial recreational purposes. It also includes roadways within public or commercial parks.

This land use category also includes the public and private school properties within the City of Libby (OU4) and the Town of Troy (OU7) that are currently used, or will be used in the future, to provide primary, secondary, or higher education. Churches that do not provide primary, secondary, or higher education and schools established in the future are part of the residential/commercial properties land use category (Section 5.1).

6.0 Identification and Role of Remedial Criteria for Cleanup of Contaminated Media

6.1 Concepts Affecting Development of Remedial Criteria

The purpose of remedial criteria was introduced in Section 3.0. Exhibits 6-1 and 6-2 provide a summary of the remedial criteria for contaminated soil and contaminated building materials, respectively. The following subsections discuss the factors considered in the development of these remedial criteria.

6.1.1 Identification of Contaminated Media

As described in Section 3.0, there are two primary source media that are the focus of the remedial criteria – soil and building materials. These are the primary source media within the four land use categories that, when disturbed, could result in LA exposures that would result in unacceptable human health risks. The following definitions for contaminated soil and contaminated building materials were developed for use in establishing remedial criteria.

Contaminated Soil

Contaminated soil is defined as granular or fine-grained earth materials (e.g., gravel, sand, fill, boulders that are subsequently crushed into soil like materials) that contain LA, which when disturbed, result in unacceptable airborne exposures and human health risks. Soil impacted by ash generated from wood or vegetation burning in outdoor areas, except an enclosed structure like a wood furnace, would also be considered contaminated soil for purposes of this definition (e.g., a fire pit).

The definition of surface soil and subsurface soil is also important in the establishment of remedial criteria, as the potential receptors and exposures can differ between these two depth intervals. In the HHRA, two depth intervals were evaluated for determining potential exposures during soil disturbances – surface soil and subsurface soil. Per EPA guidance (EPA 1989), these soil depth intervals were defined in terms of expected human exposure scenarios.

The term surface soil is used to describe soils that would be encountered by human receptors under "typical" activities. In a residential/commercial setting, this may consist of various activities such as mowing the lawn, raking leaves, playing in the yard, a child digging in the dirt, planting in a garden or flowerbed, performing sprinkler maintenance, walking on an unpaved sidewalk, and driving in an unpaved driveway. In general, these types of soil disturbance activities likely would result in disturbances of soils within a shallow (less than 6 inches) depth interval. Current property investigation protocols seek to characterize this surface soil interval since this is the interval most likely to be encountered under "typical" activities.

The term subsurface soil is used to describe soils that are below “surface soils,” as defined above. Subsurface soils would be encountered during deeper digging activities, such as a resident digging holes to plant a tree or a construction worker digging a sewer or utility line. These activities are likely to result in disturbances of subsurface soils to several feet in depth.

Attachment A provides an overview of the investigation methods that have been employed at the Site to characterize LA contamination in surface soil and provides several lines of evidence to justify why these investigation methods are also adequate for the characterization of subsurface soil.

Contaminated Building Materials

Contaminated building materials are defined as vermiculite or other manufactured building materials used in construction (e.g., insulation, log chinking, chimney mortar, plaster, cinder blocks, pipe insulation) that contain LA, which when disturbed, result in unacceptable airborne exposures and human health risks. Other insulation building materials (such as fiberglass or cellulose) that are in contact or share airspace with LA-containing vermiculite insulation would also be considered contaminated building materials for purposes of this definition.

6.1.2 Accessibility of Contaminated Building Materials

Accessibility to media contaminated with LA is an important condition that will be used for defining remedial alternatives for cleanup of contaminated building materials. Accessible, when referring to LA-contaminated building materials, means the materials are subject to disturbance by humans in the course of their normal activities under current conditions. If materials are not accessible, there is no complete exposure pathway. The concept of accessibility is important since the HHRA indicated exposures which contributed significantly to the cumulative risk were generally associated with source disturbance activities. Thus, the physical accessibility of LA-contaminated building materials, as well as the form and condition of these materials, is important to consider for the purposes of limiting exposures.

Based on the concept of physical accessibility, the evaluation of contaminated building materials within primary structures was divided into living and non-living spaces. Similarly, the presence of building materials contaminated with LA does not mean they would be a source of airborne LA; in this regard, the form and condition of the material is an important factor. Deteriorated materials containing LA would require additional evaluation (e.g., abatement inspection) to determine whether the contamination is deemed accessible from an exposure standpoint.

ICs would generally be used to require cleanup of LA contamination that is currently inaccessible but becomes accessible in the future. These situations are discussed further in Section 8.0.

6.1.3 Identification of Boundary Conditions Affecting Cleanup of Contaminated Media

Boundary conditions pertain to physical cleanup response actions where LA-contaminated soil or building materials are removed. The concept of boundary conditions is important because cleanup of LA contamination within source media that are not accessible (i.e., there is no complete exposure pathway) would not necessarily result in any additional reduction in human health risks.

Boundary conditions are defined as features or conditions that limit the ability to further remediate LA contamination due to physical or technical constraints and the related lack of accessibility the boundary conditions present. Boundary conditions include the following:

- Presence of building foundations that could be compromised by physical remedy

Presence of pavement that is relatively permanent (e.g., roadways and sidewalks, or other types of pavement difficult to remove and replace intact)

- Presence of large tree root systems
- Presence of bedrock
- Presence of groundwater that is not seasonal or perched and thus cannot be readily avoided
- A pre-set maximum vertical extent of 3 feet below ground surface, due to limited future accessibility of subsurface soils under typical residential and commercial activities
- A maximum horizontal extent to an adjacent property boundary where cleanup is likely to occur or where other boundary conditions exist (e.g., pavement, bedrock, tree roots; as identified above)

  The list of boundary conditions presented is not necessarily an all-inclusive list; other features or conditions may be identified during implementation of a physical remedy that limit the ability to further remediate LA contamination that is not readily accessible.

6.2 RALs for Contaminated Media

RALs for contaminated media are site-specific criteria used to determine whether a remedial action at a particular property or location using physical remedy components or approaches would be required due to LA contamination in soil and building materials. RALs were developed separately for each contaminated source medium (i.e., building materials and soil) due to differences in the matrix containing the LA contamination. Furthermore, the RALs were developed separately for each of the land use categories discussed in Section 5.0.

For most chemicals that cause both cancer and non-cancer effects, cancer is usually the endpoint that drives risk management decisions. That is, as exposure concentration increases, the cancer risk estimate reaches EPA's threshold of 10^{-4} before the non-cancer HQ reaches a threshold of 1. However, this is not the case for LA exposures. For LA, for any given exposure scenario, non-cancer effects are the more sensitive endpoint. As such, RALs were developed to ensure adequate protection based on non-cancer effects, which will also be protective of cancer risks.

In the HHRA, risk estimates were calculated based on two different exposure scenarios – central tendency exposures (CTE), which represent "average" exposures, and RME, which represent exposures near the upper end of the range. In accordance with EPA (1991), the RALs were developed based on RME risk estimates, which ensures risk management decisions are sufficiently protective of the general population.

6.2.1 Contaminated Soil

Soil Concentration Bins

When property investigations are conducted at the Site, soil samples are analyzed by the Site-specific polarized light microscopy using visual estimation (PLM-VE) analytical method, which was developed in 2003. PLM-VE is a semi-quantitative method that utilizes LA-specific reference materials to allow assignment of soil samples into one of four concentration "bins" as follows:

- Bin A (ND): non-detect
- Bin B1 (Trace): detected at levels lower than the 0.2 percent (by mass) LA reference material
- Bin B2 (less than 1 percent): detected at levels lower than the 1 percent (by mass) LA reference material but greater than or equal to the 0.2 percent LA reference material
- Bin C: LA detected at levels greater than or equal to the 1 percent LA reference material; results are reported to the nearest whole percent

Use of PLM-VE allows for the reliable detection of LA in soil to concentrations of about 0.2 percent in a cost-effective, rapid manner.

RALs for Contaminated Soil – Residential/Commercial

As shown in the HHRA for residential/commercial properties, exposures from surface soil disturbances alone have the potential to result in unacceptable exposures when LA is detected in the soil.

<u>Frequently Used Areas</u>

The definition of frequently used areas is in Section 5.0. The RALs for addressing surface soils in frequently used areas at residential/commercial properties are as follows:

- LA soil concentrations of Bin B2 or Bin C PLM-VE (regardless of spatial extent)

  or

- LA soil concentrations of Bin B1 by PLM-VE, if the spatial extent of the Bin B1 area is more than 25 percent of the total soil exposure area at a property

The basis for these RALs is discussed in the following paragraphs.

Risk estimates for residents and outdoor workers from surface soil exposures in yards, gardens/flowerbeds, and driveways were generally similar. Risk estimates for yard exposures tended to be higher than for gardens/flowerbeds or driveways; thus, RME HQs for yards were used as the basis of the RALs for frequently used areas.

For Bin B2/C LA soil concentrations in yards, the RME HQ is 7 based on both a residential and outdoor worker exposure scenario (CDM Smith 2015a; see Table 6-3a, -3b). Thus, it was concluded that exposure to surface soils with LA concentrations of Bin B2 or Bin C at residential/commercial properties (regardless of their spatial extent) require remediation.

For Bin B1 (trace) LA soil concentrations in yards, the RME HQ is 2 based on both a residential exposure scenario and an outdoor worker scenario (CDM Smith 2015a; see Table 6-3a, -3b). As discussed in the HHRA, the potential LA exposure for a given property will depend upon the spatial extent of varying levels of soil contamination, as determined based on a spatially-weighted exposure for the entire soil exposure area. To illustrate, if only 5 percent of the exposure area is Bin B1 and the remaining 95 percent is Bin A (non-detect), the resulting HQ from the yard soil exposure pathway would be 0.2. However, if 95 percent of the exposure area is Bin B1 and 5 percent is Bin A (non-detect), the resulting HQ from the yard soil exposure pathway would be 1.9. Thus, the surface soil RAL must consider the spatial extent of the Bin B1 soils.

In order to ensure the HQ from this soil exposure pathway is less than 1, no more than about 50 percent of the total soil exposure area can be comprised of soils ranked as Bin B1 (assuming the remainder of the soil exposure area is ranked as Bin A). The following equation illustrates this calculation:

$$\text{Area-wide HQ} = (HQ_{\text{Bin A}} \cdot 1\text{-}X) + (HQ_{\text{Bin B1}} \cdot X)$$

where:

Area-wide HQ = set equal to a target of 1

$HQ_{\text{Bin A}}$ = 0.1 (from Table 6-3a in the HHRA)

$HQ_{\text{Bin B1}}$ = 2 (from Table 6-3a in the HHRA)

X = fraction of the total soil exposure area that is Bin B1

In the above equation, when solved for X, the resulting fraction is 0.47 (rounded to 0.5 or 50 percent). Thus, if 50 percent of the total soil exposure area is Bin B1, then the resulting HQ for this exposure scenario would be 1. To ensure protectiveness, in consideration of cumulative exposures, it was decided that no more than 25 percent of the total soil exposure area for frequently used areas (e.g., yards, gardens, flowerbeds) can be comprised of soils ranked as Bin B1. If 25 percent of the total soil exposure area is Bin B1 (and the remainder is Bin A), then the resulting HQ for this exposure scenario would be 0.6.

Infrequently Used Areas
The definition of infrequently used areas is described in Section 5.1. The RAL for addressing surface soils in infrequently used areas at residential/commercial properties follows:

- LA soil concentrations of Bin B2 or Bin C by PLM-VE

The basis for this RAL is discussed in the following paragraphs.

For areas at residential/commercial properties that have infrequent use (e.g., pastures, maintained fields), RME HQs for LUAs were used as the basis of the surface soil RALs. RME HQs for LUAs were below 0.1 based on Bin B1 soil conditions, but there were no data on potential exposures based on Bin B2/C conditions (CDM Smith 2015a; see Table 6-3a). For the purposes of developing RALs, it is assumed exposures under Bin B2/C conditions would be similar to those for more frequently used areas and would require remediation.

It is possible area use of a property can change over time. Because the RAL for infrequently used areas is less stringent than for frequently used areas with regard to actions for Bin B1 soils, if the future use of an area changes such that it is used on a more frequent basis (e.g., the yard at a property is extended into what was once a pasture), the RALs for frequently used areas would then become applicable. This is also true for areas within a property that are currently not used (e.g., wooded areas, unmaintained fields, areas beneath low decks). If areas that are not used under current conditions become used in the future (either on a frequent or infrequent basis), the appropriate RALs would then apply. The use of ICs to identify and address these types of situations is discussed further in Section 8.0.

RALs for Contaminated Soil – Industrial
The RAL for addressing surface soil contamination at industrial properties follows:

- LA soil concentrations of Bin C by PLM-VE

The basis for this RAL is discussed in the following paragraphs.

As shown in the HHRA, for outdoor workers in OU5, exposures from surface soil disturbances resulted in estimated RME HQs that ranged from 0 to 1, depending upon the area where the activity-based sampling (ABS) activities were performed, with most HQs ranging from 0.2 to 0.6 (CDM Smith 2015a; see Table 6-19). These results indicate that, while risks from this scenario alone are below a level of concern, in some areas, this exposure scenario has the potential to be an important contributor to cumulative risks.

As discussed in the HHRA, because it is not feasible to evaluate outdoor worker risks by conducting ABS sampling on every acre of OU5, it was necessary to extrapolate risk conclusions about areas in OU5 where ABS air data were available. This was done by assessing the degree to which soil results from the ABS areas were similar to the soil results for areas without ABS data. Figure 6-11 of the HHRA illustrated the measured LA soil concentrations in OU5. The HHRA concluded that LA soil concentrations outside of the ABS areas were similar to, or lower than, concentrations inside the ABS areas (i.e., predominantly Bin A, with occasional Bin B1 and Bin B2 concentrations); therefore, outdoor worker exposures and risks across OU5 from soil disturbances are likely to be similar to or lower than those calculated for the ABS areas.

RALs for Contaminated Soil – Transportation Corridors
The RAL for addressing surface soil contamination along transportation corridors is as follows:

- LA soil concentrations of Bin C by PLM-VE

The basis for this RAL is discussed in the following paragraphs.

In the HHRA, exposures from surface soil disturbance activities in OU6 (along BNSF rail lines) resulted in estimated RME HQs at or below 0.1, even when based on upper-bound exposure estimates (CDM Smith 2015a; see Table 6-21 and Appendix I-10). The results indicate risks from this scenario alone are below a level of concern and not likely to be an important contributor to cumulative risks. As discussed in the HHRA, although ABS data were not available for all 40 miles of the rail line at the Site, it was concluded the ABS data are representative of conditions along the entire rail line based on the conceptual model of contamination.

For OU8, exposures from driving on roads in Libby and Troy resulted in estimated RME HQs at or below 0.3, even when based on upper-bound exposure estimates (CDM Smith 2015a; see Table 6-23 and Appendix I-11). These results indicate risks from this scenario alone are below a level of concern and not likely to be an important contributor to cumulative risks.

Exposures to recreational visitors while riding all-terrain vehicles along the right-of-way (ROW) and to outdoor workers during brush-clearing, mowing, and rotomilling activities in OU8 resulted in estimated RME HQs 0 to 0.9 (CDM Smith 2015a; see Table 6-23), with brush-clearing activities resulting in the highest exposures. As discussed in the HHRA, because ABS activities were conducted on smaller segments of the ROWs in OU8, it was necessary to extrapolate ABS results to ROW segments that had not been sampled using ABS. This was done by assessing the degree to which soil results from the ABS areas were similar to the soil results for areas without ABS data. Figure 6-15 of the HHRA illustrates the measured LA soil concentrations in OU8. The HHRA concluded that, because the segments selected for ABS were selected to be representative of the highest soil concentrations (LA soil concentrations ranged up to Bin B2), potential risks along the ROW in segments without ABS, where LA soil concentrations are lower, are likely to be lower.

Bin C concentrations of LA in soil are not expected in OU8 (CDM Smith 2015a; Figure 6-15). For the purposes of developing RALs, it is assumed outdoor worker exposures during disturbances of soils with Bin C LA concentrations, if these soils were encountered in the future in OU8, would yield HQs higher than those calculated in the HHRA and may be of potential concern.

RALs for Contaminated Soil – Parks/Schools

The RAL for addressing surface soil contamination in park/school properties is as follows:

- LA soil concentrations of Bin B2 or Bin C by PLM-VE

The basis for this RAL is discussed in the following paragraphs.

In the HHRA, exposures from surface soil disturbance activities at the parks/schools properties resulted in estimated RME HQs at or below 0.6, even when based on upper-bound exposure estimates (CDM Smith 2015a; see Table 6-8 and Appendix I-4). These results indicate risks from this scenario alone are below a level of concern and not likely to be an important contributor to cumulative risks. The outdoor ABS datasets used in the HHRA are representative of most current parks, schools, and golf courses in Libby and Troy; however, some parks/schools properties were not evaluated. To account for this, it is necessary to extrapolate ABS results for those parks/schools with ABS to areas without ABS. This is done based on an assessment of the soil results for the ABS areas. The following briefly summarizes the LA soil concentrations for parks/schools evaluated as part of the ABS investigations:

- Riverfront Park (OU1) – Extensive soil removal activities have been conducted in OU1 to address LA soil contamination. The entire park area was graded, covered with fill materials, and re-vegetated; thus, all surface soils are expected to be Bin A. (CDM Smith 2015c)
- Schools in Libby – A total of 41 soil samples were collected at five schools during the ABS activities; 10 of the 41 samples were Bin A, and the remainder were Bin B1 (EPA 2010). Since the time of the ABS, additional soil sampling at the Libby schools has confirmed soils are predominantly a mixture of Bin A and Bin B1 soil concentrations[1].
- Cabinet View Country Club – More than 70 surface soil samples were collected from tees, fairways, greens, and sand stockpiles from the golf course; LA soil concentrations were a mixture of Bin A and Bin B1, with only two samples ranked as Bin B2 (EPA 2007).
- Morrison Elementary, Timber Beast Disk Golf Course, and Roosevelt Park in Troy – More than 30 surface soil samples have been collected from the play areas, ball fields, park, and course areas; LA soil concentrations were a mixture of Bin A and Bin B1[2].

As seen, LA soil concentrations for park/school properties evaluated in the HHRA were generally representative of Bin A and Bin B1 conditions. For the purposes of developing RALs, it is assumed park/school exposures during disturbances of soils with Bin B2 or Bin C LA concentrations would yield HQs higher than those calculated in the HHRA and may be of potential concern.

Rationale for Excluding Visual Vermiculite in Development of RALs for Contaminated Soil

When the response actions for the Site were initiated in 1999, the criteria for soil removal were based upon both the presence of visible vermiculite (VV) during field observations and PLM results for soil samples that were collected. VV was determined to be a reliable indicator and rapid assessment tool for the determination of properties with LA soil contamination (EPA 2002a). The use of VV information in property investigations and removal decisions has changed over time. More recently, the elimination of VV as a "primary removal trigger" is first reflected in Amendment B (CDM Smith 2014a). The current approach for determining whether contaminated surface soil at properties should undergo a removal action relies solely on the results of soil analyses by PLM-VE. There have been several reasons for this change as discussed in the technical memorandum "*Use of Visible Vermiculite Status in Soil Removal Decisions*" (EPA 2015) and summarized below:

- Visible observations are based on vermiculite only, which is not necessarily LA. PLM-VE is preferred to VV observations because soil samples are specifically analyzed for LA, which is the contaminant of interest at the Site.
- In the past, VV was thought to be a more sensitive metric of presence of LA than analysis of soil by PLM-VE. However, improvement in analytical techniques over time has demonstrated the analytical laboratories are more likely to detect LA during the PLM-VE analysis when compared solely to visual observations of vermiculite during the field investigation.

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[1] One soil sample was ranked as Bin B2 from Libby Middle School.

[2] Based on a query of the soil results for these three properties in the Scribe database (performed on 12/11/14).

- VV observations are highly subjective and can vary among field personnel. In addition, they are dependent on variable environmental conditions (e.g., amount of cloud cover, soil moisture, ground cover).

Because the presence or absence of VV was not a component of soil conditions evaluated in the HHRA and current surface soil removal triggers are not based on VV, the RALs for soil do not utilize VV status.

6.2.2 Contaminated Building Materials

RALs for Contaminated Building Materials – Residential/Commercial

The RALs for addressing properties with contaminated building materials is as follows:

- Presence of accessible (as defined in Section 6.1.2) LA-containing vermiculite insulation in any quantity in living spaces, non-living spaces, and/or secondary structures.

  or

- Presence of accessible friable and/or deteriorated building materials (e.g., chinking, plaster, mortar, and other materials on boilers, pipes, or other appurtenances) containing greater than or equal to 0.25 percent LA by PLM using point counting such as by PLM-PC400.

The basis for these RALs is discussed in the following paragraphs.

In the HHRA, indoor exposures for residents and indoor (commercial) workers were evaluated separately for residential/commercial properties for each of three interior removal status classifications:

- **Pre-removal:** An interior removal was performed at this property, and risk estimates reflect property conditions prior to the removal being completed.
- **Post-removal:** An interior removal was performed at this property, and risk estimates reflect property conditions after the removal was completed.
- **No removal required:** This property was evaluated, and no interior removal was deemed necessary.

In addition, the HHRA evaluated LA exposures for local tradespeople, such as local contractors, electricians, plumbers, or carpet layers, who may come into direct contact with LA-containing building materials (e.g., vermiculite insulation) and indoor dust while engaging in occupational activities.

As shown in the HHRA, with the exception of exposures at “pre-removal” residential/commercial properties and during tradesperson activities, estimated RME HQs are below 1 for all indoor exposure scenarios. Residential and indoor worker exposures to LA have the potential to result in risks that are above a level of human health concern for properties where it has determined an interior removal is necessary, but no removal has been performed (“pre-removal”). Estimated RME HQs are below 1 for properties where an interior removal has been completed (“post-removal”) and where an interior removal is deemed not to be necessary (“no removal required”). These results demonstrate that interior property assessments have been effective at identifying when interior removals are not warranted and that interior removals, when performed, have been effective at mitigating sources of LA inside the property.

Under the removal program, the need for an interior removal is determined based upon the types of source media present at the property, the levels of LA in these media, as well as the presence of visible vermiculite inside the property. As demonstrated in the HHRA, these interior removal “triggers” have been effective in identifying when interior removals are/are not needed and reducing LA exposures inside properties and thus form the basis for the selected RALs for contaminated building materials.

Local tradesperson exposures have the potential to be significant and result in cancer risks above 10^{-4} and non-cancer HQs above 1 (based on both RME and CTE) if appropriate personal protective measures are not employed to mitigate exposures during active disturbances of indoor source media that contain LA. There is the potential for tradesperson exposures to occur, even for properties that have had an interior removal or where no interior removal has been deemed necessary, if source media have been left in place (e.g., LA-containing vermiculite insulation contained within walls, contaminated dust beneath carpets). This issue highlights the importance of an effective IC program (as discussed in Section 8).

As discussed previously, exposure to indoor dust is likely an important interior exposure pathway. However, indoor dust is a secondary source medium, which becomes contaminated as a result of disturbances of other source media, such as contaminated soil or contaminated building materials. Thus, because the RALs address these primary source media, it is not necessary to establish dust-specific RALs.

RALs for Contaminated Building Materials – Industrial Properties, Schools, and Other Site Buildings

The HHRA shows that RME HQs were at or below 1 for all industrial properties in OU5, schools in Libby and Troy, and buildings in other OUs (e.g., the Search and Rescue building in OU1). These results demonstrate the current interior removal triggers (which are not land-use specific) have also been effective at reducing LA exposures inside buildings regardless of land-use category. Thus, the RALs for addressing contaminated building materials inside industrial properties, schools, and other Site buildings are the same as those identified above for residential/commercial properties.

Rationale for Including Visual Criteria in Development of RALs for Contaminated Building Materials

Vermiculite insulation derived from Libby, both commercially purchased and/or obtained otherwise, was used frequently in the buildings at the Site. In the course of various Site investigations, EPA has also encountered vermiculite used as an additive in mortar, plaster, and concrete (EPA 2002b). Previous investigations conducted at the Site have shown that, while LA concentrations in bulk vermiculite insulation may vary considerably (presumably even within the same home), all or most vermiculite insulation has the ability to release LA when disturbed. This is based on the observation that analysis of vermiculite insulation samples confirmed the presence of LA approximately 74 percent of the time based on PLM. As such, vermiculite insulation found at the Site is an important potential source of current and ongoing exposure to LA. Thus, the visual presence of vermiculite insulation is considered a reasonably good indicator for the presence of LA.

Rationale for Eliminating the Collection of Dust Samples

Historically, dust samples were collected as part of the interior inspection. As part of its ongoing evaluation of project data collection procedures, EPA initiated a dust pilot study in 2007 to investigate the usefulness and reproducibility of dust sample results collected in OU4 (CDM Smith

2007). More than 150 dust samples were collected and analyzed as part of this pilot study. The low LA concentrations (i.e., less than 100 total LA structures per square centimeter [s/cm^2], well below the interior removal trigger of 5,000 s/cm^2) observed in these dust samples supported the conclusion that it is not necessary to collect indoor dust samples for properties with outdoor removal triggers to ensure protectiveness. Therefore, EPA eliminated the collection of dust samples for property investigations in July 2007.

6.3 Remedial Clearance Criteria for Contaminated Media

Remedial clearance criteria are defined as Site-specific criteria used to determine when a physical remedy component at a particular property or location would be considered complete in the context of the risk management strategy. In contrast to RALs, which define conditions when remedial actions should begin, remedial clearance criteria define conditions when the physical portion of the remedy component can end. Cleanup of contaminated media to remedial clearance criteria would allow the RAOs to be achieved when combined with other protective measures, such as ICs, and successfully implement the risk management strategy. Thus, all viable remedial alternatives developed in the FS to physically address remediation of contaminated media would have to meet the remedial clearance criteria.

6.3.1 Contaminated Soil

For contaminated soil, there are two remedial clearance criteria established, one that specifies the conditions for surface soil and one that specifies conditions for subsurface soil. Surface soil and subsurface soil are defined in Section 6.1.1.

Surface Soil

For surface soil, the remedial clearance criterion is the inverse of the RAL for the respective land use category. For example, the remedial clearance criterion for frequently used areas at residential/commercial properties is that no Bin B2 or Bin C by PLM-VE may be present, no more than 25 percent of the total soil exposure area can be Bin B1 by PLM-VE, and the remainder of the total soil exposure area is Bin A (non-detect). The surface soil remedial clearance criterion applies to both containment-focused approaches and excavation-focused approaches.

Subsurface Soil

The remedial clearance criterion for subsurface soil only applies to excavation-focused approaches. For subsurface soil, the remedial clearance criterion for residential/commercial properties and parks/school properties is as follows:

- Confirmation soil samples collected at the depth of cut are Bin A or Bin B1 by PLM-VE, unless boundary conditions are reached.

This subsurface soil remedial clearance criterion is established based on the results of the screening level subsurface soil risk calculations for construction workers in the HHRA (CDM Smith 2015a; see Table 6-5). These RME risk calculations assumed that construction-related digging activities occur at properties in OU4/OU7 at a frequency of 2 hours per day, 50 days per year, for 25 years, and the exposure scenario was time-weighted to account for the likelihood of encountering Bin A, Bin B1, and Bin B2/C soil concentrations. As shown in the HHRA, the RME HQ was 6 for a construction worker exposure scenario, primarily as a consequence of exposures to subsurface soil LA concentrations of Bin B2/C (RME HQ for this soil condition alone was 5). Although the RME HQ was 1 for a construction worker exposure scenario based on Bin B1 subsurface soil concentrations, as explained in the HHRA, the exposure data (and hence the HQs) are likely to be biased high. Thus, it was concluded that cleanup of Bin B2 and Bin C concentrations in subsurface soil should be performed for excavation-focused approaches.

The subsurface soil remedial clearance criterion for industrial properties and transportation corridors is as follows:

- Confirmation soil samples collected at the depth of cut are Bin A, Bin B1, or Bin B2 by PLM-VE, unless boundary conditions are reached.

There are no subsurface soil risk estimates in the HHRA specific to industrial properties and transportation corridors. If the risk estimates for residential/commercial properties presented above are scaled to account for the reduced exposure frequency of construction-related digging activities at industrial properties and in transportation corridors relative to the residential/commercial properties, the RME HQ for this exposure scenario alone is equal to 1. However, to ensure protectiveness in consideration of cumulative exposures, it was concluded that cleanup of Bin C concentrations in subsurface soil should be performed for excavation-focused approaches.

6.3.2 Contaminated Building Materials

As previously described, the current interior removal program has been effective in reducing LA exposures in properties under post-removal conditions. Therefore, the remedial clearance criteria for contaminated building materials adopted the same clearance criteria as have been employed under the removal program. The concept of accessibility, as well as a description of indoor living/non-living spaces, was discussed previously in Section 6.1.2. The remedial clearance criteria for contaminated building materials are subdivided into indoor non-living space and indoor living space as follows:

Indoor non-living space

- No accessible vermiculite remaining.

  and

- Five clearance air samples, collected following leaf blower disturbances in the non-living space after remedial actions are complete, have an average total LA air concentration less than 0.005 structures per cubic centimeter of air (s/cc) when analyzed by transmission electron microscopy (TEM) using Asbestos Hazard Emergency Response Act (AHERA) counting rules (achieved analytical sensitivity of 0.005 cc^{-1}).

Indoor living space

- No accessible vermiculite remaining.

  and

- All five clearance air samples, collected following leaf blower disturbances in the living space after remedial actions are complete, have total LA air concentrations that are non-detect when analyzed by TEM using AHERA counting rules (achieved analytical sensitivity of 0.005 cc^{-1}).

7.0 Role of Physical Cleanup Approaches in Achieving Protectiveness

To satisfy the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), protectiveness at the Site is expected to be achieved upon completion of ongoing removal actions initiated under the public health emergency and the remedial actions prescribed in the ROD. The selected remedy is expected to provide protection of human health and the environment, both under current and future conditions. In order to achieve and maintain human health protectiveness, risks will be managed through a combination of physical cleanup activities to address LA exposure from the primary contaminated media (soil and building materials) and establishment of ICs to address any remaining risks.

The role of physical cleanup for the Site, either as a part of the ongoing removal action or future remedial action, is to reduce the likelihood and severity of adverse human health effects from disturbance of LA-containing soil and building materials. This section describes the relative benefit to overall protectiveness achieved from performing a physical cleanup of the LA-contaminated media (soil and building materials) in the context of the risk management strategy described in Section 4.0.

7.1 Contaminated Soil – Physical Cleanup Approaches

The potential physical cleanup approaches evaluated within the FS for contaminated soil included access controls, containment, excavation/disposal, treatment, or a combination of these approaches. Section 4.0 describes how these approaches could be used in conjunction with ICs to provide protectiveness in the context of the risk management strategy. This section provides a Site-specific basis, using lines of evidence and data, to establish the degree of protectiveness afforded by these approaches.

Access controls (e.g., fencing, signage) have been used previously at the Site on a limited basis to temporarily eliminate direct exposures to LA contamination. However, the approach has not been used previously at the Site on a large-scale basis. Because LA inhalation exposures result from disturbances of source media, access controls can be an effective method of providing protectiveness if established at a sufficient distance from source media and if people adhere to them. However, access controls do not impact the spread of LA contamination to other locations and media and do not protect people that do not adhere to them. Because Site-specific lines of evidence and data have not been collected for a comprehensive access control approach at the Site and protectiveness is likely variable depending on location and method of access control, evaluation of protectiveness afforded by this approach will not be discussed further in this memorandum. Previous project experience is sufficient to make a conclusion, for purposes of alternative identification and screening in the FS, that access controls can have variable protectiveness. The FS acknowledges the limitations to protectiveness afforded by access controls since LA contamination is not physically addressed.

Treatment is also a potentially viable approach to address the risks from exposure to LA contamination. However, treatment has not been implemented previously at the Site, so there are no lines of evidence or data from previous response actions to form a Site-specific basis for protectiveness. The vendors of potentially viable treatment approaches presented in the FS do have data from other remediation projects to show the technologies can provide protectiveness through an irreversible conversion of asbestos to a non-respirable form, which would eliminate inhalation risks. That data and previous project experience is sufficient to make a conclusion for purposes of alternative identification and screening in the FS that treatment can have long-term effectiveness and permanence and thus protectiveness.

7.1.1 Containment

The objective of containment (soil covers) in providing protectiveness is to meet remedial clearance criteria and provide a barrier between LA-contaminated soil left in place and receptors engaged in surface soil disturbances to eliminate the inhalation exposure pathway. Soil covers remain effective provided the cover is not breached and subsurface soil exposures do not occur. The following information provides evidence supporting the protectiveness of this approach. Other considerations, such as thickness and composition of covers that potentially impact protectiveness, are discussed further in Sections 7.1.3 and 7.1.4, respectively.

In 2011, an ABS event (CDM Smith 2014b) was conducted for 11 properties where a curb-to-curb removal had taken place (i.e., all surface soil at the property was removed and replaced with topsoil fill material). A review of the post-removal conditions at these properties showed varying levels of LA remained in soil at depth (with LA concentrations ranging from non-detect to less than 1 percent based on analysis by PLM using National Institute for Occupational Safety and Health [NIOSH] Method 9002); the fill material cover depth ranged from 6 to 18 inches. For each of three sampling events, a single ABS air sample was collected from each property, representing a composite of three different surface soil disturbance activities (i.e., raking, digging, and mowing). These ABS air concentrations were used in the HHRA to estimate residential exposures and risks during soil disturbances at properties under post-removal conditions. The RME HQ for curb-to-curb properties is 0.1 (CDM Smith 2015a; see Table 6-24).

These results support the conclusion that even when LA contamination is left at depth, soil covers provide an effective barrier for exposures to LA contamination remaining in the subsurface soil under typical surface soil disturbance scenarios. Surface soil disturbances of cover materials do not result in unacceptable risks if thickness and composition requirements are met as discussed in Sections 7.1.3 and 7.1.4, respectively.

However, under a containment approach, soils with LA concentrations of Bin B2/C (based on analysis by PLM-VE) are left at a depth that could be encountered under a digging scenario for a construction worker scenario. To address potential exposures to LA-contaminated subsurface soils, personal protective equipment or other measures to mitigate inhalation exposures must be employed. Also, as indicated in the HHRA, the subsurface soil risk estimates apply only to exposures during the digging activity itself. If the LA-contaminated subsurface soils unearthed during these digging activities are not managed properly, and surface soils become re-contaminated as a result, it is possible significant exposures and risks could result, depending upon the type of subsurface contamination encountered and the spatial extent that it is spread at the surface. This is an important consideration for establishing protectiveness provided by ICs discussed in Section 8.

Therefore, to ensure protectiveness, the risk management strategy must (1) address soil contamination at the surface through the use of un-impacted fill for covers and (2) include controls to minimize exposures to LA-contaminated subsurface soils that remain at depth as well as controls to limit use of subsurface soils in surface applications.

7.1.2 Excavation/Disposal with Backfill

The objective of excavation/disposal of LA-contaminated soil and replacement using un-impacted backfill in providing protectiveness is to remove LA-contaminated soil to meet remedial clearance criteria so inhalation exposures are reduced for both receptors engaged in surface soil and subsurface soil disturbances. The following information provides evidence supporting the protectiveness of this approach. Other considerations, such as thickness and composition of covers, which potentially impact protectiveness, are discussed further in Sections 7.1.3 and 7.1.4, respectively.

Under an excavation/disposal cleanup, the level of protection provided will depend upon the spatial and lateral extent of the cleanup and the nature of the soils left in place. As already discussed in Section 7.1.1, in cases where a curb-to-curb cleanup is performed, the estimated RME HQ is 0.1 under a residential surface soil disturbance scenario. In cases where only a portion of the property undergoes cleanup, the estimated RME HQ will depend upon the spatial extent of the Bin B1 conditions that remain; if 75 percent of the total soil exposure area is Bin A (non-detect) and the remaining 25 percent is Bin B1 (trace), the estimated RME HQ under a residential surface soil disturbance scenario would be 0.6 (see Section 6.2.1 for supporting calculations). The estimated HQ would become even lower as the spatial extent of the Bin B1 conditions decreased. If 100 percent of total soil exposure area is Bin A, the estimated RME HQ would be 0.1. Under either excavation/disposal cleanup scenario, surface soil exposures should be protective if thickness and composition requirements are met as discussed in Sections 7.1.3 and 7.1.4, respectively.

As discussed in Section 6.3.1, the RME HQs for both a residential and construction worker scenario were less than or equal to 1 when subsurface soil concentrations were Bin A or Bin B1. Because the subsurface soil exposure estimates (and hence the HQs) were biased high, these results support the conclusion that, under an excavation/disposal cleanup scenario, subsurface soil exposures should be protective if the remedial clearance criteria are met. However, if soils with Bin B2/C concentrations are left at a depth that could be encountered under a digging scenario, which could be several feet in depth for a construction worker scenario, personal protective equipment or other measures to mitigate inhalation exposures must be employed. Also, as indicated in the HHRA and noted above, the subsurface soil risk estimates applied only to exposures during the digging activity itself. If the LA-contaminated subsurface soils unearthed during these digging activities are not managed properly and surface soils become re-contaminated as a result, it is possible significant exposures and risks could result, depending upon the type of subsurface contamination encountered and the spatial extent that it is spread at the surface. This is an important consideration for establishing protectiveness provided by ICs discussed in Section 8.

Therefore, to ensure protectiveness, the risk management strategy must (1) address soil contamination at the surface through the use of un-impacted backfill, (2) address subsurface soil contamination by covering LA-contaminated subsurface soils with an adequate layer of fill material, and (3) include controls to minimize exposures to LA-contaminated subsurface soils that remain at depth as well as controls to limit the use of subsurface soils in surface applications.

7.1.3 Required Thickness of Covers/Backfill for Protectiveness

The thickness of soil covers/backfill is an important consideration in determining whether these physical cleanup approaches for contaminated soil can be protective. The following paragraphs discuss thickness considerations that potentially impact protectiveness.

As described previously in Section 6.1.1, the term surface soil is used to describe soils that would be encountered by human receptors under "typical" activities. In general, most soil disturbance activities likely would result in disturbances of surface soils within a shallow (less than 6 inches) depth interval. The term subsurface soil is used to describe soils that are below surface soils; these soils would be encountered during deeper digging activities, such as a resident digging holes to plant a tree or a construction worker digging a sewer or utility line. These activities are likely to result in disturbances of subsurface soils to several feet in depth.

As discussed in Section 7.1.1, a review of the post-removal conditions at properties with curb-to-curb removals showed fill material cover depth ranged from 6 to 18 inches. The RME HQ for a residential surface soil disturbance scenario was 0.1 for the curb-to-curb properties. The HHRA also evaluated post-construction exposures in both OU1 and OU2. Removal actions taken at these OUs included the excavation/disposal of contaminated surface soil and placement of un-impacted backfill to various depths, ranging from 6 inches to 3 feet. The RME HQs for surface soil disturbance scenarios in OU1 and OU2 were below 0.1 (CDM Smith 2015a; see Table 6-12 and Table 6-14).

The HHRA risk estimates show the fill material depths that have been employed during the removal program, which range from 6 inches to 3 feet, depending upon the type of area and levels of LA contamination, have been effective in minimizing LA exposures during surface soil disturbances. However, regardless of fill material depth, exposures to subsurface soil with LA concentrations of Bin B2 or Bin C remaining post-remedy must be restricted. The protectiveness of the cover or backfill also will depend upon transitions with surrounding grades and ICs intended to protect from risks to contaminated subsurface soils.

7.1.4 Required Composition of Covers/Backfill for Protectiveness

The composition of soil covers and backfill (i.e., the borrow source) is an important consideration in determining whether these physical cleanup approaches to address contaminated soil can be protective. Borrow source considerations that potentially impact protectiveness are discussed below.

As discussed in the *Background Soil Report* (CDM Smith 2014c), the average total LA soil concentration in the Kootenai Valley borrow sources that have been used as topsoil fill materials was about 300,000 total LA structures per gram, which is approximately 0.009 percent LA by mass and similar to concentrations measured in Libby and Troy background soils. For borrow sources outside the Kootenai Valley, the soils were non-detect for LA (CDM Smith 2014c). The HHRA shows RME HQs range from 0.02 to 0.6 for a residential exposure scenario during disturbances of soils from background areas and borrow sources both inside and outside the Kootenai Valley (CDM Smith 2015a; see Table 6-24). Therefore, use of borrow sources from both inside and outside the Kootenai Valley will be protective. However, use of borrow material from sources inside the Kootenai Valley comes with the requirement that soil is confirmed to be non-detect (Bin A) for LA by PLM-VE. This requirement is less important when using soils from borrow sources located outside the Kootenai Valley.

7.2 Contaminated Building Materials- Physical Cleanup Approaches

The potential physical cleanup approaches evaluated within the FS to implement the risk management strategy for contaminated building materials included containment (encapsulation), removal/disposal with replacement using un-impacted building materials, interior cleaning, treatment, or a combination of these approaches.

Similar to contaminated soil physical cleanup approaches, potential protectiveness afforded by access controls and treatment will not be discussed further in this memorandum but were evaluated within the FS with similar conclusions to those for contaminated soils.

7.2.1 Encapsulation and Removal/Disposal

The objective of encapsulation is to provide a barrier between LA-contaminated building materials left in place and receptors that are inside the property to eliminate the inhalation exposure pathway. Encapsulation includes in-place sealing and covering of accessible contaminated building materials with a high performance coating to prevent release of LA fibers into indoor air. Encapsulation is effective as long as the encapsulant is not breached.

The objective of removal/disposal in providing protectiveness is to remove LA-contaminated building materials to meet remedial clearance criteria and relocate these materials to an appropriate offsite disposal location so that the inhalation exposure pathway is eliminated inside the property.

The following paragraphs provide information to support the protectiveness of these two physical cleanup approaches.

To date, interior removal actions have included both encapsulation and removal/disposal of contaminated building materials. As shown in Table 7-3 of the HHRA, the RME HQs for “post-removal” properties ranged from 0.06 to 0.5 for both OU4 and OU7. These results demonstrate that interior removal actions have been effective in reducing inhalation exposures inside “post-removal” properties to acceptable levels. Therefore, both encapsulation and removal are viable remedial cleanup approaches to be used as risk management strategies for addressing LA-contaminated building materials. However, it should be noted that LA-contaminated building materials left in place from encapsulation could pose future risks if not properly maintained or managed. This future exposure potential is an important consideration for establishing protectiveness provided by ICs discussed in Section 8.

7.2.2 Interior Cleaning

If LA-contaminated building materials occur in (or infiltrate to) indoor living spaces, indoor surfaces can become contaminated with LA. If this occurs, it is possible that significant exposures and risks could result, depending upon the type of contamination encountered and the spatial extent that is spread.

The response actions previously conducted for contaminated building materials provide justification for interior cleaning. Part of the “post-removal” cleanup approach prior to clearance sampling is to conduct interior cleaning when interior removals occurred in living spaces. As presented in the HHRA, residential exposures inside “pre-removal” properties during active disturbance scenarios contributed significantly more to the RME HQ than during passive disturbance scenarios (CDM Smith 2015a; see Table 7-3). These data support the concept that disturbances of indoor sources, such as contaminated indoor dust, are an important contributing factor to indoor air concentrations of LA. From this, it can be concluded that performing an interior cleaning after physical cleanup of contaminated building materials (such as encapsulation or removal/disposal) mitigates inhalation exposures from indoor dust and provides protectiveness. Interior cleaning is particularly important when contaminated building materials are known to have impacted indoor living spaces. Thus, indoor cleaning performed after physical cleanup of contaminated building materials is an important step in providing protectiveness in conjunction with the remedial approaches as discussed in Section 7.2.1.

8.0 Role of ICs in Achieving Protectiveness

As discussed in Section 7.0, a combination of risk management through physical cleanup activities for the contaminated media and establishment of ICs is required in order to achieve and maintain protectiveness of human health. The role of ICs in the context of the risk management strategy is to not only address unacceptable exposure from LA contamination remaining after remedial cleanups are conducted but also to address other exposures from other source media that result in unacceptable cumulative risks across the Site. This section describes the relative benefit to overall protectiveness at the Site achieved through the use of ICs as part of the overall risk management strategy.

8.1 IC Components

ICs are defined as "non-engineered instruments that help minimize the potential for exposure to contamination and/or protect the integrity of a response action" per *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites* (EPA 2012). ICs may be temporary or permanent, depending on their role in supplementing the physical cleanup. If the right mix of ICs is implemented, ICs help ensure protectiveness of a remedy (EPA 2000).

ICs are designed to assist in assuring protectiveness of the remedy over time. ICs are required if contamination remains after the physical cleanup is complete that does not allow for unlimited use/unrestricted exposure or if the physical cleanup alone cannot feasibly mitigate the risks from exposure to contamination. ICs can also be used at the Site to require cleanup of LA contamination that is currently inaccessible and becomes accessible in the future; ICs also provide a mechanism to address property use changes between land use categories that could affect protectiveness.

The ICs for the remedial action at the Site are expected to be a combination of legal controls and risk communication controls to aid in achieving and maintaining protectiveness. There are four categories of legal controls within ICs, all of which are available to be employed and implemented in layers (use of different types at the same time) at this Site.

1. Proprietary Controls
2. Government Controls
3. Enforcement Tools with IC Components
4. Informational Devices

There are also non-legal ICs, specifically risk communication controls, which involve community awareness activities and other risk communication techniques.

ICs also would be required to be maintained over time at the Site. Monitoring and reporting would be required to document whether ICs remain in place and are functioning as intended when established and whether the remedial action remains protective. Monitoring and reporting would be conducted according to an established schedule by the responsible party as established within an Institutional Control Implementation and Assurance Plan (ICIAP).

The following subsections described how IC objectives and land uses could affect protectiveness of the remedial action for the Site.

8.1.1 Land Use Categories

Because the exposure scenarios and remedial actions differ as a function of land use, the ICs also differ for each land use category. As noted previously in Section 5, there are four categories of land use to be used in risk management decision documents, as follows:

- Residential/commercial
- Industrial
- Transportation corridors
- Parks/schools

The four land use categories are designated based on anticipated receptors use and provide a risk management framework for addressing protectiveness for current and future uses. Determination of whether ICs could provide protectiveness would need to consider all four land use categories. The presence of LA contamination remaining after conducting cleanup actions would impact ICs for future property and land use category changes, as discussed in Section 8.2.

8.1.2 IC Objectives

For the Site, ICs would address potential inhalation exposures to LA after implementation of the physical cleanup (post-remedy). There are areas at the Site that have not undergone response actions due to logistical reasons (e.g., inaccessible building materials, "non-use" areas of residential and commercial properties, and properties where owners have not allowed access) as well as areas where response actions have taken place, but LA remains in place (e.g., contaminated soil deeper than excavation depths, building materials that were encapsulated in place).

Achieving the following IC objectives related to protectiveness, in context of the risk management strategy and these considerations, would be required. IC objectives are numbered as follows for reference in Section 8.2.

1. Prevent LA fibers that may remain in soil at properties beneath soil covers after meeting remedial criteria for the land use category, or at undeveloped properties from becoming a future source of unacceptable exposure
2. Prevent the LA fibers that may remain in inaccessible building materials from becoming a future source of unacceptable exposure

3. Track changes in land use and develop a notification system to ensure that property owners, prospective property owners and workers are aware of remaining or potential LA which could become a future source of unacceptable exposure, and IC requirements

8.2 Protectiveness Considerations Specific to Land Use Categories

The types of legal or risk communication IC instruments required to achieve RAOs would differ as a function of land use categories in conjunction with the physical cleanup approaches discussed in Section 7. Additionally, during development of specific IC instruments, EPA would consider how proposed future changes in land use within and between categories could affect protectiveness.

Key considerations for achieving and maintaining protectiveness for the remedial action in each land use category as they currently exist and as impacted by future changes are discussed in the following subsections.

8.2.1 Residential/Commercial

This land use category includes residential/commercial properties primarily in Libby and Troy, including non-school day care facilities or churches and schools established in the future, as well as roadways within Libby and Troy that are not part of OU8.

For residential/commercial properties, the physical cleanup would address current use. However, over time, the property usage may change, so one important role of ICs is providing a mechanism to ensure protectiveness over time. When ICs are established, potential future land use changes also need to be considered; an IC is required to initiate an assessment of whether the new use impacts the integrity of the remedy (e.g., penetrate a cap or cover) or would have the potential to change the receptor exposure to LA contamination from acceptable (based on the current use scenario) to unacceptable (based on the future use scenario).

The role of ICs is not only to protect established remedy components from being compromised and to restrict the movement of LA contamination to other areas but also to establish notification mechanisms if there were a change in property use (either within this land use category or to another land use category) to maintain protectiveness. Land ownership for residential/commercial properties is mixed private and governmental and is an important consideration for implementation of legal control ICs to achieve protectiveness.

Any change in area use at any of the residential/commercial properties would require a reassessment of the remedy and determination of the RAL commensurate with the new area use to achieve protectiveness. The residential/commercial land use category is amenable for change to any of the other land use categories. Likewise, any new residential/commercial development or future school within the Site would also need to consider whether RALs are met for this category, and if necessary, conduct physical cleanups to meet the residential/commercial RALs to achieve protectiveness. However, since the RALs for the residential/commercial land use category are the most restrictive of all the land use categories, a change to another land use category likely would not result in additional cleanups being required.

A particularly difficult situation to achieve protectiveness within this category is the conversion of a portion of a residential/commercial property that is currently an infrequent use area or non-use area. For example, a homeowner could convert a portion of the forest area behind their home (currently a non-use area) to a playground for their children (which would be designated as a frequently used area under the remedial program). If the property owner did not receive information from risk communication controls activities, and if monitoring for the legal controls was unable to detect this change of property use, potential LA exposures could result. IC instruments selected should also consider a mechanism for detection of these kinds of changes within this land use category to maintain protectiveness.

8.2.2 Industrial

All current properties that exist within the industrial land use category are located in OU5. Based on previous response actions and subsequent sampling, RALs are no longer exceeded within OU5 for this land use category. Thus, no further physical cleanups are likely necessary for industrial properties within OU5, and the role of ICs is limited to restricting access to and movement of LA contamination left in place and notification/mechanisms if there were a change in land use to another category to maintain protectiveness. Land ownership within OU5 (which is currently being redeveloped) is an important consideration for implementation of legal control ICs to achieve protectiveness.

The RALs already achieved for this land use category were developed based upon an industrial exposure scenario, meaning any change in use within properties at OU5 would require a reassessment of the remedy and determination of the RAL commensurate with the new land use category to achieve protectiveness. This OU is amenable for change to any of the land use categories, but the most likely change would be to a residential/commercial use or park/school use. This could occur within the entire OU or just within a portion of the OU due to multiple land ownership within the OU. Notifications/mechanisms for addressing a land use category changes in portions of OU5 would need to be in place to maintain protectiveness.

Although no other properties outside of OU5 currently exist in this land use category, any new industrial development within the Site would also need to consider whether RALs are met to determine whether future physical cleanups may be necessary to meet the industrial land use RALs and thus achieve protectiveness.

8.2.3 Transportation Corridors

Current properties that exist within this land use category are located in OU6 and OU8. Based on previous response actions and subsequent sampling, RALs are no longer exceeded within OU6 and OU8 for this land use category where PLM sampling was conducted. However, there are some uncertainties regarding whether RALs could be exceeded in locations where soil samples have not been collected as discussed in Section 9. Based on existing information, no further physical cleanups are likely necessary for OU6 and OU8. Given the existing information, the role of ICs is limited to restricting access to and movement of LA contamination left in place to other areas and notification/mechanisms if there were a change in land use to another category to maintain protectiveness. Land ownership within OU6 is private, but for a specific use (railroad ROW); land ownership within OU8 is governmental (highway ROW). These are important considerations for implementation of legal control ICs to achieve protectiveness. Properties owned by governmental agencies typically are more amenable to implementation of governmental controls than other legal control instruments such as proprietary controls or enforcement tools to achieve protectiveness.

The RALs already achieved for this land use category were developed based upon a transportation corridor exposure scenario, meaning any change in use at OU6 or OU8 would require a reassessment of the remedy and determination of the RAL commensurate with the new land use category to achieve protectiveness. This land use category is rarely changed and is not readily amenable for change to other land use categories except as a park within the parks/schools land use category (i.e., a "rails to trails" park scenario).

Any new transportation corridor within the Site (new railroads or highways) would also need to consider whether the transportation corridor RALs would be met; future physical cleanups may be necessary to meet the transportation corridor RALs to achieve protectiveness.

8.2.4 Parks/Schools

This land use category includes properties that are used as schools (public and private) and parks for recreational purposes as well as roadways within park/school properties. Based on previous response actions and subsequent sampling, RALs are no longer exceeded for park/school properties in Libby and Troy (OU4 and OU7) that are currently within this land use category. Thus, no further physical cleanups likely are necessary for existing park/school properties, and the role of ICs is limited to restricting access to and movement of LA contamination left in place to other areas and notification/mechanisms if there were a change in land use to another category to maintain protectiveness. Land ownership for parks/schools is primarily governmental (although a few privately owned schools do exist) and is an important consideration for implementation of legal control ICs to achieve protectiveness. Properties owned by governmental agencies typically are more amenable to implementation of governmental controls than other legal control instruments such as proprietary controls or enforcement tools to achieve protectiveness.

The RALs already achieved for this land use category were developed based upon a park/school exposure scenario, meaning any change in use at any of the properties would require a reassessment of the remedy and determination of the RAL commensurate with the new land use category to achieve protectiveness. This land use category is typically rarely changed, but the most likely changes would be to a residential/commercial use (for existing schools) or industrial use (for existing parks).

Any new park development within the Site would also need to consider whether park/school RALs are met; future physical cleanups may be necessary to meet the park/school RALs to achieve protectiveness. Any new school development within the Site would need to consider whether residential/commercial RALs would be met as previously discussed.

8.3 Protectiveness Considerations Specific to Cumulative Exposures

As highlighted in the HHRA, receptors at the Site have the potential to be exposed to LA across multiple source media, exposure scenarios, and OUs. While this memorandum focuses on contaminated soil and building materials, there are other LA-contaminated source media and exposure scenarios present at the Site that could contribute to cumulative exposures which are not addressed in this memorandum. These include, but are not limited to, exposures to LA from source media within OU3 in the vicinity of the former Libby Vermiculite Mine (e.g., mine waste, tree bark, duff, ash). For example, hiking along Rainy Creek, conducting rockhound activities in the disturbed area of the mine, performing logging or other vegetation management activities within OU3 near the mine, performing mop-up activities during fire responses, and transporting firewood out of OU3 may result in unacceptable cumulative LA exposures.

LA-containing source media specific to OU3 will be addressed by risk management decisions in a separate process that is outside the scope of this memorandum (i.e., an OU3-specific ROD). However, ICs implemented as part of the Site-wide remedial action (particularly risk communication controls) may be considered to inform/warn of activities within OU3 that could result in additional LA exposures until remedial approaches are implemented as part of an OU3-specific remedy.

9.0 Uncertainties in Protectiveness within Transportation Corridors

ABS sampling was conducted within the transportation corridors (OUs 6 and 8) to assess risks from inhalation of LA during representative exposure scenarios. Assessment of human health risks for these OUs was based on the conservative approach of focusing ABS on areas determined to be "worst case," as identified based on historical use, visible presence of source media (vermiculite spillage), and PLM-VE results.

The conclusions in the HHRA were that exposures from disturbances of LA-contaminated soil in the transportation corridors do not result in unacceptable risks. However, there are a few locations within each of these two OUs where soil sampling was not performed. As a result, PLM-VE soil results on LA concentrations are not available to determine whether those specific locations met the transportation corridor RALs. Thus, there is some uncertainty as to whether LA in soil at these locations would exceed RALs and warrant remedial action. The following subsections discuss the specific uncertainties and the conclusions regarding their impacts to determining protectiveness.

9.1 OU6 – Uncertainties Concerning LA in Soil for Portions of Rail Sidings and Troy Railyard

LA contamination has been previously identified in soil within the railroad ROW, particularly in the vicinity of the Libby Depot. Removal actions were previously performed to remove and dispose of contaminated soil that was identified, and backfill was placed in the excavations. Subsequent ABS investigations and soil confirmatory sampling have been conducted in OU6 that support the conclusion that these removal actions were effective in mitigating LA exposures.

However, there are some specific locations within OU6, specifically several rail sidings and the Troy Railyard, where PLM-VE data are not available for comparison with the transportation corridor RALs. No PLM-VE data are available for comparison to transportation corridor RALs from the Riverview Siding, Ripley Siding (mile post [MP] 1313.2 and 1311.2), Libby Siding (MP 1322.2 and 1320), Zonolite Spur (near OU2), Troy Depot, and the Former W. R. Grace Rail loading facility (MP 1330.8). Partial Rail Siding data are available for the Kootenai Falls and Troy Sidings.

Although the HHRA concluded LA inhalation exposures from disturbances of soil across OU6 were below a level of concern, it is uncertain whether LA concentrations in soil at these specific locations would exceed the transportation corridor RAL. If the RALs were to be exceeded, additional cleanups may be required in these specific locations to meet remedial clearance criteria. Soil samples could be collected from these locations and PLM-VE results compared to the RALs to eliminate these uncertainties.

9.2 OU8 – Uncertainties Concerning LA in Soil for Portions of Highways

OU8 consists of state and local roadways in Libby and Troy, Montana. ABS air samples were collected along sections of highway and roads to evaluate roadway ROW conditions for this OU.

While ABS samples were not collected along the entirety of OU8, the locations sampled focused on roadway ROWs of Highway 37, known to be historically traveled by trucks/other transporters of Libby vermiculite ore from the mine to the expansion facilities in town (TechLaw, Inc. 2010). Thus, these data represent a conservative estimate of potential LA exposures in OU8. However, there are several locations within OU8 where soil samples were not collected, including the following:

- **U.S. Highway 2**
  West of Libby (including areas of Troy): 8 segments
  South of Libby: 6 segments
- **Montana State Highway 37**
  East of Libby: 13 segments
- **Kootenai River Road**
  West of Libby: 2 segments
- **County Highway 482 (Farm to Market Road)**
  South of Libby: 1 segment
- **County Highway 567 (Pipe Creek Road)**
  North of Libby: 1 segment

Since the HHRA focused on areas within OU8 with the highest potential exposures, other (unsampled) portions of the roadways are assumed to be less contaminated. Thus, while there are uncertainties associated with the lack of PLM-VE data for these locations, it is not likely to result in a condition where LA contamination in soils would exceed the RALs and remedial action would be warranted. Soil samples could be collected from these locations and PLM-VE results compared to the RALs to eliminate these uncertainties.

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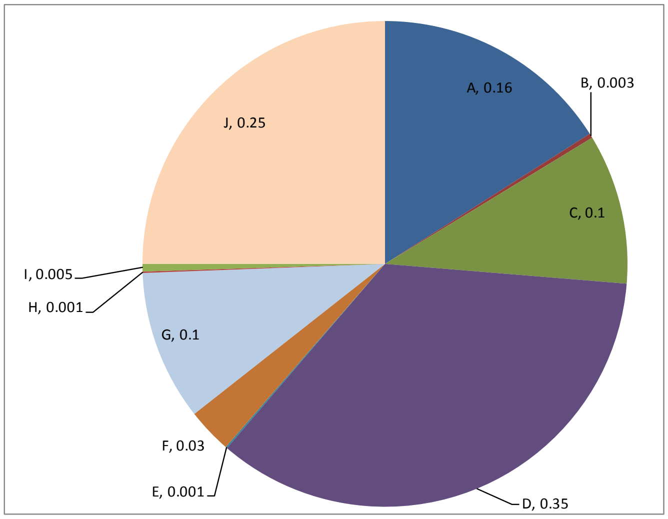
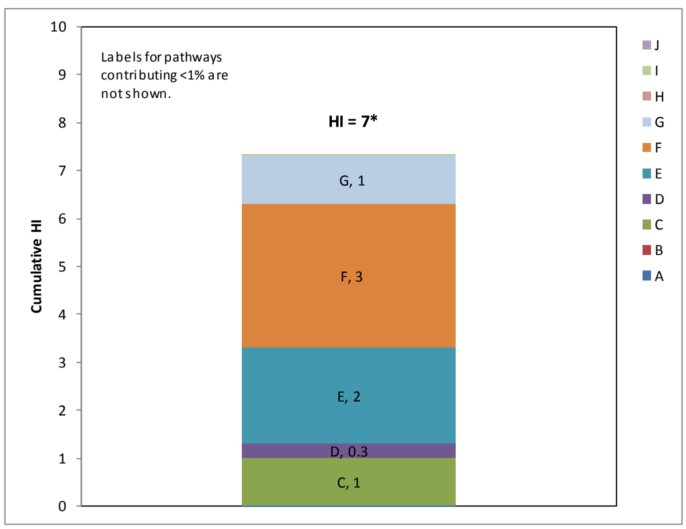
Exhibits

Exhibit 4-1. Graphical Representation of a Cumulative LA Exposure Scenario Example

Panel A: Exposure Scenario Contribution to Cumulative TWF



Panel B: Exposure Scenario Contribution to Cumulative HI



	Exposure Scenario	TWF		Risk Estimates		
		Value	% of total	Risk	HQ	% of total
A	Ambient air, OU4	0.16	16%	2E-07	0.01	0.1%
B	Outdoor air, OU3, Kootenai, fishing	0.0030	0.3%	0E+00	0	0%
C	Indoor air, OU4, pre-removal, resident, active	0.10	10%	2E-05	1	14%
D	Indoor air, OU4, pre-removal, resident, passive	0.35	35%	4E-06	0.3	4%
E	Outdoor air, OU4, yard soil, B2/C, high	0.0010	0.1%	4E-05	2	29%
F	Outdoor air, OU4, yard soil, B2/C, typical	0.030	3%	4E-05	3	43%
G	Indoor air, OU5, Cent. Maint. Bldg, worker, activ	0.10	10%	2E-05	1	14%
H	Indoor air, OU5, Cent. Maint. Bldg, worker, pass	0.0010	0.1%	4E-08	0.002	0.03%
I	Outdoor air, OU3, forest, hiking, intermed.	0.0050	0.5%	6E-07	0.04	0.6%
J	Offsite	0.25	25%	0E+00	0	0%
	cumulative*:	**1.000**		**1E-04**	**7**	

* All HQ and HI values are expressed to one significant figure; thus, the height of the bar may appear different from the HI value shown in the table.

Notes:

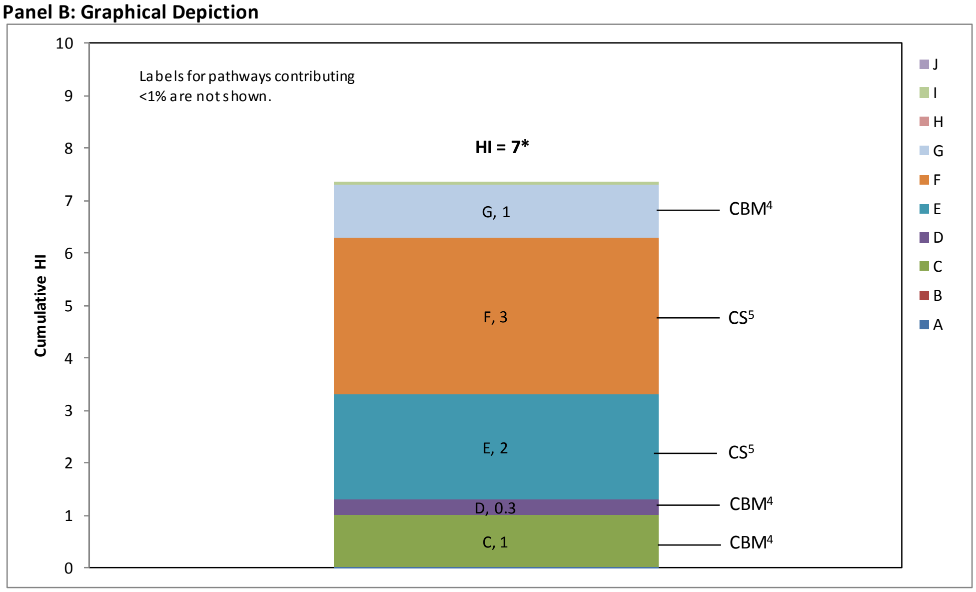
% - percent
< - less than
ATV - all-terrain vehicle
HI - hazard index
HQ - hazard quotient
LUA - limited use area
MotoX - motorcross
OU - Operable Unit
TWF - time-weighting factor

Exhibit 4-2. Illustration of Risk Management Strategy Implementation

Panel A: Tabular Summary

Exposure Scenario		Time-weighting Factor (TWF)[1]		Risk Estimates[2]			Risk Management Strategy Implementation
		Value	% of Total	Cancer Risk	Non-cancer HQ	% of Total	
A	Ambient air, OU4	0.16	16%	2E-07	0.01	0.1%	---[3]
B	Outdoor air, OU3, fishing along the Kootenai River	0.0030	0.3%	0E+00	0	0%	---[3]
C	Indoor air, OU4, pre-removal, resident, active disturbance conditions	0.10	10%	2E-05	1	14%	CBM[4]
D	Indoor air, OU4, pre-removal, resident, passive conditions	0.35	35%	4E-06	0.3	4%	CBM[4]
E	Outdoor air, OU4, yard soil, Bin B2/C (LA ≥ 0.2%), high intensity disturbances	0.0010	0.1%	4E-05	2	29%	CS[5]
F	Outdoor air, OU4, yard soil, Bin B2/C (LA ≥ 0.2%), typical intensity disturbances	0.030	3%	4E-05	3	43%	CS[5]
G	Indoor air, OU5, Central Maintenance Bldg, worker, active disturbance conditions	0.10	10%	2E-05	1	14%	CBM[4]
H	Indoor air, OU5, Central Maintenance Bldg, worker, passive disturbance conditions	0.0010	0.1%	4E-08	0.002	0.03%	CBM[4]
I	Outdoor air, OU3, forest, hiking, locations intermediate (2-6 miles) from mine	0.0050	0.5%	6E-07	0.04	0.6%	IC[6]
J	Offsite	0.25	25%	0E+00	0	0%	---[3]
	Cumulative:	**1.000**		**1E-04**	**7**		

Panel B: Graphical Depiction



Notes:

Shaded rows highlight activities that comprise the greatest contributions of cumulative LA exposure risks posed from contaminated media evaluated within this memorandum and the FS.

1 TWF values range from zero to one; these values describe the average fraction of a lifetime during which exposure occurs from the specific activity being assessed.

2 All cancer risks and non-cancer HQ and HI values are expressed to one significant figure.

3 --- No Active Remedy Required

4 CBM – Active Contaminated Building Material Remedy

5 CS – Active Contaminated Soil Remedy

6 IC – Institutional Controls Remedy

Exhibit 6-1. Contaminated Soil Remedial Criteria

Panel A: Remedial Action Levels (RALs)

Land Use Type	Surface Soil
Residential/Commercial	*Frequently Used Areas:* LA soil concentrations of Bin B2 or Bin C (regardless of spatial extent) *OR* LA soil concentrations of Bin B1, if the spatial extent of the Bin B1 area is more than 25 percent of the total soil exposure area *Infrequently Used Areas:* LA soil concentrations of Bin B2 or Bin C
Industrial	LA soil concentrations of Bin C
Transportation Corridors	LA soil concentrations of Bin C
Parks/Schools	LA soil concentrations of Bin B2 or Bin C

Panel B: Remedial Clearance Criteria

Land Use Type	Surface Soil	Subsurface Soil*
Residential/Commercial	*Frequently Used Areas:* No LA soil concentrations of Bin B2 or Bin C *AND* Spatial extent of Bin B1 is no more than 25 percent of the total soil exposure area *Infrequently Used Areas:* No LA soil concentrations of Bin B2 or Bin C	No LA soil concentrations of Bin B2 or Bin C
Industrial	No LA soil concentrations of Bin C	No LA soil concentrations of Bin C
Transportation Corridors	No LA soil concentrations of Bin C	No LA soil concentrations of Bin C
Parks/Schools	No LA soil concentrations of Bin B2 or Bin C	No LA soil concentrations of Bin B2 or Bin C

*Criteria apply for excavation-based approaches unless boundary conditions are reached

PLM-VE Bin Definitions
Bin A (ND): non-detect
Bin B1 (Trace): detected at levels lower than the 0.2 percent (by mass) LA reference material
Bin B2 (less than 1 percent): detected at levels lower than the 1 percent (by mass) LA reference material but greater than or equal to the 0.2 percent LA reference material
Bin C: LA detected at levels greater than or equal to the 1 percent LA reference material; results are reported to the nearest whole percent

Notes:
PLM-VE = polarized light microscopy using visual area estimation

Exhibit 6-2. Contaminated Building Materials Remedial Criteria

Panel A: Remedial Action Levels (RALs)

Land Use Type	Remedial Action Level
Residential/Commercial Industrial, Schools, and Other Site Buildings	Presence of accessible LA-containing vermiculite insulation in any quantity in living spaces, non-living spaces, and/or secondary structures. *OR* Presence of accessible friable and/or deteriorated building materials (e.g., chinking, plaster, mortar, and other materials on boilers, pipes, or other appurtenances) containing greater than or equal to 0.25 percent LA by PLM using point counting such as PLM-PC400.

Panel B: Remedial Clearance Criteria

Land Use Type	Remedial Clearance Criteria
Residential/Commercial Industrial, Schools, and Other Site Buildings	*Indoor non-living space:* No accessible vermiculite remaining *AND* Average clearance air concentration less than 0.005 total LA s/cc* *Indoor living space:* No accessible vermiculite remaining *AND* All clearance air samples are non-detect for total LA*

* Five clearance samples, analyzed by TEM-AHERA counting rules, with an achieved analytical sensitivity of 0.005 cc^{-1}

PLM-PC400 = polarized light microscopy using point counting (400 points examined)
s/cc = structures per cubic centimeter
TEM-AHERA = transmission electron microscopy using Asbestos Hazard Emergency Response Act counting rules
Total LA = all Libby amphibole asbestos structures with a length > 0.5 µm and an aspect ratio (length:width) ≥ 5:1

Attachment A

Surface Soil Sampling Rationale – Multiple Lines of Evidence

Attachment A:
Surface Soil Sampling Rationale - Multiple Lines of Evidence

1.0 Introduction

1.1 Document Purpose

This technical memorandum provides multiple lines of evidence to justify that the current surface soil sampling and analysis procedures employed at the Libby Asbestos Superfund Site (Site) are adequate to characterize Libby amphibole asbestos (LA) contamination in soils. The Site is divided into eight operable units (OUs); this memorandum focuses on OUs 4 through 8 (i.e., the former Libby Vermiculite Mine [OU3] and former Screening and Export Plant areas [OU1 and OU2]) are not included in this evaluation.

1.2 Overview of Investigation Procedures

During property investigations on the Site, soil samples are collected at varying depths within a given sampling area according to area use (CDM Smith 2014a). In accordance with U.S. Environmental Protection Agency (EPA) risk assessment guidance (EPA 1989), soil sampling depth intervals are defined in terms of expected human exposure scenarios. For the purposes of the Site, the term "surface soil" is used to describe soils that would be encountered by human receptors under "typical" disturbance activities. In a residential/commercial setting, this may consist of various activities, such as mowing the lawn, raking leaves, playing in the yard, digging in the dirt, planting in a garden or flowerbed, performing sprinkler maintenance, walking on an unpaved sidewalk, driving on an unpaved driveway, and similar other activities. In general, these types of activities likely would result in disturbances of soils within a shallow depth interval (less than 6 inches below the ground surface) varying according to the activity.

For the purposes of the Site, the term "subsurface soil" is used to describe soils that would be encountered by human receptors during deeper digging activities. In a residential/commercial setting, this may include a resident digging holes to plant a tree or a construction worker digging a sewer or utility line. In general, these types of activities would result in disturbances of soils up to several feet in depth.

Property investigation protocols seek to characterize the surface soil interval since this is the interval most likely to be encountered under "typical" activities. Therefore, soil samples are collected from the top 3 inches of soil in common use areas (CUAs) and limited use areas (LUAs) (e.g., yards and maintained fields, respectively) and the top 6 inches of soil in specific use areas (SUAs) (e.g., gardens, flowerbeds, and driveways) (CDM Smith 2014a). This sampling approach was developed to characterize soils that receptors are most likely to be exposed to and to focus investigation efforts in areas where sources of LA are most likely to be found based on historical trends and general field observations.

1.3 Overview of Soil Analysis Methods for LA

During a property investigation, collected soil samples are analyzed by the Site-specific polarized light microscopy visual area estimation (PLM-VE) method. LA results are reported in terms of concentration "bins" as follows:

- *Bin A (ND)*: non-detect
- *Bin B1 (Trace)*: detected at levels lower than the 0.2 percent (by mass) LA reference material
- *Bin B2 (less than1 percent)*: detected at levels lower than the 1 percent (by mass) LA reference material but greater than or equal to the 0.2 percent LA reference material
- *Bin C*: LA detected at levels greater than or equal to the 1 percent LA reference material; estimated soil concentrations are reported to the nearest whole percent

If a soil removal is performed, clearance soil samples are collected from the bottom of the excavation and analyzed by PLM in accordance with National Institute for Occupational Safety and Health (NIOSH) Method 9002 (referred to as "PLM-9002") to document LA concentrations left in place at the final removal excavation depth. Soil asbestos concentrations by PLM-9002 are reported as ND, less than1 percent (i.e., detected but at levels less than 1 percent), or to the nearest whole percent when concentrations are greater than or equal to1 percent.

1.4 Document Organization

As noted above, multiple lines of evidence are presented in the following subsections to support the assertion that current surface soil sampling and analysis procedures are adequate to characterize soils at the Site. The subsections include:

- Fate and Transport Mechanisms for LA Source Materials
- Biased Inspections
- Soil Clearance Results
- Human Health Risk Estimates

2.0 Fate and Transport Mechanisms for LA Source Materials

LA was introduced to Site properties by aerial deposition during mining and processing activities and/or anthropogenic activities (e.g., importing LA-source materials to a property). Each of these fate and transport mechanisms for LA contamination are discussed further in the following subsections.

2.1 Aerial Deposition

Mining and milling operations at the former Libby Vermiculite Mine resulted in the release of airborne dust (and LA). The emission rates from the dry mill at the mine were likely dependent on the amount of vermiculite ore processed and the type of milling operations employed (i.e., "dry" versus "wet" milling). Once released to the air, dust particles and LA fibers would be dispersed in the air and would eventually settle out onto the ground and other surfaces at the Site.

A simple calculation was performed to estimate the expected increase in surface soil LA concentrations due to the aerial deposition of LA. Historical reports for the mine show the average dry mill emission rate was 772 pounds of total particulate matter per hour (lbs/hr) over a 6-month period in 1969 (EPA 1973). Based on an assumed 8-hour work day, this would be approximately 6,200 pounds per day (lbs/d). Average estimates of the LA content in the ore deposit range from 0.76 percent (percent) to 4.97 percent, with a maximum of 5.22 percent (Eaton 1977). For the purposes of this calculation, it was conservatively assumed that 6 percent of the total particulate matter released from the dry mill was LA. Assuming a dry mill operation duration of 30 years (1960-1990)[a], this would have resulted in a release of about 1.8E+09 grams (g) of LA:

$$M_{LA} = ER \cdot CF \cdot ED \cdot F_{LA} = 6{,}200 \cdot 1.7E{+}05 \cdot 30 \cdot 0.06 = 1.8E{+}09$$

where:

M_{LA} = Total mass of LA released (g)

ER = Emission rate (lbs/d)

CF = Conversion factor (1.7E+05; convert lbs/d to grams per year [g/yr])

ED = Emission duration (years)

F_{LA} = Mass fraction of total particulate matter that is LA

If it were assumed the total LA mass released from the dry mill were deposited over an area with a radius of 8 miles centered around the mine, this would result in a surficial loading of LA on the ground surface of about 3.5E-04 grams per square centimeter (g/cm^2):

$$SL_{LA} = M_{LA} / A = 1.8E{+}09 / 5.2E{+}12 = 3.5E{-}04$$

where:

SL_{LA} = Surface loading level of LA (g/cm^2)

M_{LA} = Total mass of LA released (g)

A = Deposition area (cm^2); where A is calculated as:

$$\pi \cdot (8 \text{ miles} \cdot 1.6E{+}05 \text{ cm/miles})^2$$

If the LA deposited on the soil surface were mixed into the soil to a depth of 0.5 inches (1.27 centimeters [cm]), assuming a soil density of 1.5 grams per cubic centimeter (g/cc)[b], this would result in an average LA soil concentration within this depositional area of 0.019 percent (expressed as mass percent):

$$C_{soil} = [SL_{LA} / (D \cdot \rho)] \cdot 100 = [3.5E{-}04 / (1.27 \cdot 1.5)] \cdot 100 = 0.019 \text{ percent}$$

where:

C_{soil} = Concentration of LA in soil (mass percent)
SL_{LA} = Surface loading level of LA (g/cm^2)
D = Depth of soil mixing zone (cm)
ρ = Soil density (g/cc)

This soil LA concentration (0.019 percent) is well below the reliable detection limit of traditional asbestos analysis methods for soil (~0.2 percent), including the Site-specific polarized light

[a] Although milling occurred for approximately 30 years, it is likely that emission rates from the mill decreased after 1974, when the dry-milling process was discontinued. However, for the purposes of this screening level effort, the emission rate was not decreased to account for this processing change.

[b] A soil survey of Kootenai National Forest area soils shows bulk density of 1.2-1.8 g/cc, depending upon the type glacial till (U.S. Department of Agriculture [USDA] 1995).

microscopy visual area estimation (PLM-VE) method.

Even if the depositional calculations were adjusted to assume the entire total LA mass released from the dry mill were deposited over a smaller area with a radius of 2 miles centered around the mine, this would result in an average soil LA concentration of 0.3 percent, which is near the detection limit of PLM-VE.

These depositional estimates are supported by measured LA soil concentrations in the forested areas surrounding the mine. Figure A.1 illustrates the LA soil concentrations measured as part of the Phase I investigation for the OU3 Study Area (EPA 2015a). As part of this investigation, 74 samples of surface soil (0-2 inches) were collected along seven transects extending up to a distance of 8 miles in all directions from the mine. As shown, LA was not detected by PLM-VE in any soil samples collected beyond 2 miles from the mine.

Based on an expected soil formation rate of about 0.5 to 1 inches per 100 years (Buol *et al.* 2011), the depositional layer of LA is likely to be within the upper 1-inch of soil. If this depositional layer of LA were to become mixed into deeper soils (e.g., due to freeze-thaw cycles), this would dilute the LA concentration in both surface and subsurface soils even further.

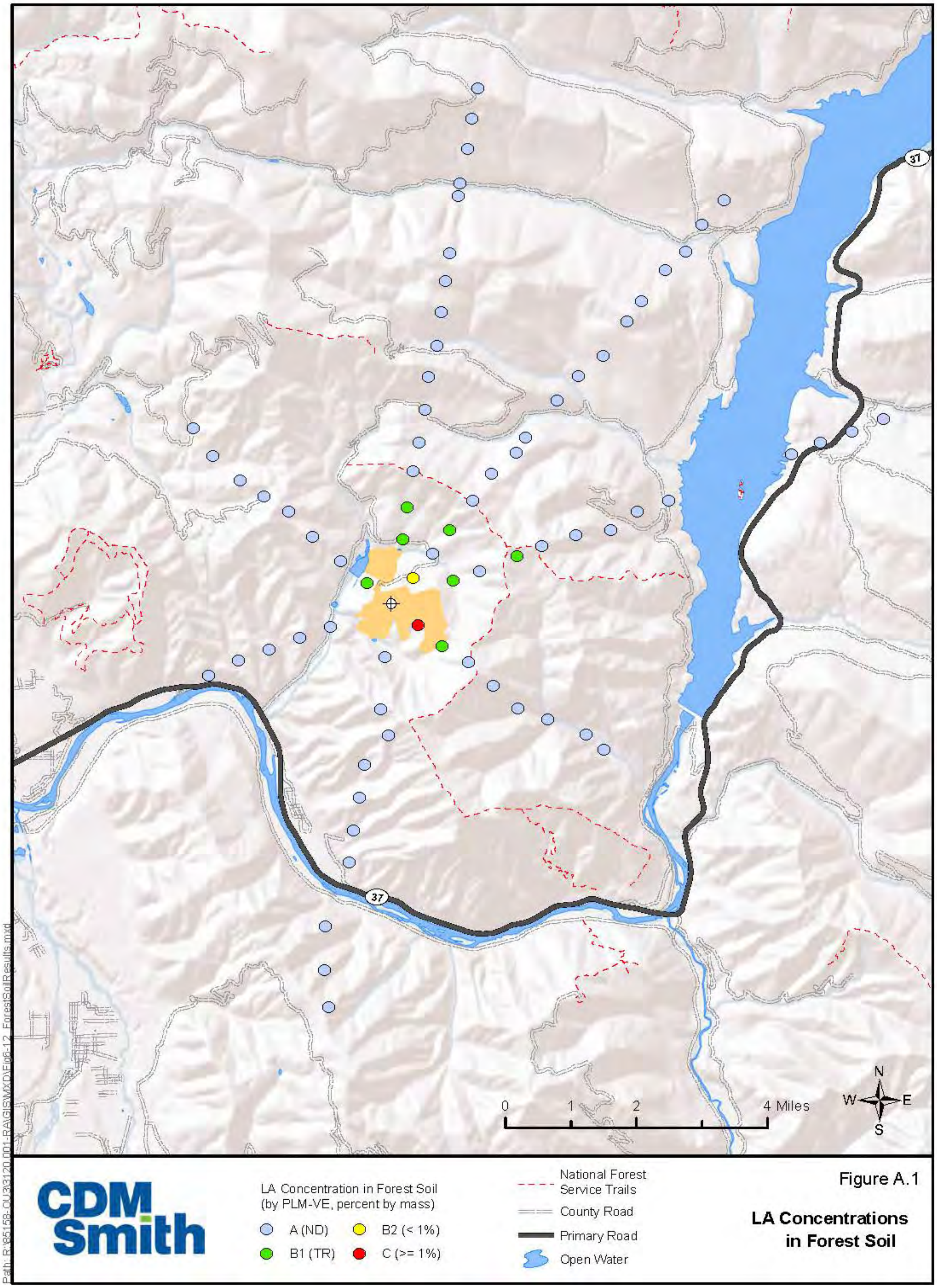
From this, it is concluded that LA impacts to surface and subsurface soils from aerial deposition alone are negligible within the City of Libby and not likely to be detectable by PLM-VE. Therefore, property investigation and removal procedures have focused on LA contamination that is a result of anthropogenic activities.

2.2 Anthropogenic Activities

Soil Amendments

Vermiculite was used extensively as a soil amendment and conditioner within the City of Libby and the Town of Troy. Property owners had access to unlimited amounts of vermiculite from the mine for use at their property. Vermiculite was added to flowerbeds and gardens and incorporated (e.g., rototilled) into the soil. As such, soils in these areas tend to be homogeneous throughout the surface soil profile. Review of soil data from properties that have had exterior removals demonstrates this homogenous characteristic (see Section 4.0). As noted above, during a property investigation, surface soil sampling depths for SUAs advance to 6 inches below ground surface (bgs) and CUAs and LUAs advance to 3 inches bgs. If soil removal is warranted, garden soils are excavated to a minimum of 18 inches bgs[c], and yards and flowerbeds are excavated to a minimum of 12 inches bgs. These minimum excavation "design depths" were selected because they are expected to be deeper than where LA is likely to be present vertically within soils in the use area.

[c] For raised garden beds, soils are excavated a minimum of 18 inches total, with at least 12 inches of that total below surrounding grade.


37
37
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Path: R:\95158-OU3\3120.001-RA\GIS\MXD\Fig6-12_ForestSoilResults.mxd
CDM Smith
LA Concentration in Forest Soil
(by PLM-VE, percent by mass)
A (ND)
B2 (< 1%)
B1 (TR)
C (>= 1%)
National Forest Service Trails
County Road
Primary Road
Open Water
Figure A.1
LA Concentrations in Forest Soil

Construction Bedding Material
Vermiculite and other mine waste was made available to the public for general construction and utility installation. Vermiculite has been found to be used as bedding material in buried utilities, such as septic systems and water lines, and, to a lesser extent, electrical lines. Due to winter frost protection considerations, these utilities are often buried deeper than 24 inches bgs. As such, LA-containing materials that have been added to soil for utility installation are considered to be part of the subsurface soil. Based on the nature of the transport mechanisms that would have resulted in subsurface contamination (e.g., use of LA-containing materials as construction fill), there is no systematic pattern of subsurface contamination; rather, there may be random “pockets” of LA contamination at depth.

This was demonstrated during the 2005 Johnston Acres study (CDM Smith 2005). This study collected 45 soil boring samples in yards and right-of-ways, sampling 15 feet bgs to characterize LA concentrations in surface and subsurface soils. The purpose of the study was to provide information on potential LA soil contamination prior to the installation of new sewer lines in the area. As such, this study targeted soil sampling in areas that had a higher probability of being constructed from fill material. No visible evidence of waste rock or vermiculite was noted in the bore holes during the sampling (CDM Smith 2005). The majority of sample results were Bin A (non-detect) for LA by PLM-VE at all depth intervals; LA was detected in four samples at Bin B1 (trace) levels; no Bin B2 or Bin C levels were encountered in any samples (CDM Smith 2014b). On this basis, it was concluded there was a low likelihood that utility workers would encounter LA-contaminated materials during the sewer line installation. Yet, workers did encounter vermiculite materials in subsurface “pockets” during construction activities that were not anticipated based on observations from the subsurface boreholes and related PLM sample results. This study highlights the fact that systematic subsurface soil investigations would have a low likelihood of finding these materials.

Fill Material
Similar to construction bedding material, vermiculite and other LA-containing mine waste was used as general fill at properties throughout the City of Libby and Town of Troy. These materials were often used to level property soils, as bedding in driveways/roadways, and as general fill. Areas where vermiculite and/or mine waste was used as fill material are generally noticeable at the soil surface or within the top 3 to 6 inches of soil. Review of soil data from properties that have had a removal support this assertion (see Section 4.0). If observed, these areas are sampled and inspected during the property investigation process.

Stockpiles
Property owners may have remnant stockpiles of vermiculite and/or LA-containing mine waste on their property for general future use. Stockpiles are generally obvious to field teams during property inspections. During property investigations, all stockpiles are visually inspected for the presence of LA-source materials and sampled in accordance with current investigation protocols (see CDM Smith 2014a).

Vermiculite Insulation from Buildings

Surface soils surrounding buildings insulated with LA-containing vermiculite can become impacted if vermiculite from the building leaks or sifts down to the adjacent soil surface. Rotting eaves, loose soffit vents, or dilapidated walls can result in vermiculite (and thus LA) being released to the soil surface. Areas surrounding buildings are always visually inspected for vermiculite; extra scrutiny is given to these areas if the building is known to contain vermiculite insulation. Since vermiculite does not migrate into the soil (unless actively mixed under anthropogenic disturbances), the surface soil sampling depth of 3 to 6 inches bgs is deemed sufficient to detect any LA contamination resulting from leaking vermiculite insulation.

3.0 Biased Inspections

During both property investigations and response actions, areas suspected of containing LA-source materials are visually inspected for vermiculite, even if these areas are beyond project inspection locations (e.g., areas not immediately adjacent to removal zones) (see CDM Smith 2014a,c). During property investigations, field teams ask property owners about areas of concern or locations where LA-source materials are suspected of being introduced on the property. Where suspected LA-containing materials may be present, field teams will occasionally sample and inspect soils below routine soil sampling depths, as needed, to confirm the presence of LA-source materials.

In addition, during soil removal activities, the bottom of the excavation area and sidewalls are visually inspected for LA-source materials to determine if any suspect material is present in subsurface soil. If high amounts of vermiculite and/or mine waste materials are identified during the excavation, the extent of the removal is expanded to the degree feasible.

4.0 Soil Clearance Results

Because soil clearance samples collected during the removal process provide information on LA concentrations in subsurface soils, these samples are useful not only in documenting LA concentrations left in place at the final excavation depth but also, in combination with the investigation samples, to draw conclusions about potential differences in LA concentrations as a function of soil depth.

4.1 Surface vs. Subsurface Conditions for Properties with Removals

LA soil concentration data for 107 properties[d] was evaluated to compare the soil results for samples collected at the surface during the property investigation to soil clearance samples collected at depth from the bottom of the excavation. The results of this comparison are presented in Table A.1 below. This table presents the number of properties within each classification category (e.g., there were nine properties where the maximum investigation surface soil LA concentration was non-detect and the maximum clearance subsurface soil concentration was non-detect).

[d] Includes 107 properties in Libby (OU4) where an exterior soil removal was conducted in 2013-2014 and where a property investigation was conducted in 2012-2014; PLM result evaluation included all soil samples collected from the property (regardless of collection date).

Table A.1. Comparison of the Maximum Surface Soil LA Concentration in Property Investigation Samples to Clearance Subsurface Soil Samples

		Maximum Clearance (Subsurface Soil) Result by PLM NIOSH 9002		
		ND	<1%*	≥1%
Maximum Investigation (Surface Soil) Result by PLM-VE	A (ND)	9	6	0
	B1 (Trace)	23	17	1
	B2 (<1%)	13	23	5
	C (≥1%)	3	6	1

*Includes both Bin B1 and Bin B2 by PLM-VE
Grey shaded cells indicate properties where the clearance soil maximum is greater than the investigation soil maximum.

As seen, for the majority of the properties evaluated (95/107; 89 percent), the maximum LA concentration for the clearance subsurface soil samples was less than or equal to the maximum for the investigation surface soil samples during the property investigation. For 11 percent of the properties evaluated (see grey shaded cells in Table A.1), the maximum LA concentration for the clearance samples was greater than the maximum for the investigation samples. There were no properties where the surface soil LA concentration was non-detect and the subsurface soil concentration was greater than or equal to1 percent. This means that, for the majority of properties where removals were conducted, the surface soil samples were representative of the LA concentrations encountered in subsurface soil during the excavation.

4.2 Surface versus Subsurface Conditions for Properties without Removals

In order to investigate whether or not LA contamination is likely to be found at depth for properties where a removal has been deemed not necessary (e.g., where the surface soil was non-detect), soil results from yards for properties with a “curb-to-curb” removal were reviewed (i.e., during a curb-to-curb removal, all surface soils at the property are removed and replaced with topsoil fill material). In particular, 15 curb-to-curb properties were identified as having surface soils ranked as Bin A by PLM-VE in the yard, but these non-detect soils were excavated as part of the curb-to-curb removal process (i.e., clearance subsurface soil samples were collected in areas with non-detect surface soils). For 14 of the 15 properties evaluated, all of the clearance subsurface soil sample results for the yard were also ranked as non-detect; thus, 93 percent of the time, the surface soil results were representative of the subsurface soil conditions.

For one of these curb-to-curb properties, LA was detected in the clearance subsurface soil samples for the yard (reported as less than1 percent by PLM-9002). Additional review of the sampling information for this property revealed that it was initially sampled during the Contaminant Screening Study (CSS) in 2002. CSS samples are recognized to have limitations relative to samples collected under current property investigation procedures. Because of this, EPA has determined many of the properties investigated under the CSS will be re-investigated under current sampling and inspection protocols (CDM Smith 2014d; 2015b). Had this one property not been part of the curb-to-curb removal, it would have been slated for re-investigation due to the presence of visible vermiculite and LA detections in surface soil in other (non-yard) areas of the property. As such, it is likely that, when the property was sampled under current sampling protocols (i.e., the sampling point density in the yard would have been greater than during the CSS), this investigation would have identified higher LA concentrations in the yard surface soil.

This evaluation supports the assertion that, in areas where surface soil results are non-detect for LA, it is unlikely LA is present in subsurface soils. Therefore, it is concluded that, for properties where soil removals have been deemed unnecessary in the past (i.e., surface soil concentrations are non-detect), there is a low probability of encountering LA-contaminated subsurface soils.

4.3 Nature of Subsurface Soils Left in Place

As of 2014, outdoor soil removal efforts have been completed at more than 1,600 properties in OU4 (CDM Smith 2014b). A review of the clearance subsurface soil results (analyzed by PLM-9002) from these properties shows that about 65 percent of these samples were non-detect for LA, about 34 percent had LA concentrations reported as less than1 percent, and less than 2 percent had LA concentrations of 1 percent or greater at the bottom of the excavation area (CDM Smith 2014b).

These clearance samples demonstrate LA concentrations are non-detect in subsurface soils for the majority of properties where removals were conducted. Where LA concentrations less than1 percent remain at depth, removal protocols for these areas specify they be covered by 6 to 18 inches of clean fill material, depending upon the current area use. In the rare cases where LA concentrations of 1 percent or greater were left at depth, removal protocols specify these LA-contaminated soils are denoted with a barrier (e.g., orange construction fencing) and, unless constructability issues[e] are encountered, excavated to a depth of 36 inches bgs.

5.0 Human Health Risk Estimates

In 2011, an activity-based sampling (ABS) event was conducted for 11 properties where a curb-to-curb removal had taken place. A review of the post-removal conditions at these properties showed varying levels of LA remained at depth in subsurface soil (ranging from non-detect to less than1 percent by PLM-9002) and the fill material cover depth ranged from 6 to 18 inches. For each of three sampling events, a single ABS air sample was collected from each property, representing a composite of three different yard soil disturbance activities (i.e., raking, digging[f], and mowing). Further discussion of this ABS scenario is included in the *2011 Residential Activity-Based Sampling Data Summary Report* (CDM Smith 2014e).

In the *Human Health Risk Assessment* (HHRA) (CDM Smith 2015c; Table 6-24), these curb-to-curb ABS air samples were used to estimate risks to residents from LA during surface soil disturbances under "post-removal" conditions based on reasonable maximum exposure (RME) parameters. The HHRA showed that estimated cancer risks and non-cancer hazards from this exposure scenario were within EPA's acceptable risk range (CDM Smith2015c). These results support the conclusion that, even when LA contamination remains in the subsurface soil, under typical exposure scenarios, the resulting exposures are not likely to result in unacceptable risks.

The HHRA also estimated potential risks for both construction workers and residents from LA exposures during subsurface soil disturbances (CDM Smith 2015c; Table 6-5). Estimated RME cancer risks and non-cancer hazards were within EPA's acceptable risk range when subsurface soil

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[e] Proximity to tree roots, foundations, etc. do not allow for desired excavation depth to be achieved.

[f] The digging scenario for this ABS effort simulated a sprinkler maintenance scenario and digging activities were performed using a long shovel and trowel. The digging depth was typically about 6-12 inches.

LA concentrations were Bin A (non-detect) or Bin B1 (trace) but had the potential to result in unacceptable exposures when LA concentrations were Bin B2 or Bin C (CDM Smith 2015c).

6.0 Summary

The current property investigation and soil sampling approaches have been designed to efficiently and effectively characterize LA concentrations in soils likely to be encountered by most human receptors under typical exposure scenarios. The multiple lines of evidence summarized above support the conclusion that current sampling procedures are adequate for characterizing LA in surface soils and will identify LA, if it is present, in the subsurface soil in cases where vermiculite and/or mine waste have been used as a soil amendment or fill material. In addition, current soil removal procedures are adequate to address LA-contaminated soils that may cause adverse health effects under typical soil exposure scenarios.

Even so, it is possible random "pockets" of subsurface contamination may be present at depths greater than 24 inches bgs due to the use of these materials in construction/utility applications. However, subsurface soil investigations are not likely to be useful in locating these areas, and conducting these investigations would be costly and time-consuming. If LA concentrations in these subsurface soils are Bin B2 or Bin C, it is possible disturbances of these materials could result in unacceptable exposures. For this reason, there are procedures in place currently at the Site to address the situation when LA-contaminated materials are encountered during digging activities (i.e., the local Asbestos Resource Program and Environmental Response Specialist program[g]). Thus, current Site procedures are adequate to handle LA in subsurface soil even if its presence is not identified during property investigation. However, these types of programs would need to continue to ensure adequate protection from subsurface LA contamination in the future. The remedial program for the Site will include appropriate controls to address this potential exposure scenario in the future.

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[g] http://www2.epa.gov/region8/cleanup-activities-libby

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APPENDIX C

SUMMARY OF FEDERAL AND STATE ARARS

Summary of Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) Libby Asbestos Superfund Site[1]

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
	Federal ARARs						
1	National Historic Preservation Act (NHPA) and Implementing Regulations 16 United States Code (U.S.C.) 470 36 CFR Part 800	Applicable	This statute and implementing regulations require federal agencies to take into account the effect of this response action upon any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (generally, 50 years old or older).	If cultural resources on or eligible for the national register are present, it will be necessary to determine if there will be an adverse effect and if so how the effect may be minimized or mitigated. The unauthorized removal of archaeological resources from public or Indian lands is prohibited without a permit, and any archaeological investigations at a site must be conducted by a professional archaeologist. To date, no such resources have been found at Libby Asbestos Superfund Site. If any are found, consultation with the State Historic Preservation Office (SHPO) and the NHPA will be addressed during remedial design.		✓	
2	Archaeological and Historic Preservation Act and Implementing Regulations 16 U.S.C. 469 43 CFR 7	Applicable	This statute and implementing regulations establish requirements for the evaluation and preservation of historical and archaeological data, which may be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.			✓	
3	Historic Sites Act 16 USC §§ 461, et seq.,* *The Act has been repealed and restated as section 1866(a) of Title 18, Crimes and Criminal Procedure, and sections 102303 and 102304 and chapter 3201 of Title 54, National Park Service and Related Programs, by Pub. L. 113–287, §§3, 4(a)(1), 7, Dec. 19, 2014, 128 Stat. 3094 , 3260, 3272.	Applicable	Requires federal agencies to consider the existence and location of potential and existing National Natural Landmarks to avoid undesirable impacts on such landmarks.	No National Natural Landmarks have been identified in Lincoln County.		✓	
4	Fish and Wildlife Coordination Act and Implementing Regulations 16 U.S.C. 662, et seq., 50 CFR 83 33 CFR 320-330	Applicable	This statute and implementing regulations require coordination with federal and state agencies for federally funded projects to ensure that any modification of any stream or other water body affected by any action authorized or funded by the federal agency provides for adequate protection of fish and wildlife resources.	If the remedial action involves activities that affect wildlife and/or non-game fish, federal agencies must first consult with the U.S. Fish and Wildlife Service and the relevant state agency with jurisdiction over wildlife resources.		✓	

[1] The ARARs determination contained in this table is specific to the selected remedy for OUs 4 through 8. EPA, in consultation with Montana Department of Environmental Quality, will conduct a comprehensive ARARs analysis and make a final ARARs determination for the Mine site (OU3) through the OU3 remedy selection process.

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			Federal ARARs				
5	Bald Eagle Protection Act 16 USC §§ 668 et seq.	Applicable	This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the appropriate program within the USFWS during remedial design and remedial construction to ensure that any cleanup of the facility does not unnecessarily adversely affect the bald and golden eagle.			✓	
6	Endangered Species Act and Implementing Regulations, 16 U.S.C. 1531 50 CFR 17 and 402	Applicable	This statute and implementing regulations provide that federal activities not jeopardize the continued existence of any threatened or endangered species. Endangered Species Act, Section 7 requires consultation with the U.S. Fish and Wildlife Service to identify the possible presence of protected species and mitigate potential impacts on such species.	Seven endangered, threatened, or candidate species have been identified in Lincoln County. If threatened or endangered species are identified within the remedial areas, activities must be designed to conserve the species and their habitat. To date no threatened or endangered species have been identified in the area of the site.		✓	
7	Migratory Bird Treaty Act and Implementing Regulations, 16 U.S.C. 703, et seq. 50 CFR 10.13	Applicable	This requirement establishes a federal responsibility for the protection of the international migratory bird resources and requires continued consultation with the U.S. Fish and Wildlife Service during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	The selected remedial actions will be carried out in a manner to avoid adversely affecting migratory bird species, bald eagle and including individual birds or their nests.		✓	
8	Clean Air Act (CAA) and Implementing Regulations 42 U.S.C. 7401, et seq. 40 CFR 61, Subpart M	Applicable	National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Asbestos.	The selected remedial actions will be carried out in a manner that will comply with all the National Emission Standard for Asbestos as required under NESHAP.	✓		✓
9	CAA Air Cleaning 40 CFR 61.145 (c) & (d)	Applicable	This requirement establishes detailed standards and specifications for demolition and renovation. The regulation provides detailed procedures for controlling asbestos release during demolition of a building containing "regulated-asbestos containing material (RACM)".	Applicable to building demolitions that may occur as part of remedial action if certain threshold volumes of RACM are disturbed.			✓
10	CAA Air Cleaning 40 CFR 61.149 Note: Section 61.149(c)(2) is not delegated to the State per 40 CFR 61.157	Relevant and Appropriate	This Act and implementing regulations, 40 CFR 61.149, establish detailed procedures and specifications for handling and disposal of asbestos containing waste material (ACM) generated by an asbestos mill. The provision allows an alternative emission control and treatment method.	Requirements under this regulation are considered relevant and appropriate to any ACM (friable material containing >1% asbestos) disposal. It is not applicable, because the facilities do not meet the regulatory definition of an asbestos mill.			✓
11	CAA Air Cleaning 40 CFR 61.150 Note: Section 61.150(a)(4) is not delegated to the State	Applicable	Standard for waste disposal for manufacturing, fabricating, demolition, renovation, and spraying operations. This regulation provides detailed procedures for processing, handling, and transporting ACM generated during building demolition and renovation (among other sources).	Applicable to RACM generated by building demolitions that may occur as part of the remedial action.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
Federal ARARs							
12	CAA Air Cleaning 40 CFR 61.151 Note: Section 61.151(c) is not delegated to the State	Relevant and Appropriate	Standard for inactive waste disposal sites for asbestos mills and manufacturing and fabricating operations. Provides requirements for covering, revegetation, and signage at facilities where RACM will be left in place. The provision allows an alternative control method.	Requirements under this regulation are considered relevant and appropriate to asbestos containing soils and/or ACM or debris left in place. It is not applicable, because the facilities that are part of this remedial action do not meet the facility definitions in the regulation.			✓
13	CAA Air Cleaning 40 CFR 61.152 Note: Section 61.152(b)(3) is not delegated to the State	Applicable	This requirement establishes detailed specifications for air cleaning used as part of a system to control asbestos emissions control system.	These requirements would be applicable if air cleaning is part of the building demolitions.	✓		✓
14	Floodplain Management Regulations Executive Order No. 11988 (referenced in 40 CFR Part 35, Appendix A to Subpart H).	Applicable	These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists.			✓	
15	Protection of Wetlands Regulations Executive Order No. 11990 (referenced in 40 CFR Part 35, Appendix A to Subpart H). 33 U.S.C. § 1344(b)(1)	Applicable	This ARAR requires federal agencies and the potentially responsible parties (PRPs) to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. 33 U.S.C. § 1344(b)(1) also prohibits the discharge of dredged or fill material into waters of the United States. Together, these requirements create a "no net loss" of wetlands standard.	If jurisdictional wetlands are delineated within areas designated for remediation, these standards would be applicable.		✓	✓
16	CAA Air Cleaning 40 CFR 61.154 Note: Section 61.154(d) is not delegated to the State	Applicable	Standard for active waste disposal sites. Provides requirements for off-site disposal sites receiving ACM from building demolitions and other specific sources.	These standards would be applicable if any portion of the site meets the definition of active waste disposal site. All building materials and soil will be disposed of properly.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
17	MACA, MCA 75-2-501 et seq., ARM 17.74.355, ARM 17.74.359	Applicable	Asbestos abatement project permits. Asbestos abatement projects require a permit from Montana Department of Quality (DEQ). Permits must meet requirements at ARM 17.74.355 and ARM 17.74.359.	Applicable to material meeting the definition of RACM. The substantive requirements for performance of the work and proper disposal will be met by the contractors used. On-site Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) actions do not require a permit. It is expected that soils excavated from the Site and debris generated in the remedial action will not be RACM. Some provisions are relevant and appropriate for non-RACM waste that contains asbestos, but less than 1% asbestos. Material, such as building material but not soils, that does not contain asbestos using standard detection methods will likely be handled under Montana solid waste provisions.			✓
18	MACA, MCA 75-2-501 et seq., ARM 17.74.357	Relevant and Appropriate	Establishes air monitoring requirements for asbestos abatement projects, including for building clearance after abatement.	EPA and DEQ have determined that the methodology in the monitoring plan is equivalent or more stringent and protective as the methodology in ARM 17.74.357.			✓
19	ARM 17.74.369	Relevant and Appropriate	Addresses transportation and disposal of asbestos-containing waste. Transportation requirements (i.e., the asbestos must be adequately wet, contained in leak-tight packaging, and both the asbestos waste and the vehicle transporting it must comply with labeling requirements). This ARAR specifies that the asbestos-containing waste must be deposited at a licensed Class II or Class IV landfill facility as soon as practical, or, if asbestos-containing waste is not disposed of as soon as practical, store any asbestos-containing waste in a secure holding facility or location accessible only to asbestos project workers or asbestos project contractor/supervisors accredited by the department. This provision also requires that the entity responsible for transport and disposal retains responsibility for the ACM until the waste is accepted by a licensed Class II or IV landfill.	The regulations are relevant and appropriate for the transportation and disposal of all LA, even if the LA does not meet the definition of asbestos-containing waste in ARM 17.74.352(4). EPA's transportation practices include using either clean laydown gravel material or plastic sheeting for haul trucks to drive on while picking up waste; waste to be hauled is wetted before, during and after excavation and transportation; all trucks have sealed tailgates and are covered with plastic sheeting to prevent the release of material during transport; and each truck is decontaminated through a thorough washing. Building materials will be disposed of properly. Soil will also be managed at an appropriate disposal facility.	✓		✓
20	ARM 17.74.371	Relevant and Appropriate	Addresses requirements for asbestos encapsulation. A person may not conduct asbestos enclosure procedures for an asbestos project unless accredited by the department as an asbestos project worker or asbestos project contractor/supervisor. Additionally, specific handling requirements (i.e., use of amended water; removal/repair of loose or hanging ACM; application requirements, including that it be applied in a manner that does not dislodge or disturb the ACM; and meeting the clearance requirements in ARM 17.74.357) must be met.	The regulations are relevant and appropriate for the encapsulation of all LA, except RACM as defined in 40 CFR §61.141, asbestos-containing waste as defined in ARM 17.74.352(4), and ACM as defined in ARM 17.74.352(3) (for each of these materials, the regulations would be applicable).			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
21	CAA of MCA 75-2-101 ARM 17.8.204	Relevant and Appropriate	Ambient Air Monitoring & Ambient Air Methods and Data require that all ambient air monitoring, sampling and data collection, recording, analysis, and transmittal shall be in compliance with the Montana Quality Assurance Manual, except when more stringent requirements are determined to be necessary.	These requirements will be followed unless an equivalent or more stringent approach is deemed appropriate by EPA.	✓		
22	CAA of MCA 75-2-101 ARM 17.8.220 ARM 17.8.221 ARM 17.8.223	Applicable	Ambient Air Quality. The standard for settled particulate matter (PM) specifies that settled PM concentrations in the ambient air shall not exceed a 30-day average of 10 grams per square meter. Concentrations of particulate matter in ambient air shall not exceed annual average scattering coefficient of particulate matter of 3×10^{-5} per meter. PM-10 concentrations in the ambient air shall not exceed 150 micrograms/cubic meter of air, on a 24-hour average and 50 micrograms/cubic meter of air on an annual average. A measurement method is also provided.	The remedial action will involve significant soil disturbance and removal of ACM. Particulate/dust levels will need to be controlled. The ambient air quality standards include specific requirements and methodologies for monitoring and detection. These requirements will be followed unless an equivalent or more stringent approach is deemed appropriate. EPA implements Best Management Practices (BMPs) to reduce dust generation and migration through wetting of all open excavations. Excavations of contaminated soils are covered with clean fill each night when removal activities have ceased. The BMPs ensure the project activities meet these ARARs. Perimeter air monitoring for LA is conducted at each active removal to demonstrate there are no releases of LA PM-10 Samples were collected at the beginning of the project. BMPs were effective, and no exceedances of PM-10 were observed. PM-10 sampling was discontinued because the BMPs are expected to continue to ensure compliance.	✓		✓
23	CAA of MCA 75-2-101 ARM 17.8.304	Applicable	Visible Air Contaminants. No source may discharge emissions into the atmosphere that exhibit opacity of 20 percent or greater, averaged over 6 consecutive minutes. This standard is limited to point sources, but excludes wood-waste burners, incinerators, residential solid-fuel combustion devises such as fireplaces and wood or coal stoves, and motor vehicles.	No visible emissions are anticipated. If any visible emissions were to occur, this ARAR would be applicable. The BMPs discussed elsewhere, including thorough wetting of the soil during excavation, wetting of roads, minimizing access, covering the transportation trucks, and covering the excavation with clean fill each night, are expected to ensure that no visible air contaminants occur.	✓		✓
24	CAA of MCA 75-2-101 ARM 17.8.308	Applicable	Airborne Particulate Matter. Emissions of airborne particulate matter from any stationary source shall not exhibit opacity of 20 percent or greater, averaged over 6 consecutive minutes.	Reasonable precautions to control emissions of airborne particulate matter will be taken, including BMPs such as thorough wetting of the soil during excavation, wetting of roads, minimizing access, covering the transportation trucks, and covering the excavation with clean fill each night.	✓		✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
25	ARM 17.8.604	Applicable	Lists certain wastes that may not be disposed of by open burning, including asbestos, asbestos-containing material, oil or petroleum products, RCRA hazardous wastes, chemicals and wood and wood byproducts that have been coated, painted, stained, treated or contaminated by foreign material. Any waste which is moved from the premises where it was generated and any trade waste (material resulting from construction or operation of any business, trade, industry or demolition project) may be open burned only in accordance with the substantive requirements of ARM 17.8.611 or 612.	None of the items in ARM 18.8.604 will be disposed of by burning.			✓
26	Montana Strip and Underground Mining Reclamation Act ARM 17.24.501	Relevant and Appropriate	This provision gives general backfilling and final grading requirements.	Substantive requirements relevant to this remedial action are 17.24.501 (3)(a), (4), (4)(c), (4)(d), and (5).			✓
27	Montana Strip and Underground Mining Reclamation Act ARM 17.24.631	Relevant and Appropriate	This provision provides that long-term adverse changes in the hydrologic balance from mining and reclamation activities, such as changes in water quality and quantity, and location of surface water drainage channels shall be minimized. Water pollution must be minimized and, where necessary, treatment methods utilized. Diversions of drainages to avoid contamination must be used in preference to the use of water treatment facilities. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.	Substantive requirements are to maintain the hydrologic balance, minimize water pollution and stabilize disturbed areas. Any backfilling will be with clean fill and regraded to slopes appropriate for its usage. Surface water controls (e.g., silt fences) will be implemented during construction to prevent erosion and runoff from contaminated soil.			✓
28	Montana Strip and Underground Mining Reclamation Act ARM 17.24.635 through 17.24.637	Relevant and Appropriate	These provisions set forth requirements for temporary and permanent diversions.	Diversions are not anticipated.			✓
29	Montana Strip and Underground Mining Reclamation Act ARM 17.24.638	Relevant and Appropriate	This provision specifies sediment control measures to be implemented during operations.	Activities are not anticipated to impact surface water; however substantive requirements are to prevent sediment discharges. Surface water controls (e.g., silt fences) will be implemented during operations to prevent erosion and runoff from contaminated soil.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
30	Montana Strip and Underground Mining Reclamation Act ARM 17.24.640	Relevant and Appropriate	This provisions provides that discharge from sedimentation ponds, permanent and temporary impoundments, and diversions shall be controlled by energy dissipaters, riprap channels, and other devices, where necessary, to reduce erosion, prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance.	Discharge structures are not anticipated.			✓
31	Montana Strip and Underground Mining Reclamation Act ARM 17.24.703	Relevant and Appropriate	When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use, and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM 17.24.701 and 702.	Quantity or quality issues with soils are not anticipated, because final surfacing will use appropriate soil material.			✓
32	Montana Strip and Underground Mining Reclamation Act ARM 17.24.713	Relevant and Appropriate	Provides that seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed preparation.	Requirements will be met by seeding in the first appropriate period based on climatic conditions.			✓
33	Montana Strip and Underground Mining Reclamation Act ARM 17.24.714	Relevant and Appropriate	Requires use of a mulch or cover crop or both until an adequate permanent cover can be established. Use of mulching and temporary cover may be suspended under certain conditions.	Requirements will be accomplished by hydro seeding.			✓
34	Montana Strip and Underground Mining Reclamation Act ARM 17.24.716	Relevant and Appropriate	Establishes the required method of revegetation, and provides that introduced species may be substituted for native species as part of an approved plan for alternate vegetation.	Requirements will be accomplished by hydro seeding weed-free seed selected for the climate.			✓
35	Montana Strip and Underground Mining Reclamation Act ARM 17.24.721	Relevant and Appropriate	Specifies that rills and gullies must be stabilized and the area reseeded and replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover.	Requirements will be met by grading in a manner to prevent rills and gullies.			✓
36	Montana Strip and Underground Mining Reclamation Act ARM 17.24.751	Relevant and Appropriate	Provides measures to prevent degradation of fish and wildlife habitat will be employed.	Alternatives will be performed in a manner to avoid degradation of fish and wildlife habitat.			✓
37	Montana Strip and Underground Mining Reclamation Act ARM 17.24.761	Relevant and Appropriate	Fugitive dust control measures must be employed during mining and reclamation activities.	The actions taken to meet the relevant and appropriate requirements include watering (properties and roads used for the response action), reducing access, minimizing the area of land disturbed, and promptly revegetating through hydro seeding.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
38	MWQA MCA 75-5-303 ARM 17.30.705	Applicable	Requires that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.708.	The beneficial uses outlined in ARM 17.30.622, 17.30.623, and 17.30.626 must be used to determine the "existing and anticipated uses." [2]	✓		
39	Montana Strip and Underground Mining Reclamation Act ARM 17.24.633	Relevant and Appropriate	Stormwater. All surface drainage from the disturbed area must be treated by the best technology currently available (BTCA). Sediment control through BTCA must be maintained until the disturbed area has been reclaimed, the revegetation requirements have been met, and the area meets state and federal requirements for the receiving stream.	Requirements will be met by common land reclamation practices (e.g., replanting and hydro seeding. Homeowners are educated on the maintenance of new yards. Additionally, remedial actions at the Site are not expected to result in runoff to surface water at OUs 4 through 8. Remedial actions will be halted if significant runoff is generated and will not resume until adequate runoff control measures (e.g., erosion matting, hay bales) are in place.			✓

[2] The relevant beneficial uses are:

ARM 17.30.622 provides that waters classified A-1 (Rainy Creek drainage to the W.R. Grace & Co. water supply intake near the mill pond, *see* ARM 17.30.609) are to be maintained suitable, after conventional treatment for removal of naturally present impurities, for drinking, culinary and food processing purposes. These waters are also to be maintained suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial water supply. This section provides also that concentrations of carcinogenic, bioconcentrating, toxic, radioactive, nutrient, or harmful parameters may not exceed standards set forth in Circular DEQ-7 Montana Numeric Water Quality Standards (DEQ-7 standards). The numerical standard for fibers longer than 10 microns in length of certain asbestos fibers, including amphibole, is based on the maximum concentration levels (MCL) for drinking water regulations of 7,000,000 fibers/liter. The concentration may not exceed this limit in any sample. This provision also sets limits on escherichia coli bacteria, reduction in dissolved oxygen, changes in pH, increases in turbidity and suspended sediment, increases in temperature, and increases in true color. Also, no increases are allowed above naturally-occurring concentrations of sediment or suspended sediment (except as permitted in 75-5-318 , MCA), settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.

Protection of the beneficial uses of the surface water may require a more stringent cleanup level than the MCL. Also, for fibers less than 10 microns in length (the MCL applies to fibers greater than 10 microns in length), the final cleanup level also must be protective of all beneficial uses.

ARM 17.30.623 provides that waters classified B-1 (Kootenai River, Carney Creek and Fleetwood Creek) are to be maintained suitable, after conventional treatment, for drinking, culinary, and food processing purposes. These waters are also to be maintained suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial water supply. This section contains limits on the same parameters as those listed in ARM 17.30.622.

ARM 17.30.626 provides that waters classified C-1 (Rainy Creek main stem from the W.R. Grace Company water supply intake to the Kootenai River) are to be maintained suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial water supply. This section contains limits on the same parameters as those listed in ARM 17.30.622.

The remedy for OU3 will address all of the surface water ARARs, including the beneficial uses listed above and § 75-5-101, et seq., MCA, § 75-5-605, MCA, and ARM 17.30.637.

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
40	ARM 17.30.601, et seq., and ARM 17.30.1301, et seq., including ARM 17.30.1341	Applicable	The substantive requirements of the general permit for stormwater for construction activities - General Permit for Storm Water Discharge Associated with Construction Activity, Permit No. MTR100000 (January 1, 2013) are applicable, http://deq.mt.gov/wqinfo/WPBForms/pdf/SW%20CONST%20PER.pdf. The substantive requirements of the general permit for industrial activities, including inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, see 40 CFR 122.26(b)(14)(iii), General Permit for Stormwater Discharges Associated with Industrial Activity, Permit No. MTR000000 (February 1, 2013), http://deq.mt.gov/wqinfo/MPDES/StormWater/pdf/MTR000000PER.pdf.	All substantive requirements of the general permits will be met for all remedial actions that would trigger the requirement to obtain coverage under a general permit, if this were not a CERCLA site. Specifically, general permit coverage under MTR100000 is triggered for construction activities that include clearing, grading, grubbing, excavation, or other earth disturbing activities that disturb one or more acres and discharge storm water to state surface waters or to a storm sewer system that discharges to a state surface water. General permit coverage under MTR000000 is triggered for facilities conducting industrial activities that discharge storm water to state surface waters or to a storm sewer system that discharges to a state surface water. Generally, the permits require best management practices to prevent discharges of sediments and other pollutants. These BMPs include minimizing the area disturbed, minimizing soil compaction in areas that do not require excavation to address LA, and use of erosion/sediment controls on steep slopes.			✓
41	MWQA MCA 75-5-101, et seq., ARM 17.30.701 - ARM 17.30.718	Applicable	Nondegradation of water quality – for all state waters, existing and anticipated uses and the water quality necessary to protect those uses must be maintained and protected.	Existing and anticipated uses of state waters and the level of water quality necessary to protect those uses must be maintained and protected. Section 75-5-317, MCA, provides an exemption from nondegradation requirements that allows changes in existing water quality resulting from an emergency or remedial activity that is designed to protect public health and environment and is approved, authorized, or required by the department. Changes in water quality caused by these activities may be considered nonsignificant.			✓
42	Montana Floodplain and Floodway Management Act and Regulations, MCA 76-5-401 et seq. and implementing regulations, ARM 36.15.601 et seq.	Applicable	The Floodplain and Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway and floodplain. The Site is adjacent to the Kootenai River, and these standards are applicable to all actions within the floodplain.	No alternatives include any of the specified uses or structures in the designated floodplain. This requirement would apply in the event that a disposal facility is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
43	Montana Floodplain and Floodway Management Act MCA 76-5-401 et seq., ARM 36.15.602(5), ARM 36.15.605, ARM 36.15.703 ARM 36.15.218(1)	Applicable	Solid and hazardous waste disposal and storage of toxic, flammable, hazardous, or explosive materials are prohibited anywhere in floodways or floodplains. The floodplain regulations provide for a variance process. The permit issuing authority may grant a variance for the new construction, substantial improvement or alteration of an artificial obstruction that is not in compliance with the minimum standards contained in these rules only if: (a) the proposed use would not increase flood hazard either upstream or downstream in the area of insurable buildings; (b) refusal of a variance would because of exceptional circumstances cause a unique or undue hardship on the applicant or community involved; (c) the proposed use is adequately floodproofed; and (d) reasonable alternative locations outside the designated floodplain are not available.	Contaminated soil and building materials will not be disposed of or stored in a floodplain or floodway. Disposal at the Libby Class II Landfill complies with this requirement, and any other disposal facilities for contaminated soils or building materials will be located outside of the floodplain or floodway, thus also meeting this requirement.		✓	
44	Solid Waste Management Act MCA 75-10-201 and implementing regulations ARM 17.50.501, et seq.	Applicable	The statute and regulations are applicable to the management and disposal of all solid wastes.	Substantive requirements of this ARAR would be applicable for management or disposal of any contaminated soils or building materials that occurs on site.			✓
45	Solid Waste Management Act MCA 75-10-201 and implementing regulations ARM 17.50.503, et seq.	Applicable	Sets forth definitions for types of solid wastes including Group III and IV wastes.	Asbestos contaminated debris generated as part of the remedial action qualifies as Group IV waste and must be disposed of in a licensed Class II or IV landfill. Soil will be managed at an appropriate disposal facility. Compliance with this requirement is met through disposal of asbestos contaminated debris at the Libby Class II Landfill. This requirement would also be applicable in the event that another on-site disposal facility is identified and used to dispose of asbestos contaminated debris from OUs 4 through 8 within the Site.			✓
46	ARM 17.50.1004	Applicable	A solid waste facility located within the 100-year floodplain may not restrict flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste that poses a hazard to human health or the environment.	Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility in the floodplain is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
47	ARM 17.50.1005	Applicable	A solid waste facility may not be located in a wetland, unless there is no demonstrable practical alternative.	Wetlands exist within the Site. It is not anticipated that contaminated soil or building material will be disposed of within the wetlands at the Site as part of the remedy. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility in a wetland is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	
48	ARM 17.50.1006	Applicable	A solid waste facility may not be located within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator submits to the department for approval a demonstration that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the solid waste facility and will be protective of human health and the environment.	The currently existing solid waste facility is not located within 200 feet of a fault that has had displacement in Holocene time. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is located within 200 feet of a fault that has had displacement in Holocene time and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	
49	ARM 17.50.1007	Applicable	A solid waste facility may not be located in a seismic impact zone without demonstration, by a Montana licensed engineer, that the solid waste structure is designed to resist the maximum horizontal acceleration in lithified earth material for the site.	The currently existing solid waste facility is not located in a seismic impact zone. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is located on-site within a seismic impact zone and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	
50	ARM 17.50.1008	Applicable	A solid waste facility may not be located in an unstable area (determined by consideration of local soil conditions, local geographic and geomorphic features, and local artificial features or events, both surface and subsurface) without demonstration, by a Montana licensed engineer, that the solid waste facility is designed to ensure that the integrity of the structural components will not be disrupted.	The currently existing solid waste facility is not located in an unstable area. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is located in an unstable area and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
51	ARM 17.50.1009	Applicable	Sets forth general requirements applying to the location of any solid waste facility. Among other things, the location must have sufficient acreage, including adequate separation of wastes from the underlying groundwater or adjacent surface water; it must be located where local roads are capable of providing access in all weather conditions and local bridges are capable of supporting vehicles with maximum rated loads; it must be located so as to prevent pollution of ground, surface, and private water supply systems; drainage structures must be installed where necessary to prevent surface runoff from entering waste management areas; and the location must allow for reclamation of the land. Subsection 1(c) requires that solid waste facilities not discharge pollutants in excess of state standards. A solid waste facility must contain a leachate collection system unless there is no potential for migration of a constituent in Appendix I or II to 40 CFR 258.	Compliance with this ARAR is met through use of the currently existing solid waste facility. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.		✓	
52	Solid Waste Management Act MCA 75-10-201 and implementing regulations ARM 17.50 Subchapter 11	Applicable	Sets forth standards that all solid waste disposal sites must meet including run-on and run-off control system requirements, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements.	Compliance with this ARAR is met through use of the currently existing solid waste facility. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.			✓
53	Solid Waste Management Act MCA 75-10-201 and implementing regulations ARM 17.50.1115	Applicable	The owner or operator of a solid waste management facility shall manage asbestos contaminated material in accordance with 40 CFR Part 61 subpart M as adopted by reference in ARM 17.74.351.	Compliance with this ARAR is met through use of the currently existing solid waste facility. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this requirement would only be triggered in the event that another disposal facility is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.			✓
54	MCA 75-10-212 and implementing regulations ARM 17.50.523	Applicable	For solid wastes, MCA 75-10-212 prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. ARM 17.50.523 specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling, or leaking from the transport vehicle.	Solid waste will not be dumped or left upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. Leaving in place LA contamination that is less than the remedial action levels or meets the remedial clearance criteria pursuant to the engineered final remedy does not trigger this ARAR.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
55	ARM 17.50.1204 ARM 17.50.1403 ARM 17.50.1404	Applicable	Provide additional design criteria, ground water monitoring, corrective action, and closure requirements for Class II and IV landfills. ARM 17.50.1204 provides that solid waste facilities must either be designed to ensure that MCLs are not exceeded or the solid waste facility must contain a composite liner and leachate collection system that complies with specified criteria. ARM 17.50.1403 sets forth closure requirements for solid waste facilities. Solid waste facilities must meet the following criteria: (1) install a final cover that is designed to minimize infiltration and erosion; (2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; and (3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth. ARM 17.50.1404 sets forth post-closure care requirements for solid waste facilities. Post-closure care must be conducted for a period sufficient to protect human health and the environment. Post-closure care requires maintenance of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 17, chapter 50, subchapter 7.	Compliance with this ARAR is met through use of the currently existing solid waste facility. Because disposal at the Libby Class II Landfill is in compliance with this requirement, this ARAR would only be triggered in the event that another disposal facility is identified and used to dispose of contaminated soil or building material from OUs 4 through 8 within the Site.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
56	MCA 75-10-206	Applicable	Provides for a variance from certain solid waste requirements where such variance would not result in a danger to public health or safety; or compliance with the rules from which a variance is sought would produce hardship without producing benefits to the health and safety of the public that outweigh the hardship.	Compliance with this ARAR is met through use of the Libby Class II Landfill. This variance process would only be necessary in the event that another disposal facility is located on-site that does not meet the requirements of another solid waste ARAR. The analysis in subsection (a) is akin to the threshold requirement under CERCLA that a remedy provide overall protection of human health and the environment. Therefore, the solid waste ARARs should be able to be met or a variance granted, as long as the remedy is protective. It is anticipated that a variance will be not required for OUs 4 through 8.			✓
57	Montana Endangered Species MCA 87-5-106, 107, and 111 ARM 12.5.201	Applicable	Endangered species must be protected in order to maintain and, to the greatest extent possible, enhance their numbers. These sections list endangered species, prohibited acts, and penalties. See also § 87-5-201, MCA, (applicable) concerning protection of wild birds, nests, and eggs.	As of May 2013, species of concern to the State of Montana that may occur in Lincoln County includes 3 amphibians, 2 reptiles, 17 birds, 8 mammals, 8 fish, 10 invertebrates, and 46 plants. If State threatened or endangered species are identified within the remedial areas, activities must be designed to conserve the species and their habitat.			✓
58	Montana Antiquities Act, MCA 22-3-421, et seq.	Relevant and Appropriate	Montana Antiquities Act addresses the responsibilities of State agencies regarding historic and prehistoric sites including buildings, structures, paleontological sites, and archaeological sites on state owned lands. Each State agency is responsible for establishing rules regarding historic resources under their jurisdiction which address National Register eligibility, appropriate permitting procedures and other historic preservation goals. The State Historic Preservation Office maintains information related to the responsibilities of State Agencies under the Antiquities Act.			✓	
59	Montana Human Skeletal Remains and Burial Site Protection Act (1991), MCA 22-3-801 et seq.	Applicable	The Human Skeletal Remains and Burial Site Protection Act is the result of years of work by Montana Tribes, State agencies and organizations interested in ensuring that all graves within the State of Montana are adequately protected.	If human skeletal remains or burial sites are encountered during remedial activities within the Libby Asbestos Superfund Site, then these requirements will be applicable.		✓	
60	Noxious Weeds, MCA 7-22-2101(8)(a) and Section 7-22-2109(2)(b), MCA ARM 4.5.201, et seq.	Applicable	MCA 7-22-2101(8)(a) "noxious weeds" must be managed consistent with weed management criteria developed under MCA 7-22-2109(2)(b).	Reclamation includes planting weed-free grasses.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
61	Noxious Weeds Section 7-22-2101(7)(a), MCA ARM 4.5.206 through 4.5.210	Applicable	Section 7-22-2101(7)(a), MCA, defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department; or (ii) as a district noxious weed by a board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM 4.5.206 through 4.5.210.				✓
62	Noxious Weeds Section 7-22-2152, MCA	Applicable	Requires that any person proposing certain actions including but not limited to a solid waste facility, a highway or road, a commercial, industrial, or government development, or any other development that needs state or local approval and that results in the potential for noxious weed infestation within a district shall notify the district weed board at least 15 days prior to the activity. The board will require that the areas be seeded, planted, or otherwise managed to reestablish a cover of beneficial plants. The person committing the action shall submit to the board a written plan specifying the methods to be used to accomplish revegetation at least 15 days prior to the activity. The plan must describe the time and method of seeding, fertilization practices, recommended plant species, use of weed-free seed, and the weed management procedures to be used. The plan is subject to approval by the board, which may require revisions to bring the revegetation plan into compliance with the district weed management plan. The activity for which notice is given may not occur until the plan is approved by the board and signed by the presiding officer of the board and by the person or a representative of the agency responsible for the action. The signed plan constitutes a binding agreement between the board and the person or agency. The plan must be approved, with revisions if necessary, within 10 days of receipt by the board.	Remedy will comply with substantive requirements of a weed management plan.			✓

	Statute and Regulatory Citation	ARAR Determination	Description	Comment	Chemical	Location	Action
			State ARARs				
63	MCA 87-5-502 and 504	Applicable	Provide that a state agency or subdivision shall not construct, modify, operate, maintain or fail to maintain any construction project or hydraulic project which may or will obstruct, damage, diminish, destroy, change, modify, or vary the natural existing shape and form of any stream or its banks or tributaries in a manner that will adversely affect any fish or game habitat. The requirement that any such project must eliminate or diminish any adverse effect on fish or game habitat is applicable to the state in approving remedial actions to be conducted. The Natural Streambed and Land Preservation Act of 1975, MCA 75-7-101, et seq., (Applicable -- substantive provisions only) includes similar requirements and is applicable to private parties as well as government agencies.	Consultation with the Montana Department of Fish, Wildlife and Parks, and any conservation district or board of county commissioners (or consolidated city/county government) is encouraged during the designing and implementing of the remedial action for Libby Asbestos Superfund Site.		✓	

APPENDIX D

STATE LETTER OF CONCURRENCE ON ROD

DEQ
Montana Department
of Environmental Quality

February 4, 2016

Shawn McGrath
Regional Administrator
EPA Region 8 1595 Wyncoop Street
Denver, CO 80202-8917

RE: Libby Record of Decision

Dear Mr. McGrath:

The State has received the final Libby Record of Decision (ROD), which is dated December 21, 2015. Due to the open and iterative process employed by the Environmental Protection Agency (EPA) to develop the ROD, the State has reviewed multiple drafts of the ROD in its consultative role under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). We sincerely appreciate EPA's incorporation of many of the State's comments on the ROD.

While the State generally agrees with the selected remedy described in the ROD, there remain significant concerns in three specific areas: institutional control development and implementation, long term operations and maintenance of the remedy, and management of changes in condition that would require future response actions. These concerns were clearly articulated in the meeting among Montana's elected officials, EPA, and DEQ on November 12, 2015, and are further discussed below.

Due to the removal actions previously taken and selected remedial action strategy to reduce health threats from LA-containing wastes, known LA occurrences have been left in configurations that presently limit exposure. To maintain that limited exposure configuration into the future, development of comprehensive institutional controls (ICs) must begin in 2016 for each operable unit.

EPA must commit to and then take specific action with the State and Lincoln County to assist in the development of the IC program. DEQ has recommended taking an operable unit by operable unit approach for the development of ICs, although DEQ recognizes that many of the ICs will apply site-wide, which is reflected in the ROD. As part of developing the needed ICs, EPA will also need to work collaboratively with the State and Lincoln County to develop operations and maintenance plans for each of the operable units. DEQ supports fully implementing the ICs program before the start of operations and maintenance, as stated in Section 12.3.2.2 of the ROD. DEQ appreciates the commitment added to the ROD to prepare an Explanation of Significant Differences to the ROD to formally include the final IC program in the decision documents.

As noted in the ROD, additional LA cleanup will be necessary where LA contamination that is currently inaccessible becomes accessible in the future and where the use of a property changes to a land use that requires a different cleanup level. As written, the ROD does not clearly articulate how EPA proposes to manage this aspect of the remedial action, although it does acknowledge a need to address future changes in condition that could impact protectiveness of the remedy. In the November 12, 2015, meeting, EPA committed to addressing these situations as part of the remedial action, even if the LA-contamination is discovered or the land use changes after the remedy is deemed to be operational and functional under CERCLA. As the site has been on the National Priorities List, DEQ understands that EPA will retain a rapid response posture to address changed conditions where LA-containing waste is uncovered that requires additional response action. As remedial actions are completed across the site, DEQ supports a cleanup level of less than 0.2% in soils to be protective of excavation workers and to minimize the need for ICs to address changes in land use.

These areas of concern encompass the State's reservations for agreeing with EPA on the preferred remedial actions. For the final ROD, the State's Acceptance (Section 10.3.1) should be stated as follows:

> "The State is providing **Concurrence with Reservations** for EPA's selected remedy for the Libby Asbestos Superfund Site Operable Units 4 through 8. The State concurs that the selected remedial action will be protective, but only after development and implementation of robust institutional controls to protect the remedy, establishment of a comprehensive operations and maintenance program to maintain remedy integrity, and creation of an EPA-lead rapid response program to address newly-discovered occurrences of LA or to address LA where changes in land use require a more stringent cleanup level."

Thank you for working so closely with the State to develop the final remedy for the Libby Asbestos site. We sincerely appreciate the commitments that EPA has made, including the commitment to address additional LA contamination, as outlined in this letter.

Sincerely,

Tom Livers

Tom Livers
Director

REF#: REM-16196

Ec: Lisa Dewitt, Project Manager
Jenny Chambers, Division Administrator
Tom Stoops, Bureau Chief
Katherine Haque-Hausrath, Attorney
Martin Hestmark, USEPA
Bill Murray, USEPA
Rebecca Thomas, USEPA
file

RESPONSIVENESS SUMMARY

RESPONSIVENESS SUMMARY

1.0 OVERVIEW AND BACKGROUND ON COMMUNITY INVOLVEMENT

Community involvement is a very important aspect of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. The U.S. Environmental Protection Agency (EPA) has implemented a robust program of community participation at the Libby Asbestos Superfund Site (Site) which began in 1999 and continues today. The activities included in this program are consistent with the requirements of CERCLA and provide extensive outreach to the community. The following section describes some of the activities that have been implemented at the Site since EPA's arrival in 1999.

In December 1999, EPA established the EPA Information Center in Libby, which serves as the primary information resource for the Libby and Troy communities on the project. Initially located at 501 Mineral Avenue and re-located to 108 East 9th Street in September 2009, the EPA Information Center is a local resource for the community and visitors inquiring about information on EPA's work, either in general or as it relates to their property.

EPA began conducting community interviews in 2000 with citizens living on or near the Site to find out general information about the properties and information on the property owner's concerns and issues with the Site, and how best to communicate with the public. Access and land use information was also gathered during those interviews. Using the information collected during these interviews, a community involvement plan was prepared and distributed in March 2001. Additional interviews were conducted in January 2009 and summarized in the revised community engagement plan (EPA 2010).

EPA has continued to support two different community groups since project inception. Initially EPA supported monthly meetings of the Community Advisory Group (CAG), which began meeting in 2000. Support included providing meeting space, advertisements, and a facilitator. In 2003 EPA began awarding a Technical Assistance Grant to the Libby Areas Technical Assistance Group (LATAG). This enabled the group to develop and hold audience-specific technical workshops aimed at helping LATAG members understand the science behind analytical methods and ongoing risk management decisions at the Site in 2004.

EPA has prepared and distributed numerous fact sheets, including an annual update, to the community since 2000. Fact sheets and other materials have been distributed to all community members who have mailing addresses within the Libby and Troy area zip codes (59923 and 59935, respectively). In addition, EPA maintains and provides updates to a mailing list of interested stakeholders (e.g., county, state, and federal elected officials and regulators associated with the Site).

Numerous public meetings, joint meetings, availability sessions, and listening sessions have been hosted by EPA since we mobilized to the site. EPA issued a Proposed Plan for operable units (OUs) 4, 5, 6, 7, and 8 on May 8, 2015. EPA announced a 60 day comment period rather than the 30 days that is typical of other Superfund sites. EPA mailed a fact sheet about the Proposed Plan to all community members who reside within the Site. The fact sheet described the Proposed Plan and public input opportunities and provided locations where copies of the Proposed Plan and other documents in the administrative record could be obtained. EPA hosted a public meeting for the Proposed Plan on May 20, 2015 in Troy and May 21, 2015 in Libby, at which EPA gave a brief presentation and answered questions about the proposed cleanup plan. In response to requests by the public and governmental agencies, the public comment period was extended an additional 30 days, which resulted in a 90 day comment period.

The Environmental Resource Specialist (ERS) program was established in 2007. The objective of the ERS program is to provide Libby area property owners with a means to mitigate potential exposure to Libby amphibole asbestos (LA) or LA-containing source materials, such as Libby vermiculite, during routine and non-routine activities at Libby properties. These activities may consist of, but are not limited to, building repair, remodeling, maintenance, utility servicing, installation, and construction. Specifically, the ERS program provides property owners and residents with information related to LA and guidance on safely working with material potentially containing LA. ERS personnel may conduct onsite evaluations of reported situations, providing recommendations, if necessary, of methods to safely continue the intended work activities. ERS personnel perform an initial assessment in order to evaluate the level of response needed. This could be an information only, emergency, interior (non-emergency designed), or exterior (non-emergency designed) response.

The City-County Board of Health for Lincoln County established the Asbestos Resource Program (ARP) in 2012 through a cooperative agreement with EPA. The mission of the ARP is to reduce exposure to asbestos found within the Site and the surrounding areas of Lincoln County. A key goal is to minimize the burden on the community members themselves. In 2015 ARP began to conduct interviews and hold workshops to discuss the development of the institutional controls (ICs) to help gain community input and acceptance prior to the final Human Health Risk Assessment (HHRA) and selection of the remedy.

A team of onsite community involvement coordinators (CICs) was established in 2002 to facilitate interaction between the field team and residents. The CICs are contractors who are responsible for assisting homeowners with issues that need to be coordinated in order for sampling and cleanups to occur. Their duties include briefing residents on the scope of work, providing information on temporary relocations, arranging for relocations, facilitating interactions between the field crew and residents, documenting the scope of work and obtaining residential approval, coordinating with residents during relocations, facilitating their return to the property, taking care of all outstanding issues, and ensuring residents were reimbursed for their costs during relocation. This support is also provided to business owners during cleanup of their properties.

In 2010 the Voluntary Recruitment Program (VRP) was initiated as an outreach program dedicated to encouraging property owners to participate in the cleanup program. Members of the VRP, which consist of contractors, call and/or visit property owners to explain the cleanup process and answer questions they may have regarding the process. If a property owner refuses or defers participation, these notes are recorded in the project file for future reference.

Libby leaders and the real estate community were concerned that work being done by EPA would slow or stop home sales, make appraisals cumbersome, and make financing more difficult to obtain. In response, EPA developed a multi-phased assistance approach for the real estate community. This included writing hundreds of "comfort letters" to support real estate transactions. EPA also provided additional information to complete mortgage transactions and arranged for representatives of federal mortgage insurers, lenders, and loan underwriters to attend meetings in Libby. EPA also makes the sampling of properties pending sale a priority and regularly adjusts schedules to accommodate these requests when possible.

To ensure development questions were answered and contractors knew the issues related to preservation of the integrity of the work conducted to date at the Site, EPA has offered a variety of workshops for target audiences including housing industry representatives (realtors and mortgage lenders) and area contractors. EPA set up training classes for area contractors on the subject of asbestos abatement in 2006, 2007, 2008, and 2009. EPA also coordinated multiple stakeholders while putting together two major workshops (in 2003 and 2006) at the Site.

Since the beginning of the project, EPA has provided materials needed to educate and engage the public on the serious health issues associated with the Site. As needs arise, information pieces are designed for a wide variety of audiences. EPA also developed a Site website that is user-friendly and presents cleanup information. The website is based in large part on the brochure EPA developed as a community resource. The address for the website is http://www.epa.gov/superfund/libby-asbestos.

EPA has made it a point to regularly provide updates to the City Council and county commissioners. These updates are made monthly at the regularly scheduled commission meetings. Presentations are also made to other local groups (e.g., Rotary Club) upon request.

EPA has conducted educational efforts targeted at specific upcoming events at the Site. The first event was in 2005 and involved a series of advertisements and meetings to provide information on the Superfund process in anticipation of a record of decision (ROD). The second event was designed to launch the Libby Area ERS position in 2007.

In 2011, EPA awarded a cooperative agreement to the City-County Board of Health to assist Lincoln County in establishing an ICs program to reduce LA exposures over the long term and to protect the final remedy. In preparation for the Proposed Plan for OUs 4 through 8, input was solicited from the LATAG on community acceptance of various potential ICs. That information was used to craft the list of potential ICs used in the Proposed Plan. ARP held a public meeting on June 15, 2015 and conducted interviews with individuals and small groups to evaluate input received on the proposed controls. Monitoring and reporting will be conducted according to a schedule established by the ICIAP, which will be prepared after the ROD is signed. EPA will continue to involve the public throughout the design process.

EPA, in conjunction with the County Extension Office, offered courses to residents on how to care for a property after a removal has been performed. Furthermore, EPA established test plots of different restoration types using the same materials that are used during the restoration of residential and commercial properties. These were created to demonstrate to the public the efficacy of the materials that are used on the project.

Other activities undertaken by EPA to engage the communities and keep the public informed have included, but are not limited to, public O&M meetings, Libby Legacy Group meetings, public meetings in Libby and Troy in May 2015 to present the Proposed Plan, and an availability session in June 2015 to discuss the Proposed Plan.

Continued community involvement will be vital as planning begins for the O&M phase. For more information on community involvement throughout the CERCLA process, see Section 3 of Part 2 of this ROD.

2.0 PUBLIC AND STAKEHOLDER COMMENTS ON THE SELECTED REMEDY

A total of 209 comments were received from 27 stakeholders on the Proposed Plan. The number that each party submitted is summarized below.

- 15 citizens – 59 comments
- U.S. Forest Service (USFS) – 6 comments
- W.R. Grace (Grace) – 43 comments[2]
- Lincoln County ARP – 32 comments
- Lincoln County Board of Commissioners – 4 comments
- City-County Board of Health for Lincoln County – 2 comments
- Lincoln County Board of Realtors – 1 comment
- Lincoln County Port Authority – 1 comment
- Montana Department of Environmental Quality (DEQ) – 31 comments
- Dr. Leslie Stayner (University of Illinois at Chicago, an outside consultant to DEQ) – 10 comments
- TRC Solutions (on behalf of BNSF) – 5 comments
- LATAG – 15 comments

Out of 209 comments received on the Proposed Plan, 83 comments were primarily on the HHRA, 45 comments were primarily on the remedy, and 81 comments were primarily on ICs. A list of the most common comments and a list of conflicting comments are presented within this section. A summary of the content of these comments is provided in Section 3.

Frequent Comments

<u>HHRA</u>

1. HHRA Purpose
2. Conceptual Site Model
3. Indirect Preparation of Filters

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[2] Only includes specific comments on the FS during the Proposed Plan comment period; additional comments were provided on the HHRA and the LA-specific toxicity values in addition to FS comments.

Remedy

1. Comment Period for Proposed Plan and Other Administrative Record Documents
2. Vagueness in the Elements of the Selected Remedy
3. Participation in Cleanup
4. Uncertainty Regarding Numbers of Properties Requiring Cleanup and Associated Quantities of Contaminated Material Requiring Additional Cleanup
5. Exclusion of Forested Areas from the Selected Remedy
6. Potential for Recontamination During and After Implementation of the Selected Remedy

ICs

1. Stakeholder Roles and Responsibilities for Development of ICs
2. Timeline for Development of ICs
3. Opinions on EPA's Preferred ICs
4. Lack of Specificity for ICs
5. Funding for ICs
6. Effectiveness of ICs
7. Impacts of New Regulations on ICs
8. Property Status Information for ICs

Conflicting Comments

HHRA

1. Exposure Parameters
2. Exposure Point Concentrations

Remedy

1. Thoroughness of Cleanup

ICs

1. No conflicting comments were received on ICs.

3.0 RESPONSE TO COMMENTS NARRATIVE

3.1 Responsiveness Summary Narrative for HHRA

HHRA Purpose: Several commenters highlighted a fundamental misunderstanding of the purpose of the HHRA with regard to the nature of the exposure scenarios evaluated (DEQ, Grace, LATAG, citizen). In accordance with EPA risk assessment guidance (EPA 1989), the purpose of the HHRA is to quantify potential human health risks from exposures to LA under current and future conditions. It does not seek to quantify historical (pre-removal) conditions or calculate risks from past exposures. The baseline risk assessment is to evaluate potential adverse health effects caused by hazardous releases from a site in the absence of any actions to control or mitigate these releases (i.e., under an assumption of ‘no action’). Thus, the HHRA intentionally ignored any site controls implemented to limit public health exposures, such as fencing off certain areas of the mine, when calculating risk estimates.

Conceptual Site Model: Several commenters provided recommendations for additional exposure scenarios and receptor populations that could be added to the HHRA. In some cases, such as exposures during wildfire responses (USFS) and on the former mine site (Grace), EPA has collected additional activity-based sampling (ABS) data since the release of the draft HHRA to allow for the quantification of exposure and risks. These new data were incorporated into the final HHRA. In other cases, such as exposures to carpet layers and horseback riders (DEQ) or exposures from irrigation water (citizen), EPA has determined that existing data are adequate to provide information on potential exposures and no additional data are necessary to support decision-making.

Exposure Parameters: Comments tended to be mixed with regard to the selected exposure parameters (i.e., exposure time, frequency, and duration). Some commenters (DEQ, LATAG, Dr. Leslie Stayner/The University of Illinois at Chicago) noted the selected values were too low, whereas another commenter (Grace) noted the selected values were too high. EPA will improve the transparency of the selected values, particularly the reasonable maximum exposure (RME) values and the time-weighting factors (TWFs) employed in the cumulative assessment, and ensure the selected exposure parameters are adequately conservative but not unrealistic. Additionally, EPA included an evaluation of spatially-weighted risks in the final HHRA, which adjusted exposure parameters to evaluate scenarios that may occur across multiple exposure areas (e.g., hiking or ATV riding in multiple locations in the forest both near and far from the mine).

Exposure Point Concentrations: Comments also tended to be mixed with regard to the derived EPCs. Some commenters (LATAG, Dr. Leslie Stayner/The University of Illinois at Chicago) noted the use of mean air concentrations in the exposure estimates and use of zero to represent non-detects resulted in risks that were biased low, whereas another commenter (Grace) noted that risks were biased high due to the fact that ABS studies were conducted under conditions intended to maximize the potential for fiber releases (e.g., under dry, summer conditions).

The collection of ABS air samples and calculation of the EPCs was performed in accordance with the methods and procedures provided in EPA asbestos guidance (EPA 2008). In particular, using the mean as the EPC and treating non-detects as zero is specifically recommended in EPA guidance (2008) and discussed extensively in Appendix B of the HHRA.

As discussed in the uncertainty assessment of the HHRA (Section 10), all of the exposure estimates are uncertain and should be considered to be approximate; actual risks may be higher or lower than estimated. The role of the risk assessment is to provide quantitative estimates of exposure and risk, and to provide a fair and balanced discussion of the uncertainties in those estimates, including identification and discussion factors that may tend to result in either an over-estimate or an under-estimate of risk. Incorporation of information on uncertainty into risk management decision-making (i.e., the need for cleanup) is not part of the risk assessment, but is part of the Proposed Plan and ROD.

Indirect Preparation of Filters: Several commenters (LATAG, DEQ, Grace, Dr. Leslie Stayner/The University of Illinois at Chicago) raised concerns about transparency in the use of the unpublished Berry et al. study as the basis of the indirect preparation adjustment factor. As such, EPA provided the results and interpretation of this study as an appendix to the final HHRA.

With regard to the indirect preparation adjustment factor of 2.5, comments tended to be mixed. One commenter (LATAG) suggested the application of the adjustment factor had the potential to bias the derived EPC low, and expressed concerns that actual risks might be higher. Another commenter (Grace) suggested the indirect preparation adjustment factor needed to be even larger than 2.5, and that actual risks were much lower. Grace also recommended that EPCs only be derived using directly prepared filters. EPA disagrees with the assertion that indirectly prepared filters are not appropriate for use in risk assessment. This view is supported by Goldade and O'Brien (2014), which concluded "(d)ata generated by either direct or indirect preparation analyses may be used in estimating LA exposure assessments intended for use in risk assessment at the Libby Asbestos Superfund Site." The indirect preparation adjustment factor is a Site-specific value derived from a study of 79 air filters prepared by both methods and the factor 2.5 is consistent with the results of the Goldade and O'Brien study. Use of an indirect preparation adjustment factor was reviewed and supported by EPA's Asbestos Technical Review Workgroup.

LA-specific Toxicity Values: Grace opposed the use of the LA-specific reference concentration (RfC) in the derivation of non-cancer hazard quotients, stating that localized pleural thickening was not an appropriate adverse health effect endpoint and that the application of uncertainty factors resulted in an RfC that was two orders of magnitude lower than necessary to protect human health. According to OSWER Directive 9285.7-53 (EPA 2003), "IRIS remains in the first tier of the recommended hierarchy as the generally preferred source of human health toxicity values." The LA-specific RfC was published in the Integrated Risk Information System (IRIS) in December 2014 (EPA 2014). Consequently, the LA-specific RfC and inhalation unit risk value (IUR) provided in IRIS were used in the HHRA. To the extent there are comments on the final LA-specific toxicity values, these are relevant to the *Toxicological Review of LA* (EPA 2014), not the HHRA.

Cumulative Risk Assessment: A few commenters (LATAG, Grace) suggested alternate exposure scenarios for inclusion in the cumulative risk assessment. There are essentially an infinite number of possible exposure scenario combinations that could be evaluated in the cumulative risk assessment. The choice of which combinations to evaluate is a matter of judgment. EPA chose examples to characterize the wide range of potential cumulative risks that may occur and to help identify which exposure scenarios tend to be the most substantial contributors to total risk. The intent was not to illustrate the risks associated with various alternative actions or to present an exhaustive evaluation of the various exposure scenario combinations. As noted previously, EPA will improve the transparency and representativeness of the selected TWFs for the cumulative scenarios to ensure consistency between exposure scenario-specific risk estimates and the cumulative risk calculations.

3.2 Responsiveness Summary Narrative – Remedy

Comment Period for Proposed Plan and Other Administrative Record Documents: Several commenters asked questions about the comment period- including the timing of the comment period relative to the completion of the remedial action, the documents covered by the review period, the timing of the comment period for each of the various documents, and the inability to comment effectively without finalized plans and information. The LATAG suggested that amendments to the HHRA, FS, and Proposed Plan be prepared and subjected to public review prior to completing the ROD. Grace commented on the timing of the comment period relative to the completion of the remedial action.

EPA initially announced a 60 day public comment period and extended the comment period for an additional 30 days. This provided additional time for citizens to review and comment on the preferred alternative along with supporting documentation. Supporting documentation includes the HHRA, which was published in December 2014. The public had a total of 8 months to comment on the risk assessment.

During the comment period, EPA accepted comments on all aspects of a Site-wide remedy, excluding the former Libby Vermiculite Mine. Comments were accepted on the Proposed Plan as well as all supporting documents, including the remedial investigation (RI), FS, and draft HHRA.

EPA has followed the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) in providing the background documents in the administrative record (including RI reports, risk assessments, and the FS) prior to issuing the Proposed Plan. In part because of public concerns about time to review documents, EPA left the HHRA as a draft document to allow opportunity for changes based on comments before finalization. There were no comments received that warranted any changes to the HHRA or FS. As such, the final HHRA was published in November 2015. It should be noted that at the time the comment was received, EPA had not yet released the ROD as one commenter suggested – that document can only be issued after review of public and State comments with this Responsiveness Summary.

Remedy Selection Consensus and Application of the Selected Remedy to Other Locations Outside the Libby Asbestos Superfund Site: One commenter indicated that consensus from other federal agencies, such as the National Institute of Environmental Health Sciences (NIEHS) and Agency for Toxic Substances and Disease Registry (ATSDR), are needed for a selected remedy at the Site, and if it includes in-place management and ICs it should be applied to homes nationwide that have vermiculite insulation containing LA.

EPA selects a remedy in a ROD following the Proposed Plan and response to all public comments. We welcome comment and opinion from all interested stakeholders. Other federal agencies, such as NIEHS and ATSDR, could have provided comments on the HHRA. The HHRA was relied upon to select the final remedy. EPA's selected remedy is based on site-specific data collected from this Superfund Site. This remedy was not developed for any other sites where one might encounter LA.

Vagueness in the Elements of the Selected Remedy: Several commenters have indicated that the preferred alternative as included in the Proposed Plan and other administrative documents is too vague and has too many unknowns related to the future cleanup of remaining LA. Commenters also expressed concerns that the planning necessary to implement the selected remedy would require considerable time and had not yet been completed.

The comments about future cleanup and vagueness appear to be related to the specifics regarding ICs, since there was also mention of future cleanup of remaining LA. EPA provided information about preferred IC approaches but did not indicate conclusively which ICs would ultimately be implemented. This is because specifics surrounding ICs are typically determined during the design phase of the project. EPA anticipates working with community members to design a detailed work plan for the ICs. The public will also be asked to provide input and comment on the final IC work plan. Including the IC details in the remedial design allows flexibility to modify the design in the future to meet the changing needs of the community.

Field-level planning is conducted as part of remedial design, which would follow selection of the remedy in the ROD. EPA anticipates utilizing experience built upon previous removal actions as a starting basis for future work plans, and these are expected to be generally consistent compared to those developed in the past.

Thoroughness of Cleanup: Several commenters indicated that the cleanup of LA from soils should be more thorough than proposed in the selected remedy. Some commenters, including the LATAG, indicated that leaving trace levels of LA will create continued exposures in the future and that the benefits of a more thorough cleanup were not valued as highly as they should have been in selecting a remedy. Some of the commenters indicated that, due to uncertainties in sampling and analysis, any positive detection of LA in soil at a property should qualify a property for cleanup. Some comments received questioned why some community members are requesting that all soils containing trace LA be removed when EPA has concluded the selected remedy is safe. One commenter indicated that treatment should be used instead of extensive ICs.

EPA's selected remedy is protective of human health and the environment and is based on the careful development of toxicity values for LA and the Site-specific HHRA. The selected remedy provides the best balance of tradeoffs among the alternatives and attains a level of achievement of the threshold and balancing criteria equal to or higher than other Site-wide alternatives that were evaluated.

There is a statutory preference for remedies that utilize treatment. EPA did not identify any treatment options that could meet the objectives of the remedial action in accordance with the nine criteria that EPA uses to select a remedy. EPA will remove asbestos from soil and building materials where it poses an unacceptable risk. Some contamination will remain undisturbed at depth in soil and in structures where there is no complete exposure pathway.

While there is uncertainty in all measures of contaminant levels in environmental media, the assertion that any detection of LA in soil should warrant cleanup is not logical, defensible, or supported by the Site-specific risk estimates.

First, exposure occurs across the exposure area, and is not specifically focused on any one subarea (which may be either higher or lower than the average across the area). From a long-term exposure perspective, the goal is to characterize the average levels within an exposure area.

Second, just because a measure of asbestos in soil has uncertainty does not mean that the risk associated with potential exposures to that soil are unacceptable. EPA utilizes a number of strategies to help minimize the chances of leaving unacceptable levels of contaminants in place, including the use of conservative estimates of exposure frequency and duration, and conservative estimates of toxicity.

Third, the HHRA demonstrates that estimated risks for numerous soil disturbance exposure scenarios yield acceptable risks, even when LA is detected in soil (Bin B1). Thus, this supports the conclusion that it is not necessary to remove any positive detection of LA to ensure protection.

Finally, Site-specific evidence indicates LA occurs naturally in soils of the Kootenai Valley. Because it is EPA policy not to clean up soils to a concentration that is lower than background (EPA 2002), a low-level detection of LA is not necessarily evidence of Site-related contamination, and is not sufficient evidence of the need for cleanup.

Participation in Cleanup: Several commenters expressed concerns that property owners who refuse to participate in investigations and cleanup activities may impact the ability to have a thorough and effective cleanup across the entire Site.

EPA agrees that participation in the cleanup is important to achieve protectiveness and allow the community to move past the Superfund project. Remedial action will be considered complete when EPA has investigated and, where necessary, completed a cleanup for all residential and commercial properties within the communities of Libby and Troy. While we have a number of outreach efforts in place to encourage participation, we recognize that not everyone will allow access. EPA will work closely with the State, County, and communities to develop a plan to address those properties where access is denied.

Uncertainty Regarding Numbers of Properties and Associated Quantities of Contaminated Material Requiring Additional Cleanup: Several commenters indicated that is it unclear how many properties still require cleanup and how those will be prioritized. There were also comments that the approach used to estimate quantities associated with cleanups is not valid.

Definitive values for the number of properties expected to be affected by future cleanup in the FS report were developed from current tracking information as part of ongoing removal action work and are not averages. However, assumptions were made for factors such as number of refusals to perform cleanup work, percentages of properties that may exceed cleanup criteria and thus warrant action, and the quantities associated with the cleanup actions taken (the focus of the comment). Quantities of contaminated media evaluated for remedial alternatives in a CERCLA FS often rely on reasonable assumptions or estimations in absence of definitive data that are more appropriately collected during remedial design. In this case the forecasting approach used for determining potential quantities of LA contamination in soils and building materials outside OU3 in distinct geographical zones is reasonable, given the long history of removal actions and extensive data sets collected as part of removal actions. This data provided a basis for anticipating future remediation work that may be required. In addition, the quantities developed for the FS are meant to be of sufficient accuracy to allow a comparative analysis of alternatives using the nine CERCLA evaluation criteria, rather than an exact estimation of quantities for purposes such as remedial action budgets.

Exclusion of Forested Areas from the Selected Remedy: Several commenters expressed concerns that a program needs to be established for determining boundaries of forested areas that are free of LA contamination and to inform the community where forest activities can be safely conducted. The USFS also expressed concerns about consistency of cleanup activities under the selected remedy with the Forest Plan for the Kootenai National Forest, including the need to evaluate bark and duff as part of the selected remedy.

EPA appreciates the comments on how the evaluations within the FS for residential/commercial properties, industrial properties, transportation corridors, and park/school properties could potentially apply to forested areas outside of those land use categories.

It should be noted that the forested properties managed by the USFS adjacent to the former Libby Vermiculite Mine will be addressed by a remedy selected for OU3; because investigations and studies for OU3 are ongoing, the issues that USFS identified in terms of how they will be applied to OU3 are yet to be determined. Work continues to define the boundary for the area impacted by activities at the mine. That work includes an evaluation of data gaps and the need for any additional investigation in forested areas.

Potential for Recontamination During and After Implementation of the Selected Remedy: Several commenters expressed concerns that leaving sources of LA in yards at any level causes a potential for recontamination of indoor areas and supports the need for more through cleanup. Commenters indicated that a long-term program should be defined to provide assurances that indoor areas are not recontaminated from other locations, both within and outside the Site. One commenter suggested that the remedial action objectives should be modified to include intra-media and inter-media transport of LA by erosion or by humans.

EPA performed an evaluation of the OU4 indoor ABS air results to determine if there were any trends or patterns in measured indoor ABS air concentrations as a function of various property characteristics (CDM Smith 2015). The results of this evaluation indicate there is no single property characteristic that can be used to gauge the level of LA that may be present in indoor air. Rather, indoor air is affected by multiple property characteristics acting in combination. While it is true that outdoor soil concentrations of LA have the potential to influence indoor air exposures, the theory that indoor environments under post-removal conditions are becoming re-contaminated due to LA in yard soil is unsupported. Rather, the 2013 Indoor ABS results (CDM Smith 2013) show that indoor ABS air concentrations are decreasing over time, not increasing. In accordance with Superfund guidance, ongoing 5 year site reviews will continue to monitor the effectiveness of the selected remedy.

ICs will be designed to manage future encounters with LA. These controls will provide information and potentially resources to help manage contamination and track-in. As part of the O&M program, the ICs will be evaluated routinely to ensure that the remedy remains protective. Details of the long-term monitoring program will be developed during remedial design following selection of the remedy.

Preliminary remedial action objectives (PRAOs) were provided in Section 3.3, page 3-7 of the FS Report. These PRAOs are intended to address all four categories of land use and thus do include OUs 4 through 8. As indicated by EPA RI/FS guidance (EPA 1988), PRAOs are primarily identified by the contaminant of concern, exposure route and receptor, and acceptable contaminant level or range of levels for each exposure route. Although EPA concurs with the commenter that transport of LA contamination is an important consideration, the evaluated alternatives in the FS aggressively remediate LA contamination and minimize remaining LA that would result in unacceptable cumulative risks. The existing RAOs as proposed, coupled with the conclusions of the HHRA and the risk management strategy presented in the FS, should be sufficient to address the concerns about LA transport through implementation of the selected remedy.

Establishment of Cleanup Levels for LA Contamination Situations that Do Not Currently Exist: One commenter pointed out that EPA established a subsurface soil industrial cleanup standard, even though risk calculations indicated no significant risk posed by these soils, and that the standard should be eliminated. This comment was specific to OU5.

The cleanup criteria (RALs and remedial clearance criteria) developed for industrial properties and other land use categories are prospective so they can also address land uses that do not currently exist but that may occur in the future. Operable unit-specific determinations of remedy related to land use categories will be made in the ROD. However, the cleanup criteria established may be considered if current land uses change in the future as tracked as part of the IC program.

3.3 Responsiveness Summary Narrative – Institutional Controls

Stakeholder Roles and Responsibilities for Development of Institutional Controls: Several commenters, including the Lincoln County Board of Commissioners, City-County Board of Health for Lincoln County, Lincoln County ARP, and citizens, requested details regarding roles, responsibilities, and authorities for stakeholder groups throughout development and implementation of the ICs.

For the remedy selected in this ROD, EPA is responsible for the design and initial implementation of the IC program and for determining that the ICs implemented provide protectiveness. The State of Montana (through DEQ) will support EPA during the design and initial implementation of the IC program and will be responsible for continued implementation of ICs after initiation of operation and maintenance.

CERCLA and the NCP do not specify a role for local governments in implementing the IC instruments identified for the selected remedy. However, a local government is often the only entity that has the legal authority to implement, monitor, and enforce certain types of ICs, particularly governmental controls such as ordinances.

Although the local government could participate in managing the routine implementation of institutional controls, EPA and DEQ would retain programmatic responsibilities. DEQ would retain the primary oversight role during operations and maintenance to monitor whether the institutional controls are meeting the objectives of the selected remedy as documented in the ROD. EPA's role would be to review the effectiveness of institutional controls in the context of the risk management strategy during post-construction 5 year site reviews.

Timeline for Development of Institutional Controls: Several commenters questioned the timeline for identifying and establishing institutional controls now, including timing relative to the completion of the remedial action.

Institutional controls are an integral component of the selected remedy; while IC objectives are identified in the ROD the specifics of the IC program will be developed during remedial design. EPA will work with DEQ and a broad-based steering committee chaired by Lincoln County and the City-County Board of Health for Lincoln County to develop a robust plan for ICs that can be effectively implemented. The IC plan will be revised and updated to reflect community needs in the future. All comments received on ICs will be shared with the steering committee and considered in the development of an IC plan.

Opinions on EPA's Preferred Institutional Controls: There were a wide variety of comments on EPA's preferred institutional controls as provided in the Proposed Plan. Besides comments from individuals, comments were also provided by the City-County Board of Health for Lincoln County and from a survey conducted by the Asbestos Resource Program. Most commenters indicated that they fully support a locally-run institutional control program with federal and state support (both financial and oversight). Most commenters support the existing institutional controls such as the UDIG program and the MDT encroachment permit. Most commenters support the idea of public access to simple data like property status, contractor certification programs, and permits for soil and building disturbances. Most commenters support the update of existing codes, ordinances, and regulations but expressed caution or concerns over establishment of new ones. Most commenters did not support filing information in a permanent property file or sitewide advisories except where necessary.

EPA is appreciative of comments regarding the ICs identified in the Proposed Plan. Since EPA wants the ICs to be supported by the local community, rather than selecting specific institutional controls in the ROD as previously mentioned, EPA will work with DEQ and a local steering committee to develop an IC plan that will be revised and updated to reflect community needs in the future. All comments received on ICs will be shared with the steering committee and considered in the development of an IC plan.

Lack of Specificity for Institutional Controls: One of the most common comments received from nearly every party that provided comments was the preferred institutional controls as indicated in the Proposed Plan are too vague to provide meaningful feedback. Commenters requested details regarding the institutional control design process and how ICs will be evaluated and changed in the future.

A number of commenters said they thought the ICs were too vaguely written. While it is likely that EPA's ROD will not have all details worked out, we look forward to working with community members to design a detailed work plan for the ICs. The public will also be asked to provide input and comment on the final IC work plan. Including the IC details in the remedial design allows flexibility to modify the design in the future to meet the changing needs of the community.

Funding for Institutional Controls: Several commenters indicated that the Proposed Plan did not provide supporting information for ICs costs, and whether money is available to fund the institutional controls program. Commenters also had a number of concerns related to what financial responsibilities property owners may have from addressing LA contamination left in place.

EPA and DEQ believe that adequate funding will be available for a comprehensive IC program. This is because 1) EPA has closely tracked costs associated with an interim IC management program involving both education and construction for the past six years, and annual costs have averaged about $600,000; and 2) funding for ICs is available from $11.8 million in settlement funds from W.R. Grace and funds that are being set aside for long-term management of asbestos contamination as a result of recently passed legislation in the State of Montana. It should be noted that 5 year site review costs are generally borne entirely by EPA.

Under the preferred remedy, inaccessible LA may be left in place in structures. LA material will be left within privately owned homes and businesses only where it does not pose a risk of exposure (e.g., sealed behind a wall). The expectation is that property owners would not disturb the inaccessible LA and the property owner would be responsible for general maintenance of the structures (outside of anything involving LA). If asbestos is encountered during maintenance or other activities (e.g., renovation), the IC program will identify who will be responsible for that LA material. Details of the IC program will be developed following selection and during the design of the remedy.

Effectiveness of Institutional Controls: Several commenters indicated concern that an overreliance on institutional controls over more extensive cleanup may fail and may not be effective in providing protection, especially when the institutional controls are voluntary. One commenter had a question about the phrase "would not be enforceable" in reference to the proposed institutional control of "asbestos program notification." The commenters (including the LATAG) also had concerns about defining measurable performance objectives related to each institutional control and its effectiveness. The Lincoln County Board of Commissioners requested details on the process for evaluating the effectiveness of ICs and for revising the program in the future.

Institutional controls are needed to manage those undisturbed areas where LA contamination might be located. EPA recognizes the challenges associated with developing a robust IC program and is taking a number of steps to ensure a successful program. Specifically, EPA has provided funding to Lincoln County's Asbestos Resource Program to develop interim ICs; a group of stakeholders in the community has proposed creation of an IC Steering Committee to work with EPA as details of the IC program are developed; and EPA is committed to public involvement during design of the ICs. We also recognize that a successful IC program will likely have multiple layers, including education, resources, and legal requirements. The IC design will detail how the program is to be implemented and maintained. The program is likely to change over time to ensure protectiveness.

Maintenance of an IC program for the Site will be facilitated by funding that has been set aside specifically for O&M and ICs from EPA's settlement with Grace. Additionally, the state legislature may provide funds for the Libby Asbestos IC program. The criteria for determining effectiveness of the IC program will be developed during remedial design and documented in the IC plan. Effectiveness of the IC program will be evaluated, at a minimum, during routine statutorily required reviews such as 5 year site reviews.

The term "not enforceable" means that EPA or the partner government agencies would not be able to compel action or adherence based on the notification; the asbestos notification program is simply providing information so the community is informed of the presence of LA contamination that may pose unacceptable risks.

Impacts of New Regulations on Institutional Controls: Several commenters indicated concern that new regulations developed after selection of the remedy may result in continuous future revisions to institutional controls to reflect more restrictive standards and related non-compliance penalties.

Regulations that are considered during evaluation and selection of a remedy are "frozen" at the time of signing the ROD. New regulations are only considered during 5 year site reviews if they affect protectiveness of the remedy already installed. As for the comment regarding ICs constituting new enforceable law, as previously mentioned, EPA will work with DEQ and a local steering committee to develop an IC plan that will be revised and updated to reflect community needs in the future. All comments received on ICs will be shared with the steering committee and considered in the development of an IC plan. ICs may not involve passage of ordinances or laws if voluntary measures meet the IC objectives and maintain protectiveness of the remedy.

Property Status Information for Institutional Controls: Several commenters asked how accessible records related to specific properties that have LA contamination would be to the public. Several commenters also asked if property status information is available to the fire departments in Libby and Troy and had questions regarding the protocol for fires at properties with LA contamination.

EPA maintains a comprehensive database with all pertinent information concerning our responses on individual properties. That information is already shared with the State and County. When the project transitions to DEQ for operation and maintenance, the database will be transferred to the State.

To the extent that someone doesn't participate in the program and never provides access, we will not have information about that property. However, we will document that we have not had access to that property.

EPA has worked closely with the Libby Fire Department to provide property statuses to enable the Fire Department to implement an appropriate response to a fire. EPA has offered to assist the Troy Fire Department, but to date the Troy Fire Department has declined EPA's offer.

4.0 MODIFICATIONS TO THE PROPOSED PLAN MADE AS A RESULT OF COMMENTS

Comments provided on the Proposed Plan were addressed through clarification and explanation in this Responsiveness Summary. Based on these written and oral comments, EPA has not made any significant changes to the original proposal but has provided clarifying information based on the comments in the ROD.

In response to requests from local government representatives, EPA and DEQ will be forming an IC steering committee. This steering committee will include members from local government entities as well as private citizens to relay community concerns and provide input on the development of the ICs with EPA. All comments received on ICs will be shared with the steering committee and considered in the development of an IC plan.

5.0 REFERENCES

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U.S. Environmental Protection Agency (EPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER 9355.3-01. October.

EPA. 1989. *Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A) - Interim Final.* Washington, D.C.: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/1-89/002. December.

EPA. 2002. *Role of Background in the CERCLA Cleanup Program.* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER 9285.6-07P. April 26.

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EPA. 2008. *Framework for Investigating Asbestos-Contaminated Sites.* Report prepared by the Asbestos Committee of the Technical Review Workgroup of the Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. OSWER Directive #9200.0-68. September.

EPA. 2010. *Community Engagement Plan, Libby Asbestos Superfund Site.* U.S. Environmental Protection Agency, Region 8. August.

EPA. 2014. *Toxicological Review of Libby Amphibole Asbestos.* Washington D.C.: U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Integrated Risk Information System. EPA/635/R-11/002F. December.

Goldade, MP, and O'Brien, WP. 2014. Use of direct versus indirect preparation data for assessing risk associated with airborne exposures at asbestos-contaminated sites. *Journal of Occupational and Environmental Hygiene* 11(2):67-76.

REMEDIAL ACTION

STATEMENT OF WORK

OPERABLE UNIT 6

LIBBY ASBESTOS SUPERFUND SITE

Lincoln County, State of Montana

EPA Region 8

April 2020

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose of the SOW. This Statement of Work (SOW) sets forth the procedures and requirements for implementing the Work.

1.2 Structure of the SOW.

- Section 2 (Community Involvement) sets forth EPA's and Settling Defendant's responsibilities for community involvement.
- Section 3 (Remedial Action) sets forth requirements regarding the completion of the Remedial Action, including primary deliverables related to completion of the Remedial Action.
- Section 4 (Deliverables) describes the content of the supporting deliverables and the general requirements regarding Settling Defendant's submission of, and EPA's review of, approval of, comment on, and/or modification of, the deliverables.
- Section 5 (Schedules) sets forth the schedule for submitting the primary deliverables, specifies the supporting deliverables that must accompany each primary deliverable, and sets forth the schedule of milestones regarding the completion of the Remedial Action.
- Section 6 (State Participation) addresses State participation.
- Section 7 (References) provides a list of references, including URLs.

1.3 The Scope of the Remedy includes the actions described in Section 12 of the ROD.

(a) The selected remedy includes the following components for OU6:

(1) Institutional Controls (ICs) including legal controls and risk communication controls to be implemented and tailored to land uses as necessary to reduce exposure risks.

(2) ICs will be monitored, maintained, and adjusted as necessary to mitigate exposure to or migration of LA to areas where they could become accessible.

(3) An Environmental Covenant addresses LA left in place at Settling Defendant's Libby railyard and a Best Management Practices Manual addresses the possibility of encountering vermiculite at depth along Settling Defendant's right-of-way property within OU6 and describes a process for managing vermiculite if encountered.

1.4 The terms used in this SOW that are defined in CERCLA, in regulations promulgated under CERCLA, or in the Consent Decree, have the meanings assigned to them in CERCLA, in such regulations, or in the Consent Decree, except that the term "Paragraph" means a paragraph of the SOW, and the term "Section" means a section of the SOW, unless otherwise stated.

2. COMMUNITY INVOLVEMENT

2.1 Community Involvement Responsibilities

(a) EPA has the lead responsibility for developing and implementing community involvement activities at the Site. Previously, EPA developed a Community Involvement Plan (CIP) for the Site.

(b) If requested by EPA, Settling Defendant shall participate in community involvement activities, including participation in (1) the preparation of information regarding the Work for dissemination to the public, with consideration given to including mass media and/or Internet notification, and (2) public meetings that may be held or sponsored by EPA to explain activities at or relating to the Site. Settling Defendant's support of EPA's community involvement activities may include providing online access to initial submissions and updates of deliverables to entities to provide them with a reasonable opportunity for review and comment. All community involvement activities conducted by Settling Defendant at EPA's request are subject to EPA's oversight.

3. REMEDIAL ACTION

3.1 Emergency Response and Reporting

(a) **Emergency Response and Reporting**. If any event occurs during performance of the Work that causes or threatens to cause a release of Waste Material on, at, or from the Site and that either constitutes an emergency situation or that may present an immediate threat to public health or welfare or the environment, Settling Defendant shall: (1) immediately take all appropriate action to prevent, abate, or minimize such release or threat of release; (2) immediately notify the authorized EPA officer (as specified in Paragraph 3.1(c)); and (3) take such actions in consultation with the authorized EPA officer and in accordance with all applicable provisions of the Health and Safety Plan and any other deliverable approved by EPA under the SOW.

(b) **Release Reporting**. Upon the occurrence of any event during performance of the Work that Settling Defendant is required to report pursuant to Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-know Act (EPCRA), 42 U.S.C. § 11004, Settling Defendant shall immediately notify the authorized EPA officer orally.

(c) The "authorized EPA officer" for purposes of immediate oral notifications and consultations under Paragraph 3.1(a) and Paragraph 3.1(b) is the EPA Project Coordinator or the EPA Regional Duty Office, who may be contacted at 303-293-1788 (if the EPA Project Coordinator is not available).

(d) For any event covered by Paragraph 3.1(a) and Paragraph 3.1(b), Settling Defendant shall: (1) within 14 days after the onset of such event, submit a report to EPA describing the actions or events that occurred and the measures taken, and to be taken, in response thereto; and (2) within 30 days after the conclusion of such event, submit a report to EPA describing all actions taken in response to such event.

(e) The reporting requirements under Paragraph 3.1 are in addition to the reporting required by CERCLA § 103 or EPCRA § 304.

3.2 Certification of Remedial Action Completion

(a) **Remedial Action Report**. Settling Defendant shall finalize the Remedial Action Report previously submitted to EPA and MDEQ requesting EPA's Certification of Remedial Action Completion. The report must: (1) include certification by Settling Defendant's Project Coordinator that the Remedial Action is complete; (2) be prepared in accordance with Chapter 2 (Remedial Action Completion) of EPA's *Close Out Procedures for NPL Sites* guidance (May 2011); and (3) be certified in accordance with Paragraph 4.4 (Certification).

(b) If EPA concludes that the Remedial Action is not Complete, EPA shall so notify Settling Defendant. EPA's notice must include a description of any deficiencies. EPA's notice may include a schedule for addressing such deficiencies or may require Settling Defendant to submit a schedule for EPA approval. Settling Defendant shall perform all activities described in the notice in accordance with the schedule.

(c) If EPA concludes, based on the initial or any subsequent Remedial Action Report requesting Certification of Remedial Action Completion, that the Remedial Action is Complete, EPA shall so certify to Settling Defendant. This certification will constitute the Certification of RA Completion for purposes of the Consent Decree, including Section XIV of the Consent Decree (Covenants by Plaintiffs). Certification of Remedial Action Completion will not affect Settling Defendant's remaining obligations under the Consent Decree.

4. DELIVERABLES

4.1 Applicability. Settling Defendant shall submit deliverables for EPA approval or for EPA comment as specified in the SOW. If neither is specified, the deliverable does not require EPA's approval or comment. Paragraphs 4.2 (In Writing) and 4.3 (General Requirements for Deliverables) apply to all deliverables. Paragraph 4.4 (Certification) applies to any deliverable that is required to be certified as provided herein. Paragraph 4.5 (Approval of Deliverables) applies to any deliverable that is required to be submitted for EPA approval.

4.2 In Writing. As provided in Paragraph 74 of the Consent Decree, all deliverables under this SOW must be in writing unless otherwise specified. Electronic deliverables are "in writing" submissions for purposes of the Consent Decree.

4.3 **General Requirements for Deliverables.** All deliverables must be submitted by the deadlines in the Remedial Action Schedule, as applicable. Settling Defendant shall submit all deliverables to EPA in electronic form, unless otherwise specified by the EPA Project Coordinator.

4.4 **Certification**. All deliverables that require compliance with this Paragraph must be signed by the Settling Defendant's Project Coordinator, or other responsible official of Settling Defendant.

4.5 **Approval of Deliverables**

(a) **Initial Submissions**

(1) After review of any deliverable that is required to be submitted for EPA approval under the Consent Decree or the SOW, EPA shall: (i) approve, in whole or in part, the submission; (ii) approve the submission upon specified conditions; (iii) disapprove, in whole or in part, the submission; or (iv) any combination of the foregoing.

(2) EPA also may modify the initial submission to cure deficiencies in the submission if: (i) EPA determines that disapproving the submission and awaiting a resubmission would cause substantial disruption to the Work; or (ii) previous submission(s) have been disapproved due to material defects and the deficiencies in the initial submission under consideration indicate a bad faith lack of effort to submit an acceptable deliverable.

(b) **Resubmissions**. Upon receipt of a notice of disapproval under Paragraph 4.5(a) (Initial Submissions), or if required by a notice of approval upon specified conditions under Paragraph 4.5(a), Settling Defendant shall, within 45 days or such longer time as specified by EPA in such notice, correct the deficiencies and resubmit the deliverable for approval. After review of the resubmitted deliverable, EPA may: (1) approve, in whole or in part, the resubmission; (2) approve the resubmission upon specified conditions; (3) modify the resubmission; (4) disapprove, in whole or in part, the resubmission, requiring Settling Defendant to correct the deficiencies; or (5) any combination of the foregoing.

(c) **Implementation**. Upon approval, approval upon conditions, or modification by EPA under Paragraph 4.5(a) (Initial Submissions) or Paragraph 4.5(b) (Resubmissions), of any deliverable, or any portion thereof: (1) such deliverable, or portion thereof, will be incorporated into and enforceable under the Consent Decree; and (2) Settling Defendant shall take any action required by such deliverable, or portion thereof. The implementation of any non-deficient portion of a deliverable submitted or resubmitted under Paragraph 4.5(a) or Paragraph 4.5(b) does not relieve Settling Defendant of any liability for stipulated penalties under Section XIII (Stipulated Penalties) of the Consent Decree.

4.6 **Supporting Deliverables**. Settling Defendant shall submit each of the following supporting deliverables for EPA approval, except as specifically provided. Settling

Defendant shall develop the deliverables in accordance with all applicable regulations, guidances, and policies (see Section 7 (References)). Settling Defendant shall update each of these supporting deliverables as necessary or appropriate during the course of the Work, and/or as requested by EPA.

(a) **Health and Safety Plan**. The Health and Safety Plan (HASP) describes all activities to be performed to protect on site personnel and area residents from physical, chemical, and all other hazards posed by the capped impacted materials remaining at the Libby Railyard and (if encountered) vermiculite in the right-of-way. Settling Defendant shall develop the HASP in accordance with EPA's Emergency Responder Health and Safety and Occupational Safety and Health Administration (OSHA) requirements under 29 C.F.R. §§ 1910 and 1926. The HASP should cover activities after RA completion. At Settling Defendant's election, the HASP may be submitted for EPA review as an appendix or attachment to the O&M Plan. EPA does not approve the HASP, but will review it to ensure that all necessary elements are included and that the plan provides for the protection of human health and the environment.

(b) **Institutional Controls Implementation and Assurance Plan**. The Institutional Controls Implementation and Assurance Plan (ICIAP) describes plans to implement, maintain, and enforce the ICs at the Site. Settling Defendant previously provided EPA and MDEQ with a draft ICIAP prepared in accordance with *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites*, OSWER 9355.0-89, EPA/540/R-09/001 (Dec. 2012), and *Institutional Controls: A Guide to Preparing Institutional Controls Implementation and Assurance Plans at Contaminated Sites*, OSWER 9200.0-77, EPA/540/R-09/02 (Dec. 2012). Settling Defendant shall finalize the draft ICIAP. The ICIAP must include the following additional requirement:

(1) A map depicting the location of BNSF owned and/or operated property within OU6 that is the subject of Institutional Controls.

(c) **O&M Plan**. The O&M Plan describes the requirements for inspecting, operating, and maintaining the Remedial Action. Settling Defendant shall develop the O&M Plan in accordance with *Operation and Maintenance in the Superfund Program*, OSWER 9200.1 37FS, EPA/540/F-01/004 (May 2001). The O&M Plan must include the following additional requirements:

(1) Description of Performance Standards required to be met to implement the ROD;

(2) Description of activities to be performed: (i) to provide confidence that Performance Standards will be met; and (ii) to determine whether Performance Standards have been met;

(3) **O&M Reporting**. Description of records and reports that will be generated during O&M, such as annual reporting to MDEQ and EPA based on the checklist attached as Exhibit A to the O&M Plan;

(4) Description of corrective action to be implemented in the event that Performance Standards are not achieved; and a schedule for implementing these corrective actions.

(5) **Best Management Practices Manual**. The Best Management Practices Manual describes Settling Defendant's process to maintain protectiveness when potential LA-containing material (i.e., vermiculite) is encountered during any soil-disturbing activities within Settling Defendant's OU6 right-of-way. Soil-disturbing activities include, but are not limited to, drilling, tilling, trenching, excavation and digging below ground surface. Routine railroad maintenance activities such as tie replacement, rail replacement, ballast cleaning or undercutting are not typically soil-disturbing activities.

(i) An environmental flag will be incorporated in to Settling Defendant's geographic information system (GIS) mapping of the OU6 right-of-way referencing the Best Management Practices Manual or the Restrictive Covenant, as applicable. GIS will be consulted by Settling Defendant before Settling Defendant begins any soil-disturbing activities within the OU6 right-of-way or enters into any agreement allowing others access to the OU6 right-of-way for the same. Settling Defendant will advise third parties of the potential to encounter vermiculite and the associated Best Management Practices Manual before any other authorized entity begins soil-disturbing activities within the OU6 right-of-way.

(ii) The Best Management Practices Manual will include a standard operating procedure (SOP) to be followed by Settling Defendant and agent of Settling Defendant, addressing procedures for handling and responding to LA or vermiculite in the OU6 right-of-way. Settling Defendant will make the SOP available to any third party authorized to enter the right-of-way, for the purpose of handling and responding to LA or vermiculite in the OU6 right-of-way. Settling Defendant will notify EPA upon receipt of information that an authorized third party failed to follow the SOP.

(iii) The Best Management Practices Manual will include a policy to deter trespasser entry or otherwise unauthorized entry into the OU6 right-of-way, and any unauthorized soil-disturbing activities within the OU6 right-of-way.

5. SCHEDULES

5.1 Applicability and Revisions. All deliverables and tasks required under this SOW must be submitted or completed by the deadlines or within the time durations listed in the RA Schedules set forth below. Settling Defendant may submit proposed revised RA Schedules for EPA approval. Upon EPA's approval, the revised RA Schedules supersede the RA Schedules set forth below, and any previously-approved RA Schedules.

5.2 Schedule

Settling Defendant previously provided EPA and MDEQ with review drafts of the ICIAP, RA Report, and O&M Plan. EPA, MDEQ and their contractors provided comments back to Settling Defendant on the drafts. Settling Defendant is preparing Draft Final documents that incorporate the pre-CD comments. The parties anticipate that there may be some additional comments to the drafts and agree to the Schedule below for submission and finalization of the Deliverables.

Description of Deliverable / Task	**¶ Ref.**	**Deadline**
Draft Final ICIAP	4.6(c)	60 days after Consent Decree is signed
Final ICIAP	4.6(c)	30 days after receipt of EPA and State comments on draft ICIAP
Draft Final RA Report	3.2(a)	60 days after final ICIAP is received by EPA and the State
Final RA Report	3.2(b)	30 days after receipt of EPA and State comments on draft Remedial Action Report
Draft Final O&M Plan	4.6(b)	60 days final RA Report is received by EPA and the State
Final O&M Plan	4.6(b)	30 days after receipt of EPA and State comments on draft O&M plan

6. STATE PARTICIPATION

6.1 Copies. Settling Defendant shall, at any time they send a deliverable to EPA, send an electronic copy of such deliverable to the State. EPA shall, at any time it sends a notice, authorization, approval, disapproval, or certification to Settling Defendant, send a copy of such document to the State.

6.2 Review and Comment. The State will have a reasonable opportunity for review and comment prior to:

(a) Any EPA approval or disapproval under Paragraph 4.5 (Approval of Deliverables) of any deliverables that are required to be submitted for EPA approval; and

(b) Any disapproval of, or Certification of Remedial Action Completion under Paragraph 3.2 (Certification of Remedial Action Completion).

7. REFERENCES

7.1 The following regulations and guidance documents, among others, apply to the Work. Any item for which a specific URL is not provided below is available on one of the two EPA Web pages listed in Paragraph 7.2:

(a) CERCLA Compliance with Other Laws Manual, Part I: Interim Final, OSWER 9234.1-01, EPA/540/G-89/006 (Aug. 1988).

(b) CERCLA Compliance with Other Laws Manual, Part II, OSWER 9234.1-02, EPA/540/G-89/009 (Aug. 1989).

(c) Guidance on EPA Oversight of Remedial Designs and Remedial Actions Performed by Potentially Responsible Parties, OSWER 9355.5-01, EPA/540/G-90/001 (Apr.1990).

(d) Guidance on Expediting Remedial Design and Remedial Actions, OSWER 9355.5-02, EPA/540/G-90/006 (Aug. 1990).

(e) National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule, 40 C.F.R. Part 300 (Oct. 1994).

(f) Remedial Design/Remedial Action Handbook, OSWER 9355.0-04B, EPA/540/R-95/059 (June 1995).

(g) Operation and Maintenance in the Superfund Program, OSWER 9200.1-37FS, EPA/540/F-01/004 (May 2001).

(h) Comprehensive Five-year Review Guidance, OSWER 9355.7-03B-P, 540-R-01-007 (June 2001).

(i) Institutional Controls: Third Party Beneficiary Rights in Proprietary Controls (Apr. 2004).

(j) Principles for Greener Cleanups (Aug. 2009), available at http://www.epa.gov/greenercleanups/epa-principles-greener-cleanups.

(k) Close Out Procedures for National Priorities List Sites, OSWER 9320.2-22 (May 2011).

(l) Recommended Evaluation of Institutional Controls: Supplement to the “Comprehensive Five-Year Review Guidance,” OSWER 9355.7-18 (Sep. 2011).

(m) Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites, OSWER 9355.0-89, EPA/540/R-09/001 (Dec. 2012).

(n) Institutional Controls: A Guide to Preparing Institutional Controls Implementation and Assurance Plans at Contaminated Sites, OSWER 9200.0-77, EPA/540/R-09/02 (Dec. 2012).

(o) Record of Decision for Libby Asbestos Superfund Site, Libby and Troy Residential and Commercial Properties, Parks, and Schools, Transportation Corridors, and Industrial Park, Operable Units 4 through 8, Lincoln County, Montana (February 2016).

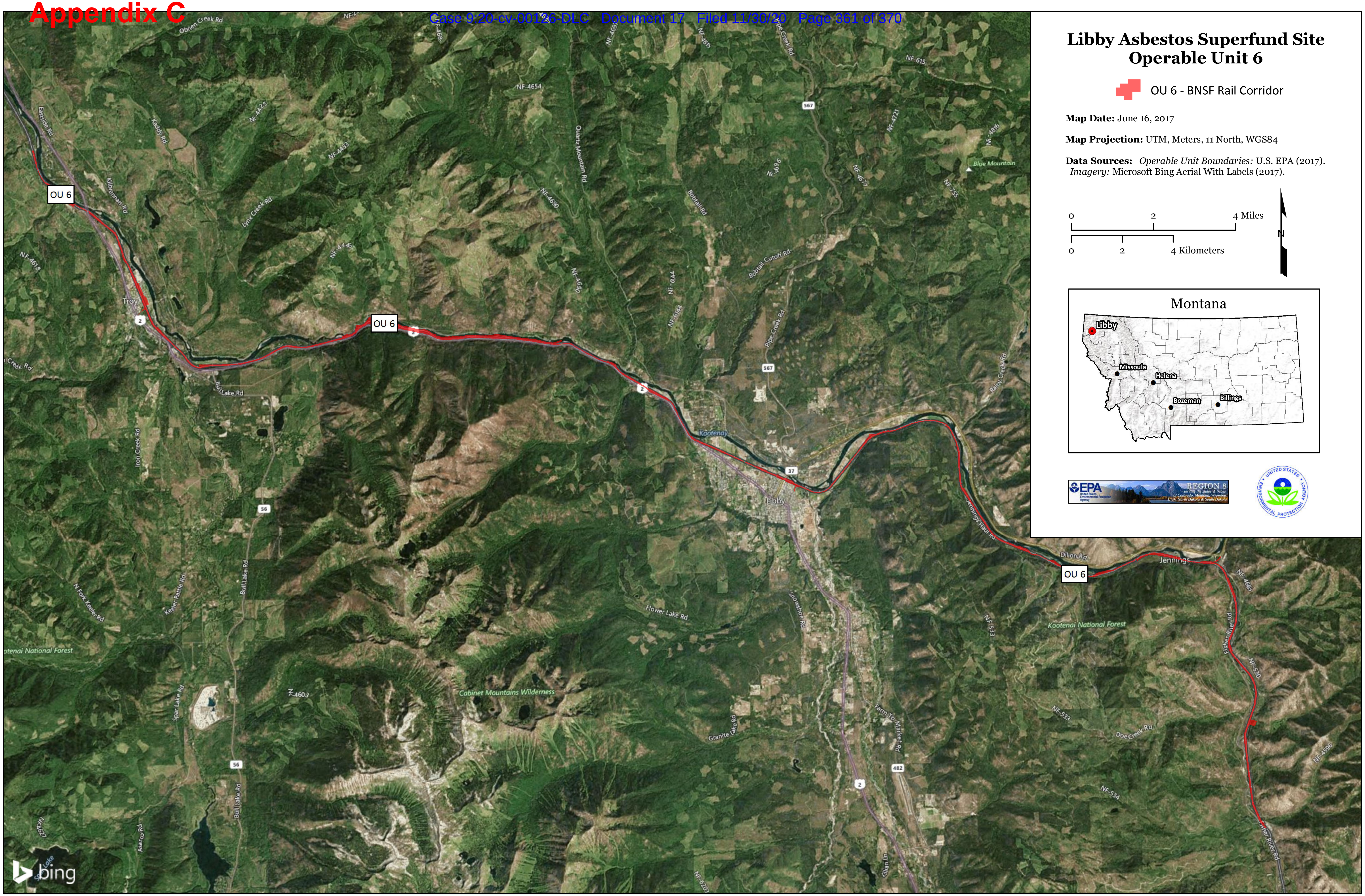
7.2 A more complete list may be found on the following EPA Web pages:

Laws, Policy, and Guidance: http://www.epa.gov/superfund/superfund-policy-guidance-and-laws

Test Methods Collections: http://www.epa.gov/measurements/collection-methods

7.3 For any regulation or guidance referenced in the CD or SOW, the reference will be read to include any subsequent modification, amendment, or replacement of such regulation or guidance. Such modifications, amendments, or replacements apply to the Work only after Settling Defendant receives notification from EPA of the modification, amendment, or replacement.

Appendix C


Libby Asbestos Superfund Site
Operable Unit 6
OU 6 - BNSF Rail Corridor
Map Date: June 16, 2017
Map Projection: UTM, Meters, 11 North, WGS84
Data Sources: Operable Unit Boundaries: U.S. EPA (2017). Imagery: Microsoft Bing Aerial With Labels (2017).
0 2 4 Miles
0 2 4 Kilometers
N
Montana
Libby
Missoula
Helena
Bozeman
Billings
EPA
REGION 8
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OU 6
OU 6
OU 6
Troy
Libby
Jennings
Kootenay
Cabinet Mountains Wilderness
Kootenai National Forest
Blue Mountain
Bull Lake Rd
Flower Lake Rd
Dillon Rd
Fisher River Rd
Farm To Market Rd
bing

After Recording Return to:

Doug McReynolds
Director of Environmental Project Controls
BNSF Railway Company
2500 Lou Menk Drive, AOB-3
Fort Worth, TX 76131

272067 BOOK: 370 RECORDS PAGE: 508 Pages: 9
STATE OF MONTANA LINCOLN COUNTY
RECORDED: 12/19/2017 4:18 KOI: COVENANTS
ROBIN A. BENSON CLERK AND RECORDER
FEE: $63.00 BY Clyde F Rm Deputy
FOR:KENNEDY/JENKS CONSULTANTS INC 303 SECOND ST SUITE 300, SAN

DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY

1. This Declaration of Restrictive Covenants on real property ("Institutional Controls") is made this 13th day of December 2017 by BNSF Railway Company ("Owner"), pursuant to Section 75-10-727, Montana Code Annotated ("MCA"), with the approval of the United States Environmental Protection Agency ("EPA") and the Montana Department of Environmental Quality ("DEQ"), third-party beneficiaries of these Institutional Controls.

2. WHEREAS, Owner is the owner of real property located in the City of Libby, County of Lincoln, State of Montana that includes approximately 3.204 acres, described and shown on Exhibit A, Sheet 1– 3 of 3 (the "Property") located in Section 3, Township 30N, Range 31W, P.M.M. of Lincoln County. The Property is currently and historically has been used for railroad purposes; and

3. WHEREAS, in the Action Memorandum dated August 17, 2001 and its amendments (Action Memorandum), EPA Region 8 selected a Removal Action for the Property which allows for suspected asbestos-impacted soils to be left at depth on the Property above levels that allow for unlimited use and unrestricted exposure providing these Institutional Controls are employed to mitigate the risk posed to public health, safety, and welfare, and the environment, limit land/resource use, and/or protect the integrity of the remedy. "Removal Action" shall mean the Removal Action described in the Action Memorandum and amendments thereto, and performed by the Owner pursuant to an Administrative Order on Consent for Removal Action, CERCLA Docket No. CERCLA-08-2003-0004 (AOC); and

4. WHEREAS, EPA has determined that the Removal Action has been completed for the Property as more particularly described in Exhibit A; and

5. WHEREAS, in the Record of Decision dated February 8, 2016 (the "ROD"), the Assistant Regional Administrator, Office of Ecosystems Protection and Remediation, for EPA Region VIII, with the State of Montana's concurrence, selected a Remedial Action for OU6 which allows for waste to be left on Site above levels that allow for unlimited use and unrestricted exposure providing these Institutional Controls are employed to mitigate a risk to the public health, safety, and welfare and the environment, limit land/resource use, and/or protect the integrity of the remedy. "Remedial Action" shall mean the Remedial Action described in the Libby Superfund Site Libby and Troy Residential and Commercial Properties, Parks and Schools, Transportation Corridors, and Industrial Park Operable Units 4 through 8 ROD, and amendments thereto; and

6. WHEREAS, as indicated on Exhibit A, suspected remaining asbestos-impacted soils have been covered with a geotextile fabric and a minimum of 12 inches of clean imported sub-ballast material has been placed over the fabric.

NOW, THEREFORE, Owner hereby agrees and declares:

7. Restrictions on Use: The following covenants, conditions and restrictions apply to the use of the Property, run with the land and are binding on the Owner and its successors and assigns:

   a) Restriction on Excavation within the Property. Any excavation or construction within the area restricted by these Institutional Controls (as shown on Exhibit A) that may remove, breach, disturb, or impair the geotextile fabric (as shown on Exhibit A) must be authorized in writing by EPA and DEQ.

   b) Protection of the Integrity of Removal Action. No action shall be taken, allowed, suffered, or omitted on the Property if such action or omission is reasonably likely to create a risk of migration of hazardous or deleterious substances or a potential hazard to public health, safety, or welfare or the environment or result in a disturbance of the structural integrity of any engineering controls designed or utilized at the Property to contain hazardous or deleterious substances or limit human or environmental exposure to hazardous or deleterious substances.

   c) Access, Cooperation and Information. Owner, on behalf of itself and any transferees, hereby grants to EPA and DEQ and their authorized representatives, including contractors, access at all reasonable times to the Property for the purpose of conducting any CERCLA response action or CECRA remedial action. EPA and DEQ will exercise all reasonable efforts to follow Owner's current health and safety plan and Owner's directions regarding railroad safety.

EPA and DEQ retain all of their access authorities and rights, as well as all of their rights to require land/water use restrictions, including enforcement authorities related thereto, under CERCLA, RCRA, and any other applicable statutes or regulations.

8. Conveyance of Property and Retained Right of Access. Any conveyance of all or a portion of the Property by Owner must clearly state that Owner shall remain an intended beneficiary of these Institutional Controls. The conveyance shall specify that the remedy of "specific performance" will be available to Owner for violations of these Institutional Controls.

9. In any conveyance of all or a part of the Property, Owner and its agents shall retain the right to enter the Property at reasonable intervals and at reasonable times of day in order to inspect for violations of the Institutional Controls contained herein.

10. Enforcement of Institutional Controls. Owner will notify DEQ and EPA of any proposed conveyance of all or a portion of its Property at least 30 days prior to any such conveyance. DEQ and EPA need not be notified of conveyances of easements that are solely overhead and do not involve any prohibited activities specified in Section 6 of these Institutional Controls, and such conveyances do not need to include these Institutional Controls. Any conveyance by Owner shall require future owners to provide notice to all potential purchasers.

11. Filing Notice of Institutional Controls. Owner and all future owners shall cause the requirements of these Institutional Controls to be placed in all instruments that convey an interest in the Property, except as provided in Section 9, above. Owner shall file these Institutional Controls in the land records of the Clerk and Recorder's Office, Lincoln County, Montana, within thirty (30) days of the date it is executed by the Owner. Owner must provide EPA and DEQ with a certified true copy of said instrument and its recording reference.

12. Notice of Institutional Controls. Owner on its behalf, and on behalf of its successors and assigns, agrees to include in any instrument conveying its interest in any portion of the Property, including, but not limited to, deeds, leases and mortgages, a notice which is in substantially the following form:

> NOTICE: THE INTEREST CONVEYED HEREBY IS SUBJECT TO INSTITUTIONAL CONTROLS, DATED __________, 20___, RECORDED IN THE PUBLIC LAND RECORDS ON __________, 20___, IN BOOK _______, PAGE ________, IN LINCOLN COUNTY.

Within sixty (60) days of the date any such instrument or conveyance is executed, Owner must provide EPA and DEQ with a certified true copy of said instrument and, if it has been recorded in the public land records, its recording reference. Any conveyance of all or a portion of the Property must include a requirement to include the language in this Section in all future conveyances.

13. Enforcement of Institutional Controls. Owner has agreed to enforce the requirements of these Institutional Controls and take prompt action to correct any violations of these Institutional Controls. Owner has also agreed to notify DEQ and EPA within 30 calendar days of receiving actual or constructive notice of any violation or potential violation of these Institutional Controls. Owner specifically agrees that the remedy of "specific performance" of these Institutional Controls shall be available to Owner in such proceedings.

Owner, as well as EPA and DEQ shall be entitled to enforce the terms of this Institutional Control by resort to specific performance or other legal process as third-party beneficiaries including, but not limited, to the authority provided by CECRA, Section 75-10-701 *et seq,* MCA, and CERCLA as amended 42 U.S.C. § 9601, *et seq*. All remedies available hereunder shall be in addition to any and all other remedies at law or in equity, including CERCLA and CECRA. Any forbearance, delay or omission to exercise rights under this instrument in the event of a breach of any term of this instrument shall not be deemed to be a waiver of such term or of any subsequent breach of the same or any other term, or of any of the rights under this instrument. Venue for enforcement of these Institutional Controls by EPA and/or DEQ shall be in the First Judicial District Court, Montana.

14. Notices. Any notice, demand, request, consent, approval or communication that any party desires or is required to give to the others shall be in writing and shall either be served personally or sent by first class mail, postage prepaid, addressed as follows:

Owner:
BNSF Railway Company
Attn: Director Environmental Controls
2500 Lou Menk Drive, AOB-3
Fort Worth, TX 76131-2828

Environmental Remediation Manager
BNSF Railway Company
800 North Last Chance Gulch, Suite 101
Helena, MT 59601

EPA:
Program Director, Superfund Remedial Program
U.S. Environmental Protection Agency
1595 Wynkoop St.

Denver, CO 80202

DEQ: Bureau Chief, Federal Superfund Bureau
Montana Department of Environmental Quality
Attn: Libby Asbestos Superfund Site
P.O. Box 200901
Helena, MT 59620-0901

Legal - Remediation Division
Montana Department of Environmental Quality
Attn: Libby Asbestos Superfund Site
P.O. Box 200901
Helena, MT 59620-0901

15. Controlling Law. The interpretation and performance of this instrument shall be governed by the laws of the United States and the laws of the State of Montana.

16. These Institutional Controls shall run with the land and be binding on all holders, owners, lessees, occupiers, and purchasers of the Property in perpetuity unless or until the Institutional Controls are removed in accordance with Section 75-10-727, MCA.

17. The rights provided to DEQ and EPA in these Institutional Controls include any successor agencies of DEQ and EPA.

BNSF hereby adopts the restriction and covenants set forth herein which shall apply to and run with property that is the subject matter hereof to the extent not preempted by applicable federal law. BNSF is a common carrier by rail and the property to which these restrictions and covenants apply are an integral part of the interstate transportation system. By adopting this restriction, BNSF does not waive preemption under the ICC Termination Act of 1995 49 U.S.C. Section 10501(b), or other applicable federal law. ICCTA preemption is codified as 49 U.S.C. Section 10501(b).

IN WITNESS WHEREOF, BNSF Railway Company has caused this instrument to be executed this 13th day of December, 2017.

By: ______________________
Mark D. Ude, solely in his capacity as
Assistant Vice President Corporate Real
Estate Development of BNSF Railway
Company, and not his individual capacity

STATE OF TEXAS)
) ss:
COUNTY OF TARRANT)

The foregoing instrument was acknowledged before me this 13th day of December 2017, by Mark D. Ude, Assistant Vice President Corporate Real Estate Development Corporate Real Estate Development on behalf BNSF Railway Company, a Delaware Corporation, and not in his individual capacity, and acknowledged the said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they are authorized to execute said instrument.

Witness my hand and official seal hereto affixed the day and year written above

RHONDA BURTON
Notary ID # 3474626
My Commission Expires
September 21, 2020

NOTARY PUBLIC
STATE OF TEXAS

Rhonda Burton
Notary Public
PO Box 112642
Carrollton, TX 75011
Address
My commission expires: 9/21/2020

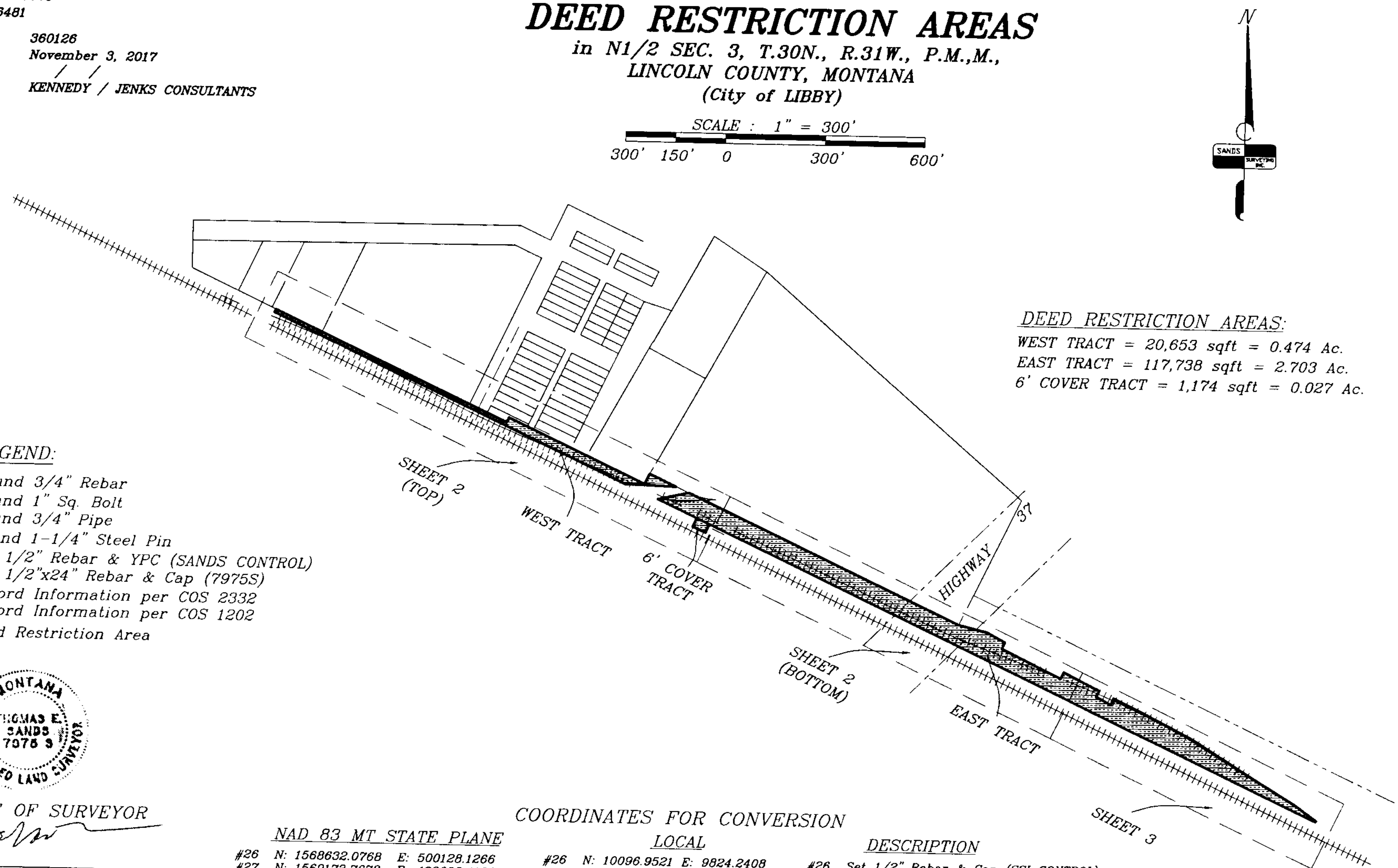
EXHIBIT "A"

By: SANDS SURVEYING, Inc.
2 Village Loop
Kalispell, MT 59901
(406) 755-6481

JOB NO: 360126
DATE: November 3, 2017
COMPLETED DATE: / /
FOR: KENNEDY / JENKS CONSULTANTS

EXHIBIT OF:
DEED RESTRICTION AREAS
in N1/2 SEC. 3, T.30N., R.31W., P.M.,M.,
LINCOLN COUNTY, MONTANA
(City of LIBBY)

SCALE : 1" = 300'
300' 150' 0 300' 600'



DEED RESTRICTION AREAS:
WEST TRACT = 20,653 sqft = 0.474 Ac.
EAST TRACT = 117,738 sqft = 2.703 Ac.
6' COVER TRACT = 1,174 sqft = 0.027 Ac.

LEGEND:
- ● Found 3/4" Rebar
- Found 1" Sq. Bolt
- Found 3/4" Pipe
- Found 1-1/4" Steel Pin
- Set 1/2" Rebar & YPC (SANDS CONTROL)
- Set 1/2"x24" Rebar & Cap (7975S)
- (R) Record Information per COS 2332
- (R1) Record Information per COS 1202
- Deed Restriction Area

MONTANA THOMAS E. SANDS 7975 S REGISTERED LAND SURVEYOR

CERTIFICATE OF SURVEYOR

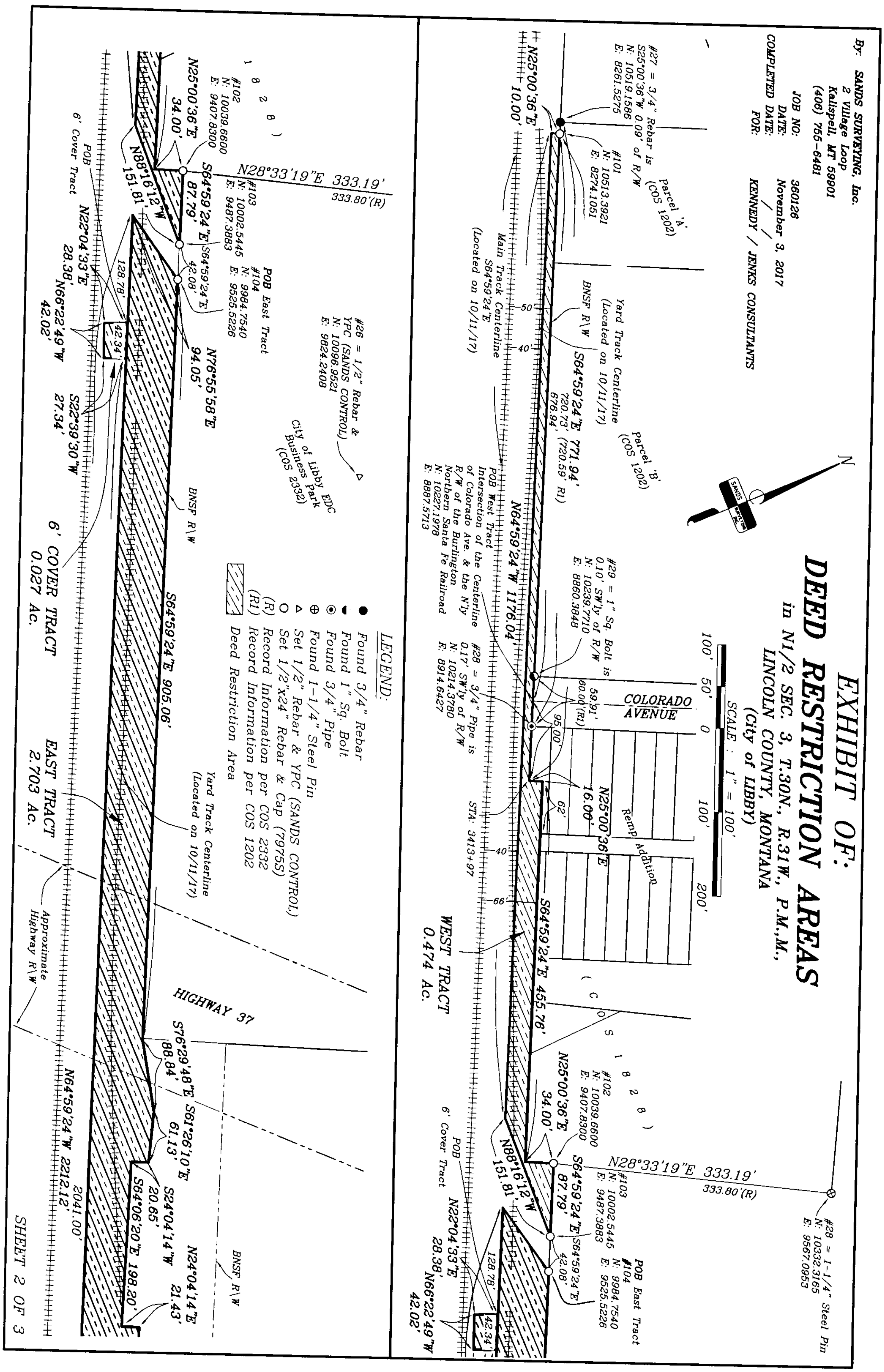
THOMAS E. SANDS 7975-S

COORDINATES FOR CONVERSION

	NAD 83 MT STATE PLANE	LOCAL	DESCRIPTION
#26	N: 1568632.0768 E: 500128.1266	N: 10096.9521 E: 9824.2408	Set 1/2" Rebar & Cap (SSI CONTROL)
#27	N: 1569173.7678 E: 498603.4126	N: 10519.1586 E: 8261.5275	Found 3/4" Rebar

SHEET 1 OF 3

Appendix D


By: SANDS SURVEYING, Inc.
2 Village Loop
Kalispell, MT 59901
(406) 755-6481
JOB NO: 36126
DATE: November 3, 2017
COMPLETED DATE: / /
FOR: KENNEDY / JENKS CONSULTANTS
EXHIBIT OF:
DEED RESTRICTION AREAS
in N1/2 SEC. 3, T.30N., R.31W., P.M.,M.,
LINCOLN COUNTY, MONTANA
(City of LIBBY)
SCALE : 1" = 100'
100' 50' 0 100' 200'
LEGEND:
Found 3/4" Rebar
Found 1" Sq. Bolt
Found 3/4" Pipe
Found 1-1/4" Steel Pin
Set 1/2" Rebar & YPC (SANDS CONTROL)
Set 1/2"x24" Rebar & Cap (7975S)
(R) Record Information per COS 2332
(R1) Record Information per COS 1202
Deed Restriction Area
#27 = 3/4" Rebar is S25°00'36"W 0.09' of R/W
N: 10519.1586
E: 8261.5275
Parcel 'A' (COS 1202)
#101
N: 10513.3921
E: 8274.1051
Yard Track Centerline (Located on 10/11/17)
BNSF R/W
Main Track Centerline S64°59'24"E (Located on 10/11/17)
N25°00'36"E 10.00'
S64°59'24"E 771.94' 720.73' (720.59' R1) 676.94'
Parcel 'B' (COS 1202)
POB West Tract
Intersection of the Centerline of Colorado Ave. & the N'ly R/W of the Burlington Northern Santa Fe Railroad
N: 10227.1978
E: 8887.5713
N64°59'24"W 1176.04'
#29 = 1" Sq. Bolt is 0.10' SW'ly of R/W
N: 10239.7710
E: 8860.3848
#28 = 3/4" Pipe is 0.17' SW'ly of R/W
N: 10214.3780
E: 8914.6427
COLORADO AVENUE
59.91' 60.00'(R1) 95.00'
N25°00'36"E 16.00'
62'
Remp Addition
STA: 3413+97
S64°59'24"E 455.76'
WEST TRACT 0.474 Ac.
(COS 1828)
N25°00'36"E 34.00'
#102
N: 10039.6600
E: 9407.8300
N28°33'19"E 333.19' 333.80'(R)
#28 = 1-1/4" Steel Pin
N: 10332.3165
E: 9567.0953
#103
N: 10002.5445
E: 9487.3883
S64°59'24"E 87.79'
N88°16'12"W 151.81'
S64°59'24"E 42.08'
POB East Tract
#104
N: 9984.7540
E: 9525.5226
6' Cover Tract
POB
N22°04'33"E 28.38'
128.78'
42.34'
N66°22'49"W 42.02'
N76°55'58"E 94.05'
#26 = 1/2" Rebar & YPC (SANDS CONTROL)
N: 10096.9521
E: 9824.2408
City of Libby EDC Business Park (COS 2332)
S22°39'30"W 27.34'
BNSF R/W
S64°59'24"E 905.06'
6' COVER TRACT 0.027 Ac.
EAST TRACT 2.703 Ac.
Yard Track Centerline (Located on 10/11/17)
Approximate Highway R/W
HIGHWAY 37
S76°29'48"E 88.84'
S61°26'10"E 61.13'
S24°04'14"W 20.65'
N24°04'14"E 21.43'
S64°06'20"E 198.20'
N64°59'24"W 2212.12'
2041.00'
SHEET 2 OF 3

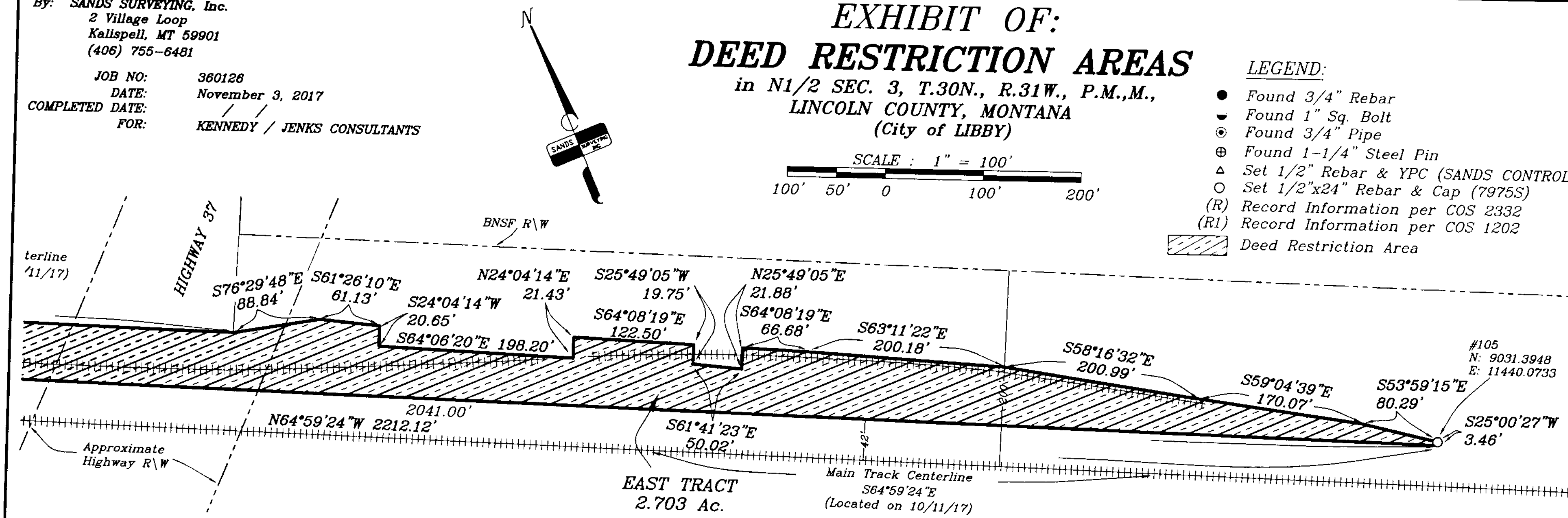
By: SANDS SURVEYING, Inc.
2 Village Loop
Kalispell, MT 59901
(406) 755-6481

JOB NO: 360128
DATE: November 3, 2017
COMPLETED DATE: / /
FOR: KENNEDY / JENKS CONSULTANTS

EXHIBIT OF:
DEED RESTRICTION AREAS
in N1/2 SEC. 3, T.30N., R.31W., P.M.,M., LINCOLN COUNTY, MONTANA (City of LIBBY)

SCALE : 1" = 100'
100' 50' 0 100' 200'

LEGEND:
- ● Found 3/4" Rebar
- Found 1" Sq. Bolt
- ⦿ Found 3/4" Pipe
- ⊕ Found 1-1/4" Steel Pin
- △ Set 1/2" Rebar & YPC (SANDS CONTROL)
- ○ Set 1/2"x24" Rebar & Cap (7975S)
- (R) Record Information per COS 2332
- (R1) Record Information per COS 1202
- Deed Restriction Area



Description:

THREE TRACTS OF LAND, SITUATED, LYING AND BEING IN THE NORTH HALF OF SECTION 3, TOWNSHIP 30 NORTH, RANGE 31 WEST, P.M.,M., LINCOLN COUNTY, MONTANA, AND MORE PARTICULARLY DESCRIBED AS FOLLOWS TO WIT:

WEST TRACT:

BEGINNING at the intersection of the centerline of Colorado Avenue (City of Libby) and the northerly R/W the Burlington Northern Santa Fe Railroad as shown on Certificate of Survey No. 1202 (records of Lincoln County); Thence along said R/W S64°59'24"E 95.00 feet; Thence N25°00'36"E 16.00 feet; Thence S64°59'24"E 455.76 feet; Thence N25°00'36"E 34.00 feet to a set iron pin; Thence S64°59'24"E 87.79 feet to a set iron pin; Thence leaving said R/W N88°16'12"W 151.81 feet; Thence N64°59'24"W 1176.04 feet; Thence N25°00'36"E 10.00 feet to a set iron pin being on said northerly R/W; Thence along said R/W S64°59'24"E 676.94 feet to the point of beginning and containing 0.474 Acres; Subject to and together with all appurtenant easements of record.

EAST TRACT:

Commencing at the intersection of the centerline of Colorado Avenue (City of Libby) and the northerly R/W the Burlington Northern Santa Fe Railroad as shown on Certificate of Survey No. 1202 (records of Lincoln County); Thence along said R/W S64°59'24"E 95.00 feet; Thence N25°00'36"E 16.00 feet; Thence S64°59'24"E 455.76 feet; Thence N25°00'36"E 34.00 feet to a set iron pin; Thence S64°59'24"E 129.87 feet to a set iron pin and THE TRUE POINT OF BEGINNING OF THE TRACT OF LAND HEREIN DESCRIBED: Thence continuing along said R/W S64°59'24"E 905.06 feet; Thence leaving said R/W S76°29'48"E 88.84 feet; Thence S61°26'10"E 61.13 feet; Thence S24°04'14"W 20.65 feet; Thence S64°06'20"E 198.20 feet; Thence N24°04'14"E 21.43 feet; Thence S64°08'19"E 122.50 feet; Thence S25°49'05"W 19.75 feet; Thence S61°41'23"E 50.02 feet; Thence N25°49'05"E 21.88 feet; Thence S64°08'19"E 66.68 feet; Thence S63°11'22"E 200.18 feet; Thence S58°16'32"E 200.99 feet; Thence S59°04'39"E 170.07 feet; Thence S53°59'15"E 80.29 feet to a set iron pin; Thence S25°00'27"W 3.46 feet; Thence N64°59'24"W 2212.12 feet; Thence N76°55'58"E 94.05 feet to the point of beginning and containing 2.703 Acres; Subject to and together with all appurtenant easements of record.

6 FOOT COVER TRACT:

Commencing at the intersection of the centerline of Colorado Avenue (City of Libby) and the northerly R/W the Burlington Northern Santa Fe Railroad as shown on Certificate of Survey No. 1202 (records of Lincoln County); Thence along said R/W S64°59'24"E 95.00 feet; Thence N25°00'36"E 16.00 feet; Thence S64°59'24"E 455.76 feet; Thence N25°00'36"E 34.00 feet to a set iron pin; Thence S64°59'24"E 129.87 feet to a set iron pin; Thence leaving said R/W S76°55'58"W 94.05 feet; Thence S64°59'24"E 128.78 feet to THE TRUE POINT OF BEGINNING OF THE TRACT OF LAND HEREIN DESCRIBED: Thence continuing S64°59'24"E 42.34 feet; Thence S22°39'30"W 27.34 feet; Thence N66°22'49"W 42.02 feet; Thence N22°04'33"E 28.38 feet to the point of beginning and containing 0.027 Acres; Subject to and together with all appurtenant easements of record.