UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

MAR 0 2 2020

MEMORANDUM

SUBJECT: First Five-Year Review for the Big River Mine Tailings Superfund Site
Operable Unit 1, CERCLIS ID #: MOD981126899

FROM: Jason Gunter, Remedial Project Manager
Lead Mining and Special Emphasis Branch

THRU: Preston Law, Chief
Lead Mining and Special Emphasis Branch

TO: Mary P. Peterson, Director
Superfund and Emergency Management Division

Attached for your review and approval is the First Five-Year Review Report, or FYR, for the above-referenced Site. The Site includes all of St. Francois County, Missouri. The Site is divided into four operable units, or OUs, one of which is addressed in this FYR. The Site resides within the Old Lead Belt, which is on the northeastern edge of the Precambrian igneous core of the St. Francois Mountains. This area is one of the world's largest lead mining districts, having produced more than nine million tons of pig lead. It is estimated that some 250 million tons of lead-contaminated mine waste was produced in the Old Lead Belt from ore milling and beneficiation processes.

The Site was listed on the National Priority List in 1992. The EPA issued a Record of Decision, or ROD, on September 30, 2011 for OU1. This OU consists of the remediation of residential properties and high child exposure areas exceeding lead levels in residential soil of 400 ppm in St. Francois County and post removal site control activities for work completed at the five site-wide mine waste source areas. OU1 is the focus of this FYR.

The Selected Remedy focuses on the remediation of lead contaminated mine ore processing waste in residential areas of OU1. Residential properties include properties that contain single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers, playgrounds, parks, and green ways. This cleanup action is one part of the EPA's overall efforts to cleanup environmental contamination resulting from historic lead mining operations at the Site. Cleanup activities of the original mine waste source areas tailings piles have already occurred and are nearly complete.

The findings of the FYR indicate that the remedy is performing in accordance with the standards in the ROD. The Remedial Action Objective will be achieved upon completion of the Remedial Action.

The state of Missouri has reviewed and concurs with the FYR. Additionally, this version has incorporated comments from EPA Headquarters, EPA Region 7 Counsel, and EPA Region 7 Risk Assessors.

If you have any questions regarding this FYR, please contact Jason Gunter at extension 7358.

Attachment

FIRST FIVE-YEAR REVIEW REPORT FOR BIG RIVER MINE TAILINGS SUPERFUND SITE ST. FRANCOIS COUNTY, MISSOURI

Prepared by

U.S. Environmental Protection Agency
Region 7
Lenexa, Kansas

Mary P. Peterson

Mary P. Peterson, Director
Superfund and Emergency Management Division

3/2/2020

Date

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
AR	Administrative Record
ARAR	Applicable or Relevant and Appropriate Requirement
ASARCO	American Smelting and Refining Company
BGS	Below Ground Surface
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
EBL	Elevated Blood Lead
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
IEUBK	Integrated Exposure Uptake Biokinetic Model
ISA	Integrated Science Assessment
µg/dL	Micrograms per deciliter
MDNR	Missouri Department of Natural Resources
MDOH	Missouri Department of Health
MR & BT	Mississippi and Bonne Terre Railroad
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NTP	National Toxicology Program
OLEM	Office of Land and Emergency Management
OU	Operable Unit
O&M	Operation and Maintenance
PPM	Parts Per Million
PRP	Potentially Responsible Party
R7	EPA Region 7
RAO	Remedial Action Objectives
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SLS & RC	St. Louis Smelting and Refining Company
TBC	To be considered
UAO	Unilateral Administrative Order
UU/UE	Unlimited Use and Unrestricted Exposure
XRF	X-Ray Fluorescent Spectrometer

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the first FYR for the Big River Mine Tailings Superfund Site. The triggering action for this statutory review is the on-site construction start date of the Operable Unit 1–Residential Action/Scource Control or, OU1, remedial action. The FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of four OUs. OU00 focuses on the removal at the site-wide mine waste source areas within the Big River Watershed and is scheduled for completion in 2020. OU1 consists of the ongoing remediation of residential properties and high child exposure areas greater than or equal to 400 parts per million (ppm) lead in St. Francois County. OU1 also includes the post removal site control at the five mine waste source areas where work has been completed. OU2 is in the Remedial Investigation/Feasibility Study (RI/FS) phase, and focuses on non-residential soil, surface water, and sediment within the Site. OU3 consists of the Interim Program and Halo Removal Action completed in 2018 to address properties with children determined to have elevated blood lead levels at the Site. This included time critical residential properties and high child exposure areas (i.e., playgrounds and daycare facilities).

Three OUs not addressed in this FYR and the associated reasons include:

- OU00 – Addressed under removal authority and is not subject to the FYR.
- OU2 – Remains in the RI/FS phase without a Record of Decision or, ROD, scheduled for completion in 2021.
- OU3 – Addressed under removal authority and is not subject to the FYR.

This FYR focuses on work completed on residential soils in OU1 and the post removal site control activities for work completed at the eight site-wide mine waste areas.

The Big River Mine Tailings Superfund Site FYR was led by Jason Gunter, EPA Remedial Project Manager. Participants included:

- Jonathan Clark, State Project Manager, Missouri Department of Natural Resources
- Steven Sanders, EPA Region 7 Counsel
- Elizabeth Kramer, EPA Community Engagement Specialist
- Venessa Madden, EPA Ecological Risk Assessor

- Jessica Kidwell, EPA Hydrogeologist
- Todd Phillips, EPA Human Health Risk Assessor

Relevant entities such as the Potential Responsible Parties (PRPs) were notified of the initiation of this FYR. The review began on March 18, 2019.

Site Background

The Big River Mine Tailings Site (EPA ID #: MOD981126899) is located in southeastern Missouri entirely within St. Francois County, approximately 70 miles southwest of St. Louis (Appendix B, Figure 1). The first recorded mining in St. Francois County occurred at Mine-a-Gabore between 1742 and 1762. Discoveries of disseminated lead in the Bonne Terre, Leadwood, and Flat River areas occurred in 1864. The introduction of the diamond drill in 1869 facilitated the discovery of additional reserves and production from the mines increased dramatically in the late 1800s. Mine output from St. Francois County peaked in 1942 when the concentrate equivalent of 197,430 tons of lead was produced. Mining ceased in the county in 1972 with the closing of St. Joe Lead Company's Federal Mine.

The Site resides within the Old Lead Belt, which is on the northeastern edge of the Precambrian igneous core of the St. Francois Mountains. This area is one of the world's largest lead mining districts, having produced more than nine million tons of pig lead. It is estimated that some 250 million tons of mill waste tailings and chat were produced in the Old Lead Belt from ore milling and beneficiation processes. The chat has been used extensively as aggregate for ballast in railroads, aggregate in concrete and asphalt, and construction fill. Some chat is used today as aggregate and fill. Tailings have been used as agricultural amendments due to the lime content.

Chat deposits include sand- to gravel-sized material resulting from the crushing, grinding, and dry separation of the ore material. Tailings deposits include sand- and silt-sized material resulting from the wet washing or flotation separation of the ore material. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. Erosion of these deposits have resulted in contaminated soil, sediment, surface water, and groundwater through transport by wind and water erosion, and have been manually relocated to other areas throughout the county. It has been discovered that mine waste has been used on residential properties for fill material and private driveways, used as aggregate for road construction, and placed on public roads throughout St. Francois County to control snow and ice in the winter. Land use at OU1 is primarily residential, and future use is expected to remain residential.

The EPA is the lead agency and the Missouri Department of Natural Resources (MDNR) is the support agency. The source of the cleanup monies is mixed funding from PRP settlements and the Superfund trust fund.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Big River Mine Tailings Superfund Site		
EPA ID: MOD981126899		
Region: 7	**State:** MO	**City/County:** St. Francois County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Jason Gunter		
Author affiliation: EPA Region 7		
Review period: 3/18/2019 - 3/18/2020		
Date of site inspection: Weekly Inspections from April 5, 2019 – October 24, 2019		
Type of review: Statutory		
Review number: 1		
Triggering action date: 3/18/2015		
Due date *(five years after triggering action date)*: 3/18/2020		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The site inspection and site assessment identified potential sources of mine ore processing waste in the Big River watershed, determined the composition of these sources, and determined that there had been a release of mining-related contaminants (heavy metals) to media within the Big River watershed. The site inspection and site assessment also identified uses of mine waste in the area and provided analytical data on soil, tailings, sediment, air, surface water, and ground water near the mine waste piles. Geographically, the site investigation included the entire Site. A limited number of samples were collected from mine waste, groundwater, sediment, and soil, and were analyzed for heavy metals. Overall, the results indicated elevated concentrations of heavy metals in samples of mine waste, groundwater, sediment, and soil.

Studies conducted by the Missouri Department of Health (MDOH) including a Preliminary Public Health Assessment in 1994 and a lead exposure study in 1997 concluded that 17% of children tested in the mining area of St. Francois County had elevated levels of lead in their blood (at least 10

micrograms/deciliter). A comparable city (Salem, Missouri) with similar aged housing stock was also studied and found to have an elevated blood lead (EBL) rate of only 3%. As a result of the EBL rate in children, in 1997 and 1998, the MDOH followed the Exposure Study with the St. Francois and Jasper Counties Lead Intervention Study in 2000 in an effort to prevent lead exposure to children at the Site.

In general, the EPA determined that the principal threat from OU1 was the human health risk caused by residential soil containing Contaminants of Concern (COCs) in concentrations exceeding the site-specific screening level. Based on Site data and evaluations of potential risk, lead was identified as the COC for OU1. The primary cause of human health risk from residential property soils at the Site is through direct ingestion (by mouth) of lead-contaminated soil.

Response Actions

The EPA and the MDOH began investigating the Site in 1988. These investigations focused on the effects of the mine waste from the Desloge (Big River) Pile. In order to investigate a broader area, the EPA performed a Listing Site Inspection in 1991 and a Site Assessment in 1992, which resulted in the Site being included on the National Priorities List (NPL) in 1992. The NPL is a national list of Superfund sites that prioritizes cleanups in order of the most serious contamination problems and greatest threats to human health and the environment.

Source Area Removal Actions

To date, eight source areas, or mine waste piles, have been identified within the Site. Part of the EPA's overall strategy for the Site was to conduct source control to reduce the continued transportation of mine waste, sources for most of the lead contamination in the Site. The EPA, with cooperation from some of the PRPs, began addressing the source areas through response actions under Removal Authority.

The eight source areas and the status of removal actions are listed below:

- Big River Mine Tailings Site (Desloge Pile Source Area) – removal action complete
- National Mine Tailings Site – removal action complete
- Leadwood Mine Tailings Site – removal action ongoing
- Elvins Mine Tailings Site – removal action complete
- Bonne Terre Mine Tailings Site – removal action complete
- Federal Mine Tailings Site – removal action ongoing
- Doe Run Pile – removal action planned
- Hayden Creek Mine – will be remediated under OU1 Remedial Action

The removal work ongoing or completed is discussed for each source area below.

Big River Mine Tailings Site (Desloge Pile Source Area)

The EPA and the PRPs entered into an Administrative Order on Consent (AOC) in 1994 for a removal action to stabilize the Desloge Pile. Stabilization work on the Desloge Pile (Big River Pile) was completed in 2000. Part of the site was left open for a repository for lead-contaminated soil under OU1. Lead-contaminated residential soil will be stored on-site and managed under the Repository Operation Plan. After the soil disposal is complete, the repository will be graded and capped with a minimum of 12-inches of soil/rock that is less than 400 ppm lead, and revegetated. The Desloge Pile is maintained by respondents under the conditions of the Post Removal Site Control Plan (Doe Run, 2016) in accordance

with the May 22, 2018 Remedial Design/Remedial Action (RD/RA) Consent Decree (CD) for OU1. Post Removal site control activities include periodic inspections with a focus on issues in the following areas:

- Regraded areas
- Drainage structures
- Cover materials
- Site security

Identified issues are repaired and reported in the annual Operation and Maintenance Report (Doe Run 2018) which is a required deliverable in the RD/RA CD for OU1.

National Mine Tailings Site

The EPA issued a Unilateral Administrative Order (UAO) in 2006 for a time critical removal action to stabilize the National Pile. This work was completed in 2012. The National Mine Tailings Site is maintained by respondents under the conditions of the Post Removal Site Control Plan (Doe Run, 2017) in accordance with the May 22, 2018 RD/RA CD for OU1. Post Removal site control activities include periodic inspections with a focus on issues in the following areas:

- Regraded areas
- Drainage structures
- Cover materials
- Site security

Issues that are identified are repaired and reported in the semi-annual Operation and Maintenance Reports (Doe Run 2018 and 2019) which are required deliverables in the RD/RA CD for OU1.

Leadwood Mine Tailings Site

The EPA issued a UAO in 2006 for a removal action to stabilize the Leadwood Pile. The major earthwork at Leadwood was completed in June 2011. Remaining work includes the construction of passive bioreactors to treat dissolved zinc in groundwater seeps located at the east seep and erosion area and at the Leadwood Dam. Part of the site is being used as a repository for lead-contaminated soil under OU1. After the soil disposal is complete, the repository will be graded and capped with a minimum of 12-inches of soil that is less than 400 ppm lead and revegetated. The Leadwood Mine Tailings Site is maintained by respondents under the conditions of the Post Removal Site Control Plan (Doe Run, 2018) in accordance with the May 22, 2018 RD/RA CD for OU1. Post Removal site control activities include periodic inspections with a focus on issues in the following areas:

- Regraded areas
- Drainage structures
- Cover materials
- Site security

Identified issues are repaired and reported in the annual Operation and Maintenance Report, (Doe Run 2018) which is a required deliverable in the RD/RA CD for OU1.

Elvins Mine Tailings Site

The EPA issued a UAO for a time critical removal action to stabilize the Elvins/Rivermines Pile in 2005. All major earthwork was complete in June 2009. Part of the site will be used as a repository for lead-contaminated soil under OU1. After the soil disposal is complete, the repository will be graded and capped with a minimum of 12-inches soil that is less than 400 ppm lead and revegetated. The Elvins Mine Tailings Site is maintained by respondents under the conditions of the Post Removal Site Control Plan (Doe Run, 2018) in accordance with the May 22, 2018 RD/RA CD for OU1. Post Removal site control activities include periodic inspections with a focus on issues in the following areas:

- Regraded areas
- Drainage structures
- Cover materials
- Site security

Identified issues are repaired and reported in the annual Operation and Maintenance Report (Doe Run 2018), which is a required deliverable in the RD/RA CD for OU1.

Bonne Terre Mine Tailings Site

The EPA issued two AOCs for the removal actions at the Bonne Terre Pile. The first was issued in 2001 and addressed the Western Portion of the Bonne Terre Pile. The second was issued in 2003 and addressed the Eastern Portion of the Bonne Terre Pile. All construction was complete in 2007. The Eastern portion is currently being used as a repository for lead-contaminated soil for OU1. After the soil disposal is complete, the repository will be graded and capped with a minimum of 12-inches soil that is less than 400 ppm lead and revegetated. The Bonne Terre Mine Tailings Site is maintained under the conditions of the Post Removal Site Control Plan for the Western Portion (Doe Run, 2013) and the Post Removal Site Control Plan for the Eastern Portion (Doe Run, 2018) in accordance with the May 22, 2018 RD/RA CD for OU1. Post Removal site control activities include periodic inspections with a focus on issues in the following areas:

- Regraded areas
- Drainage structures
- Cover materials
- Site security

Identified issues are repaired and reported in the annual Operation and Maintenance Reports for the Western Portion (Doe Run, 2018) and Eastern Portion (Doe Run, 2019), which are required deliverables in the in the RD/RA CD for OU1.

Federal Mine Tailings Site

The EPA entered into an AOC for Removal Action with the PRPs in 2011 for stabilization of the Federal Pile. Work will be completed at Federal in September of 2020 and a post removal site control plan will be developed.

History of Investigations and Residential Actions

Site-Wide RI/FS

In 1997, the EPA entered into an AOC for the development of the RI/FS with the Doe Run Resources Corporation and ASARCO Incorporated. The RI was completed in 2006. The OU1 FS was completed and released in 2011. The OU1 FS developed the alternatives for the remedial action for the OU1 residential properties.

OU3 Interim Program and Halo Removal Action

In 2000, the EPA entered into an AOC with The Doe Run Resources Corporation to implement a soil testing and removal program, along with blood lead testing and an exposure control program within the Site. This Order, referred to as the Interim Program, provided that these requirements would end when either the EPA issued a Record of Decision (ROD) for residential yards or, after four years. The Interim Program ended on March 30, 2004 resulting in a 78% sampling success rate with 1,955 residential yards sampled and 563 homeowners refusing access to sample.

In 2004, the EPA entered into another AOC for a Removal Action to replace the expiring 2000 Interim Program. The 2004 AOC was referred to as the "Halo Removal Order". The Halo Removal Order designated six of the mine waste areas in St. Francois County: National; Elvins; Bonne Terre; Federal; Desloge; and, Leadwood. The Halo Removal Order required removal actions within the "halo" around each of these waste areas. The halo was defined as the area within 500 feet of chat and tailings waste, 1,000-feet from four identified smelters/calciners, and 100- feet from mine shafts.

Under the Halo Removal Order, 69 additional yards were sampled, including 3 public parks, 5 childcare and school playground facilities, and 29 properties where owners refused sampling during the Interim Action. Seventeen of these properties were not within the Halo, but were sampled due to the presence of children with EBLs. The remaining 15 yards were primarily newly constructed residences within the Halo. Of the total yards sampled between the Halo and Interim actions, 387 were completely remediated with all areas at or above 400 ppm cleaned up, and 188 were partially remediated with some portion of the yard remaining above 400 ppm.

OU1 Fund Lead Removal Actions

From 2011-2014, the EPA remediated 539 properties under removal authority, including 39 properties in the Iron Mountain Subsite and 231 properties in the Lake Timberline Subsite.

OU1 Fund Lead Remedial Actions

From 2015-2020, the EPA remediated 414 properties under the OU1 Remedial Action.

OU1 PRP Lead Remedial Actions

In 2015, the EPA entered into an AOC with the MDNR Division of State Parks (DSP) for the sampling of up to 110 residential properties located within 1 mile of the Federal Mine Tailings Pile. The sampling resulted in 98 properties that qualified for the Remedial Action. In 2016, the EPA issued a UAO to the MDNR/DSP for the remediation of 19 of the 98 qualifying properties with young children present. The MDNR/DSP remediated all 19 of the 2016 UAO properties in calendar year 2016. In 2018, the EPA

issued a UAO for the remediation of 22 of the 98 qualifying properties. The MDNR/DSP remediated all 22 of the 2018 UAO properties in calendar year 2018. In 2019, the EPA issued a CD to the MDNR/DSP for the remediation of the remaining 57 properties that were sampled under the 2015 AOC. The MDNR/DSP has remediated 39 of the 57 remaining 2019 CD properties. The MDNR/DSP will complete the remaining 2019 CD properties by 9/30/2020.

In 2017, the EPA issued a UAO to the Doe Run Resources Corporation (DRRC) for the remediation of 100 properties within 1-mile of the mine waste source areas at Big River OU1. Doe Run completed the remediation in December of 2018. In 2018, the EPA issued a RD/RA CD to DRRC for the sampling of up to 3,648 properties and the remediation of up to 3,997 properties over a period of 13 years. The DRRC remediated 150 properties in calendar year 2019.

Remedial Action Objective(s) (RAOs)

The primary cause of human health risk from residential property soils at the Site is through direct ingestion (by mouth). Thus, the RAO for the residential property soils at the Site is to:

> ***Reduce the risk of exposure of young children (children under seven years old) to lead such that an individual child or group of similarly exposed children have no greater than a 5% chance of exceeding a blood lead level of 10 µg/dl.***

Site-specific information, including the EPA's Integrated Exposure Uptake Biokinetic (IEUBK), model and a Blood Lead Study, predicted that a young child residing at the Site will have greater than a 5% chance of having a blood lead level exceeding 10 µg/dL if the lead soil concentrations to which he or she is exposed are above 400 ppm lead under the assumed exposure conditions. Thus, 400 ppm lead in soil is the cleanup level of the remedial action.

Remedy Selection

The Selected Remedy includes the excavation of residential soil until lead concentrations are below 400 ppm in the top 12 inches, or below 1,200 ppm below 12 inches down to 24 inches below ground surface (bgs), transportation of contaminated soil to on-site soil repositories, replacement of contaminated soil with clean backfill and vegetative cover and institutional controls (ICs). Any properties with lead-levels remaining above 1,200 ppm at depth would be subject to ICs.

The 1,200-ppm cleanup level at depth is protective for occupational exposure of utility workers or other construction workers that could potentially contact subsurface soils following soil remediation.

Status of Implementation

The selected remedy for OU1 is ongoing. A total of 5,109 residential properties have been sampled to date. Each property is sampled following the guidance in the Lead Handbook (EPA, 2003). All samples are analyzed with a field portable X-Ray Fluorescent Spectrometer (XRF) with 5% of the samples sent to a certified laboratory for confirmation and instrument to lab correlation. To date, a total of 5,109 properties, approximately 77-percent, have been sampled with 3,935 properties qualifying for cleanup.

As of October 21, 2019, 635 properties have been remediated under the remedial action for OU1. Excavated soils are transported to repositories available at the site-wide source areas for disposal. For properties where soil lead concentration remains greater than or equal to 1,200 ppm at 24 inches bgs, a

highly visible orange plastic warning barrier has been placed at the base of the excavations to alert anyone accessing the subsurface of the remaining presence of contamination beneath the clean backfill. EPA Region 7 continues to develop the ICs for residential properties where contamination remains at depth.

The anticipated completion date of residential yard remediation is 2030.

IC Summary Table

ICs are required on properties greater than or equal to 1,200 ppm lead at 24-inches bgs. There are currently approximately 156 properties that are subject to ICs. At present, there are no applicable zoning ordinances in St. Francois County for residential properties. However, there are potential IC's that could be utilized. These may include the following:

- Establishing a registry of residential properties with soil lead concentrations greater than 1,200 ppm at 24-inches bgs, with barrier placed, with the St. Francois County Health Department.
- Evaluation of yards subject to the ICs during each FYR to ensure the remedy remains protective.
- Homeowner, builder and developer education programs to establish best management practices that address proper handling and disposal of heavy metal soil contamination to prevent contamination of clean properties and re-contaminating of remediated properties.
- Deed restrictions and notices, or restrictive covenants or easements.

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil	Yes	Yes	Residential yards with lead concentrations remaining ≥ 1,200 at 24-inches bgs	Restrict excavation deeper than 24-inches at impacted parcels.	To be determined. EPA will work with the local governments to establish the preferred ICs.

Operation and Maintenance

Operation and maintenance activities for the OU1 residential property remedy is limited to review and verification of IC effectiveness. Since the ICs are not yet in place, the EPA periodically inspects completed properties to assure that the soil/rock cover remains protective. This is documented in the Property Closeout Letter with the property owner.

III. PROGRESS SINCE LAST FIVE-YEAR REVIEW

This is the first FYR for the Site.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

An ad was placed in the local newspaper to inform the public about the FYR start. This is located in Appendix C.

The following ad will be placed in the local newspaper to inform the public about the five-year review process. The results of the review and the report will be made available at the Site information repository located online at https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0701639.

No interviews were conducted as part of the FYR.

Data Review

Since the remedy is under construction, environmental data is collected and analyzed to determine if Site cleanup levels have been met. Data is evaluated as it is collected from each residential property. A total of 5,109 residential properties have been sampled to date. Each property is sampled following the guidance in the Lead Handbook (EPA, 2003). All samples are analyzed with a field portable XRF, along with 5% of the samples sent to a certified laboratory for confirmation. To date, 3,935 properties have qualified for the remedial action, or approximately 77%. Starting in 2004 through 2014, PRPs remediated 387 properties under orders for removal actions. From 2011-2014, the EPA remediated 539 properties under removal authority. Since the start of the Remedial Action in 2015, the EPA and PRPs have remediated 635 properties. At the current planned rate of cleanup, it could take the EPA and PRPs approximately 13 years to finish the cleanup of OU1.

Site Inspection

Site inspections are conducted on a weekly basis since there is ongoing remediation. Residential properties are fully vegetated and properties with barrier at depth remain undisturbed. Please note that the EPA routinely inspects properties for conditions after remediation/restoration. The EPA typically waits a minimum of one year after restoration before sending the property owner a letter that officially closes out the property. This letter provides the homeowner certification that the remediation and restoration of their property is complete. All data including pre- and post-remedial field sheets are provided to the homeowners upon completion. The source areas are inspected biannually and the repositories are inspected quarterly.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

The OU1 residential soil remediation activities that have been completed are functioning as intended. The EPA continues to work with the State, land owners, local governments to determine and implement the best IC vehicle for sites where lead contaminated soils remain at depth. Post removal site control activities for the six sitewide source areas completed are functioning as intended.

Specific to the residential properties, to date, over 5,100 residential properties have been sampled for lead contamination, and over 1,500 residential yards have been remediated along with all contaminated schools, daycares, and head starts. This work is ongoing, and the EPA will continue to sample and remediate properties that are greater than or equal to 400 ppm of lead in soil. In the future, the EPA will work with local municipalities in an attempt to place ICs on properties with lead levels remaining above 1,200 ppm at 24-inches bgs.

The EPA visits all properties (both EPA and PRP-Lead) to ensure that restoration is complete before signing the property closeout forms.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Question B Summary:

The cleanup level selected for the Big River Mine Tailings Site OU1 was 400 ppm of lead in residential soils and was derived based on the 1994 and 1998 soil lead guidance documents (EPA, 1994; EPA, 1998), which identify 10 µg/dL as the blood lead level of concern. If the blood lead level of concern is revised to a value less than 10 µg/dL, the resulting cleanup level for lead in soil that is based on human health risks to a child receptor could be lower than the value currently listed in the ROD. The residential soil clean-up level for lead at this Site has been determined to be within the range that is protective of ecological receptors that would utilize residential environments. Work completed to date at the site has potentially reduced exposure to elevated lead concentrations in soil. This work is expected to result in improvements in blood lead level concentrations in target populations. The post removal site control objectives are still valid.

Changes in Standards and TBCs

For lead in soil, the EPA's Office of Solid Waste and Emergency Response Directives 9355.4-12 (EPA, 1994) and 9200.4-27P (EPA, 1998), were identified as federal chemical-specific To Be Considered guidance documents. However, since 1994 and 1998 when those documents were issued, increasing evidence has shown that blood lead levels below 10 µg/dL may also have negative health impacts. As a result, on December 22, 2016, the Office of Land and Emergency Management (OLEM) issued Directive 9200.2-167 (EPA, 2016), stating "the current scientific literature on lead toxicology and epidemiology provides evidence that adverse health effects are associated with blood lead levels less than 10 µg/dL." The Directive recommends that Regions should "consider the current scientific conclusions" when implementing OLEM's soil lead policy, specifically referencing the 2012 National Toxicology Program's Monograph on Health Effects of Low-Level Lead (NTP, 2012) and the EPA's 2013 Integrated Science Assessment for Lead (EPA, 2013). The Directive states that the 2013 ISA found clear evidence of cognitive function deficits at blood lead levels between 2 and 8 µg/dL and that the 2012 NTP's monograph found sufficient evidence of effects on cognitive measures and behavior at blood lead levels below 5 µg/dL.

The cleanup level for the Big River Mine Tailings Site OU1 was derived based on the 1994 and 1998 soil lead guidance documents, which identify 10 µg/dL as the blood lead level of concern, in contrast with the latest OLEM Directive, which indicates that adverse health effects are associated with blood lead levels of 5 µg/dL, and possibly as low as 2 µg/dL, in young children. If the blood lead level of

concern is revised to a value less than 10 µg/dL, the resulting cleanup level for lead in soil that is based on human health risks to a child receptor could be lower than the value currently listed in the ROD.

Changes in Toxicity and Other Contaminant Characteristics
The toxicity values for the COCs have not changed in a way that could impact remedy protectiveness.

Changes in Risk Assessment Methods
Changes in risk assessment methodology have occurred since the risk assessment was completed in 2009. For example, the current methodology used to assess exposure and risks via the inhalation pathway has changed (U.S. EPA, 2009). In addition, the EPA has completed an update of standard default exposure factors (EPA, 2014) for use in the IEUBK Model; thus, many of the exposure assessment input parameters in the risk assessment are different than the values currently recommended. Despite these changes, they do not have a significant impact on the conclusions of the risk assessment.

Although an ecological risk assessment was not included in the OU1 ROD, the residential soil clean-up level for lead at this Site has been determined to be within the range that is protective of ecological receptors that would utilize residential environments This conclusion is based on modeled risks to wildlife, which includes sensitive ecological receptors, such the American Robin. Robins are common migratory songbirds in residential areas that tend to be highly exposed to contaminated soil due to ingestion of soil invertebrates. Because robins are a sensitive ecological receptor, other wildlife species that are less sensitive, should also be protected.

Changes in Exposure Pathways
The EPA is unaware of any changes in land use, routes of human health and ecological exposure, contaminants, toxic byproducts, or physical site conditions.

Expected Progress Towards Meeting RAOs
The remedy is progressing towards meeting the RAO through ongoing remediation of residential properties. Under the remedial action for OU1, 635 residential properties have been remediated.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

The EPA is currently unaware of any additional information that could impact the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 01	Issue Category: Institutional Controls
	Issue: EPA needs to develop an Institutional Control Plan, and implement ICs on properties as required for properties with residual lead concentrations greater than or equal to 1,200 ppm remaining at 24-inches below ground surface and for properties where access to sample and remediate cannot be gained during the RA.
	Recommendation: • Work with the local governments to establish a registry of properties that meet the IC requirement. This will help inform the community leaders of the potential issue if properties are excavated deeper than 24 inches below ground surface for utility improvements, construction projects, etc. • Develop homeowner, builder and developer education programs to address heavy metal soil contamination and best management practices. • Deed restrictions or notices of contamination, or restrictive covenants or easements..

Affect Current Protectiveness	Affect Future Protectiveness	Party Responsible	Oversight Party	Milestone Date
Yes	Yes	EPA	EPA/State	3/18/2033

VII. PROTECTIVNESS STATEMENT

Protectiveness Statement(s)	
Operable Unit: 1	*Protectiveness Determination:* Will be Protective
Protectiveness Statement: The remedy at OU1 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities at residential properties and removal activities at the source areas completed to date have adequately addressed all exposure pathways that could result in unacceptable risk at the remediated residential properties.	

VIII. NEXT REVIEW

The next five-year review report for the Big River Mine Tailings Superfund Site is required five years from the completion date of this review.

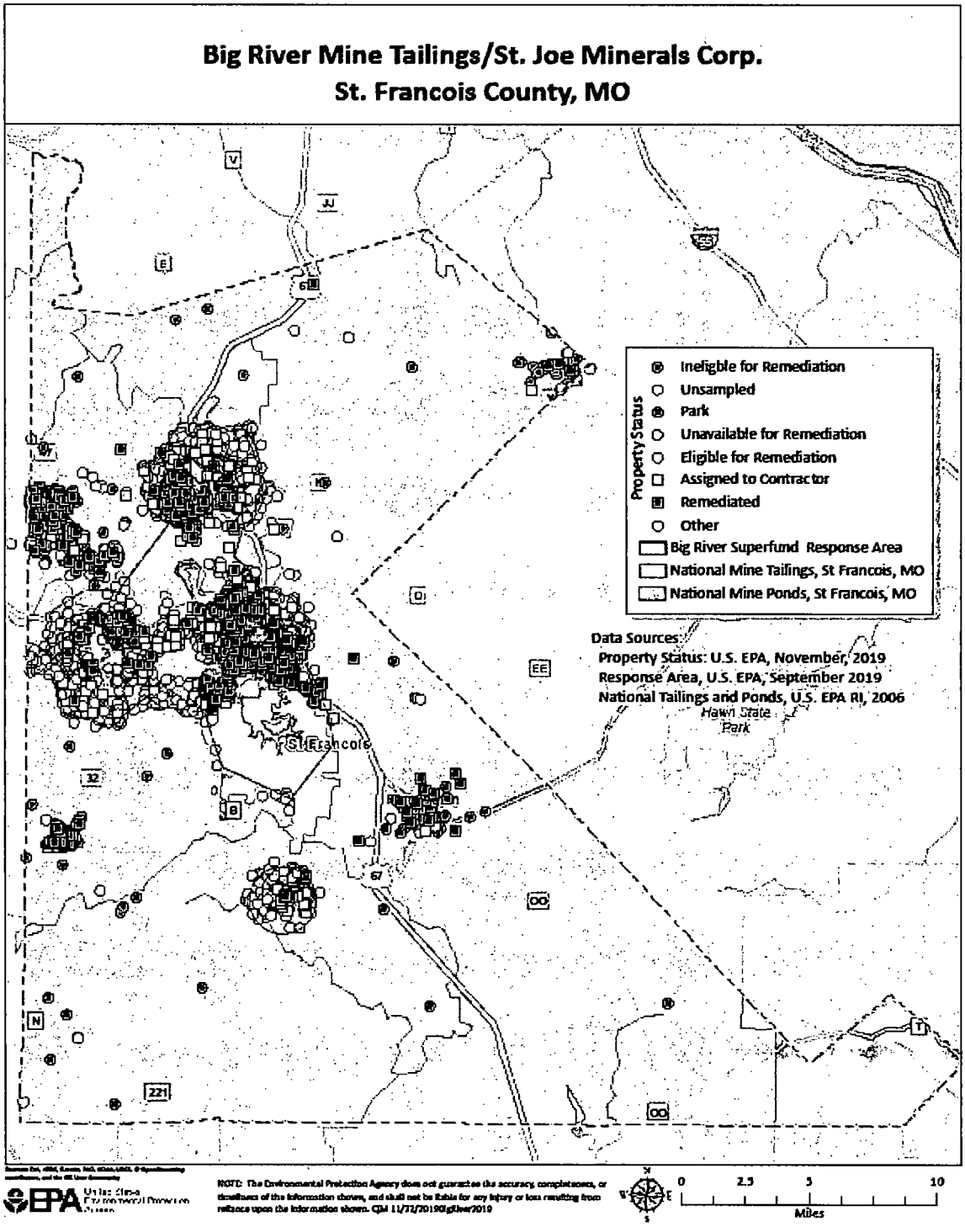
APPENDIX A
Reference List

APPENDIX A – REFERENCE LIST

- Soil Lead Guidance Documents (EPA, 1994; EPA, 1998)
- Big River Mine Tailings Initial RI (Fluor Daniel, 1995)
- Big River Mine Tailings Focused Remedial Investigation (Newfields, 2006)
- Lead Handbook (EPA, 2003)
- Big River Interim Removal Action Report (Doe Run, 2004)
- Big River OU1 Action Memorandum (EPA, 2010)
- Big River OU1 Record of Decision (EPA, 2011)
- National Toxicology Program's Monograph on Health Effects of Low-Level Lead (NTP, 2012)
- Bonne Terre West Tailings Site Post Removal Site Control Plan (Doe Run, 2013)
- Integrated Science Assessment for Lead (EPA, 2013)
- Lake Timberline (Sub-site of Big River OU1) Removal Action Report (EPA, 2014)
- Iron Mountain Lake (Sub-site of Big River OU1) Removal Action Report (EPA, 2014)
- Big River Mine Tailings Site (Desloge Pile) Post Removal Site Control Plan (Doe Run, 2016)
- Office of Land and Emergency Management issue Directive 9200.2-167 (EPA, 2016)
- National Mine Tailings Site Post Removal Site Control Plan (Doe Run, 2017)
- Desloge Mine Tailings Site 2018 Annual O & M Report (Doe Run, 2018)
- Leadwood Mine Tailings Site Post Removal Site Control Plan (Doe Run, 2018)
- Leadwood Mine Tailings Site Annual O & M Report (Doe Run, 2018)
- Elvins Mine Tailings Site Post Removal Site Control Plan (Doe Run, 2018)
- Elvins Mine Tailings Site Annual O & M Report (Doe Run, 2018)
- Bonne Terre Mine East Tailings Site Post Removal Site Control Plan (Doe Run, 2018)
- Bonne Terre Mine West Tailings Site Annual O & M Report (Doe Run, 2018)
- Big River OU1 Halo Removal Action Report (Doe Run, 2018)
- National Mine Tailings Site 2018 Semi-Annual O & M Report (Doe Run 2018)
- National Mine Tailings Site 2019 Semi-Annual O & M Report (Doe Run, 2019)
- Bonne Terre Mine East Tailings Site Annual O & M Report (Doe Run, 2019)
- Remedial Action Report for Residential Action at 22 residential properties under Unilateral Administrative Order at Big River OU1 (Missouri Department of Natural Resources, 2019)
- Remedial Action Report for Residential Action at 100 residential properties under Unilateral Administrative Order at Big River OU1 (Doe Run, 2019).
- Big River OU1 Field Logbooks for OU1 Remedial Action (EPA, 2015-2019)
- Big River OU1 Field Trip Reports for OU1 Remedial Action (EPA, 2018-2019)

APPENDIX B
Site Map

APPENDIX B – SITE MAP



APPENDIX C
Newspaper Ads

APPENDIX C
NEWSPAPER ADS

EPA

PUBLIC NOTICE

FIRST FIVE-YEAR REVIEW STARTED

Big River Mine Tailings/St. Joe Minerals Corp. NPL Superfund Site

Desloge, St. Francois County, Missouri

September 2019

EPA Region 7: Iowa, Kansas, Missouri, Nebraska, and Nine Tribal Nations

The U.S. Environmental Protection Agency (EPA) Region 7 has started the First Five-Year Review for the Big River Mine Tailings/St. Joe Minerals Corp. National Priorities List (NPL) Superfund Site. Five-Year Reviews are required by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) when hazardous substances remain on site above levels that permit unrestricted use and unlimited exposure. Five-Year Reviews provide an opportunity to evaluate the site remedy to determine whether it remains protective of human health and the environment. Lead is the main contaminant of concern. This Five-Year Review should be completed in March 2020.

EPA has assessed the ability of the public to access site information through an internet-based repository and has determined that the local community has this ability. As a result, the Five-Year Review and Administrative Records for this site will be available through this website, once completed: www.epa.gov/superfund/bigrivermine (See Site Documents & Data).

EPA encourages community members to ask questions and report any concerns about this site. Questions or requests for site information and/or the Five-Year Review process can be submitted to:

Elizabeth Kramer
U.S. EPA Community Engagement Specialist
Email: kramer.elizabeth@epa.gov

U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard, Lenexa, KS 66219
Toll-free: 1-800-223-0425