PROPOSED PLAN

RESIDENTIAL PROPERTY SOILS – OU-1

BIG RIVER MINE TAILINGS SUPERFUND SITE

ST. FRANCOIS COUNTY, MISSOURI

Prepared by:

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Region 7
901 North 5th Street
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Proposed Plan
Residential Property Soils
Big River Mine Tailings Superfund Site
St. Francois County, Missouri

PURPOSE OF THIS PROPOSED PLAN

This Proposed Plan for the Big River Mine Tailings site is intended to inform and solicit the views of the affected community regarding the Environmental Protection Agency's Preferred Alternative to address lead contamination in soil at residential yards and high child exposure areas across St. Francois County. The EPA is the lead agency and the Missouri Department of Natural Resources is the state support agency. This Proposed Plan fulfills the public participation requirements under section 117(a) of the Comprehensive Environmental, Response, Compensation and Liability Act, as amended (often called the Superfund Law), 42 U.S.C. § 9617(a) and section 300.430(f)(2) of the National Contingency Plan, 40 C.F.R. § 300.430(f)(2). The purpose of this Proposed Plan is to:

- Provide basic background information about the site.
- Identify the Preferred Alternative for remedial action at the site and explain the reasons for the EPA's preference.
- Describe the other remedial alternatives.
- Solicit public review and comments on all of the alternatives.
- Provide information on how the public can be involved in the remedy selection process.

The Comprehensive Environmental Response, Compensation, and Liability Information System identity number is MOD981126899. This CERCLIS number may be used on the EPA's website to obtain information about the site.

This Proposed Plan highlights key information from the Remedial Investigation, Baseline Human Health Risk Assessment, and Focused Feasibility Study recently released for the site for Operable Unit 1.

The Preferred Alternative is Alternative 3 — Excavation of soil until lead concentrations are below 400 parts per million (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 limited institutional controls.

For additional information regarding the proposed remedial action, these and other documents are available in the Site Administrative Record located at the St. Francois County Health Center or the EPA Regional Office in Kansas City, Kansas, at the addresses listed below:

St. Francois County Health Center
1025 West Main Street
Park Hills, Missouri 63601

Hours: Monday – Friday from 8am – 4pm
Saturday – Sunday - CLOSED

U.S. Environmental Protection Agency,
Region 7 Records Center
901 North 5th Street
Kansas City, Kansas 66101

Hours: Monday – Friday 8am – 5pm
Saturday – Sunday - CLOSED

The EPA is interested in receiving public comments on the alternatives and on the rationale for the Preferred Alternative. After the public comment period ends, the EPA will review all of the comments and make a final decision for remediation of residential properties at the site. The community's preferences are an extremely important factor and will help determine the final decision; therefore we encourage the public to provide comments to the EPA. The EPA's final decision will be explained in a document called the Record of Decision. Included in the ROD is a responsiveness summary that responds in writing to significant comments received by the EPA during the public comment period.

A glossary of common Superfund terms is included in Appendix C at the end of this document.

SITE BACKGROUND AND HISTORY

The site is located in southeastern Missouri entirely within St. Francois County, approximately 70 miles southwest of St. Louis (Appendix A, Figure 1). The first recorded mining in St. Francois County occurred at Mine-a-Gabore between 1742 and 1762. The important 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 output 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 1970 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 has been estimated that some 250 million tons of mining and mill waste in the form of tailings and chat were produced in the Old Lead Belt from ore milling and beneficiation processes. In the past, chat was used extensively as aggregate for ballast in railroads, concrete, asphalt and fill. Some chat is still used today as aggregate and fill. In the past, tailings were 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. These mine wastes have contaminated soil, sediment, surface water and groundwater. Mine waste also has been transported by wind and water erosion and manually

relocated to other areas throughout St. Francois County. It has also been reported 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 around St. Francois County to control snow and ice in the winter.

To date, eight source areas of mine waste have been identified within the St. Francois County site. These areas are shown on Figure 1 in Appendix A and are listed below:

- Desloge Pile (Big River Pile)
- National Pile
- Leadwood Pile
- Elvins Pile
- Bonne Terre Pile
- Federal Pile (St. Joe State Park)
- Doe Run Pile
- Hayden Creek

Part of the EPA's overall strategy for the site and St. Francois County was to address source control to reduce the continued transportation of mine waste. The sources of most of the lead contamination in the site are the large mine waste piles listed above. For this reason EPA, with cooperation from some of the potentially responsible parties, began addressing the mine waste piles as removal actions before beginning remediation of residential properties.

Desloge Pile (Big River Pile)

In 1887, the Desloge Lead Company acquired the Bogy Tract (formerly Mine-a-Joe) near Desloge, Missouri, and commenced its operations under the name Desloge Consolidated Lead Company. In 1890, operations began in Shaft No. 1, originally sunk in 1873 by Bogy to a depth of 224 feet, and in 1893 the mill was started. By 1924, three shafts were operating with a fourth mill shaft being sunk so that ore could be hoisted directly into the crushing plant. The St. Joseph Lead Company took over the property in 1929 and operated it until 1958, when the Desloge mill shut down.

The EPA and The Doe Run Resources Corporation entered into an Administrative Order on Consent in 1994 for a removal action to stabilize the Desloge Pile. Stabilization work on the Desloge Pile (Big River Pile) was mostly completed by 2000. Part of the site was left open for a Corrective Action Management Unit to store lead-contaminated soils on-site.

National Pile

In May 1898, the St. Louis Smelting and Refining Company, a subsidiary of the National Lead Company, purchased a block of land located near the Flat River station on the MR&BT railroad. The block included a working mine of the Flat River Lead Company (1,295 acres) and the old Taylor mines (900 acres). Shaft No. 1, sunk in 1893 by the Flat River Lead Company, and was abandoned by the SLS&RC. Shaft No. 2 was sunk in 1898, followed by Shaft No. 3 in 1899; and, the first SLS&RC ore produced from the property came in 1900. A state-of-the-art electric powered mill with a capacity of 1,200 tons per day was completed in 1901. Ore obtained from

the mine (shafts) and several other small producers was milled, and concentrates were shipped to the National Lead Company's Collinsville, Illinois, smelter. By 1910, four shafts had been sunk on the property. The property was sold to the St. Joseph Lead Company in 1933. The St. Joseph Lead Company operated the National mine for several more years after the purchase but hauled the ore underground to its mill at Federal.

The EPA issued a Unilateral Administrative Order in 2006 for a time critical removal action to stabilize the National Pile. This work is ongoing and is projected to be completed by June 2012.

Leadwood Pile

The St. Joseph Lead Company's mining operations at Leadwood commenced in the Leadwood area as early as 1894. During 1903-1904, the St. Joseph Lead Company constructed the Hoffman mill in Leadwood near Shafts Nos. 12 and 14, with a capacity of 1,000 to 1,200 tons per day. A concise description of the Hoffman concentrating plant operation is given in the Initial RI (Fluor Daniel 1995, page 2-74). Other St. Joseph Lead Company mines in the area included Shaft No. 10 at Gumbo and Shaft No. 11, known as the Hunt, at the northeast edge of Leadwood near the Big River. The Leadwood mill was modernized periodically, but ultimately closed by a strike in 1962.

The EPA issued a Unilateral Administrative Order for a removal action to stabilize the Leadwood Pile. The major earthwork at Leadwood was complete in June 2011. Remaining work includes the construction of passive bioreactors to treat dissolved zinc in groundwater seeps at the east seep and erosion area and the Leadwood Dam.

Elvins/Rivermines Pile

Flat River, Missouri, was the site of several mines and small concentrating works. A partial list of some of the companies with mining interests in the Flat River area (including the historic towns of Elvins, Central and St. Francois) included the Flat River Lead Company, the Central Lead Company, The Doe Run Lead Company, Columbia Lead Company, the Federal Lead Company and the Commercial Lead Company. In the early years, the milling operations were small and conducted at various locations. In 1891, The Doe Run Lead Company commenced mining in the Flat River area and subsequently acquired the properties of the Columbia Lead Company and the Commercial Lead Company. By 1909, The Doe Run Lead Company controlled 6,548 acres in the Flat River area and carried on mining in seven shafts. In 1911, The Doe Run Lead Company consolidated its mill operations at Elvins to 1,500 to 2,000 tons per day plant. The mill ceased operation in 1934. The property was acquired by the St. Joe Minerals Corporation in 1936 when The Doe Run Lead Company was dissolved.

The EPA issued a Unilateral Order for a time-critical removal action to stabilize the Elvins/Rivermines Pile in 2005. All major earthwork was complete in June 2009. Remaining work includes the construction of passive bioreactors to treat dissolved zinc in a groundwater seep on the south end of the site.

Bonne Terre Pile

The St. Joseph Lead Company was organized in 1864 and began mining operations at Bonne Terre in 1865 after purchasing the La Grave property. A mill was constructed and several shafts were sunk thereafter. In 1883, the Bonne Terre mill and associated works were destroyed by fire, after which a new and larger plant was constructed. The adjoining Desloge Lead Company mill, in operation since 1877, burned in 1884 and was subsequently purchased by the St. Joseph Lead Company. The smelter at Herculaneum was completed in 1892, and the furnaces from Bonne Terre were moved there. All Bonne Terre ore was smelted at Herculaneum thereafter.

The EPA issued two Administrative Orders on Consent for the removal actions at the Bonne Terre Pile. The first was issued in 2001 and addressed the Western Portion of Bonne Terre. The second was issued in 2003 and addressed the Eastern Portion of Bonne Terre. All construction was complete in 2007.

Federal Pile

The Federal Lead Company, owned by the American Smelting and Refining Company, began operations in 1902 after acquiring various properties from the Irondale Lead Company, the Derby Lead Company, the Central Lead Company, the Missouri Lead Fields Company, the Union Lead Company and others. In 1907, Federal constructed a large mill with a capacity of 3,000 tons per day (what is now the No. 3 mill at St. Joe State Park). A detailed inventory of shafts or mines operated by Federal (Buckley 1908) is presented in the Initial Remedial Investigation (Fluor Daniel 1995, page 2-58). By 1908, there were seven producing mines on Federal's property and at least nine shafts. By 1910, Federal controlled 16,000 acres in St. Francois and Washington counties and was one of three major producers in the district with St. Joseph Lead Company and Doe Run. Milling operations were consolidated at the Federal mill in 1911. The Federal mill burned in 1912 and was reconstructed. In October 1923, the St. Joseph Lead Company purchased all of the Federal Lead Company's holdings, including at least 12 shafts and the mill, which at that time was treating 4,800 tons per day. The Federal mill was permanently closed in 1970 when the mining operations in the area shifted to the Viburnum trend or New Lead Belt. St. Joe Minerals Corporation donated 8,561 acres to the state of Missouri for use as a park in 1975. The successor to the St. Joe Minerals Corporation was renamed The Doe Run Resources Corporation in 1994 and currently does business as The Doe Run Company.

The EPA entered into an Administrative Settlement Agreement and Order on Consent for Removal Action with The Doe Run Resources Corporation and the state of Missouri Department of Natural Resources, Division of Parks in 2011 for stabilization of the Federal Pile. Work will be completed at Federal in 2013.

Doe Run Pile

The Doe Run Lead Company was organized in 1886 or 1887 and began operations in the town of Doe Run on the old Wm. R. Taylor tract. Doe Run sank two shafts, one 110 feet and the other 47 feet deep at the Doe Run property. About 1890, The Doe Run Lead Company acquired a tract of

land in the Flat River area. In 1907 they acquired additional properties formerly owned by the Union Lead Company and the Columbia Lead Company. As of about 1908, The Doe Run Lead Company operated four shafts, two in the town of Doe Run and two in the Flat River area. By 1910, The Doe Run Lead Company had eleven shafts in the Flat River area. The property was acquired by St. Joe Minerals Corporation in 1936 when The Doe Run Lead Company was dissolved. St. Joe Minerals Corporation sold the site of the Doe Run Pile to an individual in 1977. The Doe Run Pile is approximately 24 acres in a rural area immediately south of the town of Doe Run.

The Doe Run pile has not been addressed. The EPA plans to address this pile as part of OU-02.

Hayden Creek Mine

The Hayden Creek mine is located one mile southwest of the town of Frankclay. The St. Joe Minerals Corporation discovered the ore body by random drilling in 1943. Underground development of the Hayden Creek or No. 22 mine started in 1949 with the sinking of the shaft. Further development was undertaken in 1951 with limited mining in 1952. Mine production averaged about 1,000 tons of ore per day. A 1,200 ton-per-day magnetic separation mill was constructed but failed to operate satisfactorily; eventually all ore produced was trucked to the St. Joseph Lead Company's Leadwood mill for processing. The Hayden Creek mine was closed in 1958, and the facilities were demolished.

Most material at Hayden Creek was addressed under the removal action for Leadwood; however, Hayden Creek will be further assessed under OU-2 to determine if additional work is required to mitigate ecological risk.

Operable Units

Currently there are four operable units designated at the site. This Proposed Plan for OU-1 addresses lead contaminated soils at residential properties at the site. The site has been divided into four operable units to organize the work into logical elements based on removal criteria.

OU-00 consists of the removal activities at the pile locations (Bonne Terre, Leadwood, Federal, Elvins, and National), time-critical residential properties, and high child exposure areas (i.e. playgrounds, daycare facilities).

OU-1 consists of the stabilization of the Desloge Pile (stabilized in 2000) and remediation of residential properties and high child exposure areas exceeding screening levels of 400 ppm in St. Francois County. OU-1 also focuses on properties in the towns of Park Hills, Desloge, Bonne Terre, Leadwood, Leadington, and Doe Run. This also includes the rural residential properties surrounding these communities.

Note: The city of Park Hills was created recently when the former towns of Flat River, Esther, Rivermines, Frankclay, Wortham, and Elvins combined.

OU-2 includes the remedial action to address terrestrial ecological risks and impacted watersheds associated with the mine wastes. OU-2 will also include future work on the Doe Run Pile.

OU-3 consists of the Interim Program and Halo Removal Action to address elevated blood lead at the site. The final ROD for the other OUs will be issued in the future.

History of Investigations

The EPA and the Missouri Department of Health (MDOH) began investigating the Site in 1991. These investigations focused on the effects of the mine waste from the Desloge (Big River) Pile. In order to investigate a broader area, EPA performed a Listing Site Inspection in 1991 and a Site Assessment in 1992, which resulted in the site listing on the National Priorities List 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.

The site inspection and site assessment identified potential sources of mine 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 a number of heavy metals in samples of mine waste, groundwater, sediment and soil.

Studies conducted by the MDOH including a Preliminary Public Health Assessment in 1994 and a lead exposure study in 1997 concluded that 17 percent of children tested in the mining area of St. Francois County had elevated levels of lead in their blood. As a result of the elevated blood lead levels in children, in 1997 and 1998, MDOH followed the Exposure Study with the St. Francois and Jasper Counties Lead Intervention Study in 2000 as an effort to reduce the percentage of elevated blood leads in children at the site.

In 1997, the EPA entered into an Administrative Order on Consent for RI/FS with the Doe Run Resources Corporation and ASARCO Incorporated. The RI//FS was completed and released in 2011. The FS developed the alternatives for the remedial action for the residential properties. As part of the FS, an investigation of lead contamination in the subsurface soils was conducted. This investigation focused on the subsurface soils at 58 residential properties in the mining areas. Soil core samples were collected in six-inch intervals, moving down in the soil profile to 30-inches bgs. The Subsurface Soil Report concluded that 93 percent of the elevated lead concentrations were found in the upper 12-inches of soil. The results of this Subsurface Investigation are part of the FS. The remedial alternatives developed and evaluated in the FS form the basis of this Proposed Plan. The FS is located in the AR for this site.

In 2000, the EPA entered into an Administrative Order on Consent with The Doe Run Resources Corporation for implementation of a soil testing and removal program, and blood lead testing and control program within the site. This Order provided that these programs would end when either the EPA issued a ROD for residential yards or after four years. In 2004, the EPA entered into another Administrative Order on Consent for Removal Action to replace the 2000 Order, which under its terms was expiring. The 2000 Order then became known as the Interim Action. The 2004 removal action is ongoing.

The 2004 Administrative Order is called 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 requires removal actions within the halo around each of these waste areas. The halo is 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.

At the end of the Interim Action (March 30, 2004), 1,955 residential yards had been sampled and 563 homeowners had refused sampling. Under the Halo Removal Order, 27 additional yards have been sampled; of these yards 22 were sampling refusals during the Interim Action, two were not within the Halo but were sampled due to the presence of a child with elevated blood-lead levels, and two were childcare facilities.

SITE CHARACTERISTICS

The primary land use within St. Francois County since mining operations have ended is agricultural crop and pasture land. Industrial activities consist of light manufacturing, aggregate production, and construction. The 2000 census indicated that the population of St. Francois County is 55,641 with most (55 percent) of the population living in Farmington, Park Hills, Desloge, and Bonne Terre. See Table 1 in Appendix B (2000 census population in the cities/communities of St. Francois County). The communities of Farmington, Bismarck and Iron Mountain Lake are outside the mining area but will be included in future investigations. The city of Park Hills and the smaller towns of Leadwood, Leadington and Doe Run are located within the site.

The site is located within the Salem Plateau section of the Ozark physiographic province. The topography is hilly with several hundred feet of relief with altitudes ranging from about 700 to 1,000 feet above mean sea level (msl). The climate in St. Francois County is continental with cold winters and hot summers. Annual precipitation is approximately 40 inches with a rainy season in fall and winter. Average annual snowfall is 13.7 inches. Prevailing winds are from the south.

The site is located on the flanks of the St. Francois Mountains, a positive topographic structure in the southeast portion of the county composed of Precambrian granite and volcanic rocks. Cambrian sedimentary rocks are present above the Precambrian rocks and are, from oldest to youngest, the Lamotte Sandstone, Bonneterre Formation, Davis Shale, Derby-Doe Run Dolomite, Potosi Dolomite and Eminence Dolomite.

The Bonneterre Formation is host to most of the ore bodies and is composed mostly of dolomite. The Bonneterre Formation is 200 to 400 feet thick. The dolomite occurs as halos around igneous knobs that extend into or through the Bonneterre Formation. Away from these igneous paleo-topographic highs, the Bonneterre Formation is composed of unmineralized limestone. The lower 100 feet contain a variety of depositional structures where the richest ore was concentrated. The most abundant sulfide minerals in the Bonneterre Formation are galena, sphalerite, chalcopyrite, pyrite, and marcasite. Sphalerite (zinc ore) is restricted to certain areas of the district and is much less common than in the Tri-State Mining District of northeast Oklahoma, southwest Missouri, and southeast Kansas.

As set forth above, past mining operations have resulted in at least eight identified major mine waste areas in the form of tailings and chat deposits from smelting and mineral processing operations in St. Francois County. Five of the mine waste deposits have been stabilized in place and there are plans in place to address the remaining areas. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. The mine waste has contaminated soil, sediment, surface water and groundwater. Mine waste has also been transported by wind and water erosion and manually relocated to other areas throughout the county. It has been reported that mine waste may have been used on residential properties for fill material and private driveways and as aggregate for road construction.

The eight mine waste areas are the source deposits and constitute the principal threat to human health and the environment. This threat is being addressed by stabilizing the mine waste deposits in place, which includes regrading and covering the mine waste deposits with clean rock and/or soil. These areas are covered with clean soil and revegetated. In place stabilization of the mine waste deposits provides adequate protection when combined with institutional controls, such as site access restrictions (fences, rock barriers, etc.). In addition, removal or treatment of the very large mine waste deposits (>5,000,000 cubic yards) is impracticable.

The residual waste found in the residential soils is considered a low-level threat waste, which is defined as surface soil containing contaminants of concern that generally are relatively immobile in air or ground water in the specific environmental setting (OSWER, Publication 9380.3-06FS, 1991). However, the residual waste in soil has the potential to be a principal threat waste when it is mobilized by mechanical means; therefore, remediation is necessary to mitigate the potential risk.

SCOPE AND ROLE OF THE RESPONSE ACTION

This Proposed Plan sets forth the proposed response action and represents EPA's approach to address OU-1, residential properties and high child exposure areas at the site. OU-1 includes lead-contaminated surface soils present at residential properties across the site that have been contaminated as a result of migration of metal-bearing materials from past mining practices via natural erosional processes, wind-blown mine waste, and human activities. For the purposes of this Proposed Plan, the term residential properties includes properties that contain single- and multi-family dwellings, apartment complexes, vacant lots in residential areas, schools, daycare centers, playgrounds, parks and green ways.

The EPA proposes to address the residential properties as the first remedial action to expedite cleanup of the areas that pose the greatest and most immediate threats to human health. This first remedial action for the site is a continuation of the residential soil cleanup actions that have been ongoing in St. Francois County since the 2000 Interim Action. Additional remedial actions at the site, such as actions for protection of the Big River watershed and stabilization of the Doe Run pile will be addressed under future Proposed Plans and RODs.

The estimated total number of residential properties with lead-contaminated soil that will be addressed under this remedial action is approximately 4,000. This estimate is based upon the 1,000 properties remaining to be addressed under the Halo Removal Action and an additional estimated 3,000 properties that have not been sampled but that potentially could exceed 400 ppm lead in soil.

As set forth below, the action level for lead in residential soil, 400 ppm, is based on the site-specific HHRA described in the next section, and the site-specific blood lead study. This action level also assumes lead is measured in the bulk soil sample with an X-Ray Spectrometer instrument.

SUMMARY OF SITE HUMAN HEALTH RISKS

A Baseline HHRA was conducted for the site by EPA in 2009. The HHRA assesses the potential risks to humans, both present and past, from site-related contaminants present in environmental media including surface soil, indoor dust, sediment, surface water, groundwater and fish tissue. The HHRA assumes that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media. The results of the HHRA are intended to inform risk managers and the public about potential human health risks attributable to site-related contaminants and to help determine if there is a need for action at the site.

The HHRA identified lead as the primary contaminant of concern for OU-1. Other metals (zinc and cadmium) were identified in non-residential soil and stream sediment and are considered COCs along with lead in OU-2. The focus of this Proposed Plan is the risk associated with lead because it is the primary COC for residential properties at the site. For further information, please refer to the HHRA in the Administrative Record.

Young children (typically defined as seven years of age or below) are the most sensitive population group potentially exposed to lead contamination at the site. Young children are most susceptible to lead exposure because they have higher contact rates with soil and dust, absorb lead more readily than adults, and are more sensitive to the adverse effects of lead than older children and adults. The effect of exposure to lead contamination of greatest concern in children is impairment of the nervous system, including learning deficits, lowered intelligence and adverse effects on behavior.

The risk for adverse health effects from exposure to lead contamination is evaluated using a different approach than for most other metals. Because lead is widespread in the environment, exposure can occur by many different pathways. Thus, the risk of exposure to lead is based on consideration of total exposure (all pathways) rather than just site-related exposure. In addition, because most studies of lead exposures and the resultant health effects in humans have traditionally been described in terms of the resulting level of lead in the blood (expressed in micrograms/deciliter [µg/dl]), lead exposures and risks are typically assessed using mathematical models.

In determining the acceptable level to clean up soil in residential yards at the site, the HHRA used the EPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children to estimate the distribution of blood lead levels in a population of residential children exposed to lead at the

site. As set forth above, the focus of a risk assessment for lead in a residential setting is on children because they are a more sensitive population than older children or adults. Thus, the IEUBK model was used to evaluate the risks posed to young children (6 to 84 months) as a result of exposure to lead contamination at the site.

The EPA's health protection goal is that there should be no more than a 5 percent chance of exceeding a blood lead level of 10 µg/dl in a given child or group of similarly-exposed children. The basis for this goal is the Centers for Disease Control and Prevention and the EPA analyses demonstrating health effects at or above a blood lead level of 10 µg/dl.

The IEUBK model uses site-specific and default inputs (e.g., soil concentration, indoor dust concentration, bioavailability) to estimate the probability that a child's blood lead level might exceed 10 µg/dl.

For a residential child, the IEUBK model used available site-specific data, including lead concentrations in residential property soil, indoor dust and groundwater. In addition, testing was performed to estimate the relative bioavailability of the lead present at the site. Bioavailability testing measures the amount of lead absorbed into the body following incidental ingestion of soil. The results indicate that bioavailability of lead at the site is greater than the IEUBK model default value of 30 percent. Based on results of site-specific measurements of *in vivo* bioavailability and *in vitro* bioaccessibility, the bioavailability of lead in soil and dust was estimated as 37 percent.

Risk Estimates for Residents from Soil

The IEUBK model was used to assess lead exposures to young children at the site and within each community. Based on site-specific information, the EPA's IEUBK model predicts that a young child residing at the site will have greater than a 5 percent 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 337 ppm under the assumed exposure conditions. This is based on a site-specific absolute bioavailability of 37 percent.

In addition to the modeling performed by the EPA, one of the potentially responsible parties for the site performed a site-specific Blood Lead Study. This study paired actual blood-lead level measurements of 162 children with the corresponding residential yard soil lead concentrations. The study plotted actual blood-lead levels with projected blood-lead levels based on the site-specific absolute bioavailability of 37 percent. The study also plotted the blood-lead levels based on the default absolute bioavailability of 30 percent. The Blood Lead Study showed that a cleanup level of 400 ppm lead in residential soils would reduce risk to children to less than a 5 percent chance of having a blood lead level exceeding 10 µg/dl. Therefore, the EPA has concluded that 400 ppm lead in residential yard soil will be the cleanup level of the remedial action as measured in the bulk soil fraction (sieving the soil sample with a #10 mesh sieve to obtain particles less than two millimeters) based on analysis with an XRF instrument. Based upon this clean up level, an estimated 4,000 homes at the site are of potential health concern with regard to lead contamination to yard soil. This number is based on existing data which shows that 79 percent of properties sampled have lead levels greater than 400 ppm.

Risk Estimates for Residents from Groundwater

During the RI, 189 wells were sampled. Many of these wells were located close together in clusters. The results of this testing show no consistent contamination at these clusters and suggests no wide-spread impacts from lead mining at the site to groundwater. Instead, elevated lead concentrations (lead > 15 µg/l) occur sporadically and were limited to four wells and could not be linked to the mining activities at the site.

Further, groundwater concentrations fall within the range of those typical for drinking water in the area. Fifty-four percent of the wells tested were found to be at or below a lead concentration of 1 µg/l, and 85 percent were at or below the IEUBK model default of 4 µg/l. Further, 97 percent of the wells tested were at or below 15 µg/l, the level at which municipal supplies must attempt to reduce lead exposure. Significantly elevated risks due to exposure to lead in groundwater appear to be limited to a small number of domestic well locations.

Summation

In past experience at Superfund sites where lead is the contaminant of concern, the EPA generally selects a residential soil cleanup level within the range of 400 ppm to 1,200 ppm for lead, based on the IEUBK model results and the nine criteria analysis included in this Proposed Plan and in accordance with the NCP. As described above, the IEUBK modeling results for the site along with the Site-Specific Blood Lead Study recommend a lead soil concentration of 400 ppm to ensure that a child has less than a 5 percent probability of having a blood-lead level exceeding 10 µg/dl.

This Proposed Plan only addresses human health risk at residential properties within the site. Since this Proposed Plan only addresses human health, a summary of the Ecological Risk Assessment has not been included in this Proposed Plan. The Ecological Risk Assessment identified significant risk to ecologically sensitive areas and the natural environment. For example, elevated lead and zinc in the sediments and surface waters of Big River and Flat River Creek pose a significant risk to aquatic biota. This and other identified risks to human health and the environment will be addressed in future cleanup decisions. OU-2 will address risk to human health and the environment from lead-impacted nonresidential soil, surface water and sediment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives consist of quantitative goals for: reducing human health and environmental risks and/or meeting established regulatory requirements at Superfund sites. RAOs are identified by reviewing: site characterization data, risk assessments, applicable or relevant and appropriate requirements and other relevant site information. This Proposed Plan addresses the risk to human health resulting from exposure to residential soils contaminated with lead mine waste.

Based on current site data and evaluations of potential risk, lead was identified as being a COC. 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, the EPA's IEUBK model and the Site-Specific Blood Lead Study predict that a young child residing at the site will have greater than a 5 percent 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 will be the cleanup level of the remedial action as measured in the bulk soil fraction using an XRF instrument.

It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health from actual or threat releases.

REMEDIAL ALTERNATIVES CONSIDERED

The FS evaluated three remedial action alternatives. The No Action Alternative was evaluated; however, the EPA believes that the No Action Alternative is not protective of human health and does not consider it a viable option. Each of the other two alternatives would require institutional controls to protect the remedy. The two action alternatives require sampling, excavation, and disposal of lead-contaminated residential yard soils with replacement of soil and reseeding of residential properties. The primary difference between the two action alternatives is the depth of the excavation. As set forth below, Alternative 3 is the EPA's Preferred Alternative. Each alternative is presented in much greater detail in the FS, which is part of the AR for the site. The remedial alternatives developed to address the RAO previously identified in this Proposed Plan for the site are presented below.

Alternative 1: No Action

Estimated Total Capital Cost: $0
Estimated Annual Operation and Maintenance (O&M) Cost Range: $0
Estimated Present Worth Cost: $0
Estimated Construction Time Frame: Zero months
Estimated Time to Achieve RAO: Infinite, RAO unachievable

The NCP requires that EPA consider a no-action alternative against which other remedial alternatives can be compared. Under this alternative, no further action would be taken to monitor, control, or remediate the threat of lead contamination in residential property soil at the site. Alternative 1 would not meet the RAO because it does not minimize or eliminate the existing or future human health risk at the site.

Alternative 2: Soil Removal with 12-inch Subgrade Barrier and Institutional Controls

Estimated Total Capital Cost: $118.3 million
Estimated Annual O&M Cost Range: $0
Estimated Annual Health Education Cost: $20 thousand
Estimated Present Worth Cost: $97.72 million
Estimated Construction Time Frame: 7 years
Estimated Time to Achieve RAO: 7 years

Under this alternative, residential properties with at least one quadrant sample testing greater than or equal to (≥) 400 ppm for lead will have that quadrant, and if applicable the drip zones, remediated. The drip zones would be remediated if the lead concentrations in the drip zone are ≥ 400 ppm. Residential properties where no quadrant samples exceed 400 ppm lead would not be addressed under this alternative. Under this alternative, approximately 4,000 residential properties contain lead soil concentrations greater than 400 ppm and will require remediation. This estimate is based on the properties that have already been sampled in addition to the properties that will be sampled. For more information please refer to the FS in the AR.

It is estimated that the soil at 4,578 residential properties at the site have not been sampled for lead contamination. Under this alternative, all residential properties within the site will be sampled for lead contamination.

This alternative includes excavation and removal of lead-contaminated soil, backfilling the excavation with clean soil and seeding. Excavation of a residential property would be triggered when the highest recorded soil sample for any defined area of the property contains ≥ 400 ppm lead. Soil would be excavated using excavation equipment and hand tools in the portions of the property where the surface soil is > 400 ppm lead. Excavation will continue until either the underlying soil at the bottom of the excavation is less than 400 ppm lead; or to a maximum depth of 12 inches bgs; except for garden areas, where the maximum depth of excavation will be 24 inches bgs.

If at 12 inches bgs the lead soil concentration is greater than 1,200 ppm, placement of a visual barrier will be required. The barrier placed will be an obvious plastic barrier that is permeable, wide meshed and will not affect soil hydrology or vegetation, such as an orange-mesh plastic sheet. The physical barrier will function as a warning that digging deeper will result in exposure to soils contaminated with lead at a level that EPA has determined to be a human health concern. A minimum of 12 inches of clean soil would be used as an adequate soil barrier for the protection of human health. The rationale for establishing a minimum clean soil thickness of 12 inches is that the top 12 inches of soil is considered available for direct human contact. Clean fill and topsoil would be used to replace soil removed after excavation, returning the residential property to its original elevation and grade.

Based on the EPA's previous soil removal activities at the site, the EPA estimates that a total of approximately 1,247,000 cubic yards (yd^3) of soil would be required for excavation, disposal and replacement. This alternative uses this quantity to develop the cost estimate.

Excavated soils will be transported in covered trucks to the soil repositories located at the Desloge (Big River) Pile and the Leadwood Pile (Figures 2 and 3, Appendix A). The contaminated soil will be placed in the soil repositories, capped with a clean 12-inch layer of soil and revegetated with an appropriate seed mix. The placement of the contaminated soil will improve conditions at each of these mine waste piles by reducing the amount of wind-blown lead contaminated dust transported off the piles. It will also reduce water infiltration of the piles. The capacity of the soil repositories has not been determined but will be determined during the Remedial Design. The Operation and Maintenance at the Big River Mine Tailings Pile will be implemented per the conditions of the Administrative Order on Consent (Docket # VII-94-F-0015). The Operation and Maintenance at the Leadwood Mine Tailings Pile will be implemented per the conditions of the Unilateral Administrative Order (Docket # CERCLA-07-2006-0272).

After replacement of topsoil at each residential property, the property will be hydroseeded to restore the vegetation. Hydroseeding is preferred over sodding for its ease of initial maintenance and significant cost reduction. However, sod may be used in areas of properties with steep slopes that would be subject to erosion before the vegetation can be established.

Health education is required under this alternative to reduce potential adverse health effects. An active educational program would be conducted in cooperation with the EPA, ATSDR, MDNR, MDHSS and the St. Francois County Health Department. The educational activities would primarily be conducted by the St. Francois County Health Department. The following activities are examples of the types of education activities that may be conducted as part of this alternative.

- Extensive community-wide blood-lead monitoring.
- In-home assessments for children identified with elevated blood lead levels.
- Distribution of prevention information and literature.
- Outreach activities directed to area physicians.
- Community education meetings; and distribution of literature at such presentations at civic clubs, schools, nurseries, pre-schools, churches, fairs.
- Family assistance.
- Special projects to increase awareness of heavy metal health risks.

Institutional Controls: Alternative 2 requires institutional controls because lead contamination will remain at unlimited concentrations below 12 inches bgs. Based upon the FS, approximately 7 percent, or about 280, of the residential properties at the site subject to remediation would remain contaminated with lead at levels above 1,200 ppm at 12-inches bgs. Each of these remediated properties would be subject to ICs.

The EPA has historically required ICs to ensure a remedy's long-term protectiveness. 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 include but are not limited to the following:

- Establishment of a registry of residential properties that have greater than 1,200 ppm at 12-inches bgs with the St. Francois County Health Department.
- Yards subject to the ICs will also be extensively evaluated during each five-year review to ensure protectiveness. This will ensure the remedy has remained protective.
- Possible building permit requirements that would involve pre-screening properties for lead.
- Builder and developer education programs for dealing with heavy metal soil contamination and best management practices for construction workers.
- Deed restrictions.

Future land use of the remediated residential properties is assumed to be residential. Under this alternative, land use will be enhanced because lead-contaminated soil will be removed from the remediated properties.

Alternative 3: Soil Removal with 24-inch Excavation with limited Institutional Controls

Estimated Total Capital Cost: $130.3 million
Estimated Annual O&M Cost Range: $0
Estimated Annual Health Education Cost: $20 thousand
Estimated Present Worth Cost: $107.62 million
Estimated Construction Time Frame: 7 years
Estimated Time to Achieve RAO: 7 years

Alternative 3 also requires remediation of residential properties where a quadrant sample result shows greater than 400 ppm lead. The entire drip zone will be remediated if the lead concentration in the drip zone is greater than 400 ppm. Residential properties where quadrant samples do not exceed 400 ppm lead would not be addressed under this alternative.

Under this alternative, approximately 4,000 residential properties contain or are expected to contain quadrant lead soil concentrations greater than 400 ppm and will require remediation. In contrast to the requirements for excavation in Alternative 2, Alternative 3 will require further excavation if the lead concentration is above 1,200 ppm at 12 inches. Excavation will continue in 6-inch lifts until either a maximum depth of 24 inches; or underlying soils at the bottom of the excavation are below 1,200 ppm lead.

Based on the Subsurface Investigation, approximately 7 percent of properties, or 280, may be contaminated with lead at concentrations greater than 1,200 ppm at 12 inches bgs. The FS estimates that a total of approximately 1,280,000 yd^3 of soil would require excavation, disposal and replacement. This estimate is used as the basis for part of the cost estimate for this alternative. This alternative also requires placement of a visual barrier if at 24 inches bgs the lead soil concentration is greater than 1,200 ppm. The barrier placed will be an obvious plastic barrier that is permeable, wide meshed, and will not affect soil hydrology or vegetation, such as an orange-mesh plastic sheet. The physical barrier will function as a warning that digging deeper will result in exposure to soils contaminated at a level that EPA has determined to be a human health concern.

A minimum of 24 inches of clean soil would be used as an adequate soil barrier from basal soil contaminated above the cleanup level for the protection of human health. The rationale for establishing a minimum clean soil thickness of 24 inches is that the top 24 inches of soil is considered available for direct human contact. Clean fill and topsoil would be used to replace soil removed after excavation, returning the residential property to its original elevation, grade, and potential.

As set forth above, the EPA estimates that approximately 4,578 residential properties have not been sampled for lead contamination. Under this alternative, all residential properties within the site will be sampled for lead contamination to determine if they have been impacted by mining-related activities. If a soil sample for a property quadrant has a lead concentration greater than 400 ppm, the property will be included in the remedial action.

ICs: ICs would be required on properties greater than 1,200 ppm lead at 24-inches bgs. The FS estimated that ICs would be applicable to approximately 2 percent or 80 properties. ICs are the same as Alternative 2.

The repositories, vegetation restoration, and health education are the same as Alternative 2. Future land use for the Site under Alternative 3 is expected to be similar to Alternative 2.

EVALUATION OF ALTERNATIVES

Summary of the Comparative Analysis of Alternatives

The NCP, 40 C.F.R. Part 300, requires the EPA to evaluate remedial alternatives against nine criteria to determine which alternative is preferred. This analysis is performed during the FS. The detailed analysis in the FS provides an in-depth analysis of the three alternatives compared against the nine criteria. The FS is available in the AR for the site. An alternative must satisfy all nine criteria before it can be selected. The first step is to meet the threshold criteria, which are overall protection of public health and the environment and compliance with ARARs. In general, alternatives that do not satisfy these two criteria are rejected.

The second step is to compare the alternatives against a set of balancing criteria. The NCP establishes five balancing criteria which include long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; implementability; short-term effectiveness; and cost. The third and final step is to evaluate the alternatives on the basis of modifying criteria, which are state and community acceptance.

Threshold Criteria

The following presents a brief description of how the alternatives satisfy the threshold criteria of overall protection of public health and the environment and compliance with ARARs.

Overall Protection of Human Health and the Environment

This criterion provides an overall assessment of whether an alternative meets the requirement that it is protective of human health and the environment. This criterion considers whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls or treatment.

Alternative 1 does not provide protection for human health and the environment at the site because of the continued risk to residents of the site. Alternative 1 does not meet the RAO identified for this site. Lead contaminated residential soil will continue to pose exposure risk for an indefinite period.

Alternative 2 provides protection to human health by removing the significant exposure pathway associated with contaminated residential property soils. Alternative 2 would meet the RAO for the site once excavation, soil replacement and revegetation is complete, and the removed soils are properly disposed, enforceable ICs are implemented and an effective health education program is implemented. Risks associated with lead-contaminated residential property soil will be mitigated.

Alternative 3 is protective of human health by addressing the risks associated with lead contaminated residential soil. Alternative 3 is more protective of human health than Alternative 2 because Alternative 3 requires removal of soil below 12 inches bgs if the soil is contaminated above 1,200 ppm lead. Alternative 3 requires removal of contaminated soil to a maximum depth of 24-inches bgs. Alternative 3 would also meet the RAO for the site. Alternative 3 would reduce the number of properties that would require ICs by an estimated 200 properties, which are potentially difficult to implement on residential properties. The FS showed that by excavating beyond 12-inches bgs and to a maximum depth of 24-inches bgs, approximately 98 percent of the properties will have safe lead concentrations and will not be subject to ICs. Because there are fewer residential properties contaminated at depth below 12 inches, fewer visual barriers would be required to be installed under Alternative 3.

Compliance with ARARs:

This criterion is used to determine whether an alternative meets federal and state ARARs as defined by section 121 of CERCLA, 42 U.S.C. § 9611. Compliance is judged with respect to chemical-specific, action-specific, and location-specific ARARs as well as to be considered requirements that include nonpromulgated criteria, advisories, guidance and proposed standards issued by federal or state governments. The ARARs for this Proposed Plan are included in attached Tables 2 through 4.

Alternative 1 does not comply with ARARs because this alternative does not take any action to mitigate the risk associated with lead.

In contrast, Alternative 2 and Alternative 3 would comply with chemical- and location-specific ARARs because they both address the risk.

Alternatives 2 and 3 will also meet the action-specific ARARs. Action-specific federal and state ARARs would be achieved by making sure all soil above the cleanup level is excavated, transported and disposed of properly. Storm water runoff will be kept to a minimum during excavation, soil replacement and hydroseeding using best management practices, thus keeping local streams free of additional sediment. Dust suppression will be used during all phases of construction and time spent at each residence will be kept to a minimum to minimize exposure to the residents. All precautions will be considered at each location to ensure that excavation will not hinder or interfere with wildlife and local streams.

Balancing Criteria

The following presents a brief description of how the alternatives developed in the FS satisfy the balancing criteria.

Long-term Effectiveness and Permanence

This criterion addresses the results of a cleanup action in terms of the risk remaining at the site after the goals of the cleanup have been met. The primary focus of this evaluation is to determine the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

Alternative 1 provides no long-term effectiveness or permanence for the protection of human health and the environment. Alternative 1 provides no controls to manage residual risk associated with lead contamination to soil at residential properties. Under Alternative 1, residual risks to human health would remain at or near current levels.

Under Alternative 2 and Alternative 3, the residual risks (the risk remaining after implementation) would be significantly reduced. Under both Alternative 2 and Alternative 3, the residual risk is the lead contamination left in place at depth after the completion of the remedy. This risk is managed by clean soil cover and use of a visual barrier to warn of the remaining contamination. While both Alternative 2 and Alternative 3 manage the residual risk in this manner, Alternative 3 would provide the most long-term effectiveness and permanence because the lead contamination (>1,200 ppm) would be covered with a 24-inch barrier of clean soil compared to the 12-inch barrier of clean soil in Alternative 2.

A significant aspect of Alternative 2 and Alternative 3 is the placement of the contaminated soils at the Desloge Pile (Big River Pile) and Leadwood Pile Soil Repositories. The repositories would require storm water controls and other design and engineering controls for long-term stability.

Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment:

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the contaminants. This criterion evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

Under Alternative 1 there is no reduction in the toxicity, mobility, or volume of contamination because lead contaminated soils are left in place.

Alternatives 2 and 3 would significantly reduce the mobility of the COC by transporting and consolidating the lead contaminated soils from the residential yards and high-child exposure areas at the Desloge Pile (Big River Pile) and Leadwood Pile Soil Repositories. Contaminated soil would be placed at the repositories in designated areas that are not prone to erosion. After placement, the contaminated soil would be capped with clean soil, less than 400 ppm and revegetated. The cap thickness and seed mix for revegetation will be determined during the final design. Although the exposure pathway would be eliminated or minimized, the toxicity and volume of the material would not be reduced by these alternatives. Proper long-term maintenance of the designated repositories is an important component of Alternatives 2 and 3 to ensure the significant reduction of heavy metal mobility.

Short-term Effectiveness

This criterion addresses the effects of the alternative during the construction until the remedial action is completed and the selected level of protection has been achieved.

Alternative 1 does not create any short term risk to the local community or workers because no work will be performed under Alternative 1. Alternative 1 also does not create any short term risk of environmental impact during construction since there is no construction under this alternative. Exposure pathways for the public and environment would remain.

Alternatives 2 and 3 have increased risks to the local communities and workers, as well as the environment from excavation and transportation of lead contaminated soil. Short-term community protection concerns are similar under both Alternative 2 and 3, and include possible fugitive dust emissions and heavy metal ingestion. Disturbed contaminated soil could enter the ambient air during excavation and transportation. Dust suppression would be implemented for the protection of the community and workers during the remedial action. Alternatives 2 and 3 would require a minimum of seven years to implement for all affected residences. However, the length of time at any one residence during excavation would be minimal. Therefore, the residential exposure to dust would be minimal.

Implementability:

This criterion addresses the technical and administrative feasibility of implementing a cleanup and the availability of various services and materials required during its implementation.

Alternative 1 does not require any implementation.

Alternative 2 and Alternative 3 are readily implementable because they are technically feasible from an engineering perspective. Excavation methods, backfilling, and revegetation are typical engineering controls. The experience gained from previous site removal actions conducted by the EPA at this and other lead mining Superfund sites has shown that Alternative 2 and Alternative 3 are readily implementable.

Cost:

This criterion addresses the direct and indirect capital cost of the remedy. Operation and maintenance costs incurred over the life of the project, as well as present worth costs, are also evaluated.

No capital or O&M costs would be associated with Alternative 1 because no remedial actions would be conducted.

The present worth cost for Alternative 2 is estimated to be $97.72 million.

The present worth cost for Alternative 3 is estimated to be $107.62 million.

For the cost estimates for both Alternative 2 and 3, capital costs are spread over a period of 30 years. A 7 percent discount rate was used to calculate the present worth. These estimates are approximate and made without detailed engineering data. The actual cost of the remedial action would depend on the final scope of the remedial action, actual length of time required to implement the alternative and other unknown factors.

The historical average amount of soil removed from each property is 305.19 yd^3. These estimates are averages of past construction activities on this Site but future costs could well vary. Annual costs of $20,000 are estimated for public health education. Additional information on cost can be found in Tables 5 and 6 of Appendix B.

Modifying Criteria

The two modifying criteria of community and state acceptance are intended to assess the views of both groups regarding the Alternatives. The EPA conducts meetings with representatives from MDNR, Missouri Department of Health and Senior Services, U. S. Agency for Toxic Substances and Disease Registry, St. Francois County Health Department, news media, visiting academics and students, and local citizens to address activities and policies at the site on a regular basis.

State/Support Agency Acceptance

MDNR supports the Preferred Alternative (Alternative 3) proposed by the EPA. MDNR has approved this same type of work in removal and remedial actions at this and other sites throughout Missouri. However, state acceptance of the Preferred Alternative will be fully determined after the public comment period closes for the Proposed Plan and associated FS.

Community Acceptance:

Community acceptance of the Preferred Alternative is expected. However, the Preferred Alternative will be reevaluated after the public comment period ends and will be modified or rejected, if necessary. A Responsiveness Summary (which addresses public comments) will be reviewed, evaluated, and considered prior to any EPA decision on a remedy selection at this site. This summary will be part of the ROD.

PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 3 — Excavation of 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 bgs; transportation of contaminated soil to on-site soil repositories; replacement of contaminated soil with clean backfill, vegetative cover and limited institutional controls.

The Preferred Alternative was chosen over the other alternatives by the EPA based on the nine NCP criteria set forth above. The Preferred Alternative provides the best balance of trade-offs and achieves the RAO. A primary consideration is the significant reduction in the number of properties that would require difficult-to-implement ICs as a result of the more extensive excavation (to a depth of 24 inches bgs) which would be required at a relatively small number of properties. However, the Preferred Alternative may be altered in response to public comment or new information.

The EPA expects the Preferred Alternative to satisfy the following statutory requirement of section 121(b) of CERCLA: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met. The following sections discuss how the Preferred Alternative meets these statutory requirements.

Protection of Human Health and the Environment

The Preferred Alternative will protect human health and the environment at remediated residential properties by achieving the RAO through conventional engineering measures. Risks associated with lead-contaminated residential soils at the site are caused by the potential for direct contact with contaminated soils. The Preferred Alternative eliminates this direct exposure pathway through excavation and replacement of lead-contaminated soils at the residential properties. Contaminated soils will be removed from residential properties, permanently eliminating this identified source of exposure. The implementation of the Preferred Alternative will not pose unacceptable short-term risks or cross-media impacts.

Compliance with ARARs

In general, preferred alternatives should comply with ARARs unless waivers are granted. The Preferred Alternative is expected to meet all chemical-specific, action-specific, and location-specific ARARs and does not involve any waivers. The ARARs for this Proposed Plan are included in Tables 2 through 4 in Appendix B.

Cost Effectiveness

The Preferred Alternative is a cost-effective solution to lead-contaminated residential soils at the site. The Preferred Alternative relies on conventional engineering methods that are easily implemented. Contaminated soils are removed and replaced, thereby providing a permanent remedy for remediated residential soils which will not be subject to future costs.

Utilization of Permanent Solutions and Alternate Treatment Technologies

The Preferred Alternative utilizes a well-demonstrated remediation approach to lead-contaminated soils that will provide a permanent remedy for residential properties. Removal and replacement of contaminated residential soils permanently removes heavy metal contaminants as a potential source of exposure. Since all contaminated soil will remain on-site, lead stabilization treatment is not required to prevent the soils from failing the Toxicity Characteristic Leaching Procedure test. The Preferred Alternative best satisfies the statutory mandates for permanence.

Preference for Treatment

The Preferred Alternative does not utilize treatment to address the threats posed by the residential property soils. The residual waste found in the residential soils is considered a low-level threat waste, which is defined as surface soil containing contaminants of concern that generally is relatively immobile in air or ground water in the specific environmental setting (OSWER, Publication 9380.3-06FS, 1991).

Additionally, no treatment technologies were identified that have definitively demonstrated the ability to reliably provide short- and long-term effectiveness, permanence and meet the other NCP criteria. Various phosphate compounds have been used at the Viburnum Tailings Pile site and the Oronogo-Duenweg Mining Belt Superfund site to treat mine waste and lead-contaminated soil. In both cases the phosphate compounds were shown to be an ineffective and unfeasible alternative when compared to soil removal and replacement.

Under the Preferred Alternative for this site, contaminated soil will be placed on the existing repositories located at the Desloge Pile (Big River Pile) and Leadwood Pile. The contaminated soil will be placed on the repositories, capped with a clean 12-inch layer of soil and revegetated with a site-specific seed mix. The placement of the contaminated soil will improve conditions on the mine waste piles by reducing the amount of wind-blown lead contaminated dust transported off the piles and will also reduce water infiltration of the piles. Since contaminated soil will remain on-site, treatment is not required to prevent the soils from failing the TCLP test.

COMMUNITY PARTICIPATION

The EPA relies on public input to ensure that the concerns of the community are considered in selecting an effective remedy for each Superfund site. To this end, an AR containing the HHRA, the RI Report, the FS Report and all other documents supporting this decision have been made available to the public for a 30-day public comment period which begins on July 22, 2011 and concludes on August 22, 2011.

A public meeting will be held on August 4, 2011, at 6:30 p.m. at Mineral Area College, North College Center, Rooms A and B, 5270 Flat River Road, Park Hills, Missouri. The EPA will present the Proposed Plan, the Preferred Alternative and receive public comments, both verbal and written.

Comments received at the public meeting, as well as written comments submitted during the comment period, will be addressed in the Responsiveness Summary section of the ROD, the document which formalizes the selection of the remedy.

As set forth above, the site was listed on the NPL in 1992. Since that time the EPA has held numerous public meetings to share the results of Engineering Evaluation/Cost Analysis at the source mine waste piles; update the public on the activities at the mine waste piles; discuss the establishment of soil repositories at the mine waste piles; and to discuss strategies for addressing lead contaminated soils. In addition to these public meetings, the EPA has conducted other outreach events and activities to support community involvement and engagement, including:

- Round table meetings which included participation from local, county, state, and federal representatives;

- Health screenings and door-to-door visits;

- Coordination with County Commissioners;

- Field office established to better respond to citizen needs;

- Involvement of the Mineral Area College & student curriculum; and,

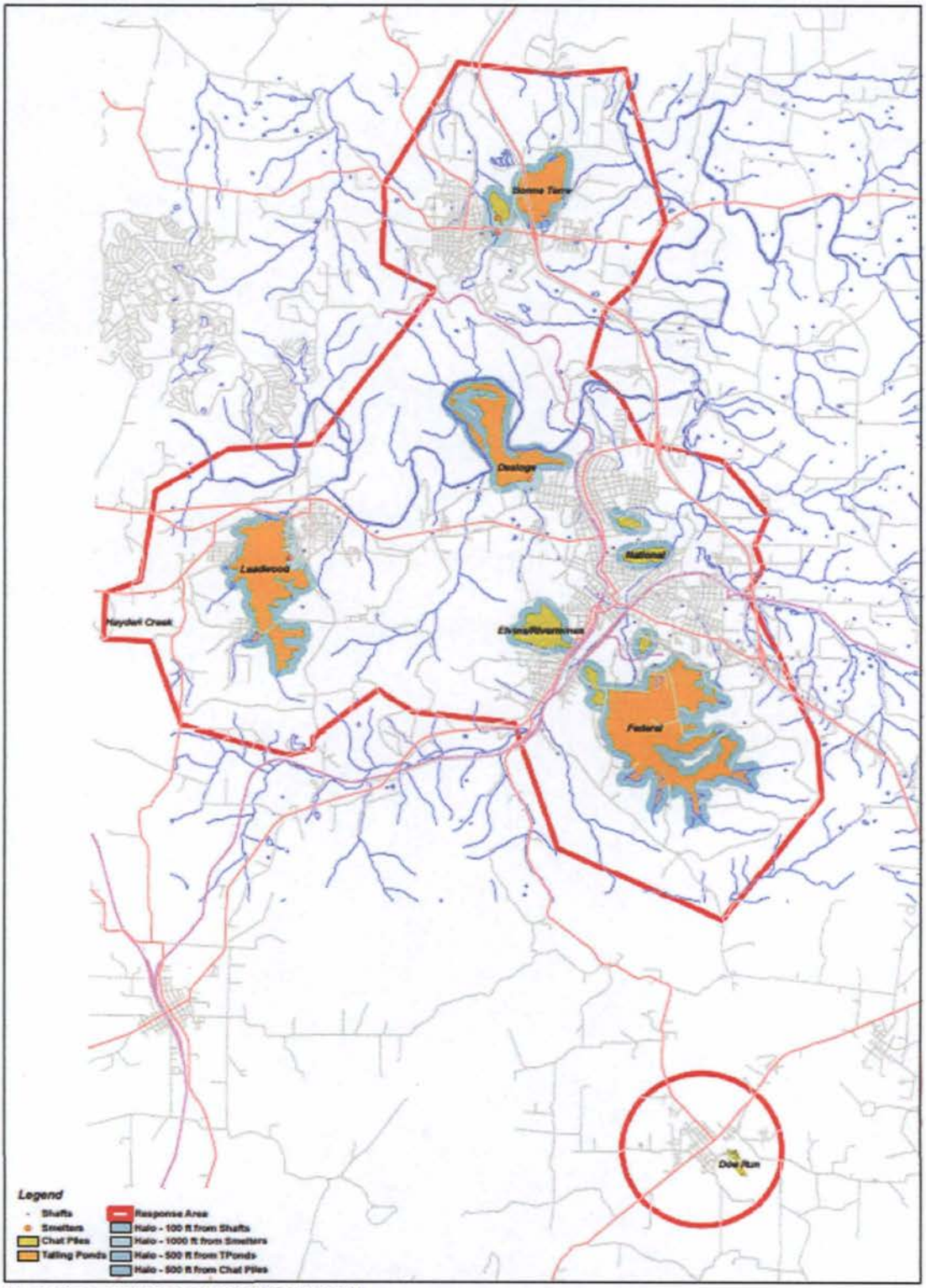
- Coordination with school officials and parents.

All written or verbal comments should be addressed to:

Ms. Debbie Kring, Public Affairs Specialist
Office of Public Affairs
U.S. Environmental Protection Agency, Region 7
901 North 5th Street
Kansas City, Kansas 66101
Telephone: 1-913-551-7725 or 1-800-223-0425
Email: kring.debbie@epa.gov

APPENDIX A

FIGURES



Source: Figure reconstructed from Halo AOC's Exhibits A and B

N

0 3,000 6,000 12,000 18,000 24,000 Feet

Figure 1
Response Area and Halo
St. Francois Co. Mined Areas

Figure 2. Big River (Desloge) Repository

Figure 3. Leadwood Repository

APPENDIX B

TABLES

TABLE 1. ST. FRANCOIS COUNTY 2000 CENSUS INFORMATION

City/Community	Population
Farmington	13,924
Park Hills	7,861
Desloge	4,802
Bonne Terre	4,039
Bismarck	1,470
Leadwood	1,160
Iron Mountain Lake	693
Leadington	206
Balance of St. Francois County	21,486

Source: United States Census Bureau, 2001

TABLE 2. FEDERAL AND STATE CHEMICAL SPECIFIC ARARS

Standard, Requirement or Criteria	Applicable	Relevant and Appropriate	Citation	Description	Comment
FEDERAL					
Hazardous Waste Criteria	Potentially	--	40 CFR 264	Establishes criteria for use in determining hazardous wastes and disposal requirements. Excavated soil would be classified as D008 hazardous waste if the lead concentration from the TCLP test was greater than 5.0 mg/L.	Would be applicable if hazardous wastes are generated and disposed of off-site at a RCRA Facility. All excavated yard soils would be disposed of in an onsite CAMU. This regulation would potential apply if any of the wastes were disposed of off-site.
National Ambient Air Quality Standards (NAAQS)	No	Yes	40 CFR Part 50	Establishes ambient air quality standards for certain "criteria pollutants" to protect public health and welfare. Standard is: 1.5 microgram lead per cubic meter ($\mu g/m^3$) maximum – arithmetic mean averaged over a calendar quarter.	NAAQS are implemented through the New Source Review Program and State Implementation Plans (SIPs). The Federal New Source Review Program addresses only major sources. Emissions associated with the remedial action would be limited to fugitive dust emissions associated with earth moving activities during construction. These activities will not constitute a major source. Therefore, attainment and maintenance of NAAQS pursuant to the New Source Review Program are not applicable. However, the standards relating to lead are relevant and appropriate.
STATE					
Missouri Ambient Air Standards	Yes	--	Missouri Code of State Regulations (CSR) 10 CSR 010-06.010	Missouri uses the NAAQS as the state standards for airborne emissions. The NAAQS air quality standards for particulates, as PM10, are 50 $\mu g/m^3$ (annual geometric mean) and 150 $\mu g/m^3$ (24 hour), as PM2.5 they are 15 $\mu g/m^3$ (annual geometric mean) and 65 $\mu g/m^3$ (24 hour). The NAAQS emission limit for lead is 1.5 $\mu g/m^3$ averaged over a three-month period.	Relevant and appropriate to actions that generate fugitive dust at individual properties and the staging area.

TABLE 3. LOCATION – SPECIFIC ARARs

Standard, Requirement or Criteria	Applicable	Relevant and Appropriate	Citation	Description	Comment
FEDERAL					
Archaeological and Historic Preservation Act	No	No	16 USC Sec. 469	Establishes procedures to provide for preservation of historical and archaeological data that might be destroyed through alteration of terrain as a result of a Federally licensed activity or program.	Area to be part of soil remedial activities is not believed to contain any historical or archaeological resources due to residential nature of Site and shallow depth (<2 ft) of excavation activities to be performed (if necessary).
Archaeological Resources Protection Act	No	No	16 USC Secs. 470 aa - mm	Requires permits for any excavation or removal of archaeological resources from public or Indian lands. Provides guidance for federal land managers to protect such resources.	Activities will not take place on public land or Indian land.
National Historic Preservation Act	No	No	16 USC Sec. 470 36 CFR Part 800 Executive Order 11593, May 3, 1971	Requires Federal agencies to take into account the effect of any Federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for Register of Historic Places.	Area to be part of soil remedial activities is not believed to contain any feature that would be eligible for registration as a historic place due to residential nature and location of Site.
Historic Sites, Buildings, and Antiquities Act	No	No	16 USC Secs. 461 - 467, 470h-2(f)	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	Area to be part of soil remedial activities is not believed to contain any National Natural Landmarks due to residential nature and location of Site.
Fish and Wildlife Coordination Act	No	No	16 USC Secs. 661 - 666	Requires any Federal agency or permitted entity to consult with the U.S. Fish and Wildlife Service and appropriate state agency prior to modification of any stream or other water body. The intent of this requirement is to conserve, improve, or prevent loss of wildlife habitat and resources.	Area to be part of soil remedial activities is not believed to directly impact any stream or water feature. However, streams adjacent to properties could be potentially affected by runoff from remedial activities.

Standard, Requirement or Criteria	Applicable	Relevant and Appropriate	Citation	Description	Comment
Fish and Wildlife Conservation Act	No	No	16 USC Secs. 2901 - 2912	Requires Federal agencies to utilize their statutory and administrative authority to conserve and promote conservation of non-game fish and wildlife species.	Area to be part of soil remedial activities is not believed to directly impact any stream or water feature. However, streams adjacent to properties could be potentially affected by runoff from remedial activities.
Endangered Species Act	No	No	16 USC Secs. 1531-1544 50 CFR Parts 17, 402	Requires that Federal agencies ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Area to be part of soil remedial activities is not believed to directly impact any critical habitat. Remedial activities will be restricted to residential properties and are not expected to adversely impact listed species.
Federal Migratory Bird Treaty Act	No	No	16 USC Secs. 703 - 712	Prohibits taking of any migratory bird.	Area to be part of soil remedial activities is not believed to directly impact any critical habitat. Remedial activities will be restricted to residential properties and not expected to adversely impact migratory birds.
Executive Order on Floodplain Management	No	No	Executive Order No. 11988	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain.	Remedial activities to be performed are comprised of restoration of residential properties. As such, no additional development within the floodplain is anticipated beyond that previously performed during the original development of the property.

Standard, Requirement or Criteria	Applicable	Relevant and Appropriate	Citation	Description	Comment
Executive Order on Protection of Wetlands	No	No	Executive Order No. 11990	Requires Federal agencies to avoid, to the maximum extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid new construction in wetlands, if a practicable alternative exists.	Remedial activities to be performed are comprised of restoration of residential properties. As such, no adverse impacts on wetlands are anticipated.
Farmland Protection Policy Act	No	No	7 USC Sec. 4201 *et. seq.*	Protects significant or important agricultural lands from irreversible conversion to uses that result in its loss as an environmental or essential food production resource.	Remedial activities to be performed are comprised of restoration of residential properties and are not expected to impact agricultural lands. As such, no loss of environmental or essential food production resources is anticipated.
RCRA – Location Standards for Hazardous Waste Facilities	Potentially	--	42 USC Sec. 6901 40 CFR 264.18	Requires that any hazardous waste facility located within the 100-year floodplain be designed, constructed, operated, and maintained to avoid washout. Also, contains requirements for locating facilities away from seismically active zones. Because most mining and mill wastes are explicitly excluded from RCRA regulations, these requirements are only TBCs for the Site.	All excavated yard soils will be disposed of in an onsite CAMU – BRMTS Repository. This unit, located on a designated mine area, is managed in accordance with the CAMU Approval Memorandum dated December 12, 2001 and the Operation Manual (NewFields 2003).
Rivers and Harbors Act	No	No	33 CFR Secs. 320 - 330	Requires preapproval of the US Army Corps of Engineers prior to placement of any structures in waterways and restricts the placement of structures in waterways.	Area to be part of soil remedial activities is not believed to directly impact any navigable stream or water feature or necessitate placement of any structures within these features.

Standard, Requirement or Criteria	Applicable	Relevant and Appropriate	Citation	Description	Comment
STATE					
Missouri Hazardous Waste Regulations	--	Potentially	10 CSR 25-7.264 - 270	Hazardous waste disposal areas shall not be placed within a 100-year floodplain or wetland. Provisions related to placement and management of hazardous waste units.	Relevant and appropriate to actions that generate hazardous waste. All excavated yard soils will be disposed of in an onsite CAMU – BRMTS Repository. This unit, located on a designated mine area, is managed in accordance with the CAMU Approval Memorandum dated December 12, 2001 and the Operation Manual (NewFields 2003).
Missouri Metallic Minerals Waste Management Act	--	Yes	10 CSR 45	Actions involving placement of metallic mineral waste shall be performed according to permit.	All excavated yard soils will be disposed of in an onsite CAMU – BRMTS Repository. This unit, located on a designated mine area, is managed in accordance with the CAMU Approval Memorandum dated December 12, 2001 and the Operation Manual (NewFields 2003).
Missouri Solid Waste Regulations	Potentially	--	11 CSR 80-11.010	Actions involving solid waste disposal areas shall not cause degradation to wetlands or jeopardize existence of endangered or threatened species protected under the Endangered Species Act of 1973 or violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972.	Relevant and appropriate to actions that generate solid waste. All excavated yard soils will be disposed of in an onsite CAMU – BRMTS Repository. This unit is managed in accordance with the CAMU Approval Memorandum dated December 12, 2001 and the Operation Manual (NewFields 2003).

TABLE 4. FEDERAL AND STATE ACTION – SPECIFIC ARARs

Action	Applicable	Relevant and Appropriate	Citation	Description	Comment
FEDERAL					
Hazardous and Solid Waste: Criteria for Classification of Solid Waste and Disposal Facilities and Practices	Yes	--	40 CFR Part 257	Establishes criteria for use in determining solid wastes and disposal requirements.	Excavated soil is a solid waste.
1. Criteria for Classification of Hazardous Waste and Disposal Facilities and Practices	Potentially	--	40 CFR Part 264	Establishes criteria for use in determining hazardous wastes and disposal requirements.	All excavated yard soils will be disposed of in an onsite CAMU – BRMTS Repository. This unit, located on a designated mine area, is managed in accordance with the CAMU Approval Memorandum dated December 12, 2001 and the Operation Manual (NewFields 2003). This regulation would potential apply if any of the wastes were disposed of off-site.
2. Hazardous Materials Transportation Regulations	Potentially	--	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	Applicable only if the remedial action involves off-site transportation of hazardous materials. The regulations affecting packaging, labeling, marking, placarding, using proper containers, and reporting discharges of hazardous materials would be potential ARARs.

Action	Applicable	Relevant and Appropriate	Citation	Description	Comment
Air Emission Control: 1. National Ambient Air Quality Standards (NAAQS)	No	Yes	40 CFR Part 50	Establishes ambient air quality standards for certain "criteria pollutants" to protect public health and welfare. Standards are: 150 $\mu g/m^3$ for particulate matter for a 24 hour period; 50 $\mu g/m^3$ for particulate matter – annual arithmetic mean; 1.5 $\mu g/m^3$ maximum – arithmetic mean averaged over a calendar quarter.	NAAQS are implemented through the New Source Review Program and State Implementation Plans (SIPs). The federal New Source Review Program addresses only major sources. Emissions associated with the remedial action would be limited to fugitive dust emissions associated with earth moving activities during construction. These activities will not constitute a major source. Therefore, attainment and maintenance of NAAQS pursuant to the New Source Review Program are not applicable. However, the standards relating to particulate matter and to lead are relevant and appropriate.
STATE					
Hazardous and Solid Waste: 1. Solid waste determination	Yes	--	Missouri Solid Waste Regulations 11 CSR 80-11	A solid waste is any discarded material that is not excluded by Regulation.	Applicable to soil excavated from residential yards.
2. Determination of hazardous waste.	Potentially	--	Missouri Hazardous Waste Regulations 10 CSR 25-7.264 - 270	If an extract from a solid waste, tested using the Toxicity Characteristic Leaching Procedure (TCLP, Test Method 1311 in "Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods", EPA publication SW 846), contains concentrations of any of the materials above the listed level (5 mg/L for lead), the waste is considered hazardous.	Applicable to soil excavated from residential yards and disposed of offsite. All excavated yard soils would be disposed of in an onsite CAMU.

Action	Applicable	Relevant and Appropriate	Citation	Description	Comment
3. Transportation of Hazardous Waste	Potentially	--	Missouri Solid Waste Regulations 11 CSR 80-11	Rules regarding Transportation of Hazardous Substances.	Applicable only if the remedial action involves off-site transportation of hazardous materials. The regulations affecting packaging, labeling, marking, placarding, using proper containers, and reporting discharges of hazardous materials would be potential ARARs.
Air Emission Control:					
1. Particulate emissions during excavation and backfill.	Yes	--	Missouri Code of State Regulations 10 CSR 010-06	Missouri air pollution regulations require persons that emit fugitive particulates to minimize emissions through use of all reasonable precautions. In addition, no visible fugitive dust transport is allowed beyond the lot line of the property where the emissions originate.	Applicable to actions that entail excavation, moving, storing, transportation of redistribution of soil.
2. Ambient Air Standard for Total Suspended Particulate Matter	No	Yes	Missouri Code of State Regulations 10 CSR 010-06	Missouri uses the NAAQS as the state standards for airborne emissions. The NAAQS air quality standards for particulates, as PM_{10}, are 50 $\mu g/m^3$ (annual geometric mean) and 150 $\mu g/m^3$ (24 hour), as $PM_{2.5}$ they are 15 $\mu g/m^3$ (annual geometric mean) and 65 $\mu g/m^3$ (24 hour).	Remedial activities will not constitute a major source and therefore regulations are not applicable. Relevant and appropriate to actions that generate fugitive dust at individual properties and the staging area.
3. Ambient Air Standards	No	Yes	Missouri Code of State Regulations 10 CSR 010-06	Missouri uses the NAAQS as the state standards for airborne emissions. Excavation and backfill of soils could potentially cause emission of hazardous air pollutants. The NAAQS emission limit for lead is 1.5 $\mu g/m^3$ averaged over a three-month period.	Relevant and appropriate to actions that generate fugitive dust at individual properties and the staging area.

Action	Applicable	Relevant and Appropriate	Citation	Description	Comment
Storm water Controls:					
1. Storm water NPDES Permit	No	Yes	Missouri Clean Water Commission 10 CSR 020-06	Missouri has established General NPDES Storm Water Permit for a land disturbance site such as would be encountered during the soil remedial action at the Site. The permit requires the establishment of best management practices (BMP) to control runoff.	This project is being performed under CERCLA as an Emergency Removal Action and therefore does not require a permit. However, the substantive requirements of the Missouri General Permit will be implemented at the site including CBMP, routine inspections and record keeping.

TABLE 5. ALTERNATIVE 2 COST ESTIMATE

Item/Description		Quantity		Est. per each costing unit	Costing Unit Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS								
Sampling								
Sampling and Analysis								
Access		4,540	properties		148	days	$680.00	$100,640
Education Materials		4,540	properties		4,540	property	$1.50	$6,810
Sampling		3,567	properties		140	days	$1,700.00	$306,000
Sampling Analysis					38	days	$1,700.00	$61,200
XRF					1	XRF	$15,500.00	$15,500
Calibration Samples to Analytical Laboratory		897	samples		897	sample	$23.00	$20,616
Data Management		4,540	properties		227	hours	$95.00	$21,565
Result Letter Mailing		3,567	properties	150 letters per	24	mailings	$711.00	$17,064
Best Effort Letters for Sampling Refusal		954	properties	46 letters per	20	mailings	$909.00	$18,180
SUBTOTAL DIRECT CAPITAL COSTS - Sampling								*$572,075*
Sampling								
Mob/Demob							10%	$57,208
Engineering/Administration Costs							10%	$57,208
Health & Safety							3%	$17,160
SUBTOTAL INDIRECT CAPITAL COSTS - Sampling								*$131,577*
TOTAL ESTIMATED CAPITAL COST SAMPLING								**$703,652**
Removal								
Interim Action Sampled Yards (Known Yards)								
Removal Access		1,001	properties					
Access and Property Documentation	100%	1,001	properties		1,001	properties	$75.00	$75,075
Best Effort Letters for Refusals	14%	140	letters		140	letters	$5.50	$770
Excavation & Placement of Clean Fill		1,001	properties	Even though 14% of all yards are expected to refuse access, the cost assumes 100% participation				
Yard Quadrants/Areas		2,471						
One Quad		218	properties	1,000	654,000	SF	$2.87	$1,876,980
Two Quads		242	properties	6,000	1,452,000	SF	$2.81	$3,053,720
Three Quads (yards reduced by 2011 yards)		295	properties	9,000	2,655,000	SF	$2.81	$5,582,550
Four Quads (yards reduced by 2011 yards)		221	properties	12,000	2,652,000	SF	$1.63	$4,322,760
Driveway								
With yard quads								
One Quad		18	areas	1,000	18,000	SF	$2.87	$51,660
Two Quads		66	areas	1,000	66,000	SF	$2.81	$33,700
Three Quads (yards reduced by 2011 yards)		18	areas	1,000	18,000	SF	$2.81	$37,830
Four Quads (yards reduced by 2011 yards)		26	areas	1,000	26,000	SF	$1.63	$42,750
Only		15	areas	1,000	15	LS	$2,870.00	$43,050
Garden (assumes 24 inch depth excavation)		Gardens are assumed to be located in excavated quads in properties with more than two quads removed, therefore,						
With yard quads		*Only 12 to 24 inch excavation included when 3 or 4 yard quadrants are remediated*						
One Quad		6	areas	625	3,750	SF	$5.74	$21,525
Two Quads		8	areas	625	5,000	SF	$4.22	$21,100
Three Quads (yards reduced by 2011 yards)		15	areas	625	9,375	SF	$2.11	$19,781
Four Quads (yards reduced by 2011 yards)		18	areas	625	11,250	SF	$1.63	$18,338
Only		4	areas	625	4	LS	$2,870.00	$11,480
Play Area								
With yard quads		Play areas are assumed to be located in excavated quads in properties with more than two quads removed						
One Quad		13	areas	150	2,250	SF	$2.87	$6,458
Two Quads		27	areas	150	4,050	SF	$2.81	$8,546
Only		5	areas	150	5	LS	$2,870.00	$14,350
Final Close-out documentation		1,001	properties		1,001	properties	$75.00	$75,075
Lawn Watering (Known Yards)		1,001	properties	7,420,050 SF	2,313,050	gallons	$2.00 /1000 gal	$6,015
Non-Interim Action Sampled Yards (Potential)		Percent estimates based on the above known yards						
Removal Access		3,012	properties	Assumes 64% of sampled properties will require some soil removal				
Access and Property Documentation	100%	3,012	properties		3,012	properties	$37.50	$112,950
Best Effort Letters for Refusals	14%	421	letters		421	letters	$5.50	$2,316
Excavation & Placement of Clean Fill		3,012	properties	Even though 14% of all yards are expected to refuse access, the cost assumes 100% participation				
Yard Quadrants/Areas		8,585	quads					
One Quad (17%)	17%	512	properties	1,000	1,536,000	SF	$2.87	$4,408,320
Two Quads (19%)	19%	572	properties	6,000	3,432,000	SF	$2.81	$7,241,520
Three Quads (26%)	26%	783	properties	9,000	7,047,000	SF	$2.81	$14,869,170
Four Quads (38%)	38%	1,144	properties	12,000	13,728,000	SF	$1.63	$22,376,640
Driveway								
With yard quads								
One Quad	5%	40	areas	1,000	40,000	SF	$2.87	$114,800
Two Quads	7%	40	areas	1,000	40,000	SF	$2.81	$84,400
Three Quads	8%	62	areas	1,000	62,000	SF	$2.81	$130,820
Four Quads	11%	126	areas	1,000	126,000	SF	$1.63	$205,380
Only	1.2%	36	areas	1,000	36,000	SF	$2.87	$103,320
Garden (assumes 24 inch depth excavation)		Gardens are assumed to be located in excavated quads in properties with more than two quads removed, therefore						
With yard quads		Only 12 to 24 inch excavation included when 3 or 4 yard quadrants are remediated						
One Quad	3%	15	areas	625	9,375	SF	$5.74	$53,813
Two Quads	3%	17	areas	625	10,625	SF	$4.22	$44,838
Three Quads	5%	28	areas	625	17,500	SF	$2.11	$36,925
Four Quads	8%	45	areas	625	28,125	SF	$1.63	$46,044
Only	0.3%	9	areas	625	9	LS	$2,870.00	$25,830
Play Area								
With yard quads		Play areas are assumed to be located in excavated quads in properties with more than two quads removed						
One Quad	7%	38	areas	150	5,250	SF	$2.87	$15,068
Two Quads	11%	62	areas	150	9,300	SF	$2.81	$26,133
Only	0.4%	12	areas	150	12	LS	$2,870.00	$34,440

Item/Description	Quantity		Est. per each costing unit	Costing Unit Quantity	Unit	Unit Cost	Total Cost
Final Close-out documentation	3,012	properties		3012	properties	$75.00	$225,900
Lawn Watering (Potential Additional Yards)	3,012	properties	25,759,350 SF	8,038,917	gallons	$2.60 /1000 gal	$20,899
SUBTOTAL DIRECT CAPITAL COSTS - Known Yards							$16,291,228
SUBTOTAL DIRECT CAPITAL COSTS - Potential Additional Yards							$60,171,180
SUBTOTAL DIRECT CAPITAL COSTS - Removal							**$45,872,407**
Interim Action Sampled Yards (Known Yards)							
Mob/Demob						10%	$1,535,123
Engineering/Administration Costs						10%	$1,535,123
Construction Management Costs						10%	$1,535,123
Health & Safety						3%	$460,537
Non-Interim Action Sampled Yards (Potential)							
Mob/Demob						10%	$5,017,318
Engineering/Administration Costs						10%	$5,017,318
Construction Management Costs						10%	$5,017,318
Health & Safety						3%	$1,505,196
SUBTOTAL INDIRECT CAPITAL COSTS - Known Yards							$5,066,905
SUBTOTAL INDIRECT CAPITAL COSTS - Potential Additional Yards							$16,555,490
SUBTOTAL INDIRECT CAPITAL COSTS - Removal							**$21,622,394**
Scope and Bid Contingencies - Removal only						35%	$20,500,680
TOTAL ESTIMATED CAPITAL COST REMOVAL							**$117,645,481**
TOTAL ESTIMATED CAPITAL COST (SAMPLING AND REMOVAL)							**$118,349,133**
ANNUAL O&M COSTS							
None							
PERIODIC COSTS							
Five-Year Review							$75,156
Sampling and Analysis = resampling surface soils at remediated properties (5 years x 574 yards/yr) at a 5% rate						$20,156	
Access	144	properties	1	days	$650.00	$650.00	
Sampling	144	properties	8	days	$1,700.00	$13,600.00	
Sampling Analysis			2	days	$1,700.00	$3,400.00	
Calibration Samples to Analytical Laboratory	30	samples	36	sample	$28.00	$1,008.00	
Data Management	144	properties	6	hours	$95.00	$780.00	
Result Letter Mailing	144	properties	1	mailings	$708.14	$708.14	
Summary of Removal Action to date					1	$20,000	
Remedial Action Report						$75,000	$75,000
TOTAL ESTIMATED PERIODIC COST							**$150,156**
TOTAL NON-DISCOUNTED COST							***$118,499,289***
TOTAL PRESENT WORTH (7% rate of return, 30 year period)							***$97,719,000***

NOTES:

Cost Assumptions are provided in Appendix A

Total Present Worth calculation presented in Table A-1

TABLE 6. ALTERNATIVE 3 COST ESTIMATE

Detailed Cost Estimate
Alternative 3 - Soil Removal with 24-inch Excavation
St. Francois County Mined Areas - Residential Feasibility Study

Item/Description		Quantity		Est. per each costing unit	Costing Unit Quantity	Unit	Unit Cost	Total Cost
CAPITAL COSTS								
Sampling								
Sampling and Analysis								
Access		4540	properties		148	days	$600.00	$100,640
Education Materials		4540	properties		4,540	property	$1.50	$6,810
Sampling		3087	properties		150	days	$1,700.00	$300,000
Sampling Analysis					36	days	$1,750.00	$61,200
XRF					1	XRF	$15,500.00	$15,500
Calibration Samples to Analytical Laboratory		857	samples		857	sample	$28.00	$25,116
Data Management		4540	properties		227	hours	$95.00	$21,565
Result Letter Mailing		3087	properties	150 letters per	24	mailings	$711.00	$17,064
Best Effort Letters for Sampling Refusal		954	properties	48 letters per	20	mailings	$909.00	$18,180
SUBTOTAL DIRECT CAPITAL COSTS - Sampling								$572,075
Sampling								
Mob/Demob							10%	$57,208
Engineering/Administration Costs							10%	$57,208
Health & Safety							3%	$17,162
SUBTOTAL INDIRECT CAPITAL COSTS - Sampling								$131,577
TOTAL ESTIMATED CAPITAL COST SAMPLING								**$703,652**
Removal								
Interim Action Sampled Yards (Known Yards)								
Removal Access		1,001	properties					
Access and Property Documentation	100%	1,001	properties		1,001	properties	$75.00	$75,075
Best Effort Letters for Refusals	14%	140	letters		140	letters	$5.50	$770
Excavation & Placement of Clean Fill		1,001	properties	Even though 14% of all yards are expected to refuse access, the cost assumes 100% participation				
Yard Quadrants/Areas		2471						
One Quad		218	properties	3,000	670,350	CF	$2.67	$1,823,905
Two Quads		342	properties	6,000	1,458,000	CF	$2.11	$3,146,380
Three Quads (yards reduced by 2011 yards)		255	properties	9,000	2,721,375	CF	$2.51	$6,742,191
Four Quads (yards reduced by 2011 yards)		221	properties	12,000	2,718,000	CF	$1.63	$4,430,625
Driveway								
With yard quads								
One Quad		18	areas	1,000	18,460	CF	$2.67	$52,982
Two Quads		16	areas	1,000	16,400	CF	$2.51	$34,604
Three Quads (yards reduced by 2011 yards)		16	areas	1,000	15,460	CF	$2.11	$36,310
Four Quads (yards reduced by 2011 yards)		25	areas	1,000	25,625	CF	$1.63	$41,719
Only		15	areas	1,000	15,375	CF	$2.67	$44,126
Garden (assumes 24 inch depth excavation)		Gardens are assumed to be located in excavated quads in properties with more than two quads removed; therefore,						
With yard quads		Only 12 to 24 inch excavation included when 3 or 4 yard quadrants are remediated						
One Quad		6	areas	625	7,500	CF	$2.67	$21,525
Two Quads		8	areas	625	10,000	CF	$2.11	$21,100
Three Quads (yards reduced by 2011 yards)		17	areas	625	10,625	CF	$2.11	$22,419
Four Quads (yards reduced by 2011 yards)		41	areas	625	25,625	CF	$1.63	$41,789
Only		4	areas	625	4	LS	$2,870.00	$11,480
Play Area								
With yard quads		Play areas are assumed to be located in excavated quads in properties with more than two quads removed						
One Quad		15	areas	150	2,306	CF	$2.67	$6,619
Two Quads		27	areas	150	4,051	CF	$2.11	$8,759
Only		5	areas	150	5	LS	$2,870.00	$14,350
Final Close-out documentation		1,001	properties		1,001	properties	$75.00	$75,075
Lawn Watering (Known Yards)		1,001		7,420,000 SF	2,315,056	gallons	$2.60/1000 gal	$6,019
Non-Interim Action Sampled Yards (Potential)		Percent estimates based on the above known yards						
Removal Access		3012	properties					
Access and Property Documentation	100%	3012	properties		3,012	properties	$37.50	$112,950
Best Effort Letters for Refusals	14%	421	letters		421	letters	$5.50	$2,316
Excavation & Placement of Clean Fill		3012	properties	Even though 14% of all yards are expected to refuse access, the cost assumes 100% participation				
Yard Quadrants/Areas		6,581	quads					
One Quad (17%)	17%	512	properties	3,000	1,574,400	CF	$2.67	$4,516,525
Two Quads (19%)	19%	572	properties	6,000	3,017,600	CF	$2.11	$7,422,556
Three Quads (25%)	26%	783	properties	9,000	7,221,175	CF	$2.51	$18,240,892
Four Quads (37%)	38%	1,144	properties	12,000	14,071,200	CF	$1.63	$22,906,056
Driveway								
With yard quads								
One Quad	6%	40	areas	1,000	41,000	CF	$2.67	$117,670
Two Quads	7%	40	areas	1,000	41,000	CF	$2.11	$86,510
Three Quads	6%	62	areas	1,000	63,550	CF	$2.51	$134,091
Four Quads	11%	125	areas	1,000	128,125	CF	$1.63	$208,844
Only	3.2%	36	areas	1,000	36,900	CF	$2.67	$105,903
Garden (assumes 24 inch depth excavation)		Gardens are assumed to be located in excavated quads in properties with more than two quads removed; therefore,						
With yard quads		Only 12 to 24 inch excavation included when 3 or 4 yard quadrants are remediated						
One Quad	3%	18	areas	625	18,750	CF	$2.67	$53,813
Two Quads	3%	17	areas	625	21,250	CF	$2.11	$44,838
Three Quads	5%	28	areas	625	17,500	CF	$2.51	$36,925
Four Quads	8%	45	areas	625	28,125	CF	$1.63	$45,844
Only	0.3%	0	areas	625	0	LS	$2,870.00	$25,830
Play Area								
With yard quads		Play areas are assumed to be located in excavated quads in properties with more than two quads removed						
One Quad	7%	35	areas	150	5,301	CF	$2.67	$15,444
Two Quads	11%	62	areas	150	9,303	CF	$2.11	$20,114
Only	0.4%	12	areas	150	12	LS	$2,870.00	$34,440

Detailed Cost Estimate
Alternative 3 - Soil Removal with 24-Inch Excavation
St. Francois County Mined Areas - Residential Feasibility Study

Item/Description	Quantity		Est. per each costing unit	Costing Unit Quantity	Unit	Unit Cost	Total Cost
Final Closeout documentation	1012	properties		1012	properties	$75.00	$225,900
Lawn Watering (Potential Additional Yards)	1012	properties	25,759,350 SF	8038.947	gallons	$2.60/1000 gal	$20,898
SUBTOTAL DIRECT CAPITAL COSTS - Known Yards							$10,754,467
SUBTOTAL DIRECT CAPITAL COSTS - Potential Additional Yards							$81,410,368
SUBTOTAL DIRECT CAPITAL COSTS - Removal							*$87,164,834*
Interim Action Sampled Yards (Known Yards)							
Mob/Demob						10%	$1,575,449
Engineering/Administration Costs						15%	$2,363,173
Construction Management Costs						15%	$2,363,173
Health & Safety						3%	$472,635
Non-Interim Action Sampled Yards (Potential)							
Mob/Demob						10%	$8,141,037
Engineering/Administration Costs						15%	$7,711,555
Construction Management Costs						15%	$7,711,555
Health & Safety						3%	$1,542,311
SUBTOTAL INDIRECT CAPITAL COSTS - Known Yards							$6,774,432
SUBTOTAL INDIRECT CAPITAL COSTS - Potential Additional Yards							$32,106,458
SUBTOTAL INDIRECT CAPITAL COSTS - Removal							*$38,880,887*
Scope and Bid Contingencies - Removal only						15%	$13,616,009
TOTAL ESTIMATED CAPITAL COST REMOVAL							**$129,661,751**
TOTAL ESTIMATED CAPITAL COST (SAMPLING AND REMOVAL)							***$130,365,403***
ANNUAL O&M COSTS							
None							
PERIODIC COSTS							
Five-Year Review							$75,156
Sampling and Analysis - resampling surface soils at remediated properties (3 years x 574 yards/yr) at a 5% rate						$20,358	
Access	144	properties	1	days	$680.00	$680.00	
Sampling	144	properties	6	days	$1,700.00	$10,800.00	
Sampling Analysis			2	days	$1,700.00	$3,400.00	
Calibration Samples to Analytical Laboratory	36	samples	36	sample	$20.00	$1,008.00	
Data Management	144	properties	8	hours	$95.00	$760.00	
Result Letter Mailing	144	properties	1	mailings	$708.14	$708.14	
Summary of Removal Action to date					1	$50,000	
Remedial Action Report					$75,000		$75,000
TOTAL ESTIMATED PERIODIC COST							***$150,156***
TOTAL NON-DISCOUNTED COST							***$130,515,559***
TOTAL PRESENT WORTH (7% rate of return, 30 year period)							***$107,618,000***

NOTES:
Cost Assumptions are provided in Appendix A
Total Present Worth calculation presented in Table A-2

APPENDIX C

GLOSSARY OF TERMS

GLOSSARY OF TERMS

This glossary defines many of the technical terms used in relation to the Big River Mine Tailings Site in this Proposed Plan. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

Administrative Record (AR): All documents which EPA considers or relies upon in selecting the response action at a Superfund site, culminating in the Record of Decision for remedial action.

ARAR: Applicable or relevant and appropriate requirements.

Baseline Human Health Risk Assessment (HHRA): A document that provides an evaluation of the potential threat to human health in the absence of any remedial action.

Bgs: Below ground surface.

Bioavailability: A risk assessment term; the fraction of an ingested dose that crosses the gastrointestinal epithelium in the stomach and becomes available for distribution to internal target tissues and organs.

Blood Lead Level or Concentration: The concentration of lead in the blood, measured in micrograms of lead per deciliter of blood (µg/dL).

Capital Cost: Direct (construction) and indirect (non-construction and overhead) costs including expenditures for equipment, labor, and materials necessary to implement remedial actions.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The acts created a special tax that went into the Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, EPA can either: (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or (2) take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government the cost of the cleanup.

Contaminant: Any physical, chemical, biological, or radiological substance or matter that can have an adverse effect on human health or environmental receptors.

Contaminant of Concern (COC): A substance detected at a hazardous waste site that has the potential to affect receptors adversely due to its concentration, distribution, and mode of toxicity.

Discount Rate: A percentage rate used in present worth analyses to identify the cost of capital and operation and maintenance expenses. It is used to value a project using the concepts of the

time-value of money where future cash flows are estimated and discounted to give them a present value.

Dolomite: A sedimentary rock containing greater than 50% of the mineral dolomite; often found with calcite in forming limestone, another sedimentary rock.

Expanded Site Inspection (ESI): A field investigation that typically follows a preliminary assessment and is designed to collect more extensive information on a hazardous waste site. The information is used to score a site using the Hazardous Ranking System to determine whether a response action is needed.

Exposure Pathways: The course a chemical or physical agent takes from a source to an exposed organism. Each exposure pathway includes a source or release from a source, an exposure point, and an exposure route.

Feasibility Study (FS): A report that analyzes the practicability of potential remedial actions; i.e., a description and analysis of potential cleanup alternatives for a site on the National Priorities List.

Groundwater: Water filling spaces between soil, sand, rock and gravel particles beneath the earth's surface, which often serves as a source of drinking water.

National Contingency Plan (NCP): The federal regulation that guides the Superfund program.

National Priorities List: EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System.

Operable Unit (OU): Term for each number of separate activities undertaken as part of a Superfund site cleanup.

Operation and Maintenance (O&M): Activities conducted at a site after response actions occur to ensure that the cleanup or containment system continues to be effective.

Present Worth: The amount of money necessary to secure the promise of future payment or series of payments at an assumed interest rate.

Proposed Plan: A plan for a site cleanup that is available to the public for comment which summarizes remedy alternatives and presents EPA's Preferred Alternative or cleanup approach.

Quadrant Sample: A composite soil sample collected from a portion (usually one quarter) of a residential property.

Record of Decision (ROD): A public document that explains which cleanup alternative(s) will be used at a National Priorities List site.

Remedial Action: The actual construction or implementation phase of a Superfund site cleanup.

Remedial Investigation (RI): An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site, establish site cleanup criteria, identify preliminary alternatives for remedial action, and support technical and cost analyses of