PROPOSED PLAN

RESIDENTIAL PROPERTY SOILS (part of operable unit 3)
at

MADISON COUNTY MINES SUPERFUND SITE

in

MADISON COUNTY, MISSOURI

Prepared by:

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April 2008

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Proposed Plan
Residential Property Soils
Madison County Mines Superfund Site
Madison County, Missouri

PURPOSE OF THIS PROPOSED PLAN

This Proposed Plan for the Madison County Mines Site (Site) is intended to inform and solicit the views of the affected community regarding the Environmental Protection Agency's (EPA) Preferred Alternative to address lead soil contamination at residential yards and public areas across Madison County. A Proposed Plan fulfills public participation requirements under Section 117(a), 42 U.S.C. § 9617 of the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA), as amended (often called the Superfund Law), and Section 300.430(f)(2) of the National Contingency Plan (NCP), 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 EPA's preference
- Describe the other remedial options considered
- Solicit public review of and comment on all alternatives described
- Provide information on how the public can be involved in the remedy selection process

The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identity number is MOD098633415. A citizen can use the CERCLIS number on EPA's website to get information on the Site.

This Proposed Plan highlights key information from the Remedial Investigation (RI), Baseline Human Health Risk Assessment (HHRA), and Focused Feasibility Study (FS) recently released for the Site for part of operable unit 3 (OU-3). These and other documents are available for additional information regarding the proposed remedial action in the Site Administrative Record (AR) located at the local Ozark Regional Library or EPA Regional Office in Kansas City, Kansas, at the addresses listed below:

Ozark Regional Library - Fredericktown Branch
115 South Main Street
Fredericktown, Missouri 63645
Hours: Monday, Wednesday – Friday (10:00 a.m. – 5:30 p.m.)
Tuesday (10:00 a.m .– 8:00 p.m.)
Saturday (10:00 a.m .– 3:00 p.m.)

or

U.S. Environmental Protection Agency, Region 7
Records Center
901 North 5th Street
Kansas City, Kansas 66101
Hours: Monday – Friday (8:00 a.m. - 5:00 p.m.)

EPA is interested in receiving public comment on the alternatives evaluated and on the rationale for the Preferred Alternative. New information that EPA receives during the public comment period could result in the selection of a final remedy that differs from the Preferred Alternative. A glossary of common Superfund terms is included at the end of this document.

COMMUNITY'S ROLE IN THE SELECTION PROCESS

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 Focused 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 April 16, 2008, and concludes on May 15, 2008.

A public meeting will be held on April 29, 2008, at 6:30 p.m. at the Black River Electric Cooperative located at 2600 Highway 67, Fredericktown, Missouri, where 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 Interim Record of Decision (ROD), the document which formalizes the selection of the interim remedy.

All written or verbal comments should be addressed to:

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SITE BACKGROUND AND HISTORY

The Site is located in Madison County, approximately 80 miles south of St. Louis, in southeastern Missouri at the southern end of the Old Lead Belt where heavy metal mining has occurred since the early 1700s and industrial mining activities since the 1800s. The Site consists of all areas within Madison County that have been impacted by past mining practices and the migration of the resulting mine waste.

Lead ore was discovered in the area of Mine La Motte (north of Fredericktown) by French explorers around 1715. The area was already known to and likely was being exploited by local natives. Mining commenced in the early 1720s and continued intermittently on a comparatively small basis through the 18th century. Mining and beneficiation activities increased significantly at Mine La Motte and what is now known as the Madison Mine beginning

in the mid-1840s and expanded throughout Madison County in the period following the Civil War. Most of the smaller mines located around the county were operated at this time. Mining in Madison County has produced copper, lead, cobalt, nickel, iron, and small amounts of zinc, silver, and tungsten.

Past mining operations have left at least 13 identified major areas of mine waste in the form of tailings and chat deposits from significant mineral processing operations and smelting in Madison County (Figure 1). 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 deposits may have contaminated soils, sediments, surface water, and groundwater. These materials also may have been transported by wind and water erosion or 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, used as aggregate for road construction, and placed on public roads around Fredericktown to control snow and ice in the winter.

The Interim ROD for OU-3 addresses soils in residential properties in Madison County. The Site has been divided into six OUs to organize the work into logical elements based on similar contaminated media, geographic and demographic features of the Site, and setting priorities for the work. The final RODs for the other OUs will be issued in the future. The six OUs are described as follows:

- OU-1 is located in northern Madison County and consists of the Mine La Motte Recreation Association (MLMRA) subsite that contains approximately 250 acres of tailings; the Slime Pond, a 100-acre lake that adjoins the MLMRA; the Harmony Lake area; the Copper Mines mine waste; the Old Jack Mine; the Lindsey Mine; the small gage feeder rail right-of-way to the abandoned Black Mountain spur; and all other areas affected by these mining activities.

- OU-2 consists of the area adjoining and just southeast of the city of Fredericktown, Missouri, and includes the A, B, C, D, and E Tailings Areas (historically called the Madison Mine); the metallurgical pond; remnants of an old mill and smelter; headframe and abandoned shafts; a mine decline; a refinery complex; a chat pile; the abandoned Black Mountain spur right-of-way through Fredericktown; and all other areas affected by these mining activities.

- OU-3 includes all residential properties including public areas in Madison County as well as the entire cities of Fredericktown, Junction City, and Cobalt Village, and the Little St. Francis River (LSFR) subsite. Within and around the cities and the LSFR area, OU-3 also includes all streets, road right-of-ways, public drainage ways, possible smelter stack and mine waste pile wind-blown contamination, groundwater, surface water and sediments in Goose Creek and Tollar Branch, and mine works locations and outflows.

- OU-4 includes the entire Conrad subsite with its mine waste as well as the adjoining Ruth mine and mill complex; surface water and sediments affected by the mine waste; eroded materials to the LSFR from the Conrad subsite; road right-of-ways and public drainage ways; possible smelter stack and mine waste pile wind-blown contamination; groundwater impacts; and mine works locations and outflows.

- OU-5 includes the Catherine Mine with its mine waste, pond, and repository; the Skaggs mine waste; and any areas affected by the overhead tram from the Catherine Mine to the LSFR subsite. OU-5 also includes surface water, sediments, road right-of-ways, public drainage ways, and groundwater affected by the Catherine or Skaggs mine waste as well as nearby mine works locations and outflows.

- OU-6 includes all other known and undiscovered mining-related contaminated areas including but not limited to the Silver Mines area, nearby groundwater, surface waters and sediments in the unnamed runoffs to the LSFR, road right-of-ways, public drainage ways, and mine works locations and outflows.

Starting in 1980, a number of investigations by various organizations were conducted on the county's mine waste and its effects, most of which focused on the areas affected by OU-2 mine waste. In order to investigate a broader area, EPA performed an Expanded Site Inspection (ESI) on the LSFR watershed at the Site in 1995. The ESI attempted to identify potential sources of mine waste in the LSFR watershed, determine the composition of these sources, and determine if there had been a release of mining-related contaminants (heavy metals) to media within the LSFR watershed. Geographically, the ESI included OU-1, OU-2, and the Skaggs, Catherine, and Conrad mine waste areas. 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. Additionally, studies conducted by the Missouri Department of Health and Senior Services (MDHSS) and the Madison County Health Department concluded that some children in Madison County had elevated levels of lead in their blood.

As a result of the elevated blood lead levels in children, the presence of mine waste piles in Madison County, and previous investigations, EPA began conducting removal assessment activities at the Site, focusing on lead-contaminated soil in residential yards and other public areas frequented by children. The removal assessment consisted of obtaining access to residential yards or public areas, documenting current property conditions, collecting soil throughout the property, and analyzing the samples for metals with a portable X-Ray Fluorescence (XRF) instrument. EPA started assessing lead-contaminated soil in the Harmony Lake area in 2001 and shifted the assessment to Fredericktown starting in 2002. Since then, EPA expanded its lead-contaminated soil assessment to cover residential properties within the county and stopped in 2006. To date, approximately 3,100 residential properties have had their soil sampled and analyzed for metals.

Since assessment results in the Harmony Lake area indicated children's health was at risk due to lead levels in residential soil, an Action Memorandum was signed by EPA on September 8, 2000, outlining the rationale for implementing a removal action in the Harmony Lake area. The

removal action consisted of excavating the soil in areas with elevated lead concentrations up to one foot below ground surface (bgs) and two feet bgs in garden areas, and replacing it with clean soil. Additionally, the approximately 30-acre Harmony Lake tailings pile was covered with one foot of soil to stabilize the mine waste and minimize its impact on human health and the environment.

In 2002, at the request of the Madison County Health Department, EPA tested mine waste recently brought in to be used as fill at a farm supply company in Fredericktown. Upon confirming elevated concentrations of metals, particularly lead, in the mine waste fill at the property and upon confirming at least one child living nearby with an elevated blood lead level (greater than 10 micrograms per deciliter [µg/dL]), EPA signed two Action Memoranda authorizing two removal actions. The first removal action, conducted by the farm supply company under a Unilateral Administrative Order, included removing all mine waste and contaminated soil with lead concentrations greater than 400 parts per million (ppm) from the farm supply property and redepositing it at its original location, currently called the LSFR subsite. In some locations on the property, clean fill material was brought in to raise the grade.

A second Action Memorandum was signed in September 2002 to minimize human exposure to lead-contaminated soils in sensitive population areas (such as daycare centers, public parks, other public recreational facilities, and homes with potentially lead-impacted children) in the Fredericktown area. Similar to the Harmony Lake removal action, the Fredericktown removal action, started in 2003, consisted of excavating the soil in areas with elevated lead concentrations up to one foot bgs and two feet bgs in garden areas, and replacing it with clean soil. In 2004, another removal action very similar to the Fredericktown removal was initiated to address a number of residential properties within OU-1. When the Fredericktown removal action was finished in October 2006, hundreds of residential properties, which included daycare centers, schools, churches, and trailer parks, had been remediated. During this removal action, approximately 128,594 cubic yards (yd^3) of lead-contaminated soil were transported from the residential properties to the repository at the Catherine Mine subsite for placement on top of the mine waste.

As part of the removal assessment, EPA also collected and analyzed a limited number of surface water and sediment samples across the Site. The results of this sampling as well as the ongoing residential property soil sampling indicated various heavy metals at concentrations greater than their respective background concentrations. Additionally, surface water samples contained iron, lead, nickel, aluminum, copper, and silver concentrations which exceeded the Missouri Department of Natural Resources (MDNR) aquatic life standards. As a result of the elevated levels of heavy metals present, the Site was placed on the National Priorities List on September 29, 2003.

Since 1999, the Madison County Environmental Roundtable (an active group of concerned citizens and government officials) has been meeting to discuss contaminated residential property soils and other environmental issues. These bi-monthly meetings have included representatives from EPA, MDNR, MDHSS, U. S. Agency for Toxic Substances and Disease Registry (ATSDR), Madison County Health Department, elected officials of both Madison County and Fredericktown, news media, visiting academics and students, and local citizens.

SITE CHARACTERISTICS

The primary land use within Madison County since mining operations have ended is agricultural crop and pasture land. Industrial activities consist of light manufacturing, aggregate production, and construction. The population is predominantly rural. According to census data, the population of Madison County was 11,800 in 2000, including 4,711 households and 3,300 families. In addition, the county has approximately 270 business structures, 6 schools, 400 farms, 16,000 miles of paved roads and streets, 800 miles of public unpaved roads, 1 major river, 1 secondary river, and 2 water supply districts.

Madison County is subdivided into the St. Francois Mountains on the western side of the county and the Salem Plateau on the eastern side of the county. Topographically, the St. Francois Mountains comprise a geologically mature landscape with rounded ridges and meandering streams that occupy comparatively wide valleys. In a few locations, rivers and streams cut across ridges, forming steep canyons.

Much of the Site is underlain by Paleozoic (Cambrian) sedimentary rocks that rest on Precambrian crystalline rocks or basement complex which form the St. Francois Mountains. The sedimentary formations vary in thickness and locally thin out or "pinch out" against structural highs of the basement complex (St. Francois Mountains). The rock formations present in the area include the following, from the Precambrian basement up: (1) the Lamotte Sandstone, (2) the Bonneterre Dolomite, (3) the Davis Formation, and; (4) the Derby-Doe Run Dolomite. Soils formed from these formations are predominantly clays with comparatively low permeabilities. Soil profiles and horizons are generally well developed.

Most lead mineralization in the Madison County area occurs within the lower part of the Bonneterre Dolomite on the flanks of buried or exposed Precambrian topographic highs, generally within a few hundred feet of the boundary where the underlying Lamotte Sandstone pinches out. Lead ore, primarily in the mineral galena, and other metallic minerals occur as deposits that have replaced dolomite crystals in portions of the Bonneterre Dolomite. The ore occurs in horizontal sheets along bedding planes, cavity fillings, and linings on the walls of joints and fractures. The deposits extend laterally for hundreds of feet and may extend 200 feet vertically. However, mineralization in the Silver Mines area is distinct, consisting of quartz veins in the Precambrian basement complex that contain galena, wolframite (iron tungstate), and additional sulfide minerals as primary ore phases for additional metals such as tungsten and silver.

As indicated previously, past mining operations have left at least 13 identified major mine waste areas in the form of tailings and chat deposits from smelting and mineral processing operations in Madison County. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. These deposits have contaminated soils, sediments, surface water, and groundwater. These materials may also have been transported by wind and water erosion or 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, used as aggregate for road construction, and placed on public roads around Fredericktown to control snow and ice in the winter.

SCOPE AND ROLE OF THE RESPONSE ACTION

This proposed response action represents EPA's interim approach to address a portion of OU-3 that includes residential properties at the Site. This portion of OU-3 includes lead-contaminated surface soils present at residential properties across Madison County that have been contaminated as a result of migration of metal-bearing materials from past mining practices via natural erosional processes and human activities. For the purposes of this document, 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 residential properties are being addressed first by this proposed remedial action to expedite cleanup of the areas that pose the greatest and most immediate threats to human health. The action proposed here is the first remedial action for the Site and is a continuation of the residential soil cleanup actions that periodically have been going on in Madison County since 2001 as removal actions. The remaining actions for OU-3 and the other OUs will be addressed by future Proposed Plans.

The total number of residential properties with lead-contaminated soil across Madison County that will be addressed under this remedial action is estimated at 1,100 properties. This number comes from properties with measured lead soil concentrations greater than 400 ppm (786 properties), and an estimated number of properties not yet sampled but that potentially could exceed 400 ppm lead in soil (314 properties). The action level for lead in residential soil, 400 ppm, is based on the site-specific HHRA described in the next section and assumes lead is measured in the bulk soil sample with an XRF instrument. As shown on Figures 2 and 3, the properties already identified for cleanup are scattered across Madison County.

The number of residential properties not yet sampled but that potentially could require remediation is calculated as follows and is estimated to be 314 properties. It is estimated that approximately 748 residential properties in Madison County have not yet been sampled. Historically, 42% of the properties actually sampled in Madison County contained lead concentrations greater than 400 ppm. Assuming the same percentage of the properties that have not yet been sampled contain lead concentrations greater than 400 ppm, the number of properties with lead levels greater than 400 ppm is estimated at 314 properties. Therefore, when adding the number of properties that are known to need remediation (786 properties) and the number of properties which are estimated to need remediation (314 properties), the total number of residential properties expected to be addressed under this remedial action is estimated to be 1,100 properties.

It should be noted that OU-3 includes both residential properties across Madison County and the LSFR subsite. Under any remedial strategy, a number of years will be required to investigate and evaluate remedial alternatives for both the residential property and mine waste pile components of OU-3. Therefore, this Proposed Plan describes the interim approach preferred by EPA to address the highest priority at the Site —human health risk posed by residential property soils— while additional evaluations are performed at OU-3. The remedy described in the Interim ROD will be consistent with the final remedial action selected for OU-3.

SUMMARY OF SITE HUMAN HEALTH RISKS

A baseline HHRA was conducted for the Site to assess the potential risks to humans, both now and in the future, 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 risk assessment are intended to help 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.

In the HHRA, lead was identified in the risk assessment as the primary contaminant of concern (COC). Other metals were identified in various media and locations as COCs in select situations. However, the risk assessment summary in this Proposed Plan will focus on lead since it is generally the primary COC in a residential property setting in a lead mining area. For further information, please refer to the HHRA in the AR.

Young children (typically defined as seven years of age or below) across Madison County 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 or dust, absorb lead more readily than adults, and are more sensitive to the adverse effects of lead than are older children and adults. The effect of greatest concern in children is impairment of the nervous system, including learning deficits, lowered intelligence, and adverse effects on behavior.

The risks or potential for adverse health effects for lead are 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, lead risks are 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 blood lead level (expressed in μg/dL), lead exposures and risks are typically assessed using mathematical models.

The risk assessment for the Site used EPA’s Integrated Exposure Uptake Biokinetic (IEUBK) 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. Typically, the focus of a risk assessment with respect to lead in a residential setting is on children since 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 the lead contamination at the Site.

The IEUBK model uses site-specific and default inputs (i.e., soil concentration, indoor dust concentration, bioavailability, etc.) to estimate the probability that a child's blood lead level might exceed 10 μg/dL. EPA's health protection goal is that there should be no more than a 5% 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 that the Centers for Disease Control and Prevention and EPA have conducted analyses demonstrating health effects at or below a blood lead level of 10 μg/dL.

For a residential child, the IEUBK model was run using 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 or the amount of lead absorbed into the body following incidental ingestion of soil. The results indicate that uptake of lead at the Site is greater than the IEUBK model default value.

Risk Estimates for Residents from Soil

Of the 970 residential properties evaluated during the HHRA, children residing at 171 properties (18%) are predicted to have greater than a 5% chance of exceeding a blood lead level of 10 μg/dL. Children in the remaining 799 homes (82%) are predicted to have blood lead levels at or below EPA's health protection goal. The risk assessment results indicate that a child exposed to residential property lead soil concentrations above 400 ppm would have greater than a 5% chance of exceeding a blood lead level of 10 μg/dL.

The 400 ppm action level is based upon sieving the soil sample with a #10 mesh sieve to obtain particles less than 2 millimeters (i.e., the bulk soil fraction) and analyzing the sample with an XRF instrument. These results indicate that a number of unremediated homes in Madison County are of potential health concern with regard to lead.

The HHRA also determined that soil at several residential properties may present a noncancer risk to children from a number of heavy metals, excluding lead, at the maximum sample concentration. It is important to note that if these risks were based on average heavy metal concentrations in soil, the residential property soils would not exceed a level of concern for children. However, at residential properties where heavy metals in soil present a risk to children and are co-located with lead, EPA will address this risk under this proposed remedial action. A determination will be made at a future date on addressing the remaining residential properties where heavy metals other than lead may present potential health risks.

Risk Estimates for Residents from Groundwater

Exposure to concentrations of lead in groundwater does not result in predicted blood lead levels exceeding EPA's health-based goal for current child residents at most locations, with the exception of two wells located in Fredericktown. If the shallow groundwater within the mine waste areas were actually used for drinking by future residents, lead groundwater concentrations would result in greater than a 5% probability of a child's blood lead level exceeding 10 μg/dL, thus not meeting EPA's health-based goal at most locations. The exception is potential shallow wells located near the Silver Mines area.

With regard to other COCs, there does not appear to be a noncancer risk to the majority of current child and adult residents from ingestion of groundwater from private water wells, although there are some risks for current residents at a number of wells. In most cases, this risk is associated with elevated levels of fluoride with additional contributions from manganese and cadmium. The Madison County Health Department has indicated that portions of northwestern Madison County have shown elevated fluoride concentrations in the past. The majority of the private water wells that potentially pose a noncancer risk to residents are located in the northwestern part of Madison County. Additionally, resampling of groundwater from three private water wells indicated that none of the heavy metals exceeded their respective primary Maximum Contaminant Levels. These wells will continue to be evaluated in the future. A determination will be made at a future date on addressing the remaining residential properties where heavy metals other than lead in groundwater may present a potential health risk.

Summation

Final cleanup levels for lead in residential property soil at Superfund sites generally are based on the IEUBK model results and the nine criteria analysis included in this Proposed Plan in accordance with the NCP. EPA generally selects a residential soil cleanup level within the range of 400 ppm to 1,200 ppm for lead. As described above, the IEUBK modeling results for the Site recommend a lead soil concentration of 400 ppm to ensure that a child has less than a 5% probability of having a blood lead level exceeding 10 µg/dL.

EPA is not aware of anyone using shallow groundwater wells in the mine waste areas of the Catherine subsite, Skaggs subsite, LSFR subsite, or Conrad subsite, which are described previously. The two Fredericktown wells identified in the previous section will be provided with an alternate water supply and further evaluated during the remedial action.

This Proposed Plan only addresses human health risk at residential properties within Madison County. Therefore, while an Ecological Risk Assessment was completed for the Site, a summary of it has not been included in this Proposed Plan. Other identified risks to human health and the environment will be addressed in future cleanup decisions.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) 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 (ARARs), and other relevant site information.

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 10 µg/dL.***

Based on Site-specific information, EPA's IEUBK model predicts that a young child residing at the Site will have greater than a 5% chance of having a blood lead level exceeding 10 µg/dL if the lead soil concentrations to which he or she is exposed are above 400 ppm 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.

REMEDIAL ALTERNATIVES CONSIDERED

Alternative 2 outlined herein and later evaluated is EPA's Preferred Alternative. Each alternative is presented in much greater detail in the Focused FS Report. All elements of the alternatives considered are common. The only major institutional control (IC) established in any alternative is a health education program. 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: Indeterminate

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 in residential property soil at Madison County. Alternative 1 would not meet the RAO because it does not minimize or eliminate the existing or future potential exposure at the Site.

Alternative 2: Excavation, Disposal, Vegetative Cover, and Institutional Controls
Estimated Total Capital Cost: $24.4 million
Estimated Annual O&M Cost Range: $0
Estimated Present Worth Cost: $22.4 million
Estimated Construction Time Frame: 4 years
Estimated Time to Achieve RAO: 4 years

Under this alternative, residential properties with at least one quadrant sample testing greater than 400 ppm for lead will have that quadrant and possibly drip zones remediated. The drip zones would be remediated if the lead concentrations in the contaminated quadrant's drip zone are greater than 400 ppm. Residential properties where no quadrant samples exceed 400 ppm lead would not be addressed under this action. Under this alternative, 1,100 residential properties contain or are expected to contain lead soil concentrations greater than 400 ppm and will require remediation.

Approximately 800 residential properties in Madison County have not had their soil sampled by EPA. Under this alternative, EPA will continue to seek access to and sample all residential properties within Madison County to determine if they have been impacted by mining-related activities. If a soil sample in a property's quadrant has a lead concentration greater than 400 ppm, the property will be included in the remedial action.

This alternative includes the 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 greater than 400 ppm lead. Soil would be excavated using limited size and lightweight excavation equipment and hand tools in the portions of the property where the surface soil exceeds 400 ppm lead. Excavation will continue in depth until the underlying soils at the bottom of the excavation are less than 400 ppm lead or to a maximum depth of 12 inches bgs, whichever is less. An exception is 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 400 ppm, EPA may choose to excavate deeper. If upon excavating to 18 inches bgs the lead soil concentration remains above 1,200 ppm, EPA will place a barrier. 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 lower will result in exposure to soils contaminated at a level that EPA has determined to be a human health concern. EPA recommends a minimum of 12 inches of clean soil be used as an adequate soil barrier from soil contaminated above the cleanup level 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, grade, and potential.

As indicated earlier, EPA estimates that 1,100 homes have been or will be discovered to have lead concentrations in soils greater than 400 ppm. Based on EPA's previous soil removal activities in and around Fredericktown, an average residential property will require removal and replacement of 186 yd^3 of soil. Therefore, an estimated total of approximately 204,600 yd^3 of soil would require excavation, disposal, and replacement, and is used as the basis for part of the cost estimate for this remedial action.

The excavated soil will be disposed at the Conrad tailings pile. The Missouri Department of Transportation has previously used the Conrad tailings pile for disposal of excavated lead-contaminated soil. The capacity of the projected Conrad repository has not been determined but will be determined during the Remedial Design (RD). For contaminated soil which would fail the Toxicity Characteristic Leaching Procedure (TCLP) analysis, a lead stabilization compound will be added to the soil at the repository until the soil meets the TCLP maximum concentration for lead.

After the topsoil has been replaced, the property would 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 could become established.

Due to the environmental problems of lead and other metals in Madison County, health education will be needed to help reduce exposures that could potentially lead to adverse health effects. An active educational program would be conducted in cooperation with EPA, ATSDR, MDNR, MDHSS, and the Madison County Health Department. The education activities would primarily be conducted by the Madison County Health Department. The following, although not an exhaustive list, indicates the types of education activities that may be conducted at the Site.

- Conducting extensive community-wide blood-lead monitoring
- Performing in-home assessments for children identified with elevated blood lead levels
- Distributing of prevention information and literature
- Holding meetings with and acting as a resource for area physicians of local families
- Providing community education through meetings; literature; talks and presentations at civic clubs, schools, nurseries, pre-schools, churches, fairs, etc.; and one-on-one family assistance
- Undertaking special projects to increase awareness of how local citizens can protect themselves from heavy metal health risks

Institutional Controls (ICs): With regard to the physical barriers that have been and may be put down at depth in residential properties during the previous removal actions and the proposed remedial action, respectively, EPA will need to ensure that the barriers and the soils below them are not disturbed for long-term protection of human health. Typically, EPA has historically looked to various types of ICs to ensure the remedy's long-term protectiveness. While EPA is considering proprietary controls such as restrictive covenants, these controls present a great difficulty at this Site given the large number of residential properties in Madison County that may be covered by the remedy. However, EPA will continue to evaluate the feasibility of these controls as the remedial action selected in the Interim ROD is being implemented. Additionally, EPA has already spoken with the repository landowner about a restrictive covenant to protect the potential repository.

Governmental controls, such as an ordinance requiring permits for earthmoving activities and restricting soil use in areas of known heavy metal contamination at depth would be an efficient and effective control measure. EPA has begun discussions with the Madison County Health Department. Further discussion, collaboration, and evaluation with the state of Missouri, Madison County Health Department, and other local departments regarding governmental controls will continue.

Because EPA is still evaluating the most effective type or types of ICs for residential properties at the Site, the final measures for either or both access restrictions and governmental controls will be worked out and described in more detail in the final FS, Proposed Plan, and final ROD for OU-3. However, as part of this FS, EPA will pilot an ICs project with MDNR and the Madison County Health Department that would include local governmental controls. Some of these controls would address protection of any physical barriers laid down at depth at residential

properties during this proposed remedial action. However, it could also include building permits for potentially mining-contaminated properties, administrative listing for the county to restrict digging at contaminated properties, builder and developer education when dealing with heavy metal soil contamination, and best management practices for construction work undertaken at potentially mining-contaminated properties. The pilot project may be modeled after the Bunker Hill Superfund Site Institutional Controls Program.

Regarding future land use of the remediated residential properties, continued residential use is anticipated. With adequate IC development, the land use will actually be enhanced since lead-contaminated soil that would pose a human health risk will be excavated from the large majority of residential properties. For residential properties where a physical barrier will be placed at depth and an IC put in place to protect the barrier, the upper 12 inches of soil at least would be available for direct human contact under this alternative.

Alternative 3: Phosphate Stabilization, Excavation/Disposal, and Institutional Controls
Estimated Total Capital Cost: $23.7 million
Estimated Annual O&M Cost Range: $0
Estimated Present Worth Cost: $21.8 million
Estimated Construction Time Frame: 4 years
Estimated Time to Achieve RAO: 4 years

Just as in Alternative 2, under Alternative 3, residential properties with a quadrant showing a quadrant sample result greater than 400 ppm for lead will be remediated. Also the drip zone may be remediated, if the lead concentrations in the drip zone is greater than 400 ppm. Residential properties where quadrant samples did not exceed 400 ppm lead would not be addressed under this action. Under this alternative, 1,100 residential properties contain or are expected to contain lead soil concentrations greater than 400 ppm and will require remediation.

Approximately 800 residences in Madison County have not had their residential property soil sampled by EPA. Under this alternative, EPA will continue to seek access to and sample all residential properties within Madison County 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.

Under Alternative 3, all residential properties and areas highly accessible to children (i.e., daycare centers, parks, and playgrounds) with lead soil concentrations exceeding 400 ppm but less than 800 ppm (an assumed concentration for costing purposes only) would be treated with phosphate to reduce the bioavailability of metals in the soil, thereby controlling the health risk to children. It is anticipated the phosphate, in the form of phosphoric acid, would be roto-tilled into the soil to a depth of 6 to 10 inches, and allowed to stabilize for 7 to 10 days. Afterward, lime would be added to the property soil to raise the pH and the lawn would then be reestablished.

This alternative would not be implemented until a Site-specific treatability study was completed to assess the effectiveness of phosphate stabilization on reducing lead bioavailability. The treatability study would consist of initial bench scale and bioavailability testing to determine the effect that phosphate addition, under ideal laboratory conditions, has on Site soils. The

second part of the study, assuming initial findings are positive, would include testing of field application methods and phosphate application rates to most effectively lower the bioavailability of lead in the soil. Although Site-specific treatability studies are necessary to determine the effect phosphate stabilization has on lowering the bioavailability of lead in residential soils, studies conducted by EPA at other residential lead sites indicate that phosphate stabilization may be somewhat effective at lowering the bioavailability of lead to young children. The final decision to proceed with phosphate stabilization of properties would be made by EPA after peer review of the treatability study and public comments on the study.

A long-term monitoring program would be instituted to assess the effectiveness of phosphate stabilization. The program would include soil chemistry monitoring to assess the effects of natural weathering and the long-term stability of the lead-phosphate minerals formed during phosphate treatment.

For residential properties with lead soil concentrations above 800 ppm, EPA will remediate these properties using a similar methodology as outlined in Alternative 2, namely, excavation, disposal, and backfilling. Please see the previous section for details.

Under this alternative, it is estimated that approximately 558 residential properties have lead soil contamination over 800 ppm and so will require excavation. Since approximately 186 yd^3 of contaminated soil would be removed from each property, based on previous residential property soil removals, an approximate total of 103,788 yd^3 of soil would require excavation, replacement, and disposal.

The repository, vegetation restoration, health education, and IC pilot project components of Alternative 3 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

According to the NCP, nine criteria are used to evaluate the different alternatives individually and against each other in order to select the best remedy. The nine evaluation criteria are (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume of contaminants through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state/support agency acceptance; and (9) community acceptance. This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other alternatives under consideration. The nine evaluation criteria are discussed below. A detailed analysis of these alternatives can be found in the Focused FS Report.

1. <u>Overall Protection of Human Health and the Environment</u>: *Determines 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 the environment or residents in Madison County because no actions are taken to mitigate the exposure to lead-contaminated soil. Alternative 2 would remove the significant exposure pathway associated with contaminated

residential property soils. Once excavation, soil replacement, and revegetation is complete, the soils are properly disposed, enforceable ICs are implemented, and an effective health education program is implemented, risks associated with metal-contaminated residential property soil will be mitigated. Therefore, Alternative 2 is protective of human health and the environment. As part of Alternative 3, a treatability study using residential property soil would be required to show that phosphate treatment of soil with lead concentrations between 400 ppm and 800 ppm would reduce the bioavailability of lead at the Site to levels that are protective of human health and the environment. Alternative 3 is protective of human health and the environment only if the phosphate treatment significantly reduces the bioavailability of lead on a long-term basis.

2. <u>Compliance with ARARs</u>: *Evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site or whether a waiver is justified.*

The ARARs for this Proposed Plan are included in attached Tables 1 through 6. The no-action Alternative does not comply with ARARs. In contrast, Alternative 2 and the excavation portion of Alternative 3 would comply with chemical and location-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. The phosphate treatment portion of Alternative 3 would be dependent on the results of a treatability study to determine if all federal and state ARARs can be met.

3. <u>Long-term Effectiveness and Permanence</u>: *Consider the ability of an alternative to maintain protection of human health and the environment over time.*

Alternative 1 provides no long-term effectiveness or permanence for the protection of human health and the environment. Under Alternative 2 and the excavation portion of Alternative 3, the residual risks (the risk remaining after implementation) would be significantly reduced. Residential properties within the Site with soil concentrations at or above 400 ppm lead in Alternative 2 and greater than 800 ppm in Alternative 3 would remove contaminated soil to a depth of 12 inches or a depth that meets the lead cleanup level. The removal of contaminated soil, replacement with clean soil, and revegetation ensures that future potential for exposure will be significantly reduced. Alternatives 2 and 3 provide permanence through complete removal and containment of contaminated soils at or above 400 ppm and at or above 800 ppm lead, respectively.

Previous studies are inconclusive as to whether phosphate treatment results in long-term reduction in the bioavailability of lead in soils. Treatment of residential soils using a phosphate amendment has not been implemented during a full-scale remediation project. The bench and pilot scale studies that have been performed have had mixed results, although the previous

studies have generally indicated that the bioavailability of lead has not been reduced by more than 50%. The long-term effectiveness under Alternative 3 for phosphate treatment of lead concentrations between 400 and 800 ppm would be dependent on the results of the treatability study.

A significant aspect of Alternative 2 and the excavation portion of Alternative 3 is the placement of the contaminated soils at the Conrad Repository. The repository would require storm water controls and other design and engineering controls for long-term stability.

4. <u>Reduction of Toxicity, Mobility, or Volume of Contaminants Through Treatment</u>: *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.*

There is no reduction in the toxicity, mobility, or volume of contamination under the no-action alternative (Alternative 1). Alternative 2 and the excavation portion of Alternative 3 would significantly reduce the mobility of the COCs by consolidation of the contaminated soils at the Conrad Repository. Although the exposure pathway would be eliminated or minimized, the toxicity and volume of the material would not be reduced by these alternatives with the exception of the treated and stabilized soils which would otherwise fail TCLP. The toxicity of the stabilized soils would decrease, although the volume of these soils is not expected to be a significant portion of the excavated residential soils. Proper long-term maintenance of the Conrad Repository is an important component of Alternatives 2 and 3 to ensure the significant reduction of heavy metal mobility.

The treatment portion of Alternative 3, assuming treatability studies show phosphate stabilization would reduce the bioavailability of lead to acceptable health-based levels, would reduce the toxicity and mobility of the contamination. The volume of the contamination would not be reduced. However, the amount of soil requiring excavation and disposal would be significantly reduced over Alternative 2 because contaminated soil between 400 and 800 ppm would be treated in situ at the residential properties.

5. <u>Short-term Effectiveness</u>: *Considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.*

The short-term risk to workers for Alternative 1 is minimal since no remediation efforts will be performed. However, exposure pathways for the public and environment would remain. Alternative 2 has increased short-term risks for the public, environment, and construction workers from excavation and transportation efforts. Disturbed contaminated soil could enter the ambient air during excavation and transportation. However, dust suppression would be implemented for the protection of the community and workers during the remedial action. The alternative would require 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.

Alternative 3 has the same risks as Alternative 2 in addition to exposing workers, residents, and animals to phosphoric acid and lime. Depending on the method of applying the phosphoric acid, there would be a risk to workers and property from aerosol spray. Workers would be required to wear protective clothing (including respiratory protection) during the application of the phosphoric acid.

6. <u>Implementability</u>: *Considers the technical and administrative feasibility of implementing the alternative such as relative availability of goods and services.*

Alternative 1 does not require any implementation. Alternative 2 and the excavation portion of Alternative 3 are readily implementable because it is technically feasible from an engineering perspective. Excavation methods, backfilling, and revegetation are typical engineering controls. The experience of previous Site removal actions conducted by EPA at this and other lead mining Superfund sites has shown that Alternative 2 and the excavation portion of Alternative 3 is readily implementable.

The phosphate treatment portion of Alternative 3 would be more difficult to implement. The application of the phosphoric acid treatment on residential properties has not been attempted on a large scale. This treatment alternative uses 85% phosphoric acid which can cause skin irritation as well as damage to the respiratory system of workers if not handled properly. Phosphoric acid is viscous, making application difficult, and it may crystallize in winter. The phosphoric acid could damage the exterior of a structure such as a home or personal property around the home if the acid is not carefully applied. The property would have to be fenced prior to the application of the phosphoric acid to restrict access to the property during treatment of the property. The fence would have to remain until the lime was applied and the property was revegetated. Small animals and birds would still have access to the property and contact with the soil prior to the application of the lime could pose a health risk to them.

7. <u>Cost</u>: *Includes estimated capital and O&M costs as well as present worth costs. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 %.*

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 $22.4 million and is presented in Table 7. The present worth cost for Alternative 3 is estimated to be $21.8 million and is presented in Table 8. For both cost estimates, capital costs are spread over a construction period of four years. A 3.5% discount rate was used to calculate the present worth. These estimates are approximate and made without detailed engineering data. The actual cost of the project 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 186 yd^3 at a construction only cost of $63 per yd^3. These estimates are averages of past construction activities on this Site but future costs could well vary. Annual costs of $125,000 are estimated for public health education. No annual O&M costs are incorporated in the cost estimates since the Preferred Alternative is for an interim ROD only. For Alternative 3, the phosphoric acid treatment estimated costs are $12,305 per property.

8. <u>State/Support Agency Acceptance</u>: *Considers whether the state agrees with EPA's analyses and recommendations of the RI/FS and the Proposed Plan.*

MDNR supports the Preferred Alternative (Alternative 2) proposed by EPA. Typically, 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 Focused FS.

9. <u>Community Acceptance</u>: *Considers whether the local community agrees with EPA's analyses and Preferred Alternative. Comments received on the Proposed Plan are important indicators of 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 discarded, if necessary, and described in the Interim ROD. A Responsiveness Summary (which captures public comments) will be reviewed, evaluated, and considered prior to any EPA decision being made on a remedy selection at this Site. This summary will be part of the Interim ROD.

PREFERRED ALTERNATIVE

The Preferred Alternative is Alternative 2 — Excavation, Disposal, Vegetative Cover, and Institutional Controls. The Preferred Alternative was chosen over the other alternatives by EPA because, based on the nine NCP criteria, it provides the best balance of trade-offs and achieves the RAO. However, the Preferred Alternative may be altered in response to public comment or new information.

Based upon the information currently available, EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria. 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.

<u>Protection of Human Health and the Environment</u>

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 1 through 6.

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 soils. Removal and replacement of contaminated residential soils permanently removes heavy metal contaminants as a potential source of exposure. For a subset of contaminated residential soil, lead stabilization treatment is needed to prevent the soils from failing TCLP. However, the volume of these soils is not expected to be a significant portion of the excavated residential soils. The Preferred Alternative best satisfies the statutory mandates for permanence.

Preference for Treatment

The Preferred Alternative does not utilize treatment to address the principle threats posed by the residential property soils. 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. For a subset of contaminated residential soil, lead stabilization treatment is needed to prevent the soils from failing TCLP. However, the volume of these soils is not expected to be a significant portion of the excavated residential soils.

Based upon the information currently available, the EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of trade-offs among the other alternative with respect to the balancing and modifying criteria. 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.

GLOSSARY OF TERMS

This glossary defines many of the technical terms used in relation to the Madison County Mines 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.

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.

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 (nonconstruction 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.

Interim: Temporary or provisional; as used in the Proposed Plan, efforts that address a portion of the Madison County Mines Site on a temporary basis until the final remedy for the entire operable unit is implemented.

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.

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.

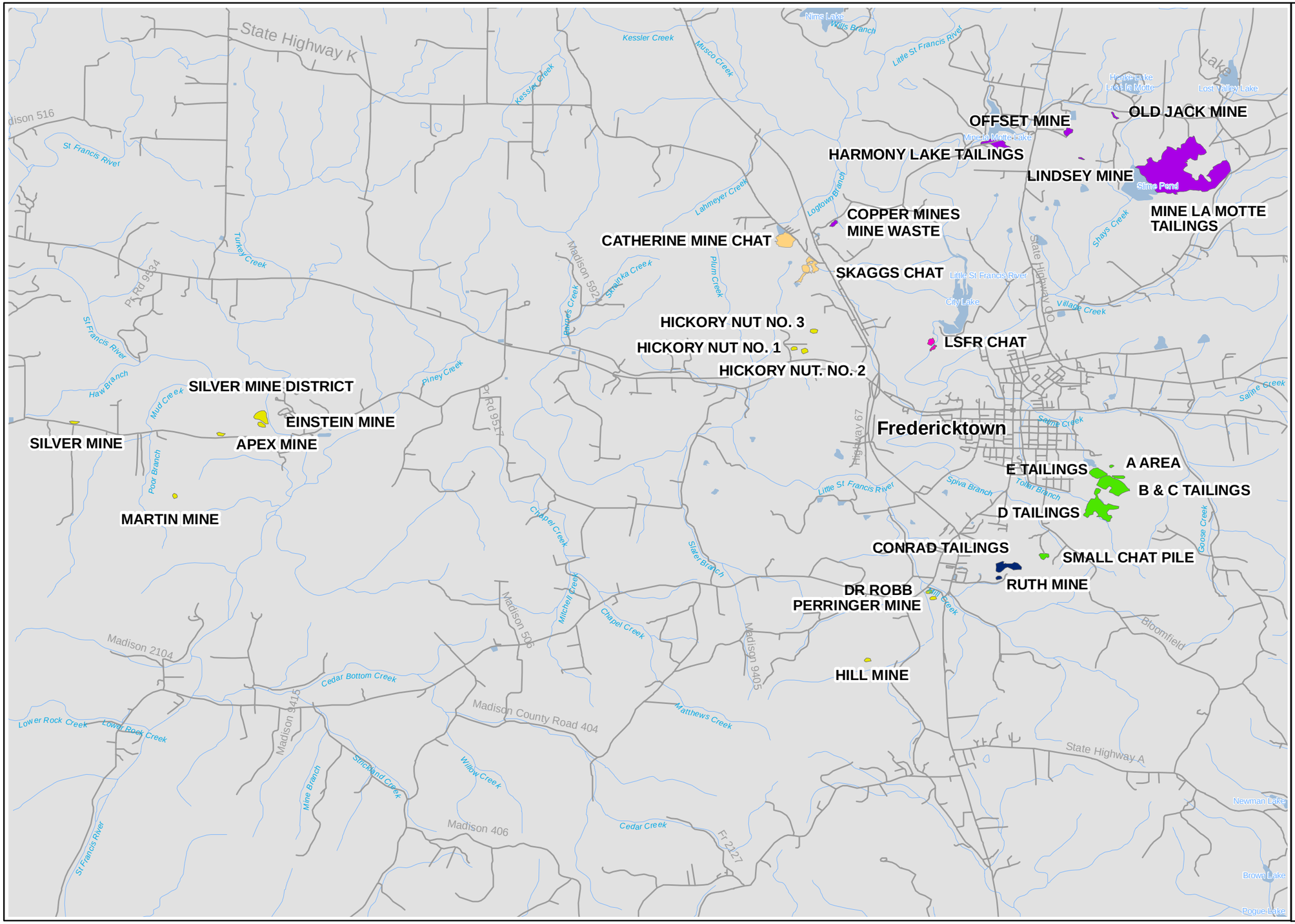
Remedial Investigation (RI): An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site, establish site cleanup criteria, identify preliminary alternatives for remedial action, and support technical and cost analyses of alternatives. The remedial investigation is usually done with the feasibility study. Together they are usually referred to as the RI/FS.

Removal Action: Short-term immediate actions taken to address releases of hazardous substances that require an expedited response.

Responsiveness Summary: A summary of oral and/or written public comments received by EPA during a comment period on key EPA documents, and EPA's response to those comments.

Salem Plateau: A dissected karst plain located in south central Missouri and northern Arkansas consisting of rolling uplands and rugged hills with deeply entrenched stream valleys and ranges between about 1,000 feet to 1,400 feet in elevation. There are abundant sinkholes, caves, springs, and losing streams.

Toxicity: The degree to which a chemical substance (or physical agent) elicits a deleterious or adverse effect upon the biological system of an organism exposed to the substance over a designated time period.



BLACK & VEATCH

Special Projects Corp.

Legend

- Mine Waste OU1
- Mine Waste OU2
- Mine Waste OU3
- Mine Waste OU4
- Mine Waste OU5
- Mine Waste OU6
- streets
- streams
- lakes

LSFR - Little St. Francis River

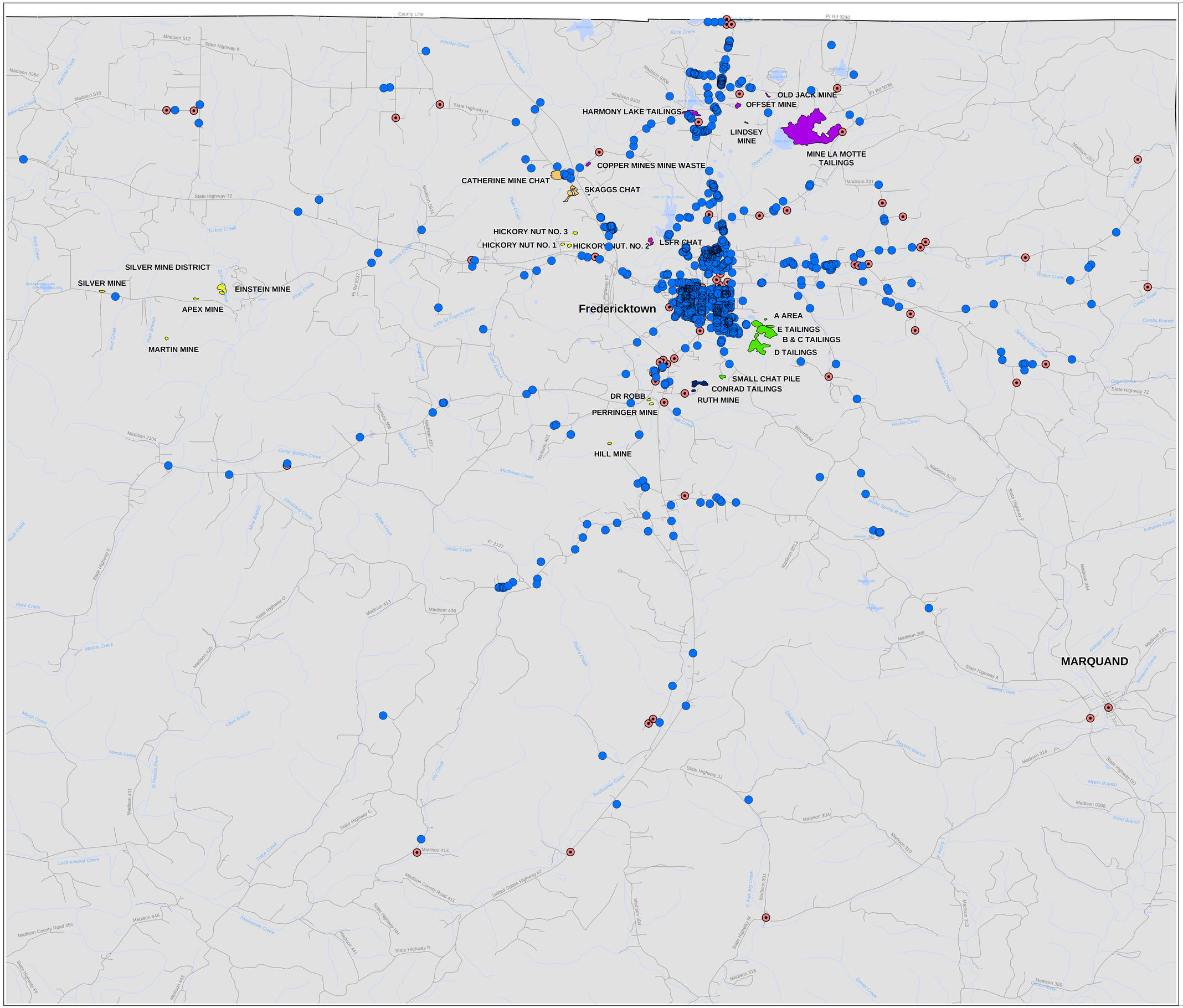
N

0 3,750 7,500 15,000

Feet

FIGURE 1:
SITE MAP

MADISON COUNTY MINES
FREDERICKTOWN, MISSOURI



BLACK & VEATCH

Special Projects Corp.

Legend

- Residential Properties that have not been remediated with Lead Concentrations Greater than 1,200 ppm
- Remediated Residential Properties with Lead Concentrations Greater than 1,200 ppm
- Mine Waste OU1
- Mine Waste OU2
- Mine Waste OU3
- Mine Waste OU4
- Mine Waste OU5
- Mine Waste OU6
- Lakes
- Streams
- Streets

LSFR - Little St. Francis River

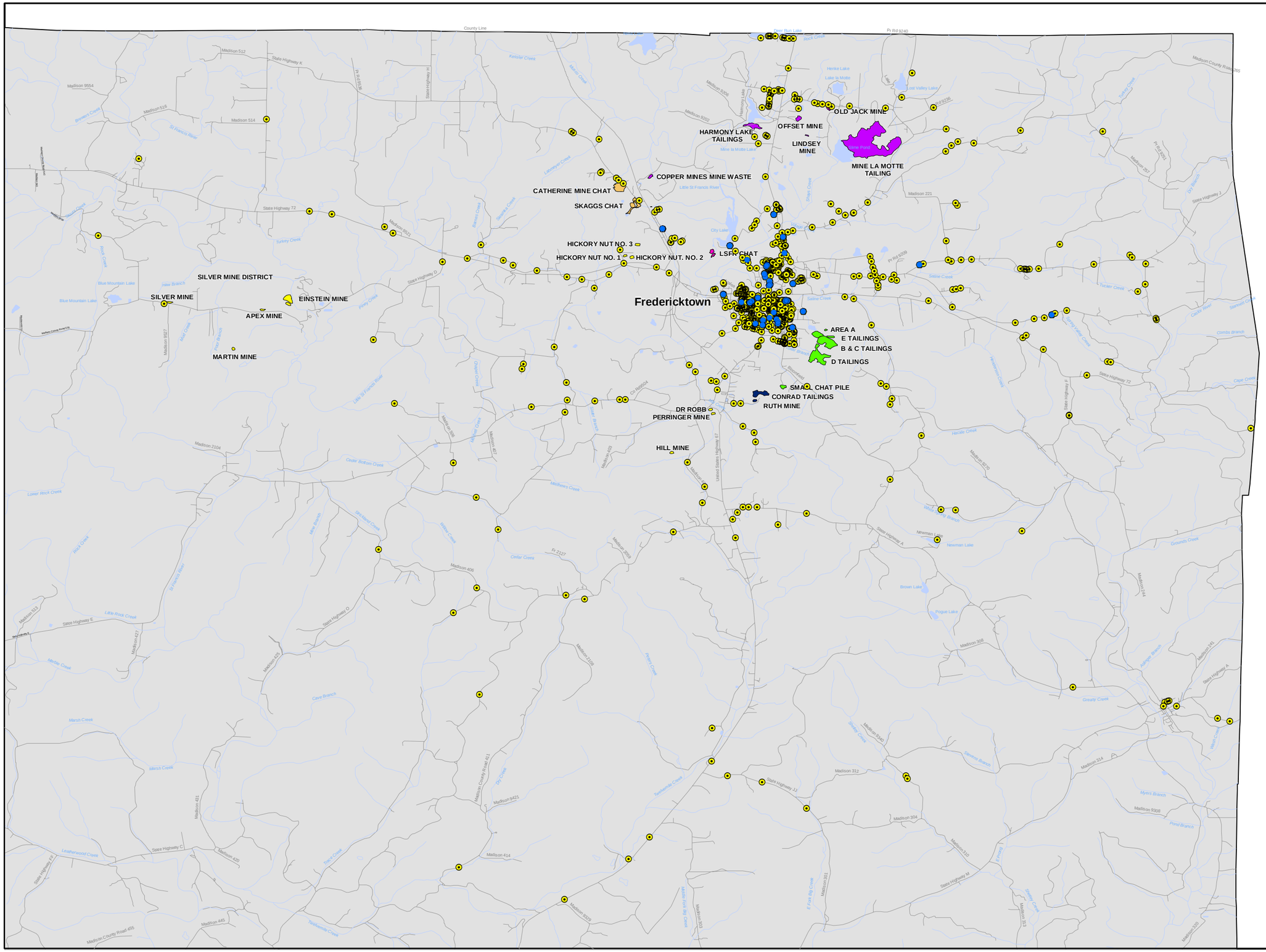
N

0 4,100 8,200 16,400

Feet

FIGURE 2:
LOCATION OF RESIDENTIAL PROPERTIES WITH LEAD CONCENTRATIONS GREATER THAN 1200 MG/KG

MADISON COUNTY MINES SITE
FREDERICKTOWN, MISSOURI



BLACK & VEATCH

Special Projects Corp.

Legend

- Residential Properties that have not been remediated with Lead Concentrations between 400 - 1,200 ppm
- Remediated Residential Properties that had Lead Concentrations between 400 - 1,200 ppm
- Mine Waste OU1
- Mine Waste OU2
- Mine Waste OU3
- Mine Waste OU4
- Mine Waste OU5
- Mine Waste OU6
- Lakes
- Streams
- Streets

LSFR - Little St. Francis River

N

0 2,500 5,000 10,000 15,000

Feet

FIGURE 3:
LOCATION OF RESIDENTIAL PROPERTIES WITH LEAD CONCENTRATIONS BETWEEN 400 - 1,200 MG/KG

MADISON COUNTY MINES SITE
FREDERICKTOWN, MISSOURI

Table 1
Federal Chemical-Specific ARARs

	Citations	Description
A. ARARs		
1. Safe Drinking Water Act	National Primary Drinking Water Standards 40 C.F.R. Part 141 Subpart B and G	Establish maximum contaminant levels (MCLs), which are health based standards for public waters systems.
2. Safe Drinking Water Act	National Secondary Drinking Water Standards 40 C.F.R. Part 143	Establish secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to protect the aesthetic quality of the water. SMCLs may be relevant and appropriate if groundwater is used as a source of drinking water.
3. Safe Drinking Water Act	Maximum Contaminant Level Goals (MCLGs) 40 C.F.R. Part 141, Subpart F	Establishes non-enforceable drinking water quality goals. The goals are set to levels that produce no known are anticipated adverse health effects. The MCLGs include an adequate margin of safety.
4. Clean Water Act	Water Quality Criteria 40 C.F.R. Part 131 Water Quality Standards	Establishes non-enforceable standards to protect aquatic life. May be relevant and appropriate to surface water discharges, or may be a TBC.
5. Clean Air Act	National Primary and Secondary Ambient Air Quality Standards 40 C.F.R. Part 50	Establishes standards for ambient air quality to protect public health and welfare.
B. To Be Considered		
1. EPA Revised Interim Soil-lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities and 1998 Clarification	Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12, July 14, 1994, OSWER Directive 9200.4-27P, August 1988	Establishes screening levels for lead in soil for residential land use, describes development of site-specific preliminary remediation goals, and describes a plan for soil-lead cleanup at CERCLA sites. This guidance recommends using the EPA Integrated Exposure Uptake Biokinetic Model (IEUBK) on a site-specific basis to assist in developing cleanup goals.
2. EPA Strategy for Reducing Lead Exposures	EPA, February 21, 1991	Presents a strategy to reduce lead exposure, particularly to young children. The strategy was developed to reduce lead exposure to the greatest extent possible. Goals of the strategy are to 1) significantly reduce the incidence above 10 µg Pb/dL in children; and 2) reduce the amount of lead introduced into the environment.
3. Human Health Risk Assessment Report (HHRA)	"Area-Wide Human Health Risk Assessment for the Madison County Mines Site, Madison County, Missouri" – prepared by Syracuse Research Corp., July 2007	Evaluates baseline health risk due to current site exposures and established contaminant levels in environmental media at the site for the protection of public health. The risk assessment approach using this data should be used in determining cleanup levels because ARARs are not available for contaminants in soils.
4. Superfund Lead-Contaminated Residential Sites Handbook	EPA OSWER 9285.7-50, August 2003.	Handbook developed by EPA to promote a nationally consistent decision making process for assessing and managing risks associated with lead contaminated residential sites across the country.
5. Preliminary Remediation Goals	Preliminary Remediation Goals for Lead in Soil at the Madison County Mines, Operable Unit 3 Site, Madison County, Missouri, January 31, 2008.	Establishes preliminary remediation goals for protection of residents from lead in surface soil at the Madison County Mines Site, Operable Unit 3.

Table 2
State Chemical-Specific ARARs

	Citation	Description
A. ARARs		
1. Missouri Air Conservation Law	Missouri Department of Natural Resources RSMo 643.010 10 CSR 10-6.010	Sets ambient air quality standards for a variety of constituents, including particulate matter and lead. Provides long range goals for ambient air quality throughout Missouri in order to protect the public health and welfare.
2. Hazardous Waste Management Law	Missouri Department of Natural Resources Identification and Listing of Hazardous Waste 10 CSR 25-4.261 (A) 1, 2, 4	Defines those solid wastes which are subject to regulations as hazardous wasters under 10 CSR 25.
3. Missouri Clean Water Law	Missouri Department of Natual Resources RSMo 644.006 10 CSR 20-7.015 (1) (2) (3) (4) (5) (6) (7) (9)	Sets forth the limits for various pollutants which are discharged to the various waters of the state. Sets effluent standards that will protect receiving streams.
4. Missouri Clean Water Law	Missouri Department of Natural Resources RSMo 644.006 10 CSR 20 – 7.031 (2) (3) (4) (5); Tables (A) (B)	Identifies beneficial uses of waters of the State, criteria to protect their uses, and defines the antidegradation policy.
B. To Be Considered	None	

Table 3
Federal Location-Specific ARARs

	Citation	Description
A. ARARs		
1. Historic project owned or controlled by a federal agency	National Historic Preservation Act: 16 U.S.C. 470, et.seq; 40 C.F.R. § 6.301; 36 C.F.R. Part 1.	Property within areas of the Site is included in or eligible for the National Register of Historic Places. The remedial alternatives will be designed to minimize the effect on historic landmarks.
2. Site within an area where action may cause irreparable harm, loss, or destruction of artifacts.	Archeological and Historic Preservation Act; 16 U.S.C. 469, 40 C.F.R. 6.301.	Property within areas of the site may contain historical and archaeological data. The remedial alternative will be designed to minimize the effect on historical and archeological data.
3. Site located in area of critical habitat upon which endangered or threatened species depend.	Endangered Species Act of 1973, 16 U.S.C. 1531-1543; 50 C.F.R. Parts 17; 40 C.F.R. 6.302. Federal Migratory Bird Act; 16 U.S.C. 703-712.	Determination of the presence of endangered or threatened species. The remedial alternatives will be designed to conserve endangered or threatened species and their habitat, including consultation with the Department of Interior if such areas are affected.
4. Site located within a floodplain soil.	Protection of Floodplains, Executive Order 11988; 40 C.F.R. Part 6.302, Appendix A.	Remedial action may take place within a 100-year floodplain. The remedial action will be designed to avoid adversely impacting the floodplain in and around the soil repository to ensure that the action planning and budget reflects consideration of the flood hazards and floodplain management.
5. Wetlands located in and around the soil repository.	Protection of Wetlands; Executive Order 11990; 40 C.F.R. Part 6, Appendix A.	Remedial actions may affect wetlands. The remedial action will be designed to avoid adversely impacting wetlands wherever possible including minimizing wetlands destruction and preserving wetland values.
6. Waters in and around the soil repository.	Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C. Parts 1251-1376; 40 C.F.R. Parts 230,231.	Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material. Four conditions must be satisfied before dredge and fill is an allowable alternative: 1. There must not be a practical alternative. 2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary. 3. No discharge shall be permitted that will cause or contribute to significant degradation of the water. 4. Appropriate steps to minimize adverse effects must be taken. Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.

Table 3 (Continued)
Federal Location-Specific ARARs

A. ARARs (Continued)	Citation	Description
7. Area containing fish and wildlife habitat in and around the removal repository.	Fish and Wildlife Conservation Act of 1980, 16 U.S.C. Part 2901 et seq.; 50 C.F.R. Part 83.9 and 16 U.S.C. Part 661, et seq. Federal Migratory Bird Act, 16 U.S.C. Part 703.	Activity affecting wildlife and non-game fish. Remedial action will conserve and promote conservation of non-game fish and wildlife and their habitats.
8. Fish and Wildlife Coordination Act	16 U.S.C Section 661 et seq.; 33 C.F.R Parts 320-330; 40 C.F.R 6.302	Requires consultation when a Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources.
9. 100-year floodplain	Location Standard for Hazardous Waste Facilities- RCRA; 42 U.S.C. 6901; 40 C.F.R. 264.18(b).	RCRA hazardous waste treatment and disposal. Facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout during any 100-year/24 hour flood.
10. Historic Site, Buildings, and Antiquities Act	16 USC Section 470 et seq., 40 CFR Sect. 6.301(a), and 36 CRF, Part1.	Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks and to avoid undesirable impacts on such landmarks.
11. Clean Air Act	National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50.12	Emissions standards for particular matter and lead.
B. To Be Considered	None	

Table 4
State Location-Specific ARARs

	Citation	Description
A. ARARs	None	
B. To Be Considered	None	

Table 5
Federal Action-Specific ARARs

	Citation	Description
A. ARARs		
1. Disposal of Solid Waste in the Permanent Repository and closure of the Removal Repository.	Subtitle D of RCRA, Section 1008, Section 4001, et seq., 42 U.S.C. '6941, et seq.	State or Regional Solid Waste Plans and implementing federal and state regulations to control disposal of solid waste. The yard soils disposed in the repository may not exhibit the toxicity characteristic and therefore, are not hazardous waste. However, these soils may be solid waste. Soils failing TCLP were contaminated by mining wastes so all wastes are exempt from definition of hazardous waste per the Bevill exemption. Contaminated residential soils will be consolidated from yards throughout the site into a few repositories. The disposal of this waste material should be in accordance with regulated solid waste management practices.
2. Clean Water Act	Water Quality Criteria 40 C.F.R. Part 131 Water Quality Standards	Establishes non-enforceable standards to protect aquatic life.
3. Clean Air Act	National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50.12	Emissions standards for particular matter and lead.
4. Hazardous Materials Transportation Act	Hazardous Materials Transportation Regulations 49 C.F.R. Parts 107, 171-177	Regulates transportation of hazardous materials.
5. NPDES Storm Water Discharge for Permanent Repository.	40 C.F.R. Part 122.26; 33 U.S.C 402 (p)	Establishes discharge regulations for storm water. Required management of repository where waste materials come into contact with storm water. Also required during construction of the repository.
6. Transportation of excavated soils.	DOT Hazardous Material Transportation Regulations, 49 C.F.R. Parts 107, 171-177	Regulates transportation of hazardous wastes.
7. Waters in and around the soil repository.	Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C. Parts 1251-1376; 40 C.F.R. Parts 230,231.	Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material. Four conditions must be satisfied before dredge and fill is an allowable alternative: 1. There must not be a practical alternative. 2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary. 3. No discharge shall be permitted that will cause or contribute to significant degradation of the water. 4. Appropriate steps to minimize adverse effects must be taken. Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem.
B. To Be Considered	None	

Table 6
State Action-Specific ARARs

A. ARARs	Citation	Description
1. Missouri Fugitive Particulate Matter Regulations	Missouri Department of Natural Resources 10 CSR 10-6.170	The Missouri fugitive particulate matter regulations contain restrictions on the release of particulate matter to ambient air. These regulations are applicable to any dust emissions that occur as a result of remedial actions taken at the site.
2. Missouri Clean Water Law – Storm Water Regulations	Missouri Department of Natural Resources 10 CSR 20-6.200	These regulations define Best Management Practices for land disturbances, including practices or procedures that would reduce the amount of metals in soils and sediments available for transport to waters of the state. Permits would not be required for actions taken under CERCLA, but the substantive provisions of these regulations would be applicable. The Missouri standards would be considered ARARs only if they are more stringent than the Federal standards. Requires permits for metal and non-metal mining facilities and land uses or disturbances that create point source discharges of storm water.
3. Missouri Hazardous Substances Emergency Response	Missouri Department of Natural Resources RSMo 260.520 10 CSR 24-3.010	Establishes a statewide emergency telephone number to notify the State whenever a hazardous substance emergency occurs and specifies the requirements for emergency notification and follow up written notice.
4. Missouri Solid Waste Disposal Law	Missouri Department of Natural Resources RSMo 260.225 10 CSR 80-5.010 (2)	Contains requirements for determining what solid wastes will be accepted at landfills and identifying any special handling requirements.
5. Missouri Solid Waste Disposal Law	Missouri Department of Natural Resources RSMo 260.225 10 CSR 80-5.010 (5) (A), (B) 1-4, (C)	Requires all waters discharged from solid waste processing facilities to be sufficiently treated to meet applicable water quality standards, including those established under the authority of the Federal Water Pollution Control Act.
6. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370 10 CSR 25-5.262	Sets forth standards for generators of hazardous waste, incorporates 40 CFR Part 262 by reference, and sets forth additional state standards.
7. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.385 and 260.395 10 CSR 25-6.263	Sets forth standards for transporters of hazardous waste, incorporates 40 CRF Part 263 and certain regulations in 49 CFR by reference, and sets forth additional state standards.
8. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370 , 260.390, and 260.395 10 CSR 25-7.264(2)(A) through (2)(G), (2)(K) through (2)(N), and/or (2)(S)	Sets forth the standards for owners and operators of hazardous waste treatment, storage and disposal facilities; incorporates and modifies the federal regulations in 40 CFR Part 264 by reference, and sets forth additional state requirements.
9. Missouri Hazardous Waste Management Law	Missouri Department of Natural Resources RSMo 260.370, 260.390, 260.395, and 260.400 10 CSR 25-7.268	Establishes standards and requirements that identify hazardous wastes that are restricted from land disposal.
B. To Be Considered	None	

Table 7 - Alternative 2 Cost Estimate
Present Worth Cost Estimate - Excavation, Disposal, Vegetative Cover, and Institutional Controls

Cost Estimate Component	Quantity	Units	Unit Cost	Capital Cost
Capital Costs				
Mobilization [1]	1		$50,000	$50,000
Property Access, Contaminant Assessment [1]	1,100	Properties	$400	$440,000
Sample Property	748	Properties	$600	$448,800
Material Movement (excavation, transport, backfill, dust suppression)	204,600	yd^3	$63	$12,889,800
Post Cleanup Reports [1]	1,100	Properties	$100	$110,000
Vegetative Cover [2]	1,100	Properties	$2,000	$2,200,000
Lead Stabilization	715	Tons SulfiTech	$225	$160,875
10 yd^3 mixer to mix soil and SulfiTech A/T (rental and labor)	24	months	$1,300	$31,200
Air Monitoring (sample and pump rental costs)	15	Samples	$88	$1,320
Road Evaluation (1yd^2 is 3-inches thick)	20,000	yd^2	$10	$200,000
Under Sink Water Filter	2	Filter	$160	$320
Repository Maintenance Cost	1,433	yd^3	$5	$7,308
DIRECT CAPITAL COST SUBTOTAL				$16,539,623
Bid Contingnency (15%)				$2,480,900
Scope Contingency (10%)				$1,654,000
TOTAL DIRECT CAPITAL COST				$20,674,523
Pemitting and Legal (2%)				$413,500
Construction Services (10%)				$2,067,500
CONSTRUCTION COST TOTAL				$23,155,523
Engineering Design (3%)				$694,700
NON-RECURRING CAPITAL COST				$23,851,000

OTHER ANNUAL COSTS				
Governmental Controls Pilot Project	1	year	$80,000	$80,000
Institutional Controls (Annual Health Education)	4	year	$125,000	$500,000
Allowance for Repository Maintenance Cost	4	year	$2,000	$8,000
Under Sink Water Filter Replacement	2	year	$148	$296

Present Worth Analysis

Year	Annual Capital Costs	Costs Include:
1	$6,169,900	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
2	$6,090,100	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
3	$6,090,000	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
4	$6,090,000	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
Total Capital Costs	**$24,440,000**	
Total Present Worth of Capital Costs	**$22,446,000**	

Cost Estimate Component	Capital Cost
TOTAL PRESENT WORTH	**$22,446,000**

Notes:
[1] - Information from Feasibility Study for Residential Yard Soil, Omaha Lead Site, Omaha, Nebraska, EPA, 2004
[2] - Information from Evaluation of Phosphate Treatment of Residential Properties; Omaha Lead Site, Omaha, Nebraska, Black and Veatch, 2007
[3] - A 3.5% discount rate was used to calculate present worth.
[4] - The bid contingency for the project was estimated to be 15% of the direct capital cost subtotal.
[5] - The scope contingency for the project was estimated to be 10% of the direct capital cost subtotal.
[6] - Permitting and legal fees for the project were estimated to be 2% of the total direct cost.
[7] - The construction services cost for the project was estimated to be 10% of the total direct cost.
[8] - The engineering design cost for the project was estimated to be 3% of the total direct cost.

Table 8 - Alternative 3 Cost Estimate
Present Worth Cost Estimate - Phophate Stabilization, Excavation, Disposal, Vegetative Cover, and Institutional Controls

Cost Estimate Component	Quantity	Units	Unit Cost	Capital Cost
Capital Costs				
Mobilization [1]	1		$50,000	$50,000
Property Acess, Contaminant Assessment [1]	1,100	Properties	$400	$440,000
Sample Property	748	Properties	$600	$448,800
Material Movement (excavation, transport, backfill, dust suppression)	103,788	yd^3	$63	$6,538,600
Post Cleanup Reports [1]	1,100	Properites	$100	$110,000
Vegetative Cover [2]	558	Properties	$2,000	$1,116,000
Phosphoric Acid Treatment and Sod [2]	542	Properties	$12,305	$6,669,300
Lead Stabilization	500	Tons SulfiTech	$225	$112,500
10 yd^3 mixer to mix soil and SulfiTech A/T (rental and labor)	24	months	$1,300	$31,200
Long-Term Monitoring Program (half of total properties at 6 months, 2 years, and 5 years)	813	Sampling Events	$344	$279,700
Long-Term Monitoring Reports	3	Reports	$9,600	$28,800
Air Monitoring (sample and pump rental costs)	15	Samples	$88	$1,320
Under Sink Water Filter	2	Filter	$160	$320
Repository Maintenance Cost	1,433	yd^3	$5	$7,308
Road Evaluation	20,000	yd^2	$10	$200,000
DIRECT CAPITAL COST SUBTOTAL				$16,034,000
Bid Contingnency (15%)				$2,405,100
Scope Contingency (10%)				$1,603,400
TOTAL DIRECT CAPITAL COST				$20,042,500
Pemitting and Legal (2%)				$400,900
Construction Services (10%)				$2,004,300
CONSTRUCTION COST TOTAL				$22,447,700
Engineering Design (3%)				$673,400
NON-RECURRING CAPITAL COST				$23,121,000

OTHER ANNUAL COSTS				
Governmental Controls Pilot Project	1	year	$80,000	$80,000
Institutional Controls (Annual Health Education)	4	year	$125,000	$500,000
Allowance for Repository Maintenance Cost	4	year	$2,000	$8,000
Under Sink Water Filter Replacement	2	year	$148	$296

Present Worth Analysis

Year	Annual Capital Costs	Costs Include:
1	$5,987,400	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
2	$5,907,400	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
3	$5,907,300	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
4	$5,907,300	Annual Capital Costs are assumed to be 25% of the Total Capital Cost.
Total Capital Costs	**$23,709,400**	
Total Present Worth of Capital Costs	**$21,775,000**	

Cost Estimate Component	Capital Cost
TOTAL PRESENT WORTH	**$21,775,000**

Notes:

[1] - Information from Feasibility Study for Residential Yard Soil, Omaha Lead Site, Omaha, Nebraska, EPA, 2004

[2] - Information from Evaluation of Phosphate Treatment of Residential Properties; Omaha Lead Site, Omaha, Nebraska, Black and Veatch, 2007

[3] - A 3.5% discount rate was used to calculate present worth.

[4] - The bid contingency for the project was estimated to be 15% of the direct capital cost subtotal.

[5] - The scope contingency for the project was estimated to be 10% of the direct capital cost subtotal.

[6] - Permitting and legal fees for the project were estimated to be 2% of the total direct cost.

[7] - The construction services cost for the project was estimated to be 10% of the total direct cost.

[8] - The engineering design cost for the project was estimated to be 3% of the total direct cost.