PROPOSED PLAN

CONRAD TAILINGS
OPERABLE UNIT 4

MADISON COUNTY MINES SUPERFUND SITE
MADISON COUNTY, MISSOURI

Prepared by:

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Region VII
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July 2011

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1.0 Introduction

This Proposed Plan has been developed by the U.S. Environmental Protection Agency to address the mine and mill waste in Operable Unit 4 of the Madison County Mines Superfund site located in Madison County, Mo. This plan is published in accordance with the requirements of section 117 of the Comprehensive Environmental Response, Compensation and Liability Act 42 U.S.C. §9617 and the National Contingency Plan at 40 CFR §300.430(f)(2). This Proposed Plan is a document that EPA is required to issue to fulfill public participation requirements under CERCLA and the NCP. The primary purpose is to inform and solicit the views of citizens on the Preferred Alternative. The purpose of this Proposed Plan is to:

- Provide basic background information about the site
- Identify the preferred alternative for remedial action at the site and explain the reasons for the EPA's preference described below in Section Ten.
- 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 EPA has coordinated the development of this Proposed Plan with the Missouri Department of Natural Resources. The EPA is the lead agency and the MDNR is the support agency.

2.0 Purpose of the Proposed Plan

The primary purpose of the Proposed Plan is to present to the public a clear explanation of the EPA's Preferred Alternative for addressing mine and mill waste at this site. The public is encouraged to review and comment on the proposed action. The public is also encouraged to review and comment on the supporting documents in the Administrative Record. The AR is a collection of all the documents and information the EPA relied on in developing the Proposed Plan. The preferred alternative is the low-permeability cap for reasons stated in Section 10.1

A 30-day review and comment period opens on July 20, 2011, and will close on August 20, 2011. A public meeting will be held July 25, 2011, at 6:30 p.m. in the Black River Electric Cooperative Facility in Fredericktown, Mo. The Proposed Plan and supporting documents in the AR are available for review during normal business hours at the following locations:

1. Fredericktown Branch of the Ozark Regional Library
   115 South Main Street
   Fredericktown, Mo. 63645

2. U.S. Environmental Protection Agency
   Superfund Records Center
   901 North 5th Street
   Kansas City, Kan. 66101

After the public comment period expires, the EPA will review all comments and make a final decision for cleanup of the mine and mill wastes at OU-4. The community's preferences are an extremely important factor and will help determine the final decision on the clean up and so we encourage the public to provide comments to the EPA. The EPA's final decision will be explained in a document called a Record of Decision. Included in the ROD will be a responsiveness summary that responds in writing to significant comments the EPA received from the public during the comment period.

3.0 Site Background Information

Location and History

The site (Comprehensive Environmental Response, Compensation, and Liability Information System identification number MOD098633415) is located near Fredericktown in southeastern Mo. The site is located at the southern end of the Old Lead Belt where heavy metal mining has occurred since the early 1700s. The site is located about 80 miles south of St. Louis, Missouri, on the southeastern edge of the Ozark Uplift. Past mining operations have left at least 13 identified major mine waste areas in the form of tailings and chat deposits in the soils from smelting and mineral processing operations in Madison County. The site was placed on the National Priorities List on September 29, 2003.

Both the MDNR and the EPA have conducted extensive investigation of the site that is available in the AR. Starting in 1980, a number of investigations occurred on the county's mine waste and its effects, most of which focused on the areas affected by OU-2 Anschutz tailings (one of six OUs at the site) which is located north and adjacent to OU-4. In order to investigate a broader area, the EPA performed an Expanded Site Inspection on the Little St. Francis River 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, 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. Fact sheets for OU-3 were issued in April 2008. In July 2008, the EPA held a public meeting on OU-3 in Fredericktown, Mo.

Lead in the mining-related contaminated area presents health risks to humans, primarily children under the age of seven. Studies conducted by the Missouri Department of Health and Senior Services and the Madison County Health Department concluded that as many as 15 percent of targeted children in Madison County possessed elevated levels of lead in their blood.

The site was historically defined by six OUs. In 2006, the EPA redesignated the former OU3 (the Ruth and Park City subsite, now commonly referred to as the Conrad subsite) as OU4. OU4 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 windblown contamination; groundwater impacts; and mine works locations and outflows.

The Conrad subsite is located about two miles south of Fredericktown, east of Highway 67 in sections 20 and 29 of Township 33N, Range 7E. Access is gained along County Road 200, which intersects Highway 67 at the Marcus Memorial Cemetery. The property adjoins the Madison Mine (Anschutz) property to the east. The Conrad tailings, produced during operation of the Ruth mine and mill, are presently owned by the Conrad family. Properties to the north and east of the tailings impoundment are owned by the Anschutz Mining Corporation.

The Conrad subsite consists of an unvegetated pile of fine sandy tailings, partially vegetated tailings that have been eroded from the pile and transported to an unnamed tributary of Mill Creek, a collapsed shaft, the foundations and ruins of a flotation plant, a mill and other support buildings. The area of the tailings impoundment is estimated to be approximately 14.55 acres. The western area of the mine waste at the Ruth mine and mill was not mapped, but is estimated to be approximately 10.5 acres. Based on the limited amount of borings installed at the Conrad subsite, it is estimated that approximately 282,600 cubic yards of tailings are present in the tailings impoundment and 8,400 cubic yards of mine waste are present at the Ruth mine and mill area. Additional soils estimated at approximately 191,275 cubic yards have been added to the subsite through its use as a residential soils repository since 2009. Surface water from the area drains southwestward along an unnamed perennial stream that discharges to Mill Creek, a tributary to the Little St. Francis River. The subsite is about 4,000 feet from the Mill Creek confluence, and is nearly 2.75 miles from the LSFR. Three sediment collection basins have been installed to control runoff to the creek.

4.0 Site Characteristics

Since mining operations have ended in Madison County the primary land use is agricultural crop and pasture land. Industrial activities consist of light manufacturing, aggregate production, and construction. The population is predominantly rural. According to 2010 census data, the population of Madison County is 12,226 including 4,857 households, and 5,929 housing units. In addition, the county has approximately 260 nonfarm businesses, 6 schools, 400 farms, 300 miles of unimproved rural roads, 100 miles of paved rural 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 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 Bonne Terre 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.

Continuous five-foot core samples through the Conrad tailings were collected at five locations using a track-mounted Geoprobe rig. The tailings samples were analyzed for target analyte list (TAL) metals. Three tailings samples were analyzed for metals using the TCLP test. Seventeen of the 18 samples collected from the tailings contained lead concentrations that exceeded the EPA Region 7 Preliminary Remediation Goal (PRG) of 400 mg/kg (milligrams per kilogram) for residential properties. The highest concentration was 3,990 mg/kg. PRGs are cleanup concentrations derived from risk assessments. The tailings samples also contained elevated concentrations of other metals including arsenic, cadmium, cobalt, copper, iron, nickel and zinc. Results of the TCLP tests indicated that the tailings have the characteristic of metals toxicity for lead.

Shallow groundwater collected from the tailings impoundment contained moderate to high concentrations of cobalt, iron, lead, manganese, nickel, and zinc. Groundwater concentrations for arsenic, antimony, and lead exceeded the EPA primary maximum contaminant levels (MCL) and concentrations of aluminum, iron, manganese and sulfate exceeded the EPA secondary MCL. In addition, the groundwater concentrations exceeded applicable surface water quality criteria for cobalt, lead, nickel, and zinc.

Surface soil samples were collected from the area adjacent to the former mill foundation, the kiln building foundation, and L-shaped foundation and analyzed for TAL metals, polychlorinated biphenyls (PCBs), and SVOCs. PCBs were detected in one sample at a concentration of 380 mg/kg. SVOCs were also detected in one sample collected near the kiln building. Four samples exceeded the EPA Region 7 PRG for lead.

Additional soil samples were collected at 100 foot intervals from the air erosion transects north and east-southeast of the tailings. Ten samples were collected along the north transect. The lead concentration detected in the sample collected 100 feet from the tailings was above the EPA Region 7 PRG of 400 mg/kg and the remaining samples contained lead concentrations below 400 mg/kg. Four samples were collected along the east-southeast transect. The lead concentration detected in the sample collected 100 feet from the tailings exceeded 400 mg/kg and the remaining samples were detected below this concentration.

Five surface soil samples were collected from the floodplain of the unnamed tributary stream that drains from the Conrad impoundment to Mill Creek and from the floodplain of Mill Creek above and below the confluence with the unnamed stream. The samples were collected from 15 to 30 ft from the channel and analyzed for TAL metals. Two of the five floodplain soil samples exceeded 400 mg/kg.

One surface water sample collected in the unnamed creek downstream of the Conrad tailings above the confluence of Mill Creek had measurable concentrations of dissolved copper (20.7 ug/l[micrograms per liter]) and lead (42.9 ug/l) that exceeded Missouri chronic Water Quality Standards (WQS) for protection of aquatic life of 6.4 ug/l and 2.6 ug/l, respectively. Concentrations of cobalt, nickel, and zinc in the sample were below the WQS. Three sediment samples from the same unnamed creek had concentrations of several metals that substantially exceeded sediment quality benchmarks. Conrad tailings material was visibly noticeable at these stations. Sediment concentrations of copper, cobalt, lead, and nickel in Mill Creek show decreasing concentration gradients as the distance downstream from the unnamed creek increases.

The mine waste contains elevated levels of heavy metals, principally lead, posing a threat to human health and the environment. These deposits have contaminated soils, sediments, surface water and groundwater. These materials have also been transported by wind and water erosion. Mine waste was also distributed for use on residential properties for fill material and private driveways, used as aggregate for road construction, and placed on public roads around Fredericktown and throughout the county to control snow and ice.

5.0 Scope and Role of the Cleanup Action

As mentioned in the previous section, the investigation and study of the site includes the mining wastes in and around 13 former mining areas located within about 390 square miles of Madison and St. Francois Counties. In addition, the EPA divided the site into six OUs for cleanup activities because of the multi-media nature of contamination. The OUs include: OU-1 - Mine La Motte, OU-2 - Anschutz Tailings, OU-3 - Residential Mine Waste, OU-4 - Conrad and Ruth Mine Tailings, OU-5 - Catherine and Skaggs Tailings and OU-6 - Silver Mines. This Proposed Plan addresses OU-4 and includes those areas in and around the locations where mine and mill wastes are located, including locations impacted by air and surface water transport.

In April 2008, a remedial investigation was completed collecting data primarily from surface soil samples, surface and subsurface mine waste samples, surface water samples and sediment samples collected from the Conrad subsite in January, February, and March 2006 in order to determine the nature and extent of the metals contamination. In addition, a Geoprobe was used to collect subsurface mine waste samples and groundwater samples from beneath the mine wastes. Soil samples were collected at the Conrad subsite and analyzed for PCBs and semi-volatile organic compounds (SVOCs). The toxicity characteristic leaching procedure (TCLP) test was performed on samples from the LSFR, Conrad, Catherine, and Skaggs subsites to determine if the waste material was a hazardous waste.

A Feasibility Study was completed in May 2011. The FS combines the information about the nature and extent of contamination in and around the operable unit described in the Remedial Investigation Report (April 2008) and the investigations characterizing and evaluating the operable unit. The FS developed alternatives for remedial action. Additional studies have been conducted by the EPA and the MDNR to assist in developing and supporting the alternatives in the Proposed Plan.

The EPA has already initiated remedial actions to address human health risks associated with direct exposure to residential soil contaminated with lead and other metals at the Madison County Mines site. An Interim Record of Decision (IROD, September 2008) for OU-3 - Residential Soils, was developed to address removal of mine waste, namely lead contaminated soil and chat from residences at the site. The Conrad subsite is currently used as a soils repository for the OU-3 Remedial Action which has resulted in the removal of soil at approximately 1,600 properties. Approximately 550 properties remain to be sampled with an estimated 300 properties remaining to be remediated. The IROD includes a Health Education Program and a Voluntary Institutional Control Pilot Project be developed as part of the remedy to protect future residents from exposure to the mine waste. These are currently funded through cooperative agreements from EPA to the Missouri Department of Health and Senior Services and implemented locally through assistance of local stakeholders to minimize human health risks.

The cleanup of mining and milling waste addressed by this Proposed Plan is necessary to mitigate the principal threat for OU-4, the risk to visitors on and near the mine waste areas containing lead (the contaminant of concern) and aquatic and terrestrial ecosystems from exposures to mill wastes, soils, sediments and surface water. This Proposed Plan for mining and mill waste is consistent with previous EPA decisions for other sites. The EPA prioritizes response actions based on the need to address human health risks first.

6.0 Summary of Site Risks

In general, the EPA has determined that the risks for OU-4 are the human health and ecological risks resulting from the contaminants of concern (COCs) that consist primarily of lead, and potential risks to terrestrial vermivores (organisms that ingest worms) that may be caused by ingesting metals from soils exceeding threshold criteria. Risks to visitors on and near the mine waste areas will also be addressed by the actions proposed. The purpose of this Proposed Plan; therefore, is to document the EPA's preferred remedial actions to mitigate the unacceptable human and ecological risks.

The objective is to achieve significant reductions in COC loadings to surface waters thus reducing risks to terrestrial vermivores and to rely on the engineering control components of this Proposed Plan to permanently protect future residents and site visitors from the human health risks from exposure to mining and milling wastes and to prevent surface runoff and seeps from the tailings from entering the drainages and unnamed tributary to Mill Creek. The actions presented in this Proposed Plan would be supplemented with a Declaration of Covenants and Restrictions to minimize the need for institutional controls that are difficult for the EPA to establish and implement, and for the state of Missouri and local governments to ensure proper operation and maintenance. The Proposed Plan also incorporates the use of the site as a repository for mine waste to complete the Remedial Action under the OU-3 Interim ROD.

6.1 Human Health Risk Assessment

A Baseline Human Health Risk Assessment was completed in July 2007 for the Madison County Mines Superfund site and was conducted 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 BHHRA 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 risks attributable to site-related contaminants and to help determine if there is a need for action at the Site. Draft Preliminary Remediation Goals were established for human receptors (EPA 2008) and are discussed in the Remedial Action Objectives.

The risk assessment addresses exposure and metals toxicity, and summarizes both quantitative and qualitative risk. Estimated metal intakes were compared to toxicity values in order to characterize non-carcinogenic effects. For estimating carcinogenic effects, estimated intakes and chemical-specific dose-response data were used to calculate the probabilities of an individual developing cancer over a lifetime. Exposures to lead were assessed separately, through the use of the Integrated Exposure Uptake Biokinetic Model. The risk assessment identified potential health risks for children and adults who live on and near mill wastes, particularly those who also consume backyard garden produce. Exposure to lead in soils, mill wastes and garden produce accounted for most of the numeric calculated health risk. Routes of exposure to humans are through ingestion of soils in mouth by children and inhalation. The assessment showed an unacceptable risk for people living on soils or mine waste impacted with lead. Please refer to the BHHRA in the Administrative Record for specific calculated risks for the various receptors.

6.1.1 Exposure Routes and Receptors

As described in the BHHRA, the following exposure pathways and receptors were used for quantitative assessments of the risks to human receptors at the Conrad subsite:

- Future Residents – Ingestion of and direct contact with surface soils combined with hypothetical future ingestion of shallow groundwater near the mine waste.
- Commercial Workers - Ingestion of and direct contact with surface soils combined with hypothetical future ingestion of shallow groundwater near the mine waste, as well as hypothetical future ingestion of shallow groundwater near the mine waste.
- ATV Riders – Ingestion, inhalation and dermal exposure to mine wastes and surface soils.
- Adult Recreational Visitor – Ingestion of and dermal exposure to floodplain surface soil, sediment, surface water and ingestion of locally caught fish.
- Child Recreational Visitor – Ingestion of and dermal exposure to floodplain surface soil, sediment, surface water and ingestion of locally caught fish.

6.2 Ecological Risk Assessment

The EPA prepared a streamlined Ecological Risk Assessment (ERA) for the Madison County Mines OU3 site (EPA 2006) and a Baseline Risk Assessment for the Conrad subsite (EPA 2008). The purpose of the ERA was to describe the likelihood, nature and severity of adverse effects that environmental chemical contamination may be having on local ecosystems. The information is used by EPA to make decisions on whether remedial activities are needed at the site to protect the environment. The Baseline Risk Assessment was conducted to define site-specific Preliminary Remediation Goals (PRGs) discussed in the Remedial Action Objectives.

The EPA conducted a field survey in June 2005 and collected ecological information from Mill Creek below the Conrad subsite including the unnamed tributary to Mill Creek. In addition, a background Site was sampled on the Castor River located in the Amidon Conservation Area approximately eight miles east of Fredericktown. EPA made field observations of ecological conditions and collected water column, sediment and pore water samples from two locations (Sites 5 and 6). The samples were analyzed for metals, hardness and total organic carbon by the EPA Region 7 laboratory. During the field survey, EPA also collected soil samples and earthworm samples at the Conrad subsite and the background site. Horsetail plants were collected at the Conrad subsite. All of these samples were analyzed for metals by the EPA Region 7 laboratory. Fish tissue samples were collected from Mill Creek below the Conrad subsite and from the Castor River background site. These samples were analyzed for metals.

The ERA describes the following exposure pathways and receptors that were used for quantitative assessments of the risks to ecological receptors:

- Aquatic biota are exposed to contaminants above risk-based criteria in surface water. Contaminants are transported to surface water via runoff from mine waste source materials and possible groundwater discharge from the shallow aquifer beneath the mine wastes.
- Aquatic biota are exposed to contaminants in mine wastes that are mobilized during rainfall events and deposited as sediments in nearby surface waters.
- Terrestrial plants are exposed to contaminants in mine waste areas via metals uptake through their roots and deposition of dust.
- Terrestrial vertebrates are exposed to contaminants in concentrations above threshold criteria through their diet of earthworms, fish or plants.

The ERA concluded there is ample evidence that both the aquatic and the terrestrial environments in the Madison County Mine Site are contaminated by mine wastes, that living organisms in both environments have elevated exposure to mining-related metals, and that the metals cause adverse effects on at least some receptors in each environment. Specific conclusions regarding the impact of these elevated exposures are summarized below.

6.2.1 Aquatic Ecosystem

Fish collected in Mill Creek had elevated levels of lead in their tissues in comparison to the background fish tissue which had very low levels of lead.

6.2.2 Terrestrial Ecosystem

- There is clear evidence of phytotoxicity to terrestrial plants in mine waste areas.
- Hazard Quotient (HQ) values are greater than 1 for terrestrial vermivores at the Conrad subsite, and consequently there is a potential hazard to woodcocks and shrews.
- HQ and Hazard Index (HI) values are greater than 1 at the Conrad subsite, and therefore there is a potential hazard to earthworms and vermivores.
- The HI for the great blue heron at Site 5 on Mill Creek below the Conrad subsite is above 1, and therefore there is a potential hazard to these avians.

7. Remedial Action Objectives

The Remedial Action Objectives (RAOs) set the goals of the remedial action and identify the RAOs for the mine wastes/source materials and transition surface soils, surface soils in the public road right-of-ways and drainage ways, surface water and sediments, and shallow groundwater at the Conrad subsite. RAOs specific to these media are presented separately in this section. RAOs are developed by reviewing site characterization data, BHHRA results, ERA results, Applicable or Relevant and Appropriate Requirements (ARARs), and other relevant site information. The EPA considers the Preferred Alternative necessary to protect human health and the environment.

This Proposed Plan would incorporate the continued use of the Conrad subsite to complete the Remedial Action under OU-3 Residential Soils. Supplemental assessments may be required during the Remedial Design to further characterize and define the horizontal and vertical extent of contamination to quantify the volume of mine waste exceeding PRGs in dynamic systems affected by surface runoff. Environmental Covenants and Restrictions would be developed with the property owner(s) to prevent access resulting in possible exposure to COCs.

The EPA guidance states that RAOs should be medium-specific goals for protecting human health and the environment and must specify the following:

- Contaminants of concern
- Exposure routes and receptors
- Acceptable contaminant level or range of levels for each identified exposure route

7.1 Contaminants of Concern

Contaminants of Concern are namely source material-related that include lead, cadmium, cobalt, and manganese. Preliminary Remediation Goals (PRGs) were developed specific to the site by Region 7 Risk Assessors for lead and cadmium. Cobalt and manganese were identified as Contaminants of Concern to human receptors only in mine tailings. Cleanup levels are not established for cobalt and manganese as the tailings would be capped under the preferred alternative. PRGs were also established for ecological risks where lead and cadmium are identified as COCs. One detection of PCBs and limited SVOCs detections are considered anomalous and are not addressed in this Proposed Plan.

7.2 MineWaste/Source Materials

The source material RAOs are designed to address the potential risks associated with direct exposure of human and ecological receptors to contaminants in mine wastes/source materials that include chat, tailings, and affected transition zone and floodplain soils in the vicinity of the source materials. The source materials include residential soils transported to the Conrad subsite. The RAOs for the mine wastes/source materials are as follows:

- Control risks to humans from exposure to manganese and cobalt from mine wastes such that the excess cancer risk is less than 1E-04, the HQ and HI values are less than 1.0, and lead such that there is no more than a 5 percent chance that an exposed individual child will have a blood lead level that exceeds 10 µg/dL (micrograms per deciliter).
- Control risks to ecological receptors from exposure to contaminants (lead and cadmium) from mine wastes such that HQ or HI values are less than or equal to 1.0.
- PRGs for mine wastes/source materials are:

Contaminant	Soil	Riparian Buffer
Lead	400 mg/kg	219 mg/kg
Cadmium	5 mg/kg	5 mg/kg

7.3 Surface Water RAOs

The surface water RAOs are designed to address the potential risks associated with exposure of human and ecological receptors to contaminants in surface streams and their tributaries resulting from surface runoff of source materials. Surface water PRGs were not established as the overall exposure is negligible compared to that of sediment and floodplain soils. Surface water runoff and seeps would be controlled by diversion structures to prevent contact with any remaining contamination, and/or diverted to containment structures preventing loading of suspended sediments with contaminants to streams.

Total noncancer risks to a child recreational visitor are above a level of concern for a reasonable maximum exposure to the visitor. The risks are attributed to the ingestion from a variety of metals in surface water. The total cancer risks from exposure to surface water are below EPA's typical level or concern for a child recreational visitor. The probability of a recreational child having a blood lead level above 10 µg/dl does not exceed EPA's health based goal of 5 percent. Based on this information, the RAOs for surface water are as follows:

- Control risks to child receptors from exposure to contaminants in surface water such that the HQ and HI values are less than 1.0 where metals are transported from the mine waste piles through erosion.
- Control exposure of aquatic biota to contaminants released and transported from the mine wastes where federal surface water quality criteria are exceeded in Mill Creek and the unnamed tributary to Mill Creek.

7.4 Groundwater RAOs

Groundwater would need to meet the surface water RAOs where it surfaces in the form of seeps or channel discharge. Groundwater will also be addressed through the Missouri Environmental Covenants Law through environmental covenants with respective property owners preventing consumptive use and future diversion of groundwater possibly resulting in exposure. Four (4) monitor wells would be installed for periodic monitoring to determine interaction or communication with surface water.

7.5 Sediment RAOs

Sediment RAOs are designed to address the potential risks associated with direct exposure of ecological receptors to contaminants in sediments from the transport of contaminants in source materials to surface streams and their tributaries. The RAOs for sediment are as follows:

- Control risk of exposure of aquatic biota to contaminants in sediments by controlling the transport of mine waste from source areas to Mill Creek and the unnamed tributary to Mill Creek such that the HQ and HI values are less than or equal to1.0.
- PRGs for sediment are:
  Lead – 150 mg/kg
  Cadmium – 5 mg/kg

7.6 Riparian Zone RAOs

Riparian zones are unique to wetlands ecosystems where soils and soil moisture are influenced by adjacent streams and rivers. Riparian zones should remain intact wherever possible with limited disturbance.

8.0 Summary of Alternative Cleanup Plans Evaluated

General response actions and various remedial technologies were evaluated and screened based on effectiveness, implementability, cost, and short and long-term risk. Available technologies for physical treatment of soils, mine waste and sediment were evaluated in the FS for the Proposed Plan, but the success of these applications could neither be fully quantified or proven. The high cost of physical treatment, the difficulty of uniform dispersment of treatment solutions, and the difficulty of identifying corrective actions if initial treatment is unsuccessful, were all cited as reasons to not retain the treatment technologies as remedial alternatives. These treatment technologies evaluated and screened can be reviewed in the FS in the Administrative Record.

The following six remedial alternatives were developed in the FS following the screening and evaluation of remedial technologies:

8.1 Alternative 1 – No Action: Under this alternative, the site would remain in its present condition with no actions being taken to control or mitigate contamination or to prevent exposure to contaminants in the environment. This remedial action is required by the NCP.

8.2 Alternative 2 – Institutional Controls: Under Alternative 2, RAOs would be addressed solely through the application of a variety of institutional controls that include a combination of land use, deed restrictions, fencing and signs. Groundwater and surface water/sediments in the vicinity of the site would be monitored for 5 years.

8.3 Alternative 3 – Source Removal and Off-site Disposal: Under Alternative 3, all sources of contamination in each sub-area would be excavated and removed from the site. Tailings from the impoundment and occurring as eroded materials and sediment in the unnamed tributary would be transported to a hazardous waste landfill in Peoria, Ill.; Ft. Wayne, Ind.; or Emelle, Ala. Areas of tailings-contaminated soil that occur beneath the tailings, on the mine and mill site, the floodplain of the unnamed tributary and along the right-of-way of County Road 200 would also be excavated and transported to the hazardous waste landfill. Although the tailings are excluded from regulation under RCRA, the tailings exhibit the toxicity characteristic for lead and it is unlikely that a Subtitle D landfill or a special waste landfill would accept the tailings. Consequently, it is assumed that the waste would be transported to a hazardous waste landfill. Groundwater in the vicinity would not be immediately positively affected by removal of the waste on the surface and would require institutional controls and monitoring for a minimum of five years.

8.4 Alternative 4 – Permeable Cover: Alternative 4 would create permeable soil and vegetation covers over areas where tailings and contaminated soil are present to prevent wind and water erosion. Contaminated material would not be excavated but would be capped in place including the tailings impoundment, some areas of the Ruth Mine and mill, and the right-of-way along County Road 200. Tailings present in the channel of the unnamed tributary and areas on the floodplain of the unnamed tributary creek would be excavated and included under the permeable cover at the tailings pile. Soils in some areas of the Ruth Mine and mill area may require excavation and placement on the tailings, and covered if necessary to have sufficient area to construct wetlands to treat the seepage from the tailings. Because the permeable cover over the tailings area would permit precipitation to infiltrate to the groundwater table, seepage from the tailings impoundment would be collected and treated using a passive system consisting of constructed wetlands. Groundwater and surface water/sediments in the vicinity of the site would be monitored for a minimum of five years. Environmental Covenants with property owners would be required for contaminants remaining on site exceeding PRGs.

8.5 Alternative 5A – Low Permeability Cap: Under Alternative 5A, the tailings impoundment would be graded, contoured, and covered with a low permeability cap. Tailings comprising the impoundment would not be excavated and moved as part of this alternative, but would be graded to meet an engineered construction design. Prior to capping, tailings and contaminated soil from the Ruth Mine and mill area, County Road 200 right-of-way and floodplain of the unnamed tributary creek would be excavated and hauled to the impoundment. Tailings eroded from the face of the dam and those occurring as sediment in the unnamed tributary channel which would also be excavated and transported to the impoundment. The low permeability cap would consist of the following components: a one-foot thick clay liner, a six-inch soil layer, and a vegetated cover. Surface water/sediments in the vicinity of the site would be monitored for five years. Environmental Covenants with property owners would be required for contaminants remaining on site exceeding PRGs.

8.6 Alternative 5B – Engineered Low Permeability Cap: Under Alternative 5B, the tailings impoundment would be graded, contoured, and covered with a low permeability cap. Tailings comprising the impoundment would not be excavated and moved as part of this alternative. Prior to capping, tailings-contaminated soil from the Ruth Mine and mill area, County Road 200 right-of-way, and floodplain of the unnamed tributary creek would be excavated and hauled to the impoundment. In addition, tailings eroded from the face of the sediment basin dams and those occurring as sediment in the

unnamed tributary channel would be excavated and transported to the impoundment. The low permeability cap would consist of the following components: a low permeability, less than 1 x 10^{-7} centimeters per second (cm/sec), two foot thick natural clay or amended soil liner or geosynthetic clay liner as a substitute; a geomembrane, 60 mil high density polyethylene (HDPE), low density polyethylene (LDPE) or 30 mil polyvinyl chloride (PVC); drainage layer; a protective soil cover; a vegetative soil layer; and vegetated cover. Groundwater and surface water/sediments in the vicinity of the site would be monitored for five years. Environmental Covenants with property owners would be required for contaminants remaining on site exceeding PRGs.

9.0 Analysis of Remedial Alternatives

A detailed evaluation of the remedial alternatives was performed using seven of the nine EPA evaluation criteria. The evaluation criteria are:

- Protection of Human Health and the Environment
- Compliance with ARARs
- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility, or Volume
- Short-Term Effectiveness
- Implementability
- Cost

Two of the criteria, state acceptance and community acceptance, cannot be adequately addressed until after the FS Report is released for regulatory and public review as well as public comment is taken on this proposed plan. These criteria will be assessed in the ROD responsiveness summary.

9.1 Threshold Criteria

9.1.1 Overall Protection of Human Health and the Environment

This criterion provides an overall assessment of whether an alternative meets the requirement that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors from other criteria, especially long-term effectiveness and permanence, short-term effectiveness and compliance with ARARs. A comparative analysis follows:

Alternative 3 (Source Removal and Off-site Disposal) would be the most protective of human health and the environment at the subsite. Excavation and removal of all media exceeding PRGs would result in attainment of RAOs throughout the site. Off-site disposal would permanently protect both human and ecological receptors by eliminating any exposure potential.

Alternatives 4 (Permeable Cover), 5A (Low Permeability Cap) and 5B (Engineered Low Permeability Cap) would all achieve a high degree of protection of human health and the environment at the site. Each of these three alternatives primarily relies on on-site containment of media exceeding PRGs to attain RAOs. Of the three alternatives, Alternative 5B (Engineered Low Permeability Cap) is likely to be the most protective because it does not rely on passive treatment to protect human health and the

environment from seepage from the tailings. The degree of protectiveness of Alternatives 4 (Permeable Cover) and 5A (Low Permeability Cap) would be similar, because the only substantial difference between the two alternatives is the amount of precipitation likely to infiltrate the tailings. Although Alternative 5A (Low Permeability Cap) would result in less infiltration, and greater protectiveness than Alternative 4, both alternatives rely on passive treatment to attain PRGs for seepage to protect surface water.

Alternative 2 (Institutional Controls) would achieve a moderate degree of protectiveness for human health, but would not be protective of the environment. Institutional controls such as installation of signs, fencing, and deed restrictions would not prevent exposures by ecological organisms.

Alternative 1 (No Action) would not be protective of human health or the environment.

9.1.2 Compliance With ARARs

This criterion is used to decide how each alternative meets applicable or relevant and appropriate federal, state and local requirements, as defined in CERCLA Section 121. Compliance is judged with respect to:

- chemical-specific ARARs
- action-specific ARARs
- location-specific ARARs
- appropriate criteria, advisories and guidance (TBCs)

Alternatives 3 (Source Removal and Off-site Disposal) and 5B (Engineered Low Permeability Cap) are expected to comply with all chemical-, location-, and action-specific ARARs. Alternative 3 (Source Removal and Off-site Disposal) would attain chemical-specific ARARs for all media through excavation and off-site disposal. Alternative 5B (Engineered Low Permeability Cap) would achieve chemical-specific ARARs for tailings, sediment, and soil through containment beneath the cap. Because the cap is expected to completely eliminate infiltration of precipitation into the tailings, discharge of contaminated groundwater through seeps and culverts is not anticipated. This alternative would meet groundwater ARARs at the edge of the containment. Surface water ARARs would be met by source removal (i.e., excavation of sediment and elimination of groundwater discharge).

Alternatives 4 (Permeable Cover) and 5A would comply with chemical-specific ARARs for tailings, soil, sediment, and surface water. Contaminated groundwater would remain beneath the tailings and continue to discharge through seeps and culverts; therefore, these alternatives would not meet chemical-specific ARARs for groundwater. Both alternatives would meet all location- and action-specific ARARs.

Alternatives 1 (No Action) and Alternative 2 (Institutional Controls) would not comply with chemical- or location-specific ARARs. Because neither alternative includes active remedial technologies, action-specific ARARs would not be triggered.

Potential chemical- and location-specific ARARs are identified in Tables 1-1 through 1- 4. Potential federal and state action-specific ARARs relating to the remedial alternatives are identified in Tables 1-5 and 1-6.

9.2 Balancing Criteria

9.2.1 Long-Term Effectiveness and Permanence

Alternative 3 (Source Removal and Off-site Disposal) would be the most permanent and reliable of the alternatives. Off-site disposal at a hazardous waste landfill is considered the most protective because it eliminates the potential for future releases at the site.

Alternative 5B (Engineered Low Permeability Cap) would also have a relatively high degree of reliability and permanence assuming proper design, construction, and maintenance of the engineered cap.

Alternatives 4 (Permeable Cover) and 5A (Low Permeability Cap) would be moderately reliable and permanent. The permanence and reliability of both alternatives relies on proper design, construction, and maintenance of the cover/cap and wetlands. Changes in environmental conditions such as drought or flooding could affect the ability of wetlands to achieve PRGs.

Alternative 2 (Institutional Controls) would be less effective and reliable because it relies on maintenance of signs and fences in addition to the public's willingness to heed warnings. This alternative is not effective in preventing exposures to ecological organisms.

Alternative 1 (No Action) is not reliable or effective in preventing exposures to humans or ecological organisms.

9.2.2 Short-Term Effectiveness

Because no remedial actions would be implemented, there are no short-term risks to the community, workers, or the environment associated with Alternative 1 (No Action). Similarly, minimal short-term risks would be associated with Alternative 2 (Institutional Controls). Alternatives 4 (Permeable Cover), 5A (Low Permeability Cap), and 5B (Engineered Low Permeability Cap) would all have moderate short-term risks to the community, workers, and environment including physical hazards associated with heavy equipment and potential human and environmental exposures to contaminants during excavation activities. The use of best management practices would significantly minimize potential adverse effects during implementation of these alternatives.

Alternative 3 (Source Removal and Off-site Disposal) would have the greatest potential for risks to workers, the community, and the environment. In addition to the physical risks associated with heavy equipment and the exposure potential during excavation activities, the volume of media requiring off-site disposal and the distance to the nearest disposal facility are expected to result in substantial risk to both humans and the environment during transport.

9.2.3 Reduction of Toxicity, Mobility, or Volume

Alternatives 3 (Source Removal and Off-site Disposal), 4 (Permeable Cover), 5A (Low Permeability Cap) and 5B (Engineered Low Permeability Cap) would achieve a high degree of reduction in mobility of contaminants in tailings, soil, and sediment by wind and surface water runoff through containment or off-site disposal of these media. Additionally, all four of these alternatives would prevent contaminants in groundwater from migrating to surface water. Alternatives 3 (Source Removal and Off-site Disposal) and 5B (Engineered Low Permeability Cap) would further reduce the mobility of contaminants by preventing precipitation from infiltrating into the tailings and leaching contaminants to the groundwater.

Alternative 3 (Source Removal and Off-site Disposal) would result in a reduction in the volume of contaminants by dewatering and treating groundwater within the tailings.

Alternatives 4 (Permeable Cover) and 5A (Low Permeability Cap) would treat a lesser volume of groundwater as it passes through the wetlands.

Alternatives 1 (No Action) and 2 (Institutional Controls) would not achieve any reductions in toxicity, mobility, or volume at the site.

9.2.4 Implementability

No remedial actions would be implemented with Alternative 1 (No Action). Similarly, minimal remedial actions would make implementation of Alternative 2 (Institutional Controls) straight forward. Implementation of Alternative 2 would require coordination with local agencies to prevent future use of groundwater for drinking water. Implementation of Alternatives 3 (Source Removal and Off-site Disposal), 4 (Permeable Cover), 5A (Low Permeability Cap), and 5B (Engineered Low Permeability Cap) primarily rely on standard earthmoving and construction technologies. Supplies and materials are readily available locally or through specialized companies (e.g., geomembranes or GCL required for engineered low permeability cap). Alternatives 4 (Permeable Cover), 5A (Low Permeability Cap), and 5B (Engineered Low Permeability Cap) would require on-going maintenance of the cover/cap containing tailings and tailings contaminated soil and coordination with local agencies to prevent disturbance of the containment areas. Alternatives 3 (Source Removal and Off-site Disposal), 4 (Permeable Cover), and 5A (Low Permeability Cap) would require coordination with local agencies to discharge treated seepage into the unnamed tributary. Additionally, maintaining the wetland employed to treat seepage in Alternatives 4 (Permeable Cover) and 5A (Low Permeability Cap) would require on-going maintenance. Alternative 3 (Source Removal and Off-site Disposal) would also require coordination with the disposal facility during implementation.

9.2.5 Cost

This criterion addresses the capital costs, annual operation and maintenance (O&M) costs, and present worth analysis. Capital costs consist of direct (construction) and indirect (nonconstruction and overhead) costs. Direct costs include expenditures for the equipment, labor and material necessary to perform remedial actions. Indirect costs include expenditures for engineering, financial and other services that

are not part of actual installation activities but are required to complete the installation of remedial alternatives. Annual O&M costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This allows the cost of remedial action alternatives to be compared based on a single figure representing the amount of money that would be sufficient to cover all costs associated with the remedial action over its planned life. The EPA and the MDNR agreed that a discount rate of 7 percent should be used. The cost estimates are expected to provide an accuracy of +50 percent to -30 percent.

9.2.5.1 Cost Effectiveness

The following presents a summary of the present worth cost and O&M costs for each alternative:

- Alternative 1 (No Action) has a present worth cost of $53,900 that is associated with EPA five year reviews at the site.
- Alternative 2 (Institutional Controls) has a present worth cost of $866,800 with total O&M costs of $473,450.
- Alternative 3 (Source Removal and Off-site Disposal) has the highest present worth cost at $91,338,390 with total O&M costs of $93,000.
- Alternative 4 (Permeable Cover) has a present worth cost of $12,352,620 with total O&M costs of $7,089,700.
- Alternative 5A (Low Permeability Cap) has a present worth cost of $12,010,220 with total O&M costs of $5,937,600.
- Alternative 5B (Engineered Low Permeability Cap) has a present worth cost of $16,429,860 with total O & M cost of $5,595,100.

9.2.5.2 Cost Sensitivity Analyses

Cost estimates involve assumptions, estimations, interpretations and engineering judgment. The purpose of a cost sensitivity analysis is to evaluate estimated costs if there is sufficient uncertainty concerning specific assumptions used to prepare the costs. A sensitivity analysis assesses the effect that variations in specific assumptions may have on the cost estimates. The purpose of this sensitivity analysis is to evaluate the effects that changes in the discount rate would have on the present worth costs of the alternatives. The discount rate used to calculate the present worth of the alternatives is 7 percent.

The present worth cost represents the amount of money that would have to be invested at the beginning of a remedial action at a given interest rate (discount rate) to pay for all of the expenditures throughout the life of an alternative.

9.3 Modifying Criteria

The modifying criteria for the alternatives are listed below.

9.3.1 State Acceptance

The MDNR has been consulted in the preparation of this Proposed Plan, and has concurred with the recommended alternative.

9.3.2 Community Acceptance

Community acceptance of the alternatives will be fully determined after the public comment period closes for the Proposed Plan.

10.0 Preferred Alternative – 5A Low Permeability Cap

This section presents the detailed description of the EPA's Preferred Alternative which is Alternative 5A – Low Permeability Cap. This alternative would meet RAOs through on-site containment and institutional controls. The Preferred Alternative can change in response to public comments or new information.

Under the Preferred Alternative, the tailings impoundment would be graded, contoured, and covered with a low permeability cap. Tailings comprising the impoundment would not be excavated and moved as part of this alternative. Prior to capping, tailings-contaminated soil from the Ruth Mine and mill area, County Road 200 right-of-way and floodplain of the unnamed tributary creek would be excavated and hauled to the impoundment: however disturbance to the riparian locations would be minimized. The low permeability cap would consist of the following components:

- A one-foot thick clay liner
- A six-inch vegetative soil layer
- Vegetated cover

The site area would be cleared and grubbed and the tailings pile would be graded to the appropriate slope and shape for closure. Grading the site would remove localized fingers along the perimeter of the stockpile. This would be performed by excavating the material from the stockpile or placement of additional contaminated material excavated on-site. The tailings would be graded to the contours necessary to direct storm water from the capped area to natural drainage.

The subgrade for the clay layer would be compacted to support the cap system and a one -inch clay layer would be placed over the prepared subgrade. A six-inch soil layer with sufficient organics to support vegetation would be placed over the clay layer. The top of the soil cover would be vegetated to provide long term erosion control. The vegetation selected would be compatible with the local climate and require low maintenance. Construction of the low permeability cap would require 10 to 12 months.

Access to the capped area would be prevented by fences and signs, and there would be environmental covenants with respective property owners to establish legal controls to prevent uses that could disturb the cap and the water management controls. A cap monitoring program would be designed and

implemented to ensure establishment of vegetation and the continued integrity of the facility. Periodic maintenance would be required to repair the cap and maintain the vegetation on the cap. Groundwater use restrictions would be employed to prevent future consumptive use.

Following removal of contaminated material, bank and channel restoration/stabilization measures would be required in certain areas of the unnamed tributary creek. Areas where tailings were excavated and removed, such as on the creek floodplain, road right-of-way, and mine and mill site, would be backfilled with topsoil and vegetated or seeded with native species.

Installation of a low permeability cap over the tailings impoundment would significantly alter the water balance of the site by removing a large area of precipitation infiltration. Consequently, stream flow in the unnamed tributary creek is likely to be larger and discharge is expected to show abrupt changes (flashy discharge). In contrast, the volume of contaminated groundwater within the tailings is expected to diminish due to the reduced infiltration. Seepage from the tailings is projected to continue to exhibit concentrations of metals.

If water balance calculations indicate that seepage would continue indefinitely, then a treatment system may be required based on observed concentrations. Contaminated groundwater resulting in seeps would be treated using a passive system consisting of constructed wetlands and/or existing riparian zones. The wetlands would be constructed as described in Alternative 4 in the FS. However, since there would likely be less seepage from the tailings following construction of the low permeability cap, a smaller wetlands area would be required for Alternative 5A, the chosen Preferred Alternative. If the seepage were reduced to six gpm, a wetlands area containing approximately 1.5 acres would be constructed. The discharge from the wetlands to the unnamed creek would be subject to an NPDES permit and monitored.

Groundwater monitoring would be performed to determine if the shallow groundwater at the site was affecting the surface water quality in the unnamed tributary. It is assumed that one upgradient monitoring well and three downgradient monitoring wells would be installed. All of the monitoring wells would be sampled semi-annually for the first two years and annually thereafter for three years or until EPA determined that the unnamed tributary was not impacted by shallow groundwater at the site. It is assumed that the groundwater monitoring wells would be approximately 20 feet deep and groundwater samples would be analyzed for TAL metals.

Surface water and sediment samples would be collected from four locations in the unnamed tributary. The surface water and sediment would be sampled annually for five years or until EPA determined that the unnamed tributary was not impacted by the tailings. Surface water samples would be analyzed for total and dissolved TAL metals and sediment samples would be analyzed for TAL metals.

Environmental Covenants with property owners would be established under the Missouri Environmental Convenants Law, incorporated as soon as possible to restrict access to any media remaining in excess of cleanup values to prevent exposure and disturbances during the continued use of the subsite as a soils repository under OU-3, and during RD/RA development.

10.1 Detailed Description of Preferred Alternative

The following describes how the proposed remedy meets the nine criteria.

10.1.1 Overall Protection of Human Health and the Environment

Placement of tailings and tailings contaminated soil and sediment from the Ruth Mine and mill areas, the County Road 200 right-of way, floodplain and tributary beneath a low permeability cap in the tailings area would eliminate potential inhalation, ingestion and dermal contact exposures by recreational users at the site. Capping of the impacted material would eliminate erosion by wind and transport of tailings to adjacent floodplains and streams by storm water runoff.

Adverse risks associated with ingestion of shallow groundwater at the site by potential future residents or commercial workers would be mitigated by institutional controls prohibiting the use of groundwater for drinking water.

Capping and vegetation of tailings and tailings contaminated soil would minimize potential adverse exposures to terrestrial organisms (e.g., woodcocks, shrews, earthworms, and blue heron) and alleviate the phytotoxicity currently observed in the tailings area. Establishment of healthy vegetation at the site would increase habitat for terrestrial organisms, help maintain the integrity of the cover and further reduce erosion by wind and storm water runoff.

Excavation of contaminated floodplain soil is expected to eliminate the phytotoxicity in the riparian zone. An increase of plant growth in this area would provide habitat for fish and benthic invertebrates. Excavation of contaminated sediment in the unnamed tributary would remove the source that is currently causing adverse impacts to aquatic organisms. Stream restoration along portions of the unnamed tributary would enhance biological recovery. Following removal actions, levels of lead in fish tissue and toxicity to benthic invertebrates are expected to decrease. It is anticipated that removal actions in and near the tributary would result in an increase in density and diversity of organisms in this area.

Installation of a low permeability cap over the tailings surface impoundment combined with grading to direct storm water away from waste areas would result in significantly less precipitation infiltrating and leaching contaminants from tailings and impacted soil. Although installation of the low permeability cover is expected to reduce infiltration through the tailings by approximately 40 percent, seepage through the culverts and seeps would continue. Passive treatment of this water by the constructed wetland would improve water quality prior to discharge to the unnamed tributary.

One of the primary RAOs for the Preferred Alternative for surface water is to prevent the exposure of aquatic organisms in the Class P streams to COCs where federal WQC are exceeded. The EPA believes the actions taken under the Preferred Alternative will reduce concentrations of metals in the Class P streams to less than federal WQC based on hardness. These actions include removal of all source material with erosion potential to the streams, and removal of all sediment delta deposits above the low water line at the mouths of the tributaries draining source areas into the Class P streams. During the remedial action for OU-4, the EPA will establish a water quality monitoring program for the Class P streams to assess the effectiveness of the remedial action on reducing metals loads. Monitoring data will be assessed during the five-year review process, and will be collected and assessed at each review until the metals concentrations are in compliance with the WQS. Should the goal of achieving the WQS fail

to be achieved within the first Five Year Review Period after completion of the remedial action, the EPA will assess the feasibility and practicality of conducting additional actions at the Conrad subsite to further reduce the metals concentrations in the Class P streams. Should additional actions be required, the work may be conducted under an amendment to the ROD for OU-4. Another option would be to establish a new operable unit (OU-7) to address contamination of the Class P streams under the St. Francis River Watershed Master Plan.

10.1.2 Compliance With ARARs

This alternative is expected to meet the state or federal chemical-specific ARARs for tailings, soil and sediment shown in Table 1-1 through 1-2 through excavation and on-site containment. This alternative is not expected to meet chemical-specific ARARs for groundwater. Potential exposures to groundwater would be controlled through Environmental Covenants with the property owner(s) of the Conrad subsite as institutional controls. Excavation of contaminated sediments within the unnamed tributary, diversion of storm water around waste sources, and treatment of water seeping from the containment area is expected to result in attainment of chemical-specific ARARs for surface water.

This alternative is expected to meet all state and federal location- and action-specific ARARs shown in Tables 1-3 through 1-4. Specifically, excavation within the floodplain and streambed of the unnamed tributary would be expected to result in significant improvement of conditions within the floodplain, wetlands, and streambed. Compliance with Executive Order 11988 (Protection of Floodplains), Executive Order 11990 (Protection of Wetlands), Clean Water Act, Fish and Wildlife Conservation Act of 1980, and the Fish and Wildlife Coordination Act along with controls to prevent adversely impacting ecological receptors within and downstream of these sensitive environments would be required.

All excavation activities would require compliance with the Clean Air Act, the Missouri Fugitive Particulate Matter Regulations, Missouri Clean Water Law, and the Missouri Hazardous Substances Emergency Response Law and the use of appropriate controls to monitor and mitigate emissions of airborne particulates and prevent storm water releases.

Construction and maintenance of an on-site containment area and cap would require compliance with Subtitle D of RCRA, Executive Order 11988 (Protection of Floodplains), Executive Order 11990 (Protection of Wetlands), Clean Water Act, the Location Standard Hazardous Waste Facilities and the Clean Air Act.

Passive treatment and discharge of groundwater collected from within the tailings impoundment would require compliance with the Clean Water Act, Missouri Clean Water Law and an NPDES Discharge Permit or equivalency.

10.1.3 Long-Term Effectiveness and Permanence

Low permeability caps are effective at reducing exposures to human and ecological receptors, limiting erosion and transport of contaminants by wind and water, and reducing infiltration. The long-term effectiveness of the engineered cap would depend on proper design and construction to direct surface water away from the waste, ensure containment of the waste and ensure the integrity of the low permeability layer. Maintenance of the cap including repair of damage caused by erosion, removal of invasive plant species with root systems that may damage the integrity of the impermeable layer and

potential periodic replanting, fertilization, or watering of vegetation may be required. Periodic maintenance of fencing would be required to prevent damage by foot or vehicular traffic.

Passive treatment of seepage is a proven technology for mining sites. Treatability studies and flow estimates would be required prior to design to ensure that the constructed wetland is able to meet surface water quality standards. Improper design or inconsistent loading to wetlands systems can cause partial treatment or failure resulting in discharge of water that does not meet discharge limits to the tributary. Additionally, weather extremes such as large storm water events or extended drought can cause failure of the wetlands by flooding resulting in inadequate retention times in the system to achieve treatment goals or by drying out and killing beneficial bacteria within the system. Ongoing monitoring and maintenance of the system would be required to keep the system functioning properly. Maintenance may include periodic replacement of substrate, repair of berms, or periodic dredging.

Long-term effectiveness and permanence of groundwater use restrictions would be dependent on the ability of the local government to track and enforce the restrictions.

10.1.4 Short-Term Effectiveness

Short-term risks to workers include exposure to contaminants and heavy machinery during relocation of the contaminated material to the tailings area and during construction of the engineered cap and wetland. The potential risks would be managed through the use of Occupational, Safety, and Health Administration certified workers, development and compliance with health and safety plans, required attendance at safety meetings and the use of best management practices for construction sites.

Risks to nearby residents include the potential for exposure to contaminants in dust generated during excavation and cap installation activities and increased noise at the site due to heavy machinery. The potential risks would be mitigated through application of water or dust suppressants as needed to control release of particulates into the air and limiting operation of heavy machinery to daylight or standard work hours (if noise is an issue).

Environmental risks during implementation include the potential for releases of sediment or impacted surface water during storm events especially while excavation is occurring in the floodplain and tributary. Mitigation measures such as silt fences, hay bales, and construction of temporary ditches to direct surface water away from the work areas would be used to minimize environmental impacts.

10.1.5 Reduction of Toxicity, Mobility, or Volume

Capping contaminated tailings, soil and sediments would result in a substantial decrease in contaminant mobility by eliminating transport by wind and surface water erosion along with significantly reducing infiltration of precipitation and subsequent leaching of contaminants in the tailings to groundwater. Excavation of floodplain soil and tributary sediments would minimize leaching of contaminants from these sources into surface water. Installation of a low permeability cover will not result in a decrease of toxicity or volume of the tailings, soil or sediment.

Installation of a low permeability cap is predicted to reduce the volume of precipitation infiltrating and leaching contaminants from the tailings by approximately 40 percent (the HELP model indicates that approximately 2.9 million gallons of water per year would percolate through the low permeable cover).

This is expected to result in a decrease in the mobility and volume of impacted groundwater within the tailings and subsequently a corresponding decrease in the rate of groundwater discharge through the culverts and seeps. Treatment of this discharge with the passive wetlands system would result in treatment of approximately 3 million gallons of impacted water annually.

Replacement of the wetland substrate or dredging would produce contaminated material that would require disposal. It is anticipated that this material would be transported to the site repository and placed under the cap for containment and stabilization.

10.1.6 Implementability

Construction of a low permeability cap, excavation and construction of wetlands are commonly employed technologies. All three technologies use standard earth moving equipment which is readily available locally. Construction of a low permeability cap would require a source of natural low permeable clay, clean borrow, topsoil and vegetation. Clean borrow and topsoil are available locally. Vegetation may also be available locally or is readily available as seed, plugs or potted plants from nurseries. Coordination with the local government would be required to place a deed restriction or a Declaration of Covenants and Restrictions with the current and future private property owner(s) preventing future excavation or disturbance of the caps.

Construction of the wetlands would require a source of substrate material such as lime and compost. These materials are readily available. Discharge of treated water from the wetlands to the unnamed tributary will require coordination with the state to obtain a new source NPDES permit and ensure water quality meets discharge limits.

Restrictions on future use of groundwater beneath the site will require cooperation with local and county governments .Deed restriction or a Declaration of Covenants and Restrictions with the current and future private property owner(s). Prohibiting installation of drinking water wells within the property boundaries may be required to ensure future protectiveness.

An operation and maintenance (O&M) program would be established to maintain the caps on the disposal areas and to maintain other engineering components of the Preferred Alternative, e.g., areas of soil application where wastes were left in place and revegetated areas. The state will be responsible for the O&M beginning one year after the completion of the remedial action.

The state's O&M responsibilities would also include a monitoring program to assess the effectiveness of the controls implemented in the Environmental Covenants with property owners. The O&M monitoring program will provide annual reports to the EPA detailing actions taken to protect engineering and environmental covenant components. Monitoring requirements would be assessed during the five-year review process and may be modified or reduced as appropriate based on data collected as part of the reviews.

10.1.7 Cost

The total capital cost for Alternative 5A is estimated to be $9,516,190. Total O&M costs for Alternative 5A are estimated to be $5,937,600. The present worth value of Alternative 5A is estimated to be $12,010,220.

10.1.8 State Acceptance

MDNR, has been consulted in the preparation of this Proposed Plan and has concurred with the recommended alternative in this Proposed Plan. State acceptance will be more fully assessed following the public comment period.

10.1.9 Community Acceptance

Community acceptance will be evaluated after the public comment period closes for the Proposed Plan.

11.0 Summary

Based on the information currently available, the EPA, as the lead agency, and MDNR as the supporting agency, believe the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoff's among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the Preferred Alternative, Alternative 5A, to satisfy the following statutory requirements of CERCLA section 121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (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.

The support agency, MDNR, has been consulted in the preparation of this Proposed Plan, and has concurred with the recommended alternative in this Proposed Plan. Additionally, the EPA has worked closely with the Natural Resource Trustees for the site, which are also in agreement with the Preferred Alternative. Full assessment of the state's, trustees and the community's acceptance of the Proposed Plan will be made at the conclusion of the public comment period.

12.0 Public Participation

The public is encouraged to review this Proposed Plan and the supporting documents contained in the AR. In order to provide the community with an opportunity to submit written or oral comments, the EPA has established a 30-day public comment period, which starts on July 20, 2011 and closes August 20, 2011. A public meeting to present, answer questions, and receive comments on the EPA's Preferred Alternative will be held on July 25, 2011, at 6:30 pm in the Black River Electric Cooperative Facility in Fredericktown, Missouri. The Proposed Plan and supporting documents are available for review during normal business hours at the Fredericktown Public Library and the EPA Region 7 Records Center. The public may submit written or oral comment at the public meeting or anytime during the 30-day comment period by the following means:

Mail: Ms. Debbie Kring, OEP
U.S. Environmental Protection Agency
901 North 5th Street
Kansas City, KS 66101

Email: kring.debbie@epa.gov
Phone: 1-800-223-0425

Public participation is important and new information or comments could result in selection of a final remedial action different than the EPA's preferred Alternative.