

US EPA ARCHIVE DOCUMENT

RECORD OF DECISION AMENDMENT PLAN

**Oronogo-Duenweg Mining Belt
Superfund Site
Jasper County, Missouri**

**Mine and Mill Waste
Operable Unit 1**



Prepared by:

**U.S. Environmental Protection Agency
Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219**

September 27, 2013

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Superfund

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RECORD OF DECISION AMENDMENT DECLARATION

SITE NAME AND LOCATION

Oronogo-Duenweg Mining Belt Site, Operable Unit 1
Jasper County, Missouri

STATEMENT OF BASIS AND PURPOSE

The U.S. Environmental Protection Agency (EPA) has prepared this decision document to present the selected remedial action for mining and milling wastes at the Oronogo-Duenweg Mining Belt site (Site) located in Jasper County, Missouri. This decision was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and to the extent practicable, the National Contingency Plan (NCP). This decision is based on the Administrative Record for this Site. The Administrative Record file is located in the following information repositories:

1. Joplin Public Library
300 Main
Joplin, Missouri
2. Webb City Public Library
101 South Liberty
Webb City, Missouri
3. U.S. Environmental Protection Agency
Region 7 Docket Room
11201 Renner Boulevard
Lenexa, Kansas

The EPA has coordinated selection of this remedial action with the Missouri Department of Natural Resources (MDNR). The state of Missouri concurs on the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this Record of Decision (ROD) Amendment, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF THE REMEDY CHANGES

This ROD Amendment provides details concerning the changes made to the 2004 ROD for Operable Unit 1, which addressed the cleanup of mining and milling wastes, soil and selected sediments contaminated with metals from past mining activities at the Site. The cleanup action is one part of the EPA's overall efforts under Superfund to deal with environmental contamination resulting from historic lead and zinc mining, milling and smelting operations in Jasper County. The major changes to the 2004 remedy are:

- Increase in the volume of on-site wastes and the associated increase in cost
- Construction of aboveground repositories
- Elimination of the use of biosolids and deep tilling

- Increase in the sediment cleanup levels based on site-specific toxicological studies
- Inclusion of contaminated soils in the tornado expedited debris removal (EDR) area in the OU-1 remedy

STATUTORY DETERMINATIONS

The selected remedy changes continue to be protective of human health and the environment; are expected to comply with chemical-, location- and action-specific federal and state requirements that are legally applicable or relevant and appropriate to the remedial action and are cost effective. These remedy changes utilize permanent solutions to the maximum extent practicable.

Because these remedy changes will result in hazardous substances remaining on the Site above health-based levels, a review will be conducted within five years to ensure that the remedy continues to provide adequate protection of human health and the environment.

Cecilia L. Tapia 9/27/13
Cecilia Tapia, Director Date
Superfund Division
U.S. EPA, Region 7

John

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1.0 Introduction and Purpose

This document has been developed by the U.S. Environmental Protection Agency, and presents the amendment to the Record of Decision (ROD) for Operable Unit 1 (OU-1) of the Oronogo-Duenweg Mining Belt Superfund site (Site) in Jasper County, Missouri. The OU-1 ROD was signed by the EPA on September 30, 2004, to address the remediation of metals-contaminated mining and milling wastes at this Site.

In compliance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) §117(c), 42 U.S.C. § 9617, and the National Contingency Plan (NCP) 40 CFR § 300.435(c)(2)(i) and 300.825(a)(2), the EPA and MDNR (the Agencies) have determined that certain remedy revisions fundamentally, and others significantly, change the remedy selected in the 2004 ROD. The EPA is therefore issuing this ROD Amendment. In general, fundamental changes in a remedy involve a change in scope or cost to the remedy, requiring a nine criteria analysis. Significant changes involve a change to a component of a remedy that does not fundamentally alter the cleanup approach. For a ROD Amendment, the EPA is required to describe to the public the nature of the fundamental changes in a proposed plan, summarize the information that led to making the changes, afford the public the opportunity to comment on the proposed changes and revise the remedy and affirm that the revised remedy complies with the NCP and the statutory requirements of CERCLA. For significant changes to the remedy, the EPA is required to make the significant differences and supporting information available to the public through issuance of an explanation of significant differences (ESD), which the EPA has done here through public notice and issuance of a proposed ROD amendment.

The EPA has coordinated the development of this amendment with the Missouri Department of Natural Resources (MDNR). The EPA is the lead agency and the MDNR is the support agency.

This ROD Amendment and supporting documents have been made part of the Administrative Record and are available for review during normal business hours at the following locations:

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|----|--|----|--|
| 3. | Joplin Public Library
300 Main
Joplin, Missouri | 3. | U.S. Environmental Protection Agency
Region 7 Docket Room
11201 Renner Boulevard
Lenexa, Kansas |
| 4. | Webb City Public Library
101 South Liberty
Webb City, Missouri | | |

2.0 Site History and Background

The Oronogo-Duenweg Mining Belt Superfund site is located in Jasper County and portions of Newton County, Missouri. The Site is a concern because of mining wastes on the surface which constitute a significant source of heavy-metals contamination with potential for exposure to people and environmental receptors. Past mining and milling practices resulted in the contamination of surface soil, sediments, surface water and groundwater in the shallow aquifer with heavy metals, primarily lead, cadmium and zinc. The Site includes the mining wastes in and around 11 former mining areas, or designated areas (DAs), located within about 270 square miles of Jasper and Newton counties. The DAs

include Snap, Neck/Alba, Thoms, Joplin, Oronogo-Duenweg, Carl Junction, Klondike, Iron Gates, Iron Gates Extension, Belleville and Waco. A map of the DAs is shown on Figure 1 in the 2004 ROD and is attached to this ROD Amendment.

Historically, approximately 160 million short tons of crude ore were mined in the DAs of which approximately 5 percent was recovered as zinc/lead concentrates, leaving an estimated 150 million short tons of discarded mill waste on the surface. Approximately 90 percent of this material has since been removed for various commercial purposes. During the early years of mining, lead concentrates were smelted in a large number of crude log furnaces. Advances in smelter technology and increasing specialization by operators led to centralization, and by 1873 there were only 17 lead smelters in the Joplin area. By 1894, the number had decreased to three, and was down to one by the 1920s. Most zinc concentrates were shipped to smelters located outside the district in areas where fossil fuel was abundant, as the smelting of zinc required considerably more heat than lead.

The EPA listed the Site on the National Priorities List (NPL) in 1990. The NPL is a national list of Superfund sites that prioritizes cleanups in order of the most serious contamination problems and greatest threats to human health and the environment. After listing, the EPA divided the Site into four Operable Units (OUs) for cleanup activities because of the multimedia nature of contamination. The OUs include OU-1, Mining and Milling Waste; OU-2, Smelter Waste Residential Yards; OU-3, Mine Waste Residential Yards; and OU-4, Groundwater. The 2004 ROD and this proposed ROD Amendment address OU-1 and include those areas in and around the DAs where mining, milling and smelter wastes are located.

A site-wide investigation was initiated in 1991, collecting data primarily on mined materials, soils, surface water, groundwater, terrestrial and aquatic biota, land use and demography, air quality and human food sources. The results of this sampling program were presented in the Remedial Investigation Report (RI) completed in 1995, and documented significant contamination levels in soil, surface water and groundwater as well as in mining wastes themselves. Contamination levels were found in all media at levels presenting an unacceptable risk to human health and environmental receptors. A detailed discussion of the Site characteristics, nature of the contamination and risk to people and the environment are found in the Administrative Record.

A feasibility study (FS) was completed in 2003. The FS combined the information about the nature and extent of contamination in and around the DAs described in the RI with the investigations characterizing and evaluating the DAs, and developed alternatives for remedial action for the entire Site. Additional studies were conducted by the EPA, MDNR and the potentially responsible parties (PRPs) to assist in developing and supporting the remedial alternatives in the FS.

The EPA issued the OU-1 Proposed Plan for public comment in July 2004, and completed the OU-1 ROD in September 2004 after holding a public meeting and receiving and addressing public comments on the Proposed Plan. The cleanup of mining and milling wastes under the ROD is necessary to mitigate the principal threat for OU-1 which is the risk to aquatic and terrestrial ecosystems from exposure to mill wastes, soils, sediments, surface water and groundwater. The main component of the remedy includes excavating and disposing of source materials in selected on-site mine subsidence pits suitable from an engineering perspective for subaqueous disposal. This same remedial component, excavation/disposal, is essential to provide long-term protection of human health from exposure to the mine and mill wastes.

3.0 Site Remedy

The 2004 ROD specified and described the selected remedy for OU-1. The remedial action selected is presented in the following sections.

3.1 Remedial Action Objectives

The media-specific remedial action objectives (RAOs) developed in the FS to address the Site risks and specified in the ROD for the selected remedy are presented and reprinted exactly below.

Source Material RAO

The source material RAO has been designed to address the potential ecological risks associated with direct exposure to contaminants of concern (COCs) in mine and mill wastes and in the affected soils surrounding the wastes. Terrestrial vertebrates, specifically vermivores whose diet consists of earthworms and other soil-dwelling invertebrates, are identified as the receptors of concern based on information from the baseline ecological risk assessment (BERA). Ecological risks associated with source material erosion (as sediment) and seepage/runoff are addressed in other RAOs.

Exposure routes consist of ingestion of earthworms and other invertebrates in source materials and affected media that provide suitable habitat for Site vermivores with levels greater than 41 mg/kg cadmium 804 mg/kg lead; or 6,424 mg/kg zinc. Based on this exposure scenario, the source material RAO is as follows:

- Mitigate risks to terrestrial vermivores from exposure to COCs from mine, mill and smelter wastes within the Site, such that the calculated toxicity quotients or hazard indexes are less than or equal to 1.0.

Sediment RAO

Sediments of concern at the Site consist of source materials that are eroded from source areas to water bodies, namely Class P streams (as defined under Missouri's water quality standards program) and their tributaries. Sediments represent a unique category of source materials that have been transported, or may be transported in the future, to aquatic environments where they potentially affect water quality and streambed substrate, thereby posing risks to aquatic biota. The exposure pathway of concern for the sediment RAO is the movement and redistribution of source materials that could result in exposure of aquatic biota to elevated COC concentrations. The COCs for sediments are cadmium, lead and zinc. The sediment RAO for OU-1 is as follows:

- Mitigate risks to aquatic biota in Class P streams and their tributaries where COC levels exceed federal aquatic life criteria (ALC) by controlling the transport of mine, mill and smelter wastes from source areas to waters of the state.

Surface Water RAOs

Two RAOs have been developed that address two different pathways of exposure to aquatic biota. The first exposure pathway of concern is the transport of COCs to Class P streams and their tributaries resulting from seepage and runoff (dissolved and particulate metals) from source materials. The second exposure pathway involves the transport of COCs to Class P streams and their tributaries resulting from mine pit and pond discharges. The criteria for Class P streams and their tributaries are the federal ALC, as calculated based on the hardness observed in the individual surface water bodies. The RAOs for OU-1 surface water are as follows:

- Mitigate exposure of aquatic biota to COCs released and transported from mine and mill wastes where applicable or relevant and appropriate requirements (ARARs) for surface water are exceeded in Class P streams and in tributaries.
- Mitigate exposure of aquatic biota to COCs released and transported from Site mine-related pits and ponds where surface water ARARs are exceeded in Class P streams and in tributaries.

Groundwater RAO

The groundwater RAO addresses exposure of aquatic biota to COCs in Class P streams that receive discharge from flowing mine openings (e.g., mine shafts, vents, subsidence pits, etc.). The contaminant criteria are federal ALC. The COCs for OU-1 groundwater are cadmium, lead, and zinc. The RAO for OU-1 groundwater is as follows:

- Mitigate exposure of aquatic biota to COCs in releases of groundwater from flowing mine shafts of the Site where surface water ARARs are exceeded in Class P streams and in tributaries.

The groundwater RAO for this OU is limited to protecting the surface water from groundwater impacts due to flowing mine shafts. The RAO of mitigating human health risks from exposure to the contaminated shallow aquifer was addressed in OU-4, Groundwater, which provides an alternate public water supply to residents and establishes ICs to mitigate the future risks of drilling new drinking water wells in the shallow aquifer. The Missouri Well Drillers law and regulations control shallow and deep aquifer well drilling in the Jasper and Newton County areas to reduce the risk to residents that might use the contaminated shallow aquifer. The ROD for OU-4 determined that it is technically impractical for the agency to remediate the shallow aquifer to achieve compliance with chemical-specific ARARs for drinking water sources. The EPA determined that it is not technically feasible from an engineering perspective to remediate groundwater because of the widespread nature of contamination throughout the shallow aquifer, karst conditions and interconnectedness of the mine workings within the shallow aquifer. Although contaminated groundwater seeps into surface waters and contributes some COCs, the groundwater RAO for this OU addresses only specific groundwater sources where remediation is technically feasible such as the flowing mine shafts because of the technical impracticability of cleaning up the entire shallow aquifer to meet maximum contaminant levels for drinking water.

3.2 Engineered Cleanup Actions

The engineered components of the selected remedy as specified in the 2004 ROD are presented and reprinted exactly below.

Source Removal and Disposal in Subsidence Pits

In- and near-stream barren chat, vegetated chat and tailings; barren chat, vegetated chat and tailings located in the flood plains and tributaries; upland chat and tailings exceeding terrestrial and human health action levels would be excavated and placed in mine subsidence pits located in proximity to the source material. Backfilling the pits would be accomplished by simply end-dumping and/or pushing the mill wastes into the pits with excavation equipment.

To the extent possible, tailings and chat would be placed at least a meter below the seasonal low static water level in the pits. Reducing repeated wetting and drying of the wastes as a result of seasonal water level fluctuations is considered important for arresting weathering, oxidation and acid generation processes, and preventing further leaching of metals from the wastes. Relatively inert materials such as development rock or low-concentration chat would be used to fill the zones where water levels may fluctuate. Flooded pits that contain high-quality habitat for fish and wildlife and contain low concentrations of metals in the water will not be used for disposal because they do not present a risk to human health or the environment. There appears to be sufficient pit space available on the Site to warrant saving good-quality habitat.

Upland Source Materials

Upland barren chat and tailings that do not exceed action levels established to protect terrestrial and human health would be left in place because they do not pose a risk to human health and the environment. Upland vegetated chat and transition zone soils that exceed human health and terrestrial cleanup criteria would be deep tilled to reduce metal concentrations and revegetated. Biosolids would be added to provide some treatment of the metals in these sources and to improve soil structure for plant growth.

Sediment Removal

Sediments in the intermittent tributaries flowing from the source areas to the Class P streams will be removed subsequent to the cleanup of the sources draining to the tributaries. The sediments will be removed to a depth where background metals concentrations or bedrock is encountered, whichever is shallower. Sediment basins and traps will be constructed at the mouths of the tributaries to be remediated to mitigate sediment transport to the Class P streams during the cleanup actions. Remediated tributaries will be restored by lining the channels with clean gravel and stabilizing the banks with natural vegetation.

Sediment removal actions in Class P streams would be limited to delta deposit built up at tributary mouths. Generally, all the sediments in the deltas exceed screening criteria for aquatic organisms. Therefore, all the sediment delta deposits at the mouths of the tributaries exposed above the waterline at low-flow conditions will be removed. Extensive removal is not anticipated under this alternative because the estimated volume of delta deposits is small based on the Site sediment surveys conducted jointly by the EPA, MDNR and NewFields in November

1999 and April 2003. The excavated sediments would be disposed of in subsidence pits with the other source materials. Removal of the delta deposit sediments will occur at each tributary at the completion of the removal of the sediment in the individual tributary. It is anticipated that all sediments from the tributaries draining source areas to the Class P stream will require complete removal up to the source areas. Once the tributaries have been cleaned of sediments, the channels will be restored to as near-natural condition as possible. This would include replacement of clean gravel in the channels and bank stabilization.

The ROD established numeric action levels for cleanup of the tributary sediments and delta deposits of 2 ppm cadmium, 70 ppm lead and 250 ppm zinc. These concentrations were derived from the average concentration of background designated soil values. The EPA also assessed screening values for sediments in the consensus-based threshold effects criteria (TEC) for freshwater developed by MacDonald et al. (2000). The MacDonald values were recommended as numeric sediment-quality criteria because TEC values are intended to predict the absence of toxicity in sediments. Although TEC values are often used for the purpose of ecological screening to determine contaminants of potential ecological concern, they also provide a reliable basis for classifying sediments as toxic or not toxic to sediment dwelling organisms. Comparing the threshold effects concentration to the probable effects concentration give a range of 1 to 5 ppm (average of 3) for cadmium, 32 to 128 ppm (average of 80) for lead and 121 to 459 ppm (average of 290) for zinc. The average background soil concentrations for the Site fall within this range of screening values and are slightly lower than the average recommended MacDonald values.

During implementation of the remedy, the EPA will initiate the surface water quality monitoring plan to assess the effectiveness of the source removal action on reducing surface water quality to meet federal ALC. If at the second five-year review after completion of the remedy (10 years or less), conducted as required for the Site, monitoring data indicated the federal ALC has not been achieved, the EPA will assess the feasibility of conducting additional actions. These may include the removal of sediments from the Class P streams, which is currently not part of the remedial actions selected in the ROD. Additional action may be taken under an amendment to the ROD, or as part of a new operable unit. If the assessment of data indicates the need for additional source material (i.e., mine waste or soil) removal is required, those additional actions would be conducted under an amendment to the ROD. Should the data indicate that sediment removal from the Class P streams is necessary to achieve the federal ALC, those actions would be conducted under a separate OU and ROD. Should the EPA determine that an additional OU and ROD for sediments is warranted, sediment removal activities would be conducted simultaneously with sediment actions in the Spring River drainage in Kansas and Oklahoma.

Recontour, Revegetate, Soil Amendments, Stabilization

A variety of drainage and erosion-control measures will be implemented during and after excavation of the source materials to manage storm water runoff and reduce metal and sediment loadings to Class P streams and their tributaries. Excavated areas will be recontoured and revegetated following complete removal of the mill wastes to control runoff and prevent surface erosion. Deep tilling would be performed to improve soil structure and moisture retention characteristics by blending the organic matter content of different soil horizons, as well as reducing contaminant concentrations, to reduce risks to human health and terrestrial biota and improve soil function. The soils would be amended with biosolids to supplement the soil organic

matter content and facilitate revegetation, which may also provide some treatment to any residual metals not excavated during subaqueous disposal. Excavated areas will be contoured to promote proper drainage, preventing ponding of water in the excavated areas. Excavated areas will be revegetated using native, warm-season grass or other grass types dependent on the wishes of the property owner. Stream channels and banks from which source materials have been removed would be stabilized through the use of appropriate restoration techniques such as recontouring, regrading, revegetating or installing erosion barriers, stone armor or riprap. Natural vegetation such as willows or cedar revetments would be used to stabilize remediated channels instead of stone rip-rap, where practical.

Selection and Capping of Disposal Pits

Pits will be evaluated during the remedial action for their suitability as disposal sites. Pits directly connected to the surface water system, containing highly oxygenated water or exhibiting high groundwater flux will preferably be excluded from consideration as disposal sites. Pits within ½ mile of Class P streams with exceedances of ALC will also be excluded, depending on the degree of karst development or mining-related conduit flow. Pits within one mile upgradient of shallow drinking-water wells that are still in use will be excluded from consideration for disposal. Pits exhibiting low dissolved oxygen concentrations and low oxidation/reduction potential will be considered good candidates for disposal sites. The filled pits will be capped with geocomposite soil covers to nearly eliminate infiltration of oxygenated rainwater, thereby reducing the weathering of the disposed wastes. Actions such as mounding the cover systems and diverting surface flows away from the capped pits will also be taken to reduce the infiltration of oxygenated water into the disposal pits. In- and near-stream transition zone soils exceeding the action level for human health and terrestrial risk or soils from beneath excavated chat piles will be excavated and used in the construction of the soil cover systems. To prevent damage to the cover systems due to consolidation and differential settling of the mill wastes placed in the pits, adequate time (six to twelve months), will be allowed for the mill wastes to consolidate in the subsidence pits prior to attempting to install the cover systems. Any subsidence that occurs during the consolidation period will be filled in with additional mill wastes or soils to provide positive slopes and adequate drainage for the cover system. Erosion-control measures will be installed at each filled pit to control runoff prior to the cap installation during the settling period. Only low-concentration mill waste or development rock will be used to fill settled areas in the pits after subsidence of initial materials disposed of prior to the cap installation. In addition, groundwater monitoring wells will be installed around the first few pits where disposal occurs to confirm the results of the Waco pilot study concerning the short-term and long-term release of metals. The monitoring data collected from the wells will be used to further define the appropriateness of various types of pits for disposal and refine disposal criteria. Monitoring will be conducted weekly for the first two months, monthly for months three through six, quarterly for the remainder of year one, then semiannually until the first five-year review.

Shaft Plugging

Surface water and sediment RAOs will be addressed through the source material and sediment-removal options described above. Where practical, the groundwater RAO will be addressed by installing shaft plugs and diversion ditches to reduce the amount of surface water entering the mine workings. The purpose of these actions will be to reduce point and nonpoint groundwater discharge from mining-related sources to streams.

Thoms DA Open Mine Pits

The acidic overburden from the Wild Goose open pit mine in the Thoms DA will be excavated and disposed of underwater in the TH-12 pit. Other mill wastes from the Thoms DA will also be disposed of in this open pit as well. Due to the size of the pit, however, there is not enough mill waste or overburden in the Thoms DA to completely fill the Wild Goose open pit TH-12. Therefore, the EPA will assess hauling wastes from other DAs to facilitate complete filling of the pit. Water displaced by the filling of the pit will be neutralized and treated with lime in a temporary mobile treatment plant to remove the cadmium, iron, lead and zinc prior to discharging it to the nearby Center Creek tributary (CC Trib 6). An open limestone drain will be installed at the outlet of the pond to neutralize any subsequent discharges that may occur following the remedial actions if the pit is only partially filled. Lands exposed by the excavation of the reactive overburden will be deep tilled, limed and amended with biosolids or other organic matter and revegetated the same as other excavated mill waste deposits.

Filling of the Wild Goose pit, with its current low pH waters, presents a special concern for subaqueous disposal of wastes. The acidic nature of these waters could mobilize metals and result in groundwater conditions not suitable for subaqueous disposal. The acidic overburden may need to be treated to reduce acidity prior to placing it into the pit with mill wastes. Only partially filling the pit will result in open water at the surface that could serve as a continual input of oxygenated water, thereby negating anaerobic conditions to stabilize metals. If open surface water is left in the pit, it could be an attractive nuisance and could harm wildlife, particularly waterfowl. This scenario of disposal needs to be fully studied and modeled to show if it is effective prior to implementing action at the pit. Pilot studies will be required to assess the effectiveness of treatment technologies prior to full implementation of the filling action. It is likely that the treatability and pilot study results will show that the pit can be filled without significant metals release, but that the pit should be completely filled and capped.

3.3 Nonengineered Actions

The nonengineered components of the Selected Remedy as specified in the 2004 ROD are presented exactly below.

Institutional Controls

The ROD for the smelter-affected and mining-affected residential yard soils in Jasper County (OU-2/3) prescribes institutional controls (ICs) to reduce future exposure of children to unacceptable concentrations of lead in soils in new residential construction in all undeveloped contaminated areas. Those ICs were envisioned to consist of a site-wide zoning ordinance that will control new development in mine-affected areas, building codes or health ordinances that will require remediation of soils exceeding the risk-based cleanup standards in new residential construction, and deed restrictions on excavated yard soil repository sites to protect them from human disturbance. The ICs are being considered and developed through a cooperative effort between the EPA, Jasper County and the city of Joplin, Missouri. However, to date, the implementing ordinances have not been enacted. Thus, the preferred alternative for OU-1

incorporates the ICs that were required under OU-2/3 and allows the County and cities greater flexibility in adopting such ICs in light of the more permanent and reliable proposed action in this ROD (i.e., disposal and containment of the source materials).

The selected alternative for OU-1 includes a site-wide building ordinance that would be enacted by Jasper County, similar to the health ordinance prescribed in the OU-2/3 ROD. The EPA has discussed this IC with Jasper County. The County would propose a building ordinance for all undeveloped areas within the Site that requires the builders of residential homes to obtain a permit for construction. Conditions of the permit would require soil testing to determine the lead concentration of the soil in the yard area of the home. The EPA will work with the County to develop appropriate sampling procedures to ensure the reliability of the results. An occupancy permit will only be granted by the County if soil lead concentrations are below 400 ppm and cadmium concentrations are below 40 ppm. Builders will be required to properly clean up soils exceeding these levels prior to receiving the occupancy permit. The EPA will provide funding to Jasper County to establish and implement the building permit ordinance. After the completion of the OU-1 cleanup, the surficial source materials (mine and milling wastes) will be contained in the subsidence pits. Thus, the building ordinance controlling residential development will no longer be required. The selected alternative does not require but tolerates a planned termination date for the County's building ordinance if the County prefers that the ordinance only be effective for a limited term. For example, the ordinance could terminate upon completion of the remedial action.

The selected alternative prescribes disposal of mine and mill wastes in mine subsidence pits followed by capping of the wastes. Some waste areas may be contained and capped in place with soils or biosolids. All capped areas and biosolids-treated areas will require ICs to prevent disturbance of the cap, thereby protecting the wastes. These ICs will likely consist of restrictions or easements placed on the property deeds for the areas where the disposal or containment occurs. The restriction will prevent the development on and disturbance of the caps placed over the wastes. Restrictive covenants may be entered into with owners of the disposal property for protection of the disposal and capped areas.

This ROD excludes chat recycling as a component of the selected alternative. The effective and more permanent engineering control components of the selected alternative eliminate the need for legal agreements to control recycling. Reducing risks to human health and the environment from chat recycling through legal agreements with individual owners/operators is administratively infeasible because of the large size of this Site, about 5,000 acres of mine waste piles and 500 owner/operators, and the far-reaching impact of such agreements (i.e., end uses, accumulation, speculation, storage, surface water protection and final closure). Moreover, the legal agreements would duplicate ARARs under the Clean Water Act (CWA) that regulate discharge of pollutants and contaminants into surface waters. If enforcement actions are needed to control surface water pollution from mine waste piles prior to completion of the engineering components selected in this ROD, the CWA may be used on a case-by-case basis to regulate surface water pollution caused by chat recycling.

Health Education

The ROD for OU-2/3 required the implementation of a health education program in Jasper County to supplement the residential soil cleanup. The EPA has been funding the Jasper County Health Department to implement that health education program since 1996. Since human health exposure risks due to direct contact with source materials containing the metals contaminations are possible until completion of the mine and mill waste cleanup described in this ROD Amendment, the EPA will continue to fund the health education program until the cleanup of OU-1 is complete. When the cleanup action is completed for OU-1, and at the completion of additional actions anticipated under OU-2/3 (which essentially means that Superfund Site sources for human exposure have been addressed), the health education program will no longer be funded by the EPA.

Stream Monitoring

One of the primary RAOs for the selected alternative for surface water is to reduce the exposure of aquatic organisms in the Class P streams to COCs where federal aquatic life criteria (ALC) are exceeded. The EPA believes the actions taken under the preferred alternative will reduce concentrations of metals in the Class P stream to less than federal ALC based on hardness. These actions include removal of all source material with erosion potential to the streams, tributary sediments and 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-1, 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. The EPA will collect monitoring data which will be used during the five-year review process, and will be collected and assessed at each review until the metals concentrations are in compliance with the federal ALC. Should the goal of achieving the federal ALC fail to be achieved within two five-year review periods (10 years) after completion of the remedial action, or if water quality standards established by states or tribes for downstream receiving surface waters show no improvement within this 10-year period, the EPA will assess the feasibility and practicality of conducting additional actions at the Site 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 this ROD for OU-1, or if warranted by an extensive, basis-wide action, a new operable unit for sediment removal may be established to address the Class P streams at the Site.

Operation and Maintenance

An operation and maintenance (O&M) program will be established to maintain the caps on the disposal areas and to maintain other engineering components of the preferred alternative (e.g., areas of biosolids or soil application where wastes were left in place, groundwater monitoring and revegetated areas). The State will be responsible for the O&M beginning one year after the completion of the remedial action. If the local government enforces the ICs, the State remains responsible for O&M of such local government controls.

The State's O&M responsibilities will include a monitoring program to assess the effectiveness of the ICs. The monitoring program will provide annual reports to the EPA detailing the

development in areas of concern to protect engineering components. Monitoring requirements will 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.

4.0 Basis for Revisions to the Selected Remedy

The following subsections discuss the changes to the 2004 ROD.

4.1 On-site Volume of Mining Wastes and Open Pit Space

The EPA began the remedial design for OU-1 cleanup in 2006 and the remedial action in 2007. During the design phase, two issues became apparent that are the basis for revising the 2004 selected remedy. First, the EPA determined during design activities that a significantly larger volume of mining waste is located on-site compared to the estimate in the 2004 ROD. Second, the EPA determined that on-site open pit space is insufficient for disposal and containment of all mining wastes located at the Site. These issues form the basis for two changes to the 2004 Selected Remedy: (1) because of the large increase in on-site mining wastes volume, open pit space for disposal is insufficient and no longer available; and (2) aboveground repositories are necessary for disposal and containment of a substantial volume of mining wastes.

4.2 Disposal in Open Pits Waiting Period

The 2004 Selected Remedy included a provision to prevent damage to the cover systems of mining wastes disposed of in on-site open pits. Due to consolidation and differential settling of the wastes after disposal in the pits, adequate time was to be allowed for wastes to consolidate in the subsidence pits prior to installing cover systems. During the last five years of construction activities, the EPA has determined that wastes disposed of in open pits have not shown any signs of settlement. Thus, a change to the 2004 Selected Remedy is necessary to remove the waiting period required before capping.

4.3 Biosolids Unavailable for Use as Soil Amendments

The 2004 ROD stated that the EPA would apply biosolids to excavated areas to add organic matter to the soil to improve growing conditions. However, the EPA has determined that sources of appropriate biosolids for use as soil amendments after excavation are not available near the Site.

4.4 Sediment Action Level Studies Complete

The 2004 ROD established numeric action levels for cleanup of the tributary sediments and delta deposits of 2 ppm cadmium, 70 ppm lead and 250 ppm zinc. As part of the OU-5 remedial investigation, the EPA contracted with the U.S. Geological Survey (USGS) to conduct a site-specific risk assessment for sediments in the perennial streams on the Site. This risk assessment developed site-specific toxicity values that are significantly higher than those specified in the 2004 ROD.

Each of these issues is discussed in detail in the following section, along with the proposed change to the 2004 ROD.

5.0 Description of Remedy Changes

The following subsections discuss in detail the changes to the OU-1 remedy.

5.1 Volume and Cost

Based on the OU-1 Feasibility Study prepared by the RPs in 1995, the 2004 ROD estimated that approximately 7.1 million cubic yards of contaminated source material exists on the Site on approximately 5,000 acres of land. The cost of the OU-1 selected remedy was \$58,543,000 as calculated from detailed cost estimates in the Feasibility Study. During the remedial design activities, the EPA obtained new information and now estimates that there are approximately 14 million cubic yards of contaminated source materials on the Site covering nearly 11,000 acres. In addition, the cost of various remedial action engineering components has increased significantly from the ROD estimates. The selected remedy was estimated to cost approximately \$8 per cubic yard for source materials remediation in 2004. Due to the additional acreage of mining wastes, fewer subsidence pits and additional repositories, the EPA now estimates costs of approximately \$12 per cubic yard. Based on known volumes and acreage, this will result in an estimated cost of approximately \$168 million not including the costs incurred by the responsible parties to remediate the areas of their responsibilities under the consent decree.

5.2 Construction of Repositories

Given the larger volume of waste now known to exist at the Site, sufficient pit space for subaqueous disposal of all on-site wastes is not available. The EPA is making use of all available pit space for disposal; however, aboveground repositories are required to be constructed in some areas of the Site where pits are small or do not exist. Through the design process, the EPA is continuing to develop innovative approaches for disposal locations that can be used for future redevelopment of the mined areas consistent with local land use plans. These include construction of repositories in road right-of-ways that are later paved by municipalities and turned into city streets; filling of an abandoned wastewater treatment lagoon that will become a new sports complex; and expanding the size of a pit-filled area to incorporate surrounding land allowing for the development of a new 40-acre commercial development site. Future repository sites will be designed with redevelopment of the area as the focus. The criteria for siting new aboveground repositories will be in compliance with the criteria presented in the 2004 ROD. Flooded pits that contain high-quality habitat for fish and wildlife with low concentrations of metals in the water will not be used for disposal because they do not present a risk to human health or the environment. In addition, pits located in close proximity to water supply wells or flowing streams where the pit may be hydraulically connected to the stream will not be utilized for disposal.

Long-term operation and maintenance (O&M) of the repository caps after completion of the remedial action would be more costly than estimated in the OU-1 ROD due to the increase in the number of aboveground repositories. The EPA estimates long-term annual O&M costs would be \$100,000.

During the remediation of residential yard soils under the OU-2 and OU-3 ROD, the EPA established a repository south of Carterville and west of Prosperity on 17th Street. This location

was used for disposal of all yard soil wastes from the remedial action. In addition, the repository has remained open and is available for use by local builders and developers for disposal of contaminated soil during the development of new residential properties, provided they comply with the Jasper County and city of Joplin's remediation ordinances. The requirement for a long-term, open repository is specified in the OU-2 and OU-3 ROD and is part of the ongoing ICs under that ROD. However, this repository is nearly filled to capacity and a new location is now required for ongoing residential soil disposal.

The EPA has identified the Beville-Chemical Plant Designated Area of the Site as the location for the new residential soil disposal repository. The specific property for the repository is located west of Malang Road and north of 7th Street on the Kansas state line. This property was formerly owned and operated by Farmland Industries (FI), which filed and completed federal bankruptcy reorganization. The property contains a large pile of waste gypsum (nearly 60 acres, known as the Gypstack). The gypsum waste was generated by FI during production of phosphoric acid at the plant located adjacent to the waste pile. Prior to FI operations, mining wastes were disposed of on this property, and subsequently FI disposed of its waste gypsum on top of the mining wastes. The waste gypsum contains high levels of phosphorous and nitrogen and low levels of radon. The mining wastes contain the COCs for this Site (lead, cadmium and zinc). Leachate from the waste gypsum exacerbates the release of heavy metals from the mining wastes into the environment. As described in the RI Report, Short Creek, downgradient of the FI property, is contaminated from the release of these COCs.

The Gypstack requires remediation. MDNR has undertaken oversight of certain activities for the Gypstack in accordance with its bankruptcy settlement with FI. For example, MDNR issued a Clean Water Act, National Pollutant Discharge Elimination System (NPDES) permit for operations at the Gypstack in 2008, NPDES Permit # MO-00533627. The permit is for zero discharge and requires collection and recirculation of leachate to a small pond on top of the Gypstack. In accordance with the OU-1 ROD, the remedial action for the Gypstack must be in accordance with the engineering control components for the OU-1 selected remedial action for capping of repositories (see section 3.2 above, Engineering Controls, Selection and Capping of Pits). This will include a geocomposite engineered cap with long-term O&M.

The EPA will use the Gypstack as a repository for mining wastes due to the lack of available subsidence pit open space in the Beville-Chemical DA. In addition, the Gypstack, due to its large size, is an appropriate location for the new long-term repository for disposal of contaminated residential yard soil, which will be addressed under this OU-1 ROD Amendment in accordance with Attachment 1, the Jasper County Health Ordinance. Mining wastes and contaminated yard soils would be placed on top of the Gypstack, raising its top elevation by up to 30 feet. Surface water and storm water runoff controls would be established during operations at the repository in accordance with ARARs. Capping of the Gypstack, mining wastes and contaminated yard soils will include a geocomposite engineered cover layer, which will be completed as the top of the Gypstack reaches maximum design elevation. Final closure of the Gypstack will be in accordance with ARARs.

The 2004 ROD specified that, to prevent damage to the cover systems due to consolidation and differential settling of the wastes placed in the pits, adequate time would be allowed for the mill wastes to consolidate in the subsidence pits prior to attempting to install the cover systems. During the construction activities conducted over the last five years, the EPA has monitored the

settlement of filled pits and has determined that wastes, even in subsidence pits over 100 feet deep, have not shown any settlement after being placed. Therefore, the requirement of allowing time (six to twelve months) for the wastes to consolidate in the subsidence pits prior to installing the cover systems is no longer required.

5.3 Use of Biosolids and Deep Tilling

The 2004 ROD specified incorporating biosolids into the excavated areas to supplement the soil's organic matter content and facilitate revegetation. Biosolids were also anticipated to provide some treatment to any residual metals remaining below the cleanup levels and not excavated during cleanup action. However, the EPA has been unable to locate local sources of appropriate biosolids for use on the Site. The sources located within a reasonable distance from the Site for economical hauling are either not of sufficient volume to accomplish the purpose, or they contain excessively high concentrations of zinc that prohibit their use on the Site. Further, all biosolids sources located near the Site are not composted, and, if placed on the Site, would create an extreme odor problem that would be unacceptable to surrounding residents. Therefore, the EPA is eliminating the requirement of using biosolids on the Site for soil amendment.

During the early phases of the remedial actions at OU-1, the EPA conducted a pilot study on deep tilling to assess the effectiveness of reducing metals contamination in thin deposits of upland source areas and transition soils and the associated costs with tilling methods. Upon completion of the study, deep tilling was determined to be ineffective at adequately reducing metals concentration within a reasonably low cost. A summary of this pilot study dated August 2013 is available in the Administrative Record. The rocky nature of the soil prevented adequate mixing of the soil and increased costs beyond that of normal excavation costs. Thus, the EPA has determined that instead of deep tilling, upland vegetative chat and transition soils will be excavated and removed along with the mine waste piles.

5.4 Sediment Cleanup Levels

The 2004 ROD established numeric action levels for cleanup of the tributary sediments and delta deposits of 2 ppm cadmium, 70 ppm lead and 250 ppm zinc. These concentrations were derived from the average concentration of background-designated soil values on the Site, along with the EPA's screening values for sediments in the consensus-based threshold effects criteria (TEC) for freshwater. The EPA began conducting investigation of the site streams and sediments throughout the Tri-State Mining District, including Kansas and Oklahoma, in 2006. As part of those studies, the EPA partnered with the U.S. Geological Survey (USGS) to conduct a district-wide ecological risk assessment and to establish site-specific sediment cleanup criteria. See the Development and Evaluation of Sediment and Pore-Water Toxicity Thresholds to Support Sediment Quality Assessments in the Tri-State Mining District (TSMD), Missouri, Oklahoma, and Kansas dated August 2008 in the Administrative Record. As a result, USGS developed toxicity values at which 10 percent of the organisms living in the streams would potentially show adverse effects (T₁₀), and at which 20 percent of the organisms living in the streams would potentially show adverse effects (T₂₀). The EPA is adopting the T₂₀ toxic effect value as the cleanup criteria for sediments in the intermittent tributaries at the Site. These values are protective for 80 percent of the aquatic organisms as shown in said USGS/EPA district-wide study.

5.5 Expedited Debris Removal Area

On May 22, 2011, an EF5 tornado struck the southern portion of the city of Joplin, Missouri, destroying approximately 7,000 homes and 3,000 businesses in an area where historic mining was conducted. A large portion of the area is underlain with mining wastes, and the tornado's path intersected a portion of the Iron Gates and Iron Gates Extension designated areas. This area has been designated the expedited debris removal (EDR) area by the city of Joplin, and is shown on the attached Figure 2.

Prior to the EF5 tornado, the EPA conducted soil sampling in the EDR area during implementation of OU-2 and OU-3, Smelter Affected and Mine Waste Affected Residential Yard Cleanups. All of the earlier sampling events in the ERD area at properties not addressed by the OU-2 or OU-3 actions did not find levels of lead or cadmium that required cleanup. After the removal of destroyed homes, structures and other tornado debris, significant quantities of mining wastes and contaminated soil have been found at the surface in residential neighborhoods.

The mining wastes and contaminated soil were discovered as a result of residential soils sampling conducted under an institutional control program and county ordinance developed by Jasper County to guide future development in mine waste areas. A copy of the ordinance is attached (see Attachment 2). The ordinance was developed under the 2004 ROD for OU-1 and requires sampling properties for lead prior to development of residential structures. It also prescribes the approach required to eliminate the unacceptable exposures to mining wastes and contaminated soils. The EPA has determined that the ordinance incorporates information and procedures from the Superfund Lead-Contaminated Residential Sites Handbook (OSWER 9285.7-50 August 2003). Therefore, the EPA is now including the Jasper County ordinance as the selected remedial action for cleanup of residential yard areas in the EDR area.

As described above, the OU-2 and OU-3 ROD for this Site also addressed cleanup of smelter, mining wastes and contaminated soil in residential yards. Those selected remedial actions are complete and remain protective as described in the five-year review reports, which are available in the Administrative Record. The EPA notes that the ROD for OU-2 and OU-3 will not be affected by this OU-1 ROD Amendment.

The EPA is reiterating with this ROD Amendment that OU-1 cleanup action levels for surface mining wastes are appropriate for protection of human health at the Site. The EPA has determined that the OU-1 cleanup action levels are also appropriate in the EDR area. In addition, the EPA is establishing that residential soils cleanup actions at the EDR area will differ from the selected remedial actions for OU-1 mine and mill waste cleanup. The cleanup in the EDR will be implemented on a property-by-property basis as decisions are made to reestablish residential uses for the parcels impacted by the tornado and in accordance with the county ordinance. Contaminated soils removed from residential properties in the EDR area will be disposed of at the Gypstack in the Belleville-Chemical DA.

6.0 Summary of Proposed Remedy Changes

6.1 Costs

Due to the known increases in volume of wastes, number of aboveground repositories and excavation costs since the 2004 ROD was prepared, the costs for remediating the wastes is now estimated to be \$168 million. In addition, the costs will increase by \$20 million due to the remediation of mine wastes and associated soils in the EDR DA. Thus, the ROD Amendment estimates the total costs for EPA for OU-1 remediation to be \$188 million. Long-term O&M is estimated to be approximately \$100,000 annually.

6.2 Aboveground Repositories

The EPA has determined that due to the increase in waste volumes and acreage identified at the Site, sufficient subsidence pit space to perform subaqueous disposal is not available. Waste will be disposed of in aboveground repositories in those areas where sufficient subsidence pit space is unavailable. In addition, the EPA has determined that the six to twelve month settlement time prior to installing caps over wastes placed in subsidence pits is not required.

The EPA has determined that the existing long-term, residential-yard contaminated soil repository has reached its full capacity. This repository was established during OU-2 and OU-3 response actions. Under OU-1, this repository was to remain open for use during implementation in accordance with local governmental controls established by the city of Joplin and Jasper County's ordinances. However, due to the need for additional capacity, it will be closed and a new long-term repository will be established located at the FI property west of Malang Road and north of 7th Street on the Missouri/Kansas state boundary. The EPA has determined that the Gypstack located within the Beville-Chemical Plant DA of the Site is an appropriate location for long-term disposal of mining wastes and contaminated residential soils from the EDR area and for other areas of new residential development provided such developments are permitted in accordance with the city of Joplin and Jasper County's environmental ordinances for residential construction.

6.3 Biosolids and Deep Tilling Eliminated

The EPA has determined that appropriate biosolids are not available for use in amending soils for organic content. Additionally, pilot studies on deep tilling showed that tilling and mixing of soils to reduce metals concentrations below action levels were ineffective. The use of biosolids and deep tilling at the Site has been eliminated from the remedy. Because biosolids and deep tilling are impractical and ineffective, upland source materials will be excavated, removed and disposed of with the other mining wastes in subsidence pits or aboveground repositories and excavated areas will be recontoured, regraded and seeded.

6.4 Sediment Cleanup Action Level Established

The EPA, in conjunction with USGS, has conducted site-specific toxicity studies for sediments at the Site and is now selecting the tributary sediment cleanup values of 219 ppm lead; 2,949 ppm zinc; and 17 ppm cadmium.

6.5 EDR Area

The EPA is including the EDR area in the OU-1 selected remedial action, which includes the mining wastes located in residential areas of the site exposed after the Joplin EF5 tornado in May 2011. Cleanup of the residential yards within the EDR area will be in accordance with the methodologies established under the Jasper County ordinance.

None of these proposed changes alter or affect the RAO presented in the 2004 OU-1 ROD, or change how the remedy meets the statutory requirements discussed in the following section. See the attached Table 1 for a summary of the changes to the remedy comparing the 2004 ROD with the ROD Amendment.

7.0 Statutory Determination

Remedy changes outlined in this ROD Amendment will continue to meet the statutory requirements of CERCLA section 121, 42 U.S.C. § 9621 and the NCP. The remedy changes are protective of human health and the environment, comply with ARARs, are cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the changes to the remedy described in this ROD Amendment meet these statutory requirements.

7.1 Protection of Human Health and the Environment

The changes will continue to protect human health and the environment by achieving the RAO through a combination of engineering measures and ICs. Existing terrestrial and aquatic risks from exposure to metals contaminated source materials will be mitigated by continued removal and disposal of the source materials in mine subsidence pits or aboveground repositories. The new selected action levels for sediment cleanup are protective of aquatic life as shown in on-site studies conducted by USGS. Future risks to human health will be reduced by source removal to include the EDR area that will be remediated at OU-1 cleanup action levels consistent with the Jasper County ordinance. Continued implementation of ICs will ensure proper construction and permitting of new residential dwellings in contaminated areas. Construction of the new residential soil repository will ensure that residential development will be consistent with these established ICs for the duration of the remedial action.

The use of biosolids and deep tilling were specified in the 2004 ROD for addressing upland vegetated chat and transition zone soil for protection of human health and the environment. Instead, these source materials will be excavated and removed to repositories within the Site. This change in the remedial action is a more protective engineering control than stabilization in place with biosolids and deep tilling because wastes will be contained in repositories with land use controls. In addition, eliminating the use of biosolids as soil amendments does not compromise the protectiveness of the remedy. Instead, the excavation, recontouring, regrading and vegetation are sufficient and more acceptable to the local community due to the extreme odor expected from uncomposted biosolids.

7.2 Compliance with ARARs

Compliance with ARARs is a requirement of the selected remedy unless waiver of an ARAR is justified. The remedy changes are expected to continue to comply with all ARARs identified in the 2004 ROD.

7.3 Long- and Short-term Effectiveness

There are no long-term, adverse, cross-media impacts expected from the remedy changes. In addition, there are no short-term threats associated with implementation of the remedy changes that cannot be readily controlled. The potential short-term risks associated with settlement of mining waste disposed of in subsidence pits prior to installing permanent repository caps no longer requires a waiting period. During remedial design/remedial action (RD/RA) implementation, the EPA has demonstrated that potential short-term risk due to settlement of the wastes is nonexistent.

7.4 Preference for Treatment as a Principal Element

The changes represent the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for this remedial action. Disposal of the wastes in subsidence pits and aboveground repositories followed by capping is a permanent solution for addressing the wastes to the maximum extent practicable.

The EPA has not been able to verify the potential for treatment of the mining waste by deep tilling and application of biosolids during RD/RA because of the lack of available biosolids and practical difficulty with deep tilling. In addition, containment in repositories or subsidence pits of upland sources of mining wastes rather than deep tilling and biosolids meets the regulatory preference for more permanent remedies because of the land use controls associated with the capped areas.

7.5 Implementability

All of the changes are fully implementable. None of the changes detract from the implementability of the remedy. However, by eliminating biosolids and deep tilling, the remedy may be more implementable. The EPA will not use biosolids in excavated areas because of the severe odor problems, which could be extremely unacceptable to the local community. By not using deep tilling equipment, the remedy is more implementable because such equipment is prone to malfunction in the rocky, clay soils found at the Site. Instead, the EPA will continue recontouring, regrading and seeding excavated areas which are functioning well and are fully implementable.

7.6 Cost Effectiveness

The changes are cost effective, including the additional costs associated with the increase in volume and acreage of wastes, the increased number of aboveground repositories, plus the added cost for addressing contaminated residential properties in the EDR area. The cost of remediating mining wastes has increased to \$12 per cubic yard, which is only a \$4 increase from the 2004 cost estimate of \$8 even though the volume has doubled from 7 to 14 million cubic yards and the

acreage more than doubled from 5,000 to 11,000 acres. The changes provide overall effectiveness proportionate to the per-unit cost increase. The changes will continue to achieve the remedial action objectives and cost effectively reduce unacceptable risks to human health and the environment. The new estimated cost for the Site for the EPA's portion of the remedy is estimated at \$188 million, plus an estimated \$100,000 annually for O&M.

8.0 State Concurrence

The EPA has consulted with MDNR on the changes in the remedy in this ROD Amendment. MDNR agrees and concurs with the proposed changes.

9.0 Public Participation

The EPA issued the Proposed Plan for the ROD Amendment for OU-1 on August 7, 2013, and provided a 30-day review and comment period which closed on September 6, 2013. A public meeting to present the proposed plan and receive comments was held on August 15, 2013, at the Phelps Theater located in the Billingsly Student Center of Missouri Southern State University, 3950 East Newman Road, Joplin, Missouri 64801. The EPA did not receive any comments to the proposed amendment that resulted in any changes to this ROD. The significant comments received from the public are included with this ROD Amendment as Attachment 3. A copy of the transcript from the public meeting and all written comments received during the comment period can be found in the Administrative Record.

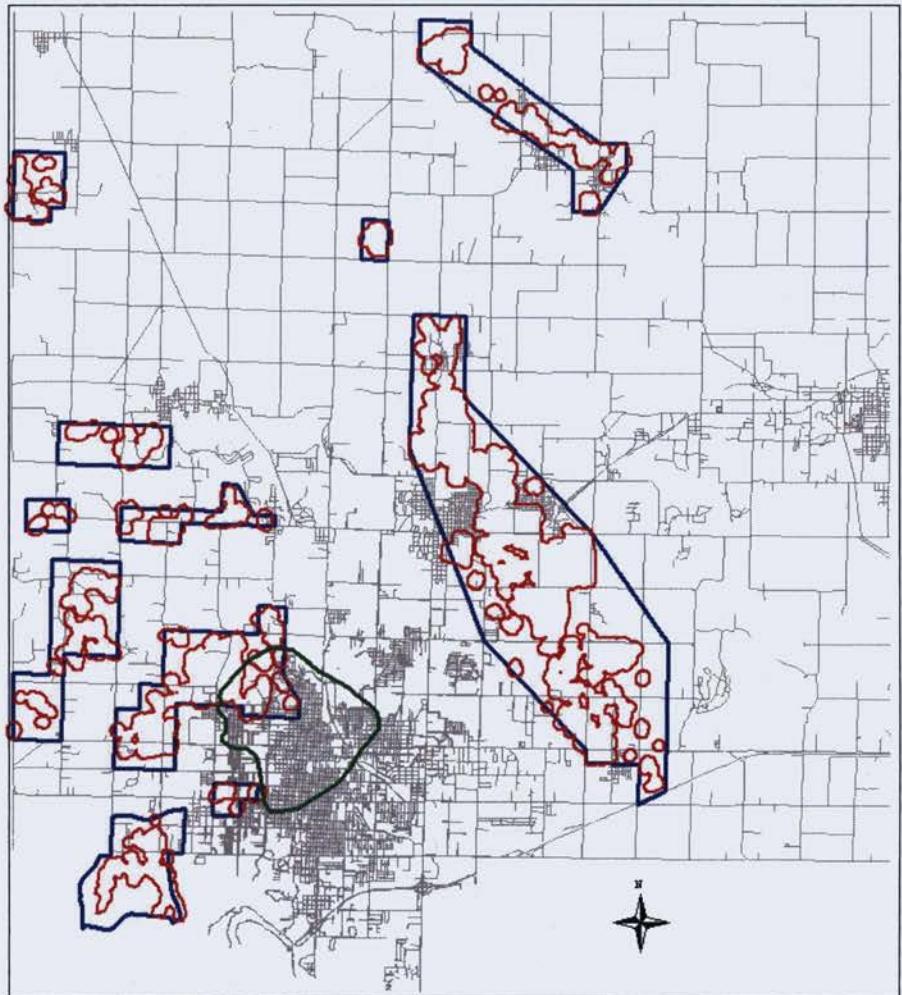
Table 1. Comparison of OU-1 ROD with changes to the remedy in Proposed ROD Amendment

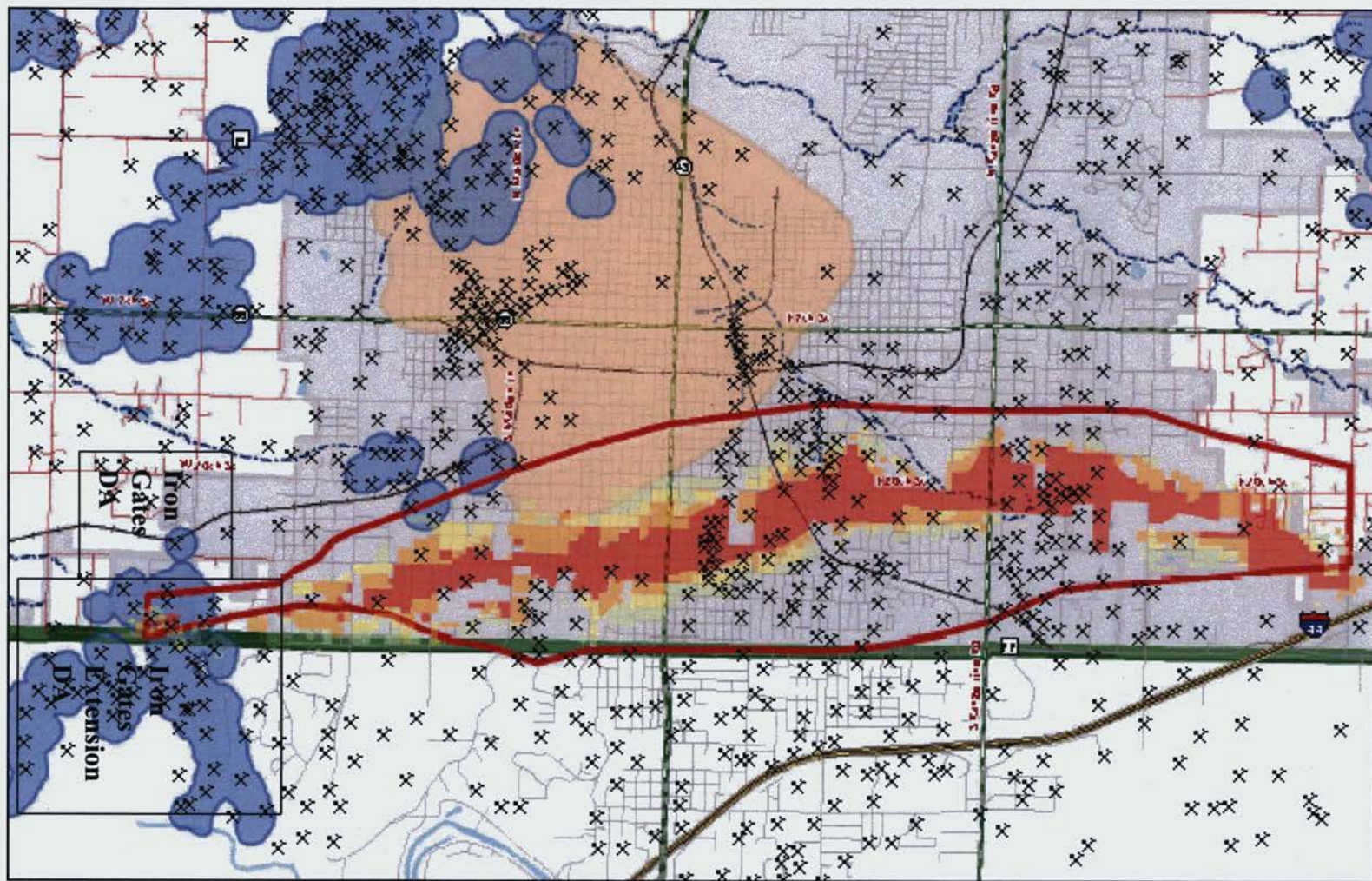
REMEDIAL ACTION COMPONENT	OU-1 RECORD OF DECISION 2004, SELECTED REMEDIAL ACTIONS	OU-1 RECORD OF DECISION AMENDMENT 2013, PROPOSED CHANGES
Aboveground waste repositories	<p>Selected Remedy – use aboveground repositories only when nearby pit space unavailable; expectation is that will be rare occasion (public comment)</p> <p>Alternatives 5(a) and 5(b) in FS considered aboveground waste repositories</p>	<p>Use Alternative 5(a) criteria for design of numerous aboveground repositories</p> <p>New long-term repository location selected at the Gypstack in the Beville-Chemical DA</p>
Biosolids and deep tilling	<p>Selected Remedy – use biosolids and deep tilling for footprint of waste piles after excavation</p> <p>Upland source materials – deep tilling and biosolids are sole remedy (no excavation/no removal)</p>	<p>No biosolids and no deep tilling anywhere on the Site</p> <p>Excavation and removal now includes all upland source material areas</p>
Sediment cleanup action levels	Alternative 4 – use EPA national screening values and site background concentrations for action levels in sediments	Use new site-specific sediment cleanup action levels developed by USGS/EPA
Gypsum Waste Pile	Alternative 4 – cap in place	New repository for short- and long-term residential soils excavation (replace OU-2 repository)
Site map and DAs	Cleanup of mining wastes within the Designated Areas	Cleanup of mining wastes in DA and the EDR area as shown in the attached Fig. 1.
Cleanup of mining wastes in EDR area	Mining waste cleanup action levels – Excavate, place barriers as needed, dispose of wastes in new residential soil repository, clean fill to restore grade, issue building permit (IC)	The EDR cleanup will be in accordance with the Jasper County ordinance (attached). Identifies EDR area where this remedial action component is available within the Site

Figure 1. Map of Designated Areas

Jasper County

Mine Waste Areas and Smelter Zone





NGA Assessment - May 31, 2011

- CATASTROPHIC
- EXTENSIVE
- MODERATE
- LIMITED

- Tomado_Path
- Mine Waste Area
- Smelter
- Inventory of Mines Occurances Prospects



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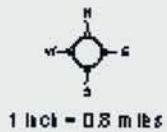


Figure 2. Location of the EDR

ATTACHMENT 1
Jasper County Health Ordinance

ENVIRONMENTAL CONTAMINATION ORDINANCE

AN ORDINANCE ESTABLISHING PUBLIC HEALTH PROTECTION RELATED TO
LEAD, CADMIUM, TRICHLORO-ETHYLENE AND OTHER IDENTIFIED CONTAMINANTS

SECTION 1. PURPOSE. The purpose of this ordinance is to provide for regulation of use, and mandatory testing of soil on designated properties located within the County. Certain Regulated Contaminants, as herein defined, have been identified in soil and in groundwater on both residential and commercial properties within the County. Most, if not all of these residential properties known to have been contaminated have been remediated to site-specific standards. Very few commercial properties have been remediated. New residential construction continues in areas of possible contamination. Regulated Contaminants pose a real threat to the health and well-being of individuals who are exposed to soil and water having elevated levels of the contaminants. In particular, children are at risk from long-term exposure to such Regulated Contaminants causing brain dysfunction and possible death. The County has identified certain areas where the Regulated Contaminants exceed allowable levels in residential yard soil or in groundwater. Such areas have been identified by the U.S. Environmental Protection Agency (EPA) and Missouri Department of Natural Resources (MDNR). This statute is intended to protect the general health of citizens, particularly children, from unnecessary exposure to contamination.

SECTION II. AUTHORITY. This ordinance is enacted pursuant to Section 192.300, R.S.Mo., and is not in conflict with any rules or regulations authorized by the State Department of Health & Senior Services.

SECTION III. ADOPTION OF RULES AND AMENDMENTS. The Jasper County Health Department shall promulgate rules to require testing of soil and groundwater in private wells, which can be more restrictive than state guidelines per R.S.Mo. § 192.290.

SECTION IV. APPLICABILITY. For the purposes of well testing requirements these regulations apply to all real property in the County. For soil testing requirements these regulations apply to the Superfund designated areas that generally include properties from Kansas State Line on the West to County Road 170 on the East and Newton County Line on the South to Highway M on the North. For soil testing, areas within these boundaries that are known to be non-contaminated will be exempted from the requirements of this ordinance. These areas will be designated using existing EPA and MDNR testing data and supplemented with local testing data. These areas will be reviewed annually as EPA/MDNR continue cleanup in the county. Maps depicting these potential contamination areas will be publicly available and updated annually.

Applicability of this ordinance will cease 6 months after completion by the EPA of Operable Unit 1 remediation project, which includes remediation of all lead mining and milling wastes and soil that exceed concentrations constituting a risk to residents.

SECTION V. DEFINITIONS. The following words and phrases used within this Ordinance have the following meanings:

- 5.01 Department: The County Health Department.
- 5.02 Commission: The County Commission.
- 5.03 County: Jasper, County, Missouri, a first class county.
- 5.04 The Health Officer: The Administrator of the County Health Department or an authorized representative.
- 5.05 Contaminated Soil: Soil having concentrations of Regulated Contaminants which exceed allowable levels established by the EPA, MDNR, or the State or County Department of Health.
- 5.06 Person: An individual, corporation or other legal entity.
- 5.07 Stop Order: A written order issued by the County Health Officer, or a designated representative, to stop all construction, installation, modification or occupation of any dwelling, child occupied facility or recreation area in areas of known contamination if in violation of this ordinance.
- 5.08 Required Soil Testing: Soil tests which conform to the requirements of the EPA and MDNR for the presence of Regulated Contaminants.
- 5.09 Required Water Well Testing: Water quality tests which conform to the requirements of the EPA and MDNR for water quality testing for Regulated Contaminants.
- 5.10 Regulated Contaminants: Those contaminants in the soil or water well which are regulated by federal, state or local laws and those contaminants which the EPA or MDNR finds may be hazardous to public health. Contaminants shall specifically include: Lead, Cadmium, Arsenic, Trichloroethylene ("TCE"), and any other heavy metal, organic solvent which is known to be, or suspected to be, present in County soils or water wells and which may cause harm to human health and well-being.
- 5.11 Qualified Testing Lab: Any testing facility which has been approved by the County, the EPA or MDNR as qualified to test for the Regulated Contaminants.
- 5.12 Soil Barriers: Any artificial or man-made structure, marker or indicator which has been placed in the soil for the purpose of notifying a Person of the presence of Regulated Contaminants.
- 5.13 Water Well: Any Domestic Well, High Yield Well or Multiple Family Well, as defined at 10 CSR 23-1.030, or converted Test Wells authorized under 10 CSR 23-6.020. Water Wells do not include public drinking water systems, or private lines accessing public drinking water systems which are regulated pursuant to 10 CRS 60-1.010.
- 5.14 Dwelling: either:
 - (a) A dwelling, including attached structures such as porches and stoops; or
 - (b) A dwelling unit in a structure that contains more than one separate residential dwelling unit and in which each such unit is used or occupied or intended to be used or occupied, in whole or in part, as the home or residence of one or more persons.
- 5.15 Child Occupied Facility: A building or portion thereof visited regularly by the same child who is six or fewer years of age including, but not limited to, day care centers, preschools and kindergarten classrooms. For the purposes of this subdivision, "visited regularly" means a minimum of two visits on different days within any week, provided that each visit lasts at least three hours and the combined weekly visits last at least six hours and the combined annual visits last at least sixty hours.

- 5.16 Recreational Area: Areas such as parks or ball fields where children are likely to congregate. This includes the portions of commercial or industrial properties that offer recreation areas where children are likely to congregate.

SECTION VI. PROHIBITIONS. No person shall:

- 6.01 Construct a dwelling or dwelling unit or other child occupied facility or recreational area as defined in this ordinance without first determining whether the property upon which the activity is to occur is property which has previously been identified as having soil contamination or which has been partially remediated for any Regulated Soil Contaminant.
- 6.02 Remove soil/mining waste from any contaminated mining site or chat pile for use in violation of EPA/MDNR standards for use as identified in EPA Mine Waste Fact Sheet dated February 2003 and other relevant documents.
- 6.03 Sell, assign, give or otherwise transfer real property without providing written notice to the buyer, assignee or transferee of the presence and concentration of Regulated Contaminants in the soil or groundwater if testing has occurred.
- 6.04 Sell, assign, give or otherwise transfer real property with a water well as defined herein without first conducting Required Testing for groundwater, and providing written results from a qualified testing lab to the Department and to the buyer, assignee or the transferee.
- 6.05 Falsify, tamper with, alter, purify or cause any activity to occur which will materially affect test samples nor falsify, tamper with or alter soil or water test results.
- 6.06 Knowingly withhold any information from the Department regarding soil or water test sampling or test results.
- 6.07 Inhabit a new structure before properly abating all identified soil hazards in accordance with EPA standards as identified in EPA document Superfund Lead Contaminated Residential Sites Handbook, August 2003, Directive # OSWER 9285.7-50 and summarized in Attachment A of this ordinance.

SECTION VII. PERMITS.

- 7.01 Building Permit: any person wishing to establish a dwelling, child occupied facility or recreation area on property within Jasper County shall apply to the County for a Building Permit except for property within political jurisdictions which issue building permits with the minimum requirements of all State and County requirements for the issuing of building permits. A permit will be issued when all county offices which govern property use have approved the permit application.
- 7.02 The Department shall provide to the applicant the information necessary to perform Required Testing of the soil and/or water prior to disturbance, including the contaminants for which testing is required, a detailed description of the method of acquiring and shipping soil samples, a list of approved Testing Labs, information pertaining to the possible human health hazards of Regulated Contaminants in soil or water. Additionally, requirements for remediation of contaminated soils in accordance with EPA guidelines will be provided by the County.

SECTION VIII. POWERS AND AUTHORITY OF INSPECTORS, AND INSPECTION PROVISIONS.

- 8.01 The Department reserves the right to establish and modify inspection procedures and standards for construction as necessary due to changes in Missouri statutes, rules, regulations best practices, manufacturers' recommendations and precedence.
- 8.02 The Department, Health Officer or a representative of the Health Officer shall be permitted to enter all properties for the purposes of inspection, observation, measurement, sampling and testing in accordance with the provisions of this ordinance. This shall include facilities permitted by another government entity. The Department has the right to enter property at any reasonable time if there is the suspicion of a violation of this ordinance.
- 8.03 Any person conducting, or having conducted on their behalf, any Required Testing as defined in this ordinance shall provide the test results to the Department of Health within five (5) days of receiving the test results. If the Department of Health reasonably determines that a health hazard exists, based on the provided test results, the Department shall have the right to conduct additional testing. Further, the Department shall have the responsibility as required by law to provide to the public any soil or water test results in their possession upon request.

SECTION IX. ENFORCEMENT

- 9.01 Any person found to be violating any provision of this ordinance in allowing the violation on their property shall be served by the Department with a written notice and/or Stop Order, stating the nature of the violation and providing a reasonable time limit for the satisfactory correction thereof. The offender shall, within the period of time stated in such notice, permanently cease all violation.
- 9.02 If violations of this ordinance continues the Department may require closure of any property which the Department believes may present a health hazard until such time as Required Testing may be performed to determine the presence of Regulated Contaminants. The Department may suspend or revoke any permits, including building permits, issued to any person violating this Ordinance until such time that the person complies with the Ordinance. All violations must be corrected before a permit can be issued or reinstated.
- 9.03 Any person who continues any violation beyond the time limit provided for in Section 9.01 may be charged with a class A misdemeanor and upon conviction thereof shall be fined as otherwise provided by law. Each day in which any violation continues shall be deemed a separate offense.
- 9.04 Any person violating any of the provisions of this ordinance or allowing violation(s) on their property shall be liable to the County for expenses, loss or damage incurred by reason such violation.

SECTION X. APPEALS.

- 10.01 Any person aggrieved by any decision of the County Health Officer or Department may appeal to the Appeals Board by filing a written application with the County Health

Officer within thirty (30) days after being notified of the decision which is the subject of the appeal.

- 10.02 The Appeals Board shall schedule a hearing on appeal, and shall give the person notice of the date of hearing at least ten (10) days prior to the hearing date and give the person reasonable opportunity to be heard.
- 10.03 Appeal hearings to the Appeal Board shall be conducted in accordance with the Commission's adopted rules and procedures. The Appeal Board shall consist of one County Commissioner, the Administrator, one Environmental Health Specialist, one soil scientist and one Citizen at Large. The Commissioner shall chair the board. The Administrator shall schedule the board hearings and determine the personnel makeup on the board. The decision of the Appeal Board is final unless overruled by a court of law. If the ruling of the Appeal Board is taken to court and the ruling prevails, any and all legal costs and personnel costs shall be paid by the Appellant.

SECTION XI. SEVERABILITY

- 11.01 If any article, chapter, section, clause or phrase of this regulation is, for any reason, held to be invalid by any court of competent jurisdiction, such decision shall not affect the remaining portions of this regulation.
- 11.02 No statement contained in this article shall be construed to interfere with any additional requirements that may be imposed by the Department.

ATTACHMENT 2
Jasper County Environmental Contamination Ordinance

- Jasper County Health Ordinance Sampling Protocol/Remediation Fact Sheet

- Environmental Contamination Ordinance Implementation Plan

Jasper County Health Ordinance Sampling Protocol/Remediation Fact Sheet

The following presents the approach for assessing soil contamination at new residential construction in Jasper County, MO.

Prior to Sampling

- Prior to sampling the XRF Spectrometer is standardized to manufacturer accepted standards to ensure accurate sampling.

Sample Vacant Lots Prior to Regulated Construction Activities

- Sample throughout the lot as described below to determine lead concentrations
- Number of required samples determined based on lot size. Collect at least one sample (0-1") in each quarter of yard area as defined in Diagram 1. On large lots, if visual observations indicate prior uses of property that may have influenced the lead and/or cadmium contamination levels, additional sampling should be performed to adequately characterize the site.
- Each sample shall consist of a 5 aliquot composite. Sample aliquots shall be equal spaced and collected in a "dice" pattern (see Diagram 1).
- Collect one sample at each of the following depths: 0"-1", 1"-12", and 12"-24". Testing excavation (e.g., septic system soil profile pit or construction excavation) pits may substitute for core sampling.
- If depth sampling indicates contamination, further depth sampling will be required.

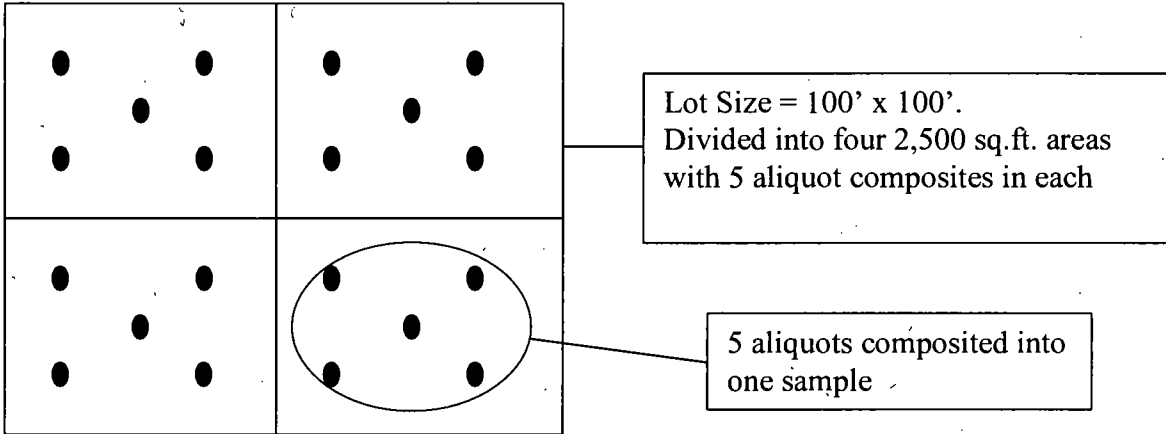
Sample Collection

- Collect approx. 4 oz. Soil from 5 distinct locations with clean implement and composite into clean container. Mix soil thoroughly. Sieve the sample through a #20 (850 micron) screen. Retain 4 oz. of soil for analysis. Depth samples will be mixed similarly before testing.
- Analyze at certified lab or with calibrated XRF.

Cleanup Requirements

- Surface soils with lead concentrations greater than 400 parts per million (ppm), and/or cadmium concentrations greater than 75 ppm must be remediated either by excavating and removing or covering with clean soil.
- Soils with lead concentrations greater than 400 ppm and less than 800 ppm, and/or cadmium concentrations greater than 75 ppm and less than 120 ppm shall be covered with a minimum of 6 inches of clean soil.
- Soils with lead concentrations greater than or equal to 800 ppm and less than 1,500 ppm, or cadmium greater than or equal to 120 ppm and less than 190 ppm shall be covered with a minimum of 12 inches of clean soil.
- Soils with lead concentrations greater than or equal to 1,500 ppm, or cadmium greater than or equal to 190 ppm shall be covered with a minimum 18 inches of soil.
- Excavated soils contaminated with lead must be disposed of in a facility approved by the County Health Department.
- Back soil or cover soil must be certified to contain less than 100 ppm lead.

Diagram 1



Environmental Contamination Ordinance Implementation Plan

The Jasper County Environmental Contamination Ordinance has two requirements that will require ongoing enforcement activities. The first is the soil contamination issue and the second is the issue of well water contamination. The soil contamination portion will impact the municipalities within the county the most and will be addressed first in this document.

Soil Contamination

- The county health department will provide all municipalities with copies of GIS maps which outline the areas of their jurisdiction that may be contaminated with mining waste or due to smelter activities. These maps will be updated as testing indicates that areas are free of contamination, at least annually.
- When individuals request building permits for new construction, either from the municipality or the county, the maps will be consulted. If it is determined that the property is in an area of concern the reviewer will request clearance from the county lead program staff prior to issuing a permit.
- Lead program staff will conduct an assessment of the property to determine the presence of contaminants within two working days of notification. If contamination levels exceed the action levels set by EPA, the county lead program personnel will contact the builder and initiate discussion regarding development of a remediation plan consistent with EPA guidance described in the fact sheet which accompanies the ordinance. If soil contamination does not exceed the EPA action level, notification will be provided to the permitting agency recommending that the permit be issued.
- If the soil conditions require a remediation plan, one will be developed by the builder which is consistent with requirements and will be approved by the health department lead program. The health department will then notify the permitting agency that the plans are approved contingent upon incorporation of the remediation into the building plan. It is anticipated that the permit will then be approved.
- If a remediation plan is required, a final inspection will be conducted by the health department lead program to assure that adequate remediation has occurred prior to occupancy of the dwelling. The permitting agency will be notified regarding the results of the final inspection. If the permitting agency requires an occupancy permit prior to habitation, it is anticipated that it will not be issued prior to receipt of a final inspection report indicating that adequate remediation has occurred. If the permitting agency does not have an occupancy permit system, the county will enforce its ordinance in restricting occupancy prior to remediation completion.

Water Contamination

- The water contamination segment of this ordinance relates only to private water wells. The MDNR already requires all new wells drilled in Jasper County to be tested for metals contamination prior to issuance of a new well certificate. MDNR and the Jasper County Health Department maintain a list of certified well testers who are qualified to conduct this task.

- This ordinance requires that all existing wells be tested for metals (Especially lead and cadmium) when property is transferred or sold. A list of certified testers is available.
- Additionally, the ordinance requires that the test results be provided to the Jasper County Health Department and to the purchaser of the property.

ATTACHMENT 3

Responsiveness Summary

The following presents the significant questions received by the U.S. Environmental Protection Agency at the public meeting held the evening of August 15, 2013. The questions have been paraphrased for conciseness. The full transcript of the meeting can be found in the Administrative Record.

Question: Considering the sizes of the pits that have been filled, and that only half of the wastes have been disposed, I assume the above ground repository EPA builds is going to be huge.

Answer: There is a tremendous amount of space still available in the Oronogo Circle and the King Jack Park pit for disposal. Numerous smaller pits and shafts still exist on-site for subaqueous disposal, some of which are two to three hundred feet deep, and will take tens of thousands of cubic yards of mining waste. The EPA is still placing as much wastes as possible underground. The ROD Amendment also calls for using the Gypstack on the west side of the site as a repository. This area is over 60 acres in size and will hold over a million cubic yards if only placed 10 feet thick across the surface of the pile. In other areas of the Site where pits are not available for disposal, the EPA will design each repository with anticipated future use in mind so the property may be developed for nonresidential use in the future.

Question: It was stated that that the disking or deep tilling process didn't work, so the new plan is to do away with that process. What process will take the place of tilling?

Answer: The EPA believed it could save excavation and disposal costs in some areas by deep tilling the soils and by mixing the contaminants with underlying clean soil to achieve action levels. Studies conducted showed this is not the case, so the EPA will now excavate and remove all wastes and soil that exceed the terrestrial action levels.

Question: The 2004 ROD specified a stream sediment action level of two part per million cadmium, seventy part per million lead, and two hundred and fifty parts per million of zinc. Now EPA is proposing to increase those levels to be seventeen per million cadmium, two hundred and nineteen per million lead, and two thousand nine hundred and forty-nine per million of zinc. If cadmium is supposed to start causing cancer at five per million, and lead is at eighty per million where we start getting a lot of health problems, are you suggesting that we will be exposed to even more, or higher levels of those toxins?

Answer: The numbers established in the 2004 ROD were derived from a variety of different studies that are done throughout the country and published in the literature. Some of the studies include coldwater species, like trout, that are extremely sensitive to metals. The EPA and USGS conducted studies using stream sediments collected from Jasper and Newton Counties in Missouri; Cherokee County, Kansas; and Ottawa County, Oklahoma. The studies were conducted by exposing aquatic organisms to the Site sediments and measuring growth, health effects and mortality. During these studies, organisms were exposed to different concentrations of metals, from very low to high concentrations, and determining the contaminant levels below which no unacceptable response could be measured. The sediment action levels presented in the ROD Amendment represent these values.

Question: Is it not correct that different organisms or different animals react differently? For example, the fish tested may not be affected, but is it possible that it will affect humans, or deer, or raccoons, or birds, and other organisms that would be exposed to those contaminants?

Answer: The EPA and the Missouri Department of Health conducted both an ecological risk assessment and human health risk assessment for the site. Those assessments determined that people swimming or recreating in Site streams were not at any significant risk. Nor were any significant risk identified for animals using the streams. Aquatic organisms are much more sensitive to the sediments and the surface water than people are, thus the proposed sediment action levels are much lower than the terrestrial action levels for soil.

The following presents comments received by EPA via mail and email during the comment period. The letters can be found in the Administrative Record.

The city of Joplin stated they support EPA for all proposed changes and specifically the continued funding of soil cleanup in the tornado devastation area.

The Environmental Task Force of Jasper and Newton Counties stated they concur with the recommendations in the Proposed ROD Amendment.

The Missouri Department of Health and Senior Services (MDHSS) stated they believe the sediment action level for cadmium should not exceed 5 parts per million (ppm) based on the Agency for Toxic Substances and Disease Registry's recommended level for protectiveness of children from soil. The EPA does not agree that 5 ppm cadmium, based on soil in residential yards, is appropriate for stream sediments for protection of children, since the sediments are submerged under water and young children would only be exposed on an infrequent recreational basis. Soil adhering to a child's hand (which is the exposure pathway to ingestion) in submerged sediments would likely be washed off upon removing them from the water. The EPA believes 17 ppm cadmium in stream sediments is protective of human health. The cadmium action level for human exposure (children in a residential setting) established in the OU 2 and 3 ROD is 75 ppm in the yard soil and 25 ppm in existing gardens. These values were based on the site-specific Human Health Risk Assessment. MDHSS was involved in reviewing and developing that risk assessment as well as the OU 2 and 3 ROD. Further, the Jasper County Health Ordinance specifies the action level for cadmium at 75 ppm in residential soils. The EPA understands that MDHSS was involved in development of the County's action level of 75 ppm, and the EPA risk assessor concurred with the value. Therefore, the sediment action level of 17 ppm cadmium is 4.4 times lower than the cadmium level agreed on for the Site by the agencies for protection of young children.

An email from an individual dated August 26, 2013, stated that the sediment action levels should not be changed and that the EPA should explain the design requirements for the mining waste repositories. The EPA believes, as explained above, that the new sediment action levels are protective of aquatic life and human health. The EPA has defined the design for repositories in the ROD issued in 2004, which includes capping and long-term O&M (see Sections 3.2 and 3.3 above in this ROD Amendment).