RECORD OF DECISION

RESIDENTIAL AREAS
OPERABLE UNIT 2
TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA

Prepared by:

U. S. Environmental Protection Agency
Region 6
1445 Ross Avenue
Dallas, Texas 75202

AUGUST 1997

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DECLARATION
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RECORD OF DECISION

Statutory Preference for Treatment as a Principal Element is Not Met and Five-Year Review is not Required

SITE NAME AND LOCATION

Tar Creek Superfund Site
Ottawa County, Oklahoma
Residential Areas

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the residential areas of the Tar Creek Superfund Site (hereinafter, the "Site"), in Ottawa County, Oklahoma, developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended by the Superfund Amendments and Reauthorization Act (SARA), ("CERCLA"), 42 U.S.C. §9601 et seq., and to the extent practicable, the National Contingency Plan (NCP) 40 CFR Part 300. This decision is based on the Administrative Record for the Site.

The State of Oklahoma and the Indian Tribes involved with the Site concur on the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE REMEDY

The remedy addresses the contamination from mining waste in the residential areas of the Site. The major components of the selected remedy include:

- Excavation of lead-contaminated surface soil in residential areas;

- Replacement of excavated soil with clean soil and restoration of the remediated areas;

- Disposal of excavated soil on-Site in dry mining waste areas remote from the residential areas or, in the event of inability to dispose of excavated materials on-Site, disposal off-Site in an approved landfill;

- Covering or replacement of mining waste in traffic areas located near residences;

- Restriction of access to mining waste areas located near residences by use of physical barriers (e.g., fences and warning signs); and,

- County-wide implementation of institutional controls, including community protective measures, to supplement engineering response actions.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for the Site; however, because treatment of the soil lead in the residential areas was not found to be practicable or cost effective, this remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. High concentrations of soil lead are addressed under the remedy selected in this ROD; however, the mobility of the soil lead is low, and the concentrations of lead are not so high as to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. Therefore, the soil lead is not considered a principal threat under the NCP; consequently, there is no expectation under the NCP that the soil lead be treated.

Because hazardous substances will not remain in the residential areas above concentrations that pose a risk to human health, five-year reviews are not necessary for the selected remedy.

Jerry Clifford
Acting Regional Administrator

August 27, 1997
Date

DECISION SUMMARY
TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA
RESIDENTIAL AREAS

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DECISION SUMMARY
TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA
RESIDENTIAL AREAS

I. SITE NAME, LOCATION AND DESCRIPTION

The Tar Creek Superfund Site (the "Site") is located in Ottawa County, Oklahoma. The U.S. Environmental Protection Agency (EPA) is addressing the contamination from mining waste in the residential areas of the Site. The Site is composed of the Oklahoma portion of the Tri-State Mining District. The Site consists of the areas of Ottawa County impacted by mining waste. The Site includes all of the area (approximately 40-square miles) in northern Ottawa County where lead and zinc mining operations were conducted (the "mining area"). The approximate boundaries of the mining area are shown on Figure 1. The Site also includes communities in Ottawa County outside the mining area that are also contaminated with mining waste. The Tri-State Mining District covers hundreds of square miles in southwestern Missouri, southeastern Kansas, and northeastern Oklahoma. The principal on-Site cities located in the mining area include Picher, Cardin, Commerce, Quapaw, and portions of North Miami. Other on-Site cities, including Miami, are located in proximity to the mining area and have been impacted by the mining waste disposed of on the Site. Approximately 15,000 people live on-Site in the mining area and in communities in close proximity to the mining area on-Site. According to available literature, mining began at the Site in the early 1900's and ceased in the 1970's. The ore removed from the mines was milled locally to produce ore concentrates, which were generally shipped to other locations outside of Ottawa County for smelting.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Tar Creek Superfund Site first came to the attention of the State of Oklahoma and EPA in 1979 when acid mine drainage began flowing to the Site surface from underground mines through abandoned mine shafts and boreholes. The Governor of Oklahoma formed the Tar Creek Task Force to investigate the effects of acid mine drainage on the area's surface and ground water. Based upon the information discovered by the Tar Creek Task Force, EPA proposed, in July 1981, to add the Site to the Superfund National Priorities List (NPL), 40 CFR Part 300, Appendix B. The NPL means the list, compiled by EPA pursuant to CERCLA section 105, of uncontrolled hazardous substance releases in the United States that are priorities for long-term remedial evaluation and response. The Site was added to the NPL in September 1983.

In the early years from about 1918 to about 1930, over 200 mills were operating at the Site. Many of the mining operations were conducted underground at depths ranging from approximately 90 to 320 feet below ground surface. It has been estimated that underground lead and zinc mines underlie approximately 2,540 acres in Ottawa County, Oklahoma.

The by-products of the mining operation were discarded mining and milling tailings (mining, milling, and possible smelter wastes, are collectively referred to in this document as mining wastes). The mill tailings, locally know as chat, are primarily composed of small chert fragments, intermingled with sand-sized particles. After the excavated rock was processed and the metal ore extracted, the mining tailings that remained were deposited into piles that were up to 200 feet in height. Many of these chat piles remain on the Site, including some piles which are over 100 feet high. An inventory conducted in the 1980's indicated that approximately 2,900 acres in Ottawa County, Oklahoma were at one time covered by mining waste. The inventory also indicates that there were approximately 265 chat piles in existence during the mining period and that only 119 were still in existence in 1980. This same inventory indicated that approximately 48 million cubic yards of chat remained on about 900 acres on the Site. In addition to piles of mining wastes, a large but lesser quantity of floatation pond tailings from the floatation milling process was produced. Most of the floatation ponds have since evaporated leaving behind a very fine mining waste sediment which remains on the Site. A numerical quantity estimate is not available, although the quantity of floatation pond tailings probably measures in the millions of tons. The 1980 inventory indicated that approximately 800 acres were utilized for tailings ponds. Over the years, the mining wastes have been used or continue to be used for a variety of purposes including the following: railroad ballast; concrete and asphalt aggregate; sandblasting sand; sandbag sand; roadway, driveway, alleyway, and parking lot aggregate; general fill material in residential areas; and impact-absorbing material in playgrounds. The EPA believes that there are uses of mining waste that can be protective of human health or the environment. Such uses include use as construction material when the mining waste is bound up with other materials and solidified (e.g., when it is used in concrete or asphalt). The mining waste should not be put to uses where it is exposed in an unbound state (e.g., it should not be used as fill in residential areas, as gravel for driveways, as gravel for roads or alleyways in residential areas, or as playground material).

Enforcement

The previous work at the Site, addressed in the June 6, 1984 Record of Decision (ROD), is referred to in this 1997 ROD as Operable Unit Number 1 (OU1). OU1 addressed the on-Site surface water impacted by mine discharges and the ground water on the Site. The EPA entered into a consent decree under Sections 107 and 122 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C.§§ 9607 and 9622, with six mining companies (hereinafter the Companies), settling their liability for costs paid by the United States in responding to the release or threat of release of hazardous substances as described in the 1984 ROD (i.e., the costs related to OU1). In 1996, EPA settled its claims regarding the Site with a bankrupt mining company which had the largest operation at the Site. On August 25, 1995, EPA issued a notice to the Companies or to their corporate successors (hereinafter the Companies and their corporate successors are referred to as the Companies), and to the U.S. Department of the Interior (DOI) which may be a potentially responsible party (PRP) under CERCLA's liability provisions. In that notice, EPA gave the Companies and DOI the opportunity to conduct or finance the removal activities described in EPA's August 15, 1995, Action Memorandum. The Action Memorandum generally called for the excavation and on-Site disposal of lead-contaminated soil in High Access Areas (HAAs) (HAAs are areas which children frequently visit such as playgrounds, day-cares, and parks). The Companies and DOI did not undertake the removal; consequently, EPA proceeded with the removal action for the HAAs on its own.

The EPA also issued a Special Notice to the Companies and to DOI on November 17, 1995. In the Special Notice, EPA gave the Companies and DOI the opportunity to undertake the Remedial Investigation and Feasibility Study (RI/FS) and remedial design (RD) for the remedial response action to address contamination in the residential areas on the Site. The Companies and DOI did not undertake the RI/FS/RD. As an alternative to RI/FS/RD, the Companies and DOI offered to perform a Community Health Action and Monitoring Program (CHAMP). The CHAMP generally calls for monitoring the health of the children in the contaminated residential areas, for thorough cleaning of homes in the contaminated area, and for education of the residents regarding the avoidance of contamination. The EPA encouraged the Companies and DOI to undertake the CHAMP, which they did; but, housecleaning and education do not provide the sort of permanent remedy that the Superfund law requires. Consequently, EPA went forward with RI/FS/RD on its own.

In order to address the imminent and substantial endangerment to human health posed by the lead-contaminated soil in the residential areas on the Site, EPA issued a March 21, 1996, Action Memorandum calling for a removal action to address the contamination. At the time the Action Memorandum was issued, EPA sent a letter to the Companies and DOI notifying them that EPA was proceeding with the removal in residential yards. In the letter, EPA told the Companies and DOI that EPA would not delay the removal action in order to negotiate; however, EPA gave the Companies and DOI the opportunity to conduct or finance the removal activities in progress. The Companies and DOI did not offer to take over the removal actions.

III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

This decision document or ROD presents the EPA-selected remedial action for the residential areas of the Tar Creek Superfund Site, Ottawa County, Oklahoma chosen in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Contingency Plan (NCP). The decision for the Site is based on the Administrative Record. An index to the Administrative Record is included as Appendix F to this ROD.

The public participation requirements of CERCLA Subsection 113(k)(2)(B)(i-v) and 117, 42 U.S.C. Subsection 9613(k)(2)(B)(i-v) and Section 9617, were met during the remedy selection process, as illustrated in the following discussion.

Beginning in Spring 1994, and continuing to the present, EPA has conducted a series of community meetings and discussions near the Site. In these meetings, the Oklahoma Department of Environmental Quality (ODEQ) and EPA officials met with citizens, local officials, Tribal leaders, Tribal members, and State and Federal agencies regarding Site issues. The EPA completed a Community Relations Plan (CRP) for the Site residential remedial action in June 1995, and released the CRP to the public. The CRP was prepared in order to identify and address community concerns. Copies of the CRP are located in the information repository maintained at the Site at the Miami Public Library in Miami, Oklahoma and at the EPA Region 6 Office in Dallas, Texas. A series of seven community meetings have been conducted over the course of the project at the Site. During these meetings, EPA informed the public of the progress of the removal activities and the RI/FS. The EPA distributed fact sheets at these meetings. The fact sheets summarized the progress of the project up to the date of the meeting in question and also explained the data that had been gathered. At the community meetings, EPA discussed field work and asked community members for information about the Site. The EPA mailed a fact sheet, which summarized EPA's Proposed Plan of Action to address contamination in the residential areas, to all individuals on the Site mailing list. The Site mailing list contains names of those who have submitted comments to EPA, the Companies and DOI, State and local officials, natural resource trustees, Tribal officials, and those community members who have attended meetings regarding the Site. The Site mailing list has been continuously updated as Site activities progress. On May 1, 1995, EPA published a notice in the Miami News-Record, a major local newspaper of general circulation, which announced to the public that Technical Assistance Grants were available. The EPA may provide Technical Assistance Grants, under Section 117 of CERCLA, 42 U.S.C. Section 9617, to any group of individuals that may be affected by a release of hazardous substances in order for such a group to obtain technical assistance in interpreting information with regard to the nature of the hazard and the CERCLA remediation process.

In January 1987, EPA released the Remedial Investigation (RI) Report for the Site. In February 1997, EPA released the Feasibility Study (FS) Report for the Site. On March 12, 1997, EPA released its Proposed Plan for the remediation of the residential areas of the Site. The EPA made the RI Report, the FS Report and the Proposed Plan, along with the administrative record file, available to the public at information repositories maintained at the Miami Public Library, Miami, Oklahoma, and at the EPA Region 6 Office in Dallas, Texas. The notice of availability for these documents was published in the newspaper of record, the Miami News-Record, on March 14, 1997, through March 16, 1997, and was also published in the Tri-State Tribune on March 13, 1997, through March 20, 1997.

On February 27, 1997, the ODEQ and EPA held an open house in Picher, Oklahoma to inform the public of the findings of the Remedial Investigation and Feasibility Study reports including the results of the Baseline Risk Assessment. The Baseline Risk Assessment is a study which characterizes the current and potential threats to human health and the environment that may be posed by the release of hazardous substances at a site. A public meeting was held in Picher, Oklahoma on March 27, 1997, to inform the public about the Proposed Plan of action for the residential areas of the Site. Also, at this Picher public meeting, representatives from EPA solicited comments and answered questions about the Site, about the remedial alternatives under consideration, and about the Proposed Plan. The EPA held a 30-day public comment period regarding the Proposed Plan, the RI and FS Reports, and the Administrative Record from March 17, 1997, to April 16, 1997. The public comment period was extended to May 16, 1997, due to a request for an extension. The public comment period was subsequently extended again to May 23, 1997, due to an additional request for an extension. A notice announcing the extension of the public comment period was published in the Miami New-Record, on April 16, 1997, and April 17, 1997. A response to verbal and written comments received during the public comment period is included in the Responsiveness Summary, which is part of this ROD (Appendix A).

IV. SCOPE AND ROLE OF THE OPERABLE UNITS

The Tar Creek Superfund Site is a former lead and zinc mining district. The years of mining and milling activities on the Site resulted in widespread contamination of the environment at the Site. The Superfund response activities at the Site are complex and, accordingly, they have been divided into functional units, called operable units, to facilitate Site cleanup. Each operable unit addresses a discrete release, threat of release, or a pathway of exposure found at the Site. The cleanup activities related to the millions of tons of mining waste that were deposited on the surface of the ground at the Site have been designated as Operable Unit 2 (OU2). This ROD and the Proposed Plan were developed for the residential area portion of OU2. That is, the selected response for the residential areas in OU2 addresses only a portion of the widespread contamination at the Site. Additional response actions will be required to address the remaining contamination in OU2 and in the rest of the Site. For the portion of OU2 which is the subject of this ROD, the land use is currently residential, and this land is expected to remain in residential use in the future. OU1 contains the portions of the Site in which surface water and ground water have been contaminated as a result of mining operations. The EPA's 1984

ROD was intended to address the surface water and ground water in OU1. The remedial action which EPA has selected as documented in this ROD, addresses cleanup of residential areas of the Site which are contaminated with mining wastes. The term "residential areas" as used in this ROD document is not limited solely to single-family residences, but also includes other residential properties (e.g., apartments, and condominiums) and high access areas (HAAs) which are places frequented by children such as day-care centers, playgrounds, and schoolyards.

Remedial Action Objective

A remedial action objective (RAO) is a general description of what a given remedial action will accomplish. RAOs aimed at protecting human health and the environment should specify: (1) the contaminants of concern; (2) exposure routes and receptors; and, (3) an acceptable contaminant level or range of levels for each exposure medium (i.e., a PRG) (see 55 Fed. Reg 8666, 8712-8713, March 8, 1990). Results of the Baseline Human Health Risk Assessment(BHHRA) issued August 1996, indicate that exposure to lead in soil is the primary human health risk for the Site. The Remedial Action Objective (RAO) for the Site is as follows:

> Reduce ingestion by humans, especially children, of surface soil in residential areas contaminated with lead at a concentration greater than or equal to 500 parts per million (ppm).

Principal Threats

Principal threats are characterized as waste that cannot be reliably controlled in place, such as liquids, highly mobile materials (e.g., solvents), and high concentrations of toxic compounds (e.g., concentrations several orders of magnitude above levels that allow for unrestricted use and unlimited exposure) [(see 55 Fed. Reg. 8666, 8703 (March 8, 1990)]. The lead-contaminated residential surface soil at the Site is generally classified as low level threat waste rather than principal threat waste. Although the soil is contaminated above health-risk-derived levels [i.e., the Remediation Goal level (see infra, Section VI)], it is not contaminated an order of magnitude above the remediation goals. Also, the lead-contaminated soil is not generally considered mobile due to the physical and chemical properties of the soil. The soil is a solid and not a liquid; moreover, the lead strongly adheres to the soil particles and does not easily migrate when subjected to ground water flow. The lead-contaminated soil could physically be controlled in place with little likelihood of migration; however, the practicability of containment of contaminated soil in a residential setting is doubtful for reasons discussed later in this document under Section VIII ("Summary of Comparative Analysis of Alternatives").

V. SUMMARY OF SITE CHARACTERISTICS

The EPA began environmental investigations at the Site in 1982. An RI/FS for the Site was completed in December 1983. Based upon the 1983 RI/FS, on June 6, 1984, EPA issued a ROD memorializing the remedy selected for certain portions (Operable Unit 1) of the Site. The Operable Unit 1 ROD addressed two concerns: 1) the surface water degradation of Tar Creek, a stream located on the Site, by the discharge of acid mine water; and, 2) the threat of contamination of the Roubidoux Aquifer which lies under the Site. At the time the ROD was issued, EPA was concerned that the Roubidoux Aquifer, which supplies water for domestic use in the Site area, would be contaminated by downward migration of acid mine water from the contaminated Boone Aquifer which is located in geologic strata which occur above the Roubidoux. Specifically, EPA was concerned that contaminated ground water from the Boone would migrate to the Roubidoux through abandoned wells connecting the Boone with the Roubidoux. Pursuant to EPA's ROD for Operable Unit 1, in order to address the surface water contamination in Tar Creek, dikes were constructed to reduce the inflow of surface water into collapsed mine shafts. By reducing the flow of surface water into the collapsed shafts, EPA's intention was to eliminate or reduce the outflow of contaminated water from the shafts to the surface and subsequently to Tar Creek. Also pursuant to EPA's ROD, in order to address the potential contamination of the Roubidoux Aquifer, abandoned wells which penetrated the Roubidoux formation were plugged. The construction of the Operable Unit 1 remedy was completed in December 1986.

At the time that the 1984 ROD was written, EPA believed that the remedy in the 1984 ROD would be protective of human health and the environment at the Site in general. The 1984 ROD did not address the tailings piles (chat piles) and ponds (floatation ponds) and other mining waste on the ground surface at the Site. In April 1994, pursuant to CERCLA Section 121(c), 42 U.S.C. § 9621(c), EPA conducted a Five-Year Review of the remedial action for Operable Unit 1 to assure that human health and the environment at the Site in general were being protected by the remedial action being implemented at Operable Unit 1. New information gathered during the 1994 Five-Year Review, including information regarding elevated levels of lead in the blood of children living on the Site, led EPA to the conclusion that additional investigations of the effect of Site mining wastes on human health were necessary. Specifically, in 1994, EPA received from the Indian Health Service test results concerning the concentration levels of lead in the blood of Indian children living in the area. The test results indicated that approximately 35 percent of the Indian children tested had concentrations of lead in their blood which exceeded 10 micrograms per deciliter (ug/dL), which is the level considered elevated for young children by the Centers for Disease Control (CDC) (see Preventing Lead Poisoning in Young Children, A Statement by the Centers for Disease Control, October, 1991). The definition of elevated blood lead in young children is the threshold level at which adverse health effects have been shown to occur. The previous lead statement issued by CDC in 1985 had defined the level of 25 ug/dL as elevated. When the ROD was signed in 1984, the level of 30 ug/dL was considered elevated by CDC. The EPA presented this new information, regarding high concentrations of lead in the blood of Indian children who lived in the Site area, as part of the Five-Year Review report for the Site which was published in April 1994. In the Five-Year Review report, EPA recommended, based on this new information, that the mining waste deposited on the surface of the ground be investigated to determine if additional remediation, beyond the remediation carried out for Operable Unit 1, at the Site was needed to protect human health or welfare or the environment.

Site Assessment Activities

From August 1994 through July 1995, EPA through its removal program (the removal program is generally the part of the Superfund program that conducts emergency or early response activities whereas the remedial program is the part which conducts long-term response activities) conducted sampling in order to determine the nature and extent of contamination at the Site. Sampling was generally divided into two phases. The first phase (Phase I) of sampling took place in High Access Areas (HAAs) which are places frequented by children such as day-care centers, playgrounds, and schoolyards. The second phase (Phase II) of sampling took place in residential yards on the Site. The site assessment activities were concentrated at HAAs and residential properties since mining wastes had been observed in many of these locations throughout the Site. Moreover, the HAAs are frequented by young children, the residential properties are inhabited or potentially inhabited by young children, and young children are the segment of the population most susceptible to lead poisoning. A total of 28 HAAs and 2,070 residential properties were sampled during the site assessment. The site assessment data was the basis of EPA's Baseline Human Health Risk Assessment (BHHRA) issued in August 1996 and EPA's Residential RI Report issued in January 1997.

The EPA's site assessment investigations explored the possibility that humans living on the residential areas of the Site may be exposed to contamination through various exposure pathways including ingestion of contaminated soil, surface water or ground water, inhalation of contaminated dust in the air, and dermal contact with contaminated water or soil. However, EPA studies found that, under the conditions found in the residential areas of the Site, ingestion of contaminated soil was the only exposure pathway that could pose a significant risk to human health.

The EPA's site assessment investigations, including the BHHRA, led EPA to the conclusion that lead contamination in soil in residential areas on the Site posed an imminent and substantial endangerment to human health--especially to children's health; consequently, EPA conducted the removal actions described in the Section of this ROD entitled "Current Removal Actions" which is part of Section V ("Summary of Site Characteristics"). This same endangerment is addressed by the remedial action selected for the remediation of the Site and described in this Record of Decision (ROD).

Nature and Extent of Contamination

Characterization of the nature and extent of contamination for the residential areas of the Site is presented in the Residential RI Report and in the BHHRA Report. During the site assessment, field investigations consisted of the following main sampling elements:

- Sampling of Study Area homes - The Study Area means the mining area of Ottawa County which was the subject of the BHHRA.

- Sampling of Study Group homes - The Study Group is the 100 homes in Picher where multi-media environmental samples were taken.

- Sampling of Reference Area/Background homes - The Reference Area/Background homes are 15 homes in Afton, Oklahoma. These 15 homes are outside of the mining area. The EPA took multi-media environmental samples at these homes so that the samples could be compared to samples taken within the mining area.

- Ambient air sampling.

The Study Area consisted of the residential areas of Picher, Cardin, Quapaw, Commerce, and portions of North Miami. During the conduct of this investigation, EPA collected site-specific sampling data at residential homes in Picher (Study Group) in order to evaluate the long-term risk associated with exposure to Site contaminants.

Samples were also collected from homes in Afton, Oklahoma, as a background reference to compare with the samples taken from the mining area. Afton is outside of the mining area and generally does not have the mining waste contamination found in the mining area on the Site. Ambient air samples were taken during a 3-month period from 5 monitoring stations located in Picher. A background air-monitoring station was located 3 miles west of Picher.

Air monitoring indicated that contaminant concentration levels in the ambient air were not above health-risk-derived levels. None of the lead concentrations in ambient air exceeded the National Ambient Air Quality Standard for lead of 1.5 ug/m^3 (maximum quarterly average).

A summary of the lead contamination levels from samples of yard soil, garden soil, and garden produce from residential homes investigated in Picher and Afton is presented in Table 1. As shown in Table 1, the average concentrations of lead in the yard soil and garden soil samples taken at the Study Group homes in Picher were found to be approximately 10 times greater than the average lead concentrations in the yard soil and garden soil samples taken at the Reference Area homes in Afton. For the garden produce, differences in lead content between the Study Group samples and the Reference Area samples were less than 1 percent.

Current Removal Actions

Based on the Phase I site assessment sampling (August 1994 to October 1994), EPA began removal actions at various HAAs on the Site. Removal actions are generally the early response actions taken by the Superfund program to address the most immediate and highest risk first. The action memorandum authorizing the removal response action at the HAAs was issued August 15, 1995. The removal action at HAAs was triggered by widespread surface soil contamination greater than or equal to 500 ppm lead and/or 100 ppm cadmium. Excavations at HAAs vary in depth as well as in the cleanup level selected. The excavation criteria utilized during the HAA response were 500 ppm lead and/or 100 ppm cadmium from 0 to 12 inches of soil depth, and 1000 ppm lead and/or 100 ppm cadmium from 12 to 18 inches of soil depth (maximum excavation depth of 18 inches). That is, if lead or cadmium were found at concentration levels which exceeded 500 ppm and 100 ppm, respectively, in the first 12 inches of soil, that soil was excavated, and, if lead or cadmium were found in soil at depth ranges of 12 to 18 inches at concentration levels which exceeded 1000 ppm or 100 ppm, respectively, then that soil was excavated. All excavated areas were back-filled with clean soil. On large properties, such as schools and parks, where unauthorized private excavation could be easily controlled, the excavation criteria were modified. The excavation criteria for these school and park areas were modified to 500 ppm lead and/or 100 ppm cadmium from 0 to 12 inches soil depth (maximum excavation depth of 12 inches). A total of 28 HAAs were evaluated. Seventeen of the 28 HAAs were determined to potentially require some sort of EPA response action. The EPA initiated response actions at HAAs in September 1995. The removal actions taken during this HAA response eliminated or reduced direct contact with contaminated surface soil at these HAAs. The continued effectiveness of the removal actions taken in residential areas and at HAAs depends on the prevention of earth-moving activity that could disturb the surface layer of clean soil thereby exposing elevated concentrations of contaminants at depth.

Based on the Phase II removal site assessment sampling (April 1995 to July 1995), EPA began removal actions at certain residential properties on the Site. The action memorandum authorizing this additional removal response action for residential areas on the Site was issued on March 21, 1996. The EPA selected a cleanup level for lead in soil of 500 ppm for the removal response action at the residential areas. This cleanup level was determined by EPA to be protective of human health. This cleanup level was based upon EPA's Integrated Exposure Uptake Biokinetic (IEUBK) model for lead in young children utilizing site-specific sampling information obtained for the preparation of the BHHRA and also upon EPA Region 6 experience with large area lead cleanups.

As part of Phase II sampling, a total of 2,055 residential homes in Picher, Cardin, Quapaw, Commerce, and North Miami were evaluated. Approximately 65 percent of these homes had concentrations of lead, in at least one part of the yard, at or above 500 ppm.

The EPA Emergency Response Team began response activities at the residential homes on June 24, 1996, and resumed response activities at the HAAs following a response action shutdown during the winter of 1995/1996. Approximately 300 residential homes are being addressed during the Phase II removal response activities (just as Phase II sampling took place in Site residential areas, Phase II removal activities address contamination in Site residential areas). The homes included in the Phase II removal response meet the following conditions:

(1) Homes with children less than 72 months of age who have blood lead levels at or exceeding 10 ug/dL, and where soil lead concentrations have been determined to be the significant contributors to elevated blood lead levels; and,

(2) Homes with soil lead concentrations greater than or equal to 1,500 ppm lead.

The response actions being conducted on these properties under Phase II of the removal response consist primarily of excavation of lead-contaminated soil, backfilling excavated areas with clean topsoil, and revegetating the backfilled areas with grass sod or seed.

Under the Phase II removal response, excavations at residential homes are being conducted in 6 inch lifts until confirmation samples show concentrations less than 500 ppm lead. The maximum depth of excavation is 18 inches. That is, if samples reveal residential soil that is contaminated with lead concentrations which exceed 500 ppm for an area (e.g., front yard, backyard, driveway, etc.) of the yard, then six inches of soil are removed for each area of the yard exceeding 500 ppm. The remaining soil in each excavated area is retested in place. This process is continued until soil is found in place which has concentrations of lead which do not exceed 500 ppm, or else 18 inches of soil depth is reached, whichever is sooner. If at 18 inches the samples indicate soil lead concentrations greater than or equal to 500 ppm, then a barrier (e.g., orange construction fence material) is placed in the excavated area prior to backfilling at that location to warn of existing contamination below that level.

Under the Phase II removal response, EPA is restoring the residential properties to as close to pre-removal conditions as is practicable. All shrubbery removed during the course of the response is being replaced according to agreements made between EPA and the individual property owners. Initially EPA waters the grass or seed which EPA places on the excavated areas. After the initial watering, however, EPA does not intend to provide maintenance including watering of the vegetative cover.

Under the Phase II removal response, the materials removed from the residential areas of the Site are being disposed of on a dry contaminated area which once contained a mill pond located between Picher and Commerce on County Road E40 near the location of the old Eagle-Picher Central Mill. Access to the property is being controlled by a barbed wire fence and gate. A sign is posted on the gate. The material is being spread over the former mill pond area. Following the completion of the EPA response actions in the area, the property will be turfed.

The EPA is spraying excavation sites with water for dust suppression during excavation of the contaminated soil. Dump trucks used to excavate contaminated soil are equipped with covers to prevent dust from blowing out of the trucks. To assure that the dust suppression activities are adequate to protect residents and workers, EPA is conducting an extensive air monitoring program. The program consists of real time dust monitoring as well as air sampling. “Real time” monitoring means that EPA does not have to wait to get the results of its air monitoring, but instead the monitoring equipment keeps EPA informed of the concentration levels of airborne contaminants at all times. In this manner, EPA is made aware of any airborne releases as they occur.

VI. SUMMARY OF SITE RISKS

An evaluation of potential risks to human health from Site contaminants for the residential areas of the Site was conducted during the RI and is detailed in the BHHRA. Because the scope of the RI was limited to the residential areas, only residential exposure scenarios were considered for evaluation. Current and potential future residential exposure conditions in the Study Area are expected to be essentially the same; therefore, a separate exposure scenario for future conditions was not evaluated. The BHHRA identified lead as the only Site-related chemical of concern, and identified oral ingestion as the only significant exposure route or pathway. An exposure route or pathway is the way in which contaminants may enter a human being (e.g, inhalation, oral ingestion, and absorption through the skin). Cadmium and zinc are also Site-related chemicals, but the concentrations in the different media (soil, air, drinking water, etc.) for cadmium or zinc were not high enough to exceed acceptable exposure levels as systemic toxicants or as carcinogens. The BHHRA demonstrated that the elevated concentrations of lead in soil found at many residences at the Site pose a significant health risk to young children living at those residences (or to those children who may live at those residences in the future). Young children (six-years old and younger) who now play (or children six-years-old and younger who may play in the future) in the residential areas on the Site may be exposed to lead through incidental ingestion of lead-contaminated soil during normal hand-to-mouth activity during play, and this lead may pose an imminent and substantial endangerment to the health of such children. In addition, lead-contaminated soil may be tracked from residential yard soil into the homes of children where it may be ingested during play or at mealtime, and this lead may pose an imminent and substantial endangerment to the health of such children. See BHHRA; and see Centers for Disease Control (CDC) "Preventing Lead Poisoning in Young Children" (October 1991) at pages 20 and 71.

As part of the Feasibility Study process, EPA selects preliminary remediation goals (PRGs). The PRGs are concentrations of contaminants for each exposure pathway that are believed to provide adequate protection of human health and the environment based on preliminary site information. The PRGs are developed on the basis of chemical-specific applicable or relevant and appropriate requirements (ARARs) (see the Section of this document entitled “Compliance with ARARs” for an explanation of ARARs) when available, other available information, and site-specific risk-related factors. As explained in this document, no ARARs were available for the establishment of a PRG for lead-contaminated soil at the Site; consequently, the PRG was based on the BHHRA, lead-risk computer modeling, and on EPA Region 6's experience with other soil lead remediation sites [see Section 1.0 (Introduction) of the

Feasibility Study Report for a complete explanation of the PRG, and an explanation of the manner in which the PRG was selected].

A concentration of lead in the blood of 10 ug/dL or greater for a young child is considered elevated by the Centers for Disease Control (CDC, October, 1991). In developing a PRG for CERCLA sites with soil lead contamination in residential areas, EPA recommends that soil lead cleanup levels be determined so that a typical child or group of children exposed to lead at the PRG would have an estimated risk of no more than 5 percent of exceeding a blood lead level of 10 ug/dL (hereinafter this 5 percent risk is referred to as the 5 percent benchmark). One of the methods which EPA uses to estimate the risk which lead at a given site poses to children is the Integrated Exposure Uptake Biokinetic (IEUBK) model for lead [see Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive No. 9355.4-12 (July 14, 1994) at p. 10; see also Guidance Manual for the Integrated Uptake Biokinetic Model for Lead in Children, OSWER Directive No. 9285.7-15-1 (February 1994)]. The IEUBK Model is designed to model exposure from lead in air, water, soil, dust, diet, and paint and other sources with pharmacokinetic modeling to predict blood lead levels in children 6 months to 7 years old.

When EPA was deciding what method to use to estimate the risk that lead may pose to the residential population at the Site, EPA considered the following methods: slope studies, direct blood-lead measurements, and IEUBK modeling. However, EPA decided that the IEUBK model was the best method for determining the risk posed by lead at the Site. Slope studies are studies of empirical correlations between lead in environmental media and blood lead. A slope factor derived from a slope study is the relationship of the expected increase in blood lead level to a certain increase in lead in an environmental media (e.g., soil). Unlike the IEUBK model, slope studies are difficult to generalize to situations beyond those where the data were specifically collected. Also, unlike the IEUBK model, "biological and physical differences between sites and study populations cannot be incorporated explicitly and quantitatively into regression slope factors from different studies" [see Guidance Manual for the Integrated Uptake Biokinetic Model for Lead in Children, OSWER Directive No. 9285.7-15-1 (February 1994) page 1-6]. That is, slope studies do not explicitly include factors that influence lead uptake and behavior in the body (e.g., ingestion rate, absorption through the gut, etc.). Slope studies lack the flexibility of the IEUBK model. That is, slope studies are limited in their ability to estimate the effects of alternate lead abatement methods with different exposure pathways and different lead sources known to exist at the Site. Direct blood lead measurements are primarily a "snapshot" of current risks, which may have been influenced by health education activities at the Site, and are not a prediction of long-term risk conditions. For the Tar Creek Superfund Site risk evaluations, the IEUBK was considered the best scientific approach for assessing lead risk for the BHHRA, for predicting potential long-term blood lead levels for children, and for supporting the establishment of remediation goals.

Based on the results of running the IEUBK Model for the Study Group residences, the BHHRA predicted that children living in 79 of the Study Group's 100 homes had a greater than 5 percent risk of blood lead levels exceeding 10 ug/dL. That is, the risk to children living in those Study Group homes was greater than EPA's 5 percent benchmark. Overall risk for the Study Group (an estimate of community risk) was calculated by mathematically averaging the probabilities of exceeding the 10 ug/dL blood lead level for each home (assuming one hypothetical child per home). The overall risk for the Study Group was 21.6 percent, which is substantially greater than EPA's 5 percent benchmark. The estimated probability of a child having blood lead levels which exceed 10 ug/dL in the Reference Area (i.e., Afton) is less than the 5 percent benchmark. The BHHRA for the Site indicates that the percentage of children at the Site exposed to unsafe levels of Site-related lead contamination in residential areas is much greater than EPA's 5 percent benchmark for risk management of lead poisoning.

The BHHRA also showed that soil lead concentrations exceed the PRG of 500 ppm (see the Section of this document entitled "Remediation Goals" for an explanation of the basis of the 500 ppm PRG for lead in soil) in 77 percent of the yards of Study Group homes in Picher, and in 45 percent of the yards of the homes in the Study Area. The EPA generally recommends remedial action when the PRG is exceeded [see Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, OSWER Directive No. 9355.4-12 (July 14, 1994) at p.10].

The BHHRA indicated that, in most cases, the elevated blood lead levels predicted by the IEUBK model are due primarily to elevated concentrations of lead in outdoor soil, although indoor dust also contributes significantly in many cases [of course, a primary source of indoor dust may be contaminated outdoor soil tracked into the home (CDC, October 1991, at p. 71)]. Young children were the segment of the population considered to be at greatest risk from exposure to lead according to the BHHRA findings. The BHHRA also indicated that elevated levels of lead in indoor dust found in many homes on the Site pose a significant health risk to children living in those homes (or who may live in those homes in the future). The BHHRA indicated that the residential yard soil was likely to be a significant source of lead in indoor dust in these homes.

In an independent blood lead survey conducted by the Oklahoma State Department of Health (OSDH) in October 1995, in Picher, Oklahoma, OSDH found a percentage of young children with elevated blood lead levels (10 ug/dL or greater) similar to the percentage predicted in EPA's BHHRA for the Picher Study Group (the OSDH survey was an actual measurement of lead in children's blood and not a prediction). Later surveys conducted in August 1996 and September 1996, on behalf of certain mining companies, which once operated at the Site, found that 38.3 percent (31 of 81) of the children tested in Picher had blood lead concentrations exceeding 10 ug/dL, that 62.5 percent (10 of 16) of the children tested in Cardin had blood lead concentrations exceeding 10 ug/dL, and that 13.4 percent (9 of 67) of the children tested in Quapaw had blood lead levels which exceeded 10 ug/dL.

In order to develop response action alternatives to address the lead contamination, EPA conducted a Feasibility Study (FS). The FS developed and evaluated appropriate remedial action alternatives such that relevant information concerning the remedial action options to address the contamination would be presented to EPA decision-makers and an appropriate remedy selected. Once the FS was complete, EPA prepared a Proposed Plan which identified the alternative that, based on the FS, best met the requirements of 40 CFR § 300.430(f)(1), and EPA presented that Proposed Plan for public comment. After evaluating comments received on the Proposed Plan during the public comment period, EPA prepared this ROD which describes the remedial alternative which EPA has selected to address the contamination at the residential areas on the Site.

IEUBK Model Default Parameters

The Geometric Standard Deviation (GSD) is an expression of the variability of a set of data (e.g., blood lead levels). Bioavailability with regard to lead exposure is an expression of the extent to which lead that enters the body is taken up by the blood. Comments from the public regarding EPA's removal actions have included statements saying that GSD and bioavailability values that are lower than the IEUBK model default values should be used by EPA in selecting its remedial action for the residential areas in Operable Unit 2. Lowering either of these values would tend to raise the remediation goals based on IEUBK modeling. The following enumerated paragraphs discuss EPA's reasons for not lowering the GSD and the bioavailability values:

1. Bioavailability - The EPA has determined that lead oxides and lead carbonates are major forms of lead in the tailings in the Tri-State Mining District based on results of studies on samples taken from Tri-State Mining District tailings and tailings-contaminated materials by EPA Region 8 in 1996, and by the University of Colorado, Department of Geological Sciences in 1996. More soluble forms of lead such as the lead oxides and lead carbonates found on the Site are relatively more bioavailable than less soluble forms of lead such as galena (PbS) (EPA, February 1994). Therefore, since the forms of lead found on the Site are of the more bioavailable type of lead, there was no reason for EPA to lower the bioavailability parameter in the IEUBK model below the 30 percent default value in the development of the BHHRA.

2. GSD - Estimates of GSD for lead mining sites have increased toward larger GSD values as the geometric mean blood levels have decreased (EPA, February 1994). That is, as average blood lead levels have decreased in the U.S. (this decrease in national average blood lead levels has been a trend in recent years), the GSD values (as an expression of degree of mathematical spread about the average blood lead level) <u>at mining sites</u> have tended to <u>increase</u>. Therefore, since the trend in GSD values is upward at sites like the Tar Creek Superfund Site, there was no basis to lower the GSD from the IEUBK model default value of 1.6 in the development of the BHHRA.

Ecological Risks

The residential areas at the Site are not associated with exposed ecological communities. The residential areas do not support wildlife or wild species of flora. Without receptors of ecological concern, the residential area represents an incomplete ecological risk pathway. That is, there is no identified exposure pathway along which the contaminants of concern could travel to reach wild flora or fauna, and cause a detrimental effect. Because there is no relevant completed exposure pathway associated with the residential properties, an evaluation of ecological risk at the residential areas of the Site was not considered appropriate.

Remediation Goals

As explained above, remedial action objectives are the more general description of what the remedial action will accomplish. Remediation goals are a subset of remedial action objectives, and consist of medium-specific or operable unit-specific chemical concentrations that are protective of human health and the environment and serve as goals for the remedial action.

The BHHRA identified lead-contaminated soil as the medium which posed the greatest threat to human health on the Site. The EPA recommends that, for soil lead, a remediation goal be selected such that a typical child or group of children exposed to the soil in question would have an estimated risk of no more than 5 percent of exceeding a blood lead concentration of 10 ug/dL (EPA, July 1994). The EPA's preliminary remediation goal (PRG) was set at a level which should meet the 5 percent benchmark; therefore, EPA has decided to make the remediation goal for soil cleanup the same as the PRG--500 parts lead per million parts soil (ppm). The remediation goal and the PRG are based on the BHHRA, on IEUBK modeling, and on Region 6 experience with other soil lead remediation sites. The PRG for lead in soil of 500 ppm was derived from recommendations in the document entitled "Preliminary Remediation Goals for the Tar Creek Superfund Site" (September 1996)(hereinafter PRG Report). The PRG Report is based upon sampling data generated for the Baseline Human Health Risk Assessment (August 1996). The PRG Report develops estimated cleanup goals using a statistical and an empirical approach. Both analyses are based upon EPA's IEUBK model. Under the two analyses undertaken in the PRG Report, the cleanup goals estimated for the Site ranged from 456 ppm (empirical estimate) to 500 ppm (statistical estimate). A PRG/remediation goal of 500 ppm for lead-contaminated soil in residential areas was selected based on the following reasons:

(1) EPA Region 6 has extensive experience cleaning up lead-contaminated soil at other sites and cleanup levels for residential areas have generally been selected at or near 500 ppm.

(2) The additional risk reduction to be achieved by selecting 456 ppm versus 500 ppm is insignificant and does not warrant a departure from established successful past Region 6 practice.

(3) The incremental cost difference between a remedial action which utilizes 456 ppm as a cleanup level and a remedial action which utilizes 500 ppm as a cleanup level is not proportional to the difference in effectiveness.

In short, EPA has adopted 500 ppm, the PRG which EPA developed for FS purposes, as the final remediation goal for soil lead. This 500 ppm remediation goal should not be confused with the "action level." In this ROD, the term "action level" means a contaminant concentration in the environment (e.g., surface soil in residential areas) high enough to warrant or trigger an engineering response (e.g., excavation or capping). The remediation goal (500 ppm) is the same for all remedial action alternatives (RAAs) discussed in this ROD, regardless of the action level.

For example, the 800 ppm action level proposed for Alternative 3 is higher than the remediation goal (500 ppm). Under Alternative 3, the 800 ppm action level is the level at which excavation would be triggered. However, since excavation to 800 ppm does not reach the remediation goal, residual risk remains, and additional measures must be taken. Under Alternative 3, the additional measures intended to address residual risk consist of Community Protective Measures (CPMs) (e.g., health education, house cleaning and health monitoring). The CPMs are intended to address the residual risk posed by any soil which may remain in place with lead concentrations between 500 and 800 ppm. An 800 ppm excavation action level is not protective without measures to address the residual risk between 500 ppm and 800 ppm; however, an 800 ppm action level with perpetual CPMs to address the residual risk may be protective if the CPMs can be maintained forever (or at least as long as the contamination above the remediation goal remains).

VII. DESCRIPTION OF ALTERNATIVES

Common Elements in All Alternatives

To supplement active engineering measures, some institutional controls will be required under all the remedial action alternatives in order to address Site contamination. To put some of these institutional controls into effect, the authority of other governmental entities may be required (e.g., zoning restrictions may require municipal authority, lease restrictions may require DOI authority); accordingly, they are contingent on the cooperation of those authorities. These institutional controls may include the following items: (1) restrictions and management controls on unsafe uses of mine tailings; (2) restrictions and management controls on activities that would cause recontamination at remediated properties; (3) restrictions and management controls on activities that would contaminate clean Site property with mine tailings; (4) restrictions and management controls intended to prevent future exposure of children to unacceptable levels of lead in the soil at new residential developments that are located in areas with high lead levels in soil (in some cases these controls may be implemented at existing residential developments); (5) restrictions and management controls on building and construction activities in order to prevent building and construction practices that would increase exposure to lead-contaminated soil; (6) restrictions and management controls on access to contaminated property through physical barriers (e.g., fencing) or notices (e.g., warning signs); (7) public health and environmental ordinances and controls related to lead exposure and management of mine tailings; (8) placing notices in property deeds regarding contamination; (9) sampling and analysis of lead sources; (10) blood lead monitoring; (11) health education; and, (12) lead-contaminated dust reduction activities. All of the enumerated items listed above in this paragraph would be implemented under Alternatives 2 through 8. Items 9 through 12 would be implemented on the largest scale under Alternative 3, but may be used under the other alternatives. At residences with children at which lead-contaminated soil was not excavated (e.g., where access for remedial action was not granted), health education, lead-contaminated dust reduction activities, and blood lead monitoring may be utilized. The restrictions related to mining waste in enumerated items 1 through 6 will generally be implemented through the appropriate authority for the property in question (i.e., Bureau of Indian Affairs for Indian lands under its management, Ottawa County Reclamation Authority for properties under its control, local governmental bodies for properties within their jurisdiction, etc.). The supplementary institutional controls will be selected from the preceding list; however, since there are hundreds of residential properties to be remediated, and since each property is unique in certain respects, the supplementary institutional controls to be used at a given property cannot be determined until the Remedial Action phase, when each property is separately remediated. However, many of the institutional controls such as community-wide health education, community-wide lead-contaminated dust reduction activities, and community-wide blood lead monitoring, are considered appropriate for community-wide application in residential areas throughout Ottawa County.

Moreover, soil excavation to a maximum depth of 18-inches may not be the most appropriate response action at certain residential properties, or at portions of a residential property, due to physical features, use, or other constraints. Such situations cannot be evaluated until the remedial action phase, when each property is separately remediated. In such cases measures selected from the following list may be used: (1) capping of contaminated areas with clean soil; (2) vegetating poorly vegetated or unvegetated areas; (3) capping contaminated areas with base coarse material and/or paving; and (4) excavating to depths other than 18-inches.

In addition, certain sources of lead contamination, which are near or located within the residential areas to be remediated, may have the potential to recontaminate remediated areas. For example, certain residences may be near sources (e.g., chat piles) of lead-contaminated waste material; accordingly, rainwater runoff, wind-blown dust, or other mechanisms that transport contaminated material from the piles may recontaminate remediated yards. Therefore, the following measures may be taken at source areas to prevent recontamination or to minimize recontamination potential of residential areas: (1) vegetating poorly vegetated or unvegetated areas; (2) capping with soil; (3) capping with base coarse material or paving (4) applying dust suppressants or other dust control measures; (5) controlling drainage; (6) consolidation of source materials; (7) containment of source materials; and (8) abating lead sources to prevent releases into the environment that would recontaminate remediated areas. Due to the unique nature of each situation in which recontamination may occur, it cannot be determined in advance which measures will be used; therefore, recontamination prevention measures will be selected from the preceding list on a case-by-case basis during the Remedial Action phase.

During the Remedial Action phase, land owners may decide to permanently change land use, for certain residential properties which are the subject of the Remedial Action, to commercial or other non-residential use. In such cases, remediation of the property in question would be deferred until the remediation can be incorporated into a CERCLA response action addressing contaminated non-residential properties on the Site.

The establishment of a permanent long-term on-Site disposal area primarily for the purpose of disposing of lead-contaminated soil excavated during response actions, but also for disposing of contaminated soil from areas of new construction will be supported.

In the event that the EPA is unable to dispose of excavated materials on-site, off-site disposal will be required. However, since the materials are not a hazardous wastes under the Resource Conservation and Recovery Act (RCRA), EPA does not consider RCRA hazardous waste management requirements to be applicable, relevant or appropriate, including without limitation the waste analysis requirements found at 40 CFR §§ 261.20 and 261.30, the RCRA manifesting requirements found at 40 CFR § 262.20, and the RCRA packaging and labeling requirements found at 40 CFR § 262.30. Since the remedy involves no on-site storage of hazardous wastes, storage requirements found at 40 CFR Part 265 are not applicable, relevant or appropriate. All off-site transportation of hazardous waste (if any) will be performed in conformance with applicable U.S. Department of Transportation (USDOT) requirements. Any off-site disposal of CERCLA waste (if any) will be in conformance with EPA's procedures for planning and implementing off-site response action, 40 CFR § 300.440.

For certain residential properties, to be identified during the Remedial Action phase, where the recontamination potential is significant or where restoration is not practicable and where the residents move to alternate properties at the Site, the alternate properties may be prepared for residential use by performing non-structural improvements, similar to the excavation and restoration activities provided for the other residential properties at the Site. The EPA would not provide the alternative properties or houses, nor would EPA move or temporarily house the residents.

Alternatives (Alternatives 2, 3, 5, 6, 7, and 8) propose excavation, which would require short-term dust control to protect the community and the workers. Additionally, as part of all remedial alternatives which call for excavation, the workers would be required to use personal protective equipment to ensure their protection during the remedial action, especially during excavation activities.

Significant changes and additions between the ROD and the Proposed Plan are described in the Section of this ROD entitled "Documentation of Significant Changes." All of the significant changes and additions described in that section would have been part of any alternative selected except for the no-action alternative.

Remedial Action Alternatives

Seven alternatives, in addition to the no-action alternative, were developed in the FS to meet the RAO. The EPA regulations require the inclusion of a no-action alternative. A listing of the alternatives and the associated costs are presented in Table 2. The alternatives were developed to specifically address the mining waste contamination in the residential areas of the Site.

In the descriptions of the response action alternatives which appear below, the following terms are used:

- Capping - Capping an area means covering it with uncontaminated material generally clay and soil.

- Vegetating - Vegetating means establishing or planting vegetation (generally grass) on an area. In order to control erosion and to create an aesthetically appealing cleanup area, EPA frequently utilizes vegetation or revegetation for areas which have been remediated.

- Solidification and stabilization - Solidification and stabilization means mixing contaminated material with a binding agent such as Portland cement. This helps ensure that the contaminant stays in place and does not migrate due to rainwater runoff, ground water percolation, or wind erosion.

- Backfilling - Backfilling means putting clean soil back in areas where the contaminated soil has been excavated.

- Geotextile marker - A geotextile marker is a type of plastic material (usually a fabric or wide mesh safety fencing material) that is put in the bottom of an excavated area before it is backfilled. The purpose of the marker is to warn those who excavate the backfilled area in the future that contamination lies below the barrier.

Alternative 1 (No Action): The no-action alternative provides a baseline against which other alternatives can be evaluated. Under this alternative, no remedial action will be taken. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $0
Present Worth: $0
Annual O&M Costs: $0
Excavation volume: None
Implementation time: None

Alternative 2 (Soil Excavation with a 500 ppm Action Level) consists of the following:

a. Contaminated surface soil will be excavated until there is no lead at concentrations above the action level (which is the same as the remediation goal) to a maximum depth of 18 inches.

b. Areas will be backfilled with clean material. The type of backfill will depend on the use of the areas. Yard areas will be backfilled with topsoil and revegetated. Driveways and other traffic areas will be backfilled with road base material (e.g., gravel). Yard areas which are affected by the remedial action (e.g., excavated, or used as staging areas) will be landscaped in order to, if practicable, return the areas to the condition which they were in prior to the remedial action. Trees, shrubs and plants will be replaced with commercially available equivalent or similar items. Fences or other structures which must be moved will be removed and placed back at or near their original locations, or demolished and replaced with commercially available equivalent or similar items.

c. If soil lead concentrations exceed the action level at 18 inches, a marker consisting of a geotextile fabric or other suitable material will be placed in the excavated area prior to backfilling with clean fill.

d. All excavated contaminated soil will be disposed of on-Site in dry rural mining-waste-contaminated areas, such as the former locations of tailings ponds. These areas are mining waste disposal areas that are already highly contaminated with lead. These areas are located away from heavily populated areas.

e. The soil excavated from the residential areas will be spread over the disposal area to blend into the contours of the surrounding land. Upon final completion of the disposal of contaminated soil at the disposal area, the disposal area will be vegetated with grass. The disposal area will also be capped with clean soil prior to vegetating, unless the surface of the disposal area already has soil lead concentrations less than 500 ppm. Contaminated soil excavated from the yards will generally be removed in 6-inch layers, and, consequently, this excavated soil usually contains some soil with lead concentrations less than 500 ppm. As the excavated soil is handled, incidental mixing will generally occur, and generally soil lead concentrations greater that 500 ppm will be reduced due to dilution from this mixing. As a result of mixing during normal handling of excavated soil, soil contamination in many parts of the disposal area may be lower than the remediation goal; consequently, no clean soil cap will be needed in these parts of the disposal area. The on-Site areas that will be used for disposal will actually be environmentally enhanced by the disposal. The soil that is being placed in the disposal areas is actually less contaminated than the mining waste already present in the disposal areas. Also, establishing vegetative cover on the disposal areas is an enhancement since these dry mining areas typically do not support vegetation and typically are sources for further spreading of contamination and for wind and surface water erosion. The eroded mining waste is transported by wind and surface water and redeposited in other areas, including residential areas. The establishment of vegetative cover will reduce dust generation and erosion at the disposal areas.

f. Summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation:

Capital Costs: $26,764,400
Present Worth: $24,478,219
Annual O&M Costs: $60,000
Excavation volume: 364,400 cubic yards
Implementation time: 6 years

Alternative 3 (Soil Excavation with 800 ppm Action Level along with Community Protective Measures) consists of excavation, backfilling, revegetation, and disposal in the same manner and to the same depth as Alternative 2. That is, all the steps described above for Alternative 2 will be taken, except that the action level would be 800 ppm which means that some contamination above the remediation goal (500 ppm) may remain in place. To address the residual risk resulting from the contaminated surface soil left in place with lead concentrations between 500 ppm and 800 ppm, CPMs would be perpetually implemented. CPMs would include the following principal provisions:

a. Annual blood lead screening of the children living in residences with residual risks.

b. Sampling of lead sources for characterization and monitoring purposes at individual residences with residual risks.

c. Individual follow-up lead exposure reduction counseling.

d. Community lead poisoning and prevention health education.

e. "Super cleaning" using high efficiency particulate vacuum cleaners (HEPA VAC) to reduce the levels of dust in residences with residual risks.

f. Summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation:

Capital Costs: $12,764,800
Present Worth: $17,194,533
Annual O&M Costs: $360,000
Excavation volume: 171,900 cubic yards
Implementation time: 3 years (with perpetual CPMs)

Alternative 4 (Capping In-Place with 500 ppm Action Level) consists of in-place capping for containment of residential soil exhibiting lead concentrations greater than or equal to 500 ppm.

Residential soil would be covered in place with twelve to twenty-four inches of clean soil or gravel. Remediated areas would be regraded and revegetated, and landscaped and repaired as described under Alternative 2. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $14,360,800
Present Worth: $14,156,949
Annual O&M Costs: $60,000
Excavation volume: None
Implementation time: 3 years

Alternative 5 (Soil Excavation with 500 ppm Action Level and with Solidification/Stabilization Treatment) consists of excavation of residential yard soil exhibiting lead concentrations greater than or equal to 500 ppm, and solidification/stabilization treatment of the excavated soil. The excavation, backfilling, revegetation, landscaping, repair and disposal components of Alternative 5 would be the same as in Alternative 2. Treatment facilities would be established at the Site for treatment of contaminated soil prior to permanent disposal. Treatment would incorporate the most feasible technologies available to solidify or stabilize lead contaminants while minimizing volume increases. Traditional solidification agents such as pozzolanics would be considered in conjunction with proprietary chemicals based on treatment results and costs. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $55,694,400
Present Worth: $50,136,522
Annual O&M Costs: $60,000
Excavation volume: 364,400 cubic yards
Implementation time: 6 years

Alternative 6 (Soil Excavation with 500 ppm Action Level and with Washing/Leaching Treatment) consists of excavation of residential soil exhibiting lead concentrations greater than 500 ppm, and washing/leaching treatment of the excavated soil. The excavation, backfilling, revegetation, landscaping and repair components would be the same as in Alternative 2. Treatment facilities would be established at the Site. Soil washing/leaching would consist of the following: 1) the addition of water and chemical additives such as surfactants, acids, bases, and chelates to the soil in order to produce a slurry feed; 2) injection of the slurry into separators and other equipment to create mechanical and fluid sheer stress; and 3) removal of contaminated silts and clays from granular soil particles. That is, in the third step described in the previous sentence, the fine-grained contaminated particles would be removed by washing the soil through fine screens, and the contaminants in the coarser soil fraction would be removed by flowing wash water through the soil. Both physical agitation and washing additives would be used to improve removal efficiency. This treatment technology would achieve the following three output streams: 1) coarse clean fraction - to be disposed on-Site without capping, 2) contaminated fine fraction - to be disposed of on-Site in dry mining waste areas with subsequent capping, and 3) process wash water to be treated to remove solubilized heavy metal fractions prior to return to process or discharge. Initial physical screening to remove coarse rock and debris may also be required prior to soil washing/leaching in order to ensure that treatment results are effective. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $74,663,600
Present Worth: $67,004,294
Annual O&M Costs: $60,000
Excavation volume: 364,400 cubic yards
Implementation time: 6 years

Alternative 7 (Soil Excavation with 500 ppm Action Level and with Lead-Reduction Chemical Treatment) consists of excavation of lead-contaminated soil exhibiting lead concentrations greater than or equal to 500 ppm, and lead-reduction chemical treatment of the excavated soil. The excavation, backfilling, revegetation, landscaping, repair and disposal components would be the same as in Alternative 2. Treatment facilities would be established at the Site for treatment of contaminated soil prior to permanent disposal. Excavated soil would be treated with chemical additives to reduce the valence state of the lead contaminants, thereby reducing their mobility, bioavailability and exposure risks. Reducing the valence state means that the lead gains negative electrical charges. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $36,413,600
Present Worth: $33,059,038

Annual O&M Costs: $60,000
Excavation volume: 364,400 cubic yards
Implementation time: 6 years

Alternative 8 (Soil Excavation with 500 ppm Action Level and with Electrokinetic Remediation) consists of excavation of residential soil exhibiting soil lead concentrations which exceed 500 ppm, and electrokinetic remediation treatment of the excavated soil. The excavation, backfilling, revegetation, landscaping, repair and disposal components would be the same as in Alternative 2. Treatment facilities would be established at the Site for treatment of contaminated soil prior to permanent disposal. The removal of lead in contaminants in the excavated soil would be achieved by a combination of electrodes and managed recirculating electrolytes to desorb, migrate and recover ionic lead contaminants. In other words, the contaminated material would be placed into solution in a container with positive and negative electrically charged poles (electrodes). Lead being positively charged would be repelled from the positively charged electrode, and would be drawn to the negatively charged electrode where it would be removed from the solution. A summary of estimated costs, estimated quantities of materials to be excavated, and estimated time of implementation is as follows:

Capital Costs: $48,265,000
Present Worth: $42,763,795
Annual O&M Costs: $0
Excavation volume: 364,400 cubic yards
Implementation time: 6 years

Basis of Maximum 18-inch Surface Soil Excavation Depth

The excavation depth of 18 inches is based on the maximum depth required to reach a soil lead concentration of 500 ppm and the low uptake of lead in plants at the Site. Field observations by EPA during the removals at the Site have indicated that with few exceptions 18 inches is the maximum excavation depth required to remove soil with a lead concentration greater than 500 ppm. Also, based on samples of produce taken at the Site, the uptake of lead from vegetable gardens at the Site is low. For vegetable gardens at the Site, 18 inches of clean soil would reduce lead uptake in plants to insignificant levels.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The selection of a remedial action alternative is a two-step process. First, EPA, in conjunction with ODEQ and the Indian Tribes involved with the Site, reviewed the results of the RI/FS to identify the preferred alternative (in this case Alternative 2). The EPA then presented the preferred alternative to the public for review and comment, along with supporting information and analysis, in the Proposed Plan. Second, EPA reviewed the public comments, and consulted with ODEQ and the Indian Tribes involved in order to evaluate whether the preferred plan was still the most appropriate remedial action for the residential areas of the Site and EPA made the final remedy selection decision.

The EPA identified the preferred alternative and the final remedy selection based on an evaluation of the major tradeoffs among the remedial alternatives in terms of the nine evaluation criteria listed at 40 CFR §300.430(e)(9)(iii). In order to be eligible for selection, remedial alternatives must meet the two threshold criteria from among the nine criteria. To meet these two criteria, the remedial alternatives must be protective of human health and the environment and comply with ARARs (or justify a waiver).

Among those remedial alternatives that met the threshold criteria, EPA balanced the tradeoffs among the alternatives with respect to the balancing criteria which are long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability and cost. This analysis is described in the Section of this ROD entitled "Summary of Comparative Analysis of Alternatives."

After the public comment period on the Proposed Plan concluded, EPA factored in ODEQ, Indian Tribe, and community acceptance as modifying criteria. This process is also discussed in the Section of this ROD entitled "Summary of Comparative Analysis of Alternatives." This ROD memorializes EPA's decision to select Alternative 2 (Soil Excavation with a 500 ppm Action Level) as the remedial action to address the contamination in the residential areas on the Site.

Threshold Criteria

Overall Protection of Human Health and the Environment

This criterion requires EPA to determine, as a threshold requirement, whether each alternative meets the requirement that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under the evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Alternatives 2, 5, 6, 7, and 8, provide protection by excavation of lead-contaminated soil at or above the health-risk-derived level of 500 ppm to a maximum depth of 18 inches with complete removal of the excavated soil from the residential areas, followed by backfilling with clean soil. Additionally, Alternatives 5, 6, 7, and 8, provide protection through treatment of the excavated soil prior to final disposal. Alternative 3 provides protection by a combination of excavation and CPMs. Under Alternative 3, risks associated with lead-contaminated soil with lead concentrations between the 500 ppm remediation goal and the 800 ppm action level (800 ppm is not a health-risk-derived level) are addressed by CPMs. Alternative 4, capping in-place, provides protection by installation of a soil and sod barrier between residents and underlying contaminated materials, thereby removing the contaminated soil from the human exposure pathway.

Alternative 1 (no action) would not be protective of human health and the environment, because it does nothing to address the soil lead contamination which has been determined in the BHHRA to pose and unacceptable health risk, especially to children.

Compliance With ARARs

This criterion is used to decide how each alternative meets ARARs, as defined in CERCLA Section 121, 42 U.S.C. § 9621, and as defined in the NCP at 40 CFR § 300.5. Compliance is judged with respect to chemical-specific, action-specific and location-specific ARARs as well as appropriate criteria, advisories and guidance. All alternatives meet the ARARs. An evaluation of ARARs is presented in Table 3 through Table 5 of this ROD. A summary of the evaluation is provided below:

a. Chemical-specific ARARs - There are no Federal or State ARARs for lead-contaminated soil. The soil lead remediation goal of 500 ppm that is applicable to all the alternatives considered was based on the BHHRA, IEUBK modeling, and Region 6 experience at other soil lead remediation sites. The soil lead excavation action level of 800 ppm, used in

Alternative 3, was based on remedial actions by Region 7 to address soil lead contamination in Joplin, Missouri and Galena, Kansas.

b. Location-specific ARARs - All proposed activities at the Site are compliant with any location-specific ARARs.

c. Action-specific ARARs - The lead contamination in the soil is primarily from mining waste (overall the evidence leads to this conclusion) which is a solid waste, but not a hazardous waste under the Resource Conservation and Recovery Act (RCRA), because it is solid waste from the extraction, beneficiation, and processing of ores and minerals, according to 40 CFR § 261.4(b)(7). Disposal of excavated lead-contaminated soil will be on-Site within the area of contamination, but away from residential areas. Dust generation will be controlled during construction to meet relevant and appropriate Federal and State air quality laws and regulations.

d. To-be-considered (TBCs) - In addition to ARARs, other advisories, criteria, or guidance that may be useful in developing the remedy were, as appropriate, identified and considered.

Balancing Criteria

Long-term Effectiveness and Permanence

This criterion of the NCP requires EPA to assess alternatives based on the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Regarding the Site, the primary focus of this evaluation was to determine the extent and effectiveness of the controls that may be required to manage the residual risk posed by treated and/or untreated soil at the Site.

Alternatives 2, 5, 6, 7, and 8, which propose a 500 ppm excavation action level would essentially eliminate exposure risks in residential areas by removing lead-contaminated surface soil above the health-risk-derived level to a maximum depth of 18 inches. The contaminated soil would be consolidated and placed in contaminated areas of the Site away from the residential population. The treatment remedies (Alternative 5, 6, 7, and 8), which propose to treat lead contaminants after excavation and removal from the yards, would not be significantly more effective than excavation alone, as called for in Alternative 2, at reducing residential risks because the Site areas that are proposed for disposal are already highly contaminated, and the disposal areas are located safely away from residential populations. No significant additional benefits result from treating the soil before it is placed in these remote and previously contaminated areas. Alternative 3, which proposes an 800 ppm excavation action level, results in residual risks. The residual risks are associated with the surface soil with lead contamination between 500 ppm (the remediation goal) and 800 ppm (the proposed action level under Alternative 3) that would not be excavated, and the indoor dust resulting from the contaminated soil remaining in the yards. The residual risks are addressed by Alternative 3 through the implementation of perpetual CPMs. Health education to reduce lead exposure, and super cleaning using HEPA VACs to control the levels of indoor lead-contaminated dust would be major components of the CPMs. Alternative 3, which proposes excavation at or above an 800 ppm action level, which is not a health risk-based level, is less source protective than the remedies which excavate using the 500 ppm level. Alternative 3 permanently protects the residents from the portion of the contaminated soil that is excavated above the 800 ppm lead action level. However, to protect the residents from the residual risks from surface soil remaining in place below the 800 ppm action level, Alternative 3 relies on CPMs. CPMs are not permanent like excavation, and must be continued in perpetuity. There are concerns about the long-term effectiveness of the CPMs in reducing lead exposure because of the difficulty of permanently altering human behavior in residential settings at the Site through health education. It is unlikely that CPMs could be continued in perpetuity. That is, it may be possible to educate the present generation of children and parents who live in the residential areas on the Site with regard to lead exposure reduction, but it may not be feasible to establish a permanent program to educate future generations. Also, CPMs place a greater burden of responsibility for lead exposure reduction on the residents at the Site as compared to permanent engineering controls. For example, for Alternative 2 and Alternatives 4 through 8, normal house cleaning by residents would be adequate to control indoor dust originating from outdoor lead-contaminated soil; whereas, for Alternative 3, super cleaning using HEPA VACs would be required for residences where the yard soil was not excavated. Perpetual CPMs would be required, since lead contamination at levels which would pose a health risk would remain in the residential areas under Alternative 3. Finally, to the degree that residual risk remains to be addressed by perpetual CPMs, Alternative 3 is inconsistent with the statutory preference for permanent remedies under CERCLA Section 121, 42 U.S.C. § 9621.

Residual risks from contaminants above the health-risk-derived level remaining in residential areas are also a concern with Alternative 4, capping in-place, and Alternative 1 which proposes no action. Alternative 4 which utilizes barriers or covers to prevent direct human contact with contaminated soil has doubtful long-term effectiveness and is not considered permanent like excavation because the potential for disruption of the barriers through normal residential digging activities (e.g., gardening, tree planting, utility trenching, etc.) is substantial. In addition, there is significant potential for the caps to be disrupted by erosion which may result from inadequate maintenance of the vegetative cover in the future since such maintenance will be up to the individual homeowner or occupant. Such disruptions of the caps could once again expose children to the lead. Indefinite future monitoring and maintenance to ensure integrity of covers, and institutional controls to prohibit disturbance of the covers are not considered practicable for the residential yards at the Site. Due to the difficulty of maintaining the caps intact in a residential setting, Alternative 4 is considered the least effective of the engineering remedies over the long-term. In addition, since the final grades of the covers would typically be higher than the existing residence foundations and adjacent property grades, existing drainage patterns would be altered and significant drainage problems would probably be created. The terrain of the residential areas is mostly flat, and residential drainage problems already exist. The potential for drainage problems to be significantly worsened by the addition of soil covers is substantial. In short, the capping alternative may address the problem of direct lead exposure in the short term, but in the long-term, since maintenance is not assured, the cap is likely to be broken; moreover, capping will create drainage problems.

Institutional controls include measures such as deed notices, warning signs, and zoning restrictions against certain excavation activities. Institutional controls would be required to a greater degree as a risk-management component for those alternatives where contaminated surface soil with lead concentrations above the remediation goal (500 ppm) remained in the residential areas. Accordingly, institutional controls would be required to a greater degree for Alternative 4 because, under Alternative 4, lead-contaminated surface soil with lead concentrations above 500 ppm level is not removed, but is capped in place. Institutional controls, primarily CPMs, would also be required to a greater degree for Alternative 3 which calls for lead-contaminated surface soil with lead concentrations between 500 ppm and 800 ppm to remain exposed in place within the residential areas. The CPMS for Alternative 3, would be required to a much greater degree than for the other alternatives in order to manage residual risks remaining in residential areas. These residual risks, under Alternative 3, are associated with the potential for direct contact with surface soil where the soil was not removed because lead concentrations were not greater than 800 ppm. Alternative 2 and Alternatives 4 through 8 do not require the same degree of institutional controls, including the implementation of CPMs, as Alternative 3 requires in order to be protective.

In general, permanence of the remedial action at the Site is greatest for Alternatives 2, 5, 6, 7, and 8 because these alternatives require excavation of lead-contaminated surface soil to the health-risk-derived action level of 500 ppm, to a maximum depth of 18 inches, followed by permanent disposal of the excavated soil away from the residential areas.

Short-term Effectiveness

This criterion addresses the effects of the alternatives during the construction period until the remedial actions have been completed, and the selected level of protection has been achieved. Alternative 4, which proposes immediate containment without lead-contaminated soil disturbance, is considered the most effective in the short-term, because it has much less potential to generate lead-contaminated dust, compared to the excavation alternatives. Implementation of Alternative 1, no action, will not increase or decrease the short-term effects on human health or the environment.

All the other alternatives (Alternatives 2, 3, 5, 6, 7, and 8) propose excavation, which would require short-term dust control to protect the community and the workers. Additionally, as part of all remedial alternatives which call for excavation, the workers would be required to use personal protective equipment to ensure their protection during the remedial action, especially during excavation activities.

Under those alternatives which call for treatment of the excavated contaminated soil, environmental impacts would be further mitigated with treatment of lead-contaminated soil (as proposed in Alternatives 5, 6, 7, and 8). However, treatment alternatives would require the greatest length of time to achieve the remedial response objectives, and, consequently, the short-term airborne dust control would continue for the longest period of time under these treatment alternatives.

Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, the mobility or the volume of the contaminants. The lead-contaminated residential soil is not classified as a principal threat; therefore, there is no expectation under 40 CFR § 300.430(a)(1)(iii) that the soil should be treated. Alternatives 2, 3, and 4 are not treatment remedies. Alternatives 5, 6, 7, and 8 are treatment remedies. Alternative 5, stabilization/solidification, would effectively reduce waste material mobility; however, the original contaminant toxicity would remain a disposal issue requiring long-term monitoring; moreover, the volume requiring management may actually be increased. Alternatives 6, soil washing/leaching, and

Alternative 8, electrokinetic remediation, would serve to reduce the waste material volume; however, the original toxicity and mobility of contaminants would exist in the remaining treatment residuals, requiring proper management. Alternative 7, lead reduction through chemical treatment, should reduce the valence state of lead contaminants and, as such, would reduce the toxicity and mobility of the contaminated material, with minimal waste volume increases requiring management. Alternative 4 would essentially limit direct contact exposure to contaminants without changing the volume, mobility, or toxicity, and without removing the long-term risk potential of the contamination. No treatability studies using Site soils have been conducted for any of the treatment technologies used for the treatment remedies (Alternative 5 through 8). Treatability studies would be needed for all the treatment technologies utilized by Alternatives 5 through 8 prior to initiation of remedial action in order to access all implementability considerations.

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative, and also addresses the availability of various services and materials required during the alternative's implementation. The no-action alternative is a non-implementation option. With regard to technical implementabilty, the non-treatment remedies (Alternatives 2, 3, and 4) are more implementable (i.e., they have higher technical implementability) than the remedies that treat the soil following excavation from the yards (Alternatives 5, 6, 7, and 8). The treatment components of these alternatives are not as well developed as the non-treatment components (e.g., excavation, backfilling, turfing, and other straightforward, well-developed construction technologies). The treatment components would require bench- and/or pilot-scale testing to ensure their effectiveness, particularly for innovative technologies. Alternative 4 has high technical implementability, in that the type of construction required is straightforward. Alternatives 2 and 3 also have high technical implementability in that they utilize basic construction technologies which are well developed.

With regard to administrative implementability, none of the alternatives pose significant administrative implementation problems at the Site, except for Alternative 3. The degree to which Alternative 3 relies on CPMs poses significant administrative problems at the Tar Creek Superfund Site. Under

Alternative 3, contaminated soil with lead concentrations between the remediation goal (500 ppm) and the action level (800 ppm) would remain in place, posing a residual risk to children's health. Perpetual CPMs are required under Alternative 3 in order to address this residual risk. The future cooperation of the public and governmental entities, upon which a successful CPM program for the Site would rely, is unpredictable. Alternative 3, by relying on CPMs to address residual risks, also shifts the costs and implementation of addressing the residences, with surface soil contamination below the 800 ppm level, to the post construction operation and maintenance (O&M) phase. The responsibility for the O&M phase would primarily be borne by the State and local governmental entities who in general have expressed concern about the long-term effectiveness of CPMs and have not expressed a willingness to fund permanent CPMs on the scale associated with Alternative 3. For these reasons, in the long-term it is not practicable to implement Alternative 3 at the Site.

Cost Effectiveness

This criterion addresses the cost effectiveness of the alternatives based on direct and indirect capital costs. Operation and maintenance costs incurred over the life of the project, as well as present worth costs, are also evaluated. A summary of the costs for the remedial action alternatives evaluated is presented in Table 2.

The no-action alternative is a no-cost alternative. The no-action alternative does nothing to actually reduce the risks at the Site, and is therefore not protective of human health. Comparing present worth costs of the other alternatives, the treatment remedies (Alternatives 5, 6, 7, and 8), which treat the soil excavated above the 500 ppm soil lead level, are the most expensive. However, the small increase in effectiveness realized by treating the excavated soil, rather than just disposing of the excavated soil without treatment, as in Alternative 2, is not proportional to the significant additional costs required for treatment. Of the treatment remedies, Alternative 7 has the lowest cost, and Alternative 6 has the highest cost. Of the remaining two treatment remedies, Alternative 5 is more expensive than Alternative 8. Overall, the treatment remedies are similar in effectiveness. The overall effectiveness of each of the treatment remedies is not proportional to the significant increase in cost which treatment requires. Alternative 4, capping in-place, is the least expensive alternative, but, because future cap maintenance is uncertain, and because capping creates drainage problems, Alternative 4 is, relatively, the least effective of all the alternatives, except for the no-action alternative. Moreover, under Alternative 4, there is a significant potential for operation and maintenance cost to escalate in the future due to drainage problems. As a result of such cost escalation, it is likely that Alternative 4 would lose much of its cost advantage over the other alternatives.

Alternative 2 is cost-effective because its increased cost compared to the lower-cost alternatives (Alternative 3, Alternative 4, and the no-action alternative) is proportional to its increased overall effectiveness compared to the overall effectiveness of the lower-cost alternatives.

The increased cost of Alternative 2 is proportional to the overall increased effectiveness of Alternative 2 compared to the effectiveness of Alternative 3. The increased cost is proportional because Alternative 2 addresses about 1,312 residential properties by using a permanent excavation remedy--a remedy which is effective over the long-term; whereas, Alternative 3 only addresses about 619 residential properties with a permanent excavation remedy. In order to address the remaining residences, Alternative 3 uses CPMs which cannot be relied upon to provide long-term effectiveness and permanence at the Site. Moreover, the annual operation and maintenance costs for Alternative 3, which includes the maintenance of a permanent CPM office at the Site, are much higher than the operation and maintenance costs of Alternative 2. As a result, in the long-term, Alternative 3 would lose much of its cost advantage over Alternative 2.

The increased cost of Alternative 2 is proportional to the overall increased effectiveness of Alternative 2 compared to the effectiveness of Alternative 4. The increased cost is proportional because Alternative 2 addresses the residences by excavating the contaminated soil--a permanent remedy; whereas, Alternative 4 utilizes capping which may be breached and which is likely to cause drainage problems and erosion problems leading to further migration of contamination. That is, Alternative 2 utilizes a permanent remedy, but Alternative 4 does not.

Cost of Carry-Over Properties: When the remedial action for the residential areas begins, the removal actions for the residential areas will be phased out. Removal actions at all the residential properties targeted for removal action at the Site may not be complete at the time that the remedial action starts. For example, although EPA's March 21, 1996, Action Memorandum for the Site calls for a removal response action at approximately 300 residential properties with soil lead concentrations which exceed the removal action level of 1,500 ppm, removal actions may not be completed at all of those residential properties before the remedial action begins under this ROD and before the removal action is phased out. Any residential properties targeted for removal action (including residential yards and HAAs), but unremediated by the removal program, will be addressed by and included in the remedial action described in this ROD. Until the remedial action begins and the removal action is phased out, it is unknown how many of theses properties will be carried over from the removal program to the remedial program (hereinafter carry-over properties). These carry-over properties will add to the total number of properties to be addressed by the remedial action. The cost estimates for the remedial action alternatives (RAAs) evaluated in preparation for this ROD, do not include the cost to remediate these additional carry-over properties. Therefore, the costs for each of the RAAs would increase by the additional amount required to remediate these carry-over properties.

Modifying Criteria

State Acceptance

The State concerns that were assessed included the following: (1) The State's position and key concerns related to the preferred alternative and other alternatives; and (2) State comments on ARARs. Comment letters from ODEQ, the Inter-Tribal Environmental Council of Oklahoma(ITEC), the Quapaw Tribe of Oklahoma, and the Wyandotte Tribe of Oklahoma are included as Appendices B through E to this ROD, respectively. A complete summary of the comments received from ODEQ, ITEC, the Quapaw Tribe, and Wyandotte Tribe (hereinafter collectively referred to as the State and Tribes) during the public comment period and EPA's responses to those comments are included in the Responsiveness Summary which is Appendix A of this ROD. A summary of the main comments from the State and the Tribes received before and during the public comment period is as follows:

a. The State and the Tribes prefer Alternative 2.

b. The State and the Tribes do not believe that CPMs can effectively address the residual risk posed by soil left in place with lead concentrations between 500 ppm and 800 ppm as called for under Alternative 3.

c. The State and the Tribes have expressed that the treatment alternatives (Alternatives 5, 6, 7, and 8) are not cost-effective when compared to the non-treatment alternatives. The State and the Tribes have expressed that the small net increases in benefits provided by the treatment alternatives compared to the non-treatment alternatives do not justify the much higher costs of the treatment alternatives.

d. The State and the Tribes have expressed that Alternative 4 (Capping In-Place) is not practical due to the potential for disruption of the caps in a residential setting, and due to the potential for the creation of drainage problems.

e. The State and the Tribes have expressed that under Alternative 2, health education and monitoring may be necessary for those residences where EPA was not granted access to remediate the soil.

f. The State and the Tribes have expressed concerns about the difficulty EPA is having in obtaining access to the Indian lands at the Site in order to conduct response actions. To facilitate obtaining access to the Indian land, the State and the Tribes have suggested that EPA should do more to alleviate the concerns that the owners of Indian land have regarding owner liability under CERCLA; moreover, the State and the Tribes believe that EPA should do more to educate the owners of Indian land about the benefits of the remediation.

g. The State and the Tribes have suggested that some remedial response actions should be extended to areas that are impacted in the Miami area.

Community Acceptance

The EPA's assessment of community acceptance included a determination regarding which components of the alternatives that interested persons in the community support, have reservations about, or oppose. Generally speaking, those individuals living on the Site (i.e., those most affected by the remedial action) support EPA's preferred alternative--Alternative 2. With the exception of comments from mining companies that formerly operated at the Site and the Department of the Interior which manages Indian land at the Site, the public expressed support for EPA's preferred alternative. A complete summary of the comments on the Proposed Plan received from the public during the public comment period and EPA's responses are included in the Responsiveness Summary which is Appendix A of this ROD.

IX. SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, and based on consideration of the requirements of the NCP including without limitation a detailed analysis of the remedial action alternatives using the nine NCP criteria [40 CFR § 300.430(e)(9)] that included, among other things, an analysis of public comments, EPA has determined that **Alternative 2 (Soil Excavation with a 500 ppm Action Level)**, is the most appropriate remedy for the residential areas in OU2 of the Tar Creek Superfund Site in Ottawa County, Oklahoma. The selected remedy provides adequate protection of human health and the environment, complies with ARARs and is cost-effective.

The EPA estimates that surface soil at approximately 1,312 residential yards contains concentrations of lead which exceed 500 ppm. This estimate does not include the approximately 300 residential yards targeted for response action under the ongoing removal action. Any contaminated residential properties not addressed by the removal action will be addressed by the remedial action.

The selected remedy requires the excavation of soil with a lead concentration greater than or equal to 500 ppm to a maximum depth of 18 inches in contaminated parts of the residential areas on the Site. Individual hot spots in the residential areas, for example a part of a residential property where it is obvious that chat is present (even though random sampling which took place at that property found no contamination above the 500 ppm lead level), will also be addressed on a case-by-case basis. Most soil in lead-contaminated residential yards will be excavated using lightweight mechanical excavation equipment. Hand excavation methods will be used to remove soil in areas where mechanical excavation is not suitable. Excavated soil will be placed into trucks for transportation to the disposal area.

If soil lead concentrations exceed 500 ppm at 18 inches of soil depth, a marker consisting of a geotextile fabric or other suitable material will be placed in the excavated area prior to backfilling. The main purpose of the marker is to alert the resident or others of the contamination remaining at depth in the event of any future digging or construction.

The type of material used to backfill areas which EPA excavates will depend on the use of the particular area in question. Yard areas (i.e., the curtilage of residential homes) will be backfilled with clean topsoil and revegetated. In residential yards, and other open unpaved areas, grass will typically be reestablished using sodding, but seeding will be used when it is advantageous to do so. Lead-contaminated driveways and other traffic areas will be backfilled with road base material (e.g., gravel or crushed limestone). Some lead-contaminated soil with lead concentrations above the action level, which is located in driveways and traffic areas, may be excavated to less than 18 inches if it is clear that the areas will continue to be used primarily as driveways or traffic areas in the future. These contaminated driveways or traffic areas may also be paved over, leaving the lead-contamination in place. Some lead-contaminated traffic areas (e.g., chat-covered alleyways), may be surfaced with base coarse material and/or paved without first excavating any contaminated soil.

An x-ray fluorescence (XRF) instrument may be used for post-excavation soil analysis in order to confirm that remediation goals are being achieved. Utilization of XRF instrumentation, instead of other more traditional soil analytical methods, minimizes analytical turnaround time and costs.

All excavated contaminated soil will be disposed of on-Site in dry mining waste areas which are already contaminated. The planned on-Site disposal area is the former location of a milling pond which is now dry. The disposal area is located on private land between Picher and Commerce on County Road E40 near the location of the old Eagle-Picher Central Mill. Public access to the disposal area is restricted. The planned disposal area is already contaminated with lead above the 500 ppm level. The disposal area is presently being utilized for the removal actions currently in progress. The soil excavated from the residential areas will be spread over the disposal area to blend into the contours of the surrounding land. Once EPA has finished using the disposal area, the disposal area will be vegetated with grass. The grass will help control erosion by wind or water. The disposal area will also be capped with clean soil prior to vegetating, unless the surface of the disposal area already has soil lead concentrations less than 500 ppm. Contaminated soil excavated from the residential properties will generally be removed in 6-inch layers, and, consequently, this excavated soil usually contains some soil with lead concentrations less than 500 ppm. As the excavated soil is handled, incidental mixing will generally occur, and generally soil lead concentrations greater that 500 ppm will be reduced due to dilution from this mixing. As a result of mixing during normal handling of excavated soil, soil contamination in many parts of the disposal area may be lower than the remediation goal; consequently, no clean soil cap will be needed in these parts. Since the residential soil at the Site is classified as a low level threat and not a principal threat, containment without treatment is consistent with CERCLA and the NCP.

In situations where it is more feasible for governmental entities other than EPA to perform remediation activities, for example using city maintenance crews to repair streets damaged by remediation activities or to surface alleyways in residential neighborhoods, agreements with other government entities to perform the work at EPA expense will be considered.

Water spraying will be used for dust suppression during excavation of contaminated soil. Dump trucks used to transport contaminated soil will be equipped with covers to prevent dust from blowing. To assure that the dust suppression activities are adequate to protect residents and workers, an air monitoring program will be implemented. The program will consist of real-time dust monitoring as well as air sampling.

The engineering remedial response actions for the residential yard and HAA area portions of the selected remedy will be consistent with the removal action for the residential yards and HAAs.

The selected remedy also contains the elements described in the Section of this ROD entitled "Common Elements in All Alternatives" and the seven enumerated paragraphs in the Section of this ROD entitled "Documentation of Significant Changes."

Cost

The construction cost of the selected remedy is estimated at $26,764,400, as shown on Table 1. This is based on an estimate of the overall cost of $20,000 per residential property. The overall cost includes all construction and associated activities required to address the lead contamination in the residential areas at the Site, except for the contracting agency administration cost. The contracting agency administration cost is estimated to be $2,676,440 which is 10 percent of the construction cost of $26,764,400. The total estimated remedial action cost is **$29,440,840** which consists of the construction cost ($26,764,400) plus the contacting agency administration cost ($2,676,440). Annual O&M after construction is completed, including without limitation the maintenance of the disposal area and supplemental institutional controls, is estimated to cost $60,000.

X. STATUTORY AUTHORITY FINDINGS AND CONCLUSIONS OF LAW

The EPA's primary responsibility at Superfund sites is to select remedial actions that are protective of human health and the environment. Section 121 of CERCLA, 42 U.S.C. § 9621, also requires that the selected remedial action for a site comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws, unless a waiver is granted. The selected remedy must be cost-effective and utilize treatment or resource recovery technologies to the maximum extent practicable. The statute also contains a preference for remedies that include treatment as a principal element. The following sections discuss how the selected remedy for residential soil at the Tar Creek Superfund site meets the statutory requirements.

A. Protection of Human Health and the Environment

The selected remedy provides protection by excavation of lead-contaminated soil at or above the health-risk-derived level of 500 ppm to a maximum depth of 18 inches with complete removal of the excavated soil from the residential areas, followed by backfilling with clean soil. The selected remedy supplementally provides protection by other engineering elements and institutional controls detailed in the Section of this ROD entitled "Common Elements in All Alternatives," and the seven enumerated paragraphs in the Section of this ROD entitled "Documentation of Significant Changes."

The selected remedy provides protection primarily by reducing concentrations of contaminants through excavation and removal of contaminated soil from residential areas. The protection provided by the selected remedial alternative is equivalent to or better than the protection offered by any of the other alternatives evaluated for the remediation of lead-contaminated soil in the residential areas. As explained above in the Section of this ROD entitled "Short-term Effectiveness," no unacceptable short-term risks will be caused by implementing this selected remedy. ROD Section IX, "Summary of Comparative Analysis of Alternatives," and ROD Section X, "The Selected Remedy," provide an analysis of the ways in which the selected remedy provides the best overall protection of human health and the environment, and explains that the selected remedy causes no unacceptable short-term risk.

B. Compliance With ARARs

The selected remedy which consists primarily of the excavation and disposal of the residential soil will attain all applicable or relevant and appropriate requirements (ARARs). Tables 3 through 5 of this ROD list ARARs developed for the remedial action of the residential areas for the Tar Creek Superfund Site. A summary of the evaluation of the ARARs is provided below:

a. Chemical-specific ARARs - There are no Federal or State ARARs for lead-contaminated soil. The soil lead remediation goal of 500 ppm that is applicable to all the alternatives considered was based on the BHHRA, IEUBK modeling, and Region 6 experience at other soil lead remediation sites.

b. Location-specific ARARs - All proposed activities at the

Site are compliant with location-specific ARARs.

c. Action-specific ARARs - The lead contamination in the soil is primarily from mining waste (overall the evidence leads to this conclusion) which is a solid waste, but not a hazardous waste under the Resource Conservation and Recovery Act (RCRA) because it is solid waste from the extraction, beneficiation, and processing of ores and minerals, according to 40 CFR § 261.4(b)(7). Disposal of excavated lead-contaminated soil will be on-Site within the area of contamination, but away from residential areas. Dust generation will be controlled during construction to meet relevant and appropriate Federal and State air quality laws and regulations.

d. To-be-considered (TBCs) - In addition to ARARs, other advisories, criteria, or guidance that may be useful in developing the remedy were, as appropriate, identified and considered.

C. Cost-Effectiveness

The EPA believes that the selected remedy is cost-effective in mitigating the threat of direct contact with contaminated residential soil because its costs are proportional to its overall effectiveness. The NCP at 40 CFR §300.430(f)(ii)(D) requires EPA to determine cost-effectiveness by evaluating the following three of the five balancing criteria to determine overall effectiveness: long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the selected remedy is cost-effective. The EPA believes the selected remedy meets these criteria.

The estimated cost of the selected remedy (Alternative 2) for the residential soil is $26,764,400 (capital cost). The no-action alternative is a no-cost alternative. The no-action alternative is ineffective. It does nothing to actually reduce the risks at the Site, is not protective of human health, and, therefore, cannot be selected under the NCP criteria. Comparing present worth costs of the other alternatives, the treatment remedies (Alternatives 5, 6, 7, and 8), which treat the soil excavated above the 500 ppm soil lead level, are the most expensive. However, the small increase in effectiveness realized by treating the excavated soil, rather than just disposing of the excavated soil without treatment, as in Alternative 2, is not proportional to the significant additional costs required for treatment. Of the treatment remedies, Alternative 7 has the lowest cost, and Alternative 6 has the highest cost. Of the remaining two treatment remedies, Alternative 5 is more expensive than Alternative 8. Overall, the treatment remedies are similar in effectiveness. The overall effectiveness of each of the treatment remedies is not proportional to the significant increase in cost which treatment requires. Alternative 4, capping in-place, is the least expensive alternative, but, because future cap maintenance is uncertain, and because capping creates drainage problems, Alternative 4 is, relatively, the least effective of all the alternatives, except for the no-action alternative. Moreover, under Alternative 4, there is a significant potential for operation and maintenance cost to escalate in the future due to drainage problems. As a result of such cost escalation, it is likely that Alternative 4 would lose much of its cost advantage over the other alternatives.

Alternative 2 is cost-effective because its increased cost compared to the lower-cost alternatives (Alternative 3, Alternative 4, and the no-action alternative) is proportional to its increased overall effectiveness compared to the overall effectiveness of the lower-cost alternatives.

The increased cost of Alternative 2 is proportional to the overall increased effectiveness of Alternative 2 compared to the effectiveness of Alternative 3. The increased cost is proportional because Alternative 2 addresses about 1,312 residential properties by using a permanent excavation remedy--a remedy which is effective over the long-term; whereas, Alternative 3 only addresses about 619 residential properties with a permanent excavation remedy. In order to address the remaining residences, Alternative 3 uses CPMs which cannot be relied upon to provide long-term effectiveness and permanence at the Site. Moreover, the annual operation and maintenance costs for Alternative 3, which includes the maintenance of a permanent CPM office at the Site, are much higher than the operation and maintenance costs of Alternative 2. As a result, in the long-term, Alternative 3 would lose much of its cost advantage over Alternative 2.

The increased cost of Alternative 2 is proportional to the overall increased effectiveness of Alternative 2 compared to the effectiveness of Alternative 4. The increased cost is proportional because Alternative 2 addresses the residences by excavating the contaminated soil--a permanent remedy; whereas, Alternative 4 utilizes capping which may be breached and which is likely to cause drainage problems and erosion problems leading to further migration of contamination. That is, Alternative 2 utilizes a permanent remedy, but Alternative 4 does not.

All of the alternatives have controllable short-term impacts and none have unacceptable short-term risks. Therefore, short-term effectiveness was not a major factor in the consideration of overall effectiveness as used in the cost-effectiveness evaluation.

D. Utilization of Permanent Solutions and Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

The EPA believes that the selected remedy represents the maximum extent to which permanent solutions can be utilized in a cost-effective manner for the Tar Creek Superfund Site. Treatment/resource recovery technologies cannot be utilized in a cost-effective manner for the Tar Creek Superfund Site. All of the treatment alternatives (Alternatives 5, 6, 7, 8) were significantly more expensive than the selected remedy. However, small increase in effectiveness by treating the excavated soil, rather than just disposing of the excavated soil without treatment, as in the selected remedy, is not proportional to the significant additional cost for treatment. Alternative 8 is the only alternative that allows possible resource recovery because it permanently separates metals from the soil so that it may be sold and beneficially reused. High concentrations of soil lead are addressed under the remedy selected in this ROD; however, the mobility of the soil lead is low, and the concentrations of lead are not so high as to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. Therefore, the soil lead is not considered a principal threat under the NCP; consequently, there is no expectation under the NCP that the soil lead be treated. Remedies which involve resource recovery are preferred under CERCLA Section 121(b), 42 U.S.C. § 9621(c). However, the difference in cost of Alternative 8 over the selected remedy is greater than the potential value of metals that could be recovered. Therefore, resource recovery technologies were not deemed appropriate for this Site.

E. Preference for Treatment as a Principal Element

This criterion addresses the statutory preference for selecting remedial actions that treat principal threats in order to permanently and significantly reduce the toxicity, the mobility or the volume of the contaminants. High concentrations of soil lead are addressed under the remedy selected in this ROD; however, the mobility of the soil lead is low, and the concentrations of lead are not so high as to be several orders of magnitude above levels that allow for unrestricted use and unlimited exposure. Therefore, the soil lead is not considered a principal threat under the NCP; consequently, there is no expectation under the NCP that the soil lead be treated. The lead-contaminated residential soil is not classified as a principal threat; therefore, there is no expectation under 40 CFR § 300.430(a)(1)(iii) that the soil should be treated. Alternatives 2, 3, and 4 are not treatment remedies. Also, the treatment remedies (Alternatives 5, 6, 7, and 8) were not cost-effectiveness compared to the selected remedy.

XI. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Tar Creek Superfund Site was released for public comment on March 17, 1997. The Proposed Plan identified Alternative 2, (Soil Excavation with a 500 ppm Action Level), as the preferred alternative to address the contamination from mining waste in the residential areas of the Site. The EPA reviewed all written and verbal comments submitted during the public comment period. Upon review of these comments, it was determined that significant changes to the remedy, as originally identified in the Proposed Plan, were necessary. The significant changes are a logical outgrowth of the information available in the Administrative Record and comments received from the public. The response actions required by these changes are the same types of actions originally planned; however, the scope of the response action has been extended to other areas and communities in Ottawa County which are outside of the boundaries of the mining area, but which have been impacted by mining waste.

Comments submitted during the public comment period have led EPA to reexamine the remediation approach which it will take under this remedial action regarding certain other areas on the Site which are contaminated by lead-contaminated mining waste. These other lead-contaminated areas are not in residential yards, but may affect children living in residential areas due to the proximity of these other areas to the residences, or due to the fact that lead contamination may be migrating from these other areas into the residential areas.

On or near the residential areas of the Site, lead-contaminated mining waste is found in many chat piles and in many locations where milling discharge ponds were once located (these pond areas are now generally dry). Moreover, on or near the residential areas of the Site, lead-contaminated chat has been used in alleyways, parking lots, roads, driveways, and other areas. Natural armoring, crusting and vegetation helps to reduce the amount of lead released from these various places which contain lead-contaminated material on or near the residential areas of the Site. However, any of these places which hold lead-contaminated mining waste on or near the Site, when disturbed by vehicle traffic, foot traffic, or other physical disruption, become sources for further spread of contamination to residential areas, and they also become sources of potential recontamination of the residential areas where lead contamination has been cleaned up or will be cleaned up under this ROD. In addition, children who live on the Site, may wander into these uncontrolled areas, and come into direct contact with this lead-contaminated mining waste on the surface of the ground. These children may ingest dangerous levels of lead via normal hand-to-mouth contact during play in these areas.

During the public comment period, EPA also received comments which pointed out that certain residential communities in Ottawa County, which were not within the scope of EPA's Proposed Plan, have had lead-contaminated mining waste placed in these communities. These communities were not within the scope of EPA's Proposed Plan because they are outside the historic mining and milling area (hereinafter the mining area) which EPA had generally defined as the "Site." However, as the comments explained, and as EPA investigations have determined, lead-contaminated mining waste has been transported to nearly all of the communities in Ottawa County which are located outside of the mining area (as well as to those communities within the mining area). In these communities located outside the mining area, the lead-contaminated mining waste has been used for driveway material, playground material, and for other uses for which loose gravel is typically used. Accordingly, since children in these other communities, which were not within the scope of the Proposed Plan, may come into contact with this lead-contaminated waste, and since the children may ingest dangerous levels of lead via normal hand-to-mouth contact during play in these areas, EPA has decided to expand the Site to include these other communities under the scope of this ROD. Generally the contamination in these other communities is such that it will not require the extensive yard-soil excavation and soil disposal (with the exception of the HAAs which may require extensive excavation) which is planned for the residential areas located within the mining area. Instead, as described below, this ROD generally calls for institutional controls, coverage or replacement of chat in traffic areas, and establishment or improvement of ground cover (e.g., grass) for the communities located within Ottawa County, but outside the mining area; however, if EPA should come across residential areas (including without limitation HAAs) with soil lead concentrations over 500 ppm, this ROD gives EPA the authority to undertake the selected soil removal actions (i.e., Alternative 2) in these residential areas outside of the mining area.

Finally, Tar Creek, which flows near residential areas of the Site is contaminated with lead. In addition to lead contamination from acid mine discharges from the underground mine workings, leachate and surface water runoff from the mining waste on the surface of the ground also contain lead which contributes significantly to the contamination of the waters of Tar Creek. From time to time, Tar Creek overflows its banks, and flood waters contaminated with lead flow into the residential areas located downstream on the Site, depositing a sediment containing lead. These lead-contaminated sediments in some instances may hold dangerous concentrations of lead (levels in excess of 500 ppm), and children who live in flooded residential areas may come into contact with the sediment once the flood waters recede. These children may ingest dangerous amounts of lead from this sediment via normal hand-to-mouth contact during play.

In light of the comments described above and EPA's investigations, and based on documents in the administrative record for this ROD, EPA has made significant changes between the ROD and the Proposed Plan as follows:

1. The Site is expanded to include all portions of Ottawa County impacted by mining waste.

2. Response actions prescribed in Alternative 2 for the residential areas within the mining area will also apply to the floodplain of Tar Creek, including the portion of the floodplain in Miami, and to the HAAs outside the mining area in Ottawa County.

3. Institutional controls, including without limitation health education, lead-contaminated dust reduction activities, and blood lead monitoring are extended to

include more residential communities than just the residential areas in the mining area. Institutional controls under the ROD will be extended to community-wide application in all residential communities, including Miami, within Ottawa County.

4. Road base material (e.g., gravel or crushed limestone) will be used to cover or replace chat material in alleyways, parking lots, roads, driveways, and other such areas near mining area residences, and near residences in communities, including Miami, within Ottawa County. Decisions to replace or cover chat material and decisions on which areas require such remediation will be made on a case-by-case basis during the remedial design and remedial action.

5. Physical barriers (e.g., fences and warning signs) will be used, as appropriate, to restrict access to mining waste which is located near residences. Physical barriers were included in the Proposed Plan in order to restrict access to contaminated property, but the change described in this paragraph extends the use of physical barriers to broader application in the mining area and throughout Ottawa County.

6. For certain residential properties generally outside the mining area, but within Ottawa County, establishment or improvement of ground cover (e.g., grass) will be used to address bare contaminated soil areas. Decisions to provide or improve ground cover and decisions on which areas require such remediation will be made on a case-by-case basis during the remedial design and remedial action.

7. For certain residential properties generally outside the mining area, but within Ottawa County, where medical monitoring has found that a resident has elevated blood lead levels close to or greater than 10 ug/dL, and where the residential yard is contaminated with lead-contaminated soil with concentrations at or above 500 ppm, the soil will be excavated and replaced as called for under the selected remedy.

The costs for these significant changes to the Proposed Plan would not significantly affect the comparative analysis of the RAAs, since the cost of each of the RAAs would increase by about the same amount with the addition of these changes. The costs of the selected remedy as set forth in this ROD are within +50% to -30% of the costs estimated for the preferred alternative in the Proposed Plan. Any differences in cost estimates between the Proposed Plan and the remedial action did not affect selection of the final alternative.

TABLE 1
SUMMARY OF ANALYTICAL RESULTS FOR LEAD
Residential Areas
Tar Creek Superfund Site

[The following chart is a summary of the lead-contamination levels in three media that were sampled from the Study Group residences in Picher, Oklahoma and from the reference area residences in Afton, Oklahoma.]

	Study Group (PPM[1])			Reference Area (PPM)		
Media	**Range of Values**	**Mean**	**Median**	**Range**	**Mean**	**Median**
Yard Soil	156-2218	852	756	40-348	109	70
Garden Soil	30-1230	339	253	13-76	31	22
Garden Produce	.033-.137	.05	.03	.037-.09	.044	.03

(1) Parts Per Million

Table 2

REMEDIAL ACTION ALTERNATIVES, COST SUMMARY[1]
TAR CREEK SUPERFUND SITE, OTTAWA COUNTY, OKLAHOMA

[The following chart is a summary of the costs of each of the eight remedial action alternatives (RAAs). The costs of each alternative are broken down into capital (construction) cost, annual operation and maintenance (O&M) cost, and present worth. The present worth represents the amount of money, if invested at the start of the remediation, that would cover all costs associated with the remedial action over its planned life.]

RAA No.	RAA	Capital Costs	Annual O&M Costs	Present Worth
1	No Action	$0	$0	$0
2	Soil excavation[2], 500 ppm action level	$26,764,400	$60,000	$24,478,219
3	Soil excavation, CPMs[3], 800 ppm action level	$12,764,800	$360,000	$17,194,533
4	Capping in place, 500 ppm action level	$14,360,800	$60,000	$14,156,949
5	Excavate soils, stabilize/solidify, 500 ppm action level	$55,694,400	$60,000	$50,136,522
6	Excavate soils, wash/leach, 500 ppm action level	$74,663,600	$60,000	$67,004,294
7	Excavate soils, lead reduction treatment, 500 ppm action level	$36,413,600	$60,000	$33,059,038
8	Excavate soils, electrokinetic treatment, 500 ppm action level	$48,265,000	(4)	$42,763,795

Notes:
(1) Capital and operation and maintenance (O&M) costs are estimated within +50 percent to -30 percent.
(2) Disposal of all excavated soils would be in dry tailings ponds.
(3) Community Protective Measures (CPMs) would consist of monitoring of affected persons and media, health education, and lead exposure reduction measures
(4) Alternative 8 permanently detoxifies the lead and no long-term O&M is required.

Table 3

POTENTIAL CHEMICAL-SPECIFIC ARARS
TAR CREEK SUPERFUND SITE, OTTAWA COUNTY, OKLAHOMA

	Citations	Prerequisite	Requirement
A. **Applicable Requirements**	None		
B. **Relevant and Appropriate**	None		
C. **To Be Considered**	None		

Table 4

POTENTIAL LOCATION-SPECIFIC ARARS
TAR CREEK SUPERFUND SITE, OTTAWA COUNTY, OKLAHOMA

	Citation	Prerequisite	Requirement
A. **Applicable Requirements**			
1. National Historic Preservation Act	16 USC 470, et. Seq 40 CFR §6.301	Property within areas of the site is included in or eligible for the National Register of Historic Places.	The remedial alternative will be designed to minimize effects on historic landmarks. Coordinate with State Historic Preservation Officer (SHPO).
2. Archeological and Historic Preservation Act	16 USC 469 40 CFR 6.301(b) 36 CFR Part 800.	Property within areas of the site contains historical and archaeologic data.	The remedial alternative will be designed to minimize effects on historical and archeological data. Coordinate with State Historic Preservation Officer (SHPO).
3. Historic Sites, Buildings, and Antiquities Act	16 USC Secs. 461-467 40 CFR Sec. 6.301(a)	Property within or near landmarks on the National Registry of Natural Landmarks.	The remedial alternative will be designed to avoid undesirable impacts on such landmarks. Coordinate with State Historic Preservation Officer (SHPO).
4. Endangered Species Act of 1973; Federal Migratory Bird Act; Oklahoma Wildlife Statutes	16 USC 1531-1543 50 CFR Parts 17, 402 40 CFR 6.302(h) 16 USC 703-712 Title 29, Section 5-412	Site located in critical habitat upon which endangered or threatened species exist.	The remedial alternative will be designed to conserve endangered or threatened species and their habitat, including consultation with the Department of Interior and the Oklahoma State Department of Wildlife if such areas are affected.
5. Oklahoma Water Statutes	Title 29, Section 7-401	Remediation activities include discharge to waters of Oklahoma.	The remedial alternative will be designed to prevent placement of deleterious, noxious or toxic substances into affected waters.
6. Nationwide Permit (NWP)	33 CFR 330, pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act (CWA).	Remediation activities affect waters of the United States.	The remedial alternative will ensure that all activities in affected areas meet regulatory permit requirements

Table 4

POTENTIAL LOCATION-SPECIFIC ARARS
TAR CREEK SUPERFUND SITE, OTTAWA COUNTY, OKLAHOMA

	Citation	Prerequisite	Requirement
B. **Relevant and Appropriate Requirements**	None		
C. **To Be Considered**	None		

Table 5

POTENTIAL ACTION-SPECIFIC ARARS
TAR CREEK SUPERFUND SITE, OTTAWA COUNTY, OKLAHOMA

	Citation	Prerequisite	Requirement
A. **Applicable Requirements**			
1. Toxic Substances Control Act (TSCA)	49 CFR 107, 171-177	Remedial activities involve the transport of hazardous materials.	Transportation of hazardous materials must comply with Department of Transportation (DOT) regulations.
2. Clean Water Act (CWA)	40 CFR 122.41 and 125.100	Remedial activities involve discharges to the environment.	Best management practices must be maintained by the operator of the discharge system and discharges must be monitored to assure compliance with effluent discharge limits.
3. Clean Air Act (CAA)	40 CFR 50 40 CFR 60	Remedial activities involve particulate emissions.	Remedial activities must control particulate emissions to ambient air.
B. **Relevant and Appropriate Requirements**	None		
C. **To Be Considered**	None		

RECORD OF DECISION
CONCURRENCE DOCUMENTATION

FOR THE

TAR CREEK SUPERFUND SITE
OTTAWA COUNTY, OKLAHOMA
OPERABLE UNIT 2, RESIDENTIAL AREAS

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